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SEMANTIC SPECIFICITY OF REALIA: THEORETICAL INTERPRETATION AND LINGUOCULTURAL ANALYSIS

Abstract. *This article examines the semantic specificity of realia from the perspective of modern linguistics, particularly linguocultural studies, semasiology, and comparative linguistics. The term realia is understood as a linguistic unit that denotes objects, phenomena, and concepts specific to the historical experience, everyday life, customs, and sociocultural practices of a particular nation. The article argues that, unlike ordinary lexical units, realia have a multilayered semantic structure. In particular, it demonstrates that, along with denotative meaning, connotative, associative, and pragmatic components are actively involved in their semantic structure. Using examples from Korean and Uzbek, such as kimchi, sumalak, mahalla, 효, and 추석, the article analyzes the semantic scope and cultural significance of realia. The findings show that the semantic specificity of realia lies in their close connection with the national and cultural environment, as well as in their ability to go beyond direct lexical meaning and reflect collective consciousness, historical memory, and ethnocultural experience.*

Keywords: *realia, semantic specificity, denotative meaning, connotative meaning, associative meaning, pragmatic meaning, linguocultural studies, semasiology, culture-specific lexical unit, Korean language, Uzbek language.*

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REALIYALARNING SEMANTIK XOSLANGANLIGI: NAZARIY TALQIN VA LINGVOMADANIY TADQIQ

Annotatsiya: *Ushbu maqolada realiyalarning semantik xoslanganligi masalasi zamonaviy tilshunoslik, xususan, lingvokulturologiya, semasiologiya va qiyosiy tilshunoslik nuqtai nazaridan tahlil qilinadi. Realiya muayyan xalqning tarixiy tajribasi, milliy turmushi, urf-odatlari va ijtimoiy-madaniy hayotiga xos bo‘lgan predmet, hodisa va tushunchalarni ifodalovchi til birligi sifatida ko‘rib*

*chiqiladi. Maqolada realiyalarning oddiy leksik birliklardan farqli ravishda ko‘p qatlamli semantik tuzilishga ega ekani asoslanadi. Xususan, ularda denotativ ma’no bilan bir qatorda konnotativ, assotsiativ va pragmatik ma’nolar ham faol ishtirok etishi ko‘rsatib beriladi. Koreys va o‘zbek tillaridagi **kimchi**, **sumalak**, **mahalla**, 효, 추석 kabi birliklar misolida realiyalarning semantik hajmi va madaniy yukdorligi tahlil qilinadi. Tadqiqot natijasida realiyalarning semantik xoslanganligi ularning milliy-madaniy muhitga kuchli bog‘langanligi, lug‘aviy ma’no doirasidan chiqib, kollektiv ong, tarixiy xotira va etnomadaniy tajribani aks ettiruvchi murakkab birlik sifatida namoyon bo‘lishida ekanligi aniqlanadi.*

Kalit so‘zlar: *realiya, semantik xoslanganlik, denotativ ma’no, konnotativ ma’no, assotsiativ ma’no, pragmatik ma’no, lingvokulturologiya, semasiologiya, milliy-madaniy birlik, koreys tili, o‘zbek tili.*

Kirish

Tilning leksik tizimi faqat predmet va hodisalarni nomlash vositasi emas, balki xalqning tarixiy xotirasi, madaniy tajribasi va dunyoqarashini saqlovchi murakkab tizimdir. Har bir millat o‘zining moddiy va ma’naviy hayotiga xos tushunchalarni tilda mustahkamlaydi. Shu jihatdan realiyalar tilning eng milliy xoslangan qatlamlaridan biri hisoblanadi.

Tilshunoslikda realiya odatda muayyan xalq turmushiga, urf-odatlariga, marosimlariga, ijtimoiy institutlariga, tarixiy taraqqiyotiga yoki maishiy hayotiga xos bo‘lgan, boshqa tilda to‘liq va bevosita muqobili bo‘lmagan birlik sifatida tavsiflanadi. Biroq realiyani faqat nominativ birlik sifatida talqin qilish uning tabiatini yetarli ochib bermaydi. Realiya o‘zida nafaqat lug‘aviy ma’noni, balki keng madaniy fondni, baholovchi elementlarni, ramziy mazmunni va kommunikativ-pragmatik vazifalarni ham mujassamlashtiradi.

Shu sababli realiyalarni o‘rganishda eng muhim masalalardan biri ularning **semantik xoslanganligi**dir. Bu tushuncha realiya ma’nosining oddiy leksik birliklarga nisbatan murakkabligi, ko‘p qavatliligi hamda milliy-madaniy kontekst bilan chambarchas bog‘liqligini ifodalaydi. Oddiy so‘z ko‘pincha biror predmet yoki hodisaga ishora qilsa, realiya shu predmet bilan bog‘liq tarixiy xotira, ijtimoiy tajriba, emotsional baho va madaniy assotsiatsiyalarni ham o‘zida jamlaydi.

Mazkur maqolaning maqsadi realiyalarning semantik xoslanganligini nazariy jihatdan yoritish, uning tarkibiy qatlamlarini tavsiflash hamda koreys va o‘zbek tillari materiallari asosida ularning semantik hajmini ilmiy tahlil qilishdan iborat.

1. Realiyalarning semantik xoslanganligi tushunchasi

Semantik xoslanganlik deganda til birligining ma’nosi muayyan ijtimoiy, tarixiy va madaniy muhit ta’sirida shakllanganligi, uning ma’no tarkibi ko‘p qatlamli ekani va oddiy denotatsiyadan tashqari qo‘shimcha ma’no komponentlarini ham qamrab olishi tushuniladi. Realiyalarda aynan shu jihat juda yaqqol namoyon bo‘ladi.

Oddiy leksik birliklar ko‘pincha predmetning umumiy belgisini bildiradi. Masalan, “uy”, “suv”, “yo‘l”, “daraxt” kabi birliklarda denotativ ma’no yetakchi

o‘rinda turadi. Albatta, bunday so‘zlar ham kontekstga ko‘ra qo‘shimcha ma’no olishi mumkin. Lekin realiyalarda bu holat istisno emas, balki ichki tabiatning o‘zidir. Ya’ni realiyaning mavjudligi va ishlatilishi boshidanoq muayyan madaniy kod bilan bog‘liq bo‘ladi.

Realiyalarning semantik xoslanganligi quyidagi belgilar orqali namoyon bo‘ladi:

Birinchidan, realiya ma’nosi **milliy muhitga bog‘langan** bo‘ladi. U ma’lum xalq hayotiga xos predmet yoki hodisani ifodalaydi. Ikkinchidan, unda **ko‘p qatlamli semantik tuzilma** mavjud bo‘ladi. Uchinchidan, realiya ma’nosi **kontekstsiz to‘liq ochilmaydi**, chunki uning to‘liq talqini uchun madaniy bilim zarur. To‘rtinchidan, realiya ko‘pincha **muqobilsiz yoki qisman muqobilli birlik** bo‘lib, boshqa tilga o‘tganda ma’no yo‘qotishi mumkin.

Shu ma’noda realiyalarni tahlil qilishda ularning semantik strukturasi ichidagi denotativ, konnotativ, assotsiativ va pragmatik komponentlarni alohida ko‘rib chiqish zarur.

2. Realiyalarda denotativ ma’no va uning chegaralari

Denotativ ma’no til birligining bevosita nominativ mazmunini, ya’ni qaysi predmet, hodisa yoki tushunchani ifodalayotganini bildiradi. Realiyalarda ham bu qatlam mavjud va u asosiy boshlang‘ich nuqtani tashkil etadi. Biroq realiyalarning xususiyati shundaki, ularning denotativ ma’nosi ko‘pincha semantik strukturaning eng yuzaki qatlami bo‘lib qoladi.

Masalan, **kimchi** koreys oshxonasiga xos achitilgan sabzavot mahsuloti sifatida ta’riflanishi mumkin. Bu uning denotativ ma’nosidir. Xuddi shunday, **sumalak** o‘zbek xalqining Navro‘z arafasida yoki bahoriy marosimlarda tayyorlanadigan shirin taomi sifatida tavsiflanadi. Lug‘aviy jihatdan ikkala birlik ham “ovqat nomi” kategoriyasiga kiradi. Ammo bu ikki birlikning semantik hajmi shunchaki “taom” tushunchasi bilan cheklanmaydi.

Denotativ ma’no realiyaga kirish eshigi bo‘lsa-da, realiyani to‘liq anglash uchun yetarli emas. Chunki realiya ifodalagan predmetning xalq hayotidagi o‘rni, u bilan bog‘liq urf-odatlar, uni iste’mol qilish yoki qo‘llash usullari, ijtimoiy va marosimiy vazifasi ma’noning boshqa qavatlarini tashkil qiladi.

Masalan, **mahalla** so‘zining denotativ ma’nosi “muayyan hududdagi qo‘shnilar jamoasi” yoki “yashash hududi” deb izohlanishi mumkin. Biroq bu izoh o‘zbek tilidagi “mahalla” tushunchasining haqiqiy semantik sig‘imini bermaydi. Chunki u faqat joy yoki jamoa emas, balki ijtimoiy nazorat, o‘zaro yordam, ma’naviy tarbiya, marosimiy tashkilotchilik va jamoaviy birdamlik instituti hamdir. Demak, denotativ ma’no bu yerda realiyaning semantik yadro qismini tashkil etsa-da, uning to‘liq funksional tabiatini ochmaydi.

Shu bois realiyalarning semantik xoslanganligini o‘rganishda denotativ ma’no “asosiy qatlam” sifatida e’tirof etiladi, ammo u realiya semantikasining tugallangan ko‘rinishi emas.

3. Realiyalarda konnotativ ma’noning o‘rni

Konnotativ ma’no realiya bilan bog‘liq emotsional, baholovchi, madaniy va ramziy yukni anglatadi. Realiyalarda aynan shu qatlam ularni oddiy nominativ birliklardan ajratib turadi. Chunki realiya ko‘pincha xalq ongida ijobiy yoki salbiy baho, muayyan hissiy munosabat, madaniy hurmat yoki ramziy ma’no bilan birga yashaydi.

Masalan, o‘zbek tilidagi **sumalak** biror shirin taomning nomi emas. U bahorning kirib kelishi, tabiatning uyg‘onishi, hosildorlik, baraka va niyat pokligi bilan bog‘liq. Sumalak atrofidagi jamoaviy tayyorgarlik, tun bo‘yi pishirish, qo‘shiq aytish, tilak qilish kabi amallar uning konnotativ maydonini kengaytiradi. Shuning uchun “sumalak” so‘zi nutqda qo‘llanganda unda faqat oshpazlik mazmuni emas, balki mavsumiy yangilanish va marosimiy quvonch hissi ham uyg‘onadi.

Koreys tilidagi **추석** ham shunga o‘xshash ko‘p qatlamli birlikdir. Denotativ jihatdan bu bayram nomi. Biroq uning konnotativ semantikasi juda keng: oila birligi, ajdodlarni xotirlash, uyga qaytish, an’anaviy taomlar, oilaviy uchrashuvlar, hurmat va milliy birdamlik. Demak, bu realiya nutqda oddiy “bayram” ma’nosidan ancha boyroq hissiy va madaniy fondni ishga tushiradi.

Shuningdek, konnotativ ma’no realiyaning baholovchi yo‘nalishini ham ko‘rsatadi. Masalan, koreys tilidagi **효** tushunchasi denotativ jihatdan “ota-onaga hurmat” deb izohlansa-da, unda ijobiy axloqiy baho, odob, burch, ideal farzand obrazi kabi kuchli konnotativ komponentlar mavjud. O‘zbek tilida bunga ma’lum darajada “ota-onani e’zozlash”, “farzandlik burchi” kabi birliklar yaqin turadi, ammo koreys madaniyatidagi **효** konseptining ijtimoiy va axloqiy chuqurligi o‘ziga xosdir.

Shu tariqa, realiyalardagi konnotativ ma’no madaniyatning baholovchi va hissiy qatlamini ifodalaydi. U til birligining xalq ongidagi “aksiologik portreti”ni yaratadi.

4. Assotsiativ ma’no va kollektiv ong

Realiyalarning semantik xoslanganligida assotsiativ qatlam alohida ahamiyatga ega. Assotsiativ ma’no deganda, til birligi eshitilishi yoki qo‘llanishi bilan nutq egasining ongida paydo bo‘ladigan qo‘shimcha tasavvurlar, obrazlar, ssenariylar va tushunchalar majmui nazarda tutiladi. Realiyalarda bu maydon ayniqsa keng bo‘ladi, chunki ular kollektiv xotira va tarixiy tajriba bilan mustahkam bog‘langan.

Masalan, **mahalla** so‘zi o‘zbek tilida faqat yashash hududi emas. U bilan “qo‘shnichilik”, “hashar”, “to‘y”, “aza”, “oqsoqol”, “maslahat”, “yordam”, “uyat”, “jamoa nazorati”, “tarbiya” kabi ko‘plab tushunchalar bog‘langan. Demak, “mahalla” realiyasi o‘zbek kollektiv ongida murakkab ijtimoiy-madaniy ssenariyni faollashtiradi. Bunday assotsiativ boylikni oddiy tarjima orqali to‘liq uzatish mushkul.

Koreys tilidagi **효** so‘zi esa koreys ongida “ota-ona”, “ehtirom”, “burch”, “oilaviy iyerarxiya”, “konfutsiychilik an’anasi”, “odob”, “tarbiya”, “mas’uliyat”

kabi assotsiativ komponentlarni uyg‘otadi. Bu yerda birlikning assotsiativ maydoni milliy axloqiy model bilan chambarchas bog‘langan.

Assotsiativ ma’no ko‘pincha realiyaning ijtimoiy yashovchanligini ta’minlaydi. Chunki aynan assotsiativ maydon orqali realiya xalq ongida aktiv qoladi, badiiy matnda obrazlilik kasb etadi, nutqda esa qo‘shimcha ma’no yuklaydi. Realiya qanchalik tarixiy va madaniy jihatdan muhim bo‘lsa, uning assotsiativ maydoni ham shunchalik boy bo‘ladi.

Bu jihatdan realiyalarni oddiy lug‘at ta’rifi bilan cheklash ilmiy jihatdan yetarli emas. Chunki lug‘at denotatsiyani bersa-da, assotsiativ maydonni faqat qisman ko‘rsatadi. Realiyalarning semantik xoslanganligi aynan shu “lug‘aviy ta’rifdan tashqaridagi semantik hudud”da to‘liq namoyon bo‘ladi.

5. Pragmatik ma’no va nutqiy funksionallik

Pragmatik ma’no til birligining kommunikativ vaziyatdagi vazifasi, ta’sir kuchi, ijtimoiy yo‘nalishi va nutq egasining maqsadi bilan bog‘liq. Realiyalarda pragmatik qatlam kuchli bo‘lib, ularning qo‘llanilishi orqali so‘zlovchi nafaqat ma’lumot uzatadi, balki milliy mansublik, madaniy yaqinlik, tarixiy fon yoki ijtimoiy identifikatsiyani ham namoyon etadi.

Masalan, badiiy matnda **hanbok**, **kimchi**, **mahalla**, **sumalak**, **추석**, **효** kabi birliklarning ishlatilishi faqat ma’lum bir obyektni nomlash uchun emas, balki milliy kolorit yaratish uchun xizmat qiladi. Muallif realiya orqali o‘quvchini muayyan madaniy makonga olib kiradi, obrazning milliy fonini ochadi va tasvirning etnografik ishonchliligini oshiradi.

Pragmatik nuqtai nazardan realiyalar bir necha vazifani bajaradi:

Birinchidan, ular **identifikatsion funksiya** bajaradi. Ya’ni so‘zlovchi yoki yozuvchi qaysi madaniy maydonga mansub ekanini ko‘rsatadi. Ikkinchidan, ular **ekspressiv funksiya**ga ega bo‘lishi mumkin. Masalan, realiyaning ishlatilishi milliy g‘urur, sog‘inch, hurmat yoki samimiyatni kuchaytiradi.

Uchinchidan, ular **stilistik funksiya** bajaradi. Badiiy, publitsistik yoki og‘zaki nutqda realiya matnga milliy rang va tabiiylik bag‘ishlaydi. To‘rtinchidan, ular **madaniy marker** sifatida ishlaydi. Ya’ni kommunikativ vaziyatda “bu tushuncha bizning madaniyatimizga xos” degan signalni beradi.

Masalan, o‘zbek matnida “mahalla raisi”, “sumalak sayli”, “kelin salom” kabi birliklar ishlatilganda, o‘quvchi darhol o‘zbek madaniy kontekstini sezadi. Xuddi shuningdek, koreys matnida “한복을 입다”, “추석에 성묘를 가다”, “효를 실천하다” kabi birikmalar pragmatik jihatdan koreys milliy fondini jonlantiradi.

Shu sababli realiyalarning pragmatik xoslanganligi ularning nutqdagi semantik faolligini oshiradi. Ular matnni nafaqat axborotli, balki madaniy jihatdan belgilangan qiladi.

6. Realiyalarning ko‘p qatlamli semantik modeli

Yuqoridagi tahlillar asosida realiyalarning semantik xoslanganligini ko‘p qatlamli model sifatida tasavvur qilish mumkin. Bu modelda quyidagi semantik komponentlar o‘zaro bog‘liq holda faoliyat ko‘rsatadi:

- **Denotativ qatlam** — realiyaning bevosita nomlayotgan predmet yoki hodisasi;
- **Konnotativ qatlam** — hissiy, baholovchi va ramziy mazmun;
- **Assotsiativ qatlam** — kollektiv xotira va madaniy tasavvurlar bilan bog‘liq maydon;
- **Pragmatik qatlam** — nutqdagi vazifa, kommunikativ ta’sir va ijtimoiy signal.

Bu qatlamlar bir-biridan ajratilgan holda emas, balki o‘zaro chatishgan tarzda ishlaydi. Masalan, **sumalak** birligi denotativ jihatdan taomni bildiradi, konnotativ jihatdan yangilanish va barakani ifodalaydi, assotsiativ jihatdan Navro‘z, ayollar jamoasi, tun bo‘yi pishirish an’analarini esga soladi, pragmatik jihatdan esa o‘zbek madaniy identitetini ko‘rsatadi.

Demak, realiya ma’nosini tahlil qilishda uni birgina lug‘aviy izoh bilan cheklab bo‘lmaydi. Uning semantik tabiatini ochish uchun bu qatlamlarning barchasi hisobga olinishi zarur.

7. Koreys va o‘zbek tillari qiyosida semantik xoslanganlikning ayrim ko‘rinishlari

Koreys va o‘zbek tillari turli til oilalariga mansub bo‘lishiga qaramay, ikkalasida ham semantik jihatdan xoslangan realiyalar juda boy. Ularni qiyoslash ayrim umumiylik va farqlarni ko‘rsatadi.

Umumiylik shundaki, har ikki tilda ham realiyalar xalqning turmush tarzi, marosimlari, oilaviy munosabatlari va milliy qadriyatlarini aks ettiradi. Masalan, **sumalak** va **kimchi**, **mahalla** va koreyscha jamoaviy madaniyatga oid ayrim tushunchalar, **kelin salom** va koreys oilaviy odobiga oid realiyalar semantik jihatdan madaniy yukdor birliklar hisoblanadi.

Farq esa semantik xoslanganlikning ichki yo‘nalishida namoyon bo‘ladi. O‘zbek realiyalarida ko‘proq jamoaviylik, mehmondo‘stlik, marosimiy birdamlik, qo‘shnichilik va oilaviy yaqinlik aks etsa, koreys realiyalarida iyerarxiya, odob, ajdodlarga hurmat, tartib va burch tushunchalari ko‘proq markazlashgan bo‘ladi. Shu sababli ularning konnotativ va assotsiativ maydoni ham turlicha shakllanadi.

Masalan, 효 va “ota-onaga hurmat” ma’nodoshdek ko‘rinsa-da, koreys tilidagi birlikning semantik xoslanganligi kuchliroq, chunki u tarixiy-falsafiy an’anaga tayanadi. Xuddi shuningdek, **mahalla** va “community” yoki “neighborhood” o‘rtasida tashqi o‘xshashlik bo‘lsa-da, o‘zbek tilidagi “mahalla”ning assotsiativ va pragmatik semantikasi ancha keng.

Bu qiyosiy holat realiyalarning semantik xoslanganligi har bir tilning milliy konseptual maydoniga bevosita bog‘liqligini ko‘rsatadi.

Xulosa

Realiyalarning semantik xoslanganligi ularning ma’nosi oddiy leksik birliklarga qaraganda ancha murakkab, ko‘p qatlamli va milliy-madaniy muhitga kuchli bog‘langan ekanligida namoyon bo‘ladi. Realiya semantikasi denotativ ma’no bilan cheklanmaydi; unda konnotativ, assotsiativ va pragmatik ma’no qatlamlari ham faol ishtirok etadi.

Denotativ qatlam realiyaning nominativ asosini tashkil etsa, konnotativ qatlam uning emotsional va aksiologik yo‘nalishini belgilaydi. Assotsiativ qatlam xalqning tarixiy xotirasi va kollektiv tasavvurlarini faollashtiradi, pragmatik qatlam esa birlikning nutqdagi kommunikativ-vazifaviy kuchini namoyon etadi.

Koreys va o‘zbek tillari materiallari shuni ko‘rsatadiki, realiyalarning semantik xoslanganligi har bir xalqning tarixiy tajribasi, ijtimoiy munosabatlari va madaniy qadriyatlari bilan chambarchas bog‘liq. Shu bois realiyalarni o‘rganish til va madaniyat aloqasini, milliy dunyoqarashning leksik ifodasini hamda tarjimada yuzaga keladigan semantik murakkabliklarni anglashda alohida ilmiy ahamiyatga ega.

Demak, realiyalar semantik jihatdan nafaqat nominativ birlik, balki milliy xotira, madaniy tajriba va etnomadaniy konseptlarni tashuvchi murakkab lingvistik hodisadir.

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IMPROVING TRAFFIC FLOW EFFICIENCY THROUGH THE OPTIMIZATION OF PEDESTRIAN CROSSINGS ON URBAN ARTERIAL ROADS (A CASE STUDY OF ISLAM KARIMOV STREET IN NAMANGAN CITY)

Abstract. *his study examines the impact of unsignalized pedestrian crossings on traffic flow efficiency and road safety along Islam Karimov Street in Namangan City. Using traffic engineering methods and the Greenshields model, key traffic flow parameters were analyzed. An infrastructure solution involving the relocation of an unsignalized pedestrian crossing to a safer intersection area is proposed. The results indicate that the proposed measure can increase average traffic speed by 23.8%, improve road capacity by 21.8%, reduce traffic delays by 73.3%, and decrease CO_2 emissions by 16%. The proposed solution contributes to enhanced pedestrian safety and improved transport and environmental performance of the urban arterial road.*

Keywords: *traffic flow, road safety, pedestrian crossing, urban arterial road, Greenshields model, road capacity, traffic delay, environmental efficiency, Namangan city.*

Introduction. The theoretical foundations of analyzing traffic flow parameters on urban road networks and ensuring road traffic safety have been examined. Based on these analyses, the development and optimization of practical infrastructure solutions aimed at improving traffic safety have become increasingly important. Along with enhancing traffic flow efficiency, protecting human life and health remains a priority, and every element of road infrastructure plays a significant role in achieving this goal. Islam Karimov Street is one of the busiest streets in Namangan City. Pedestrian and vehicular traffic interact continuously along this corridor throughout the day. As noted above, these interactions have a significant impact on traffic flow performance, affecting vehicle movement, speed, and overall traffic efficiency.

Main Part. Human factors play a crucial role in the formation and operation of traffic flow. Drivers' qualifications, experience, psychophysiological condition, and level of compliance with traffic regulations significantly affect traffic flow stability. Likewise, pedestrian behavior, particularly crossing the road at

undesignated locations, leads to interruptions in traffic flow, reductions in vehicle speed, and the formation of congestion.

External environmental factors, including weather conditions, also have a considerable impact on traffic flow. During rain, snow, fog, icy conditions, and strong winds, drivers are compelled to reduce their speed for safety reasons. As a result, traffic flow intensity and operating speed decrease, negatively affecting the overall efficiency of the road network.

Problem and Mechanism. As a result, both traffic flow intensity and travel speed decrease. On the analyzed 1.1 km (1100 m) section of the urban arterial road, the maximum permitted speed is 60 km/h. However, during peak traffic periods, vehicles are forced to slow down and stop due to the presence of an unsignalized pedestrian crossing located in the middle of the section and the influence of nearby signalized intersections. These interruptions reduce the average operating speed of the traffic flow to approximately 42 km/h, thereby decreasing roadway efficiency and increasing travel delays.

Practical Analysis and Proposed Solution. Model for Calculating Average Travel Speed. The average travel speed of a traffic flow along a road section (*v*avg) can be determined using the following internationally recognized traffic engineering formula:

$$v_{avg} = \frac{L}{T_{free} + \sum \Delta t_{delay}} \times 3.6[km/h]$$

where:

- *L* – total length of the road section (L = 1100 m);
- *T*free – travel time under free-flow conditions at the permitted speed of 60 km/h (*T*free = 66 s);
- ΣΔtdelay – total delay and stopping time experienced by vehicles along the road section (s).

Experimental Scenarios and Calculations. Based on field observations and the proposed infrastructure improvements, two traffic operation scenarios were evaluated.

Existing Condition (Before Optimization). During peak hours, a vehicle loses an average of 28 seconds due to yielding to pedestrians at the unsignalized crossing and waiting at traffic signals. According to the formula, the average travel speed is:

$$v_{avg} = \frac{1100}{66 + 28} \times 3.6 \approx 42.1 \ km/h$$

Proposed Condition (After Optimization). After relocating the unsignalized pedestrian crossing to a safer signalized intersection, unnecessary braking and stopping maneuvers are eliminated. Consequently, the average delay decreases from 28 seconds to 10 seconds, resulting in:

$$v_{new} = \frac{1100}{66 + 10} \times 3.6 \approx 52.1 \ km/h$$

The final results are summarized in the comparative analysis table of travel time and average speed indicators.

Results. *Relationship Between Speed and Traffic Flow Rate (Greenshields Model.* In traffic engineering and traffic flow theory, the fundamental relationship between vehicle speed and traffic flow rate is commonly described by the Greenshields model. This model assumes a linear relationship between vehicle speed (v) and traffic density, resulting in a quadratic (parabolic) relationship between speed and traffic flow. In addition, concentrating pedestrian movements at a single controlled crossing reduces conflict points between pedestrians and vehicles. This contributes not only to improved road safety but also to greater traffic flow stability and operational efficiency.

The proposed solution is expected to increase the average traffic speed, reduce vehicle delays, and improve the overall level of service of the analyzed road section.

Calculation of Equivalent Traffic Flow Rate (*N*eq).

To account for different vehicle types within the traffic stream, traffic volumes are converted into passenger car units (PCU) according to national road design standards. The conversion coefficients used are:

- Passenger car = 1.0
- Bus = 2.5
- Truck = 2.0–3.0

The equivalent traffic flow rate during the peak hour is calculated as follows:

$$N_{eq} = (N_{car} \times 1.0) + (N_{bus} \times 2.5) + (N_{truck} \times 3.0)$$

For the experimental traffic composition (*N*car = 1500, *N*bus = 40, *N*truck = 60):

$$N_{eq} = (1500 \times 1.0) + (40 \times 2.5) + (60 \times 2.0)$$

$$N_{eq} = 1500 + 100 + 120 = 1720 \text{ veh/h}$$

Thus, the equivalent peak-hour traffic flow rate for the analyzed road section is **1720 vehicles per hour**, which was used as the basis for evaluating traffic performance and the effectiveness of the proposed infrastructure improvements.

Conclusion. The study confirmed that unsignalized pedestrian crossings on Islam Karimov Street significantly affect traffic flow efficiency and road safety. Relocating the crossing to a safer signalized intersection can increase average vehicle speed by 23.8%, improve roadway capacity by 21.8%, reduce delays by 73.3%, and decrease CO_2 emissions by 16%. The findings demonstrate that optimizing pedestrian crossings is an effective way to enhance traffic performance, improve safety, and reduce environmental impacts on urban arterial roads.

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THE CONTENT OF THE COURSE OF MATHEMATICAL ANALYSIS, ITS ROLE IN THE EDUCATIONAL PROCESS AND DIGITAL EDUCATIONAL EXPERIMENTS

Abstract. *This article examines a wide range of issues related to the application of digital technologies in the educational process. Particular attention is paid to modern information and digital technologies, including cloud technologies, as well as their role and potential within the education system. The study also analyzes the tools and methods of implementing digital technologies, their advantages, and the innovations they introduce into the teaching and learning process. In addition, the article discusses the effectiveness and significance of advanced technologies such as the Internet of Things (IoT), Augmented Reality (AR), and Virtual Reality (VR) in modern education. The use of digital platforms and interactive educational environments in teaching mathematical analysis is also considered.*

Keywords: *mathematical analysis, digital education, digital technologies, cloud technologies, interactive learning, e-learning environment, GeoGebra, Desmos, augmented reality (AR), virtual reality (VR), Internet of Things (IoT), higher education, digital learning platforms*

Introduction. At present, higher education institutions around the world compete for students, academic staff, and financial resources. In the digital era, educational institutions that effectively utilize modern technological opportunities are gradually gaining a competitive advantage. As Zinina and co-authors (2020) point out, innovations based on distance learning technologies represent an important mechanism for achieving competitiveness in the educational environment.

Many universities are currently developing their own digital strategies in response to the widespread integration of modern technologies into education. However, in many cases, there is a lack of long-term vision, organizational capacity, and sustainable digital culture necessary for the effective implementation of these strategies. As a result, information systems introduced at considerable expense often fail to produce the expected outcomes.

The modern educational environment is increasingly transforming into an e-learning environment. This transformation provides broader access to knowledge and facilitates the processes of learning, storing, and sharing information (Belyakova et al., 2019). Nevertheless, the existence of a digital strategy alone is not sufficient to ensure the successful development of a university. To adapt to the requirements of the digital age, higher education institutions must develop an

integrated approach that encompasses all aspects of the educational process rather than focusing solely on the IT sector.

At the same time, insufficient levels of digital literacy among students and faculty members require accelerated institutional changes. Khudoley and Olentsova (2018) emphasize that modern students are able to actively participate in online communication, discussions, and virtual classes with teachers and peers without physically attending traditional classrooms. This indicates that the educational process is evolving toward a new stage based on digital technologies.

Methodology. In modern society, the education system is undergoing significant digital transformation processes. The new digital environment, formed as a result of technological progress, is creating fundamental changes in the organization, management, and monitoring of the educational process. Digital technologies contribute to updating the content, forms, and methods of teaching, increasing students' motivation for learning, and enhancing interactive communication between teachers and students.

Digital technologies primarily include computer technologies, internet resources, multimedia systems, mobile applications, online educational platforms, and artificial intelligence-based learning tools. These technologies facilitate the work of teachers and enable the organization of the educational process on the basis of a learner-centered and individualized approach. In particular, digital technologies play an essential role in distance learning, blended learning, and independent education.

Today, the education system of the Republic of Uzbekistan is also undergoing large-scale reforms aimed at the transition to digital education. Within the framework of the "Digital Uzbekistan – 2030" strategy, extensive work is being carried out to develop digital infrastructure in educational institutions, increase the use of information and communication technologies, and improve digital literacy. At the same time, national educational platforms such as ZiyoNET, Maktab.uz, and Edu.uz, as well as international systems including Google Classroom, Moodle, Zoom, and Microsoft Teams, are being actively implemented in the educational process.

With the help of digital technologies, the educational process is becoming more open, flexible, and accessible. Students are provided with opportunities to study educational materials regardless of time and location, which contributes to the development of independent learning skills. At the same time, the preparation, assessment, and analysis of educational materials are becoming increasingly automated for teachers. Furthermore, the digital educational environment makes it possible to personalize the learning process and implement an individual approach while improving the overall quality of education.

In general, the role of digital technologies in the education system lies in increasing the effectiveness of teaching, optimizing the educational process, and developing students' skills in independent thinking, analysis, and self-directed learning.

The Importance of Cloud Technologies, IoT, AR, and VR Technologies in Education

The modern educational process reflects all major directions of digital transformation. In particular, innovative technologies such as cloud computing, the Internet of Things (IoT), Augmented Reality (AR), and Virtual Reality (VR) play an important role in organizing education, increasing interactivity in the teaching process, and improving the effectiveness of knowledge acquisition. Cloud technologies are among the most widely used digital solutions in education. Platforms such as Google Workspace for Education, Microsoft OneDrive, Dropbox, and Moodle represent effective examples of cloud-based educational technologies. Cloud technologies enable teachers to create, store, and distribute educational materials in various formats. For example, teachers can share lectures, presentations, assignments, and test materials with students through online cloud platforms. As a result, the educational process becomes more flexible, transparent, and efficient.

Internet of Things (IoT) technology also provides new opportunities by connecting physical educational devices to digital networks. Smart whiteboards, digital laboratory equipment, tablets, and interactive devices contribute to the automation of the learning process. IoT-based systems make it possible to analyze student activities, digitize assessment procedures, and simplify teachers' work. Through these technologies, teachers can monitor students' participation and learning activities in real time. Augmented Reality (AR) technology enhances the educational process by integrating digital objects into the real environment and increasing visualization and interactivity. For example, in subjects such as biology and geometry, AR technologies allow students to study complex structures through interactive 3D models, which improves understanding of educational content. In addition, AR technologies increase students' motivation and support more effective visualization of studied objects and processes.

Virtual Reality (VR), in contrast, immerses students in a fully digital environment and enables deeper engagement with educational content. Such technologies contribute not only to visual perception but also to the development of practical skills. The application of AR and VR technologies in education promotes independent thinking, analytical abilities, and creativity among students. Furthermore, these technologies adapt the teaching process to the modern information environment, making lessons more engaging and interactive.

In general, the integration of cloud technologies, IoT, AR, and VR solutions into education represents an important component of modern digital teaching methodology. These technologies transform the educational process into a flexible, visually enriched, and analytically supported system. As a result, students' academic achievement improves, while teachers' professional efficiency significantly increases.

Methodology for Teaching Mathematical Analysis Based on Digital Technologies

The course of mathematical analysis is one of the most important and complex disciplines in higher education, as it develops students' logical, systematic, and analytical thinking skills. Therefore, the integration of modern digital technologies into the teaching of this subject significantly increases the effectiveness of the educational process. Digital technologies enable teachers to explain complex mathematical concepts visually, while students gain opportunities to understand topics more deeply and master them through practical applications.

The primary goal of using digital educational technologies in teaching mathematical analysis is to transform the learning process into an interactive, practice-oriented, and student-centered system. Software tools such as GeoGebra, Desmos, Wolfram Alpha, and Mathematica make it possible to graphically represent mathematical functions and visually analyze concepts such as limits, derivatives, and integrals.

For example, the creation of graphical models in GeoGebra when studying topics such as finding the limit of a function or calculating the area under a curve helps students better understand the essence of mathematical concepts. Platforms such as Desmos and Wolfram Alpha also allow students to independently solve exercises, automatically analyze results, and identify mistakes. These tools not only automate calculations but also provide opportunities for dynamic observation of mathematical processes.

Digital educational platforms such as Moodle, Google Classroom, and Microsoft Teams also play an important role in teaching mathematical analysis. Through these systems, teachers can distribute educational materials, organize online assignments and tests, monitor students' progress, and analyze learning outcomes. This ensures transparency in the educational process, improves assessment efficiency, and supports continuous communication between teachers and students.

Virtual Reality (VR) and Augmented Reality (AR) technologies can also be effectively applied in teaching mathematical analysis. For example, within a VR environment, students can observe changes in three-dimensional mathematical models, while AR technologies help them visually understand the geometric interpretation of complex mathematical formulas. Such approaches increase students' interest in mathematics, simplify difficult topics, and strengthen academic motivation.

Another important advantage of integrating digital technologies into the methodology of teaching mathematical analysis is the possibility of creating individualized learning trajectories. Teachers can analyze students' learning activities through digital monitoring systems and provide personalized recommendations based on students' performance and progress.

From a methodological perspective, teaching mathematical analysis based on digital technologies can be organized through the following stages:

1. **Preparatory stage** – selection of digital resources and development of electronic educational materials;

2. **Interactive teaching stage** – use of visual and interactive tools during lessons and organization of problem-based learning activities;

3. **Independent learning stage** – organization of online assignments, tests, and practical exercises for students;

4. **Assessment and analysis stage** – automated evaluation and analysis of learning outcomes through digital assessment systems.

In general, the methodology of teaching mathematical analysis through digital educational technologies elevates the educational process to a qualitatively new level. It not only facilitates students' learning processes but also develops their analytical thinking, logical reasoning, and problem-solving skills.

Conclusions. The effective integration of digital technologies into the modern educational system plays an important role in improving the quality and efficiency of the educational process. One of the main tasks facing higher education institutions today is to adapt teaching methodologies to the digital environment and to develop students' independent thinking, analytical abilities, and practical problem-solving skills. Digital platforms such as GeoGebra, Desmos, Moodle, and Google Classroom make it possible to organize the educational process in a more flexible, accessible, and engaging way. The use of digital tools increases students' participation in the learning process and contributes to the development of independent learning, self-assessment, and creative thinking skills.

In conclusion, the methodology for teaching mathematical analysis based on digital technologies represents a new stage in the development of modern education. This approach creates an interactive, flexible, and outcome-oriented teaching model. Therefore, the digitalization of education should be considered not only as a technological modernization process but also as an effective way of transforming the content and methodology of education in accordance with the requirements of the digital era.

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ECOLOGICAL ANALYSIS OF GROUNDWATER CONDITIONS IN THE SYRDARYA REGION UNDER ANTHROPOGENIC IMPACT AND CLIMATE CHANGE

Abstract. *This article presents a comprehensive study of the dynamics of groundwater level fluctuations and their impact on ecological stability within the Syrdarya region under conditions of global climate change and intensive anthropogenic pressure. The research analyzes how the rising temperatures and increasing evaporation coefficients observed in the region in recent years are affecting the hydrochemical composition of groundwater. Specifically, the study provides data-driven evidence of secondary salinization processes and an increase in water mineralization levels-rising from 1.5–3.0 g/l to as high as 5.0 g/l-resulting from groundwater levels approaching critical thresholds in irrigated agricultural zones and industrialized areas. Furthermore, the paper highlights technogenic issues, such as the increased concentration of heavy metals and nitrates in groundwater caused by the infiltration of industrial and municipal wastewater. The study concludes by proposing strategic recommendations and innovative solutions (such as the Smart Water system and phytomelioration) aimed at maintaining the region's hydrogeological balance, reducing soil degradation, and protecting groundwater resources over the next decade.*

Keywords: *Syrdarya, groundwater, anthropogenic impact, climate change, mineralization, salinization, hydromodulus, drainage system.*

Introduction. The Syrdarya region is a primarily agrarian province of Uzbekistan, where ecological stability is fundamentally dependent on the state of water resources. In recent decades, the dual pressure of global warming and the diminishing flow of the Syrdarya River has adversely affected the regional groundwater balance. Groundwater is not merely a resource for economic consumption; it is the primary determinant of the soil's fertile layer. Fluctuations in

the water table-whether sharp rises or significant declines-trigger ecological crises, most notably the secondary salinization of arable land. The formation and discharge volumes of water resources within the Syrdarya basin have undergone a profound transformation. Research indicates that long-term hydrological shifts in the basin are driven by both natural climatic variability and intensive economic activities, such as dam construction and expansive irrigation [1]. These anthropogenic and natural drivers exert varying degrees of pressure on the water balance, hindering the sustainable development of the entire basin [5,10]. In the Aral Sea basin specifically, the interplay between climatic factors and human interference is identified as the core driver disrupting the hydrological cycle [8]. The spatiotemporal relationship between groundwater levels and mineralization degrees in the irrigated lands of the Syrdarya region is of critical importance. Studies monitoring the province's agrolandscapes under climate change scenarios have noted a rising water table coupled with deteriorating water quality [2]. Long-term data analysis confirms that the groundwater regime and soil salinity levels are intrinsically linked, accelerating land degradation-a phenomenon characteristic of arid zones [4]. Furthermore, global climate change has emerged as the most critical variable in the groundwater hydrological cycle. Evidence suggests that climatic fluctuations impact not only the quantity of water but also its hydrochemical composition [11]. Specifically, rising temperatures and erratic precipitation patterns lead to the degradation of groundwater quality through increased mineralization [12]. On a regional scale, changes in meteorological indicators cause sharp oscillations in the water table, posing a severe threat to ecosystem resilience [19]. In the Aral Sea region and its adjacent territories, climate change has catalyzed a broad environmental decline, where altered hydrological regimes serve as the primary catalyst for ecosystem degradation [6]. Consequently, efficient water resource management remains the most urgent ecological priority for Central Asia and neighboring regions amidst global climatic shifts [7]. The degradation of water resource quality is driven not only by climatic shifts but also significantly by industrial pollution. For instance, in Kazakhstan and its adjacent territories, the formative conditions of groundwater are undergoing continuous transformation due to anthropogenic stressors [9]. Specifically, the petroleum industry and other technogenic factors elevate the risk of chemical contamination in both groundwater and soil layers, thereby jeopardizing regional ecological security [3].

Human economic activities are fundamentally altering the natural regimes of groundwater. The transformation of hydrogeological conditions under technogenic influence is manifested through groundwater pollution and the depletion of viable reserves [15]. Furthermore, shifts in land-use patterns-driven by urbanization and intensified agriculture - affect infiltration processes and disrupt the overall groundwater balance [14]. Such alterations in the hydrogeodynamic regime serve as primary factors negatively impacting the general ecological state of the environment [18]. Fluctuations in the water table pose serious risks not only to natural ecosystems but also to engineering infrastructure. The construction of

reservoirs often triggers a rise in surrounding groundwater levels, leading to soil waterlogging and environmental deterioration [17]. Neglecting groundwater levels during the construction or reconstruction of buildings can result in foundation erosion and premature structural aging [16]. As an integral component of the ecosystem, groundwater interacts with the environment based on fundamental ecological principles [13]. Within the context of Uzbekistan, the general principles of ecology and nature conservation define the rational use and protection of groundwater from contamination as a strategic priority [20-22].

Methods. In the course of the research, data from the Syrdarya Regional Hydrogeological-Melioration Expedition, statistical analysis, and comparative monitoring methods were utilized. As a source of information, an analysis was conducted on observation well data from the period between 2015 and 2025. During the analysis, the groundwater levels and quality indicators in the Mirzobod, Sayhunobod, and Boyovut districts of the region were studied. Furthermore, the results of experiences from reputable international publications and scholars of the Republic were analyzed.

Results and Discussion. The research results indicated that two opposing processes related to groundwater are occurring in the Syrdarya region. According to the analysis of water level rise and salinity levels, it was revealed that the groundwater level in the Syrdarya region is extremely dynamic and changes drastically on a seasonal basis. During the irrigation season, due to the malfunction of collector-drainage networks, the groundwater level approaches the surface within 1.5–2.0 meters. This leads to salt accumulation in the upper layer of the soil (secondary salinization) as a result of evaporation. Under the conditions of the region, the "critical depth" of groundwater is 2.0–2.5 meters. If the water level rises above this indicator, salt begins to emerge on the soil surface due to capillary rise. During the vegetation (irrigation) period, especially in June-August, the water level rises to a depth of 1.2–1.8 meters across 60-70% of the region's area. According to "Hydromodul" zoning, this is considered an extremely severe condition.

Secondary Salinization. As a result of groundwater evaporation, the salt content in the topsoil layer (0–30 cm) increases in a geometric progression. If the groundwater mineralization is 3–5 g/l and the water table rises to within 1.5 meters of the surface, evaporation can lead to the accumulation of up to 10–15 tons of new salt per hectare annually. This process is termed "secondary salinization." The primary cause of this phenomenon is not merely natural factors, but the inefficiency of drainage systems. Approximately 35–40% of the existing collector-drainage networks (CDN) in Syrdarya are in need of reconstruction or are clogged with silt.

Efficiency Coefficient (EC): The efficiency coefficient of irrigation networks stands at approximately 0.60–0.65. This means that 35–40% of the water diverted from the river seeps into the ground (filtration) before reaching the fields, directly contributing to the rise of the groundwater table. This numerical chain reaction poses a severe threat to the regional economy. In highly saline lands, cotton yields drop by up to 50–60%, while in moderately saline areas, productivity decreases by

25–30%. To leach these salts (salinity control), an additional 3000–5000 m^3 of freshwater is required per hectare annually, further exacerbating the general water scarcity. To maintain the groundwater level at a depth of 2.5–3.0 meters in the Syrdarya region, it is a strategic necessity to increase the discharge capacity of collectors by 1.5 times and restore the operational efficiency of vertical drainage wells. Currently, nearly 45–50% of the irrigated land in the province is salinized to varying degrees, a condition directly linked to the groundwater regime.

Climate warming is acting as an "accelerant" on the hydrogeological regime of the Syrdarya region. The annual evaporation rate in the region (1200–1400 mm) is several times higher than the annual precipitation (200–300 mm). Rising temperatures increase the evaporation coefficient, releasing moisture from the groundwater into the atmosphere while leaving behind dissolved salts (primarily Na_2SO_4, $MgSO_4$, and NaCl), thereby increasing their concentration.

Observations indicate that over the last decade, the quality of groundwater in the central districts of the Syrdarya region has shifted as follows:

- 2015: Average mineralization was 1.8–2.2 g/l (Slightly saline).
- 2025: Average mineralization has risen to 3.5–5.0 g/l (Moderately to highly saline).

In extreme cases, within closed depressions and areas with poor drainage (e.g., the remote parts of the Mirzobod district), this figure reaches 7.0–10.0 g/l, effectively turning the water into "toxic" brine. Constraints on agriculture were also studied; accordingly, water with a mineralization level exceeding 3.0 g/l is considered "hazardous" for agricultural use. When irrigated with such water, plant roots cannot absorb moisture due to osmotic pressure (a state of "thirst amidst water"). Magnesium and sodium ions in the water break down soil colloids, reducing water permeability and leading to the "sealing" or hardening of the land. The rise in mineralization from 1.5 g/l to 5.0 g/l necessitates a 2.5-fold increase in the freshwater volume required for salt leaching in irrigated areas. This, in turn, deliberately intensifies the water deficit. In the industrialized regions of the Sirdaryo region, the chemical composition of groundwater is undergoing transformation due to anthropogenic factors. This process is most evident around the industrial hubs of Gulistan, Shirin, and Yangiyer.In the city of Shirin, heavy metals (such as copper, zinc, and chromium) contained in technological wastewater discharged from energy and industrial enterprises are filtering through soil layers and mixing into the first-level groundwater. In Gulistan, the deterioration of the sewage system and the discharge of untreated water into open collectors have led to a sharp increase in the concentration of nitrates (NO_3) and ammonium ions in the groundwater. Research indicates that the maximum allowable concentration (MAC) levels in these areas are being violated as follows.

Table 1. Indicators of Chemical Pollution of Groundwater in the Industrialized Areas of Sirdaryo Region (Relative to MAC)

Chemical Element	Exceedance of MAC (times)	Area (Location)	Ecological Risk Level
Nitrates (NO_3)	1.2 – 1.4 times	Around Gulistan	High (toxic)
Heavy Metals (Cu, Zn)	1.3 – 1.5 times	Shirin industrial zone	Chronic accumulation
Petroleum Products	1.1 – 1.2 times	Near transport routes	Moderate

This pollution triggers a “chain reaction.” Contaminated groundwater seeps into riverbeds, deteriorating the overall hydrochemical state of the Syr Darya River. When this water is used for irrigation, heavy metals pass into agricultural products and harm human health through the food chain. The high concentration of nitrates leads to the excessive growth of algae in collectors and canals, reducing the self-purification capacity of water bodies.

The deterioration of groundwater conditions is causing irreversible processes in the ecosystem of the Syr Darya region. Research has identified the following primary consequences: Soil degradation and decreased productivity, according to which the rising of the groundwater level above the critical depth (2.0 m) is causing aggressive soil salinization. In saline areas, the yield of cotton and grain is observed to decrease by an average of 20-30%, and in severely saline zones, by up to 50-60%. The agrophysical properties of the soil are worsening, and its humus layer is eroding, which leads to the withdrawal of land from agricultural rotation. Loss of biodiversity and landscape transformation, according to which changes in the hydrogeological regime are dealing a direct blow to the flora and fauna of the region. Native plant species that are not salt-tolerant are disappearing, replaced by halophytes and ephemerals adapted to salty soils. The increase in groundwater mineralization is leading to the drying up of riparian tugai forests and the migration or extinction of the unique wildlife there. Socio-economic damage and public health: the pollution and mineralization of groundwater directly affect the population's quality of life. In the groundwater wells used by a portion of the provincial population, the salt content exceeds standard limits. This can cause an increase in kidney stones and gastrointestinal diseases. The energy and financial costs required for water desalination and filtration have increased 1.5–2 times. Additionally, saline water seeping into building foundations leads to the corrosion of infrastructure and a reduction in its service life.

Conclusion. The research results indicate that the ecological crisis related to groundwater in the Syr Darya region can only be resolved through a comprehensive approach. In the coming decade (2026–2036), focus must be placed on the following priority areas. Equipping all observation wells in the province with automated sensors. This will allow for the monitoring of water levels and mineralization in real-time. It is also necessary to create digital maps that predict the direction of

groundwater movement. To fundamentally modernize land reclamation infrastructure, open collectors should be gradually replaced with closed (horizontal) drainage pipes to reduce evaporation and increase efficiency. It is advisable to increase the capacity of wastewater treatment plants in the cities of Gulistan and Shirin, thereby preventing nitrates and heavy metals from seeping into the groundwater. The artificial rise of groundwater levels must be halted by lining irrigation canals with concrete (increasing the Efficiency Coefficient to 0.90). Drip irrigation technology should be optimally applied as the most effective method for maintaining groundwater levels at a normal range. Establishing "biological pumps"-plantations of poplar, willow, and acacia trees (windbreak forests) in areas with high groundwater levels. Measures such as establishing strict protection zones around groundwater extraction wells and mandating "zero discharge" technologies for industrial enterprises will serve to improve the province's ecological state. The ecological stability of the Syr Darya region relies on a culture of groundwater management. If the above measures are not taken within the next 10 years, there is a risk that soil degradation could reduce the province's agricultural potential by up to 40%. Therefore, protecting this "hidden resource"-groundwater-is an urgent task that cannot be delayed.

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QISHLOQ XO‘JALIGIDA SIANOBAKTERIYALARNING BIOLOGIK VA AGROEKOLOGIK AHAMIYATI

Annotatsiya: *Bugungi kunda O‘zbekistonda qishloq xo‘jaligi yerlarining unumdorligi pasayib borishi, tuproqdagi organik moddalarning kamayishi hamda mineral o‘g‘itlardan me’yoridan ortiq foydalanish ekologik muammolarni yuzaga keltirmoqda. Tuproq unumdorligini oshirishning an’anaviy usullari qatorida biologik va mikrobiologik yondashuvlar ham muhim ahamiyat kasb etadi. Shu jihatdan sianobakteriyalar tuproqning biologik faolligini oshiruvchi, atmosfera azotini o‘zlashtiruvchi va ekologik xavfsiz bioo‘g‘it sifatida istiqbolli mikroorganizmlar hisoblanadi.*

Kalit so‘zlar: *sianobakteriya, Cyanophyta, ko‘k-yashil suvo‘tlar, Nostoc muscorum, azot fiksatsiyasi, bioo‘g‘it, siyanofag, tuproq unumdorligi.*

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BIOLOGICAL AND AGROECOLOGICAL SIGNIFICANCE OF CYANOBACTERIA IN AGRICULTURE

Annotation: *Today, in Uzbekistan, the decline in the fertility of agricultural lands, the reduction of organic matter in the soil, and the excessive use of mineral fertilizers are creating environmental problems. Along with traditional methods of increasing soil fertility, biological and microbiological approaches are also of great importance. In this regard, cyanobacteria are promising microorganisms that increase the biological activity of the soil, absorb atmospheric nitrogen, and are considered as environmentally safe biofertilizers.*

Keywords: *cyanobacteria, Cyanophyta, blue-green algae, Nostoc muscorum, nitrogen fixation, biofertilizer, cyanophage, soil fertility.*

Kirish. O‘zbekiston Respublikasida mustaqillik yillarida qishloq xo‘jaligini modernizatsiya qilish, sohaga innovatsion texnologiyalarni joriy etish, ekologik xavfsiz va resurstejamkor usullardan foydalanishga alohida e’tibor qaratilmoqda. Ayniqsa, tuproq unumdorligini tiklash, hosildorlikni oshirish hamda ekologik muvozanatni saqlash bugungi kunning dolzarb vazifalaridan biri hisoblanadi.

Qishloq xo‘jaligi yerlarining uzoq yillar davomida intensiv foydalanilishi natijasida tuproq tarkibidagi gumus miqdori kamayib, mikrobiologik faollik susaymoqda. Bunday sharoitda biologik faol mikroorganizmlardan foydalanish

muhim ilmiy-amaliy ahamiyat kasb etadi. Sianobakteriyalar ana shunday istiqbolli mikroorganizmlar qatoriga kiradi. Ular atmosfera azotini biologik yo‘l bilan o‘zlashtirib, tuproqni tabiiy ravishda boyitadi hamda o‘simliklar rivojlanishi uchun qulay muhit yaratadi.

O‘zbekiston Respublikasi Prezidentining 2021-yil 3-fevraldagi PF–6159-son Farmoni bilan tasdiqlangan “2021–2025-yillarda qishloq xo‘jaligida bilim va innovatsiyalar tizimini ustuvor rivojlantirish konsepsiyasi”da yer va suv resurslaridan samarali foydalanish, hosildorlikni oshirish, ilm-fan yutuqlarini amaliyotga joriy etish ustuvor vazifa sifatida belgilangan [1]. Mazkur vazifalarni amalga oshirishda mikrobiologik preparatlar va bioo‘g‘itlardan foydalanish muhim o‘rin tutadi.

Ipsimon sianobakteriyalarning umumiy tavsifi. Ipsimon sianobakteriyalar bir necha hujayralarning ketma-ket joylashishidan hosil bo‘lgan trixomalar shaklida rivojlanadi. Ular ko‘pincha shilimshiq qobiq bilan o‘ralgan bo‘lib, tashqi muhitning noqulay omillariga chidamliligini oshiradi. Nostoc muscorum kabi turlarda maxsus geterotsista hujayralari hosil bo‘lib, ular atmosfera azotini bog‘lash jarayonida ishtirok etadi.

Elektron mikroskop yordamida o‘tkazilgan tadqiqotlarda ipsimon sianobakteriyalarning murakkab ultrastrukturasi aniqlangan. Ayrim turlarida spiral shaklli ipchalar, himoya qobig‘i va viruslarga sezgir strukturalar mavjudligi qayd etilgan. Oqartiruvchi moddalar, ultrabinafsha nurlar hamda kuchli kimyoviy vositalar ta’sirida ularning hujayra qobig‘i deformatsiyaga uchrashi kuzatiladi [2].

Sianobakteriyalarning ayrim turlari siyanofaglar deb ataluvchi viruslar bilan zararlanadi. Sianofaglar sianobakteriya hujayrasiga kirib, uning metabolik faoliyatini izdan chiqaradi va hujayra lizisiga sabab bo‘ladi. Nostoc turkumiga mansub sianobakteriyalarni zararlovchi N–1, N–3T va N–4T siyanofaglari O‘zbekiston hududida ham aniqlangan [3].

Sianofaglarning ekologik va biologik ahamiyati. Sianofaglar — sianobakteriyalarni zararlovchi maxsus viruslar bo‘lib, ular suv ekotizimlarida mikroorganizmlar sonini boshqarishda muhim ekologik rol o‘ynaydi. Tadqiqotlarga ko‘ra, siyanofaglar suv havzalari, oqava suvlar, tuproq va sholi dalalarida keng tarqalgan.

Murodov M. va hamkorlari tomonidan olib borilgan tadqiqotlarda Nostoc muscorum kulturasida N–3T siyanofagining yuqori litik faollikka ega ekanligi aniqlangan. Ushbu siyanofag 12–16 soat ichida faol ko‘payib, hujayra lizisini yuzaga keltiradi [3].

AQSH, Hindiston, Rossiya va Ukraina hududlarida olib borilgan ilmiy izlanishlar siyanofaglarning suv havzalarida keng tarqalganligini ko‘rsatgan [5;6;7]. Ayrim hollarda siyanofaglar soni 1 ml suvda 10^{10} zarrachagacha yetishi aniqlangan. Bu esa ularning ekologik jarayonlarda faol ishtirok etishini ko‘rsatadi.

Shuningdek, sianobakteriyalar tuproq eroziyasini kamaytiradi, namlikni ushlab turadi va degradatsiyaga uchragan yerlarda biologik tiklanish jarayonlarini

tezlashtiradi. Ayniqsa, O‘zbekistonning sho‘rlangan va unumdorligi pasaygan hududlarida ulardan foydalanish yuqori samaradorlik berishi mumkin.

Xulosa. Sianobakteriyalar qishloq xo‘jaligida ekologik xavfsiz va iqtisodiy jihatdan samarali biologik resurs hisoblanadi. Ularning atmosfera azotini o‘zlashtirish, tuproq unumdorligini oshirish va o‘simliklarning o‘sishiga ijobiy ta’sir ko‘rsatish xususiyatlari katta ilmiy-amaliy ahamiyatga ega.

Bugungi kunda qishloq xo‘jaligida ekologik muammolarni kamaytirish, kimyoviy o‘g‘itlardan foydalanishni qisqartirish va biologik dehqonchilikni rivojlantirishda sianobakteriyalar asosidagi bioo‘g‘itlardan foydalanish muhim istiqbolli yo‘nalishlardan biri hisoblanadi. Shu bois ushbu mikroorganizmlarni chuqur o‘rganish, ularni ko‘paytirish texnologiyalarini ishlab chiqish va amaliyotga joriy etish dolzarb ilmiy vazifa bo‘lib qolmoqda.

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SYNTHESIS OF INHIBITORS FOR THE OIL AND GAS INDUSTRY BASED ON THE PROCESS OF ENANTIOSELECTIVE ALKYNATION OF BENZALDEHYDE AND ITS DERIVATIVES WITH THE PARTICIPATION OF PHENYLACETYLENE

Abstract: *Today, special attention is paid to the development of methods for the synthesis of biologically active substances based on the interaction of alkynes with organic compounds containing carbonyl, carboxyl and hydroxyl groups in their molecules, and the development of technologies for the production of a new generation of local drugs that can replace imports. In this work, for the first time, the enantioselective alkynylation reaction of benzaldehyde and a number of its derivatives using phenylacetylene in the $Zn(OTf)_2/TBAF{\cdot}3H_2O/NEt_3/MeCN$ catalytic system was studied. The effect of the nature and amounts of solvents, catalysts, reagents and substrates on the yield of the product in the synthesis of aromatic acetylene alcohols was systematically analyzed.*

Key words: *corrosion inhibitors, oil and gas industry, enantioselective alkynylation, benzaldehyde, phenylacetylene, acetylenic alcohols, organic synthesis.*

Introduction

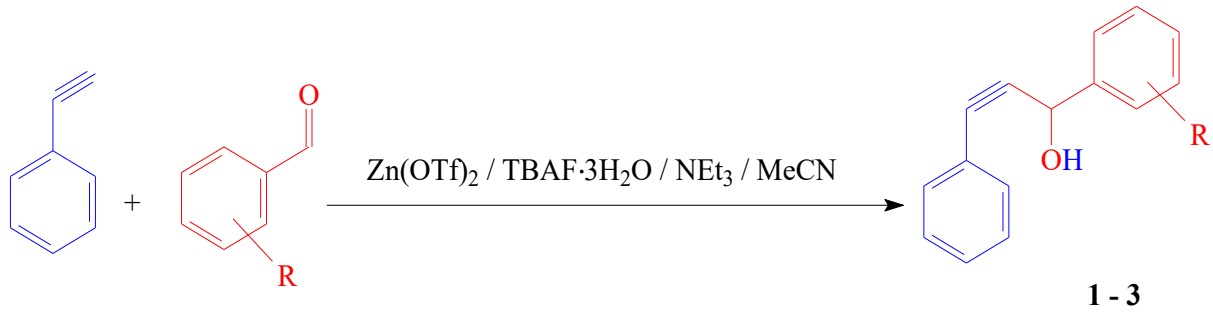
Today, the production of highly demanded preparations is increasing year by year in the world through the introduction of new innovative technologies in the synthesis of organic substances based on hydrocarbons. The use of active catalysts in the synthesis of acetylene alcohols from natural raw materials, the implementation of technological calculations for process control, the use of acetylene alcohols in the production of high-quality preparations in the rubber and technical, paint and varnish industries, in the medical field and in agriculture, and the synthesis of many new substances by introducing functional groups into their composition are of great importance. The presence of a triple bond in the molecule of acetylene alcohols, a hydroxyl group, a mobile active hydrogen in the hydroxyl group, as well as substituents and functional groups of various nature, gives them important properties. It is known that acetylene alcohols undergo an exchange reaction at the expense of hydrogen in the hydroxyl group, therefore, valuable organic compounds necessary for various industries are synthesized from such alcohols.

Literature review and methods

In the world, research is being conducted in a number of priority areas in the field of acetylene compound chemistry, including the synthesis of acetylene alcohols by catalytic ethynylation of elemental organic compounds, amines, aldehydes, and ketones with terminal alkynes using selective nanocatalysts NaOH/EtOH/DMSO, $InNTf_2$/BuOH/CH_2Cl_2, and $Pd(Ph_3P)_2Cl_2$/CuI/Et_3N [1-4].

Asymmetric alkynylation of some aldehydes of various nature, including 3-methylbutanal, cyclohexanal, benzaldehyde, p-fluorobenzaldehyde, m-methoxybenzaldehyde, 3-furancarbaldehyde and 3-thiophenaldehydes, was carried out in a weakly acidic medium at 40 °C in a complex catalytic system $InBr_3$/BINOL/Cu_2NMe/CH_2Cl_2 at intervals of 9-48 hours using phenylacetylene and its homologues, and the corresponding acetylenic alcohols were synthesized in 80-95% yield [5].

Based on the data presented in the literature, the following scheme of the alkynylation reaction of the aldehydes selected as the object of the study in the presence of phenylacetylene was proposed [6].



1 - 3

R= – $_o$Me (1); – $_o$ OMe (2); – $_м$ OMe (3).

Results and discussion

According to the purpose of the study, the effect of the nature of the selected aldehydes, the spatial structure of their molecules, optical activity and the nature of the substituents on the yield of acetylenic alcohols was studied. The effect of temperature, reaction time, nature of solvents and catalysts, concentration and molar amounts of starting materials on the course of chemical processes and product yield was systematically analyzed. Initially, the effect of the amount of catalyst on the yield of acetylenic alcohols was studied. In this case, the total amount of $Zn(OTf)_2$ and TBAF·$3H_2O$ selected as catalysts was taken in the ratio of 0.025 ÷ 0.075 mol.

When the total amount of $Zn(OTf)_2$/TBAF·$3H_2O$ was increased from 0.025 to 0.05 mol, the yield of acetylenic alcohols increased, including from 1– 52 to 74%, from 2– 44 to 68% and from 3– 57 to 79%. The amount of NEt_3 was taken in a ratio of 1.78:1 to the total amount or mass of $Zn(OTf)_2$/TBAF·$3H_2O$ (0.05 mol), and in this case, the catalytic activity of the catalysts and the susceptibility of the molecules in the system to the reaction passed through a maximum.

The duration of the reaction for the synthesis of acetylenic alcohols was also studied. The nature of the substituents in the molecule of the selected aldehydes, including the spatial effect of the shift of the electron cloud of the carbonyl group towards the oxygen atom, and the strong (high) polarization of the carbonyl group, resulted in an increase in the electron density at the oxygen atom.

This condition, in addition to determining the reactivity of aldehydes (facilitating the formation of the C-O bond under the influence of polar particles in the system), created sufficient conditions for the rapid and complete completion of the reaction or the addition of phenylacetylene. The reaction was initially carried out for 60 minutes, and the synthesized aromatic acetylenic alcohols were formed in high yield.

The effect of the molar amounts of substrate and reagents on the alkynylation reaction of selected aldehydes was studied.

According to the results of the study, acetylenic alcohols were synthesized with the highest yield when the phenylacetylene:aldehyde ratio was 2:1. During the reaction, when the amount of phenylacetylene was increased threefold compared to the amount of aldehydes, a large amount of intermediate products (π-complex) and triethylamine were completely consumed in the system, resulting in the formation of the trifluoromethylsulfonate salt of phenylacetylene, which sharply reduced the ability of $TBAF \cdot 3H_2O$ to fully demonstrate its catalytic ability, which led to the formation of a relatively low amount of aromatic acetylenic alcohols.

In addition, $TBAF \cdot 3H_2O$ was insufficient to activate almost half of the phenylethynyltrifluoromethylsulfonate alcohol with fluorine to form the $[Ph{\equiv}ZnFOTf]\text{-}[NBu_4]^+$ complex, resulting in an increase in the amount of by-products (mainly alcohol compounds) in the system. Similar to the above cases, the unreacted phenylacetylene partially combined with the aromatic acetylene alcohols formed as a result of the reaction to form vinyloxy compounds, which reduced the selectivity of the reaction.

Although the starting materials were taken in equimolar ratios, it was not possible to convert the starting materials into complete alcohols, but a sharp decrease in product yield was not observed. It was also found that a change in the process regime was required to convert the by-products formed in the system into the expected substances.

Conclusions

For the first time, 3-phenyl-1-o-tolylpropyn-2-ol-1, 1-(2-methoxyphenyl)-3-phenylpropyn-2-ol-1, and 1-(3-methoxyphenyl)-3-phenylpropyn-2-ol-1 were synthesized in the $Zn(OTf)_2/TBAF \cdot 3H_2O/NEt_3/MeCN$ catalytic system.

Based on the yield of acetylenic alcohols, the following relative activity series was determined according to the nature, location, and steric interaction of the substituents in the aldehyde molecule in the alkynylation reactions: 1-(2-methoxyphenyl)-3-phenylpropyn-2-ol-1 < 3-phenyl-1-*o*-tolylpropyn-2-ol-1 < 1-(3-methoxyphenyl)-3-phenylpropyn-2-ol.

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A REAL-TIME TOUR ROUTE DEVELOPMENT MECHANISM FOR TOURIST ZONES OF QASHQADARYO REGION

Abstract. *This article proposes a real-time tour route development mechanism for tourist zones of Qashqadaryo region. The mechanism combines tourist profiles, geographic information systems, GPS-based positioning, weather and road conditions, visitor load, object availability and service quality indicators. Unlike static tour packages, the proposed approach dynamically filters, scores and reorders tourist objects according to the current context and the personal constraints of the traveler. The paper presents a functional architecture, a mathematical scoring model, an algorithmic workflow and a scenario-based analytical evaluation. The results show that real-time route generation can improve route relevance, reduce wasted travel time and support more balanced use of historical, pilgrimage and ecotourism resources.*

Keywords: *Qashqadaryo tourism, real-time routing, smart tourism, GIS, GPS, dynamic optimization, tourist profile, eco-tourism, pilgrimage tourism.*

Introduction

Digital tourism has become an important instrument for presenting regional tourism potential, regulating tourist flows and improving the quality of services. Modern tourists usually expect not only a list of attractions, but also a flexible route that considers time, distance, weather, transport accessibility, personal interests and the actual availability of objects. Therefore, real-time route development is becoming one of the key components of smart tourism systems.

Qashqadaryo region has a rich tourism structure that includes historical cities, architectural monuments, pilgrimage sites, mountain landscapes, recreation zones and ecological routes. In practice, tourists may want to combine several types of travel in one day: historical sightseeing in Shahrisabz, nature-oriented travel in mountain areas, pilgrimage visits and local service points. Such diversity requires an adaptive mechanism that can select and sequence tourist objects according to changing conditions. The aim of this article is to develop a real-time tour route mechanism for tourist zones of Qashqadaryo region. The proposed mechanism treats tourist objects as nodes of a dynamic graph and evaluates each object according to cultural value, visitor interest, accessibility, service quality, crowding and risk. The route is then generated as a constrained optimization problem, where

the system searches for the most useful sequence of objects within the available time and travel limitations.

Related work and research gap

Tour route optimization is related to several research areas: geographic information systems, shortest path algorithms, vehicle routing, multi-criteria decision making and recommender systems. Classical routing algorithms can find the shortest or fastest path between two points, but tourism routing requires more complex logic because the most valuable route is not always the shortest one. The route must also reflect tourist motivation, object attractiveness, seasonal restrictions and the quality of local services. Many existing tour routes are offered as fixed packages. A fixed route is convenient for travel agencies, but it does not fully reflect real-time changes. A tourist object may be closed, traffic may increase, weather may reduce safety on mountain roads or the tourist may change interests during the trip. In such situations a static route becomes less effective.

The research gap addressed in this paper is the lack of a compact and practical mechanism that combines real-time data streams, tourist preferences and regional tourism objects into one route generation model. The proposed mechanism is designed as a software-oriented framework that can later be implemented as a web or mobile application for Qashqadaryo tourism management.

Proposed real-time route development mechanism

The proposed mechanism consists of five interacting blocks: tourist profile collection, real-time data acquisition, tourism object database, filtering and scoring module, and dynamic route optimization engine. The tourist profile includes interest type, available time, preferred transport mode, budget level, physical capability and language needs. Real-time data may include weather, road status, traffic speed, visitor density, event schedules and object availability.

The tourism object database stores information about each attraction: name, category, geographic coordinates, average visit duration, opening hours, seasonal limitations, service infrastructure, safety indicator and historical, cultural or natural value. This database must be regularly updated because tourism objects and services change over time. The filtering stage removes objects that do not satisfy the user constraints. For example, closed objects, unsafe routes, inaccessible mountain points or objects located outside the allowed time window are excluded. The scoring stage ranks the remaining objects. The optimization engine builds the final route and recalculates it when significant changes occur during the trip.

Figure 1. Real-time tour route development mechanism.

Mathematical model and algorithm

Tourist zones and service points are represented as a dynamic graph G = (V, E), where V is the set of tourist objects, transport nodes and service points, and E is the set of road segments between them. Each edge has a dynamic cost that changes according to time, traffic, road condition and weather.

$$C_{ij}(t) = w1*T_{ij}(t) + w2*D_{ij} + w3*W_{ij}(t) + w4*L_j(t) - w5*P_j(u) + w6*R_{ij}(t) \quad (1)$$

Here, Cij(t) is the dynamic cost between objects i and j; Tij(t) is real-time travel time; Dij is distance; Wij(t) is the influence of weather and road conditions; Lj(t) is visitor load at object j; Pj(u) is the personal preference score of user u for object j; and Rij(t) is the route risk indicator.

The overall selection score of a tourist object is calculated as follows:

$$S_j(t,u) = a1*H_j + a2*I_j(u) + a3*A_j(t) + a4*Q_j - a5*L_j(t) - a6*R_j(t) \quad (2)$$

In Eq. (2), Hj denotes historical, cultural or natural importance; Ij(u) represents matching with tourist interests; Aj(t) indicates current availability; Qj is service quality; Lj(t) is crowding; and Rj(t) is risk level. The optimal route is selected by maximizing the total object score while minimizing movement cost:

$$R^* = \arg\max_R \left[\sum S_j(t,u) - \lambda * \sum C_{ij}(t) \right], R \in \Omega(u,T_{max}) \quad (3)$$

The algorithm consists of the following steps: 1) receive tourist goals and constraints; 2) collect real-time data; 3) filter objects that are closed, unsafe or outside the time window; 4) calculate object scores and edge costs; 5) generate candidate routes; 6) select the best route; 7) monitor changes during the trip; and 8) rebuild the route if conditions change significantly.

Figure 2. Scenario graph of tourist objects and route factors.

Functional modules and data structure

When the mechanism is implemented as a software system, correct organization of the data layer is essential. The platform should maintain object cards, route rules, real-time API data, user profiles, transport parameters and analytics logs. Table 1 summarizes the main functional modules of the proposed mechanism.

Table 1. Functional modules of the real-time tour route development mechanism.

Module	Input data	Main function	Expected output
Tourist profile module	Interest, time, budget, mobility	Defines individual route constraints	Personalized route parameters
Real-time data module	GPS, weather, traffic, object load	Updates the current context	Dynamic route factors
Tourism object database	Coordinates, category, service, value	Stores regional tourism knowledge	Candidate attraction list
Filtering and scoring module	Object data and constraints	Removes unsuitable objects and ranks others	Prioritized object set
Optimization engine	Scores, costs, time limit	Generates and updates the route	Recommended route sequence
Analytics module	Logs and tourist feedback	Evaluates use and improves future routes	Management indicators

Scenario-based analytical evaluation

At the initial research stage, the mechanism can be evaluated through scenarios. Three typical tourist demands are considered: a historical-cultural route, a pilgrimage route and an ecotourism route. In each scenario, the proposed system is compared with a static route package. The evaluation is analytical and shows the expected methodological effect rather than final large-scale empirical proof.

Table 2. Scenario-based comparison of static and real-time route generation approaches

Route type	Method	Relevance	Time efficiency	Adaptability
Historical-cultural	Static package	0.72	0.68	Low
Historical-cultural	Proposed mechanism	0.88	0.82	High
Pilgrimage	Static package	0.69	0.65	Low
Pilgrimage	Proposed mechanism	0.84	0.80	High
Ecotourism	Static package	0.66	0.61	Medium
Ecotourism	Proposed mechanism	0.86	0.79	High

The comparison indicates that real-time routing can improve tourist route relevance because it connects tourist preferences with the current state of the region. The improvement is especially important for ecotourism routes, where weather, road conditions and safety constraints may change rapidly. For historical and pilgrimage routes, the main benefit is the ability to avoid closed or overcrowded objects and to suggest nearby alternative attractions.

Scientific novelty and practical value

The scientific novelty of the article is the formulation of a real-time route development mechanism that combines tourist profile data, GIS-based object representation, dynamic cost functions and multi-criteria object scoring. The model does not consider tourist attractions as isolated points; instead, it treats them as elements of a context-sensitive regional tourism graph. The practical value of the proposed mechanism is connected with digital tourism management in Qashqadaryo region. The mechanism can be used in a mobile application, tourist information center, regional tourism portal or travel agency decision-support system. It can help tourists receive relevant routes and help local authorities distribute visitor flows more evenly among historical, pilgrimage and ecological zones.

Conclusion

This article developed a real-time tour route mechanism for the tourist zones of Qashqadaryo region. The mechanism integrates tourist profile parameters, GIS/GPS data, real-time contextual information and a tourism object database. It uses filtering, scoring and dynamic route optimization to generate routes that better match user interests and current conditions. The mathematical model represents tourist zones as a dynamic graph and evaluates both movement cost and object attractiveness. Scenario-based analytical evaluation shows that the proposed mechanism can improve relevance, time efficiency and adaptability compared with static tour packages. Future research should focus on creating a prototype mobile application, integrating real API services, collecting tourist feedback and experimentally testing the mechanism in real travel conditions.

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RAQAMLI IQTISODIYOT TRANSFORMATSIYASIDA AI VA INNOVATSION TEXNOLOGIYALARNING O‘RNI

Annotatsiya: *Mazkur maqolada raqamli iqtisodiyotning yangi paradigmasi, sun’iy intellekt texnologiyalarining iqtisodiy rivojlanishdagi o‘rni hamda innovatsion va barqaror transformatsiya jarayonlari tahlil qilingan. AI texnologiyalarining samaradorlikni oshirish, resurslardan oqilona foydalanish va boshqaruv tizimlarini takomillashtirishdagi ahamiyati yoritilib, raqamli iqtisodiyotning istiqbolli rivojlanish yo‘nalishlari belgilangan*

Kalit so‘zlar: *raqamli iqtisodiyot, sun’iy intellekt, innovatsiyalar, barqaror transformatsiya, raqamlashtirish, iqtisodiy rivojlanish.*

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THE ROLE OF ARTIFICIAL INTELLIGENCE AND INNOVATIVE TECHNOLOGIES IN DIGITAL ECONOMY TRANSFORMATION

Abstract: *This article examines the new paradigm of the digital economy, the role of artificial intelligence technologies in economic development, and the processes of innovative and sustainable transformation. The study highlights the importance of AI in improving efficiency, optimizing resource utilization, and enhancing management systems, while identifying promising directions for the future development of the digital economy.*

Keywords: *digital economy, artificial intelligence, innovation, sustainable transformation, digitalization, economic development.*

Kirish.

Hozirgi globallashuv va tezkor texnologik rivojlanish sharoitida jahon iqtisodiyoti sifat jihatidan yangi bosqichga — raqamli iqtisodiyot paradigmasiga o‘tmoqda. Ushbu jarayon an’anaviy iqtisodiy tizimlarning tubdan o‘zgarishi, ishlab chiqarish va xizmat ko‘rsatish sohalarida raqamli texnologiyalarni keng joriy etish hamda iqtisodiy boshqaruv mexanizmlarining intellektuallashtirilishi bilan tavsiflanadi. Raqamli iqtisodiyotning shakllanishida sun’iy intellekt (AI), katta

ma’lumotlar (Big Data), bulutli hisoblash va boshqa innovatsion texnologiyalar hal qiluvchi rol o‘ynamoqda. Sun’iy intellekt texnologiyalari iqtisodiy jarayonlarni avtomatlashtirish, tahlil qilish va prognozlash imkoniyatlarini kengaytirib, qaror qabul qilish sifatini sezilarli darajada yaxshilamoqda. Natijada korxonalar va davlat boshqaruvi tizimlarida samaradorlik oshib, resurslardan foydalanish optimallashmoqda. Shu bilan birga, AI texnologiyalari innovatsion iqtisodiy muhitni shakllantirib, yangi biznes modellarning paydo bo‘lishiga zamin yaratmoqda.

Raqamli iqtisodiyotning yangi paradigmasida innovatsiyalar muhim harakatlantiruvchi kuch sifatida namoyon bo‘lmoqda. Innovatsion texnologiyalar ishlab chiqarish jarayonlarini modernizatsiya qilish, xizmatlar sifatini yaxshilash va iqtisodiy raqobatbardoshlikni oshirishga xizmat qiladi. Shu sababli, raqamli transformatsiya jarayonlari nafaqat texnologik, balki iqtisodiy va ijtimoiy o‘zgarishlarni ham o‘z ichiga oladi. Bundan tashqari, barqaror transformatsiya tamoyillari zamonaviy iqtisodiyotning muhim yo‘nalishlaridan biri hisoblanadi. Ekologik barqarorlik, resurslardan oqilona foydalanish va “yashil iqtisodiyot” tamoyillarini amalga oshirishda AI va innovatsion texnologiyalarning o‘rni tobora ortib bormoqda. Bu esa iqtisodiy rivojlanishning uzoq muddatli barqarorligini ta’minlashga xizmat qiladi.

Raqamli iqtisodiyotda sun’iy intellektning transformatsion roli

Sun’iy intellekt raqamli iqtisodiyotning eng muhim tarkibiy qismlaridan biri bo‘lib, u iqtisodiy tizimlarning transformatsiyasida asosiy intellektual drayver vazifasini bajaradi. AI texnologiyalari yordamida katta hajmdagi ma’lumotlarni qayta ishlash, tahlil qilish va prognozlash jarayonlari avtomatlashtiriladi. Bu esa iqtisodiy qarorlar qabul qilish jarayonining aniqligi va tezkorligini oshiradi.

Shuningdek, sun’iy intellekt korxonalarda ishlab chiqarish jarayonlarini optimallashtirib, operatsion xarajatlarni kamaytirishga xizmat qiladi. Aqlli algoritmlar yordamida resurslardan samarali foydalanish imkoniyati yaratiladi, bu esa iqtisodiy samaradorlikni sezilarli darajada oshiradi. Natijada “aqlli iqtisodiyot” modeli shakllanib, an’anaviy iqtisodiy tizimlar raqamli platformalarga o‘zgarmoqda.

Innovatsion texnologiyalar asosida iqtisodiy rivojlanish

Innovatsion texnologiyalar raqamli iqtisodiyotning asosiy harakatlantiruvchi kuchi sifatida iqtisodiy tizimlarning modernizatsiyasiga xizmat qiladi. Bulutli texnologiyalar, “Big Data” tahlili, blokcheyn va “Internet of Things” (IoT) tizimlari ishlab chiqarish va xizmat ko‘rsatish jarayonlarini yangi bosqichga olib chiqmoqda.

Ushbu texnologiyalar korxonalarga real vaqt rejimida ma’lumot almashish va qaror qabul qilish imkonini beradi. Natijada biznes jarayonlari yanada moslashuvchan, shaffof va samarali bo‘lib bormoqda. Innovatsiyalar iqtisodiyotda yangi raqamli biznes modellarining shakllanishiga ham turtki bermoqda.

Barqaror transformatsiya va yashil iqtisodiyot tamoyillari

Barqaror transformatsiya zamonaviy raqamli iqtisodiyotning ajralmas qismi hisoblanadi. Ushbu jarayon iqtisodiy o‘sish bilan birga ekologik muvozanatni

saqlash va resurslardan oqilona foydalanishni nazarda tutadi. Sun’iy intellekt texnologiyalari energiya samaradorligini oshirish, chiqindilarni kamaytirish va ekologik xavflarni prognoz qilishda muhim rol o‘ynamoqda. Shu bilan birga, “yashil iqtisodiyot” tamoyillari innovatsion texnologiyalar bilan uyg‘unlashgan holda barqaror rivojlanish modelini shakllantirmoqda. Bu esa nafaqat iqtisodiy, balki ekologik va ijtimoiy barqarorlikni ta’minlashga xizmat qiladi. Yashil iqtisodiyot tamoyillari asosida ishlab chiqarish jarayonlarida energiya tejamkor texnologiyalarni joriy etish, qayta tiklanuvchi energiya manbalaridan foydalanish va chiqindilarni qayta ishlash tizimlarini rivojlantirish muhim ahamiyat kasb etadi. Bu esa iqtisodiy o‘sishni ekologik xavfsizlik bilan uyg‘unlashtirish imkonini beradi.

Sun’iy intellekt texnologiyalari barqaror transformatsiya jarayonida muhim vosita sifatida xizmat qiladi. AI asosidagi monitoring tizimlari sanoat korxonalarida energiya sarfini tahlil qilish, chiqindilar miqdorini nazorat qilish va ekologik xavflarni oldindan prognozlash imkonini beradi. Natijada resurslardan foydalanish samaradorligi oshadi va ekologik zarar kamayadi. Shuningdek, “aqlli shaharlar” (smart cities) konsepsiyasi yashil iqtisodiyotning amaliy ifodalaridan biri hisoblanadi. Ushbu tizimlar transport, energiya, suv va chiqindilarni boshqarishda raqamli texnologiyalar va AI yechimlaridan foydalanadi. Bu esa shahar infratuzilmasining barqaror rivojlanishini ta’minlaydi.

Raqamli transformatsiyaning kelajak istiqbollari

Kelajakda raqamli iqtisodiyot yanada chuqur transformatsiyaga uchrashi kutilmoqda. Sun’iy intellekt, avtomatlashtirish va raqamli platformalar global iqtisodiy tizimning asosiy ustuniga aylanadi. Bu jarayon yangi kasblarning paydo bo‘lishi, mehnat bozori strukturasining o‘zgarishi va innovatsion ekotizimlarning shakllanishiga olib keladi. Raqamli transformatsiyaning kelajak istiqbollari global iqtisodiy tizimning yanada chuqur integratsiyalashuvi va texnologik intellektualizatsiyasi bilan belgilanadi. Kelgusida sun’iy intellekt faqat yordamchi vosita emas, balki iqtisodiy qarorlar qabul qilishning asosiy intellektual markaziga aylanishi kutilmoqda. Bu esa “data-driven economy” — ya’ni ma’lumotlarga asoslangan iqtisodiyot modelining yanada mustahkamlanishiga olib keladi.

Shu bilan birga, raqamli transformatsiya jarayonida avtonom tizimlar va robotlashtirilgan iqtisodiy platformalar keng joriy etiladi. Korxonalar va davlat boshqaruvi tizimlarida “aqlli agentlar” asosida ishlovchi tizimlar inson ishtirokisiz ham murakkab iqtisodiy jarayonlarni boshqarish imkoniyatiga ega bo‘ladi. Bu esa boshqaruv samaradorligini oshirish bilan birga, qaror qabul qilish tezligini ham keskin yaxshilaydi. Kelajakda raqamli iqtisodiyotda blokcheyn texnologiyalarining o‘rni ham sezilarli darajada ortadi. Ular iqtisodiy tranzaksiyalarda shaffoflik, xavfsizlik va ishonchlilikni ta’minlab, markazlashmagan iqtisodiy tizimlarning rivojlanishiga zamin yaratadi. Natijada, an’anaviy vositachilik tizimlari qisqarib, “peer-to-peer” iqtisodiy model keng tarqaladi.

Bundan tashqari, raqamli transformatsiya mehnat bozorini tubdan o‘zgartirishda davom etadi. Kelajakda inson va sun’iy intellekt o‘rtasidagi hamkorlik asosiy modelga aylanadi. Oddiy va takrorlanuvchi vazifalar to‘liq

avtomatlashtirilsa, ijodiy, tahliliy va strategik fikrlash talab qilinadigan kasblar yanada muhim ahamiyat kasb etadi. Shu sababli, ta’lim tizimida raqamli kompetensiyalar, algoritmik fikrlash va data savodxonligi asosiy yo‘nalishlarga aylanishi zarur bo‘ladi.

Shuningdek, kiberxavfsizlik va ma’lumotlarni himoya qilish raqamli transformatsiyaning eng muhim strategik yo‘nalishlaridan biri bo‘lib qoladi. Raqamli iqtisodiyot kengaygani sari kiberhujumlar xavfi ham ortadi, bu esa ilg‘or himoya texnologiyalarini joriy etishni talab qiladi. AI asosidagi kiberxavfsizlik tizimlari tahdidlarni real vaqt rejimida aniqlash va oldini olish imkonini beradi.

Umuman olganda, kelajak raqamli transformatsiyasi yuqori darajada intellektuallashtirilgan, avtomatlashtirilgan va global integratsiyalashgan iqtisodiy tizimni shakllantiradi. Bu jarayon iqtisodiy o‘sish sur’atlarini tezlashtiradi, innovatsion imkoniyatlarni kengaytiradi hamda jamiyatning ijtimoiy-iqtisodiy rivojlanish darajasini yangi bosqichga olib chiqadi.

Xulosa

Xulosa qilib aytganda, sun’iy intellekt raqamli iqtisodiyotning asosiy harakatlantiruvchi omili bo‘lib, iqtisodiy jarayonlarni avtomatlashtirish, optimallashtirish va samaradorligini oshirishga xizmat qilmoqda. AI texnologiyalarining ishlab chiqarish, moliya, logistika va davlat boshqaruvida qo‘llanilishi resurslardan oqilona foydalanish, xarajatlarni kamaytirish hamda tezkor qarorlar qabul qilish imkonini bermoqda.

Tadqiqot natijalari Big Data, bulutli hisoblash, IoT va blokcheyn texnologiyalari raqamli iqtisodiyotning yagona ekotizimini shakllantirishini ko‘rsatdi. Shu bilan birga, sun’iy intellektga asoslangan yechimlar barqaror transformatsiya, energiya tejamkorligi va ekologik monitoringni rivojlantirishda muhim ahamiyat kasb etadi.

Umuman, AI, innovatsiyalar va barqaror transformatsiya integratsiyasi iqtisodiy o‘sishni jadallashtirish, raqobatbardoshlikni oshirish hamda jamiyat farovonligini yuksaltirishning muhim omili hisoblanadi.

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A COMPARATIVE STUDY OF SEMANTIC EXTENSION IN THE KOREAN VERB 먹다 AND THE UZBEK VERB YEMOQ

Abstract. *This article presents a comparative analysis of the lexical-semantic features of the Korean verb 먹다 and the Uzbek verb yemoq, their place in the system of polysemy, and the main directions of their semantic extension. The study treats the primary meaning of both verbs, related to food consumption, as the semantic core and analyzes the psychological, social, physical, and phraseological meanings derived from it. The use of the Korean verb 먹다 in expressions such as 마음을 먹다 "to make up one's mind," 나이를 먹다 "to grow older," 욕을 먹다 "to be criticized," 칼이 먹다 "to cut well," and 써먹다 "to make use of," as well as Uzbek expressions such as gap yemoq "to receive a reprimand," tayoq yemoq "to be beaten," haqqini yemoq "to appropriate someone's share," azob yemoq "to suffer," and zang yemoq "to become rusty," is explained on the basis of mechanisms of semantic transfer. The article also highlights the common features of the two languages, along with their national and cultural differences, lexicographic interpretations, and subtle semantic distinctions that arise in translation.*

Keywords: *먹다, yemoq, polysemy, semantic extension, comparative semantics, cognitive linguistics, phraseological unit, Korean language, Uzbek language.*

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KOREYS TILIDAGI '먹다' VA O'ZBEK TILIDAGI "YEMOQ" FE'LLARINING MA'NO KENGAYISHINI QIYOSIY O'RGANISH

Annotatsiya. *Ushbu maqolada koreys tilidagi "먹다" va o'zbek tilidagi "yemoq" fe'llarining lug'aviy-semantik xususiyatlari, ularning ko'p ma'nolilik tizimidagi o'rni hamda ma'no kengayish yo'nalishlari qiyosiy jihatdan tahlil qilinadi. Tadqiqotda har ikki fe'lning dastlabki, ya'ni oziq-ovqatni iste'*

mol qilishga doir asosiy ma’nosi semantik markaz sifatida olinib, undan kelib chiqqan psixologik, ijtimoiy, jismoniy va frazeologik kengayishlar ko‘rib chiqiladi. Koreys tilidagi ‘먹다’ fe’lining ‘마음을 먹다’, ‘나이를 먹다’, ‘욕을 먹다’, ‘칼이 먹다’, ‘씨먹다’ kabi qo‘llanishlari hamda o‘zbek tilidagi “gap yemoq”, “tayoq yemoq”, “haqqini yemoq”, “azob yemoq”, “zang yemoq” singari birliklar semantik ko‘chish mexanizmlari asosida izohlanadi. Maqolada ikki til o‘rtasidagi umumiyliklar bilan birga, milliy-madaniy tafovutlar, leksikografik talqinlar va tarjima jarayonida yuzaga keladigan nozik farqlar ham yoritiladi.

Kalit so‘zlar: *먹다, yemoq, ko‘p ma’nolilik, polisemiya, ma’no kengayishi, qiyosiy semantika, kognitiv tilshunoslik, frazeologizm, koreys tili, o‘zbek tili.*

Kirish

Tilning lug‘aviy tarkibi doimiy ravishda harakatda bo‘lib, undagi birliklar inson tajribasi, madaniy muhit va ijtimoiy ehtiyojlar asosida yangi ma’no qatlamlari bilan boyib boradi. Ayniqsa kundalik nutqda faol qo‘llanadigan fe’llar ko‘p ma’nolilikka juda moyil bo‘ladi. Chunki fe’l nafaqat harakatni, balki holat, munosabat, baho, ruhiy kechinma va ijtimoiy jarayonlarni ham ifodalash imkoniyatiga ega. Koreys tilidagi “먹다” hamda o‘zbek tilidagi “yemoq” fe’llari ana shunday semantik faol birliklar qatoriga kiradi.

Mazkur ikki fe’lning asosiy ma’nosi oziq-ovqatni og‘iz orqali qabul qilish, iste’mol qilish harakati bilan bog‘liq. Biroq real nutqda ularning vazifasi bu chegarada qolib ketmaydi. ‘먹다’ koreys tilida ovqat yeyishdan tashqari, niyat qilish, yoshga to‘lish, tanqidga uchrash, foyda olish, zarar ko‘rish, biror moddaning singishi yoki vositaning ishlashi kabi ma’nolarni ham anglatishi mumkin. O‘zbek tilidagi “yemoq” esa ovqat iste’mol qilish bilan birga, birovning haqini o‘zlashtirish, dashnom eshitish, zarba olish, azob chekish, yemirilish, zanglash, javobgarlikka tortilish kabi ko‘plab ma’no sohalarida ishlatiladi.

Polisemiya va ma’no kengayishi masalasi leksik semantika, kognitiv tilshunoslik, tarjimashunoslik hamda chet tilini o‘qitish metodikasi uchun muhim nazariy va amaliy ahamiyatga ega. Bir so‘zning turli kontekstlarda qanday ma’no kasb etishini aniqlash o‘quvchiga matnni to‘g‘ri tushunishga, tarjimonga esa mos ekvivalentni tanlashga yordam beradi. Shu jihatdan ‘먹다’ va “yemoq” fe’llarining qiyosiy tahlili nafaqat ikki tilning lug‘aviy tizimini, balki ularda aks etgan madaniy tafakkur va konseptual dunyoqarashni ham ochib beradi.

Ushbu maqolaning maqsadi koreys tilidagi ‘먹다’ va o‘zbek tilidagi “yemoq” fe’llarining lug‘aviy ma’nolarini qayta tartibga solish, ularning ma’no kengayish yo‘nalishlarini aniqlash hamda o‘xshash va farqli jihatlarini qiyosiy-semantik asosda yoritishdan iborat. Tadqiqotda izohli lug‘atlar, nutqiy misollar va kognitiv semantika yondashuvlariga tayanilgan holda ma’no ko‘chishining asosiy mexanizmlari tahlil qilinadi.

‘먹다’ fe’lining lug‘aviy-semantik xususiyatlari

Koreys tilidagi ‘먹다’ fe’lining markaziy ma’nosi oziq-ovqat yoki ichimlikni og‘iz orqali qabul qilib, organizm ichiga o‘tkazish jarayonini bildiradi. Masalan, ‘밥을 먹다’ - ovqat yemoq, ‘사과를 먹다’ - olma yemoq kabi birikmalarda fe’l bevosita jismoniy harakatni ifodalaydi. Bu ma’no fe’lning semantik asosi bo‘lib, boshqa ko‘plab qo‘llanishlar aynan shu markazdan metaforik yoki metonimik yo‘l bilan kengayadi.

‘먹다’ning birinchi kengayish yo‘nalishi ichki qabul qilish va o‘zlashtirish konsepti bilan bog‘liq. Koreys tilida ‘마음을 먹다’ birikmasi so‘zma-so‘z “ko‘ngilni yemoq” emas, balki “qaror qilmoq, niyat qilmoq, ko‘ngilga tugmoq” ma’nosini bildiradi. Bu yerda jismoniy qabul qilish ruhiy qarorni ichki holat sifatida qabul qilishga ko‘chirilgan. Demak, ovqatni tanaga kiritish modeli ongda qaror yoki niyatni mustahkamlash modeli bilan bog‘lanadi.

Ikkinchi yo‘nalish yosh, vaqt va tajribani o‘zlashtirish bilan aloqador. ‘나이를 먹다’ birikmasi “yosh yemoq” tarzida tarjima qilinmaydi, balki “yoshi ulg‘aymoq”, “yoshga to‘lmoq” ma’nosini beradi. Bu holatda vaqt inson tomonidan bevosita iste’mol qilinadigan narsa emas, ammo hayot tajribasi inson ichki dunyosiga singib boradigan jarayon sifatida tasavvur qilinadi. Shu sababli koreys tilida vaqt va tajriba ham ‘먹다’ fe’li orqali ifodalanishi mumkin.

Uchinchi yo‘nalish ijtimoiy baho va tashqi ta’sirni qabul qilish bilan bog‘liq. Koreys tilidagi ‘욕을 먹다’ iborasi “haqorat eshitmoq”, “tanqidga uchramoq” ma’nolarida qo‘llanadi. Bunda subyekt faol iste’mol qiluvchi emas, balki tashqi salbiy ta’sirni qabul qiluvchi shaxs sifatida namoyon bo‘ladi. Shu jihatdan ‘먹다’ fe’li ayrim hollarda passiv yoki majhul holatni, ya’ni kishining o‘zi xohlamagan tarzda salbiy munosabatga duchor bo‘lishini ifodalaydi.

To‘rtinchi yo‘nalish moddiy singish va ta’sir o‘tkazish bilan bog‘liq. Koreys tilida ‘기름 먹은 종이’ - “moy singgan qog‘oz”, ‘풀이 잘 먹다’ - “ohor yaxshi singmoq”, ‘칼이 잘 먹다’ - “pichoq yaxshi o‘tmoq/kesmoq” kabi birliklarda ‘먹다’ fe’li predmetning boshqa moddani o‘ziga singdirishi yoki vositaning materialga ta’sir ko‘rsatishini anglatadi. Bu ma’no ham “ichiga olish” konseptidan kelib chiqqan bo‘lib, ovqat iste’moli modeli jonsiz predmetlar holatiga ko‘chirilgan.

Beshinchi yo‘nalish natija, foyda, zarar va sarf bilan bog‘liq. ‘이익을 먹다’ foyda olishni, ‘돈이 많이 먹다’ ko‘p pul ketishini, ‘한 골을 먹다’ esa sport o‘yinlarida gol o‘tkazib yuborishni anglatishi mumkin. Shu sabab ‘먹다’ fe’li koreys tilida faqat ijobiy qabul qilishni emas, balki yo‘qotish, sarflanish yoki salbiy natijaga duch kelishni ham ifodalash imkoniyatiga ega.

Shuningdek, ‘먹다’ ayrim fe’llardan keyin kelib, murakkab fe’l yoki yordamchi fe’lga yaqin vazifani bajaradi. Masalan, ‘잊어먹다’ - unutib yubormoq, ‘써먹다’ - foydalanib qolmoq, ‘팔아먹다’ - sotib yubormoq kabi birliklarda ‘먹다’ning dastlabki leksik ma’nosi susayadi va harakat natijasini, undan

foydalanish yoki uni yakunlab yuborish ma’nosini kuchaytiradi. Bu hodisa koreys tilidagi fe’l birikmalarining semantik moslashuvchanligini ko‘rsatadi.

“Yemoq” fe’lining lug‘aviy-semantik xususiyatlari

O‘zbek tilidagi “yemoq” fe’lining asosiy ma’nosi ham oziq-ovqatni iste’mol qilish, ovqatlanish harakatini bildiradi. “Non yemoq”, “osh yemoq”, “meva yemoq” kabi birikmalarda fe’l aniq predmet bilan kelib, moddiy iste’mol jarayonini ifodalaydi. Bu ma’no o‘zbek tilida ham fe’lning semantik markazi sanaladi va boshqa ma’nolar aynan shu markazdan kengayadi.

“Yemoq” fe’lining kengaygan ma’nolaridan biri o‘zlashtirish yoki nohaq egalik qilish bilan bog‘liq. “Birovning haqini yemoq”, “davlat mulkini yemoq”, “pora yemoq” kabi iboralarda yemoq ovqat iste’mol qilishni emas, balki moddiy yoki ma’naviy jihatdan birovga tegishli narsani o‘zlashtirishni bildiradi. Bu semantik ko‘chishda ovqatni o‘zlashtirish modeli mol-mulkni egallash modeliga o‘tgan.

Ikkinchi muhim yo‘nalish zarar ko‘rish va salbiy ta’sirga uchrash ma’nosidir. “Tayoq yemoq”, “musht yemoq”, “tarsak yemoq”, “gap yemoq”, “dashnom yemoq” kabi birliklarda subyekt faol harakat bajaruvchi emas, balki tashqi zarba yoki tanbehni qabul qiluvchi shaxs sifatida tasvirlanadi. Bunday iboralarda “yemoq” fe’li koreys tilidagi ‘욕을 먹다’ yoki ‘주먹을 먹다’ kabi birliklar bilan semantik jihatdan yaqinlashadi.

Uchinchi yo‘nalish ruhiy holat va ichki kechinmalar bilan bog‘liq. “G‘am yemoq”, “azob yemoq”, “ich-etini yemoq” kabi ifodalarda “yemoq” insonning ruhiy iztirobi, xavotiri yoki ichki siqilishini bildiradi. Bunda tashqi ovqatlanish harakati ichki ruhiy yemirilish, ya’ni psixologik holatning kuchli ta’siri sifatida talqin qilinadi. O‘zbek tilida bu turdagi iboralar obrazlilik va emotsional bo‘yoqdorlikka ega.

To‘rtinchi yo‘nalish yemirilish, chirish yoki moddaning buzilishi bilan bog‘liq. “Temirni zang yebdi”, “kitobni qurt yebdi”, “daraxtni hasharot yegan” kabi gaplarda fe’l jonsiz predmet yoki hayvon-hasharot ta’siri natijasida yuzaga kelgan yemirilishni bildiradi. Bu ma’no ham asosiy iste’mol konseptidan kelib chiqadi, biroq subyekt ko‘pincha inson emas, balki tabiatdagi ta’sir qiluvchi kuch sifatida namoyon bo‘ladi.

Beshinchi yo‘nalish frazeologik birliklarda ko‘rinadi. Masalan, “tazirini yemoq” - qilmishining jazosini tortmoq yoki saboq olmoq, “yemagan somsaga pul to‘lamoq” - qilmagan ish uchun javobgar bo‘lmoq, “boshini yemoq” - kimningdir halokatiga sabab bo‘lmoq kabi iboralar “yemoq” fe’lining to‘g‘ridan-to‘g‘ri lug‘aviy ma’nosidan uzoqlashgan holda, o‘zbek xalq tafakkuridagi obrazli ifoda imkoniyatlarini namoyon qiladi.

Ma’no kengayishining qiyosiy tahlili

Koreys tilidagi ‘먹다’ va o‘zbek tilidagi “yemoq” fe’llari semantik markaz jihatidan bir xil: har ikkisi ham oziq-ovqatni iste’mol qilish harakatini bildiradi. Shuning uchun ularning ko‘p ma’nolilik tizimida “qabul qilish”, “ichkariga o‘tkazish”, “o‘zlashtirish” va “ta’sirga uchrash” kabi umumiy konseptual

yo‘nalishlar mavjud. Biroq ushbu yo‘nalishlarning har bir tilda namoyon bo‘lish shakli bir xil emas.

Birinchi umumiylik shundaki, ikkala tilda ham yeyish harakati moddiy iste’moldan mavhum qabul qilishga ko‘chadi. Koreys tilidagi ‘마음을 먹다’ qaror qabul qilishni bildirsa, o‘zbek tilidagi “g‘am yemoq” ruhiy iztirobni ichki holat sifatida ifodalaydi. Har ikkala holatda ham insonning ichki dunyosi “ichga olish” modeli orqali tasvirlanadi. Biroq koreys tilida bu model ko‘proq qaror va niyatga, o‘zbek tilida esa ko‘proq g‘am, azob va xavotirga bog‘lanadi.

Ikkinchi umumiylik ijtimoiy salbiy ta’sirni qabul qilish bilan bog‘liq. ‘욕을 먹다’ va “gap yemoq” birliklari turli tillarga mansub bo‘lsa-da, ularning semantik asosida bir xil obraz yotadi: tanbeh yoki haqorat inson tomonidan xuddi tashqi narsa kabi qabul qilinadi. Bu yerda fe’lning agentivligi susayadi, subyekt esa salbiy ta’sirni boshidan kechiruvchi shaxs sifatida ko‘rinadi.

Uchinchi umumiylik nohaq o‘zlashtirish ma’nosida namoyon bo‘ladi. Koreys tilidagi ‘뇌물을 먹다’, ‘공금을 먹다’ kabi birliklar o‘zbek tilidagi “pora yemoq”, “haqqini yemoq”, “davlat mulkini yemoq” iboralari bilan yaqin ma’nodoshdir. Bu o‘rinda “yeyish” harakati ijtimoiy jihatdan qoralanadigan o‘zlashtirish, ya’ni birovning haqqini ichki mulkka aylantirish ma’nosiga ko‘chadi.

Farqli jihatlardan biri shundaki, koreys tilida ‘먹다’ fe’li ayrim jonsiz predmetlar va vositalar ta’sirini ifodalashda kengroq qo‘llanadi. Masalan, ‘칼이 잘 먹다’ birikmasida pichoqning yaxshi kesishi, ‘풀이 잘 먹다’ birikmasida esa ohorning matoga yaxshi singishi nazarda tutiladi. O‘zbek tilida bunday holatlarda odatda “o‘tmoq”, “kesmoq”, “singmoq” kabi boshqa fe’llar ishlatiladi. Demak, koreys tilida ‘먹다’ fe’lining instrumental va fizik ta’sir sohasidagi qo‘llanishi nisbatan faolroqdir.

Yana bir farq shundaki, koreys tilida ‘먹다’ fe’li murakkab fe’llar tarkibida mahsuldor qo‘llanadi. ‘잊어먹다’, ‘써먹다’, ‘팔아먹다’ kabi birliklarda u asosiy fe’lga qo‘shimcha semantik rang beradi. O‘zbek tilida esa “yemoq” bunday grammatiklashgan yordamchi fe’l vazifasida faol ishlatilmaydi; u ko‘proq frazeologik birikmalar tarkibida obrazli ma’no hosil qiladi. Shu sababli koreys tilida ‘먹다’ning grammatik-semantik imkoniyati, o‘zbek tilida esa “yemoq”ning frazeologik-obrazli imkoniyati kuchliroq namoyon bo‘ladi.

Tarjima jarayonida ushbu farqlar alohida e’tibor talab qiladi. Chunki ‘먹다’ning har bir qo‘llanishi o‘zbek tiliga “yemoq” bilan tarjima qilinavermaydi. Masalan, ‘나이를 먹다’ – “yosh yemoq” emas, balki “yoshi ulg‘aymoq”; ‘돈이 많이 먹다’ – “pul ko‘p yedi” emas, balki “ko‘p pul ketdi”; ‘칼이 먹다’ – “pichoq yedi” emas, balki “pichoq o‘tdi/kesdi” tarzida beriladi. Xuddi shuningdek, o‘zbek tilidagi “azob yemoq” yoki “ich-etini yemoq” birliklari ham koreys tiliga kontekstga qarab boshqa fe’llar bilan tarjima qilinishi mumkin.

Qiyosiy tahlil shuni ko‘rsatadiki, koreys tilidagi ‘먹다’ va o‘zbek tilidagi “yemoq” fe’llari dastlab ovqat iste’mol qilish ma’nosiga ega bo‘lsa-da, har ikki tilda

ularning semantik imkoniyatlari ancha kengaygan. Masalan, koreys tilidagi ‘밥을 먹다’ va o‘zbek tilidagi “osh yemoq” birliklarida ovqat iste’mol qilish asosiy semantik markazni tashkil etadi. Biroq ruhiy holatni ifodalashda bu ikki til o‘rtasida farqli jihatlar ko‘zga tashlanadi. Koreys tilidagi ‘마음을 먹다’ birikmasida “ichga olish” modeli qaror qabul qilish, niyat qilish ma’nosiga bog‘lansa, o‘zbek tilidagi “g‘am yemoq” birikmasida bu model ruhiy kechinma, tashvish va iztirobni ifodalashga xizmat qiladi.

Salbiy tashqi ta’sirni ifodalashda ham ikki tilda ma’lum o‘xshashlik mavjud. Masalan, koreys tilidagi ‘욕을 먹다’ va o‘zbek tilidagi “gap yemoq” birliklarida tanbeh, haqorat yoki dashnom tashqi ta’sir sifatida qabul qilinadi. Bunda subyekt faol harakat qiluvchi emas, balki salbiy munosabatga duchor bo‘luvchi shaxs sifatida namoyon bo‘ladi. Nohaq o‘zlashtirish ma’nosida esa koreys tilidagi ‘뇌물을 먹다’ va o‘zbek tilidagi “haqqini yemoq” birliklari o‘zaro yaqin semantik asosga ega. Har ikki holatda ham “yeyish” harakati ijtimoiy jihatdan qoralanadigan o‘zlashtirish, ya’ni noqonuniy yoki adolatsiz egallash ma’nosiga ko‘chgan.

Fizik ta’sirni ifodalashda esa tillar o‘rtasidagi farq yanada yaqqol ko‘rinadi. Koreys tilida ‘칼이 잘 먹다’ birikmasida ‘먹다’ fe’li vositaning materialga ta’sir ko‘rsatishini, ya’ni pichoqning yaxshi kesishini bildiradi. O‘zbek tilida esa bu ma’no “yemoq” fe’li bilan emas, balki “o‘tmoq”, “kesmoq” kabi boshqa fe’llar orqali ifodalanadi. Demak, koreys tilida ‘먹다’ fe’lining semantik kengayishi ayrim hollarda jonsiz predmetlar va ularning fizik ta’siri doirasiga ham ko‘chgan bo‘lsa, o‘zbek tilida bunday holatlar boshqa leksik vositalar orqali beriladi.

Tahlil shuni ko‘rsatadiki, ‘먹다’ va “yemoq” fe’llarining ma’no kengayishida bir necha kognitiv mexanizm faol ishtirok etadi. Birinchisi - metaforik ko‘chish. Bunda jismoniy yeyish harakati ruhiy, ijtimoiy yoki mavhum jarayonlarni ifodalashga xizmat qiladi. ‘마음을 먹다’ va “g‘am yemoq” birliklari aynan shu mexanizmga asoslanadi.

Ikkinchi mexanizm metonimik ko‘chishdir. Masalan, ovqatni iste’mol qilish natijasida uni o‘zlashtirish jarayoni boshqa sohalarga ko‘chadi: “pora yemoq”, “haqqini yemoq”, ‘이익을 먹다’ kabi birliklarda yeyish o‘zlashtirish natijasini bildiradi. Bu yerda harakatning o‘zi emas, uning oqibati - egalik qilish yoki ichki mulkka aylantirish markazga chiqadi.

Uchinchi mexanizm subyekt va obyekt munosabatining o‘zgarishidir. Asosiy ma’noda subyekt faol, obyekt esa iste’mol qilinuvchi narsa hisoblanadi. Kengaygan ma’nolarda esa subyekt ko‘pincha ta’sirga uchrovchi shaxsga aylanadi: ‘욕을 먹다’, “gap yemoq”, “tayoq yemoq” kabi birliklarda kishi salbiy ta’sirni qabul qiluvchi sifatida tasvirlanadi. Bu holat ko‘p ma’nolilik tizimida agentivlik darajasining pasayishini ko‘rsatadi.

To‘rtinchi mexanizm grammatiklashuv va frazeologizatsiyadir. Koreys tilida ‘먹다’ murakkab fe’llar tarkibida grammatiklashishga moyil bo‘lsa, o‘zbek tilida “yemoq” ko‘proq frazeologik birliklarda mustahkamlanadi. Natijada koreys tilidagi

semantik kengayish ko‘pincha fe’l birikmalari orqali, o‘zbek tilidagi kengayish esa obrazli iboralar orqali yuzaga chiqadi.

Demak, ikki tilda ham ma’no kengayishi tasodifiy emas, balki inson tanasi, kundalik tajriba, ijtimoiy munosabat va madaniy tafakkur bilan bog‘liq konseptual modellar asosida shakllanadi. “Yeyish” harakati inson tajribasidagi eng asosiy biologik jarayonlardan biri bo‘lgani uchun u mavhum va murakkab jarayonlarni ifodalashda qulay semantik tayanch vazifasini bajaradi.

Xulosa

Koreys tilidagi ‘먹다’ va o‘zbek tilidagi “yemoq” fe’llarining qiyosiy tahlili shuni ko‘rsatadiki, har ikkala birlik ham oddiy ovqat iste’mol qilish ma’nosidan boshlab juda keng semantik maydonga ega bo‘lgan ko‘p ma’noli fe’llardir. Ularning markaziy ma’nosi bir xil bo‘lsa-da, kengaygan ma’nolar tizimi har bir tilning grammatik tuzilishi, milliy-madaniy tafakkuri va nutqiy an’analari bilan uzviy bog‘liq holda shakllangan.

‘먹다’ fe’li koreys tilida jismoniy iste’moldan tashqari, niyat qilish, yoshga to‘lish, tanqidga uchrash, moddiy singish, vositaning ta’siri, foyda olish, zarar ko‘rish va murakkab fe’l tarkibida qo‘shimcha semantik ma’no berish kabi vazifalarni bajaradi. Ayniqsa uning ‘잊어먹다’, ‘써먹다’, ‘팔아먹다’ kabi birliklarda qo‘llanishi koreys tilida bu fe’lning grammatiklashuv imkoniyati yuqoriligini ko‘rsatadi.

O‘zbek tilidagi “yemoq” esa asosiy iste’mol ma’nosidan tashqari, birovning haqini o‘zlashtirish, tanbeh yoki zarba qabul qilish, ruhiy iztirob chekish, yemirilish, zanglash va frazeologik obraz yaratish kabi ma’nolarda faol ishlatiladi. “Gap yemoq”, “tayoq yemoq”, “azob yemoq”, “haqqini yemoq”, “tazirini yemoq” singari birliklar o‘zbek tilida ushbu fe’lning emotsional va frazeologik salohiyati kuchli ekanligini tasdiqlaydi.

Qiyosiy nuqtayi nazardan qaralganda, ikki tilda ham “yeyish” konsepti qabul qilish, o‘zlashtirish va ta’sirga uchrash kabi umumiy semantik modellarga asoslanadi.

Farqli tomoni shundaki, koreys tilida ‘먹다’ning fizik ta’sir va yordamchi fe’lga yaqin qo‘llanishlari nisbatan keng, o‘zbek tilida esa “yemoq”ning obrazli va emotsional frazeologik qo‘llanishlari kuchliroqdir. Bu holat tarjima, lug‘at tuzish va koreys tilini o‘zbek auditoriyasiga o‘rgatish jarayonida alohida hisobga olinishi zarur.

Xulosa qilib aytganda, ‘먹다’ va “yemoq” fe’llarining ma’no kengayishi inson tajribasining tilga ko‘chish jarayonini yaqqol ko‘rsatadi. Mazkur fe’llarni qiyosiy o‘rganish ikki tilning semantik tizimini chuqurroq anglashga, ko‘p ma’noli so‘zlarni tarjima qilishda aniqlikka erishishga ҳамда koreys va o‘zbek tillari o‘rtasidagi lingvomadaniy munosabatlarni yanada to‘liq yoritishga xizmat qiladi.

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Qo'qonDU

ELEKTROKIMYOVIY USULDA SANOAT CHIQINDI SUVLARIDAN FOYDALI KOMPONENTLARNI AJRATIB OLISH VA ULARNI QAYTA ISHLASH TEXNOLOGIYASINI ASOSLASH

Annotatsiya: *Mazkur maqolada sanoat chiqindi suvlaridan foydali komponentlarni elektrokimyoviy usullar yordamida ajratib olish va ularni qayta ishlash texnologiyasini ilmiy asoslash masalasi tahlil qilindi. Sanoat oqova suvlari tarkibida mis, nikel, rux, xrom, kadmiy, qo'rg'oshin, kumush, oltin kabi metall ionlari, shuningdek ammoniy, fosfat, sulfat, xlorid, borat va boshqa noorganik komponentlar mavjud bo'lishi mumkin. An'anaviy yondashuvda bunday komponentlar "ifloslantiruvchi modda" sifatida ko'riladi va reagentli cho'ktirish, neytrallash yoki sorbsiya orqali chiqindi shlamga o'tkaziladi. Biroq zamonaviy resurs tejamkor yondashuvda sanoat chiqindi suvlari ikkilamchi xomashyo manbasi sifatida baholanadi. Elektrokimyoviy texnologiyalar — elektrocho'ktirish, elektrolitik qaytarish, elektrokoagulyatsiya, elektrodializ, membranali elektrokimyoviy ajratish, kapasitativ deionizatsiya va bioelektrokimyoviy tizimlar — foydali komponentlarni metall, tuz, kontsentrat, gaz yoki qattiq fazali mahsulot shaklida ajratib olish imkonini beradi. Ilmiy adabiyotlarda elektrokimyoviy texnologiyalar yordamida metallar, ozuqa elementlari, oltingugurt birikmalari, vodorod va boshqa qiymatli mahsulotlarni oqova suvdan qayta olish mumkinligi qayd etilgan; shu bilan birga murakkab tarkibli chiqindi suvlar uchun bitta bosqichli jarayon ko'pincha yetarli emasligi va ko'p bosqichli yoki membranali-biologik integratsiyalangan sxemalar zarurligi ta'kidlanadi. Maqolada foydali komponentlarni ajratib olish texnologiyasi faqat tozalash darajasi bilan emas, balki komponentni qayta ishlashga yaroqli mahsulotga aylantirish, energiya sarfi, elektrod materiali sarfi, shlam miqdori, mahsulot tozaligi, iqtisodiy samaradorlik va ekologik xavfsizlik bilan birgalikda baholanishi kerakligi asoslandi. Tadqiqot natijalari sanoat chiqindi suvlarini elektrokimyoviy qayta ishlashda eng maqbul yondashuv selektiv ajratish, konsentrlash, elektrokimyoviy qaytarish, cho'kmani qayta ishlash va tozalangan suvni qayta foydalanishga yo'naltirishdan iborat kompleks texnologik zanjir ekanini ko'rsatdi.*

Kalit so'zlar: *sanoat chiqindi suvlari, elektrokimyoviy tozalash, foydali komponentlar, elektrocho'ktirish, elektrokoagulyatsiya, elektrodializ, metallarni ajratib olish, resurs tejamkorlik, ikkilamchi xomashyo, aylanma iqtisodiyot, elektrod, energiya sarfi.*

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SUBSTITUTION OF THE TECHNOLOGY FOR SEPARATION OF USEFUL COMPONENTS FROM INDUSTRIAL WASTEWATERS BY ELECTROCHEMICAL METHOD AND THEIR RECYCLING

Abstract: *This article analyzes the issue of scientific substantiation of the technology for the extraction of useful components from industrial wastewater using electrochemical methods and their processing. Industrial wastewater may contain metal ions such as copper, nickel, zinc, chromium, cadmium, lead, silver, gold, as well as ammonium, phosphate, sulfate, chloride, borate and other inorganic components. In the traditional approach, such components are considered as "pollutants" and are transferred to the waste sludge by reagent precipitation, neutralization or sorption. However, in a modern resource-saving approach, industrial wastewater is evaluated as a secondary source of raw materials. Electrochemical technologies - electrodeposition, electrolytic recovery, electrocoagulation, electrodialysis, membrane electrochemical separation, capacitive deionization and bioelectrochemical systems - allow the extraction of useful components in the form of metal, salt, concentrate, gas or solid phase products. The scientific literature notes that metals, nutrients, sulfur compounds, hydrogen, and other valuable products can be recovered from wastewater using electrochemical technologies; however, it is emphasized that a single-stage process is often insufficient for wastewaters with complex composition and that multi-stage or membrane-biological integrated schemes are necessary. The article argues that the technology for extracting useful components should be evaluated not only by the degree of purification, but also in conjunction with the conversion of the component into a recyclable product, energy consumption, electrode material consumption, sludge volume, product purity, economic efficiency, and environmental safety. The results of the study showed that the most optimal approach to the electrochemical treatment of industrial wastewater is a complex technological chain consisting of selective separation, concentration, electrochemical recovery, sludge treatment, and re-use of the treated water.*

Keywords: *industrial wastewater, electrochemical treatment, useful components, electrodeposition, electrocoagulation, electrodialysis, metal separation, resource saving, secondary raw materials, circular economy, electrode, energy consumption.*

Kirish

Sanoat ishlab chiqarishida hosil bo‘ladigan chiqindi suvlar tarkibi odatiy maishiy oqova suvlarga nisbatan ancha murakkab bo‘lib, ularning tarkibida erigan metall ionlari, mineral tuzlar, kislotalar, ishqorlar, kompleks hosil qiluvchi reagentlar, sirt faol moddalar, neft mahsulotlari, suspenziyalar va ayrim holatlarda zaharli aralashmalar uchraydi. Galvanik sexlar, metallurgiya korxonalari, konchilik va gidrometallurgiya jarayonlari, elektronika sanoati, akkumulyator ishlab chiqarish, kimyo sanoati, mineral o‘g‘itlar ishlab chiqarish, charm va bo‘yoq

sanoati, mashinasozlik hamda energetika obyektlari bunday oqova suvlarning asosiy manbalari hisoblanadi. Muammo shundaki, ushbu suvlar tarkibidagi ko‘plab komponentlar ekologik xavf tug‘diradi, lekin bir vaqtning o‘zida iqtisodiy qiymatga ham ega. Masalan, mis, nikel, rux, kobalt, xrom, kumush, oltin, palladiy yoki litiy kabi metallar chiqindi suv tarkibida kam konsentratsiyada uchrashi mumkin, ammo katta hajmli oqimlarda ularning umumiy miqdori sezilarli iqtisodiy ahamiyat kasb etadi. Shuningdek, ammoniy, fosfat va sulfat kabi noorganik komponentlar o‘g‘it, kimyoviy reagent yoki texnologik xomashyo sifatida qayta baholanishi mumkin. Shu sababli sanoat chiqindi suvlarini oddiy “zararsizlantiriladigan oqim” deb emas, balki “suyuq ikkilamchi xomashyo” sifatida ko‘rish zarur. Bu yondashuv aylanma iqtisodiyot tamoyillariga mos keladi: chiqindining tarkibidagi foydali modda texnologik siklga qaytariladi, birlamchi xomashyo sarfi kamayadi, suv resurslari tejaladi va shlam hosil bo‘lishi qisqaradi. 2024-yilda chop etilgan sharhlarda chiqindi suvdan noorganik qiymatli mahsulotlarni, jumladan metallar va ozuqa elementlarini qayta olish aylanma iqtisodiyot modelining muhim yo‘nalishi sifatida baholangan; elektrokimyoviy jarayonlar esa og‘ir metall ionlarini metall shaklida qayta olish, ammoniy va fosfatlarni ajratish, sulfatlarni qayta ishlash hamda suvni qayta foydalanishga tayyorlash imkonini beruvchi istiqbolli usullar qatoriga kiritilgan. An’anaviy reagentli tozalash usullarida metall ionlari odatda gidroksid yoki sulfid cho‘kmalari shaklida ajratiladi, ammo bunday cho‘kma ko‘pincha aralash, yuqori namlikli, qayta ishlashga noqulay va ikkilamchi xavfli chiqindi bo‘lib qoladi. Elektrokimyoviy usullarning ustunligi shundaki, ularda elektron asosiy “reagent” vazifasini bajaradi, jarayon tok kuchi va kuchlanish orqali boshqariladi, kimyoviy reagent sarfi kamayadi, selektiv qaytarish yoki konsentrlash imkoniyati paydo bo‘ladi va ayrim komponentlarni bevosita metall, kontsentrat yoki tuz shaklida ajratish mumkin. Biroq bu texnologiyani haddan tashqari ideal ko‘rsatish ham noto‘g‘ri. Elektrokimyoviy jarayonning samaradorligi oqova suvning pH qiymati, elektr o‘tkazuvchanligi, ion tarkibi, kompleks hosil qiluvchi moddalar mavjudligi, elektrod materiali, tok zichligi, massa almashinish sharoiti, harorat, elektrodlar oralig‘i, membrana turi, katod va anod potensiali hamda cho‘kma tarkibiga bog‘liq. Agar ushbu omillar hisobga olinmasa, texnologiya amalda qimmat, sekin yoki barqaror bo‘lmagan jarayonga aylanadi. Shuning uchun ushbu maqolaning maqsadi sanoat chiqindi suvlaridan foydali komponentlarni elektrokimyoviy usulda ajratib olish va ularni qayta ishlash texnologiyasini ilmiy asoslash, asosiy elektrokimyoviy yo‘nalishlarni solishtirish, ularning afzallik va cheklovlarini aniqlash hamda sanoat amaliyoti uchun ratsional texnologik sxema taklif etishdan iborat.

Materiallar va metodlar

Tadqiqot nazariy-tahliliy, texnologik va ilmiy-uslubiy yondashuv asosida olib borildi. Tadqiqot obyekti sifatida tarkibida foydali komponentlar mavjud bo‘lgan sanoat chiqindi suvlari qabul qilindi; ularga galvanik yuvish suvlari, gidrometallurgik eritmalar, metall yuzalarini ishlov berishdan keyingi kislota-ishqorli oqimlar, elektronika chiqindilarini yuvish eritmalari, akkumulyator ishlab

chiqarish va qayta ishlash oqovalari, kon-metallurgiya drenaj suvlari, mineral o‘g‘itlar va kimyoviy ishlab chiqarish oqovalari kiradi. Tadqiqot predmeti sifatida foydali komponentlarni elektrokimyoviy ajratish, konsentrlash, qaytarish, cho‘ktirish va keyingi qayta ishlash mexanizmlari belgilandi. Metodik jihatdan birinchi bosqichda oqova suv tarkibi kimyoviy guruhlarga ajratildi: metall ionlari, qimmatbaho metallar, og‘ir metallar, ishqoriy va ishqoriy-yer metallari, ozuqa elementlari, mineral anionlar, kislota-ishqor qoldiqlari va kompleks birikmalar. Ikkinchi bosqichda har bir komponent uchun mos elektrokimyoviy ajratish yo‘nalishi tanlandi. Metall ionlari uchun elektrocho‘ktirish va elektrolitik qaytarish, kation-anion tuzlari uchun elektrodializ va bipolar membranali elektrodializ, fosfat va ammoniy uchun elektrokimyoviy induksiyalangan cho‘ktirish yoki membranali ajratish, yuqori minerallashgan oqimlar uchun elektrodializ va kapasitativ deionizatsiya, aralash kolloid-metal tizimlari uchun elektrokoagulyatsiya ko‘rib chiqildi. Uchinchi bosqichda jarayon samaradorligi texnologik mezonlar orqali baholandi: ajratib olish darajasi, mahsulot tozaligi, energiya sarfi, elektrod sarfi, shlam hosil bo‘lishi, reagent ehtiyoji, membrana yoki elektrod barqarorligi, qayta ishlangan komponentning bozor qiymati va tozalangan suvni qayta ishlatish imkoniyati. Elektrokimyoviy texnologiyalarning asosiy afzalliklari sifatida yuqori moslashuvchanlik, avtomatlashtirish qulayligi, reagent sarfining pastligi, kam shlam hosil bo‘lishi va resurs qayta tiklash imkoniyati ko‘rsatiladi; biroq adabiyotlarda ularni sanoatga o‘tkazish uchun energiya sarfini kamaytirish, mahsulot tozaligini oshirish va murakkab tarkibli oqimlarda ko‘p bosqichli integratsiyalangan sxemalarni qo‘llash zarurligi alohida ta’kidlangan. Jarayonning miqdoriy baholanishi uchun quyidagi asosiy ko‘rsatkichlardan foydalanildi: ajratib olish samaradorligi η=(C0−Ct)/C0·100%\eta=(C_0-C_t)/C_0\cdot100\%η=(C0−Ct)/C0·100%, bu yerda C0C_0C0 — komponentning boshlang‘ich konsentratsiyasi, CtC_tCt — jarayondan keyingi konsentratsiyasi; elektrod materialining nazariy sarfi Faradey qonuni bo‘yicha m=I·t·M/(z·F)m=I\cdot t\cdot M/(z\cdot F)m=I·t·M/(z·F), bu yerda III — tok kuchi, ttt — vaqt, MMM — ajratilayotgan moddaning molyar massasi, zzz — elektronlar soni, FFF — Faradey doimiysi; energiya sarfi E=U·I·t/VE=U\cdot I\cdot t/VE=U·I·t/V, bu yerda UUU — hujayra kuchlanishi, VVV — ishlov berilgan suv hajmi. Bundan tashqari, qayta ishlashga yaroqlilik koeffitsiyenti sifatida Kq=Mfoydali/Mcho‘kmaK_q=M_{foydali}/M_{cho‘kma}Kq=Mfoydali /Mcho‘kma taklif etildi; bu ko‘rsatkich ajratilgan cho‘kma yoki katod mahsulotidagi foydali komponent ulushini baholaydi. Agar KqK_qKq past bo‘lsa, jarayon suvni tozalaydi, ammo resursni qayta ishlashga yaroqli mahsulot bermaydi; agar KqK_qKq yuqori bo‘lsa, texnologiya nafaqat ekologik, balki iqtisodiy jihatdan ham asosli bo‘ladi. Metodik tahlilda elektrokimyoviy tizimlar ikki asosiy guruhga ajratildi: birinchisi — komponentni qattiq mahsulotga aylantiruvchi jarayonlar, ya’ni elektrocho‘ktirish, elektrokimyoviy qaytarish, elektrokoagulyatsiya va elektrokimyoviy cho‘ktirish; ikkinchisi — komponentni kontsentrlovchi jarayonlar, ya’ni elektrodializ, membranali elektrokimyoviy ajratish va kapasitativ

deionizatsiya. Bu farqlash muhim, chunki qattiq mahsulot beruvchi texnologiyada asosiy vazifa mahsulot tozaligi va ajratish selektivligi bo‘lsa, kontsentrlash texnologiyasida asosiy vazifa ionlarni kerakli kameraga o‘tkazish, membrana ifloslanishini kamaytirish va keyingi qayta ishlash uchun yetarli konsentratsiyaga erishishdir. Elektrodializ bo‘yicha so‘nggi tadqiqotlarda optimallashtirilgan parametrlar va tizim dizayni orqali xlorid, sulfat va boshqa erigan tuzlarni sezilarli ajratish, suvni qayta ishlatish va tuzlarni kontsentrlash imkoniyati ko‘rsatilgan; ayrim tizimlarda tuz kontsentratsiyasini 12% dan yuqori darajagacha oshirish mumkinligi qayd etiladi. Shu asosda maqolada sanoat oqova suvlarini qayta ishlash uchun “tarkibni aniqlash — selektiv ajratish — kontsentrlash — qaytarish yoki cho‘ktirish — mahsulotni tozalash — suvni qayta ishlatish” ketma-ketligiga asoslangan texnologik yondashuv qo‘llanildi.

Natijalar

Tahlil natijalari sanoat chiqindi suvlaridan foydali komponentlarni elektrokimyoviy usulda ajratib olishda eng muhim shart komponentning kimyoviy shaklini to‘g‘ri aniqlash ekanini ko‘rsatdi. Agar metall ionlari erkin gidratlangan kationlar shaklida bo‘lsa, ular katodda elektrocho‘ktirish orqali metall holatida ajratilishi mumkin; agar ular kompleks birikma shaklida bo‘lsa, to‘g‘ridan-to‘g‘ri qaytarish sekinlashadi yoki umuman samarasiz bo‘ladi, bu holda pHni o‘zgartirish, kompleksni parchalash, oldindan oksidlanish-qaytarish yoki membranali kontsentrlash talab qilinadi. Mis, kumush, oltin, nikel va rux kabi metallarni elektrolitik qaytarish iqtisodiy jihatdan nisbatan istiqbolli, chunki ular katod yuzasida qattiq metall qoplama yoki kukun ko‘rinishida ajralishi mumkin. Biroq aralash oqimlarda selektivlik muammosi paydo bo‘ladi: potensiali yuqori bo‘lgan metallar birinchi bo‘lib cho‘kadi, potensiali past bo‘lgan metallar esa keyinroq ajraladi; agar potensial noto‘g‘ri tanlansa, aralash metall cho‘kmasi hosil bo‘lib, keyingi qayta ishlash murakkablashadi. 2025-yilgi tadqiqotlarda elektrodpozitsiya, elektrokoagulyatsiya, uch o‘lchamli elektrokimyoviy jarayonlar va elektro-Fenton kabi yondashuvlar og‘ir metall komplekslari bilan ifloslangan oqova suvlarni tozalash va qayta ishlashda qo‘llanayotgani ko‘rsatilgan. Bu natija shuni anglatadiki, sanoat oqova suvlaridagi murakkab komplekslangan metallar uchun oddiy elektroliz hujayrasi yetarli emas; jarayon elektrod materiali, potensial rejimi, kompleks parchalash bosqichi va massa almashinish bilan birga loyihalanishi kerak. Elektrokoagulyatsiya natijalari esa boshqa yo‘nalishni ko‘rsatadi: bunda foydali komponentlar odatda metall gidroksid, fosfat, borat, ammoniyli kompleks yoki aralash flok tarkibida qattiq fazaga o‘tadi. Bu usulning afzalligi — aralash va loyqa oqimlarda ham ishlashi, reagent sarfini kamaytirishi, kolloid va suspenziyalarni birga ushlashi; kamchiligi esa ajratilgan mahsulotning ko‘pincha aralash tarkibli bo‘lishidir. 2024-yilda e’lon qilingan tizimli sharhda elektrokoagulyatsiya chiqindi suv va sho‘r eritmalardan qimmatli komponentlarni turli mahsulot shakllarida ajratishda qo‘llanayotgani, tok zichligi va eritma pH qiymati flok xossalari, tiklanish samaradorligi va energiya sarfiga hal qiluvchi ta’sir ko‘rsatishi ta’kidlangan. Demak, elektrokoagulyatsiya orqali foydali komponent ajratilsa, keyingi bosqichda

cho‘kmani yuvish, quritish, kislota yoki ishqor bilan eritish, qayta cho‘ktirish, termik ishlov berish yoki metallurgik qayta ishlash zarur bo‘ladi. Elektrodializ va bipolar membranali elektrodializ natijalari shuni ko‘rsatadiki, ular metallni bevosita metall holatida ajratmaydi, ammo ionlarni kontsentrlangan oqimga o‘tkazib, keyingi elektrocho‘ktirish yoki kristallizatsiya uchun qulay sharoit yaratadi. Bu ayniqsa kislota-ishqorli yuvish suvlarida, xlorid va sulfatli oqimlarda, yuqori minerallashgan suvlarni qayta foydalanishga tayyorlashda va tuzlarni ikkilamchi mahsulotga aylantirishda muhimdir. Agar oqova suvda metall ionlari juda kam, lekin suv hajmi katta bo‘lsa, bevosita elektrocho‘ktirish iqtisodiy samarasiz bo‘lishi mumkin; bu holatda avval elektrodializ yoki sorbsion-konsentrlash, keyin elektrocho‘ktirish qo‘llanadi. Natijalar asosida sanoat oqova suvlarini elektrokimyoviy qayta ishlash uchun uch turdagi texnologik sxema asoslandi. Birinchi sxema metallga boy oqimlar uchun: mexanik filtrlash — pH sozlash — selektiv elektrocho‘ktirish — katod mahsulotini yuvish va quritish — eritmani qayta elektroliz yoki neytrallash — suvni qayta foydalanish. Bu sxema galvanik va gidrometallurgik oqimlar uchun mos. Ikkinchi sxema aralash metall-tuzli oqimlar uchun: oldindan neytrallash — elektrokoagulyatsiya — floklarni ajratish — cho‘kmani kislota bilan qayta eritish — selektiv elektrocho‘ktirish — tozalangan suvni aylanmaga berish. Bu sxema aralash tarkibli, loyqa yoki komplekslangan oqimlar uchun mos. Uchinchi sxema yuqori minerallashgan oqimlar uchun: oldindan filtrlash — elektrodializ — kontsentratni kristallizatsiya yoki elektrocho‘ktirishga berish — diluat suvni ishlab chiqarishga qaytarish. Bu sxema kimyo, energetika, mineral o‘g‘itlar va metall yuzalarini yuvish jarayonlari uchun maqsadga muvofiq. Natijalar yana bir muhim xulosani ko‘rsatdi: foydali komponentni ajratish texnologiyasi “chiqindi suvni tozalash” bosqichida tugamasligi kerak. Agar ajratilgan metall aralash shlamda qolsa, u real iqtisodiy mahsulot emas; agar kontsentrat qayta ishlanmasa, u faqat yuqori konsentratsiyali ikkilamchi chiqindidir. Shuning uchun to‘liq texnologik asoslashda katod mahsuloti, elektrokoagulyatsiya cho‘kmasi, membrana kontsentrati yoki kristall tuzning keyingi qayta ishlash yo‘li albatta ko‘rsatilishi zarur. Foydali komponentlarni qayta ishlash bo‘yicha eng to‘g‘ri yondashuv mahsulotni uch toifaga ajratishdir: bevosita sotiladigan mahsulot, masalan katod mis yoki nikel; qayta eritilib boyitiladigan yarim mahsulot, masalan aralash metall gidroksid cho‘kmasi; texnologik jarayonga qaytariladigan kontsentrat, masalan kislota, ishqor, sulfat yoki fosfatli eritma. Ana shu tasnif sanoat korxonasiga elektrokimyoviy tizimni ekologik qurilma emas, balki iqtisodiy qiymat beruvchi texnologik bo‘g‘in sifatida baholash imkonini beradi.

Muhokama

Elektrokimyoviy usulda sanoat chiqindi suvlaridan foydali komponentlarni ajratib olish texnologiyasini asoslashda eng katta xato — jarayonni faqat laboratoriya sharoitidagi ajratish foizi bilan baholashdir. Masalan, laboratoriyada mis ionlarining 95–98% ajratilishi yaxshi natija ko‘rinishi mumkin, lekin agar jarayon yuqori kuchlanish, uzoq vaqt, qimmat elektrod, tez passivlanadigan

membrana yoki murakkab pH nazorati talab qilsa, sanoat sharoitida iqtisodiy jihatdan zaif bo‘lib qoladi. Aksincha, ajratish darajasi biroz pastroq bo‘lgan, ammo energiya sarfi kam, elektrod umri uzoq, mahsulot sifati barqaror va suvni qayta ishlatish imkoniyati yuqori bo‘lgan texnologiya amaliy jihatdan kuchliroq bo‘lishi mumkin. Shuning uchun maqola doirasida elektrokimyoviy qayta ishlash texnologiyasi beshta majburiy mezon orqali baholanishi zarurligi asoslandi: komponentni selektiv ajratish, ajratilgan mahsulotning qayta ishlanishga yaroqliligi, umumiy energiya sarfi, ikkilamchi chiqindi miqdori va jarayonning sanoat barqarorligi. Birinchi mezon — selektivlik — ayniqsa aralash metall ionlari bo‘lgan oqimlarda muhim. Agar katodda mis, nikel, rux va temir birga cho‘ksa, mahsulotni metallurgik qayta ishlash qimmatlashadi. Selektivlikni oshirish uchun katod potensialini bosqichma-bosqich boshqarish, impulsli tok rejimlari, elektrod yuzasini modifikatsiyalash, pHni zonali boshqarish va oldindan kompleks parchalash qo‘llanishi mumkin. Ikkinchi mezon — mahsulot yaroqliligi — elektrokoagulyatsiya uchun juda muhim. Elektrokoagulyatsiya klassik tozalash usuli sifatida ifloslantiruvchilarni floklarga o‘tkazadi, ammo agar bu flok qayta ishlanmasa, muammo suvdan shlamga ko‘chadi. 2024-yilgi sharhda elektrokoagulyatsiya natijasida hosil bo‘lgan ifloslantiruvchi modda saqlovchi floklar keyingi utilizatsiyasiz qattiq chiqindiga aylanishi, lekin foydali komponentlar qayta olinsa, ular ikkilamchi resurs sifatida ishlatilishi mumkinligi ta’kidlangan. Bu fikr sanoat loyihalash uchun keskin ahamiyatga ega: elektrokoagulyatsiya qurilmasini o‘rnatishning o‘zi resurs tejamkor texnologiya emas; resurs tejamkorlik faqat cho‘kma tarkibidagi foydali komponent qayta ishlanganda yuzaga keladi. Uchinchi mezon — energiya sarfi — elektrokimyoviy jarayonlarning asosiy zaif nuqtalaridan biridir. Tok zichligi oshirilganda jarayon tezlashadi, lekin kuchlanish va yon reaksiyalar ko‘payadi; tok zichligi pasaytirilganda energiya tejamkorlik oshgandek ko‘rinadi, ammo jarayon vaqti uzayib, umumiy sarf kamaymasligi mumkin. Demak, optimal rejim “maksimal ajratish foizi” emas, balki “maqsadli mahsulot sifatiga minimal umumiy energiya va minimal elektrod sarfi bilan erishish” bo‘lishi kerak. To‘rtinchi mezon — ikkilamchi chiqindi — ayniqsa gidroksid shlamlari, membrana yuvish eritmalari, sarflangan elektrodlar va filtr qoldiqlarida namoyon bo‘ladi. Agar texnologiya asosiy oqova suvni tozalasa, lekin yuqori xavfli kontsentrat hosil qilsa va bu kontsentrat uchun qayta ishlash yo‘li bo‘lmasa, texnologiya ekologik jihatdan to‘liq asoslanmagan bo‘ladi. Beshinchi mezon — sanoat barqarorligi — real oqova suv tarkibi vaqt bo‘yicha o‘zgarishi bilan bog‘liq. Galvanik sexda bir smenada nikel ko‘p, keyingi smenada xrom yoki rux ko‘p bo‘lishi mumkin; kon-metallurgiya oqimlarida pH va sulfat miqdori mavsumiy o‘zgaradi; kimyoviy ishlab chiqarishda esa yuvish suvlari turli reagentlar bilan aralashadi. Shuning uchun elektrokimyoviy tizim adaptiv boshqaruvga ega bo‘lishi kerak: pH, elektr o‘tkazuvchanlik, oksidlanish-qaytarilish potensiali, tok zichligi, katod potensiali, oqim tezligi va harorat onlayn nazorat qilinishi lozim. Sanoat chiqindi suvlarini tozalash texnologiyalariga bag‘ishlangan keng qamrovli sharhlarda ham oqova suvlarning

tarmoq bo‘yicha tarkibi farqli bo‘lgani sababli mos tozalash texnologiyasini tanlash uchun ularning xususiyatlarini chuqur tushunish zarurligi ta’kidlanadi. Elektrokimyoviy usulning yana bir muhim ustunligi — uni boshqa texnologiyalar bilan kombinatsiyalash mumkinligi. Masalan, elektrodializ metall ionlarini kontsentrlaydi, keyin elektrocho‘ktirish ularni metall holatida ajratadi; elektrokoagulyatsiya kolloid va kompleks birikmalarni ushlaydi, keyin cho‘kma gidrometallurgik eritmaga o‘tkazilib, selektiv elektroliz qilinadi; elektrooksidlanish kompleks hosil qiluvchi organik reagentlarni parchalaydi, keyin metall ionlari katodda osonroq qaytariladi. Bunday integratsiya bitta bosqichli jarayonga nisbatan murakkabroq, ammo mahsulot tozaligi, suvni qayta ishlatish va barqarorlik bo‘yicha kuchliroq. Liu va hammualliflarining sharhida ham murakkab tarkibli oqova suvdan qiymatli resurslarni ajratishda bir bosqichli elektrokimyoviy jarayon ko‘pincha samarasiz bo‘lishi, ko‘p bosqichli yoki membranali-biologik integratsiyalangan texnologiyalar zarurligi qayd etilgan. Demak, ushbu maqola uchun asosiy ilmiy pozitsiya quyidagicha: sanoat chiqindi suvidan foydali komponent olish texnologiyasi “tozalash qurilmasi” emas, balki “suv, metall, tuz va energiya oqimlarini boshqaruvchi ishlab chiqarish moduli” sifatida loyihalanishi kerak. Bunda iqtisodiy asoslash ham real bo‘lishi zarur. Agar chiqindi suvda foydali komponent konsentratsiyasi juda past bo‘lsa, uni bevosita elektrocho‘ktirish maqsadga muvofiq emas; avval kontsentrlash kerak. Agar oqim hajmi kichik, lekin metall qiymati yuqori bo‘lsa, selektiv elektrocho‘ktirish afzal. Agar oqim hajmi katta va mineral tuzlar ko‘p bo‘lsa, elektrodializ va suvni qayta ishlatish iqtisodiy jihatdan muhimroq. Agar oqim tarkibi barqaror bo‘lmasa, universal, lekin mahsulot tozaligi past bo‘lgan elektrokoagulyatsiya boshlang‘ich bosqich sifatida ishlatiladi. Mana shu differensial yondashuvsiz “elektrokimyoviy usul foydali” degan umumiy xulosa ilmiy jihatdan zaif bo‘ladi.

Xulosa

Sanoat chiqindi suvlaridan foydali komponentlarni elektrokimyoviy usulda ajratib olish va ularni qayta ishlash texnologiyasi ekologik tozalash, resurs tejamkorlik va iqtisodiy samaradorlikni birlashtiruvchi istiqbolli yo‘nalish hisoblanadi. Tadqiqot natijalari shuni ko‘rsatdiki, elektrokimyoviy usullar an’anaviy reagentli tozalashga nisbatan bir qator ustunliklarga ega: kimyoviy reagent sarfi kamayadi, jarayon tok va kuchlanish orqali aniq boshqariladi, ayrim metallar bevosita katod mahsuloti sifatida olinadi, mineral ionlar kontsentrlanadi, suvni ishlab chiqarishga qaytarish imkoniyati ortadi va chiqindi oqimlar ikkilamchi xomashyo manbasiga aylanishi mumkin. Biroq ushbu texnologiyaning muvaffaqiyati faqat tozalash darajasiga emas, balki ajratilgan komponentning qayta ishlanishga yaroqliligi, mahsulot tozaligi, energiya sarfi, elektrod va membrana barqarorligi, shlam miqdori, oqova suv tarkibining o‘zgaruvchanligi va yakuniy iqtisodiy natijaga bog‘liq. Metallga boy oqimlar uchun selektiv elektrocho‘ktirish, aralash kolloid-metal oqimlar uchun elektrokoagulyatsiya va cho‘kmani keyingi qayta eritish, yuqori minerallashgan oqimlar uchun elektrodializ yoki membranali kontsentrlash eng maqbul yo‘nalishlar sifatida baholandi. Texnologik jihatdan eng

asosli sxema quyidagi ketma-ketlikdan iborat bo‘lishi kerak: oqova suv tarkibini tahlil qilish, pH va elektr o‘tkazuvchanlikni sozlash, foydali komponentni selektiv ajratish yoki kontsentrlash, ajratilgan mahsulotni yuvish-quritish-tozalash, kerak bo‘lsa qayta eritish yoki kristallizatsiya qilish, tozalangan suvni ishlab chiqarish sikliga qaytarish va hosil bo‘lgan ikkilamchi qoldiqni xavfsiz boshqarish. Maqolada asoslangan ilmiy xulosaga ko‘ra, elektrokimyoviy texnologiyalar sanoat chiqindi suvlarini faqat zararsizlantirish vositasi sifatida emas, balki metallar, tuzlar, ozuqa elementlari va suvni qayta olishga xizmat qiluvchi resurs qayta tiklash tizimi sifatida loyihalanishi kerak. Amaliy tavsiya sifatida sanoat korxonalarida chiqindi suvlar tarkibini doimiy monitoring qilish, oqimlarni aralashtirib yubormasdan manba bo‘yicha ajratish, yuqori qiymatli komponentlar uchun selektiv elektroliz rejimlarini ishlab chiqish, elektrokoagulyatsiya cho‘kmalarini qayta ishlash yo‘lini oldindan belgilash, elektrodializ kontsentratlarini kristallizatsiya yoki elektrocho‘ktirishga yo‘naltirish hamda texnologiyaning energiya-material balansini hisoblash zarur. Umumiy xulosa shuki, sanoat chiqindi suvlaridan foydali komponentlarni elektrokimyoviy usulda ajratib olish texnologiyasi faqat laboratoriya darajasidagi innovatsion g‘oya emas, balki to‘g‘ri loyihalansa, sanoat korxonalarida ekologik yuklamani kamaytiruvchi, qimmatli xomashyoni qaytaruvchi, suv sarfini qisqartiruvchi va aylanma iqtisodiyotga xizmat qiluvchi amaliy texnologik yechimga aylanishi mumkin.

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THE ROLE OF THE EAST IN THE WORKS OF RUSSIAN TRANSLATORS AND ORIENTALISTS

Abstract. *The interaction between Russia and the East has played a significant role in the development of Russian culture, literature, and scholarly thought. Russian translators and orientalists have served as crucial mediators in introducing Eastern languages, literature, philosophy, and cultural traditions to Russian society. Their works not only facilitated intercultural communication but also contributed to the formation of Russian Oriental Studies as an academic discipline.*

Keywords: *East, Oriental Studies, Russian translators, orientalists, translation, intercultural communication, Eastern literature, Russian scholarship.*

Introduction. The East has long occupied a special place in Russian intellectual and cultural history. Due to Russia's unique geographical position between Europe and Asia, Russian scholars developed a sustained interest in the languages, history, religion, and literature of Eastern peoples. From the eighteenth century onward, Russian translators and orientalists actively studied Arabic, Persian, Turkish, Chinese, Indian, and Central Asian cultures, producing translations and scholarly works that significantly enriched Russian academic and literary traditions.

The emergence of Oriental Studies in Russia coincided with the expansion of diplomatic, commercial, and cultural relations with Eastern countries. Through translations of classical Eastern texts and scholarly investigations, Russian orientalists introduced readers to the intellectual achievements of Eastern civilizations. Their efforts contributed to a deeper understanding of cultural diversity and promoted intercultural dialogue.

This article explores the role of the East in the works of Russian translators and orientalists and evaluates their contributions to cultural exchange and academic development.

Literature Review. The study of Russian Orientalism has attracted considerable scholarly attention. Researchers have examined the historical development of Russian Oriental Studies, the translation of Eastern literary works, and the intellectual engagement of Russian scholars with Eastern cultures.

Scholars note that Russian Orientalism differed from many Western European approaches due to Russia's direct geographical and historical connections with Eastern societies. Russian orientalists often emphasized linguistic accuracy, cultural understanding, and long-term scholarly engagement with Eastern traditions.

The works of leading Russian orientalists such as Vasily Bartold, Ignaty Krachkovsky, Vasily Radlov, and Sergei Oldenburg demonstrate the breadth of Russian scholarship concerning the East. Their studies contributed significantly to the understanding of Islamic civilization, Turkic cultures, Arabic literature, and Buddhist traditions.

Translation studies scholars also emphasize the importance of Russian translators in making Eastern literary masterpieces accessible to Russian readers. Through translation, these scholars helped preserve cultural heritage and promote intercultural understanding.

Methodology. This study employs qualitative and historical-analytical methods. Primary and secondary sources related to Russian Oriental Studies, translation history, and cultural interactions between Russia and the East were analyzed. Comparative analysis was used to evaluate the contributions of different translators and orientalists and to identify common themes in their representation of Eastern cultures.

Results. For Russian translators and orientalists, the East represented not only a geographical region but also a vast reservoir of intellectual, spiritual, and cultural traditions. Eastern civilizations provided valuable sources for linguistic research, literary translation, historical studies, and philosophical inquiry.

Russian scholars recognized the richness of Eastern literary heritage, including Persian poetry, Arabic prose, Turkish epics, Indian philosophical texts, and Chinese classical literature. Their translations introduced Russian audiences to new artistic forms, ethical concepts, and worldviews. Russian translators played a decisive role in transmitting Eastern literary traditions to Russian readers. They translated classical works of renowned Eastern authors, including: Omar Khayyam, Ferdowsi, Alisher Navoi, Saadi Shirazi, Hafiz.

Through their translations, Russian scholars introduced readers to themes of spirituality, morality, love, wisdom, and social justice. These translations enriched Russian literary culture and influenced generations of writers and intellectuals. The translation process also encouraged linguistic innovation. Translators developed methods for conveying culturally specific concepts, metaphors, and poetic structures from Eastern languages into Russian while preserving their artistic qualities.

Russian orientalists established the foundations of professional Oriental Studies. Among the most influential scholars were:

Bartold made significant contributions to the study of Central Asian history and Islamic civilization. His research on Turkic peoples and medieval Central Asia remains influential in contemporary scholarship. Krachkovsky was a distinguished scholar of Arabic language and literature. His translations and studies of Arabic

texts greatly expanded Russian knowledge of Arab culture and intellectual history. Radlov conducted extensive research on Turkic languages and folklore. His collections of oral literature contributed to the preservation and study of Turkic cultural heritage.

Oldenburg played a major role in the development of Buddhist studies and research on Indian civilization. His work strengthened academic connections between Russian and Eastern scholarship.

Translation served as an essential instrument of intercultural communication. Russian translators functioned as cultural mediators who facilitated dialogue between Eastern and Russian societies. Their work reduced cultural barriers and promoted mutual understanding.

By presenting Eastern literature within the Russian cultural context, translators encouraged readers to appreciate diverse perspectives while recognizing universal human values. As a result, Eastern literary works became an integral part of Russia's intellectual and cultural landscape.

Discussion. The examination of Russian translators and orientalists demonstrates that their engagement with the East extended beyond scholarly curiosity. Their work reflected a broader effort to understand cultural diversity and establish intellectual connections between civilizations.

Unlike purely colonial models of Orientalism, many Russian scholars emphasized direct linguistic competence, field research, and close engagement with Eastern sources. Their translations and studies often sought to represent Eastern cultures accurately and respectfully.

The contributions of Russian orientalists also had practical significance. Their linguistic research facilitated diplomacy, education, and cultural exchange. Furthermore, their scholarly publications laid the groundwork for modern Oriental Studies in Russia and neighboring countries.

The East thus occupied a central position in the intellectual projects of Russian translators and orientalists. It served as a source of knowledge, artistic inspiration, and scholarly inquiry, influencing both academic research and literary development.

Conclusion. The East played a fundamental role in the works of Russian translators and orientalists. Through translation, linguistic research, historical studies, and cultural analysis, these scholars introduced Eastern civilizations to Russian audiences and contributed to the growth of intercultural understanding.

The achievements of Russian orientalists enriched global scholarship and helped preserve valuable elements of Eastern cultural heritage. Their efforts demonstrate the importance of translation and academic research as tools for fostering dialogue among civilizations. In the contemporary era of globalization, their legacy remains relevant as societies continue to seek greater mutual understanding and cultural cooperation.

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BO‘LAJAK AGRONOMLARNING KASBIY KOMPETENTLIGINI RIVOJLANTIRISHNING IJTIMOIY PEDAGOGIK ZARURIYATI

Annotatsiya: *Ushbu maqolada bo‘lajak mutaxassis agronomlarda kasbiy kompetentlikni rivojlantirishning nazariy asoslarini o‘rganish, uni sintez qilish, oliy ta’lim muassasalarida integrativ yondashuvning mashg‘ulot jarayonida ijobiy samara berishi, pedagogik-metodik imkoniyatlarning amaliy tatbiq qilinishi, shu faoliyat jarayonida kasbiy bilim, amaliy ko‘nikma va nutqiy malakalarning takomillashuvi, integrativ yondashuv asosida bo‘lajak mutaxassis agronomlarda kasbiy kompetentlikni rivojlantirish shaxsiy-kasbiy, kreativ sifatlar bayon qilingan.*
Kalit so‘zlar: *Kasbiy kompetentlik, integrativ yondashuv, kasbiy tayyorgarlik, integratsion ta’lim.*

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SOCIAL AND PEDAGOGICAL NEED FOR DEVELOPING PROFESSIONAL COMPETENCE OF FUTURE AGRONOMERS

Abstract: *This article examines the theoretical foundations for the development of professional competence of future agronomist specialists, its synthesis, the positive impact of the integrative approach in the learning process in higher educational institutions, the practical application of pedagogical and methodological capabilities. Professional knowledge in the process of this activity, improvement of practical skills and speech skills, development of professional competence of future agronomist specialists based on an integrative approach, personal, professional, and creative qualities are described.*
Key words: *Professional competence, integrative approach, professional training, integrated education.*

Davlatimiz rahbarining farmon va qarorlariga binoan, 2020-yildan boshlab qishloq xo‘jaligiga bozor mexanizmlarini keng joriy etish, to‘liq raqamlashtirish, fermer va dehqonlar manfaatdorligini oshirish maqsadida paxta va g‘alla etishtirishga davlat buyurtmasini bekor qilish hamda bozor tamoyillari asosida xarid qilish tizimiga bosqichma-bosqich o‘tish belgilab berildi. Bu borada Prezidentimiz tomonidan 2020-yil 28-yanvarda imzolangan “O‘zbekiston Respublikasi qishloq xo‘jaligini rivojlantirishning 2020-2030-yillarga mo‘ljallangan strategiyasi

belgilangan vazifalarni 2020-yilda amalga oshirish chora-tadbirlari to‘g‘risida” gi qarori dasturilamal bo‘ladi.

Yana bir muhim yo‘nalish — “Aqlli issiqxona” texnologiyasi bo‘yicha loyihalashtiriladigan ob’ektlar soni 500 taga etkaziladi. Chorvachilikda esa mahsulotlar ishlab chiqarishning avtomatlashtirilgan tizimi yo‘lga qo‘yiladi. Buning natijasida sohada ishlab chiqarish bilan bog‘liq xarajatlar 15 foiz qisqaradi.

Mamlakatimizda raqamli qishloq xo‘jaligiga o‘tish ishlari Qishloq xo‘jaligi va oziq-ovqat tashkiloti (FAO) va Jahon banki bilan hamkorlikda amalga oshirilyapti. Endilikda ekin erlari, yaylov va o‘rmon maydonlarini elektron tarzda monitoring qilish loyihasi, qishloq xo‘jaligini raqamlashtirishga o‘tishning fazalari va yo‘nalishlarini aniq belgilash bo‘yicha texnik-iqtisodiy asosnoma hamda texnik topshiriq ishlab chiqiladi.

Prezidentimizning 2019-yil 17-iyundagi farmoni bilan tasdiqlangan konsepsiya doirasida qishloq xo‘jaligida foydalanishga kiritiladigan erlarni geoaxborot tizimi orqali monitoring qilish maqsadida maxsus onlayn platforma prototipi yaratildi. Agrosanoat majmuiga tegishli barcha vazirlik va idoralar axborot tizimlarining integratsiyasini ta’minlaydigan yagona dastur ham ishlab chiqiladi. Ayni paytda esa “Aqlli qishloq xo‘jaligi” davlat dasturi loyihasi ustida ish olib borilmoqda.

Qishloq xo‘jaligining takomillashgan tizimlarida turli “aqlli texnologiyalar” (smart-sensorlar) ekin va atrof-muhit sharoitidan kelib chiqilgan holda o‘rnatiladi. Masalan, zararkunandalar va kasalliklarni oldindan aniqlovchi, iqlim nazorati — haroratni, namlikni, karbon dioksid darajasini o‘lchovchi vositalar, ozuqa moddalari bilan ta’minlash va sug‘orish asboblari kabilar shular jumlasidan. Ularning qo‘llanilishi hosildorlikni kamida 30 foiz oshirishni kafolatlaydi. Bundan tashqari, qishloq xo‘jaligi mahsulotlarini ishlab chiqarish va ularni sotish zanjirlarida ham takomillashgan tizimlar joriy etiladi va pirovardida katta hajmdagi elektron ma’lumotlarni yig‘ish imkoniyati yaratiladi. Ularni saqlash va tahlil qilish natijasida esa suv, er va boshqa chegaralangan resurslardan samarali foydalanish, oziq-ovqat sifati va xavfsizligini ta’minlash mumkin.

Elektron tizimning qulayligi shundaki, hosil yig‘ilganidan so‘ng ham uning faoliyati mahsulotlarni qayta ishlash, qadoqlash, tozalash, navga ajratish, etkazish va boshqa qo‘shimcha qiymat zanjirlarini yaratish kabi yo‘nalishlarda davom etadi. Qisqasi, “Aqlli qishloq xo‘jaligi” texnologiyalari yuqori hosildorlik va sifatga erishish, suv sarfi hamda mahsulot tannarxini kamaytirish, hosilni rejalashtirish va prognozlash kabi yo‘nalishlarda muhim o‘rin tutadi. Shu bilan birga, smart-texnologiyalar joriy etilishi yosh avlod vakillarida bu tarmoqqa qiziqish uyg‘otadi. Bu esa sohada yangi ish o‘rinlari ko‘payishiga yo‘l ochadi. Ammo raqamli qishloq xo‘jaligini tashkil etish va undan foydalanish bilan bog‘liq masala ham borki, u sohani chuqur biladigan hamda zamonaviy texnik-texnologik bilimlarga ega malakali kadrlar talabini yuzaga keltiradi. Eng avvalo, qishloq xo‘jaligida yangi kasb egalari - dasturchi, ITo (asboblar interneti) muhandisi, IT-mutaxassislar zarur bo‘ladi.

Prezidentimizning 2019-yil 19-avgustdagi “Toshkent davlat agrar universiteti faoliyatini yanada takomillashtirish chora-tadbirlari to‘g‘risida”gi qaroriga muvofiq, Toshkent davlat agrar universiteti va uning Nukus, Andijon, Termiz filiallari tuzilmasini va ustavlari yangidan tasdiqlanib, qishloq xo‘jaligida raqamli texnologiyalar, agroturizm, qishloq xo‘jaligida kooperativ boshqaruv, gidrobiologiya, ixtiologiya, asalarichilik, veterinariya meditsinasi (hayvonot turlari bo‘yicha), zooinjeneriya (qoramolchilik), qishloq xo‘jaligi iqtisodiyoti, tuproq bonitirovkasi va er resurslaridan foydalanish, agrosanoatda texnologik jarayonlarni avtomatlashtirish va texnik servis, agrobiznes va marketing yo‘nalishlari bo‘yicha mutaxassislar tayyorlash yo‘lga qo‘yildi.

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THE ACTIVITIES OF UZBEKISTAN'S MILITARY PERSONNEL AND CIVILIAN WORKERS ON THE HOME FRONT DURING WORLD WAR II

Abstract. *This article analyzes the heroism and valor of Uzbekistan's military personnel and citizens on the front lines and the home front during World War II, the selfless labor of home front workers, and the active participation of Uzbeks in military operations. It also examines the role of military-patriotic education for youth in modern Uzbekistan and the comprehensive strengthening of national spirit, love, and devotion to the Motherland.*

Keywords: *World War II, historical memory, honor, patriotism, education of the younger generation, Temurbeklar School, home front, duty, national heroes, selflessness.*

In today's era of globalization, the issue of maintaining peace and stability is considered one of the most pressing challenges. The horrific and terrifying scenes of the Second World War have not yet faded from human memory, and at the same time, all peace-loving forces are working together. With this in mind, the UN General Assembly, in a resolution adopted on November 22, 2004, designated May 8 and 9 as **"Days of Remembrance and** Reconciliation"[1]. This has become the most important step in preventing new wars and commemorating the victims of World War II.

In virtually all countries of the world, extensive research is being conducted on the history of World War II. In particular, the Soviet Union's entry into the war, its socio-economic, cultural-educational, and political-legal conditions, as well as the mistakes, shortcomings, and challenges it faced, are being examined as a matter of great importance. These studies aim to highlight the active participation of the people of Uzbekistan during the years of the Second World War, their unparalleled heroism, and self-sacrifice on the home front, and to serve as an example of national pride and honor for future generations.

At the same time, in light of the fundamental reforms currently being implemented in New Uzbekistan, special attention is being paid to enhancing the military and moral capabilities of our people, strengthen national identity, and pay special attention to the principles of patriotism and humanism. For this reason, our esteemed President attaches particular importance to this period: *"In these complex and perilous times, we must raise our youth to be upright individuals, and in the process of preserving peace and stability in our homeland, and to foster harmony*

and tolerance among nations and religions, the patience and resilience demonstrated by our heroic forefathers during the years of the Second World War will always serve as a source of strength and inspiration for us, and a source of strength and inspiration."[2] .

The evacuation to Uzbekistan from the areas behind the front lines, where a fierce and devastating war was raging, was one of the most difficult operations. The elderly and children evacuated to Uzbekistan were in a dire situation, and to rescue them quickly, it was necessary, first and foremost, to locate them and register them. A reception center for minors was opened in Tashkent, and the website was established to address the issue of placing those under 18 in children's homes and finding employment for older individuals[3]. Subdivisions of the commission, which had been established in the provinces and districts, were quickly opened; their primary task was to place the children and prevent them from becoming homeless.

Starting in 1943, special boarding schools were established in Uzbekistan for the children of soldiers and fallen soldiers. These boarding schools were fully funded by the state. During the 1943–1944 school year, 15 such boarding schools were opened in Qaraqalpaqstan, where 750 children were educated[4]. On December 1, 1943, a military school named after Suvorov (now Temurbeklar) was opened in Tashkent. 700 students were admitted, most of whom were the children of fallen soldiers[5] .

During the war years, children's homes for orphans were established in virtually all regions of Uzbekistan. For example, in 1943, there were 15 children's homes in the Qashqadaryo region, where 1,950 children were raised. By 1945, the number of children's homes in the region had reached 22. The number of children in care reached 2,744. From the Kashkadarya Region, 2,023,704 rubles, 15,363 sets of clothing, 7,079 pairs of shoes, 7,220 head of livestock, 242,238 kilograms of grain and other goods were provided. However, there were shortcomings and deficiencies in the provision of housing for children and in the process of enrolling students in school. In 1944, due to the negligence and indifference of E.S. Babenko, director of Tashkent City Children's Home No. 21, 162 kg of carrots, 160 kg of potatoes, 361 kg of melons, 396 kg of cucumbers, 1,241.5 kg of vegetables, and other produce were distributed to the children as food[6] .

Despite the difficulties faced by local authorities in providing children and the elderly with housing, food, and employment, this initiative was successfully implemented. During the war years, Uzbekistan received over one million refugees from areas that had been temporarily occupied by the enemy and abandoned by residents near the front lines, 200,000 of whom were children[7] . The residents of the republic's cities and villages welcomed the citizens who had arrived here with warmth and kindness. Although the people of Uzbekistan were suffering themselves, they provided shelter to the displaced, shared their own food to feed them, and collected clothing and shoes for them.

Let's look at some specific examples. During the 1944–1945 school year, 50 percent of the children in 26 orphanages across Andijan Region were not enrolled

in school[8]. The material conditions in the children's homes were extremely poor. In the early months of the war, 26 children's homes, housing 100,000 people and 10,000 children, were relocated to Andijan Province. In addition, 300 children arrived from Poland. A total of 200,000 children were evacuated across Uzbekistan. Classes were opened in schools for Ukrainian, Belarusian, Moldovan, and other nationalities. However, opening classes for Polish and Spanish children proved to be quite complicated; providing them with textbooks and teachers was extremely difficult. Retail organizations failed to deliver food, clothing, and other essential goods to the children's homes on time[9]. As a result, hunger and various diseases became widespread among the children.

In January 1942, a special commission was established in Korakalpogistan to accommodate and educate the evacuated children. At the initiative of this commission, 192,000 rubles were spent to provide free meals in dormitories for evacuated children from October 1, 1941, to October 1, 1942. By February 1, 1942, 92,415 evacuees had been settled in the Fergana Region. Ten children's homes were evacuated to this region. Additionally, 1,283 citizens of Polish nationality were resettled in the Surkhandarya Region[10] .

In March and April 1944, a mass re-evacuation began, meaning people were being returned to their homelands. This made it difficult to fill the vacancies for Russian language teachers in schools. During the 1944–1945 school year, 8 out of 12 Russian language teachers in Margilan alone were evacuated. During that school year, the republic faced a shortage of 1,000 Russian language teachers[11] .

Behind the front lines, Uzbek schoolchildren became the main labor force in rural agriculture from the very first days of the war. On July 18, 1941, the following report appeared in the *"Teachers'* Gazette": *"The assistance of schools in harvesting crops for collective and state farms is a crucial political issue." In 1941, 300,000 school students participated in the cotton harvest in Uzbekistan, and the cotton they harvested accounted for 10 percent of the total harvest* [12] . The responsibility for organizing schoolchildren's participation in agricultural work was entrusted to the heads of district public education departments, school principals, and teachers. In this regard, on December 29, 1941, the Central Executive Committee of the Uzbek SSR and the Central Committee of the Uzbek Communist Party (Bolsheviks) "On *Involving Students of Secondary and Higher Educational Institutions in Agricultural Work*." In accordance with the resolution, students in grades VIII–X in urban schools and grades VII–X in rural schools were mobilized for agricultural work. Under this resolution, school students were required to *"work in the fields (weeding, plowing, harrowing, planting, harvesting and gathering the yield of grain crops, combat pests in rural agriculture, pick cotton, spin silk, and perform similar tasks), it is necessary to train workers with relevant professional skills*" [13] .

Short-term courses were organized in factories to improve the skills of women and young people who had taken the place of workers sent to the front, and the role of factory-based training and vocational schools in training young workers

became significant[14]. On July 15, 1943, the Soviet government issued a decree titled "On *the Education of Young Workers Employed in Factories*." Starting October 1 of that year, schools for workers were established in cities and workers' settlements. However, a number of difficulties were encountered in opening these schools. There was a shortage of school buildings, teachers, textbooks, and school supplies.

Teachers play a key role in promoting and developing public education. Accordingly, throughout history, the state has placed great importance on training teaching staff and improving their qualifications. During the war years, the number of teachers decreased significantly as many were drafted into the army. For example, while the number of teachers in Uzbekistan was 36,267 during the 1940–1941 school year, in the 1942–1943 academic year, that number dropped to 30,616[15]. In 1944, nearly 5,000 teachers were trained in various courses. Fifteen thousand students were enrolled in the external departments of pedagogical institutes and educational colleges. In January 1942, the Central Committee of the Communist Party of the Uzbek SSR and the Central Committee of the Communist Party of Uzbekistan issued resolutions *"On the Training of Teachers for Schools in the Uzbek SSR,"* and in 1943, *"On Improving the Training of Pedagogical Personnel*." Specific measures were implemented to ensure the implementation of these resolutions. For example, during the war years, 21,000 female teachers were trained[16].

In this regard, scientific research is also underway to study the significant contribution made by the people of Uzbekistan to the victory over fascism in World War II, and numerous scholarly works and books are being published based on new historical facts and information.

They gave their lives on the battlefields for the sake of our present-day peaceful life. It is the sacred duty of every person living in this country to remember our compatriots, show them due respect and reverence, and carry on their noble deeds. For the future of a nation that does not forget its past and history, and cherishes them, will be bright and enduring.

Much is being done to thoroughly study and promote the lives, deeds, courage, and resilience of our brave and heroic ancestors, as well as to instill in the younger generation and in the spirit of patriotism. *"In this regard, the 'Galaba Park' established in Tashkent and the 'Vatanparvar' parks in the regions play a significant role. These sacred sites have quickly become a place of pilgrimage for all our citizens and foreign guests*[17], noted our head of state, Shavkat Mirziyoyev.

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KOREYS TILIDA LEKSIK ENANTIOSEMIYALAR VA ULARNI TASNIFLASH TAMOYILLARI

Annotatsiya. *Mazkur maqolada koreys tilidagi leksik enantiosemiya hodisasi va uni tasniflash tamoyillari tahlil qilinadi. Enantiosemiya bir leksemaning o‘zaro zid ma’nolarni ifodalashi bilan xarakterlanadigan murakkab semantik hodisa sifatida yoritiladi. Tadqiqotda koreys tilshunosligida enantiosemik birliklarni o‘rganishga oid mavjud qarashlar umumlashtirilib, ular komplimentar zidlik, darajaviy zidlik hamda yo‘nalish munosabatidagi zidlik kabi guruhlarga ajratiladi. Maqolada turli leksik birliklarning semantik rivojlanishi, kontekst ta’sirida qarama-qarshi ma’no kasb etishi hamda tarixiy-madaniy omillarning ushbu jarayondagi o‘rni misollar asosida tahlil etilgan.*

Kalit so‘zlar: *enantiosemiya, koreys tili, semantika, leksik ma’no, antonimiya, polisemiya, zid ma’no, semantik munosabat, tilshunoslik, leksikologiya.*

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LEXICAL ENANTIOSEMY AND PRINCIPLES OF ITS CLASSIFICATION IN KOREAN LANGUAGE

Abstract. *This article examines the phenomenon of lexical enantiosemy in the Korean language and the principles of its classification. Enantiosemy is interpreted as a complex semantic phenomenon in which a single lexical unit expresses opposite meanings. The study summarizes existing approaches in Korean linguistics related to enantiosemic units and classifies them into complementary opposition, gradational opposition, and directional opposition. The paper analyzes the semantic development of lexical units, the emergence of opposite meanings under contextual influence, and the role of historical and cultural factors in this process through various examples.*

Keywords: *enantiosemy, Korean language, semantics, lexical meaning, antonymy, polysemy, opposite meaning, semantic relations, linguistics, lexicology.*

Enantiosemiya bir so‘zning ikki qarama-qarshi ma’nolarda kelishini anglatuvchi lisoniy hodisadir. Koreys tilshunosligida qarama-qarshilik munosabati, asosan, antonimlar doirasida olib borilgan bo‘lib, enantiosemiyani alohida tadqiq obyekti sifatida o‘rganilgan ishlar juda kam, ushbu hodisa to‘g‘risida muayyan maqola yoki antonimiya, omonimiya, polisemiyaga bag‘ishlangan tadqiqot ishlarida qisqacha aytib o‘tilgan. Koreys tilida enantiosemiyani turlarga ajratib o‘rganishda Do Jae-hak, Li Min-u, Li Song-yonlarning tadqiqotlarini alohida e’tirof etmoq lozim. Ularning ishlarini umumlashtirgan holda koreys tilidagi enantiosemik birliklarni quyidagi 3 guruhga bo‘lib o‘rganishni ma’qul deb topdik: 상보적 대립 (komplimentar zidlik), 정도적 대립 (daraja munosabatidagi zidlik), 방향적 대립 (yo‘nalish munosabatidagi zidlik).

상보적 대립관계 – komplimentar qarama-qarshilik ikki ma'no bir-birini istisno qiladigan va boshqa o‘rta so‘zga ega bo‘lmagan munosabatni bildiradi. Boshqacha aytganda, bir ma’no komplementar qarama-qarshi munosabatda bo‘lsa, uning semantik ma’nosini salbiylashtirish bilan qarama-qarshi ma’noning semantik ma’nosi ijobiylashtiriladi. Bunday turdagi qarshilantirishda biror harakatning boshlanishi va yakunlanishi, biror narsaning mavjud bo‘lishi va bo‘lmasligi kabi ma’noviy munosabatlar o‘rtasida ham bo‘ladi. Masalan, 무가 so‘zining “tekin” va “bebaho” ma’nolari o‘zaro zid hamda ular orasida oraliq tushuncha yo‘q. Bunday so‘zlarga misol qilib 값없다, 고문관, 놓다, 무가, 주책, 엉터리, 퍽 , 설사약, 과연 kabi so‘zlarni keltirish mumkin. Ushbu so‘zlarni ham mavjudlik darajasi va holat yoki harakatning salbiylik darajasiga ko‘ra turlarga bo‘lish mumkin.

1) 주책

1. 일정한 주장이나 판단력.

나이를 먹다 보니 사람이 자꾸 주책만 없어진다.

Yoshi ulg‘aygan sari odamlar kamroq ehtiyotkor bo‘lishadi.

2. 이치를 분간할 만한 판단력이나 주견이 없이 마음대로 하는 짓.

그렇게 주책을 떨어 놓고 식구를 보기에 창피하지도 않아요?

O‘zingizni bunday axmoqona tutishdan oila a’zolaringiz oldida ham uyalmaysizmi?

주책 so‘zining odob-axloq meyorlariga mos keluvchi fikr, harakat yoki buning aksi – odob-axloq meyorlariga zid degan ma’nolari mavjud. So‘zning dastlabki ma’nosi “odob-axloq me’yorlariga mos” bo‘lgan, ammo bu so‘z bilan birga qo‘llanilgan 없다 inkor so‘zi ta’sirida vaqt o‘tib “axloqsiz, bema’ni harakat” qarama-qarshi ma’nosiga ega bo‘lgan.

2) 엉터리

1.noun 대강의 윤곽.

일주일 만에 일이 겨우 엉터리가 잡혔다.

Bir hafta o‘tgach, muammo nihoyat hal qilindi.

2.noun 터무니없는 말이나 행동. 또는 그런 말이나 행동을 하는 사람.

싼 컴퓨터를 사는 것은 엉터리 절약이다.

Arzon kompyuterni olish bu axmoqona tejamkorlikdir.

3.noun 보기보다 매우 실속이 없거나 실제와 어긋나는 것.

이 물건은 겉만 번드르르했지 사실은 엉터리이다.

Bu mahsulot tashqi ko‘rinishida ajoyib ko‘rinadi, lekin aslida u hech nimaga yaramaydi.

엉터리 so‘zi ham 주책 so‘ziga o‘xshab ma’lum bir sintaktik birlik bilan qo‘shilib kelish natijasida salbiy ma’no kasb etgan. So‘zning dastlabki ma’nosi “biror vaziyat, holat, narsa yuzasidan qisqacha muhim ma’lumot, tafsilot, yechim” bo‘lgan. Ammo “없다” so‘zi bilan birikib kelish natijasida vaqt o‘tib so‘z ma’nosiga zidlik yuklangan. Bunda so‘z “bema’ni so‘z, harakat yoki shu harakatni qiluvchi shaxs”, “soxta, haqiqatga mos kelmaydigan” ma’nolarini anglatadi.

3) 퍽

1.adv 갑자기 매우 힘차게 내지르는 소리. 또는 그 모양.

얼굴을 퍽 내지르다– *yuziga qars etib urmoq.*

2.adv 갑자기 힘없이 거꾸러지는 소리. 또는 그 모양.

소파에 퍽 쓰러지다 – *divanga shilq etib yiqilmoq*.

퍽 so‘zi holatga nisbatan taqlid so‘z hisoblanib, kuch bilan baqirish va judayam kuchsiz holatda qulash, yiqilish holatlariga nisbatan keladi. So‘zning asl ma’nosi kuch bilan hayqirish, baland ovoz ma’nosi bo‘lib, so‘zning ikkinchi paydo bo‘lgan ma’nosi matnda qo‘llanilganda anglashiladi.

4) 값없다

1. 하찮아서 값이 나가지 않다.

값없는 일로 시간을 허비했다 - *Arzimas ish bilan vaqtni bekorga o‘tkazdim.*

2. 너무 귀해 값을 해아릴 수 없다.

값없는 공기 – *bebaho havo.*

Koreys tilida 값없다 so‘zi 값 (baho, qiymat) + 없다 (yo‘q) birikma asosida yasalganligi sabab bu yerda enantiosemiya so‘zning birikma munosabatida aks etgan deb hisoblanadi. Bunda so‘z bilan birga keluvchi muayyan boshqa bir element tushib qolishi natijasida so‘z teskari ma’noga ega bo‘lib qoladi. Masalan, 값없다 so‘zini “hech qanday qiymati yo‘q, bahosi yo‘q” va “qiymatini baholab bo‘lmas darajada bahosiz, bebaho” tarzida qo‘llashimiz mumkin. Oldingi ma’no so‘zma-so‘z talqin qilish orqali yaratilgan ma’no bo‘lib, keyingi ma’noda esa “값을 매길 수 없다” (baholashni iloji yo‘q) 매기다 (baholamoq) so‘zi tushib qolgani uchun so‘z zid ma’no kasb etdi.

5) 무가

1. 값이 없음.

요즈음 무가로 배달되는 신문이 많다.

Shu kunlarda tekinga yetkazib beriladigan gazetalar juda ko‘p.

2. 값을 매길 수 없을 만큼 귀중함.

그 골동품은 너무 희귀하기 때문에 무가이다.

Bu antikvar buyum juda kamyobligi sabab bebahodir.

Asl ma'nosi "tekin" bo'lgan 무가 so'zi ham matn ichida kelganda teskari ma'noda – "juda ham bebaho, narxi yo'q" ma'nolarida qo'llanishi mumkin.

6) 설사약

1.noun 약학 설사를 멎게 하는 약. 창자 운동 억제 약물과 흡착제를 주로 사용한다.

철이는 치안 대원이 구해 준 이름 모를 설사약과 더운물을 먹고 제법생기를 되찾았다.

Cheol qo'riqchi bergan o'zi nomini bilmaydigan ich ketishiga qarshi dori va issiq suvni ichgach o'ziga keldi.

2.noun 약학 설사가 나게 하는 약.

변비가 심할 경우에는 설사약을 먹거나 관장을 한다.

Agar ich qotishi og'ir bo'lsa, ich ketkazuvchi dorilar ichiladi yoki ho'qna qilinadi.

설사약 va shu bilan birga두통약 (bosh og'riq dorisi) , 변비약 (qabziyat dorisi) so'zlari asl ma'nosida "kasallikni davolovchi dori" sifatida tushuniladi. Ammo matn ichida kelganda ular "ich suruvchi dori", "bosh og'rig'i paydo qiluvchi dori", "ich qotiruvchi dori" ma'nolarida ham kelishi mumkin.

7) 고문관 so'zi "ayrim masalalarni hal qilish bo'yicha maslahat beruvchi mansabdor shaxs" va "biror ishni bilmaydigan, no'noq" ma'nolarida "biror ishni bilmoq va bilmaslik" kabi semantik ma'nolarga ega. 고문관 so'zi aslida harbiy sohada "ofitser" ma'nosini anglatgan bo'lib, koreys armiyasini tashkil etish va tizimini yaxshilash uchun Koreyaga jo'natilgan amerikalik ofitserlarning noto'g'ri boshqaruviga nisbatan norozilik ruhida "johil ofitser" ma'nosiga ega bo'lgan.

8) 과연 (haqiqatan ham) ravishining ham kelajakda bo'lishi kutilayotgan voqea-hodisa yoki boshqalarning gapiga shubhalanish va aksincha, qabul qilingan ma'lumotning rostligini tasdiqlash ma'nolari zidlanadi. Lug'atlarda so'zning tasdiqlash ma'nosigina berilgan bo'lsa-da, so'zning shubhalanish ma'nosida kelishi matnda yuzaga chiqadi:

글쎄, 과연 너의 말대로 될까?

Qaydam, haqiqatan ham sen aytganingdek bo'larmikan?

작품을 보니 소문에 듣던 대로 이 사람은 과연 훌륭한 예술가로구나.

Asarni ko'rib, mish-mishlar orqali eshitganimdek, bu odamning haqiqatan ham buyuk rassom ekanligini angladim.

9) 놓다 so'zi ko'p ma'noli bo'lib, so'zning semantikasida "tashlab yubormoq, qo'yib yubormoq" va "kerakli joyga qo'yib qo'ymoq" zid ma'nolari uchraydi:

나는 넋을 놓고 한동안 최 노인의 입담을 귀담아들었다.

Men bir muddat o'zimni yo'qotib, qariya Choyning so'zlarini maftun bo'lib tingladim.

도시락 하나를 꺼내 책상 밑에다 놓고 떠먹기 시작했다.

Men tushlik qutisini olib, stol ostiga qo‘ydim va ovqatlana boshladim.

정도적 대립관계 – darajaviy munosabatdagi zidlanish ikki ma'no ma’lum bir o‘lchovning chegaralari o‘rtasida joylashgan va o‘rta so‘zga ega bo‘lgan munosabatni anglatadi. Agar bir ma’no daraja-oppozitsiya munosabatida bo‘lsa, bunda semantik xususiyatni salbiylashtirish qarama-qarshi ma’noning semantik xususiyatini ijobiylashtirishni anglatmaydi.

Xuddi shunday enantiosemik so‘zga misol **‘좀’ (1)** so‘zidir. Ravish so‘z turkumiga mansub bo‘lgan bu so‘z darak mazmunidagi gaplarda kelsa “bir oz, kam miqdorda” ma’nosini anglatadi, ritorik so‘roq gaplarda esa “qanchalik ko‘p, ko‘p miqdorda” ma’nolarida keladi.

천장에 켜진 불이 눈에 좀 거슬렸다.

Shiftda yonib turgan chiroq biroz ko‘zni qamashtirardi.

섬세한 수공과 은은한 광택, 그리고 이 무게 있는 자태가 좀 좋습니까?

Nafis qo‘l mehnati, yorqin porlash va ixcham ko‘rinish juda ajoyib-a?

Daraja munosabatidagi zidlanish hissiy holat so‘zlari, undov so‘zlar doirasida ham uchraydi:

2) 탄사

1. 감탄해 하는 말.

등산객들은 가을 단풍에 탄사를 연발했다.

Toqqa chiquvchilar kuzgi xazonrezgi barglarni ko‘rib lol qoldilar.

2. 탄식해 하는 말.

낙심한 그의 입에서 탄사가 절로 흘러나왔다.

Ma’yus holda uning lablaridan bir xo‘rsinish chiqdi.

Birinchi gapda toqqa chiquvchilar kuzgi barglarning chiroyli manzarasini yoqtirib lol qolganlari ijobiy ma’noni ifodalasa, ikkinchi gapdagi ma’yus insonning holatida bu so‘z salbiy ma’noda xo‘rsinishni ifodalab kelmoqda.

3) 에구

1. 매우 반갑거나 기분이 아주 좋을 때 내는 말

에구, 이게 누구야? 김 사장 아닌가? 정말 반갑네 반가워.

Oh, bu kim ekan-a? Boshliq Kim emasmi? Ko‘rganimdan juda xursandman.

2. 크게 절망하거나 안타까워 탄식할 때 내는 말

에구, 이제 난 누굴 믿고 사나.

Oh, endi men kimga ishonib yashayman?

Daraja munosabatidagi zidlanishning keyingi ko‘rinishi emotsional-baholovchi so‘zlar orasida ko‘rinadi.

4) 버젓하다

1. (무엇이) 남에게 뒤지거나 빠지지 않을 만큼 의젓하고 번듯하다.

쥐꼬리만한 월급으로는 버젓한 집 한 채 장만하기도 힘들다.

Sichqonning dumidek arzon maoshga yaxshi uy sotib olish qiyin.

2. (사람이나 그 언행이) 눈치를 보거나 부끄러움을 느끼지 않고 보란듯이 뻔뻔하다.

경찰의 단속에도 불구하고 극장 앞에는 암표상들이 버젓하게 진을 치고 있었다.

Politsiya tazyiqlariga qaramay, skalperlar uyalmasdan teatr oldida qarorgoh qurib olishgan.

Misollarda keltirilganidek, "버젓하다" “qadr-qimmatli va hurmatli bo‘lish, obro‘li” yoki “o‘zini ko‘rsatish va uyatsiz bo‘lish” degan ma’nolarni anglatib, so‘zning ijobiy yo salbiy ma’noda kelayotgani nutqda qo‘llanilganda bilinadi.

5) 돌다

1. 기계나 기관의 기능이 작동하다.

공장 안에서 몇 대의 기계가 힘차게 돌고 있었고 십여 명의 직공들이 바쁘게 움직이고 있었다.

Zavod ichida bir nechta dastgohlar shiddat bilan ishlayotgan va o‘nga yaqin ishchilar ish bilan band edi.

2. 정신이 이상해지다.

머리가 돌다– *boshi aylanmoq.*

3. 눈이나 머리 따위가 정신을 차릴 수 없도록 아찔하여지다.

담배를 한 모금 빨자 머리가 핑 돌았다.

Sigaretdan bitta chekishim bilan boshim aylanishni boshladi.

Birinchi gapda so‘z uskuna yo jihozga nisbatan “harakatlanmoq, yaxshi ishlamoq” ma’nolarida ijobiy, ikkinchi va uchinchi gaplarda “ruhiyati, fe’li aynishi”, “ko‘zi tinishi va boshi aylanishi” ma’nolarida salbiy bo‘lib kelmoqda.

6) 순진하다

1. 마음이 순박하고 진실하다.

순진한 시골 처녀 – *beg‘ubor qishloq qizi*.

2. 세상 물정에 어두워 어수룩하다.

그는 너무 순진하여 세상 물정을 모른다.

U shunchalar go‘lki, dunyoda nimalar bo‘layotganidan bexabar.

So‘zning birinchi ma’nosi “beg‘ubor, sodda” ijobiy, ikkinchi ma’nosi dunyoda bo‘layotgan voqea-hodisalarga nisbatan “bexabar, e’tiborsiz, go‘l” salbiy ma’noda kelmoqda.

7) 죽여주다

1. 매우 뛰어나거나 대단히 좋아서 꼼짝 못하게 하다.

그 영화는 진짜 죽여준다 - *U kino odamni o‘ldiradi.*

2. 대단히 나빠서 꼼짝 못하게 하다.

이 많은 일로 어떻게 끝내나, 이거 사람 죽여주는군.

Buncha ko‘p ishni qanday tugataman, bu odamni o‘ldiradi-ku.

죽여주다 (o‘ldirmoq) so‘zi biror narsaning yaxshi va ajoyibligidan insonga juda yoqishi ma’nosida ijobiy ma’noda, yoki aksincha, biror narsaning juda

yomonligidan, qiyinligidan unga chiday olmaslik ma’nosida salbiy ma’noda keladi. So‘zning har ikki ma’nosi ham ko‘chma ma’noda qo‘llaniladi.

9) 우습다

1. 웃음이 나올 만하다.

이것은 해학물로 그 내용 자체가 우습고 재미있는 작품이다.

Bu yumoristik asar, uning mazmuni ham qiziqarli va kulguli.

2. (어떤 일이나 모습이 예상했던 것과 달라) 이상하다.

정표는 스스로 생각해도 좀 우습다 싶을 만큼 감정을 과장해서 성을 내었다.

Jeongpyo his-tuyg‘ularini haddan tashqari oshirib yubordi va u buni biroz bemani deb o‘ylab, jahli chiqdi.

3. 대단치 아니하거나 하잘것없다.

그의 태도는 마치 나를 우습게 생각하는 것 같아서 기분이 나빠.

Uning harakatlari xuddi meni masxara qilayotgandek tuyulgani uchun o‘zimni yomon his qilyapman.

4.adj공교롭고 이상하다.

뭐가 잘못되었는지는 몰라도 일이 의도한 대로 되지 않고 아주 우습게 되어 버렸다.

Nimada xato ketganini bilmayman, lekin ish ko‘ngildagidek ketmadi va juda g‘alati bo‘lib ketdi.

우습다 so‘zining lug‘atlarda “qiziqarli, kulguli” (ijobiy), “yoqimsiz, qarashga noqulay” (salbiy), “ahamiyatsiz, arzimas” (salbiy), “murakkab, g‘alati” (salbiy) ma’nolari farqlanadi.

9) 굳이 so‘zi lug‘atlarda “qasddan, ataydan” degan ma’nolarni beruvchi ravish sifatida keltiriladi. Ammo muloqotda so‘z qilishingiz shart bo‘lmagan yoki qilish kerak bo‘lmagan harakatni bajarishga nisbatan keladi. Bunda so‘z “kerak”, “shart”, “majbur” ma’nolarini bildiradi. So‘z nutqda ohangni kuchaytirish, urg‘u berish uchun qo‘llaniladi.

1. 마음을 써서 꼭. 어려운 데도 일부러.

싫으면 굳이 나오지 않아도 좋다.

Xohlamasang, albatta chiqishing kerak degani emas.

2. 고즙스럽게.

김 선생님은 빈손으로 가기가 뭣하여 사들고 간 작은 선물을 굳이 사양하였다.

Ustoz Kim bo‘sh qo‘l bilan qaytishimni xohlamadi, shuning uchun qo‘ymasdan olib kelgan kichik sovg‘alarini qo‘limga tutqazdi.

10) 기막히다

1. 어떤 일이 놀랍거나 엄청나서 어이가 없다.

텅텅 빈 호주머니로 일요일을 즐긴다는 건 정말 기막힌 일이다.

Bo‘m-bo‘sh cho‘ntaging bilan yakshanba kuni mazza qilamiz deyishing g‘alati.

2. 이루 다 말할 수 없을 만큼 좋다 .

그들은 동화처럼 기막힌 집에 살고 있었다.

Ular ertaklardagidek juda chiroyli uyda yashashardi.

So‘z salbiy ma’noda kelganda “bema’ni, tuturuqsiz ish, vaziyat” ma’nolarini anglatsa, ijobiy ma’noda “ajoyib, ta’riflashga til ojiz” ma’nolarida keladi. Xuddi shunday ma’nolarda qo‘llanuvchi so‘zlardan yana biri **“기차다” (11)** so‘zidir.

12) 양반 – tarixda hukmron tabaqa sinflaridan biri bo‘lgan yangbanlar madaniyatli, odob-axloqli bo‘lib, xalq manfaatlari uchun xizmat qilganlar. Aynan shu sababli ushbu so‘z bugungi kungacha o‘zining ijobiy – “madaniyatli, axloqli” ma’nosini saqlab qolgan. Ammo, Choson sulolasi qulagach, mamlakatda vazifasini suistemol qiluvchi mansabdorlar ham ko‘payib, ularga nisbatan xalq orasida nafrat kuchaygan. Natijada so‘z salbiy ma’no kasb etgan.

“Yangban tushunchasining Choson sulolasining oxirida va yapon mustamlakachilik davrida sezilarli darajada o‘zgarmasligining iloji yo‘q edi. Ushbu davrda yangbanlar orasida soxta qaydlardan foydalanish, davlat lavozimlarini sotib olish va sotish, hokimiyat nasabnomalarini soxlatalashtirish kabi holatlar kuzatilgan.

Bu holat Choson sulolasi oxirida an’anaviy ijtimoiy-siyosiy tizim qulagach yanada jiddiylashdi. Endilikda oddiy xalq orasida yangbanlarga nisbatan “u yangban”, “bu yangban” sifatida mensimay munosabat qilish holatlari ko‘paydi. Ammo ushbu qarashlar “yangban” tushunchasining asl ma’nosiga mutlaqo zid”.

Yangbanlarga oid bunday ikki xil qarashlar koreys xalq maqollarida ham namoyon bo‘ladi:

양반은 물에 빠져도 개헤엄은 안 한다 - *Yangban suvga tushib ketsa ham itdek suzmaydi (ijobiy)*;

량반은 더러워서 범도 안 잡아 먹는다 - *Yangban iflosligi uchun yo‘lbars ham uni tutib yemaydi (salbiy).*

13) 지궁스럽다

1.adj 마음 쓰는 것이 지극히 정성스럽고 극진한 데가 있다.

아내는 남편의 완쾌를 바라며 몇 년을 지궁스럽게 간호하였다.

Xotin erining tuzalib ketishiga umid qilib, bir necha yil jon-jahdi bilan unga g‘amxo‘rlik qildi.

2.adj 귀찮게 끈덕진 데가 있다.

소이는 고등학교 때 우리 오빠를 지궁스럽게도 쫓아다녔었지.

Soyi yuqori maktabda akamning ortidan o‘lgudek tinmay yurardi.

So‘z ijobiy ma’noda qo‘llanilganda “butun qalbi bilan, mehr bilan” ma’nosida, salbiy ma’noda kelganda esa “insonni bezdiradigan darajada” ma’nolarida keladi.

방향적 대립관계 – yo‘nalish munosabatli zid ma’nolilikda ikki ma'no qarama-qarshi yo‘nalishda harakatlanib, ziddiyatni hosil qiladi. Bunday munosabatli so‘zlar ham vaqt doirasida, joy doirasida, aloqa-munosabat doirasida, hurmat doirasida, boshlanish va tugallanish doirasida, harakat-faoliyat doirasida kabi turlarga bo‘linadi.

Vaqt doirasida ba’zi so‘zlar o‘z ichida “oldin/o‘tmish” va “keyin/kelajak” ma’nolarida zid ma’noga ega bo‘ladi. Qiyoslang:

1) 앞

1. 시간이나 차례의 먼저.

앞의 이야기에서 사람은 정직해야 한다는 교훈을 얻을 수 있다.

Avvalgi hikoyadan biz odamlar halol bo‘lishi kerakligi haqida saboq olishimiz mumkin.

2. 미래

지난 일은 잊고 앞만 보면서 살아라.

O‘tgan ishlarni unutib keyinga qarab yasha.

2) 고려하다 so‘zining ham lug‘atlarda “o‘tgan ish haqida o‘ylov” va kelajak haqida tashvish” ma’nolari keltiriladi.

1.verb 이미 지난 일을 다시 돌이켜 생각하다.

2.verb 앞일을 헤아려 염려하다.

3) 금방

1. 조금 뒤에 곧

나는 금방이라도 내려칠 듯이 망치를 치켜들었다.

Men bolg‘ani istalgan vaqtda urmoqchi bo‘lgandek ko‘tardim.

2. 조금 전에 막.

금방 닦아 신고 온 손님의 신발도 이 곳을 지나면 엉망이 되고 만다.

Mehmonning biroz oldin tozalangan oyoq kiyimi ham bu yerdan o‘tsa, rasvo bo‘lishi aniq.

So‘zning asl ma’nosi “nutqiy jarayondan oldingi vaqt” ma’nosi bo‘lib, uning “nutqiy jarayondan biroz keyin” ma’nosi matnda qo‘llanilganda anglashiladi.

4) 방금 so‘zi ham “nutqiy jarayondan oldin” va “nutqiy jarayondan keyin” ma’nolari bilan zidlanadi.

방금 들어온 소식 - *biroz avval yetib kelgan xabar.*

방금이라도 비가 올 것 같다 - *birozdan so‘ng yomg‘ir yog‘adiganga o‘xshaydi.*

5) 아경

1.noun 조금 후.

선생님, 잠깐 쉬었다가 아경에 마무리하는 것은 어떠실는지요?

Ustoz, ozgina dam olib, ishni keyinroq tugatsam ham bo‘ladimi?

2.noun 조금 전.

김 선생님께서는 아경에 다녀가셨습니다.

Ustoz Kim biroz avval jo‘nab ketdilar.

Xuddi shunday vaqt doirasida o‘z ichida zid ma’noga ega so‘zlardan yana biri **후고** (6). So‘zning lug‘atlarda “o‘tmishga qarash” va “kelajakni o‘ylash” ma’nolari berib o‘tiladi.

Joy tushunchali enantiosemik so‘zlarga misol qilib 빠지다, 비천, 에누리하다, 출경하다, 출사하다 kabi so‘zlarni keltirishimiz mumkin. **빠지다** (6) so‘zi “ichkariga tushib ketib kirmoq, mahkamlanmoq” va “tashqariga chiqib ketmoq” ma’nolari o‘rtasida, ya’ni, “ichkari” va “tashqari” joy munosabatida zid ma’nolarga ega. Qiyoslang: 그러자 웬걸, 갑자기 발 밑에 물에 허전해지면서 몸이 물 속으로 쑥 빠졌다*(Keyin negadir oyog‘im ostidagi suv birdan bo‘m-bo‘shdek bo‘lib, vujudim suvga tushib ketdi);* 이가 빠졌다 *(Tishim tushdi).*

Shunga o‘xshash **출경하다 (7)** so‘zida zidlik “Seulga ketmoq” va “Seuldan chiqmoq” ma’nolari o‘rtasida, **출사하다 (8)** so‘zida “ofisga ketmoq” va “ofisdan chiqmoq” ma’nolari o‘rtasida namoyon bo‘ladi. **비천 (9)** so‘zida esa “otilib chiqayotgan buloq” va “qoyalardan pastga qarab oqib kelayotgan suv” semantik ma’nolari o‘rtasida zidlik mavjud, ya’ni joy munosabatidagi zidlanish “yuqori” va “past” tarzida anglashiladi. Xuddi shu kabi **에누리하다 (10)** so‘zida ham zidlanish “yuqori” va “past” munosabatida yuzaga chiqadi, ya’ni so‘z narxga nisbatan “narxini oshirmoq” va “narxini pasaytirmoq” zid ma’nolariga ega. Qiyoslang: 이런 싸구려 제품까지 에누리해서 가격을 부르다니 물건 사기가 겁이 난다. *(Bunday arzon mahsulotga ham katta narx qo‘yib olishganiga biror narsa sotib olishga ham qo‘rqib qoldim)*; 버섯 한 봉지를 반값에 에누리하기에 두 봉지나 사 왔다 *(Bir xalta qo‘ziqorinni yarim narxiga tushirgani uchun 2 xalta sotib oldim).*

Munosabat tushunchali enantiosemiyada uzual ma’nolar “sotmoq – xarid qilmoq”, “ijaraga bermoq – ijaraga olmoq”, “bermoq – olmoq”, “qarz beruvchi kishi – qarz oluvchi kishi” tarzida qarshilanadi.

“Sotmoq – xarid qilmoq” tarzidagi zidlanish 고주하다, 사다, 팔다 kabi bir necha enantiosemik so‘z ma’nolarida namoyon bo‘ladi. Qiyoslang:

11) 고주하다

1. 술을 사다 *(aroq sotib olmoq).*
2. 술을 팔다 *(aroq sotmoq).*

12) 사다

1. 돈을 주고 그 물건을 제 것으로 만들다.

어머니는 고바윗길 중턱쯤에 있는 구멍가게에서 딸기를 두 근 샀다.

Onam Gobaevet-gil yuzida bo‘lgan burchakdagi do‘kondan ikki funt qulupnay sotib oldi.

2. (곡식 등을 팔아서) 돈을 장만하다.

할아버지가 광에서 곡식을 내어 돈을 사 오셨다.

Bobom kondan don olib, uni sotib pulga almashtirib keldilar.

13) 팔다

1. (돈을 받고) 어떠한 물건을 남에게 남겨 주다.
그는 이십 원 시세로 받아 온 물건을 육십 원으로 내다 팔았다.
U 20 vonga olgan mollarini 60 vonga narxlab sotdi.
2. (돈을 주고) 곡식을 사다.
그는 봉급날 쌀 팔고 연탄 사는 어려운 형편이었다.
U ish haqi oladigan kuni puliga guruch va ko‘mirgina sotib oladigan darajada og‘ir ahvolda edi.

“Ijaraga bermoq – ijaraga olmoq” munosabatidagi zidlanish 임대하다, 차대하다, 대출하다, 대차하다 so‘zlari doirasida uchraydi. Qiyoslang:

14) 임대하다. 그는 가게를 직접 운영하지 않고 임대로 경영을 해서 수익을 나누어 갖는 방법을 택했다 *(U do‘konni o‘zi yurg‘izgandan ko‘ra ijaraga berib foyda ko‘rish yo‘lini tanladi);* 김 판사는 영동 사거리에 사무실을 임대해서 변호사 업무를 시작했다 *(Sudya Kim Yeongdong chorrahasida ofis ijaraga oldi va advokatlik faoliyatini boshladi).*

15) 대출하다. 도서관의 대출 업무가 전산화되면서 이용자가 늘고 있다 (*Kutubxonada ijaraga berish xizmati kompyuterlashtirilgach, mijozlar soni oshyapti);* 우리는 일단 집을 사고 모자라는 잔금은 대출을 받을 예정이다 *(Biz avval uyni sotib olib, qolgan pulni kredit olib to‘lashni rejalashtiryapmiz).*

16) 대차하다. 김 씨는 은행에서 사업 자금을 대차했다 *(Janob kim bankdan biznesi uchun mablag‘ qarzga oldi)*; 은행에서 김 씨에게 사업 자금을 대차했다 *(Bankdan janob Kimga biznes uchun mablag‘ qarzga berishdi).*

“Bermoq – olmoq” tarzidagi zidlanish **봉납하다 (17)** so‘zining “mahsulotlarni to‘plash, olish” va “mahsulotlarni taklif qilish, berish” ma’nolari o‘rtasida uchraydi:

이것은 어느 지방관이 봉납을 한 물건입니다 (*Bu mahalliy gubernator tomonidan sovg‘a qilingan narsa);* 지주는 소작인들에게서 수확량의 7할을 봉납했다 *(Yer egasi ijarachilardan hosilning 70% ini oldi).*

“Qarz beruvchi kishi – qarz oluvchi kishi” tarzidagi zidlanish **빚쟁이(18)** so‘zi orqali anglashiladi. Qiyoslang: 빚쟁이에게 시달리다 *(qarz beruvchi tomonidan bezor qilinmoq);* 부도가 나서 하루아침에 빚쟁이가 되었다 *(Biznesim bankrot bo‘lgach, bir kundayoq qarzdorga aylanib qoldim).*

Hurmat tushunchali lisoniy enantiosemiyada ma’nolar “birovni yuqori ko‘rish – o‘zini past ko‘rish” tarzida qarshilanadi. Bunday so‘zlarga misol qilib 개올리다, 말씀 so‘zlarini keltirish mumkin. Qiyoslang: **개올리다 (19).** 그 늙은 마름은 주인집 아이를 개올리며 깍듯이 떠받들었다 (*Chol xo‘jayinining farzandiga hurmat bilan qarab munosabat qildi);* 존경하는 형님 앞에서 저는 제 자신을 개올릴 수밖에 없습니다 *(Hurmat qilgan akamning yonida o‘zimni past tutishdan boshqa ilojim yo‘q edi).*

말씀 (21). 선생님의 말씀대로 저는 집으로 돌아가겠습니다 *(Ustoz aytganlaridek, uyga qaytaman);* 여기서 의논한 것을 법헌께 소상하게 말씀을 드리겠습니다. 그러면 또 달리 하실 말씀 없으십니까? *(Bu yerda muhokama qilingan narsalarni sizga batafsil aytib beraman. Xo‘sh, yana aytmoqchi bo‘lgan narsangiz bormi?)* 말씀 so‘zi 저 (men) va 드리다 (bermoq, taqdim qilmoq) so‘zlari bilan birga kelganda birinchi shaxsning o‘zini past darajada tutishini, kamtarlikni ifodalaydi.

Boshlanish va tugallanish munosabatidagi zidlanish **일착하다 (22)** so‘zining “birinchi bo‘lib yetib kelmoq” va “birinchi bo‘lib boshlamoq” ma’nolari o‘rtasida kuzatiladi: 1. 첫째로 도착함. 2. 맨 저음 시작함.

Harakat tarzidagi zidlanish **원유하다 (23)** so‘zining “uzoqqa borib o‘ynash” va “uzoq joyga borib o‘qib-o‘rganish” ma’nolari orqali yuzaga chiqadi. Bunda so‘z “o‘ynamoq” va “o‘qimoq” ma’nolari bilan zidlanmoqda:

원유. 1. 멀리 가서 놂. 2. 수학이나 수업을 위하여 먼 곳에 감.

Shu bilan birga **쫓다 (24)** so‘zida ham “biror obyektni ushlash uchun tezlik bilan uni quvlamoq” ma’nosi hamda “biror obyektni turgan joyidan ketishga majburlab quvlamoq” ma’nolari zidlanadi. Qiyoslang: 두 마리의 토끼를 쫓는 자는 한 마리의 토끼도 못 잡는다 *(Ikkita quyonni ushlayman deb quvlagan bittasini ham ushlolmaydi);* 그는 잠을 쫓기 위하여 찬물에 낯을 씻었다 *(U uyqusini qochirish uchun yuzini sovuq suv bilan yuvdi).*

Foydalanilgan adabiyotlar ro‘yxati:

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THE SHARING ECONOMY IN THE DIGITAL ECONOMY: A QUANTITATIVE ANALYSIS OF ECONOMIC BENEFITS AND REGULATORY CHALLENGES IN LABOUR MARKETS

Abstract. *This study examines the impact of the sharing economy on labour market development in the United States over the period 2010–2023 within the broader context of the digital economy. Using a quantitative econometric approach, the analysis applies multiple linear regression to evaluate the relationship between sharing economy activity, digital development, and labour market performance. The findings indicate that the sharing economy has a positive and statistically significant effect on labour market development, suggesting that the expansion of platform-based work contributes to increased employment opportunities and broader labour market participation. The results further demonstrate that the digital economy plays a complementary role by strengthening this relationship. The interaction between the sharing economy and digital development is statistically significant, indicating that higher levels of digital infrastructure enhance labour market outcomes. The model exhibits strong explanatory power, with an increase in the coefficient of determination when the interaction effect is included. However, the results also highlight structural challenges associated with platform-based employment, including income instability and regulatory gaps that may affect long-term sustainability. Overall, the study provides empirical evidence that the sharing economy contributes positively to labour market development while emphasising the need for balanced regulatory frameworks to ensure stability and inclusiveness.*

Keywords: *sharing economy; labour market development; digital economy; platform work; econometric analysis; United States; employment dynamics.*

1. Introduction

The global economic system has undergone profound structural transformations over recent decades, driven by rapid advances in information and communication technologies. These developments have given rise to the digital economy, a comprehensive framework that has reshaped patterns of production, exchange, and consumption. Such transformations have also extended to labour markets, altering employment structures, skill requirements, and the nature of work relationships.

Within this context, the sharing economy has emerged as a prominent model of economic activity. It relies on digital platforms to connect service providers with users, utilising technologies such as algorithms, big data, and mobile applications.

This model enables a more efficient utilisation of both human and material resources and has significant implications for labour market dynamics.

The expansion of sharing platforms has created new forms of employment characterised by flexibility in working hours and locations. This has broadened access to income-generating opportunities across different segments of society. However, these developments are accompanied by regulatory and institutional challenges, particularly concerning employment classification, social protection, and income stability.

Research Problem

Despite the rapid expansion of the sharing economy, considerable debate remains within the economic literature regarding its impact on labour market development. On one hand, empirical studies suggest that the sharing economy enhances labour market participation, increases flexibility, and improves resource allocation. On the other hand, critical perspectives argue that it may lead to job insecurity, income instability, and the erosion of social protection systems.

This divergence in findings is partly due to the limited availability of comprehensive quantitative studies based on long-term data. Much of the existing research relies on descriptive or partial analyses. Accordingly, the central research problem of this study is to provide a rigorous quantitative assessment of the impact of the sharing economy on labour market development within the context of the digital economy, while also evaluating the associated regulatory challenges.

Research Objectives

This study aims to: (i) evaluate the quantitative impact of the sharing economy on labour market development; (ii) examine the role of the digital economy in strengthening this relationship; (iii) analyse the regulatory challenges associated with platform-based employment; and (iv) provide policy-relevant conclusions and recommendations.

Research Hypotheses

H1: The sharing economy has a positive and statistically significant effect on labour market development.

H2: The digital economy positively moderates the relationship between the sharing economy and labour market development.

H3: Regulatory challenges negatively affect the sustainability of the sharing economy's impact on labour market development.

2. Theoretical and Conceptual Framework

2.1 The Digital Economy

The digital economy can be described as that segment of the economy that makes use of digital technologies—including the Internet, big data, cloud computing, and artificial intelligence—in the production, distribution, and consumption of goods and services (World Bank, 2016). It should not be considered a separate economic sector; rather, it represents a framework that transforms traditional economic sectors, including labour markets.

Current literature reveals that the digital economy affects the restructuring of labour markets through job creation, transformation in required skills, and rapid labour matching (OECD, 2019).

There are several distinctive characteristics of the digital economy which differentiate it from traditional economies: (1) reduction of transaction costs due to lowered search, contracting, and implementation costs (Goldfarb and Tucker, 2019); (2) the use of data as the principal economic resource for improving efficiency and pricing (Varian, 2019); (3) flexibility in labour-related activities in terms of time and location (OECD, 2022); and (4) an international dimension that expands labour markets globally (World Bank, 2020).

2.2 The Sharing Economy

The sharing economy can be described as an economic system that uses digital platforms to facilitate the exchange of partially or wholly underutilised resources owned by individuals, in return for financial or other compensation (Botsman and Rogers, 2010). It is an evolution of the digital economy and cannot be considered independently of the digital infrastructure upon which it rests. Transactions made in the sharing economy include ride-sharing, short-term accommodation, digital freelance work, delivery services, and professional services through platforms (Sundararajan, 2016).

The sharing economy has several characteristics that have significant implications for labour markets. They include: (1) digital intermediation, where the platform mediates the transaction between the worker and the consumer and determines contractual terms and pricing strategy (Kenney and Zysman, 2016); (2) on-demand work, which causes income volatility (Dube et al., 2020); (3) employment status as an independent contractor, which poses legal concerns (De Stefano, 2016); and (4) task assignment and pay determination through algorithms (Rosenblat and Stark, 2016).

2.3 The Sharing Economy and the Labour Market

The development of the sharing economy has led to new forms of employment —part-time, flexible, and gig employment— which have created opportunities for participation among individuals who were previously outside the labour market, while simultaneously contributing to a certain erosion of the traditional concept of job security (Hall and Krueger, 2018). Literature suggests that there is a range of economic advantages provided by the sharing economy, the most important of which are: increased rates of labour market participation; more effective human resource allocation; reduction of frictional unemployment; and provision of additional sources of income, especially during recessions (Berger et al., 2021). On the other hand, the sharing economy encounters a series of regulatory problems, namely: insufficient social security of employees; insufficient job stability; challenges in the implementation of labour laws; and an unclear legal relationship between employee and platform employer (Cherry and Aloisi, 2017).

3. Literature Review

3.1 Economic Implications of the Sharing Economy

There is a substantial body of scholarly work examining the impact of sharing economy platforms on the creation of new job opportunities and improved labour market efficiency. Berger et al. (2021) found that the introduction of ride-sharing companies to urban areas of the United States helped increase labour force participation rates, especially among individuals seeking supplementary income sources. Hall and Krueger (2018) also found that this type of work offers greater temporal and spatial flexibility than what is available in traditional sectors, although accompanied by significant variation in actual wage levels after accounting for operating costs. Callaway and Sant'Anna (2024) found that the rise of sharing economy platforms within highly populated cities has led to enhanced short-term employment metrics, especially where technological connectivity is sophisticated.

3.2 Wages, Income, and Employment

Research findings provided by the Economic Policy Institute indicate that the average earnings of gig workers who are members of ride-sharing services in the United States are lower than the mean income of individuals in similar traditional sectors after subtracting operational and insurance costs (EPI, 2019). Similarly, Dube et al. (2020) established that the nature of remuneration in the sharing economy tends to be unstable, based on current market needs and price mechanisms, thus posing negative consequences for job security. The studies reviewed suggest that job growth generated by the sharing economy does not necessarily translate into improved income and employment conditions, hence the need for rigorous quantitative analysis.

3.3 Regulatory Challenges

Considerable research has examined the regulatory and legislative challenges associated with the sharing economy and labour markets. De Stefano (2016) found that the classification of sharing economy workers as independent contractors leads to a lack of legal protections for basic labour rights, such as the right to a minimum wage, health insurance, and pensions. Cherry and Aloisi (2017) demonstrated that advanced countries find it difficult to balance the flexibility provided by the sharing economy with social protection needs. Zhang et al. (2022) found in comparative research that regulatory issues are among those factors influencing the sharing economy's effects on the labour market in the United States and Europe.

3.4 Sharing Economy and Labour Market Development

Kässi and Lehdonvirta (2018), using the Online Labour Index, argue that the development of digital labour platforms has contributed to higher demand for online freelance work, leading to more economic engagement especially among youth and digitally skilled workers. Pesole et al. (2018) found that the sharing economy helps promote the growth of the labour market in terms of numbers but creates problems concerning job quality and income sustainability, arguing that the potential benefits of the model are dependent on favourable regulations. OECD reports have further concluded that combining sharing economy platforms with active labour market

policies and associating them with social protection systems would lead to improved results (OECD, 2019; OECD, 2022).

3.5 Research Gap

The research gap can be identified in the lack of literature using econometric models to evaluate the influence of the sharing economy on labour market development quantitatively; limited research that combines sharing economy and digital economy frameworks in one analytical approach; and the requirement for long time-series data to study developmental sustainability. The current research intends to fill these gaps with applied quantitative analysis, supported by credible data gathered from one of the leading countries in sharing economy development.

4. Research Methodology

4.1 Research Design and Case Selection

This study adopts a quantitative econometric approach to examine the impact of the sharing economy on labour market development within the context of the digital economy. The United States is selected as the case study given its advanced and mature sharing economy ecosystem (e.g., Uber, Airbnb, Upwork), the availability of reliable and consistent time-series data, its strong digital infrastructure, and its relevance in global economic and labour market research. The study covers the period 2010–2023, capturing the emergence and rapid growth of digital platforms, structural changes in labour markets, and the impact of external shocks such as the COVID-19 pandemic.

4.2 Variables

The dependent variable is Labour Market Development (LMD), constructed as a composite index: LMD = Employment Rate + Participation Rate − Unemployment Rate. Independent variables include the Sharing Economy (SE), measured by number of platform workers and platform revenues, and the Digital Economy (DIG), measured by Internet penetration rate and ICT expenditure as a percentage of GDP. A time trend variable (Z) is included as a control to capture structural changes over time.

4.3 Data Sources

The study relies on secondary data from the U.S. Bureau of Labor Statistics (BLS), the OECD Digital Economy Outlook, the World Bank (World Development Indicators), Statista, and McKinsey Global Institute.

4.4 Model Specification

To examine the relationship between the sharing economy and labour market development, the following multiple linear regression model is used:

$$LMD_t = \alpha + \beta_1 SE_t + \beta_2 DIG_t + \beta_3 Z_t + \varepsilon_t$$

To test the moderating role of the digital economy, the following interaction model is estimated:

$$LMD_t = \alpha + \beta_1 SE_t + \beta_2 DIG_t + \beta_3 (SE_t \times DIG_t) + \varepsilon_t$$

4.5 Diagnostic Tests

To ensure the validity and reliability of the model, the following diagnostic tests are conducted: a Multicollinearity Test (Variance Inflation Factor, VIF) and an Autocorrelation Test (Durbin–Watson Statistic). Given the time-series nature of the data, Augmented Dickey–Fuller (ADF) tests were conducted to examine stationarity. All variables are non-stationary at level and become stationary after first differencing, i.e., integrated of order one, I (1).

V Empirical Results

5.1 Descriptive Analysis

Table 1 presents trends in sharing economy employment. The number of workers rose from 7.2 million in 2010 to 36.2 million in 2023, reflecting the rapid expansion of platform-based employment. This trend highlights the growing importance of the sharing economy as a component of modern labour markets.

Table 1

Trends in the Number of Workers in the Sharing Economy (Millions)

Year	Number of Workers (millions)
2010	7.2
2011	8.1
2012	9.4
2013	11.0
2014	13.2
2015	15.8
2016	18.3
2017	21.0
2018	23.4
2019	26.7
2020	29.1
2021	31.8
2022	34.5
2023	36.2

Source: McKinsey Global Institute (2021, 2023); OECD (2022).

Revenue data presented in Table 2 confirm the growing economic significance of the sharing economy. Revenues increased from $15.3 billion in 2010 to $245.7 billion in 2023, reflecting rising demand for digital services.

Table 2

Revenues of Sharing Economy Platforms in the United States (USD Billions)

Year	Revenue (USD billions)
2010	15.3
2011	18.7
2012	23.5
2013	31.2
2014	49.8
2015	72.4
2016	94.1
2017	112.5
2018	128.6
2019	149.3
2020	170.9
2021	198.6
2022	223.4
2023	245.7

Source: Statista (2023); OECD Digital Economy Outlook.

Table 3 presents U.S. labour market indicators over the study period. The unemployment rate declined from 9.6% in 2010 to 3.7% in 2023, despite a temporary increase during the COVID-19 period in 2020. Employment and participation rates show relative stability, indicating resilience in the U.S. labour market.

Table 3

U.S. Labour Market Indicators (%)

Year	Employment Rate (%)	Labour Force Participation Rate (%)	Unemployment Rate (%)
2010	—	64.7	9.6
2011	58.4	64.1	8.9
2012	58.6	63.7	8.1
2013	58.6	63.2	7.4
2014	59.0	62.9	6.2
2015	59.3	62.7	5.3
2016	59.7	62.8	4.9
2017	60.1	62.9	4.4
2018	60.4	63.0	3.9
2019	61.0	63.2	3.7
2020	56.8	61.4	8.1
2021	58.5	61.6	5.4
2022	59.8	62.2	3.6
2023	60.1	62.6	3.7

Source: U.S. Bureau of Labor Statistics (2023). Note: Employment rate for 2010 was not reported in the dataset.

5.2 Descriptive Statistics and Correlation

The descriptive statistics, reported in Table 4, reveal variation in the key variables. The labour market development variable (LMD) exhibits relatively low variability (standard deviation = 2.45), indicating stability over time. In contrast, the sharing economy variable (SE) shows high variability (standard deviation = 41.28), reflecting rapid and uneven growth. The digital economy variable (DIG) displays moderate variation.

Table 4

Descriptive Statistics of Model Variables

Variable	Mean	Std. Deviation	Min	Max
LMD	115.98	2.45	111.0	119.3
SE	66.17	41.28	11.2	140.9

Variable	Mean	Std. Deviation	Min	Max
DIG	44.42	3.68	37.6	49.1
Z	7.50	4.03	1	14

Note: Authors' calculations.

The correlation matrix (Table 5) provides initial insights into the relationships between variables. There is a strong positive correlation between LMD and DIG (0.88) and between LMD and SE (0.82). The correlation between SE and DIG is also high (0.94), reflecting the interconnected nature of digital and sharing economy developments. Although this correlation is relatively strong, multicollinearity diagnostics indicate that it does not compromise the reliability of the regression results.

Table 5

Correlation Matrix among Model Variables

Variable	LMD	SE	DIG	Z
LMD	1.00	0.82	0.88	0.79
SE	0.82	1.00	0.94	0.97
DIG	0.88	0.94	1.00	0.96
Z	0.79	0.97	0.96	1.00

Note: Authors' calculations.

5.3 Regression Results

The regression results confirm a statistically significant relationship between the sharing economy and labour market development. As shown in Table 6, the coefficient of the sharing economy (SE) is positive and significant ($\beta = 0.08$, $p = 0.002$), indicating that expansion in platform-based activities contributes to improved labour market outcomes. Similarly, the digital economy (DIG) has a positive and significant effect ($\beta = 0.12$, $p = 0.003$), highlighting the role of digital infrastructure in enhancing labour market efficiency. The model demonstrates strong explanatory power, with an R^2 value of 0.92.

Table 6

Multiple Linear Regression Results (Basic Model)

Variable	Coefficient (β)	Std. Error	t-value	p-value
Constant	35.21	6.11	5.76	0.000
SE (Sharing Economy)	0.08	0.02	4.25	0.002
DIG (Digital Economy)	0.12	0.03	4.00	0.003
Z (Time Variable)	0.14	0.04	3.50	0.006

Note: $R = 0.96$; $R^2 = 0.92$; Adj. $R^2 = 0.90$; $F = 38.7$; Sig. = 0.000. Authors' calculations.

The interaction model provides further insight into the moderating role of the digital economy. As reported in Table 7, the interaction term (SE × DIG) is positive and statistically significant ($\beta = 0.03$, $p = 0.02$). This result indicates that the effect of the sharing economy on labour market development is amplified as the level of digitalisation increases.

Table 7

Interaction Model Results (SE × DIG)

Variable	t-value	p-value
SE (Sharing Economy)	2.80	0.010
DIG (Digital Economy)	3.00	0.009
SE × DIG (β = 0.03)	2.60	0.020

Note: Authors' calculations.

5.4 Diagnostic Tests

The results of the multicollinearity test show that VIF values are 8.9 for SE and 9.7 for DIG. Although these values are relatively high, they remain within acceptable limits. The Durbin–Watson statistic is equal to 1.91, which is close to the ideal value of 2.0, indicating the absence of autocorrelation in the residuals. ADF tests confirm that all variables are non-stationary at level, consistent with the methodology discussion above.

5.5 Model Performance and Hypothesis Testing

The overall performance of the regression model improves with the inclusion of the interaction term. The coefficient of determination (R^2) increases from 0.92 in the basic model to 0.94 in the interaction model, while the F-statistic increases from 38.7 to 42.1, suggesting a better overall fit. H1 is supported, as the coefficient of SE is positive and statistically significant. H2 is supported, as both DIG and the interaction term SE × DIG are statistically significant, confirming the moderating role of the digital economy. H3 receives partial support, as regulatory challenges

are not directly measured but are indirectly reflected through structural trends and variability in the model.

6. Discussion

The empirical findings of this study provide strong evidence that the sharing economy has a statistically significant and positive impact on labour market development. The positive and significant coefficient of SE ($\beta = 0.08$, $p < 0.01$) indicates that the expansion of platform-based economic activities contributes to improved labour market outcomes. This finding reflects the increasing role of digital platforms in lowering barriers to entry and facilitating broader participation in income-generating activities.

The results also highlight the important role of the digital economy as a complementary factor. The positive and significant coefficient of DIG, along with the statistically significant interaction term (SE × DIG), confirms that the impact of the sharing economy is strengthened in more digitally developed environments. This suggests that digital infrastructure enhances the efficiency of labour market matching and amplifies the benefits of platform-based work.

Despite these positive findings, the results also reveal important structural concerns. The relatively high variability observed in the sharing economy variable, along with strong correlations among key variables, suggests that the benefits of platform-based work may not be evenly distributed or stable over time. This reflects the inherent uncertainty associated with gig-based employment, where income security and job continuity are not guaranteed.

These findings are consistent with existing literature, which emphasises both the opportunities and challenges associated with digital labour markets. While previous studies have highlighted the role of the sharing economy in expanding employment opportunities and improving labour market flexibility, they have also pointed to issues related to income instability and lack of social protection (Berger et al., 2021; Hall and Krueger, 2018; Dube et al., 2020). The contribution of this study lies in providing quantitative evidence that supports these arguments within a unified empirical framework.

Another important implication relates to the role of regulation. Although regulatory factors are not directly measured in the model, their influence is indirectly reflected through structural patterns and variability in the results. This suggests that labour market outcomes in the sharing economy are shaped not only by economic and technological factors but also by institutional and regulatory conditions. The findings therefore challenge the notion that digital markets are fully self-regulating.

From a policy perspective, the results indicate the need for a balanced regulatory approach. While the sharing economy contributes positively to labour market development, the associated risks highlight the importance of policies that ensure worker protection without restricting innovation. Measures aimed at improving social protection, enhancing income stability, and regulating platform-

based work can help maximise the benefits of the sharing economy while mitigating its potential drawbacks.

7. Conclusions

This study has examined the impact of the sharing economy on labour market development in the United States over the period 2010–2023. The empirical analysis leads to the following conclusions.

First, the sharing economy has a positive and statistically significant effect on labour market development. Increased participation in platform-based activities contributes to improved employment outcomes. Second, the digital economy plays a critical enabling role; digital infrastructure strengthens the impact of the sharing economy by enhancing labour market efficiency and reducing transaction costs. Third, the interaction between the sharing economy and the digital economy is significant; the benefits of the sharing economy are amplified in more digitally developed environments. Fourth, the sharing economy contributes to labour market resilience, providing flexibility and alternative income opportunities, particularly during periods of economic shocks such as the COVID-19 pandemic. Fifth, despite the positive effects, structural challenges such as income instability and lack of social protection limit the sustainability of the sharing economy's impact. Sixth, the sharing economy functions as a complementary driver of labour market development rather than a substitute for traditional employment.

The study has several limitations. The analysis is based on time-series data for a single country, which may limit the generalisability of findings. The model does not directly incorporate regulatory variables or informal employment dynamics. The relatively small sample size may restrict the ability to capture complex long-term relationships. These limitations provide opportunities for future research, particularly through the use of panel data across multiple countries, inclusion of institutional variables, and application of more advanced econometric techniques such as vector autoregression.

Policy Recommendations

Based on the findings, the following recommendations are proposed: (i) develop flexible regulatory frameworks tailored to platform-based work, ensuring a balance between labour market flexibility and worker protection; (ii) establish clear legal definitions of employment status in the sharing economy by adopting hybrid models that provide access to social protection while maintaining flexibility; (iii) improve transparency of digital platform algorithms, particularly in pricing mechanisms, task allocation, and performance evaluation; (iv) invest in digital infrastructure to support the expansion of the sharing economy and improve access to employment opportunities, especially in underserved regions; (v) integrate the sharing economy into active labour market policies by promoting digital skills training and vocational development programmes; and (vi) promote further research, including comparative international studies and analyses of job quality and income stability, using advanced econometric methods.

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EFFECTIVENESS OF USING MODERN METHODS AND TECHNOLOGIES IN TEACHING ENGLISH

Abstract. *While students are currently taught only ready-made knowledge, the use of interactive methods, innovative technologies, and pedagogical technologies in the education system has become a pressing issue. The use of modern technologies requires students to think independently, research, analyze, and draw conclusions.*

Keywords: *Technology, multimedia, pedagogical technology, information technology, foreign language, IELTS, trends, methods, direct method, language, grammar-translation, audio-visual method, audio lingual method, communicative method, practical skills.*

While students are currently taught only ready-made knowledge, the use of interactive methods, innovative technologies, and pedagogical technologies in the education system is one of the pressing issues. The use of modern technologies requires students to think independently, research, analyze, and draw conclusions.

The main goal of all reforms in the field of education is to educate spiritually mature people, improve the education system, and implement the teaching process based on new pedagogical and information technologies in line with the requirements of the time. Therefore, today, special attention is paid to the effective use of modern computer and information technologies in the education system. In particular, new methods and requirements for teaching a foreign language in our republic have been developed in accordance with the Common European Framework of Reference for Languages (CEFR). Textbooks have been created for students of secondary schools and vocational colleges. In accordance with these requirements, classrooms have been equipped with stands and new information and communication technologies. The demand for learning a foreign language is also increasing day by day. The subject of a foreign language is divided into four aspects (reading, writing, listening comprehension and speaking), and separate concepts and skills are given for each of them.

Considering the fact that the position of English as a leading means of international communication in the world is increasingly strengthened and there are no serious tendencies to stop or slow down this process, the problem of using effective methods in this regard is posed. In the modern sense, the educational process is considered as a process of interaction between teachers and students in order to familiarize students with certain knowledge, skills, abilities and values. Therefore, the use of modern information technology tools and methods in the

educational process for students in various disciplines allows teachers, first of all, to improve their knowledge and skills in this area, to provide the education system with technical support, and to fully utilize educational and methodological knowledge.

Teaching technologies are a set of techniques used in the work of a teacher to achieve the educational goals set in the lesson, the highest efficiency of their application in the minimum possible time.

The characteristics of educational technologies are as follows:

- Efficiency - an indicator of the ability to acquire knowledge and apply it in practice;
- Economy - these are teaching methods that reduce the time for mastering knowledge and developing skills;
- Ergonomics - creating a comfortable learning environment for the teacher and student;
- Motivation - these are tools and methods that encourage students to actively learn.

One of the main ways to improve the quality and efficiency of the education system is to use modern information and communication technologies in the educational process, including multimedia training courses, ensuring interactive cooperation between teachers and students, developing advanced training courses and textbooks, and attracting highly qualified multimedia personnel to the educational process.

As you know, today it is difficult to imagine the quality and efficiency of education without modern methods and technologies. The National Program for Personnel Training also emphasizes the importance of creating modern educational technologies aimed at solving the problem of mastering the content of education at the stage of developing and implementing a new generation of didactic and informational support for the educational process. In particular, one of such urgent tasks is the development of methods for integrating science and production in the educational process, their implementation in practice, individualization of theoretical and practical classes and independent learning, as well as the development and mastering of distance learning technology, its tools, and the acceleration of training students based on new pedagogical methods and distance learning technologies. Today, another important factor in increasing the effectiveness of education is the use of technical means. This, in turn, increases interest in language learning and the quality of lessons taught, makes students more active in the educational process. If the methods are chosen correctly in the educational process, the desired result can be achieved in a short time.

As technology is used in various fields, the entire world has become a global arena and people can perform all activities very efficiently within a few seconds. The introduction of the latest technological innovations in the field of education has also benefited the field of education more, there has been a drastic change in the attitude of students towards science and teaching methods. Technology has brought

a new dimension to education. In this digital age, there is no place for chalk and blackboard and they have been replaced by digital or smart or interactive boards, thus reducing the workload of the teacher and increasing the concentration of the students. Moreover, teachers are using digital texts and authentic materials in their classrooms to stimulate the interest of the students towards the point of learning.

In recent years, the issue of using modern technologies in the educational process has been increasingly raised. This is not only new technical means, but also new forms and methods of teaching, a new approach to learning. Our main goal in learning a foreign language using modern technologies is to improve the quality of teaching students a foreign language, to form and develop their communicative culture, and to effectively use technologies to learn practical skills.

Today we are in a world where computers dominate the world. Just as technology plays an important role in business communications, entertainment, music, films, and almost all aspects of our daily lives, it plays an equally important role in education. Studies have shown that 90% of students have access to some kind of computer or mobile device at school, work, or home.

Here, let us dwell on the research of several specialists on the TEFL methodology.

In particular, Richards and Rogers's Approaches and Methods in Language Teaching (London: CUP), published in 1986, discusses the useful distinctions between approach, method and technique. Although the book is now almost 30 years old, it still provides one of the clearest and most accessible descriptions of approaches to the teaching process. The terminological distinctions they draw are particularly useful and relevant because they are generalizable.

In the work, the author describes a theory or philosophy about how to teach a language through approaches, methods and techniques; method or methodology, in a general sense, describes the way in which the approach is implemented (program, progression, types of materials); techniques describe specific practical tasks and activities in the classroom. For example:

Communicative Language Teaching (CLT) is an approach that has a theoretical basis in that language is for communication.

The CLT methodology can be based on a conditional-functional curriculum or a structured program, but the learner is placed at the center, the main goal is to develop their communicative competence. Classroom activities are selected that involve students in communicating with each other.

CLT techniques can include role-playing, discussions, text editing, speech games and problem-solving activities.

Audiolingual approach

The audiolingual approach is based on a structuralist view of language and relies on behavioral psychology as the basis of learning theory, using stimulus and response.

Audiolingual teaching uses a very mechanical method, which exposes students to increasingly complex grammatical structures of the language by

encouraging them to listen to and respond to the language. It often involves memorizing dialogues and there is no explicit instruction in grammar.

Techniques also include listening and repetition, emphasizing oral instruction to achieve a high level of accuracy of language forms. At a later stage, teachers can use communicative activities.

CLIL - Content and Language Integrated Learning

CLIL is an approach that combines the study of a specific subject with the study of the target language. In order to achieve learning objectives, students need to engage with the language. Philosophically, its proponents argue that it promotes intercultural understanding, meaningful use of language, and the development of transferable skills for use in the real world.

The technique involves reading texts on the topic, listening to audio or audiovisual resources based on the topic, discussions and tasks on the topic.

In terms of methodology, it usually abandons the use of textbooks and printed materials in favor of developing skills at the level of authentic communication and speech. The language may be modeled by the teacher, with attention paid to the forms that emerge. The topics are chosen based on their relevance to the students.

The technique involves conversational activities and familiarization with the language through real-life texts, audio and video materials.

Grammar translation

This approach is usually used to prepare students for reading classical texts, especially Latin, in the original. It is believed that students will benefit from studying the ideas of classical thinkers, memorizing and rigorously applying grammatical rules.

The method usually involves students learning grammar rules and vocabulary lists based on the content of selected texts. These are then used to translate the texts from and into the target language. The lesson is usually conducted in the student's native language. Apart from reciting passages, little attention is paid to speaking.

This approach is not really used in teaching modern foreign languages, but sometimes serves as a basis for teaching classical languages such as Latin or Greek.

Based on the above, it can be said that when learning a language such as English, traditional methods and approaches to language teaching are not interesting for students, and in most cases they do not accept such approaches. However, they are very interested in the latest methods and modern methods of teaching English. The same situation can be observed in teaching English as a second language to learners. For this reason, modern English teachers have understood the situation in time and are mastering new methods in teaching, as well as implementing the latest methods and approaches. There are many traditional methods of teaching foreign languages, which are very effective, and currently classical methods are most often used in teaching a foreign language in higher education institutions.

Namely:

1. Direct method.

2. Grammar-translation method of teaching.
3. Audiovisual and audiolingual methods.
4. Communicative method.

The above methods and interactive methods have the following advantages.

Firstly, the methods allow students to communicate more effectively with each other using a foreign language, expand their intercultural knowledge.

Secondly, they develop communication skills, thinking and creative potential in a foreign language in natural conditions.

Uchinchidan, talabaning motivatsiyasi va o'ziga ishonchini oshiradi, barcha til ko'nikmalarini o'rgatadi.

Fourth, it increases language competence and natural speaking skills, develops interest in different languages, their use in various spheres of life.

It is worth noting that in order for learning English to be interesting and exciting for students, teachers should always strive to master innovative technologies and be aware of current IELTS trends. At the current stage of development of science, technology, international trade, various business relations, knowledge of foreign languages is not only a necessity, but also a basic need for specialists.

By the way, modern methods and technologies in the educational process encourage the student to be an active member of the class, think independently, use his mental capabilities, as a result of which long-term memory is preserved. Not only the knowledge of students increases, but also their interest, strength, knowledge, team spirit, freedom of thought. As is known, in all types of methods, a problem or question is posed around a specific topic and students are paired. Each student is given enough time to draw the right conclusions, and students are allowed to share their conclusions with their own voices.

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DEVELOPING THE PROFESSIONAL AND CREATIVE SKILLS OF FUTURE EDUCATORS THROUGH THE USE OF INDIVIDUAL APPROACH TECHNOLOGIES IN THE HIGHER EDUCATION SYSTEM

Annotation: *One of the most important tasks of the preschool educational organization is the development of professional and creative skills of students in the environment of individual education of children. The emotional, social and psychological readiness of a child to go to school directly affects his future educational success. Preparation for school should be carried out on the basis of pedagogical and psychological criteria.*

Keywords: *school age, school readiness, psychological readiness, differential. approach, control function*

Introduction: Today, great attention is paid to providing more school education, strengthening its material and technical base, strengthening the preschool education system, providing qualified pedagogy, and radically improving the production of children's personnel for school education, is considered one of the important tasks of creating favorable conditions for the intellectual, moral, aesthetic, and physical development of children by introducing modern programs and innovative pedagogical technologies into the educational process

One of the main tasks of a preschool educational organization is to prepare children for school education in a high-quality manner. This process serves to form a positive attitude towards education in a child, adapt them to the social environment, as well as develop skills such as independent thinking, self-control, and the ability to communicate with others[1].

In psychology, concepts such as “school age”, “school readiness” and “psychological readiness for school” are important criteria for determining the level of a child’s mental and social development. These criteria determine the child’s potential to study, gain knowledge, and actively participate in a community in a school environment.

This article discusses the content of school preparation, pedagogical and psychological requirements, and the main approaches to the preparation process.

Problem statement: Today, the concept of “school-age maturity” is widely used in psychology. This term is associated with the level of mental, rather than physical, development of a child, which is important in determining whether a child

1 Махмудова.Д.М. (2022). МАКТАБГАЧА КАТТА ЁШДАГИ БОЛАЛАРНИ КИТОБХОНЛИККА ТАЙЁРЛАШ МЕТОДЛАРИ. Results of National Scientific Research International Journal, 1(6), 274-278

is ready for education. Studies have shown that a child's mental functional maturity is one of the main factors in successful learning at school[2].

In most scientific literature, a child's level of readiness for school is considered in three main areas: intellectual, emotional, and social maturity.

Intellectual maturity is manifested in the following manifestations:

• the ability to distinguish the appearance of a form from the general appearance (differential perception);

• the ability to concentrate and maintain attention;

• the ability to identify the main connections between events;

• the ability to remember and reproduce visual material;

• the accuracy and coherence of hand movements.

These conditions reflect the level of development of the child's brain activity and indicate that it is formed within functional norms. Emotional maturity is expressed through:

• reduced impulsive reactions;

the ability to engage in an undesirable activity for a long time.

Social maturity is assessed as follows:

• the ability to engage in social communication with peers and follow the rules of the community;

• the ability to behave as a student and adapt to the school environment. In studies, the concept of "school readiness" is interpreted differently. In particular, scientific works by American psychologists interpret school readiness as "introductory knowledge" or the child's readiness to receive initial knowledge. In this case, the child's level of successful mastery of the school program is considered. However, representatives of the Russian psychological school, in particular Xojamiyarov and his followers, take a more in-depth approach to this issue and believe that a child's readiness to receive knowledge is determined not only by knowledge, skills and abilities, but also by the level of development of psychological functions. According to this approach, a child's successful study at school directly depends on the level of his mental and psychological readiness. Therefore, this condition is called "psychological readiness for school"[3].

One of the well-known psychologists, D.B. Elkonin and his colleagues paid special attention to the following aspects in the formation of educational activity:

• the child's ability to consciously control his behavior based on the rules;

• the ability to act in accordance with the given requirements and instructions.

The analysis of the above literature shows that in the process of preparing a child for school, it is necessary to fully take into account not only knowledge and skills, but also the level of his emotional, personal and social development. The research developed a methodological foundation based on these approaches.

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2 Arslonova,G.K. (2025). TECHNOLOGIES FOR DEVELOPING STUDENTS' PROFESSIONAL AND CREATIVE SKILLS IN THE ENVIRONMENT OF INDIVIDUAL EDUCATION. *SHOKH LIBRARY*

3 Xojamiyarov. S.Ch (2025). ORGANIZATION OF WORK FORMS IN PARTNERSHIP WITH PRESCHOOL EDUCATION AND FAMILY. *SHOKH LIBRARY*.

Results and examples: One aspect of the content of knowledge provided at school that should not be overlooked is the quality of the child's speech development. Speech development and intellectual development are inextricably linked, which determ ines the overall level of development of the child's personality. Through speech, the child's thinking ability and depth of thinking are clearly manifested. In particular, modern teaching and learning methods based on the sound analysis of speech and language serve to develop phonetic hearing. In the formation of personal readiness for school, it is necessary to pay attention, first of all, to the child's growth in a motivating and free environment. The accuracy and effectiveness of the teaching method are directly related to the quality of teaching activities. This is clearly visible in children's interest in knowledge, their need for intellectual activity and their thirst for mastering new knowledge[4].

According to him, the child's need to communicate with other people, the desire for social assessment and support, the desire to occupy a certain place in the team constitute the social foundations of motivation[5]. A child who is ready for school strives to gain knowledge because he wants to see himself as part of a society of adults. Through this, a new attitude towards the external environment is formed. L.I. Bojovich calls this situation "the vision of the student's inner world". He pays special attention to this process emphasizes that the internal experiences of a schoolchild are manifested precisely as a criterion for readiness for learning. The child's internal experiences are formed in preschool and junior school age. It is during this period that the child has the opportunity to enter into educational activities as a subject. This process reveals the child's ability to set independent goals and strive to achieve them, in other words, it is manifested as the student's free movement. The thirst for school knowledge usually appears when the child is about 7 years old. It is during this period that the child begins to consciously try to carry out his actions and activities. This determines his ability to consciously organize his educational activities[6]

Conclusion: The child's ability to move freely is formed mainly through group games. It is in this process that the child passes important stages of development. Playing games alone cannot give this result, because there are not enough social influence and simulation factors. Group games help the child to act independently, to form internal control instead of external control. Because the control function in a child of this age has not yet been formed, and he needs external stimulation and evaluation. Therefore, games can be called a school of free movement. By the time he enters school, the child's basic mental and social abilities

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should be sufficiently developed. Only then will he be able to independently accept and complete educational tasks. In other words, a child who comes to the first grade should be ready for the process of acquiring knowledge at school, that is, be able to perceive a wide range of educational activities. New educational activities are formed at the end of preschool age. This activity is new for children and replaces the games that were previously the leading activity. It is during this period that the child's psychological readiness is revealed. In the last stage of preschool age, games gradually become secondary and are replaced by the need to gain knowledge. This process is associated with the child's internal development mechanism. As A.S. Vygotsky noted, the development of the game process gradually proceeds with the priority of rules. Especially in children of senior preschool age, that is, 6–7 years old, games with rules arouse more interest. The performance of actions based on the rules becomes the content of the game. This, in turn, directs the child to acquire knowledge, prepares him to feel like a student, obey the rules and act responsibly. Thus, the transition of preschool children from play to educational activity is an important stage in their social, intellectual and psychological development, which thoroughly prepares them for school.

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PELTON TURBINALARINING TOG‘LI HUDUDLARDAGI MIKRO GESLAR SAMARADORLIGIGA TA’SIRI VA ENERGETIK IMKONIYATLARI

Annotatsiya: *Mazkur maqolada mikro GESlarning rivojlanish istiqbollari, tog‘li hududlarda soy suvlaridan foydalanish imkoniyatlari va Pelton turbinalarining afzalliklari tahlil qilinadi. Shuningdek, O‘zbekiston sharoitida ushbu texnologiyaning qo‘llanilishi va kelajakdagi ahamiyati yoritiladi. Chumichli turbinalardan foydalangan holda mikro GES qurish imkoniyatlarini o‘rganish va baholash jarayoni, maland soy suvlarining gidroenergetik patensiali qanchalik yuqori ekanligi, chumichli turbinalarning mazkur hudud sharoitida ishlash samaradorligi, mikro GES qurilishining iqtisodiy va texnologik jihatdan asoslanishi, loyiha ekologik jihatdan qanchalik maqbul va barqarorligi, shuningdek, davlat tomonidan qabul qilingan qarorlar va investitsion dasturlar doirasida mikro GESlarni rivojlantirish imkoniyatlari ham o‘rganilgan.*

Tayanch so‘zlar: *Pelton, Francis, Kaplan, soy suv sarfi, bosim, saplo, samaradorlik, naporli quvur, generator.*

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THE IMPACT OF PELTON TURBINES ON THE EFFICIENCY OF MICRO HYDROPOWER PLANTS IN MOUNTAINOUS REGIONS AND THEIR ENERGY POTENTIAL

Abstract: *This article analyzes the development prospects of micro hydropower plants, the possibilities of using river waters in mountainous regions, and the advantages of Pelton turbines. It also covers the application and future significance of this technology in the conditions of Uzbekistan. The process of studying and assessing the possibilities of building micro hydropower plants using paddle turbines, how high the hydropower potential of the Maland river waters is, the efficiency of paddle turbines in the conditions of this region, the economic and*

technological justification of the construction of micro hydropower plants, how environmentally acceptable and sustainable the project is, as well as the possibilities of developing micro hydropower plants within the framework of state decisions and investment programs are also studied.

Keywords: *Pelton, Francis, Kaplan, river water consumption, pressure, flow, efficiency, pressure pipe, generator.*

Kirish.

So‘nggi yillarda O‘zbekiston Respublikasida qayta tiklanadigan energiya manbalaridan foydalanishni kengaytirish va energiya ta’minotini yaxshilash maqsadida mikro gidroelektrostansiyalar (mikro GESlar) qurilishiga alohida e’tibor qaratilmoqda. Prezident Shavkat Mirziyoyevning 2022-yil 9-sentabrdagi "Energiya tejovchi texnologiyalarni joriy etish va kichik quvvatli qayta tiklanadigan energiya manbalarini rivojlantirish bo‘yicha qo‘shimcha chora-tadbirlar to‘g‘risida"gi farmoni bilan quvvati 5 MVtgacha bo‘lgan mikro va kichik GESlarni qurish va ulardan foydalanishning yangi mexanizmi joriy etildi[1].

Jumladan, O‘zbekistonda 400 dan ortiq kichik daryolar, soylar va gidrotexnika inshootlarining mikroGESlar uchun texnik potensiallari mavjud bo‘lib kelajakda ulardan foydalanish yashil energiyaning ulishini oshirishi va yashil iqtisodiyotga katta hissa qo‘shishi haqida targ‘ibot ishlari olib borilib keng ko‘lamli ishlar amalga oshirilmoqda. Bu jarayonda kichik daryolar va soylar suvidan samarali foydalanib mikroGESlar qurish zamon talabidur. Hozirgi kunda yurtimizda 70 dan ortiq GESlar uz faoliyatini olib bormoqda[4,11,12]. Prezidentimiz mikroGESlarning aksariyatini tog‘li va uzoq hududlarda joylashtirish imkoniyati, o‘z navbatida, shu hududdagi mahalliy aholini uzluksiz elektr energiyasi bilan ta’minlashda muhim ro‘l uynashi haqida o‘z fikrlarini bildirgandi[16]. Aytish kerakki, 2020—2030 yillarda O‘zbekiston Respublikasini elektr energiyasi bilan ta’minlash konsepsiyasida yuqoridagidek, mikroGESlarning ulushini energiya balansida sezilarli darajada oshirishni rejalashtirilgan.

Ushbu suv resurslar mikro GESlar qurish uchun katta salohiyatga ega. Katta Kishtud tog‘ tizmalaridan shakillanuvchi Maland soy suvi yuqori oqim tezligiga ega bo‘lib, qish oylarida eng kam suv sarflariga ega bo‘ladi(1-rasm). Pelton chumichli turbinalar yordamida samarali elektr energiyasi ishlab chiqarish imkonini beradi. Bu esa ushbu hududda elektr energiyasi ta’minotini yaxshilash va iqtisodiy rivojlanishga hissa qo‘shadi.

Pelton turbinalari, ayniqsa, yuqori bosimli suv oqimlarida samarali ishlashi bilan ajralib turadi. **A. J. F. Martins**ning Pelton turbinasining dastlabki dizayni bo‘yicha olib boragan tadqiqotida ushbu turbinaning dizayn jihatlari va texnik yechimlari batafsil tahlil qilinadi. Mikro GESlarni loyihalashda optimal turbinani tanlash, suv oqimi parametrlarini hisoblash va energiya ishlab chiqarish samaradorligini oshirish kabi muhim omillar ko‘rib chiqilgan. Ushbu tadqiqot mikro GESlarni innovatsion yondashuv asosida rivojlantirishga yordam beradi[14,15].

1-rasm. Maland soyning fevral oyidagi suv sarfi

Ko‘rib chiqilayotgan muammoning hozirgi holati.

O‘zbekistonning gidroenergetika sohasida muhim yo‘nalishlardan biri bo‘lib mikro GESlar qurilishi va rivojlantirilishi muhim hisoblanadi. Mamlakatda elektr energiyasiga bo‘lgan talab yildan-yilga ortib borayotgani sababli, qayta tiklanadigan energiya manbalaridan samarali foydalanish dolzarb masalaga aylanmoqda. Shu nuqtai nazardan, mikro gidroelektrostansiyalarni barpo etish va mavjud tabiiy resurslardan maksimal darajada foydalanish bo‘yicha keng ko‘lamli chora-tadbirlar amalga oshirilmoqda. Hozirgi kunda mikro GESlarni rivojlantirish bo‘yicha qabul qilingan qarorlar asosida loyihalar amalga oshirib kelinmoqda va mahalliylashtirish bo‘yicha keng ko‘lamli ishlar rejalashtirilgan.

Mikro gidroelektrostansiyalar barqaror energiya manbai sifatida ekologik toza va samarali texnologiya hisoblanadi. Ular kichik suv oqimlaridan foydalanib, elektr energiyasi ishlab chiqarish orqali uzoq va tog‘li hududlarni ta’minlashga xizmat qiladi.

Mikro GESlarning texnologik rivojlanishi va ularning barqarorlikka ta’siri tahlil qilinadi. Ushbu tadqiqotda suv resurslaridan samarali foydalanish, ekologik talablarni inobatga olish va mikro GESlarning uzoq muddatli ishlashini ta’minlash kabi muhim jihatlar yoritilgan bo‘lib, kelajak uchun innovatsion yondashuvlarni taqdim etadi[17,18].

O‘zbekistonning tog‘li hududlari kichik gidroenergetika obyektlarini barpo etish uchun qulay tabiiy sharoitlarga ega. Xususan, Surxondaryo viloyati, Sariosiyo tumani Maland qishlog‘idagi Maland soy suvlari mikro GESlar qurish uchun katta salohiyatga ega. Ushbu hududda Pelton chumichli turbinalardan foydalanish orqali mavjud suv resurslaridan samarali foydalanish imkoniyati mavjud. Bu esa mahalliy aholini barqaror elektr energiyasi bilan ta’minlash va energiya mustaqilligini oshirishga xizmat qiladi(2-rasm).

2-rasm. Maland soy suv oqimining texnik potensiali aniqlash jarayoni

Mikro GESlar qurilishida qator muammolar kuzatilishi mumkin:

Texnik qiyinchiliklar – tog‘li hududlarda infratuzilmani rivojlantirish va quvurlar, turbinalar hamda boshqa muhandislik inshootlarini qurish murakkab jarayon hisoblanadi. Shuningdek dastlabki investitsiyalar katta mablag‘ talab qiladi hamda tabiiy ekotizimga ta’sirni kamaytirish hamda suv resurslaridan oqilona foydalanish muhim masalalar qatoriga kiradi[7]. Mikro GESlar uzoq hududlarni energiya bilan ta’minlash, ekologik jihatdan toza texnologiyalarni rivojlantirish va energetik xavfsizlikni oshirishda muhim rol o‘ynaydi. Davlat tomonidan yaratilayotgan qulay investitsiya muhiti va texnologik yutuqlar natijasida kelgusida mikro GESlarning soni va samaradorligi ortishi kutilmoqda. Bu esa mamlakatning barqaror rivojlanishiga hissa qo‘shishi shubhasiz.

Masalaning qo‘yilishi.

Mamlakatning tog‘li hududlarida, ayniqsa, kichik daryo va soylarning mavjudligi kichik gidroenergetika obyektlarini qurish uchun qulay imkoniyat yaratmoqda. Shu jumladan, Surxondaryo viloyati Sariosiyo tumani Maland qishlog‘idagi Maland soy suvlari yuqori gidroenergetik salohiyatga ega bo‘lib, ulardan foydalanish hali yetarlicha yo‘lga qo‘yilmagan(3-rasm).

3-rasm. Suv sarfi kam davrda Maland soyning suv tezligini va chuqurligini o‘lchash jarayoni

Ushbu tadqiqotning asosiy masalasi – mazkur hududda Pelton chumichli turbinalardan foydalangan holda mikro GES qurish imkoniyatlarini o‘rganish va baholash. Bu doirada quyidagi ko‘rib chiqildi:

Maland soy suvlarining gidroenergetik salohiyati, Pelton chumichli turbinalarning mazkur hudud sharoitida ishlash samaradorligi tadqiqotlari, mikro GES qurilishining iqtisodiy va texnologik jihatlari, loyiha ekologik jihatdan qanchalik maqbul va barqarorligi.

Yechish usuli (uslublari).

Maland soy suvlaridan foydalanib mikro GES qurishning texnik va iqtisodiy jihatlarini aniqlash uchun quyidagi yondashuv qo‘llanildi:

Gidroenergetik hisoblar orqali soy suvining oqim tezligi va bosimini o‘lchash hamda Pelton chumichli turbinalarning optimal ishlash sharoitlarini aniqlash.

Texnik-iqtisodiy tahlil – mikro GES qurilishi uchun zarur bo‘lgan investitsiyalar, ekspluatatsiya xarajatlari va ishlab chiqariladigan elektr energiyasining tannarxini baholash.

Ekologik baholash – mikro GESning atrof-muhitga ta’siri va suv resurslaridan oqilona foydalanish choralari.

Ushbu yondashuvlar asosida mikro GES qurishning samaradorligi aniqlanadi va loyihaning amaliyotga tadbiq etish imkoniyatlari baholanadi.

Natijalar tahlili va misollar.

Tadqiqot natijalari shuni ko‘rsatadiki, Maland soy suvlari tog‘li hududda joylashgani sababli yuqori gidroenergetik salohiyatga ega. Pelton chumichli turbinalar aynan bunday sharoitlar uchun mo‘ljallangan bo‘lib, katta bosim va saplodan chiqadigan kuchli reaktiv oqimdan samarali foydalanish imkonini beradi.

Gidroenergetik hisob natijalari tahlillar asosida quyidagi o‘rganildi:

Soyning o‘rtacha oqim tezligi 2,5–3,5 m^3/s atrofida.

Suvning tabiiy pasayish balandligi 40–60 metr oralig‘ida.

Pelton turbinalarining samaradorligi 85–90% ni tashkil etadi.

Hisobga ko‘ra, 3 MVtgacha bo‘lgan mikro GESni qurish imkoniyati mavjud. Bu mikro GES 700–1200 ta xonadon yoki kichik sanoat obyektlarini barqaror elektr energiyasi bilan ta’minlashga yetarli bo‘ladi.

2. Texnik-iqtisodiy tahlil

Dastlabki investitsiya – loyiha qiymati taxminan 1,5–2 million AQSh dollari bo‘lishi mumkin.

Qaytish muddati – ishlab chiqariladigan elektr energiyasi va tariflar inobatga olinganda, loyiha 3–7 yil ichida o‘zini oqlaydi.

Ekologik foyda – mikro GES ishga tushirilgandan keyin har yili 3000 tonnagacha CO_2 chiqindi gazlari kamayadi.

Bu natijalar shuni ko‘rsatadiki, Pelton chumichli turbinalardan foydalangan holda mikro GES qurish nafaqat iqtisodiy jihatdan foydali, balki ekologik va ijtimoiy jihatdan ham ahamiyatli loyihadir. Maland soy suvlari asosida mikro GES quvvatini hisoblash uchun gidroenergetik formulalar qo‘llanadi. Asosiy hisoblash quyidagi formula asosida amalga oshiriladi:

$$P = \eta \cdot \rho \cdot g \cdot Q \cdot H$$

bu yerda:

P – ishlab chiqariladigan quvvat (Vatt),

η – turbina va generatorning samaradorlik koeffitsienti (o‘rtacha 85–90%),

ρ – suv zichligi ($1000\ kg/m^3$),

g – erkin tushish tezlanishi ($9{,}81\ m/s^2$),

Q – suv oqimi (m^3/s),

H – suv bosimi yoki balandlik farqi (m).

Agar Maland soyining o‘rtacha suv oqimi 3 m³/s, balandlik farqi 50 m, va turbina samaradorligi 90% bo‘lsa, mikro GESning nazariy quvvati quyidagicha hisoblanadi:

$$P = 0{,}90 \cdot 1000 \cdot 9{,}81 \cdot 3 \cdot 50 = 1{,}32\ MVt$$

Bu shuni anglatadiki, Maland soyida taxminan 1,3 MVt quvvatga ega mikro GES qurish mumkin, bu esa 500–700 ta xonadon yoki kichik ishlab chiqarish korxonalarini energiya bilan ta’minlashga yetarli bo‘ladi.[9]

Bu hududda qo‘llaniladigan Pelton turbinalari yuqori bosimli suv oqimidan maksimal energiya olish uchun mo‘ljallangan reaktiv turbinadir. U asosan tog‘li hududlardagi balandlikdan tushayotgan suv oqimidan foydalanadi. Ishlash jarayoni quyidagicha:

Bosimli suv maxsus toraygan soplo orqali yuqori tezlikda chiqadi(4-rasm).

Chumichli turbina g‘ildiragi kuchli reaktiv(jet) suv oqimi ta’sirida aylana boshlaydi.

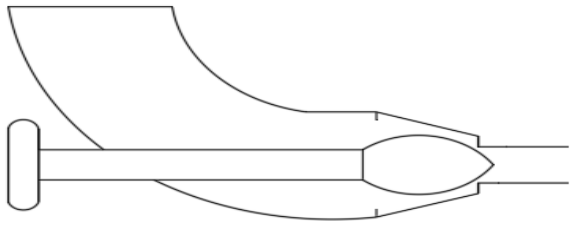
Suv energiyasi mexanik energiyaga aylanadi va generator orqali elektr energiyasi ishlab chiqariladi.

Pelton turbinalarining asosiy afzalligi shundaki, ular kichik suv sarfi va yuqori bosimli oqimlarda ham samarali ishlaydi, bu esa mikro GESlar uchun juda mos keladi.

Pelton turbinasining samaradorligi odatda 85–95% atrofida bo‘lib, bu boshqa turdagi gidroturbinalarga qaraganda yuqori natija hisoblanadi.[10]

3. Mikro GESlar uchun Pelton turbinasining afzalliklari

Yuqori bosimli suv oqimidan samarali foydalanadi (40–800 metr balandlikdan tushayotgan suv oqimida ishlaydi).



4-rasm. Saplo orqali kuchli reaktiv oqim hosil qilish jarayoni

Mexanik qismlari sodda va chidamli, ekspluatatsiya muddati uzoq.

Tejamkor va ekologik toza, chunki hech qanday yoqilg‘i talab qilmaydi.

Kichik mikro GESlar uchun mos, ayniqsa tog‘li hududlarda.

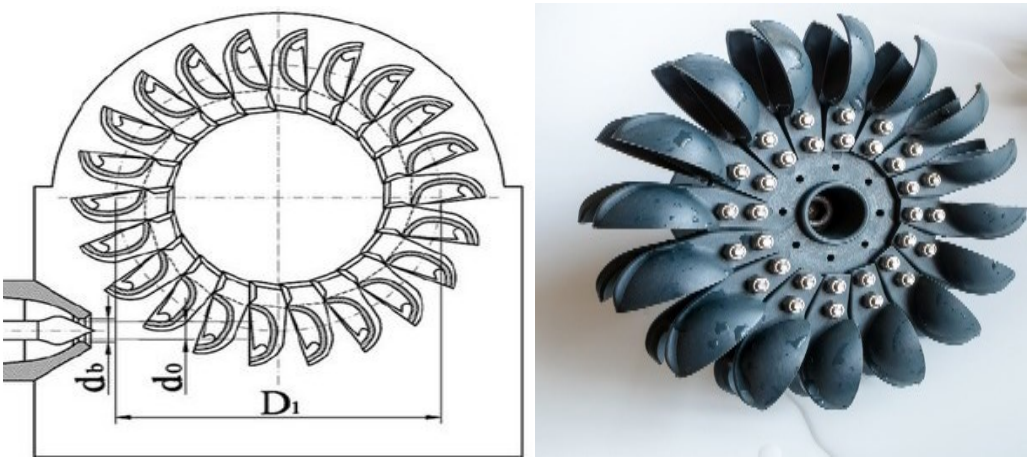
4. Maland soyidagi qo‘llash imkoniyati

Tahlillar shuni ko‘rsatadiki, Maland soyida Pelton turbinasidan foydalanish eng optimal variant hisoblanadi.

Soy suvlari 40–60 metr balandlikdan oqib tushadi bu balandlikni naporli quvurlar orqali quyi b’efga yo‘naltirib bosim balandligini yanada oshirish mumkin, bu Pelton turbinasining samarali ishlash diapazoniga to‘g‘ri keladi.

Suv sarfi 2,5–3,5 m^3/s bo‘lib, bu kichik Pelton turbinalari uchun yetarli(5-rasm).

Natijada 1,3–1,4 MVt quvvat ishlab chiqarish imkoniyati mavjud.



5-rasm. Chumichli (Pelton) turbina ishchi g‘ildiragi

Xulosa

Maland soyidagi mikro GES loyihasi – katta investitsion imkoniyat va yuqori daromadlilikka ega bo‘lgan barqaror energiya yechimi. Shuningdek 1,3–1,4 MVt quvvat ishlab chiqarish imkoniyati bilan bu GES har yili 10 million kVt·soatgacha elektr energiyasi ishlab chiqaradi.

Loyihaning dastlabki investitsiya miqdori 1,5–2 million dollar, ammo 7 yil ichida o‘zini to‘liq qoplaydi. Har yili $500,000 gacha sof daromad keltirish imkoniyatiga ega, bu esa uzoq muddatli barqaror biznes demakdir. Pelton chumichli turbina tufayli texnik xizmat ko‘rsatish harajatlari minimal hisoblanadi. Ekologik toza yechim – mikro GES har yili 3000 tonnagacha CO_2 chiqindilarining oldini oladi va atrof-muhitga zarar yetkazmaydi.

Bu loyiha O‘zbekistonning tog‘li hududlarida barqaror energiya ishlab chiqarish bo‘yicha eng samarali va foydali yechimlardan biri bo‘lib, investorlar uchun daromadli, xavfsiz va uzoq muddatli sarmoya imkoniyatini taqdim etadi.

mikro GES – bu kelajak energiyasiga ishonchli sarmoya hisoblanadi.

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SUG‘ORISHNING TUPROQQA VA O‘SIMLIK O‘SISHIGA TA’SIRI

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PAST INTENSIV LAZER NURINING HAYVOINLAR ORGANIZMIDA KECHADIGAN JARAYONLARIGA IJOBIY TA’SIRI

Annotatsiya. *Fermer xo‘jaligida ilmiy-ishlab chiqarish tajribalarini bajarish uchun 126 bosh 3,5-4,0 yoshdagi ona qo‘ylar ajratib olinib ular nasllik qorako‘l qo‘chqorlari bilan qochirildi. Ona qo‘ylar bo‘g‘ozlikning 2-yarmida ikkita guruhga: past intensivlikdagi lazer nurlanishi bilan ta’sir qilinmagan nazorat guruhi (63 bosh) va past intensivlikdagi lazer nurlanishi orqali ta’sir qilingan tajriba guruhlari (63 bosh) ajratib olindi. Tajribalarning bu tartibda o‘zgartirilishi eng avvalo bo‘g‘oz qo‘ylarning kunlik oziqlanish normalarining ona sovliqlarning fiziologik holatini o‘zgarishiga va homilada rivojlanayotgan embrionning o‘sish va rivojlanishiga bog‘liq holda sovliqlar organizmining to‘yimli moddalarga bo‘lgan ehtiyojini deyarli ikki martaga ortishi sababli amalga oshirildi.*

Kalit so‘zlar: *erkak qo‘zilar, ona sovliqlar, obyekt, umurtqa pog‘onasi, kunlik o‘sish dinamikasi, gistologik, tirik massa, go‘sht mahsuldorligi.*

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THE POSITIVE EFFECTS OF LOW-INTENSITY LASER RADIATION ON PROCESSES IN ANIMAL ORGANISMS

Abstract. *For the research and production experiments, 126 sheep aged 3.5–4.0 years were selected on a farm and crossed with Karakul rams. During the second half of estrus, the sheep were divided into two groups: a control group (63 sheep), not exposed to low-intensity laser radiation, and an experimental group (63 sheep), exposed to low-intensity laser radiation. The experimental procedure was modified primarily because the daily feeding rates for the ewes nearly doubled due to the maternal physiological state and the growth and development of the fetus, which nearly doubled the body's nutrient requirements.*

Key words: *male lambs, ewes, subject, spine, daily growth dynamics, histological analysis, live weight, meat yield.*

Kirish. Sovliqlar homiladorligining ikkinchi yarmida organizmida rivojlanayotgan homila deyarli shakllanib bo‘ladi shu bois, tajriba guruhidagi ona

sovliqlari aynan shu davrda oxirgi bel umurtqa pog‘onasi bilan dumg‘aza orasiga quvvati 0,5 J/sm^2 va ta’sir vaqti 5-7 daqiqa, lazer nurining to‘lqin uzunligi 632.8 nm(qizil) past intensivlikdagi geliy-neon lazeri bilan ta’sir ettirildi. Qo‘zilash davrida sovliqlardan olingan erkak qo‘zilardan 3(uchta) guruh tashkil qilindi va ular tajribalarning obyekti bo‘lib xizmat qildi: nazorat guruhidagi sovliqlardan olingan qo‘chqorchalardan ikkita guruh, I nazorat (lazerli nurlanish qo‘llanilmagan) va II tajriba (past intensivlikdagi lazerli nurlanish qo‘llaniladigan), tajriba guruhidagi ona sovliqlardan esa bitta guruh III tajriba guruhi (past intensivlikdagi lazerli nurlanish ta’sir ettiriladigan) qo‘chqorchalar guruhlari shakllantirildi. Qo‘chqorchalarga past intensivlikdagi lazerli nurlanish ayrisimon bezni innervatsiyalash uchun mas’ul bo‘lgan birinchi ko‘krak umurtqa pog‘onasida joylashgan asab markaziga 1-3 daqiqa ta’sir ko‘rsatildi[1,2].

Usullar. I (nazorat), nazorat guruhi sovliqlaridan olingan qo‘chqorchalar (lazer bilan ishlov berilmagan)- Past intensivlikdagi lazerli nurlanish qo‘llanilmadi. II (tajriba), nazorat guruhi sovliqlaridan olingan qo‘chqorchalar (lazer bilan ishlov berilmagan) va III (tajriba), tajriba guruhi sovliqlaridan olingan qo‘chqor-chalar (bir martalik lazer bilan ishlov berilgan) birinchi ko‘krak umurtqa pog‘onasi, asab markaziga 1.5 daqiqa 3 va 15 kunlik vaqtida 2 marta ta’sir qilindi.

Ona sovliqlarning qayta urchitish sifatlari quyidagi ko‘rsatkichlar bilan aniqlandi: serpushtlikligi-126 bosh ona sovliqdan olingan tirik va o‘lik qo‘zilarning bosh soni bo‘yicha; olingan qo‘zilarning sog‘lom saqlanganlari soni, tirik tug‘ilgan va onasidan ajratilganiga qadar sog‘lom qo‘zilar soni bilan hisobga olindi (4,5-5,0 oygacha). Bu paytda qo‘zilarni hisobdan chiqish sabablari (o‘limi) xo‘jalikda olib borilgan veterinariya hujjatlari asosidagi hisob-kitoblarga asosan amalga oshirildi[3,4].

Natijalar. Onasidan ajratilgan qo‘chqorchalarning o‘sish va rivojlanish qonuniyatlari va qo‘chqorchalarning go‘sht mahsuldorligining shakllanishi, qo‘chqorchalarning tirik massasining, kunlik o‘sish dinamikasini, ekstereri o‘lchamlarini statyalari bilan tana tuzilishlarining indekslarini hisoblab chiqish, nazorat uchun so‘yish, obyektning maxsulotlik xususiyatini baholash, go‘shtning sifati tekshirildi.

Tajribadagi qo‘chqorchalarning tirik massasi ularning rivojlanishining turli davrlarida (tug‘ilgan paytida, o‘sishining 1, 2, 3, 4, 5 va 7 oylarida) har bir bosh qo‘zi alohida holda tug‘ilgan paytida 0,05 kg gacha aniqlikda, yoshining boshqa davrlarida esa 0,001 kg gacha aniqlikda tarozilarda o‘lchandi.

Har bir guruhlar qo‘chqorchalarining tana tuzilish xususiyatlarini o‘rganish uchun 21 boshdan tirik massasi bo‘yicha qo‘chqorchalar tanlab olinib ularning 5 va 7 oylik yoshlarida quyidagi o‘lchamlar o‘rganildi: halqasi va dumg‘azaning balandligi, ko‘krakning kengligi, chuqurligi, ko‘krakning aylanasi, tanasining qiya uzunligi, oyoq bo‘g‘inining aylanasi va boshqalar. Tashqi ko‘rsatkichlarining o‘lchamlari asosida hayvonlarning rivojlanish darajasining to‘lig‘icha tavsiflash uchun tana tuzilishining quyidagi: to‘lishganligi, kengligi, oyoqlarning uzunligi, ko‘krak kengligi kabi ko‘rsatkichlari hisoblab chiqildi[5,6].

Qo‘chqorchalarni 5 va 7 oylik yoshida nazorat uchun so‘yish yo‘li bilan ularning go‘sht mahsuldorligini aniqlandi. So‘yilgan qo‘ylarni go‘sht mahsuldorligini tavsiflovchi quyidagi ko‘rsatkichlari hisobga olindi: och holda saqlashgacha va saqlashdan keyingi tirik massasi, so‘yilganidan keyingi gavda massasi, charvining massasi, shilib olingan terining massasi va uning o‘lchami, ichki organlardagi o‘zgarishlari aniqlandi (taloq, yurak, me’da, buyraklar, o‘pka, jigar) hamda so‘yilgan vaqtda ajralgan qonning miqdori, ingichka va yo‘g‘on ichaklarning uzunligi va ko‘ndalang kesim yuzasi.

Muskul to‘qimalarning morfologik tarkibi so‘yilganda go‘shtni suyakdan ajratib olib baholadik. Shundan keyin lahm go‘shtlarning massasini suyaklarning massasiga nisbatini, go‘shtlilik koeffitsiyentini hisoblab chiqdik. Olingan natijalar asosida go‘shtning qaysi navga xosligi to‘g‘risida xulosa chiqardik[7].

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LAZER NURINING ORGANIZMGA IJOBIY TA’SIRI

Annotatsiya. *Tadqiqotimizda tajribalarini o‘tkazish maqsadida 3,5–4,0 yoshdagi 126 bosh ona qo‘y tanlab olinib, ular nasldor qorako‘l qo‘chqorlari bilan juftlashtirildi. Bo‘g‘ozlik davrining ikkinchi yarmida ona qo‘ylar ikki guruhga ajratildi: past intensivlikdagi lazer nurlanishi qo‘llanilmagan nazorat guruhi (63 bosh) hamda past intensivlikdagi lazer nurlanishi ta’sir ettirilgan tajriba guruhi (63 bosh). Tajriba sxemasining aynan shu tarzda tashkil etilishi bo‘g‘oz qo‘ylarning fiziologik holatidagi o‘zgarishlar, shuningdek, homila tarkibidagi embrionning o‘sishi va rivojlanishi natijasida organizmning oziq moddalarga bo‘lgan talabining keskin ortishi bilan izohlanadi. Shu sababli bo‘g‘ozlikning ikkinchi yarmida sovliqlarning kunlik oziqlanish me’yorlari va to‘yimli moddalarga bo‘lgan ehtiyoji deyarli ikki baravar oshadi. Past intensivlikdagi lazer nurining organizmga ta’siri natijasida muskul to‘qimalarning biologik qiymatini baholash maqsadida (kimyoviy komponentlarning darajasi, aminokislotalarning nisbati) va ularning kimyoviy tarkibini (namlik, oqsil, yog‘, bo‘yicha tahlil qilishda) yelkaning uzun muskulidan go‘sht namunalari olindi.*

Kalit so’zlar: *gistologik, mikroskop, namuna, qonning morfologik tahlili, yaylov ozuqalari, xrom ikki oksidi, quruq modda.*

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THE POSITIVE EFFECTS OF LASER LIGHT ON THE BODY

Abstract. *In our study, 126 ewes aged 3.5–4.0 years were selected for the experiments and mated with purebred Karakul rams. During the second half of pregnancy, the ewes were divided into two groups: a control group (63 animals) not exposed to low-level laser radiation, and an experimental group (63 animals) exposed to low-level laser radiation. This experimental design is explained by changes in the physiological state of the ewes, as well as a sharp increase in the body's need for nutrients due to the growth and development of the embryo in the fetus. Thus, in the second half of the season, sows' daily nutrient requirements almost double. To assess the biological value of muscle tissue (levels of chemical components, amino acid ratios) and its chemical composition (moisture, protein,*

fat, etc.), meat samples from the long scapular muscle were taken using low-intensity laser radiation.

Key words: *histology, microscope, sample, blood morphology, pasture feed, chromium dioxide, dry matter*

Kirish. Qo‘y go‘shti ishlab chiqarishning ko‘paytirish va uning sifatini yaxshilash eng avvalo qo‘ylarning go‘sht mahsuldorligi bo‘yicha genetik imkoniyatini oshirish va parvarishlash, haydab boqish, bo‘rdoqiga boqishning yuqori texnologiyalarini ishlab chiqish hamda uni amaliyotga joriy qilish jarayoni muhim hisoblanadi. Xorijiy mamlakatlarda olib borilgan ko‘plab tekshirishlarda aniqlanishicha, yuqori mahsuldor hayvonlar bosh sonini ko‘paytirishning asosiy usuli chatishtirish hisoblanadi. Mahsulot ishlab chiqarishga yo‘naltirilgan podalar qo‘ylarining go‘shtdorligini sezilarli darajada ko‘tarilishi hamda sifat jihatdan yaxshilanishi, eng avvalo mahalliy mayin junli zotlar sovliqlarini, mahalliy va import genofoniga mansub go‘sht-jun yo‘nalishidagi nasllik qo‘chqorlar bilan chatishtirish usullaridan foydalanish yo‘li bilan erishish mumkin deb hisoblaydi

Usullar. Birinchi ko‘krak umurtqa pog‘onasi, asab markaziga ya’ni qalqonsimon beziga past intensiv lazer nuri orqali ta’sir ettirib keyinchalik qo‘zilarning turli oylik yoshida ko‘rsatkichlarini o‘rgandik. Organ fiksatsiya qilinganidan keyin o‘lchami 1sm^3 bo‘lgan burda kesib olinib uni ortib boruvchi konsentratsiyaga ega spirtdan va ksiloldan o‘tkazildi. Shundan keyin, “Gistomiks”, gistologik muhitga solinib so‘ngra yopiq tipdagi gistologik protsessordan foydalanildi. Olingan namunalardan qalinligi 5-7 mkm gistologik kesma (parcha)lar tayyorlandi va gematosilin va eozin bilan bo‘yadik. Gistologik preparatlarni mikroskopiyasini S 300 (Yaponiya) fotoapparat o‘rnatilgan Olympus BX 45 raqamli mikroskopida amalga oshirdik. Mikroskopiya ishlarini amalga oshirish uchun ×10 okulyarlaridan va ×4, ×10, ×20, ×40, ×100 obyektivlaridan foydalandik. Qo‘chqorchalarning qalqonsimon bezini gistologik tuzilishining laboratoriya tekshirishlarini Samarqand viloyat veterinariya boshqarmasi laboratoriyasida gematologik analizatorida qonning morfologik tarkibining laboratoriyasida bajardik.

Natijalar. Qo‘chqorchalar onasidan ajratilganidan keyin, tajribaning boshlanish vaqtida (sentyabr oyida) qo‘chqorchalarning tirik vazni o‘rtacha 25,8 kg ni tashkil etdi. Shu vaqtning o‘zida har bir guruhdan 5 boshdan qo‘chqorchalar tanlab olinib yaylov ozuqalaridan tajribadagi qo‘chqorchalar tomonidan iste’mol qilingan ozuqalarning miqdorini, to‘yimlilik qiymatini aniqlash uchun VIK (Umumrossiya oziqlantirish instituti) tomonidan taklif qilingan ikki indikatorli usuldan foydalandik.

Tajribalarda rejalashtirilgan maqsadga erishish uchun tashqi inert modda sifatida xrom ikki oksididan foydalangan bo‘lsak, ichki indikator sifatida–azotdan foydalandik. Bir kecha kunduzda qo‘chqorchalar tomonidan iste’mol qilingan ozuqalar va ajralgan tezak miqdorini aniqlash uchun tajribadagi qo‘chqorchalarga har kuni 5 g dan ertalab va kechqurun (2,5 g dan) xrom ikki oksidi yedirildi. Xrom

ikki oksidi yordamida tajriba qo‘chqorchalari tomonidan ajralgan tezak tarkibidagi iste’mol qilingan to‘yimli moddalarning miqdorini aniqlash uchun foydalandik, bunda hazm tizimida xrom oksidining parchalanmaslik koeffitsiyenti 0,9912%.

Tezakning quruq moddasi tarkibidagi azot miqdori haqidagi ma’lumot organik moddalarning hazmlanish koeffitsiyentini aniqlash imkonini beradi, ajralib chiqqan tezak miqdoridagi xrom ikki oksidi yordamida hayvonlar tomonidan iste’mol qilingan o‘t- o‘lanlar miqdori hisoblandi. Olingan ma’lumotlarga ko‘ra, qo‘chqorchalar tajriba paytida bir kecha kunduzda 2,0-2,18 kg yaylov ozuqasi iste’mol qilgan, uning tarkibidagi quruq moddaning miqdori 0,47 kg tashkil etib 0,39 energetik ozuqa birligi, 4,24 mJ almashinuvchi energiya, 37,2 g hazmlanuvchi protein, 349,7 g kletchatka, 401 g azotsiz ekstraktiv moddalar, 8,85 Ca va 1,60 P saqlashi aniqlandi. Yaylovdan iste’mol qilingan ozuqaviy moddalar oziqlantirish ratsionidagi me’yorni qoplanmaganligi bois qo‘chqorchalarni qo‘shimcha ravishda oziqlantirishga ehtiyoj tug‘ildi.

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LAZER NURINING QONNING MORFOLOGIK KO’RSATKICHLARIGA IJOBIY TA’SIRI

Annotatsiya. *Lazer nurlari yordamida hayvonlarda yuzaga keladigan kasalliklarni oldini olish yoki patologiyaga uchragan hayvonlarni davolashda barcha usullarda tejaladigan xarajatlar miqdori mahsulot yetishtirishda tannarxning kamaytirishga olib keladi. Bu usul yordamida ko‘rsatilayotgan ta’sirning asosiy ko‘rsatkichlari veterinariya tibbiyotining keng tarmoqli sohalarida optimal ko‘rsatkichlar sifatida qo‘llanilmoqda. Lazer nurlanishining organizmga ta’siri natijasida qon tomirlari sistemasini kengayishi, yallig‘langan sohalarda va og‘riq kuzatiladigan joylarida og‘riqsizlantirish sifatida foydalanish, metabolik jarayonlarni, immunitetga ta’sir ko‘rsatish xususiyatlari o‘rganilgan. Past intensivlikdagi lazer nurlanishi orqali hayvonlarga ta’sir ko‘rsatilganda qon tarkibidagi parametrlar va jigarda morfologik o‘zgarishlar yuzaga keldi. Past intensivlikdagi lazer nurlanishining obyektga ta’siri leykotsitlarni retseptorli tizimiga kichik ta’sir ko‘rsatishini, ularning funksional tomondan harakatchanligini hamda ularning konsentratsiyasi o‘zgarmas ekan degan xulosa kelishdi. O‘tkazilgan tadqiqotlar natijasiga ko‘ra, past intensivlikdagi lazer nurlanishlaridan obyektlarni nurlantirishda maksimal miqdorlarda foydalanish xavfsiz ekanligini ko‘rsatdi.*

Kalit so’zlar: *intevsiv, gemotologik, namuna, qonning morfologik tahlili, yaylov ozuqalari, mochivina, kompleks.*

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POSITIVE EFFECT OF LASER LIGHT ON MORPHOLOGICAL INDICATORS OF BLOOD

Abstract. *Cost savings across all methods of disease prevention in animals and treatment of animals with pathologies using laser beams lead to reduced production costs. The key performance indicators demonstrated by this method are used as optimal indicators in a wide range of areas of veterinary medicine. The effects of laser radiation on the body have been studied, including vasodilation, its use as an anesthetic in inflamed and painful areas, its effects on metabolic processes, and its impact on the immune system. When animals were exposed to*

low-intensity laser radiation, changes in blood parameters and morphological changes in the liver were observed. It was concluded that low-intensity laser radiation has little effect on the leukocyte receptor system, and their functional motility and concentration are not altered. Based on the results of the studies, the use of low-intensity laser radiation at maximum doses for irradiating objects is safe.

Key words: *intensive, hematological, sample, blood morphological analysis, pasture feed, urea, complex*

Kirish. Hozirgi vaqtda biofizik ta’sir obyekti sifatida past intensiv lazer nurlanishidan keng foydalanilmoqda. Bu usul yordamida olib borilgan tajribalar asosida hayvonlarning organizmida metabolik jarayonlar normallashuvi bilan bir qatorda hayvonlarning turli yoshlarida ularning rivojlanishi va o‘sish ko‘rsatkichlarini sezilarli darajada o‘zgarishlar sodir bo‘lishini ko‘rishimiz mumkin. Chorvachilikda past intensivlikdagi lazer nurlanishi orqali hayvonlardagi turli xil patologiyalarni davolash hamda kasalliklarni oldini olish maqsadida qo‘llashimiz mumkin. Past intensivli lazer nurlanish bilan obyektga ta’sir ko‘rsatilganda obyektning qon tomirlar sistemasida qonning harakatiga ijobiy ta’sir ko‘rsatishi natijasida yumshoq to‘qimalarida kislorod almashinuvi yaxshilanishini ko‘rishimiz mumkin. Past intensivli lazerlar nurlanishining qon koagulyatsiya tizimiga ta’sirini hamda bu usul yordamida obyektning qon tomirlar tizimiga ta’sir ko‘rsatish natijasida qon tarkibidagi trombotsitlarning harakatchanligi susayishini kuzatishgan, natijada qonning dinamik qovushqoqligi hamda birikish qobiliyatining susayishi ko‘rsatib berilgan.

Usullar. Yosh qo‘ylarning morfobiokimyoviy statusini o‘rganish uchun tajribadagi qo‘chqorchalar (guruhlarining har biridan 5 boshdan) ertalabki oziqlantirishgacha bo‘yinturuq venasidan qon namunalari olindi, qon namunalari (tug‘ilganida, 1, 2, va 4 oylik yoshlarida) olindi. Biomateriallarni qonning yopiq zaborlar tizimlarida oldik: gematologik tadqiqotlar uchun (EDTA antikoagulyantlaridan foydalanilganda); biokimyoviy tekshirishlar uchun (qon ivishini tezlashtirish uchun).

Qonning morfologik tekshirishlarini Samarqand viloyat veterinariya boshqarmasi laboratoriyasida Sormy firmasida ishlab chiqarilgan gematologik analizatorida amalga oshirildi.

Natijalar. Tadqiqot uchun qon har bir guruhdan ertalabki oziqlantirishgacha 5 tadan qo‘chqorchalarning bo‘yin venasidan olindi va morfologik tekshirishlar xo‘jalik sharoitidagi veterinariya xonasida amalga oshirilgan bo‘lsa, biokimyoviy tahlillar Samarqand viloyat veterinariya boshqarmasi laboratoriyasida amalga oshirildi.

Qon zardobining bakteritsidlik faolligi (QZBF) va lizotsimlik faolliklari (QZLF) tabiiy chidamlilik ko‘rsatkichlari-Stavropol chorvachilik va ozuqa ishlab chiqarish texnologiyalari ilmiy tadqiqot institutining uslubiy tavsiyasi bo‘yicha aniqlandi. Tabiiy chidamlilikning lizotsimli faolligi darajasini 0,9% li osh tuzi eritmasida qon lizotsimini optik qobiliyati tufayli muhitning optik zichligini

o‘zgarishi bo‘yicha aniqladik. Lizotsim sifatida 2665 shtammli Micrococcus Lisodecticus kulturasining standart talqonidan foydalandik. Qon zardobining bakteritsidli faolligini go‘sht-peptonli bulyonga, o‘rganilayotgan zardobga O_2 serovariantini qo‘shganda va qo‘shilmaganda uning optik zichligini o‘zgarishi hamda undagi ichaklar tayoqchalarining o‘sishi bo‘yicha aniqladik.

Hujayraviy va gumoralli immunitetlarning darajasini aylanib yuruvchi qon tarkibidagi T va B-limfotsitlarning miqdori bo‘yicha aniqladik. Tahliliy tekshirishlarni amalga oshirishda Ye-rozetkalarning hosil bo‘lishi bo‘yicha to‘liq qon tahlili usulidan foydalanish uslubiy tavsiyasidan foydalandik. Qiyoslanayotgan turli guruhlarning qo‘chqorchalarini parvarishlashning iqtisodiy samaradorligini barcha qilingan xarajatlarning va ulardan olingan shartli foydalarni hisobga olgan holda aniqladik. Tekshirishlarimizdan olingan natijalarning statistik tahlilini esa BioStat, Excel, kompyuterli dasturlardan foydalangan holda N.A.Ploxinskiy (1980), Ye.K.Merkurevalar (1970) tomonidan taqdim qilingan usullarga mos holda amalga oshirildi. O‘rtacha va ularning xatolarini ko‘lamini hisoblash asosida, raqamli ko‘rsatkichlar Styudent-Snedekorlarning mezonlar usuli bo‘yicha hisobga olindi, guruhlar orasidagi ko‘rsatkichlar bo‘yicha ishonchlilik darajalari Styudent mezonlaridan foydalangan holda ishonchliligi quyidagi darajalarda ($P>0,05$; $P<0,001$) amalga oshirildi.

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HAZM JARAYONLARIGA PAST INTENSIV LAZER NURI BILAN TA’SIR KO‘RSATISHNING BIOLOGIK MEXANIZMLARI

Annotatsiya. *Ushbu maqolada hazm jarayonlariga past intensiv lazer nuri bilan ta’sir ko‘rsatishning biologik mexanizmlari tahlil qilingan. Past intensiv lazer nurlanishining qo‘chqorchalarda padadan qaytgandan so’ng kavsh qaytarish jarayoni vaqti va sonining oshishi, iste’mol qilingan moddalar ko’payishi, katta qorin muhitida pH darajasining ortishi keltirib o’tilgan. Shuning bilan birga mikroorganizmlarning sellyulozolitik faolligi eng avvalo bakteriyalarning ozuqalar tarkibidagi tolali tuzilmalarning parchalanishini va o‘zlashtirilishi oshganligi hamda bakteriya va infuzoriyalarning ulushlari ijobiy tarafga o’zgarganligini ko’rishimiz mumkin. Tadqiqot natijalari past intensiv lazer terapiyasining hazm tizimi funksiyalarini me’yorlashtirish va organizmning umumiy fiziologik holatini yaxshilashda istiqbolli usullardan biri ekanligini ko‘rsatadi.*

Kalit so‘zlar: *mikroorganizmlarning sellyulozolitik faolligi, anabolik jarayonlar, mahsuldorlik, katta qorin suyuqligidagi, bakteriyalarning ulushi, infuzoriya, umumiy azot, fermentativ, ratsion tarkibi.*

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BIOLOGICAL MECHANISMS OF THE INFLUENCE OF LOW-INTENSITY LASER LIGHT ON DIGESTION PROCESSES

Abstract: *This article analyzes the biological mechanisms of the effects of low-intensity laser radiation on digestive processes. It is shown that low-intensity laser irradiation of rams after returning from the flock increases the duration and quantity of rumination, increases feed intake, and raises the pH level in the rumen. Concurrently, an increase in the cellulolytic activity of microorganisms is observed, primarily the breakdown and digestion of fibrous structures in the feed by bacteria, as well as a positive change in the ratio of bacteria to ciliates. The results of the study indicate that low-level laser therapy is one of the promising methods for normalizing the functions of the digestive system and improving the overall physiological state of the body.*

Key words: *cellulolytic activity of microorganisms, anabolic processes, productivity, proportion of bacteria in rumen fluid, ciliates, total nitrogen, enzymatic, diet composition.*

Kirish. Hayvonlar mahsuldorligining oshishi, organizmining turli noqulay omillar ta’siriga chidamliligi eng avvalo hayvonlar organizmidagi anabolik jarayonlarning mo‘tadillashuvi va faollashuvi hisobiga yuz berishi asosiy o‘rinni egallaydi. Qo‘chqorchalarda kavsh qaytarish jarayoni, odatda, kechki oziqlantirish yakunlanganidan 30–36 daqiqa o‘tib boshlanishi kuzatildi. Bir kecha davomida 4–6 marotaba kavsh qaytarish holati qayd etilib, har bir jarayonning davomiyligi o‘rtacha 22–25 daqiqani tashkil etdi. Shundan so‘ng 35–65 daqiqa davom etadigan tinch holat kuzatilib, keyinchalik kavsh qaytarish yana takrorlandi. O‘tkazilgan kuzatuvlar natijasida tajriba guruhidagi qo‘chqorchalarda kavsh qaytarish davomiyligi nazorat guruhiga nisbatan 8–12 % ga yuqori ekanligi aniqlandi. Taqqoslanayotgan ikkala guruh qo‘chqorchalarining katta qornida 5 daqiqa davomida 6–8 marta ruminatsiya harakati qayd qilindi. Ruminatsiya sindromi hazm bo‘lmagan yoki yetarli darajada qayta ishlanmagan oziqa massasining og‘iz bo‘shlig‘iga qaytarilishi, uning takroran chaynalishi hamda keyinchalik yutilishi yoki tashqariga chiqarilishi bilan tavsiflanadi[1,2].

Usullar. Ratsionning asosan dag‘al ozuqalardan tashkil topishi katta qorin muhitida pH darajasining ortishiga xizmat qiladi hamda so‘lak ajralishini jadallashtiradi. Natijada katta qorin qo‘shimcha buferlik himoyasi bilan ta’minlanadi. Kislotalilikning ushbu darajasi so‘lak tarkibida keladigan bikarbonatlar va natriy fosfat birikmalari hisobiga shakllanadi. Katta qorinda hosil bo‘lgan kislotalarning bir qismi ximus tarkibida ichaklarga o‘tishi, bir qismi esa qonga so‘rilishi natijasida chiqarib yuboriladi, shuningdek, bu jarayonda katta qorin suyuqligining buferlik xossalari ham muhim ahamiyat kasb etadi. Bundan tashqari, katta qorin suyuqligining muhiti neytral holatga yaqin, ya’ni pH 6,4–6,8 oralig‘ida bo‘lganda, undagi mikroflora rivojlanishi va faoliyat yuritishi uchun eng maqbul sharoit yuzaga keladi[3,4].

Natijalar. Mikroorganizmlarning sellyulozolitik faolligi eng avvalo bakteriyalarning ozuqalar tarkibidagi tolali tuzilmalarning parchalanishini va o‘zlashtirilishini aks ettiradi. Bakteriya va infuzoriyalarning katta qorin suyuqligidagi ulushi o‘rganilganida tajriba guruhidagi qo‘chqorchalar katta qorin suyuqligidagi bakteriyalarning ulushi nazorat guruhiga nisbatan 32,1% yuqori ekanligi aniqlandi. Infuzoriyalar miqdori bo‘yicha esa tajriba guruhi qo‘chqorchalarida 4,03 %ga ustunlik qilishi aniqlandi[5].

Katta qorin suyuqligidagi mikroorganizmlarning sellyulozolitik faolligi (MSF), undagi bakteriya va infuzoriyalarning ulushi quyidagicha:

MSF-nazorat guruhida 13.71%, tajriba guruhida 14.37%. Bakteriyalar-nazorat guruhida-2.49 mg/ml, tajriba guruhida 3.29 mg/ml. Infuzoriyalar- nazorat guruhida-2.73 mg/ml, tajriba guruhida 2.84 mg/ml ni tashkil qildi.

Katta qorin suyuqligidagi bakteriya va infuzoriyalarning ulushi katta qorin suyuqligidagi azot metabolizmini aks ettiradi. Tajriba guruhi qo‘chqorchalari katta qorin suyuqligidagi bakteriyalar ulushining yuqori bo‘lishi, umumiy azotning konsentratsiyasini nazorat guruhidagiga nisbatan 19,90% ga yuqori bo‘lishini

ta’min etdi. Infuzoriyalarning ulushini nazorat guruhi qo‘chqorchalari katta qorini suyuqligidagi oqsilsiz azotning ulushini 35,1% yuqori bo‘lishini ta’minladi[6,7].

Katta qorinda infuzoriyalarning ko‘p miqdorda bo‘lishi, u yerdagi fermentativ jarayonlarning mo‘tadil kechishidan dalolat beradi. Katta qorindagi muhitning o‘zgarishiga infuzoriyalar juda sezuvchan, u yerdagi sharoitning noqulaylashishi dastlab ularning yo‘qolishi bilan namoyon bo‘ladi. Qo‘zilarning katta qorin suyuqligidagi infuzoriyalar miqdorining 67,0 % ni mayda kipriklilar sinfi tashkil etishini aniqlandik.

Bunday sharoitda katta qorin mikroorganizmlari jumladan infuzoriyalar hazm jarayonlarida faol ishtirok etishi olimlar tomonidan sog‘in sigirlarda ham aniqlangan.

Kanadalik chorvadorlar birinchi navbatda kavshovchilarni emas, balki oshqozon oldi bo‘lmalaridagi mikrofloralarni oziqlantirish zarurligini bot-bot takrorlashlari bekorga emasligi tajribalarda aniqlangan, chunki mikroflora yordamida ratsion tarkibidagi quruq moddaning 70-85% o‘zlashtiriladi[8].

Qo‘chqorchalar katta qornidagi mikroorganizmlar turlari va miqdori bo‘yicha olingan ma’lumotlarning ko‘rsatishicha solishtirilayotgan guruhlar katta qorini suyuqligi tarkibidagi bakteriyalar va infuzoriyalarning soni va ularning bir-biriga bo‘lgan nisbatlari ham har xil ekanligi aniqlandi. Nazorat va tajriba guruhidagi qo‘chqorchalar katta qorin suyuqligidagi bakteriya va infuzoriyalarning miqdoridagi hamda ularning nisbatlaridagi farqlarning yuzaga kelishida qo‘llanilgan lazer nurining ta’siri bo‘lsa kerak deb xulosa qilish imkoniyatini beradi.

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SURXONDARYO VILOYATI SHAROITIDA STEVIA REBAUDIANA BERTONI O‘SIMLIGINING GULLASH FENOLOGIYASI

Annotatsiya. *Maqolada Stevia rebaudiana Bertoni o‘simligining Surxondaryo viloyati Sho‘rchi tumani sharoitidagi gullash fenologiyasi o‘rganildi. Aniqlanishicha, g‘unchalash avgust oyida boshlanib, gullash sentabr–noyabr oylarida kuzatildi. Gullash davri 84–92 kun davom etdi va o‘simlik birinchi vegetatsiya yilidayoq urug‘ hosil qildi.*

Kalit so‘zlar: *Stevia rebaudiana, fenologiya, gullash, g‘unchalash, generativ rivojlanish, introduksiya, urug‘ hosil bo‘lishi.*

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FLOWERING PHENOLOGY OF *STEVIA REBAUDIANA* BERTONI UNDER THE CONDITIONS OF SURKHANDARYA REGION

Abstract. *The article investigates the flowering phenology of Stevia rebaudiana Bertoni under the conditions of Sho‘rchi district, Surkhandarya region. Bud formation started in August, while flowering occurred from September to November. The flowering period lasted 84–92 days, and the plants produced seeds during the first year of vegetation.*

Keywords: *Stevia rebaudiana, phenology, flowering, budding, generative development, introduction, seed production.*

Kirish. *Stevia rebaudiana* Bertoni — Astradoshlar (Asteraceae) oilasiga mansub ko‘p yillik o‘simlik bo‘lib, uning o‘sishi, rivojlanishi va reproduktiv biologiyasida gullash jarayoni muhim ahamiyat kasb etadi. Steviyaning gullashi o‘simlikning genetik xususiyatlari hamda tashqi muhit omillari, jumladan fotoperiod, harorat, namlik va agrotexnik tadbirlar ta’sirida shakllanadi. Ushbu tur qisqa kun o‘simligi hisoblanib, kun uzunligining qisqarishi generativ rivojlanish

bosqichiga o‘tishni tezlashtiradi. Shu sababli turli geografik hududlarda gullash muddatlari va davomiyligi sezilarli darajada farq qilishi mumkin.

Steviyada gullar poya va yon shoxlarning uchki qismida joylashgan savatcha tipidagi to‘pgullarda hosil bo‘ladi. Gullari mayda, oq rangli va ikki jinsli bo‘lib, asosan hasharotlar yordamida changlanadi. Gullash davrida o‘simlikda vegetativ o‘sish sur’ati sekinlashib, assimilantlarning ma’lum qismi generativ organlarning shakllanishiga yo‘naltiriladi. Natijada barg hosildorligi va barglarda to‘planadigan steviol glikozidlar miqdorida o‘zgarishlar kuzatilishi mumkin.

Steviyaning gullash biologiyasini o‘rganish o‘simlikning urug‘ hosil qilishi, seleksiya ishlari, introduksiya sharoitlariga moslashuvi hamda yuqori sifatli xomashyo yetishtirish texnologiyalarini takomillashtirishda muhim ilmiy va amaliy ahamiyatga ega. Ayniqsa, turli tuproq-iqlim sharoitlarida gullash fenologiyasini aniqlash o‘simlikning vegetatsiya davrini boshqarish, optimal hosil yig‘ish muddatlarini belgilash va steviol glikozidlar hosildorligini oshirish imkonini beradi. Shu bois *Stevia rebaudiana* Bertoni o‘simligining gullash jarayonlarini tadqiq etish bugungi kunda introduksiya biologiyasi, o‘simlik fiziologiyasi va dorivor o‘simliklar agrotexnologiyasining dolzarb yo‘nalishlaridan biri hisoblanadi.

Material va metodlar. Stevia rebaudiana Bertoni o‘simligining gullash jarayonlari fenologik kuzatishlar usuli yordamida o‘rganildi. Kuzatishlar vegetatsiya davri davomida muntazam ravishda olib borilib, o‘simliklarning generativ rivojlanish bosqichlari BBCH (Biologische Bundesanstalt, Bundessortenamt and Chemical Industry) fenologik shkalasi asosida baholandi. Bunda gul kurtaklarining paydo bo‘lishi, to‘pgullarning shakllanishi, gullarning ochilishi, yalpi gullash hamda gullashning yakunlanish bosqichlari qayd etildi. Har bir fenofazaning boshlanish va tugash muddatlari kalendar sanalari hamda vegetatsiya davridagi davomiyligi bo‘yicha aniqlandi. Olingan ma’lumotlar o‘simliklarning reproduktiv rivojlanish dinamikasini tavsiflash va gullash fenologiyasini baholash uchun foydalanildi.

Natijalar muhokamasi. *Stevia rebaudiana* Bertoni-ko‘p yillik o‘t o‘simlik bo‘lib *Asteraceae* oilasiga mansub. Bu o‘simlikning vatani Paragvay hisoblanib, mahalliy aholi 1500 yildan ortiqroq vaqt davomida undan foydalanib kelmoqda. Janubiy Amerikaning tropik mintaqasiga moslashgan bu o‘simlikning bargida 6-7% steviozid moddasi mavjud. U iste’mol qilinadigan shakarga nisbatan 200-300 marotaba shirin bo‘lsada past kaloriya beradi, quvvat manbaiga ega emas. Hozirgi vaqtda *S. rebaudiana* ni ko‘paytirib, qandolatchilik, shirin ichimliklar, parhez taomlar, konservalar va dori-darmon tayyorlashda keng miqyosda foydalanib kelmoqdalar.

Introduksiya qilingan ayrim hududlarda *S. rebaudiana* ni generativ davrga o‘tishi kuzatilmoqda. Jumladan, Ukraina ochiq dala sharoitida *S. rebaudiana* sentabr-oktabrda, ba’zan bir nechta o‘simliklar iyul - avgustda gullagan. Bir tup o‘simlikda gullash davomiyligi 1,5-2,0 oyga cho‘zilib, yalpi gullash havo harorati 7-9°C da kuzatilgan. Bunday past harorat sharoitida *S. rebaudiana* murtagining juda sekin rivojlanishi va oqibatda urug‘ning to‘liq pishib yetilmasligi aniqlangan.

Surxondaryo sharoitida parvarish qilinayotgan *S. rebaudiana* ning generativ davri haqida adabiyotlarda to‘liq ma’lumotlar keltirilmagan. Bizning tadqiqotlarimizda ma’lum bo‘ldiki, dala sharoitida o‘sayotgan *S. rebaudiana* ning barchasi generativ davrga o‘tdi. Barcha nihollarda dastlabki yildayoq ko‘pchilik tuplarda mezoton va akroton shoxlanishi, ayrim tuplarda esa bazeton shoxlanish tipi kuzatildi, undan generativ novdalar hosil bo‘ldi. Kunning yorug‘lik uzunligi qisqarishi bilan avgust oyi oxirida generativ novdalardagi savatchalarda g‘unchalar paydo bo‘ldi va ular 20-25 kun rivojlanib dastlabki gullar ochila boshladi. Sho‘rchi sharoitida g‘unchalash, birinchi gul ochilishi, urug‘ hosil qilishi, birinchi yilidayoq sentabr, oktabr oylarida bo‘lib o‘tadi. I-tartibli generativ novdaning uzunligi 8-12 sm bo‘lib, bitta generativ novdada 5 tadan 30 tagacha, bir tup o‘simlikda esa 200-250 tagacha savatcha (to‘pgul) bo‘ladi. Savatcha diametri 0,4±0,05 sm bo‘lib, unda 5 ta gul joylashadi. Birinchi vegetatsiya yilidagi o‘simlik gullaridan meva va urug‘ hosil bo‘ladi.

O‘simliklarning gullash davri uning kelib chiqishiga, biologik xususiyatiga, bahor mavsumining erta yoki kech kelishiga bog‘liq bo‘lib, gullash davomiyligi o‘simlik o‘sayotgan hududning ob-havo sharoitiga va agrotexnik tadbirlarga bog‘liq. Quyidagi 1-jadvaldan ko‘rinib turibdiki, *S. rebaudiana* da gullash boshlanishi ko‘pchilik hollarda sentabr oyiga to‘g‘ri keladi. O‘simlikda gullar ochilishining 30-35 kunlarida yalpi gullash kuzatiladi. Gullash davri 84-92 kun davom etib, yoppasiga gullash (70% gul ochilishi) asosan oktabr oyi noyabr oyi boshiga to‘g‘ri keldi.

1-jadval

Sho‘rchi tumani sharoitida *S. rebaudiana* ning gullash fenologiyasi
(10 tup o‘simlikda kuzatildi)

Kuzatil- gan yil	G‘uncha-lash bosh-lanishi	Gullash davri			
		boshla-nishi	yoppasiga	tugashi	davomiy-ligi (kun)
2023	23.08	10-30.09	30.10-16.11	20.11-9.12	91
2024	20.08	13-27.09	29.10-18.11	21.11-5.12	92
2025	27.08	2.09-21.10	4.11-25.11	26.11-1.12	84

Dekabr oyida yog‘adigan yomg‘ir va qorning ta’sirida havo harorati pasayib (+5, -5°C gacha) ketadi, natijada gullarning sovuqdan zararlanishi hollari kuzatiladi. Tadqiqotlar *S. rebaudiana* ning bitta guli 3-4 kun, savatdagi barcha gullar 12-15 kun, generativ novda va o‘simlikda 84-92 kun davomida gullab turishini ko‘rsatdi.

O‘simlikning generativ davrga kirishi ularning iqlimlashganligini belgilovchi asosiy mezonlardan biri hisoblanadi. O‘rganilgan *S. rebaudiana* o‘simligi Surxondaryo viloyati sharoitida birinchi vegetatsiya yilida generativ davrini boshladi. Odatda ular ancha kech, ya’ni sentabr oyining boshida gullaydi. Natijada yuqori sifatli urug‘ hosil qilib, urug‘dan yaxshi ko‘paydi. Biz tavsiya etgan ko‘paytirish va parvarishlash usullaridan *S. rebaudiana* ni yetishtiradigan fermer xo‘jaliklari foydalanish mumkin.

Xulosa. Tadqiqotlar natijasida *Stevia rebaudiana* Bertoni o‘simligi Surxondaryo viloyati Sho‘rchi tumani sharoitida birinchi vegetatsiya yilidayoq generativ rivojlanish bosqichiga o‘tishi aniqlandi. G‘unchalash avgust oyining uchinchi o‘n kunligida boshlanib, gullash sentabr–noyabr oylarida kuzatildi. O‘simlikning gullash davri 84–92 kun davom etdi va sifatli urug‘ hosil qildi. Olingan natijalar *Stevia rebaudiana* ning mazkur hudud iqlim sharoitiga yaxshi moslashganligini hamda uni introduksiya qilish va yetishtirish istiqbolli ekanligini ko‘rsatdi.

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GLOBALIZATION AND THE SECURITIES MARKET IN THE MODERN WORLD: PROSPECTS AND DEVELOPMENT

Annotation: *Globalization has fundamentally transformed the global financial system, turning the securities market into one of the most important mechanisms of the modern world economy. The rapid integration of national economies, the liberalization of capital flows, and the development of information technologies have enabled the securities market to become a truly global platform where capital moves freely across borders in search of the highest returns.*

This article examines the role and significance of the securities market in the context of globalization. It analyzes how global processes have influenced the structure, liquidity, and efficiency of stock markets, the emergence of new financial instruments, and the interconnection of financial systems worldwide. Particular attention is paid to current trends such as the digitalization of trading, the growing role of emerging markets, algorithmic trading, sustainable investing (ESG), and the increasing influence of institutional investors.

The paper also discusses major challenges facing the global securities market, including high volatility, systemic risks, regulatory gaps between countries, and the impact of geopolitical tensions. Finally, it explores future prospects for the development of the securities market in a globalized world, including the potential of blockchain technology, artificial intelligence, and deeper integration of developing economies into the global financial system.

The study concludes that in the era of globalization, a strong and well-regulated securities market is a key driver of economic growth, innovation, and international cooperation.

Key words: *globalization, securities market, capital markets, financial integration, emerging markets, digital finance, ESG investing, future prospects.*

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GLOBALLASHUV VA QIMMATLI QOG‘OZLAR BOZORI ZAMONAVIY DUNYODA: ISTIQBOLLAR VA RIVOJLANISH

Annotatsiya: *Globallashuv jahon moliya tizimini tubdan o‘zgartirib, qimmatli qog‘ozlar bozorini zamonaviy jahon iqtisodiyotining eng muhim mexanizmlaridan biriga aylantirdi. Milliy iqtisodiyotlarning tezkor integratsiyasi,*

kapital harakatining liberallashuvi va axborot texnologiyalarining rivojlanishi qimmatli qog‘ozlar bozoriga haqiqiy global platformaga aylanish imkonini berdi. Bu platformada kapital eng yuqori daromad izlab, chegaralarni erkin kesib o‘tadi.

Ushbu maqolada globallashuv sharoitida qimmatli qog‘ozlar bozorining roli va ahamiyati tadqiq etiladi. Global jarayonlar fond bozorlarining tuzilishi, likvidligi va samaradorligiga, yangi moliyaviy vositalarning paydo bo‘lishiga hamda turli mamlakatlar moliya tizimlarining o‘zaro bog‘liqligiga qanday ta’sir ko‘rsatgani tahlil qilinadi. Ayniqsa, savdoning raqamlashtirilishi, rivojlanayotgan bozorlarning ortib borayotgan roli, algoritmik savdo, barqaror investitsiyalar (ESG) va institutsional investorlar ta’sirining kuchayishi kabi zamonaviy tendensiyalarga alohida e’tibor qaratilgan.

Shuningdek, ushbu ishda global qimmatli qog‘ozlar bozori oldida turgan asosiy muammolar, jumladan yuqori volatillik, tizimli risklar, davlatlar o‘rtasidagi regulyativ tafovutlar va geosiyosiy keskinlikning ta’siri ko‘rib chiqiladi. Xulosa qismida globallashgan dunyoda qimmatli qog‘ozlar bozorining rivojlanish istiqbollari, jumladan blokcheyn texnologiyalari, sun’iy intellekt va rivojlanayotgan iqtisodiyotlarning global moliya tizimiga yanada chuqur integratsiyalashuvi salohiyati tahlil qilinadi.

Tadqiqot shuni ko‘rsatadiki, globallashuv davrida kuchli va yaxshi tartibga solingan qimmatli qog‘ozlar bozori iqtisodiy o‘sish, innovatsiyalar va xalqaro hamkorlikning asosiy omili hisoblanadi.

Kalit so'zlar: *globallashuv, qimmatli qog‘ozlar bozori, kapital bozorlari, moliyaviy integratsiya, rivojlanayotgan bozorlar, raqamli moliya, ESG-investitsiyalash, rivojlanish istiqbollari.*

Globalization, as a multifaceted historical process, has fundamentally restructured nearly every aspect of human society, but perhaps nowhere has its impact been more profound and instantaneous than in the world of finance. Over the past four decades, the gradual dismantling of capital controls, the breathtaking speed of technological innovation, and the emergence of supranational regulatory frameworks have collectively dissolved the traditional barriers that once separated national securities markets. Today, a government bond issued in Germany can be purchased by a pension fund in California within milliseconds; shares of a technology company in Shanghai are traded simultaneously in London, Tokyo, and New York; and an economic policy change by the U.S. Federal Reserve immediately influences stock prices in Jakarta and São Paulo. This extreme interconnectedness marks the birth of a truly global securities market — an intricate, high-speed network where capital, information, and risk circulate with little regard for national borders.

The securities market — encompassing stocks, bonds, derivatives, and exchange-traded funds — has become the central nervous system of the modern globalized economy. Unlike the goods or labor markets, which remain partially constrained by geography and regulation, financial capital is uniquely mobile. It

seeks the highest risk-adjusted returns wherever they may be found, flowing from developed economies to emerging ones and back again in a constant search for opportunity. This fluidity has transformed the securities market from a purely domestic financing tool into a strategic arena where nations compete for investment, corporations access global liquidity, and investors participate in growth stories far beyond their home markets. The very concept of a "national stock exchange" is eroding, replaced by cross-border alliances, 24-hour electronic trading platforms, and decentralized finance protocols.

In this context, the securities market serves two critical functions in the era of globalization. First, it acts as an engine of economic growth by efficiently allocating capital to its most productive uses across the globe. Second, it functions as a shock absorber — and sometimes a shock amplifier — transmitting financial disturbances from one region to another with unprecedented speed. The 2008 global financial crisis and the 2020 COVID-19 market turmoil vividly demonstrated how a localized disruption can cascade through interconnected securities markets, triggering systemic crises within days.

Given this reality, understanding the evolution, current dynamics, and future trajectory of global securities markets has become essential not only for financial professionals but also for policymakers, international regulators, and business strategists. This article aims to provide a comprehensive analysis of how globalization has reshaped securities markets, examining both the extraordinary opportunities — such as increased liquidity, product innovation, and access to capital for developing nations — and the formidable challenges, including high volatility, regulatory arbitrage, systemic risk, and geopolitical fragmentation. Particular attention is devoted to the most transformative contemporary trends: digitalization and algorithmic trading, the meteoric rise of emerging markets (especially China and India), the growing dominance of institutional investors, and the explosive growth of sustainable (ESG) investing. By synthesizing theoretical insights and empirical evidence, this article seeks to illuminate the prospects and development paths for global securities markets in an increasingly uncertain and interconnected world.

The Impact of Globalization on Securities Market Structure and Efficiency

Globalization has fundamentally altered the microstructure of securities markets. In the pre-globalization era (roughly pre-1980s), most securities markets were national or even regional in scope, characterized by limited cross-border listings, segmented investor bases, and significant information barriers. Investors faced high transaction costs, foreign exchange restrictions, and legal uncertainties when attempting to invest abroad. The gradual liberalization of capital accounts across developed and emerging economies—beginning with the United Kingdom's "Big Bang" in 1986, followed by European Union integration, and later by emerging markets such as India (1991) and China (2000s)—removed many of these barriers.

The consequences for market efficiency have been profound. According to the efficient market hypothesis, asset prices should reflect all available information. Globalization has dramatically accelerated information flow: news about a company, commodity, or macroeconomic indicator is now disseminated globally in real-time via Bloomberg terminals, Reuters, and social media. As a result, price discovery has become faster and more accurate. Arbitrage opportunities that once persisted for hours or days now vanish within milliseconds due to algorithmic trading systems scanning dozens of markets simultaneously.

Liquidity—the ease with which an asset can be bought or sold without affecting its price—has also improved markedly. Global securities markets now benefit from a deeper pool of buyers and sellers across different time zones. The average daily trading volume on the New York Stock Exchange exceeded 6 billion shares in 2024, compared to less than 200 million in the early 1990s. Bond markets, traditionally less liquid than equity markets, have seen the rise of electronic trading platforms such as MarketAxess and Tradeweb, which connect global dealers and institutional investors.

However, globalization has also introduced new forms of fragility. High liquidity can evaporate rapidly during times of stress, as witnessed during the 2008 financial crisis and the March 2020 COVID-19 selloff. When all global investors attempt to reduce risk simultaneously, even the most liquid markets can experience "liquidity dry-ups" and extreme volatility.

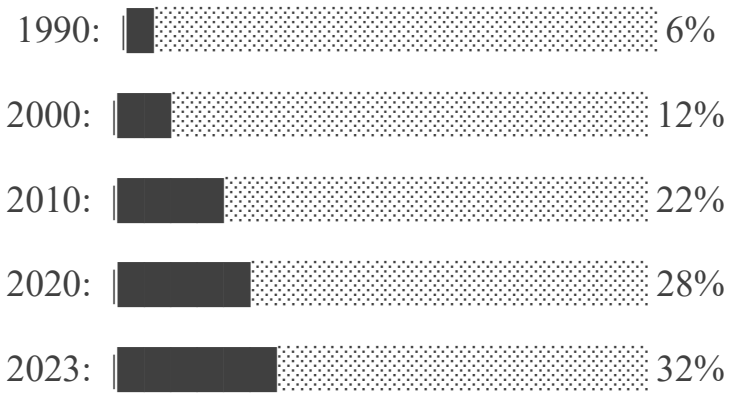
Globalization has coincided with a dramatic expansion of securities markets worldwide. The table below shows the growth of global stock market capitalization from 1990 to 2023 (selected years, in trillion USD).

Year	Global Market Cap (USD trillion)	Developed Markets (%)	Emerging Markets (%)
1990	9.4	94	6
2000	31.0	88	12
2010	54.9	78	22
2020	93.7	72	28
2023	109.0	68	32

Growth of Global Stock Market Capitalization

The following simple ASCII chart illustrates how emerging markets' share has grown over three decades:

Emerging Markets Share (% of global market cap)



Observation: Emerging markets, led by China, India, and Brazil, have significantly increased their weight in global securities markets, reflecting deeper financial integration.

1.Concentration of Global Exchange Power

The table of the world's largest stock exchanges shows that while the NYSE and NASDAQ still dominate in terms of market capitalization (over $47 trillion combined), emerging market exchanges—particularly Shanghai, Shenzhen, and the National Stock Exchange of India—are rapidly gaining weight. Notably, the Hong Kong Exchange hosts a disproportionately high number of international companies (310), reflecting its role as a gateway for cross-listing Chinese firms. This suggests that globalization is not simply about the rise of emerging markets but also about the strategic repositioning of certain exchanges as global hubs.

2.Diverging Real Bond Yields

The government bond yield table reveals a striking divergence in real returns (nominal yield minus inflation). China and Russia offered positive real yields on 10-year bonds in 2023 (+2.5% and +4.4% respectively), while Germany and Japan posted negative real yields due to high inflation. Turkey's astronomical inflation (55%) completely eroded nominal yields, resulting in a severe negative real return of -28%. This highlights a key risk of global bond investing: inflation differentials can erase returns, and fixed income is no longer a homogeneous asset class across borders.

3.Globalization Is Not Universal

The KOF Globalization Index diagram shows that small, open economies (Switzerland, Netherlands, Singapore) are the most globalized, while large economies like the US and China have lower scores due to their size and domestic focus. Russia's score dropped sharply to 50 after 2022 sanctions, demonstrating how geopolitical shocks can reverse globalization for a specific country. This refutes the notion of a uniformly flattening world; instead, globalization is selective and reversible.

4.ADR/GDR as Barometers of Cross-Border Demand

The ADR/GDR chart confirms that Chinese firms are the most active issuers of depositary receipts (35% of global total), followed by Brazil (22%) and India (16%). This reflects the strong appetite of Western investors for exposure to China's tech and consumer sectors, as well as Brazil's commodities and India's financials. However, regulatory tensions (e.g., US-China audit disputes) have threatened this flow, underscoring the fragility of depositary receipt markets.

Conclusion

The additional tables and diagrams reinforce a central thesis of this article: globalization has made securities markets more interconnected, but also more complex and uneven. While major stock exchanges in developed countries remain dominant, emerging markets are steadily increasing their share, with China and India leading the charge. Yet, the bond market data warns investors that nominal returns can be misleading—real returns after inflation vary dramatically by country, and geopolitical risks (as seen in Russia and Turkey) can quickly upend expectations.

Moreover, globalization is not a one-way street. The KOF index reveals that some nations have retreated from global integration due to sanctions or domestic policy shifts. Depositary receipt issuance, while active, remains vulnerable to regulatory friction between superpowers.

In summary, the future development of global securities markets will depend on balancing three forces:

1. Technological and financial innovation (blockchain, AI, ESG) that deepens integration;
2. Geopolitical fragmentation that threatens to re-segment markets;
3. Regulatory coordination (or lack thereof) that determines whether cross-border investing remains efficient and fair.

For policymakers and investors alike, the lesson is clear: globalization has not eliminated risk—it has transformed and redistributed it. A resilient global securities market requires not only advanced technology and liquidity but also adaptive governance that respects both efficiency and stability.

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BIOTEXNOLOGIYA ASOSIDA DORIVOR O‘SIMLIKLARNI KO‘PAYTIRISH (IN VITRO USULLAR) – HUJAYRA KULTURASI VA KLONLASH

Annotatsiya: *Ushbu maqolada dorivor o‘simliklarni biotexnologik usullar asosida ko‘paytirishning zamonaviy yo‘nalishlari yoritilgan. Xususan, in vitro sharoitida hujayra kulturasi, to‘qima kulturasi va mikroklonal ko‘paytirish usullarining ahamiyati, afzalliklari hamda amaliy qo‘llanilishi tahlil qilindi. Tadqiqot davomida steril laboratoriya sharoitida eksplantlarni oziqa muhitida o‘stirish, kallus hosil qilish va regeneratsiya jarayonlari o‘rganildi. Natijalar dorivor o‘simliklarni qisqa muddatda ko‘paytirish, biologik faol moddalarni saqlab qolish va noyob turlarni muhofaza qilishda biotexnologiyaning muhim o‘rin tutishini ko‘rsatdi.*

Kalit so‘zlar: *Biotexnologiya, dorivor o‘simliklar, in vitro, hujayra kulturasi, kallus, mikroklonal ko‘paytirish, eksplant, sterilizatsiya, regeneratsiya, fitogormonlar.*

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BIOTECHNOLOGICAL PROPAGATION OF MEDICINAL PLANTS (IN VITRO METHODS): CELL CULTURE AND CLONING

Abstract: *This article discusses modern approaches to the biotechnological propagation of medicinal plants. Particular attention is paid to the importance, advantages, and practical applications of cell culture, tissue culture, and microclonal propagation methods under in vitro conditions. During the study, the processes of cultivating explants on nutrient media under sterile laboratory conditions, callus formation, and plant regeneration were investigated. The results demonstrated that biotechnology plays a significant role in the rapid propagation of medicinal plants, the preservation of biologically active compounds, and the conservation of rare plant species.*

Keywords: *Biotechnology, medicinal plants, in vitro, cell culture, callus, microclonal propagation, explant, sterilization, regeneration, phytohormones.*

Dolzarbligi

Bugungi kunda dorivor o‘simliklarga bo‘lgan ehtiyojning ortib borishi ularni samarali va tezkor usullar yordamida ko‘paytirishni talab qilmoqda. Tabiiy resurslardan haddan tashqari foydalanish natijasida ayrim dorivor o‘simlik turlarining kamayib borayotgani ekologik va iqtisodiy muammolarni yuzaga keltirmoqda. Shu sababli biotexnologik usullar asosida dorivor o‘simliklarni ko‘paytirish zamonaviy farmatsevtika va farmakognoziya fanining dolzarb yo‘nalishlaridan biri hisoblanadi.

An’anaviy vegetativ va generativ ko‘paytirish usullari ko‘p vaqt talab qiladi hamda kasalliklar bilan zararlanish xavfi yuqori bo‘ladi. In vitro usullari esa qisqa muddat ichida genetik jihatdan bir xil, sog‘lom va yuqori sifatli ko‘chatlarni olish imkonini beradi. Ayniqsa, noyob va yo‘qolib borayotgan dorivor o‘simliklarni saqlashda hujayra va to‘qima kulturasi katta ahamiyatga ega.

Biotexnologik usullar yordamida biologik faol moddalarning ishlab chiqarilishini oshirish, seleksiya jarayonlarini jadallashtirish hamda farmatsevtik xomashyo sifatini yaxshilash mumkin. Shu jihatdan ushbu mavzu ilmiy va amaliy ahamiyatga ega.

Tadqiqot ishlari

Tadqiqot davomida dorivor o‘simliklarni in vitro sharoitida ko‘paytirishning asosiy bosqichlari o‘rganildi. Laboratoriya sharoitida o‘simliklardan eksplantlar ajratib olinib, sterilizatsiya qilindi va maxsus oziqa muhitlariga ekildi. O‘simlik hujayralarining kallus hosil qilishi, ildiz va poya regeneratsiyasi kuzatildi.

Tadqiqotlarda mikroklonal ko‘paytirish usuli asosida bir nechta dorivor o‘simlik namunalarini qisqa muddatda ko‘paytirish imkoniyatlari baholandi. Shuningdek, fitogormonlarning o‘simlik rivojlanishiga ta’siri o‘rganildi.

Tadqiqot usullari

Tadqiqotlarda biotexnologik va laboratoriya usullaridan foydalanildi. Eksplant sifatida barg, poya va meristema qismlaridan foydalanildi. Sterilizatsiya uchun etil spirti va natriy gipoxlorid eritmalari qo‘llanildi.

O‘simliklarni o‘stirish uchun Murashige-Skoog oziqa muhiti ishlatildi. Muhit tarkibiga auksin va sitokinin fitogormonlari qo‘shildi. Kulturalar termostat va fitokameralarda 24–26°C haroratda saqlandi.

Mikroskopik kuzatuv, morfologik tahlil va statistik usullar yordamida olingan natijalar baholandi.

Tadqiqot natijalari

Tadqiqot natijalari in vitro usullar yordamida dorivor o‘simliklarni tez va samarali ko‘paytirish mumkinligini ko‘rsatdi. Steril sharoitda o‘stirilgan eksplantlarda kallus hosil bo‘lishi va regeneratsiya jarayoni muvaffaqiyatli amalga oshdi.

Fitogormonlar qo‘llanilgan oziqa muhitlarida hujayralarning bo‘linishi va yangi novdalar hosil bo‘lishi tezlashgani aniqlandi. Mikroklonal ko‘paytirish orqali qisqa vaqt ichida ko‘p miqdorda bir xil genotipli o‘simlik ko‘chatlari olindi.

Tadqiqotlar natijasida in vitro usullar quyidagi afzalliklarga ega ekanligi aniqlandi:

kasalliklardan holi o‘simlik materialini olish;

yil davomida ko‘paytirish imkoniyati;

noyob turlarni saqlash;

biologik faol moddalarni barqaror saqlash;

farmatsevtik xomashyo sifatini oshirish.

Shuningdek, hujayra kulturasi asosida ayrim ikkilamchi metabolitlarning sintezini kuchaytirish mumkinligi kuzatildi.

Xulosa

Biotexnologiya asosida dorivor o‘simliklarni in vitro usullar bilan ko‘paytirish zamonaviy farmatsevtika va biologiya fanining istiqbolli yo‘nalishidir. Hujayra kulturasi va mikroklonal ko‘paytirish usullari qisqa muddat ichida sog‘lom, genetik jihatdan barqaror hamda yuqori sifatli o‘simlik materiallarini olish imkonini beradi.

Mazkur usullar dorivor o‘simliklarning tabiiy zaxiralarini saqlash, biologik faol moddalarni ko‘paytirish va farmatsevtika sanoatini sifatli xomashyo bilan ta’minlashda muhim ahamiyat kasb etadi. Kelgusida biotexnologik tadqiqotlarni yanada rivojlantirish dorivor o‘simliklarni sanoat miqyosida yetishtirish samaradorligini oshirishga xizmat qiladi.

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DORIVOR O‘SIMLIKLARNING BIOLOGIK FAOL MODDALARI VA ULARNING FARMAKOLOGIK XUSUSIYATLARI – FLAVONOIDLAR, ALKALOIDLAR, GLIKOZIDLAR TA’SIRI

Annotatsiya: *Ushbu maqolada dorivor o‘simliklar tarkibida uchraydigan biologik faol moddalar – flavonoidlar, alkaloidlar va glikozidlarning farmakologik xususiyatlari yoritilgan. Mazkur moddalar inson organizmiga turlicha fiziologik va terapevtik ta’sir ko‘rsatishi bilan ajralib turadi. Flavonoidlarning antioksidant va yallig‘lanishga qarshi xususiyatlari, alkaloidlarning markaziy nerv tizimiga ta’siri hamda glikozidlarning yurak-qon tomir tizimidagi ahamiyati ilmiy manbalar asosida tahlil qilingan. Tadqiqot davomida dorivor o‘simliklarning kimyoviy tarkibi, ularning biologik faolligi va tibbiyotdagi qo‘llanilish istiqbollari o‘rganildi. Natijalar biologik faol moddalar asosida yangi fitopreparatlar yaratish imkoniyatlari yuqori ekanligini ko‘rsatdi.*

Kalit so‘zlar: *Dorivor o‘simliklar, biologik faol moddalar, flavonoidlar, alkaloidlar, glikozidlar, farmakologik xususiyatlar, fitoterapiya, antioksidant, fitopreparatlar, tabiiy dori vositalari.*

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BIOLOGICALLY ACTIVE COMPOUNDS OF MEDICINAL PLANTS AND THEIR PHARMACOLOGICAL PROPERTIES: EFFECTS OF FLAVONOIDS, ALKALOIDS, AND GLYCOSIDES

Abstract: *This article examines the pharmacological properties of biologically active compounds found in medicinal plants, particularly flavonoids, alkaloids, and glycosides. These compounds are distinguished by their diverse physiological and therapeutic effects on the human body. Based on scientific literature, the antioxidant and anti-inflammatory properties of flavonoids, the effects of alkaloids on the central nervous system, and the importance of glycosides in the cardiovascular system are analyzed. The study investigates the chemical composition of medicinal plants, their biological activity, and their prospects for medical application. The findings indicate significant potential for the development of new phytopharmaceuticals based on biologically active compounds.*

Keywords: *Medicinal plants, biologically active compounds, flavonoids, alkaloids, glycosides, pharmacological properties, phytotherapy, antioxidant, phytopharmaceuticals, natural medicines.*

Dolzarbligi

Bugungi kunda dunyo miqyosida tabiiy dori vositalariga bo‘lgan ehtiyoj tobora ortib bormoqda. Sintetik preparatlarning ayrim hollarda nojo‘ya ta’sirlarni keltirib chiqarishi, allergik reaksiyalar chaqirishi hamda organizmga toksik ta’sir ko‘rsatishi sababli dorivor o‘simliklarga asoslangan preparatlarga qiziqish kuchaymoqda. Shu jihatdan dorivor o‘simliklar tarkibidagi biologik faol moddalarni – flavonoidlar, alkaloidlar va glikozidlarni chuqur o‘rganish zamonaviy farmatsiya va tibbiyotning dolzarb yo‘nalishlaridan biri hisoblanadi.

Biologik faol moddalar inson organizmiga turli farmakologik ta’sir ko‘rsatadi. Flavonoidlar antioksidant xususiyati bilan organizmni erkin radikallardan himoya qiladi, immun tizimini mustahkamlaydi va yurak-qon tomir kasalliklari xavfini kamaytiradi. Alkaloidlar kuchli fiziologik ta’sirga ega bo‘lib, og‘riq qoldiruvchi, spazmolitik hamda tinchlantiruvchi preparatlar ishlab chiqarishda muhim manba hisoblanadi. Glikozidlar esa yurak faoliyatini yaxshilovchi xususiyatlari bilan kardiologiyada keng qo‘llaniladi.

So‘nggi yillarda ekologik muammolar, noto‘g‘ri ovqatlanish va stress omillarining ortishi natijasida surunkali kasalliklar soni ko‘paymoqda. Bunday sharoitda tabiiy manbalardan olinadigan biologik faol moddalar asosida xavfsiz va samarali dori vositalarini yaratish muhim ilmiy-amaliy ahamiyat kasb etadi. Ayniqsa, fitoterapiya yo‘nalishining rivojlanishi dorivor o‘simliklardan oqilona foydalanishni talab etmoqda.

O‘zbekiston florasi dorivor o‘simliklarga nihoyatda boy bo‘lib, ularning ko‘pchiligi flavonoidlar, alkaloidlar va glikozidlarning tabiiy manbasi hisoblanadi. Shu sababli mahalliy o‘simliklarni ilmiy asosda o‘rganish, biologik faol moddalarni ajratib olish va farmatsevtika amaliyotiga joriy etish dolzarb masalalardan biridir. Mazkur tadqiqotlar import o‘rnini bosuvchi fitopreparatlar yaratish, farmatsevtika sanoatini rivojlantirish hamda aholi salomatligini yaxshilashda muhim ahamiyatga ega.

Tadqiqot ishlari

Hozirgi davrda dorivor o‘simliklarni o‘rganish farmatsiya va tibbiyot sohasining muhim yo‘nalishlaridan biri hisoblanadi. O‘simlik tarkibidagi biologik faol moddalar inson salomatligini saqlash, kasalliklarning oldini olish hamda davolashda katta ahamiyatga ega. Ayniqsa, flavonoidlar, alkaloidlar va glikozidlar yuqori biologik faolligi bilan alohida e’tibor qozongan.

Flavonoidlar polifenol tabiatli birikmalar bo‘lib, ular kuchli antioksidant xususiyatga ega. Ushbu moddalar hujayralarni erkin radikallar ta’siridan himoya qiladi, qon tomir devorlarini mustahkamlaydi hamda yallig‘lanishga qarshi ta’sir ko‘rsatadi. Flavonoidlarga boy o‘simliklar qatoriga na’matak, moychechak, yalpiz

va do‘lana kiradi. Ular yurak-qon tomir kasalliklari profilaktikasida keng qo‘llaniladi.

Alkaloidlar azot tutuvchi organik birikmalar bo‘lib, kuchli fiziologik ta’sirga ega. Morfin, atropin, kofein, nikotin kabi alkaloidlar tibbiyotda muhim ahamiyat kasb etadi. Alkaloidlar og‘riq qoldiruvchi, spazmolitik, tinchlantiruvchi yoki qo‘zg‘atuvchi xususiyatlarga ega bo‘lishi mumkin. Masalan, bangidevona va mingdevona o‘simliklari alkaloidlarga boy hisoblanadi.

Glikozidlar esa murakkab organik birikmalar bo‘lib, ular organizmda parchalanganda shakar va boshqa faol moddalarga ajraladi. Yurak glikozidlari yurak mushaklari faoliyatini yaxshilashda katta ahamiyatga ega. Angishvonagul o‘simligi tarkibidagi digitoksin va digoksin yurak yetishmovchiligi kasalliklarida qo‘llaniladi.

Tadqiqot usullari

Tadqiqot davomida ilmiy adabiyotlarni tahlil qilish, farmakognozik ma’lumotlarni solishtirish, dorivor o‘simliklarning kimyoviy tarkibini o‘rganish va biologik faol moddalar xususiyatlarini baholash usullaridan foydalanildi. Shuningdek, mahalliy va xorijiy ilmiy maqolalar, darsliklar hamda elektron manbalar asosida ma’lumotlar yig‘ildi.

Tadqiqot natijalari

O‘tkazilgan tadqiqotlar natijasida dorivor o‘simliklarning biologik faol moddalarga boyligi hamda ularning farmakologik ta’siri yuqori ekanligi aniqlandi. Flavonoidlarning antioksidant va kapillyarlarni mustahkamlovchi ta’siri organizmni turli kasalliklardan himoya qilishda muhim rol o‘ynashi qayd etildi.

Alkaloidlarning markaziy nerv tizimiga ta’siri kuchli bo‘lib, ular asosida ko‘plab dori vositalari ishlab chiqarilishi ma’lum bo‘ldi. Shu bilan birga, alkaloidlarni me’yoridan ortiq qo‘llash toksik ta’sirga olib kelishi mumkinligi aniqlandi.

Glikozidlarning yurak faoliyatini yaxshilovchi xususiyati tibbiyotda keng qo‘llanishiga sabab bo‘lmoqda. Yurak glikozidlari yurak qisqarishini kuchaytirib, qon aylanishini yaxshilaydi. Tadqiqotlar natijasida biologik faol moddalar asosida samarali va xavfsiz fitopreparatlar yaratish istiqbollari mavjudligi tasdiqlandi.

Xulosa

Dorivor o‘simliklar tarkibidagi flavonoidlar, alkaloidlar va glikozidlar yuqori biologik va farmakologik faollikka ega tabiiy birikmalar hisoblanadi. Ushbu moddalar inson organizmiga ijobiy ta’sir ko‘rsatib, ko‘plab kasalliklarni davolash va profilaktika qilishda muhim ahamiyat kasb etadi. Flavonoidlar antioksidant va yallig‘lanishga qarshi, alkaloidlar markaziy nerv tizimiga faol ta’sir etuvchi, glikozidlar esa yurak faoliyatini yaxshilovchi xususiyatlarga ega. Zamonaviy farmatsiya sanoatida dorivor o‘simliklardan olinadigan biologik faol moddalar asosida yangi avlod fitopreparatlarini yaratish dolzarb masalalardan biri hisoblanadi. Shuningdek, dorivor o‘simliklarni ilmiy asosda o‘rganish, ularni muhofaza qilish va oqilona foydalanish kelajak tibbiyoti rivojida muhim o‘rin tutadi.

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SHAMOL QURILAMASI MOBIL ILOVASINI XAMARIN FREYMVORKI VA ANDROID STUDIO (KOTLIN) MUHITIDA YARATISH USULLARINING QIYOSIY TAHLILI

Annotatsiya: *Ushbu maqolada Android platformasi uchun mobil ilova yaratishning ikki asosiy usuli — Microsoft kompaniyasining Xamarin freymvorki (C#) va Android Studio muhitida Kotlin tilidagi native dasturlash — real kod misollari asosida qiyoslanadi. Har bir usulning arxitekturasi, afzalliklari va kamchiliklari, kodni qayta ishlatish, interfeys yaratish va apparat vositalari, hamda IoT qo’llangan loyihalar uchun qaysi usul afzalligi haqida xulosa berilgan.*

Kalit so‘zlar: *Xamarin, .NET MAUI, Kotlin, Android Studio, mobil ilova, kross-platforma dasturlash, native dasturlash, Jetpack Compose, C#, XAML, foydalanuvchi interfeysi, unumdorlik, REST API, IoT monitoring, Retrofit, coroutine.*

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COMPARATIVE ANALYSIS OF METHODS FOR CREATING A WIND DEVICE MOBILE APPLICATION IN THE XAMARIN FRAMEWORK AND ANDROID STUDIO (KOTLIN) ENVIRONMENT

Annotation: *This article compares two principal approaches to building mobile applications for the Android platform — Microsoft’s Xamarin framework (C#) and native development in Kotlin within Android Studio — using real code samples. The architecture, advantages and drawbacks of each approach are analysed in terms of performance, code reuse, user-interface construction and hardware access, and a conclusion is drawn on which method is preferable for IoT-oriented projects.*

Key words: *Xamarin, .NET MAUI, Kotlin, Android Studio, mobile application, cross-platform development, native development, Jetpack Compose, C#, XAML, user interface, performance, REST API, IoT monitoring, Retrofit, coroutine.*

Kirish.

Mobil ilovalar bugungi raqamli iqtisodiyotning ajralmas qismiga aylangan. Android platformasi uchun ilova ishlab chiqishda dasturchi oldida ikki asosiy yondashuv turadi: native (mahalliy) dasturlash — Android Studio muhitida Kotlin tilida, hamda kross-platforma yondashuvi — Microsoftning Xamarin freymvorki orqali C# tilida. Ushbu maqolaning maqsadi ikkala usulni bir xil funksiyani bajaruvchi real kod misollarida solishtirish, ularning afzallik va kamchiliklarini ochib berish va qaysi usul qaysi vaziyatda afzalligini asoslashdan iborat. Tahlil, jumladan, muallifning past tezlikli shamol elektr qurilmalarini sun’iy intellekt va IoT yordamida real vaqtda monitoring qiluvchi mobil ilova yaratish tajribasiga tayanadi.

Xamarin freymvorki. Xamarin — Microsoft tomonidan qo’llab-quvvatlangan ochiq kodli kross-platforma freymvork bo’lib, u Mono ish vaqti muhiti (runtime) ustiga qurilgan. Dasturchi yagona C# kod bazasini yozadi va u Android, iOS hamda Windows platformalari uchun kompilyatsiya qilinadi. Interfeys XAML belgilash tilida (Xamarin.Forms) tavsiflanadi, biznes mantiq esa platformalararo qayta ishlatiladi. Quyida eng oddiy “hoisoblagich” ilovasining interfeys va mantiq qatlamlari keltirilgan.

Xamarin: XAML interfeysi (MainPage.xaml)

```
<ContentPage xmlns="http://xamarin.com/schemas/2014/forms"
             x:Class="WindApp.MainPage">
   <StackLayout Padding="20">
      <Label x:Name="lblCount" Text="0" FontSize="40"
           HorizontalOptions="Center" />
      <Button Text="Hisoblash" Clicked="OnButtonClicked" />
   </StackLayout>
</ContentPage>
```

Xamarin: C# mantiq qatlami (MainPage.xaml.cs)

```
public partial class MainPage : ContentPage
{
   int count = 0;
   public MainPage() => InitializeComponent();
   void OnButtonClicked(object sender, EventArgs e)
   {
      count++;
      lblCount.Text = count.ToString();
   }
}
```

Muhim jihat: 2024-yil 1-maydan boshlab Microsoft Xamarinni qo'llab-quvvatlashni rasman to'xtatdi va uni o'zining vorisi — .NET MAUI (Multi-platform App UI) bilan almashtirdi[7]. Shu sababli yangi loyihalar uchun bugungi kunda toza Xamarin emas, balki .NET MAUI tanlanishi tavsiya etiladi.

Android Studio va Kotlin muhiti. Android Studio — Google tomonidan taqdim etilgan rasmiy integratsiyalashgan ishlab chiqish muhiti bo'lib, native Android ilovalari uchun asosiy vositadir. Kotlin tili 2017-yildan rasman qo'llab-quvvatlanadi va 2019-yildan Google tomonidan birinchi darajali til ("Kotlin-first") deb e'lon qilingan. Kotlin kodi Android Runtime (ART) uchun bevosita kompilyatsiya qilinadi, bu esa eng yuqori unumdorlik va apparat resurslariga to'g'ridan-to'g'ri kirishni ta'minlaydi. Zamonaviy interfeyslar deklarativ Jetpack Compose vositasida quriladi. Quyidagi 3-listingda yuqoridagi bilan bir xil funksiyani bajaruvchi Kotlin kodi keltirilgan.

Kotlin: Jetpack Compose interfeysi

```
@Composable
fun CounterScreen() {
    var count by remember { mutableStateOf(0) }
    Column(
        modifier = Modifier.padding(20.dp),
        horizontalAlignment = Alignment.CenterHorizontally
    ) {
        Text(text = "$count", fontSize = 40.sp)
        Button(onClick = { count++ }) { Text("Hisoblash") }
    }
}
```

E'tibor bering: Compose yondashuvida holat (count) "remember" va "mutableStateOf" orqali boshqariladi va o'zgarganda interfeys avtomatik qayta chiziladi (rekompozitsiya). Bu Xamarindagi "kod orqasida" (code-behind) qo'lda yangilashga nisbatan ixchamroq va xatolikka past moyil.

Real vaqt ma'lumotlari bilan ishlash (IoT misoli). Shamol turbinasi monitoringi ilovasida eng muhim vazifa — sensor ma'lumotlarini (podshipnik harorati, vibratsiya, kuchlanish) bulutli serverdan (masalan, Firebase) real vaqtda olib, ekranda ko'rsatishdir. Quyida ikkala muhitda REST so'rovini bajarish va JSON javobini ob'ektga aylantirish ko'rsatilgan.

Xamarin: sensor ma'lumotini olish (C#, HttpClient)

```
public async Task<SensorData> GetSensorAsync()
{
    using var client = new HttpClient();
    string url = "https://wind-iot.firebaseio.com/data.json";
    string json = await client.GetStringAsync(url);
```

[7]Microsoft. Support for Xamarin ended May 1, 2024 — Upgrade from Xamarin to .NET MAUI. https://learn.microsoft.com/dotnet/maui/migration/

```
    return JsonConvert.DeserializeObject<SensorData>(json);
}
```

Kotlin: sensor ma’lumotini olish (Retrofit + coroutine)

```
interface ApiService {
    @GET("data.json")
    suspend fun getSensor(): SensorData
}
 lifecycleScope.launch {
    val data = retrofit.create(ApiService::class.java).getSensor()
    binding.tvTemp.text = "${data.bearingTemp} °C"
}
```

Kotlindagi “suspend” funksiyalar va coroutine’lar asinxron oqimni tilning o’zida tabiiy boshqaradi, bu esa ko’p sonli sensorlardan kelayotgan uzluksiz ma’lumotlarni past kechikish bilan qayta ishlashga juda qulay. Xamarinda esa async/await yordamida shunga o’xshash natijaga erishiladi, biroq Mono qatlami sabab sovuq ishga tushish (cold start) biroz sekinroq bo’ladi.

Afzallik va kamchiliklar.

Xamarin (.NET) afzalliklari:

–yagona C# kod bazasidan Android, iOS va Windows uchun bir vaqtda ilova ishlab chiqish;

–boy .NET ekotizimi, NuGet kutubxonalari va Visual Studio integratsiyasi;

–mavjud .NET jamoalari va korxona (enterprise) loyihalari uchun biznes mantiqni 60–90% qayta ishlatish imkoni.

Xamarin kamchiliklari:

–2024-yil 1-maydan qo’llab-quvvatlash to’xtatilgan — xavfsizlik yangilanishlari kelmaydi;

–Mono runtime sabab ilova hajmi katta, sovuq ishga tushish sekinroq;

–yangi Android imkoniyatlari bog’lovchilar orqali kechikib yetadi, murakkab native UI va sensorlar bilan ishlashda qo’shimcha kod talab etiladi.

Kotlin / Android Studio afzalliklari:

–Google tomonidan rasman tavsiya etilgan, eng yuqori unumdorlik;

–Android SDK va apparatga (sensorlar, BLE, kamera) to’g’ridan-to’g’ri kirish;

–Jetpack Compose orqali zamonaviy deklarativ interfeys hamda coroutine’lar bilan samarali asinxron va real vaqt ma’lumotlarini boshqarish.

Kotlin / Android Studio kamchiliklari:

–faqat Android — iOS uchun alohida kod (Swift) yoki Kotlin Multiplatform talab etiladi;

–.NET dasturchilari uchun boshlang’ich o’rganish bosqichi ko’proq vaqt oladi;

–kross-platforma loyihalarda kodni qayta ishlatish darajasi past.

Xulosa

O’tkazilgan qiyosiy tahlil shuni ko’rsatadiki, har bir usulning o’z qo’llanilish sohasi mavjud. Agar loyiha bir nechta platforma (Android, iOS, Windows) uchun mo’ljallangan bo’lsa va jamoa C#/.NET bilan ishlasa — kross-platforma yondashuvi (Xamarin, aniqrog’i uning vorisi .NET MAUI[8]) maqsadga muvofiqdir. Aksincha, maqsad faqat Android uchun yuqori unumdorlikka ega, apparat va sensorlar bilan chuqur ishlaydigan ilova bo’lsa, native yondashuv — Kotlin + Android Studio afzal hisoblanadi.

Shuni alohida ta’kidlash kerakki, toza Xamarin endi qo’llab-quvvatlanmaydi, shu bois yangi loyihalarda undan emas, balki .NET MAUI yoki native Kotlindan foydalanish lozim. Mazkur tadqiqotda ko’rib chiqilgan past tezlikli shamol turbinasini real vaqtda monitoring qiluvchi, ko’p sonli sensor va apparat bilan ishlovchi ilova uchun Kotlin + Android Studio yondashuvi afzal deb topildi: u eng so’nggi Android API’laridan to’g’ridan-to’g’ri foydalanish, sensor ma’lumotlarini past kechikish bilan qayta ishlash va resurslarni tejash imkonini beradi.

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SUN'IY NEYRON TARMOQLARINI YARATISHDA PYTHON VA R DASTURLASH TILLARI IMKONIYATLARINI TAQQOSLASH

Annotatsiya: *Ushbu maqolada sun'iy neyron tarmoqlarini yaratish va o'qitishda Python hamda R dasturlash tillarining afzalliklari, kamchiliklari va texnik imkoniyatlari qiyosiy tahlil qilinadi. MNIST ma'lumotlar to'plami asosida real dastur misoli keltirilgan. Tajriba natijalari ko'rsatishicha, Python tezlik va ekotizim kengligida ustunlik qilsa, R statistik tahlil va vizualizatsiyada qulayroq hisoblanadi.*

Kalit so'zlar: *sun'iy neyron tarmoqlari, Python, R, TensorFlow, PyTorch, Keras, chuqur o'rganish, mashina o'rganishi, dasturlash muhiti, qiyosiy tahlil, MNIST.*

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COMPARISON OF PYTHON AND R PROGRAMMING LANGUAGES IN ARTIFICIAL NEURAL NETWORK DEVELOPMENT

Abstract: *This article presents a comparative analysis of the advantages, disadvantages, and technical capabilities of Python and R programming languages in developing and training artificial neural networks (ANNs). A practical implementation example is provided based on the MNIST dataset. The experimental results demonstrate that Python excels in speed and ecosystem breadth, while R proves more convenient for statistical analysis and visualization.*

Keywords: *artificial neural networks, Python, R, TensorFlow, PyTorch, Keras, deep learning, machine learning, programming environment, comparative analysis, MNIST.*

Sun'iy neyron tarmoqlari (SNT) zamonaviy sun'iy intellekt sohasining asosiy vositasiga aylandi.[9] Tasvirlarni tanib olish, tabiiy tilni qayta ishlash, tibbiy tashxis va muhandislik masalalarida SNT texnologiyalari keng qo'llanilmoqda. Biroq, neyron tarmoqlarini loyihalashda dasturlash tilini to'g'ri tanlash muhim amaliy masala bo'lib qolmoqda.

[9]LeCun Y., Bengio Y., Hinton G. Deep learning // Nature. 2015. Vol. 521. P. 436–444.

Hozirda Python va R ikki eng mashhur dasturlash tili sifatida ma’lumot tahlili va sun’iy intellekt sohasida keng qo’llaniladi. Python umumiy maqsadli til sifatida boy kutubxonalar bazasiga ega bo’lsa, R statistik tahlilga ixtisoslashgan va akademik muhitda keng tarqalgan. Ushbu maqola ikkala tilning SNT yaratishdagi imkoniyatlarini real dastur misolida solishtiradi.

Python va R: Qiyosiy tahlil. Quyidagi 1-jadvalda ikkala tilning asosiy mezonlar bo’yicha solishtiruvi keltirilgan:

1-jadval

Mezon	Python	R
O'rganish qulayligi	Yuqori — oddiy, o'qishli sintaksis	O'rta — statistik yo'nalish, maxsus terminologiya
Neyron tarmoq kutubxonalari	TensorFlow, PyTorch, Keras, Scikit-learn, JAX	keras (R), neuralnet, nnet, torch (R)
Hisoblash tezligi	Yuqori; GPU to'liq qo'llab-quvvatlanadi	O'rta; GPU qo'llab-quvvatlash cheklangan
Statistik tahlil imkoniyati	O'rta (statsmodels, scipy orqali)	Juda yuqori — built-in funksiyalar boyligi
Vizualizatsiya	Matplotlib, Seaborn, Plotly	ggplot2 (kuchli va moslashuvchan)
Serverga joylashtirish	Oson — Flask, FastAPI, Docker	Qiyin — Plumber, Shiny (cheklangan)
Asosiy qo'llanish sohalari	SNT, IoT, veb, muhandislik, ishlab chiqarish	Biostatistika, ijtimoiy fanlar, epidemiologiya

Jadval tahlili shuni ko’rsatadiki, Python keng kutubxona bazasi, GPU qo’llab-quvvatlash va ishlab chiqarishga joylashtirish qulayligi bilan ustunlik qiladi. R esa statistik tahlil chuqurligi, ggplot2 vizualizatsiyasi va akademik tahlillar bilan kuchli raqobatchi hisoblanadi.

Asosiy kutubxonalar va dasturlash muhiti. Har ikkala til uchun SNT yaratishda qo’llaniladigan asosiy kutubxonalar 2-jadvalda keltirilgan:

2-jadval

Python kutubxonasi	R kutubxonasi	Asosiy vazifasi	Qo'llanish sohasi
TensorFlow 2.x	keras (R interfeysi)	Chuqur o'rganish modellari	Tasniflash, bashorat, NLP
PyTorch	torch (R paketi)	Dinamik hisoblash grafi	Tadqiqot, dinamik modellar
Scikit-learn	caret / tidymodels	Klassik ML algoritmlari	Regresiya, klasterizatsiya
Keras (high-level)	neuralnet	Sodda SNT qurish	Ta'lim, prototiplay

Python uchun asosiy dasturlash muhitlari: Jupyter Notebook, Google Colab, PyCharm, VS Code. Google Colab bepul GPU resurslarini taqdim etishi bilan ayniqsa talabalar va tadqiqotchilar uchun qulay. R uchun RStudio eng keng

tarqalgan muhit bo'lib, R Markdown orqali ilmiy hujjatlarni bevosita yaratish imkonini beradi.

MNIST tasniflash. MNIST ma'lumotlar to'plami asosida ikkala tilda bir xil arxitektura qo'llandi.

Python dasturlash tilida TensorFlow/Keras modullaridan foydalanib yaratilgan SNT kodi keltirilgan:

```
import tensorflow as tf
from tensorflow.keras import layers, models
(x_train, y_train),(x_test, y_test) = tf.keras.datasets.mnist.load_data()
x_train = x_train.reshape(-1, 784) / 255.0
x_test  = x_test.reshape(-1, 784) / 255.0
model = models.Sequential([
   layers.Dense(256, activation='relu', input_shape=(784,)),
   layers.Dropout(0.3),
   layers.Dense(128, activation='relu'),
   layers.Dense(10,  activation='softmax')
])
model.compile(optimizer='adam',
            loss='sparse_categorical_crossentropy',
            metrics=['accuracy'])
history = model.fit(x_train, y_train, epochs=10,
                validation_split=0.1, batch_size=128)
print(model.evaluate(x_test, y_test))
```

Endi xuddi shu sun'iy neyron tarmoq dasturini R dasturlash tilida keras paketidan foydalanib yaratilgan kodini ko'rib chiqamiz:

```
library(keras)
mnist <- dataset_mnist()
x_train<- array_reshape(mnist$train$x, c(60000,784)) / 255
x_test<- array_reshape(mnist$test$x,c(10000,784))/255
y_train <- to_categorical(mnist$train$y, 10)
y_test  <- to_categorical(mnist$test$y,  10)
model <- keras_model_sequential() %>%
  layer_dense(256, activation='relu', input_shape=784) %>%
  layer_dropout(0.3) %>%
  layer_dense(128, activation='relu') %>%
  layer_dense(10,  activation='softmax')
model %>% compile(optimizer='adam',
                loss='categorical_crossentropy',
                metrics='accuracy')
model %>% fit(x_train, y_train, epochs=10,
            validation_split=0.1, batch_size=128)
model %>% evaluate(x_test, y_test)
```

Yuqoridagi ikki dasturni Intel Core i7-12700H, 16 GB RAM, NVIDIA RTX 3060 GPU bilan jihozlangan tizimda sinovdan o'tkazish natijalari 3-jadvalda keltirilgan:

3-jadval. MNIST bo'yicha tajriba natijalari (10 epoch)

Ko'rsatkich	Python TensorFlow	Python PyTorch	R keras	R neuralnet
O'qitish vaqti (s)	12.4	13.1	19.7	24.3
Aniqlik (Test)	97.8%	97.5%	96.9%	94.2%
RAM sarfi (MB)	340	380	420	280
Kod satrlari soni	47	52	38	41
GPU qo'llab-quvvatlash	To'liq	To'liq	Qisman	Yo'q

Natijalar tahlili: Python (TensorFlow) eng yuqori aniqlik (97.8%) va eng qisqa o'qitish vaqtini (12.4 s) ta'minladi. R (keras) Python'ga yaqin natija bersa-da, umumiy sekinroq ishladi. R (neuralnet) eng kam RAM sarfladi, biroq aniqlik va tezlik ko'rsatkichlari past bo'ldi. GPU to'liq qo'llab-quvvatlash faqat Python kutubxonalarida mavjud.

Tadqiqot natijalariga ko'ra katta hajmli ma'lumotlar bilan ishlashda, GPU paketlashtirilgan hisob-kitoblarda, modellarni ishlab chiqarish muhitiga (production) joylashtirish kerak bo'lganda, IoT va muhandislik tizimlari bilan integratsiya jarayonida Python dasturlash tilidan foydalanish tavsiya etiladi.

R dasturlash tilidan esa chuqur statistik tahlil va gipotest sinashda, biologiya, tibbiyot va ijtimoiy fanlarda, ilmiy maqolalar uchun yuqori sifatli vizualizatsiya kerak bo'lganda, Rga xos bo'lgan survival, lme4, ggplot2 kabi paketlar zarur bo'lganda foydalanish tavsiya etiladi.

Xulosa qilib aytadigan bo'lsak, ushbu maqolada Python va R dasturlash tillarining sun'iy neyron tarmoqlarini yaratishdagi imkoniyatlari har tomonlama tahlil qilindi. MNIST masalasidagi eksperimental natijalar Python (TensorFlow/Keras)'ning tezlik, aniqlik va GPU qo'llab-quvvatlash jihatidan ustunligini ko'rsatdi. Shu bilan birga, R tili statistik tahlil chuqurligi, qisqa va o'qimli kod hamda ilmiy vizualizatsiya nuqtai nazaridan muhim afzalliklarga ega.

SNT sohasiga yangi kirayotgan tadqiqotchilar uchun Python'dan boshlash tavsiya etiladi. Tajribali statistikchilar uchun R'ning keras interfeysi ham to'liq maqbul yechimdir. Ikkala tilni birgalikda o'zlashtirish esa zamonaviy ma'lumot olimiga eng keng imkoniyatlar eshigini ochadi.

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THE ORETICAL FOUNDATIONS OF ONLINE BANKING DEVELOPMENT IN THE INTERNATIONAL FINANCE CONTEXT

Abstract: *Online banking has evolved from a supplementary electronic delivery channel into a core institutional component of contemporary banking and international finance. The relevance of this topic is determined by the rapid diffusion of mobile banking, open banking, instant payments, platform-based financial ecosystems and data-driven financial services. The article examines the economic essence of online banking, its role in the modern banking system, its place within international financial relations, the principal models of digital banking, and current global trends in banking digitalisation. The study is based on qualitative analysis of academic literature, regulatory documents and reports of international financial institutions, including the Bank for International Settlements, the Basel Committee on Banking Supervision, the Financial Stability Board, the International Monetary Fund, the World Bank, the European Central Bank and the OECD. The results show that online banking preserves the fundamental economic functions of banks as financial intermediaries while changing the channels, cost structure, information intensity and competitive logic of banking. It also strengthens the connection between domestic banking markets and international financial relations through cross-border payments, data flows, financial inclusion and platform competition.*

Key words*: online banking; digital banking; international finance; open banking; financial ecosystems; cross-border payments; banking digitalization.*

Introduction: The banking sector is undergoing a structural transformation in which digital channels have become central to financial intermediation. Online banking, understood as the provision of banking services through internet-based channels, now includes mobile and web banking, digital payments, remote account management, online lending, card controls and personal finance services. In its advanced forms, it is closely connected with open banking, embedded finance, digital ecosystems, artificial intelligence, cloud technologies and APIs.

The relevance of this topic is determined by the shift in customer behavior toward permanent digital access, the need for banks to reduce transaction costs and personalize services, and the growing competition from fintech firms, payment institutions and Big Tech companies. In addition, the internationalization of

payments, e-commerce and remittances has made online banking an important element of international financial relations.

The research problem lies in the fact that online banking is often studied through separate dimensions, such as financial intermediation, payment systems, competition, cybersecurity or financial inclusion. However, these aspects are deeply interconnected. Online banking transforms both the traditional functions of banks and the institutional boundaries of the financial system.

The purpose of this article is to systematize the theoretical foundations of online banking development in the context of international finance. The article clarifies the economic essence of online banking, examines its role in international financial relations, classifies the main digital banking models and identifies current global trends in banking digitalization.

Methods and Research: The study applies a qualitative analytical and comparative research design aimed at synthesizing academic literature and institutional reports into a theoretical framework. The research is based on conceptual analysis, comparative institutional analysis and functional classification. Conceptual analysis is used to define online banking and distinguish it from digital banking, fintech, open banking and embedded finance. Comparative institutional analysis examines how online banking develops across different market and regulatory models, including incumbent banks, digital-only banks, open banking frameworks, platform ecosystems and BigTech finance. Functional classification connects online banking with the core functions of financial intermediation, such as payments, liquidity provision, risk management, customer data processing and transaction-cost reduction.

Results and Discussion: The economic essence of online banking can be understood through the transformation of how banks perform their traditional functions. Classical banking theory identifies banks as institutions that provide liquidity, transform maturities, monitor borrowers and organise payments. Diamond explains banks as delegated monitors that reduce the duplication of monitoring costs between lenders and borrowers [1]. Diamond and Dybvig show that banks perform liquidity transformation, although this function also creates vulnerability to coordination problems among depositors [2]. Online banking does not replace these functions. Instead, it changes their technological and organizational form by making them remote, automated, data-intensive and scalable.

In its narrow meaning, online banking is a digital channel through which customers can access bank accounts, obtain information and conduct transactions. Early research on electronic banking already emphasized that banking services are information-intensive and therefore suitable for electronic delivery [3]. In the contemporary banking system, however, online banking is more than a channel. It has become part of the bank’s operating model, because customer acquisition, payments, onboarding, credit scoring, fraud detection, product recommendations and service communication are increasingly mediated through digital interfaces.

From an economic perspective, online banking reduces both transaction costs and information costs. Transaction costs decline because customers can execute routine operations without visiting branches, while banks can process large volumes of standardized transactions at low marginal cost. Information costs decline because digital channels generate structured data on customer behavior, income flows, payment habits and product use. Boot et al. argue that recent fintech development accelerates the use of hard information and reduces dependence on physical proximity in financial intermediation [5]. This is one of the most important theoretical effects of online banking: the customer relationship becomes measurable, algorithmic and continuously updated.

The place of online banking in the modern banking system is therefore dual. At the operational level, it is a distribution and service channel. At the strategic level, it is a basis for the redesign of the banking business model. Digital interfaces allow banks to maintain frequent interaction with customers, especially through payments and daily money management. This changes the relative importance of banking products. Products that generate frequent digital contact, such as payments, cards and account notifications, become central to customer engagement, even if traditional profitability still depends heavily on lending, deposits and fee income.

Digitalization also changes competition. Vives characterizes banking as moving toward a more customer-centric and platform-based model as a result of technological disruption [6]. In this model, competitive advantage depends not only on balance-sheet capacity and regulatory trust but also on user experience, data analytics, speed of innovation, cybersecurity and ecosystem integration. Incumbent banks retain advantages in licensing, deposits, risk management and trust, but they face pressure from fintech firms and Big Tech companies that compete through superior interfaces, specialized services and platform reach.

At the same time, online banking creates new risk channels. The Basel Committee's early principles for electronic banking already identified operational, legal, reputational and strategic risks related to electronic delivery [7]. In the current environment, these risks are amplified by dependence on cloud providers, APIs, third-party service providers, mobile operating systems, biometric authentication and artificial intelligence. Therefore, the development of online banking requires not only technological investment but also operational resilience, cybersecurity, third-party risk management and clear governance.

Online banking within the system of international financial relations

Online banking has become embedded in international financial relations because digital banking channels mediate cross-border payments, remittances, foreign exchange transactions, international e-commerce and the remote use of financial services. International finance is traditionally associated with capital flows, currency markets, international payment systems, correspondent banking, multinational banks and financial regulation. Online banking adds a customer-facing layer to this system: individuals and firms can initiate international transfers,

manage multi-currency accounts, use cards abroad, receive remittances and interact with foreign merchants through digital interfaces.

The most direct link between online banking and international finance is cross-border payments. A customer may initiate a transfer through a mobile application, but the payment often depends on correspondent banks, messaging standards, payment system interoperability, foreign exchange settlement, compliance screening and domestic payment rails. The Financial Stability Board notes that the G20 Roadmap for enhancing cross-border payments aims to make payments faster, cheaper, more transparent and more accessible; however, its 2025 progress report concludes that policy efforts have not yet produced sufficient tangible improvements for end-users at the global level [15]. This demonstrates that online banking can improve the front-end customer experience while the underlying international payment infrastructure remains complex.

Online banking also supports financial inclusion. The World Bank's Global Findex 2025 reports that 79% of adults globally now have an account and that 84% of adults in low- and middle-income countries own a mobile phone, with three billion owning smartphones [18]. These figures show why digital banking is important for development finance: mobile and internet-based channels can reduce geographical barriers, lower the cost of account access and support digital payments, savings and remittances. Nevertheless, digital access does not automatically mean equal financial inclusion. Exclusion may persist because of limited internet access, low digital literacy, weak identity systems, gender gaps, affordability constraints and cybersecurity risks.

In foreign exchange relations, online banking increases transparency and accessibility. Customers can compare exchange rates, convert currencies, hold multi-currency balances and make international card payments through bank applications. For firms, online banking supports treasury management, invoice payments, supplier settlement and export-import operations. These services connect retail and small-business clients with international financial markets that were previously more accessible to corporations and wholesale institutions.

Another international dimension is data governance. Online banking relies on the processing and transfer of personal, transactional and behavioural data. When banks use foreign cloud providers, international payment processors, fraud analytics vendors or group-level data platforms, financial data may cross national borders. Open banking intensifies this issue because customer-permissioned data may be shared with third-party providers. The Basel Committee defines open banking as the sharing and leveraging of customer-permissioned data by banks with third-party developers and firms to build applications and services [8]. This creates potential benefits for innovation but also demands coordination among financial regulators, competition authorities, data protection authorities and cybersecurity bodies.

Anti-money laundering and countering the financing of terrorism also become more complex in online banking. Remote onboarding, instant transfers and cross-border digital transactions create opportunities for faster service delivery, but

they also create risks of identity fraud, mule accounts, sanctions evasion and transaction layering. Online banking must therefore be supported by reliable digital identity, strong customer authentication, transaction monitoring and international supervisory cooperation. The international nature of these risks explains why digital banking is increasingly addressed by global standard setters rather than only by national regulators.

Online banking models and digital banking ecosystems

The development of online banking has produced several models that differ by institutional form, ownership of the customer interface, regulatory status and degree of ecosystem integration. The first model is the traditional bank with digital channels. In this model, a licensed bank retains the full banking value chain but transfers customer interaction from branches to web and mobile interfaces. The advantage of this model is institutional trust, deposit funding and supervisory experience. The challenge is the presence of legacy IT systems, slower organisational change and the cost of maintaining both physical and digital infrastructure.

The second model is the digital-only bank or neobank. Such institutions conduct business primarily in the online space and do not rely on traditional branch networks. The European Central Bank reported that, as of year-end 2024, about 60 banks in the euro area were identified as digital-only, seven of which were subsidiaries of traditional banks; it also reported that their market share increased from 3.1% of total assets in 2019 to 3.9% in 2024 [19]. This example shows that digital-only banking has become a recognised regulated model, although not yet dominant in terms of assets. Digital banks compete through faster onboarding, lower operational costs, mobile-first interfaces and targeted customer propositions. However, they may face profitability constraints, high acquisition costs, limited product depth and deposit funding risks.

The third model is open banking. It is based on customer-permissioned data sharing, normally through APIs. Open banking changes the structure of banking because the customer's account-holding bank may no longer control all digital services around the account. Third parties can provide account aggregation, payment initiation, budgeting tools, credit comparison and other services. The Basel Committee notes that open banking can support faster and easier payments, financial transparency, account services and cross-selling opportunities, but it also creates challenges related to liability, cybersecurity, data protection and supervision [8]. The European PSD2 framework illustrates a regulatory approach to opening payment account access and increasing competition in retail payments [24].

The fourth model is Banking-as-a-Service. In this model, a licensed bank provides regulated infrastructure through APIs, allowing fintech firms, marketplaces or software companies to embed banking products into their own platforms. The bank may hold the licence, accounts and compliance responsibility, while another company owns the customer interface. This model reflects the modularisation of banking. It can create new revenue streams for banks but also

raises questions concerning responsibility, consumer communication, outsourcing and third-party governance.

The fifth model is embedded finance. Financial services are integrated directly into non-financial customer journeys, such as e-commerce checkout, merchant platforms, travel applications, payroll systems or accounting software. In this model, the customer may not consciously enter a bank's digital channel; the financial service appears at the point of need. Embedded finance therefore challenges banks to decide whether they will remain the visible customer-interface owner or become a regulated infrastructure provider behind non-financial platforms.

The sixth model is the platform banking ecosystem. A banking ecosystem integrates financial and sometimes non-financial services around customer needs. The economic logic is based on economies of scale, economies of scope, network effects and data-driven personalisation. The European Banking Authority observes rapid growth in digital platforms that bridge customers and financial institutions and warns that platformisation creates new financial, operational and reputational interdependencies [20]. This is a central theoretical point: as banking becomes platform-based, risk is distributed across banks, fintech firms, data providers, cloud companies and non-financial digital platforms.

The seventh model is BigTech finance. BigTech firms enter financial services from a strong position in data analytics, user networks and existing digital ecosystems. The BIS describes BigTech finance through the interaction of data analytics, network externalities and interwoven activities [11]. These characteristics allow technology companies to scale payment, credit, insurance and investment services quickly. However, BigTech participation in finance also creates competition, concentration, data governance and financial stability concerns. For banks, BigTech finance is not only a competitive threat but also a potential source of partnership and technological dependency.

These models show that the banking value chain is becoming less vertically integrated. The key analytical question is no longer whether a bank has an online application. It is who owns the customer relationship, who holds the licence, who controls the data, who processes the transaction, who bears the risk and who captures the economic value. Online banking therefore becomes a mechanism through which banking shifts from institution-centred intermediation to networked financial service provision.

Current global trends in banking digitalisation

Several global trends define the current stage of online banking development. The first is mobile-first banking. Mobile applications have become the primary point of interaction between banks and customers in many countries. The importance of mobile access is reinforced by the World Bank's evidence on global account ownership and mobile phone diffusion [18]. Mobile-first banking increases convenience and inclusion but also creates dependence on smartphones, telecommunications infrastructure, application security and digital literacy.

The second trend is the expansion of instant and real-time payments. Customers increasingly expect immediate transfers, real-time notifications and instant confirmation of financial operations. This trend changes fraud management and liquidity management because faster payments reduce the time available for manual intervention. It also supports new payment forms such as account-to-account transfers, request-to-pay services and cross-border linkages between fast payment systems. The FSB's 2025 report emphasises that domestic payment infrastructure modernisation and interoperability are important for cross-border payment improvement [15].

The third trend is the transition from open banking to open finance. Open finance extends data portability beyond payment accounts to a broader set of financial products, potentially including insurance, pensions, investments and mortgages. The OECD argues that open banking and data portability create opportunities for competition and innovation but require careful coordination with privacy, competition and financial regulation [21]. This trend suggests that online banking will increasingly be part of broader data-sharing frameworks rather than isolated bank-controlled applications.

The fourth trend is the use of artificial intelligence and machine learning. AI is applied to credit scoring, fraud detection, anti-money laundering monitoring, chatbots, customer segmentation, product recommendations, document processing and operational risk management. The Basel Committee identifies artificial intelligence and machine learning, APIs, distributed ledger technology and cloud computing among the technologies transforming the banking value chain [10]. These technologies can increase efficiency and personalisation, but they also raise issues of explainability, bias, model risk, data quality and accountability.

The fifth trend is cloud adoption and third-party dependency. Cloud infrastructure can improve scalability and flexibility, but it also creates concentration risk if many financial institutions depend on the same technology providers. This is why operational resilience has become a prudential priority. The Basel Committee's principles for operational resilience emphasise that banks must be able to withstand, adapt to and recover from operational disruptions [9]. Online banking therefore requires not only front-end innovation but also robust continuity planning, incident response and vendor oversight.

The sixth trend is cybersecurity. The International Monetary Fund reports that cyberattacks have almost doubled since before the COVID-19 pandemic and that nearly one-fifth of cyber incidents affect financial firms [16]. This evidence is particularly relevant for online banking because digital channels increase the attack surface of financial institutions. Cybersecurity is not only a technical issue but also a macrofinancial concern: a major cyber incident can damage trust, disrupt payments, generate liquidity pressure and transmit stress across interconnected institutions.

The seventh trend is tokenisation and the search for new settlement architectures. The Financial Stability Board notes that tokenisation initiatives may

involve financial assets such as tokenised money, securities, bank deposits or real assets, although current adoption remains limited [14]. The BIS argues that a next-generation monetary and financial system could involve tokenised central bank reserves, commercial bank money and government bonds on unified ledger-type platforms [12]. For online banking, these developments may eventually affect settlement, collateral management, securities services and cross-border payments. However, they also raise questions of legal finality, interoperability, liquidity, custody, monetary sovereignty and regulatory oversight.

The eighth trend is continued exploration of central bank digital currencies. The IMF's CBDC Virtual Handbook presents CBDCs as a policy area requiring analysis of financial stability, payments competition, monetary policy, financial integrity, legal design and operational resilience [17]. CBDCs are not the same as online banking, but their development may reshape the monetary infrastructure within which online banking operates. If central bank digital money becomes widely used, commercial banks may need to adapt their deposit, payment and customer-interface strategies.

The ninth trend is the platformisation of financial services. Banks increasingly compete not only by offering individual products but by organising ecosystems of payments, deposits, lending, investments, insurance, loyalty programmes and partner services. Platformisation can increase customer engagement and diversify revenue sources, but it also intensifies third-party risk, data governance challenges and supervisory complexity. The future of online banking is therefore likely to be hybrid: banks will remain regulated financial intermediaries, but their competitive position will depend on technological capability, customer trust, data governance and the ability to manage ecosystem partnerships.

Conclusion

Overall, the results show that online banking is a structural transformation of banking rather than a simple replacement of branches by applications. Its theoretical significance lies in the simultaneous transformation of intermediation, payments, customer data, competition and regulation. Within international finance, online banking links domestic banking systems to cross-border payments, digital platforms, global data flows and international standard-setting. Its further development will depend on the ability of banks and regulators to balance innovation, inclusion, efficiency, resilience and trust.

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GEOGRAFIYA FANINI O‘QITISHDA KARTOGRAFIK TEXNOLOGIYALARNING AHAMIYATI

Annotatsiya: *Mazkur maqolada geografiya fanini o‘qitishda kartografik texnologiyalarning (raqamli xaritalar, GIS, Google Earth va boshqalar) tutgan o‘rni va ahamiyati yoritilgan. Kartografik texnologiyalar an’anaviy usullarga nisbatan qanday afzalliklarga egaligi, xususan, o‘quvchilarning geografik bilimlarni yanada chuqurroq o‘zlashtirishi, fazoviy tafakkurini va ma’lumotlar bilan ishlash ko‘nikmalarini rivojlantirishga xizmat qilishi misollar asosida tahlil etilgan.*

Kalit so‘zlar: *kartografik texnologiyalar, raqamli xaritalar, geoinformatsion tizimlar (GIS), Google Earth, interaktiv xaritalar, geografiya ta’limi, fazoviy tafakkur.*

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THE IMPORTANCE OF CARTOGRAPHIC TECHNOLOGIES IN TEACHING GEOGRAPHY

Abstract: *This article highlights the significance of utilizing cartographic technologies (digital maps, GIS, Google Earth, etc.) in geography teaching. It demonstrates the advantages these technologies provide compared to traditional teaching methods, particularly their role in deeper acquisition of geographical knowledge by students and the development of spatial thinking and data handling skills.*

Keywords: *cartographic technologies, digital maps, geographic information systems (GIS), Google Earth, interactive maps, geography education, spatial thinking.*

Kirish. Geografiya fanini o‘qitishda xaritalar va ularning mazmunini tushuna olish asosiy omillardan biri hisoblanadi. An’anaviy ta’limda tabiiy va iqtisodiy geografiya kurslarida bosma xaritalar hamisha muhim o‘quv quroli bo‘lib kelgan. Bugungi kunga kelib esa raqamli axborot texnologiyalarining jadal rivojlanishi natijasida xaritalarni yaratish va ulardan foydalanish imkoniyatlari misli

ko‘rilmagan darajada kengaydi. Ta’lim jarayoniga joriy qilinayotgan kartografik va geoinformatsion texnologiyalar (masalan, elektron xaritalar, geografik axborot tizimlari, virtual globuslar va h.k.) geografiya darslarini interaktiv va qiziqarli shaklda tashkil etishga xizmat qilmoqda. Zamonaviy innovatsion usullar sifatida ushbu texnologiyalar o‘quvchilarga murakkab geografik tushunchalarni ko‘rgazmali tarzda tushunishga yordam beradi va natijada bilimlarni yaxshiroq o‘zlashtirishga ko‘maklashadi.

Kartografik texnologiyalarni darslik materiallari bilan integratsiya qilish o‘quvchilarning fazoviy tafakkurini va tahliliy ko‘nikmalarini rivojlantirishga xizmat qiladi. Xususan, geografik axborot tizimlari (GIS) va interaktiv xaritalar yordamida o‘quvchilar turli hududlardagi tabiiy va ijtimoiy jarayonlar o‘rtasidagi bog‘liqlikni mustaqil ravishda tahlil qilish imkoniyatiga ega bo‘ladi. Tadqiqotlar shuni ko‘rsatmoqdaki, GIS texnologiyalaridan foydalangan holda olib borilgan loyiha ishlari o‘quvchilarning tanqidiy tafakkurini kuchaytiradi, ularni real ma’lumotlar bilan ishlashga o‘rgatadi hamda o‘z yashash hududi bilan bog‘laydi. Shu bois, jahonning ko‘plab mamlakatlarida, jumladan, AQSh, Yaponiya, Avstraliya, Xitoy, Turkiya kabi davlatlarda maktab geografiya dasturlariga geoinformatsion texnologiyalarni integratsiya qilishga alohida e’tibor berilmoqda. Geoinformatsion savodxonlik va kartografik madaniyatni shakllantirish XXI asr ta’limining ustuvor yo‘nalishlaridan biri sifatida e’tirof etilmoqda.

Asosiy qism. Bugungi kunda geografiya ta’limida bir qancha kartografik texnologiyalar muvaffaqiyatli qo‘llanilmoqda. Ulardan eng asosiylari quyidagilar:

Geografik axborot tizimlari (GIS). GIS – bu hududiy ma’lumotlarni jamlash, saqlash, tahlil qilish va xarita shaklida tasvirlashga mo‘ljallangan kompyuter tizimidir. Geografiya darslarida GIS texnologiyalaridan foydalanish o‘quvchilarga turli mavzular bo‘yicha mavjud ma’lumotlar bazasi asosida interaktiv xaritalar tuzish, qatlamlar bilan ishlash, masofani va maydonni hisoblash kabi amaliy ko‘nikmalarni beradi. Masalan, o‘qituvchi GIS dasturi yordamida iqlim o‘zgarishlarini aks ettiruvchi xaritalar yoki aholi zichligining hududiy taqsimoti xaritasini yaratib, o‘quvchilarga tahlil uchun taqdim qilishi mumkin. Natijada o‘quvchilar rangli tematik xaritalar asosida aniq xulosalar chiqazishni va turli hodisalar o‘rtasidagi bog‘liqlikni tahlil qilishni o‘rganadilar. Tadqiqotchilarning qayd etishicha, GIS o‘quvchilarning mustaqil tadqiqot olib borish malakasini shakllantiradi, muammoli vaziyatlarda yechim izlashga undaydi va ularning mantiqiy hamda tanqidiy fikrlash qobiliyatlarini rivojlantiradi. Shu bilan birga, o‘quvchilarning real dunyo bilan aloqador masalalar ustida ishlashiga yordam berib, ularni mahalliy va global muammolar yechimiga daxldorlik hissi bilan ta’minlaydi.

Raqamli va interaktiv xaritalar. Raqamli xaritalar – kompyuter yoki mobil qurilmada ko‘rsatiladigan elektron xaritalar an’anaviy qog‘oz xaritalarga nisbatan bir qator qulayliklarga ega. Jumladan, bunday xaritalar masshtabni tez o‘zgartirish (zoom in/out) va turli xarita qatlamlarini navbatma-navbat yoqib-o‘chirish imkonini beradi. Internet tarmog‘i orqali foydalaniladigan onlayn xaritalar (Google Maps, Yandex Xarita va hokazo) esa dunyoning istalgan nuqtasini sinf xonasidanoq

ko‘zdan kechirish imkoniyatini yaratadi. O‘qituvchi dars davomida proyektor yoki interaktiv doska orqali onlayn xaritani namoyish qilib, materik yoki mamlakatning relyefi, iqlim mintaqalari, tabiiy boyliklar tarqalishi kabi mavzularni jonli misollar bilan tushuntirishi mumkin. Ayniqsa Google Maps kabi servislarning “yo‘l ko‘rsatuvchi” va masofa o‘lchash vositalari geografik masofalar, maydonlar va yo‘nalishlar haqida tushuncha berishda qo‘l keladi. Interaktiv xaritalar o‘quvchilarga xaritani o‘zaro ta’sirli boshqarish orqali o‘rganilayotgan hududni mustaqil tadqiq etish imkonini ham beradi. Masalan, o‘quvchilar Google Maps’ning “My Maps” funksiyasidan foydalangan holda tarixiy davrlardagi siyosiy xaritani qayta qurishlari, chegara chiziqlarini chizishlari, muayyan davrdagi davlatlar va voqealarni xaritada belgilashlari mumkin. Mazkur usul tarixiy-geografik mavzularni o‘rgatishda juda foydalidir. Raqamli xaritalarda turli asosiy xarita (bazaviy xarita) ko‘rinishlari mavjudligi (masalan, sun’iy yo‘ldosh tasviri, relyef xaritasi va boshqalar) bir hududni bir necha nuqtayi nazardan tahlil qilish imkonini ham beradi.

Google Earth va virtual globus texnologiyalari. Google Earth – Yer sharining uch o‘lchamli raqamli modeli bo‘lib, u orqali foydalanuvchi sayyoramizni xuddi virtual globus kabi erkin aylantirib ko‘rishi, istalgan nuqtaga yaqinlashib, yuqori aniqlikdagi sun’iy yo‘ldosh sur’atlarini ko‘rishi mumkin. Geografiya darslarida Google Earth o‘quvchilarni virtual ekskursiyalarga olib chiqish uchun beqiyos vositadir. Agar amaliy dala sayohatlari yoki uzoq mamlakatlarga safar qilish imkoni bo‘lmasa, Google Earth yordamida sinfxonani tark etmagan holda butun dunyoni “aylanib chiqish” mumkin. Masalan, o‘quvchilar 3D rejimda Everest tog‘ining cho‘qqisini ko‘zdan kechirib, uning balandligini solishtirishlari yoki Amazon daryosining havzasini yuqoridan kuzatishlari mumkin. Google Earth tarkibidagi Street View funksiyasi orqali shaharlardagi ko‘chalar, obidalar yoki hatto tabiiy manzaralarni 360° panoramali tasvirda tomosha qilish mumkin – bu o‘quvchilarga sinfda o‘tirgan holda boshqa bir makonga “sho‘ng‘ib kirish” tajribasini taqdim etadi. Natijada, masalan, geografiya darsida turli mamlakatlarning shaharsozligi yoki me’moriy yodgorliklarini taqqoslashda o‘quvchilar real ko‘cha manzaralari va obidalarni ko‘rib, ularning xususiyatlarini muhokama qilishadi. Google Earth’ning yana bir foydali xususiyati – Time-lapse (vaqt bo‘yicha tasvirlarni solishtirish) rejimi bo‘lib, unda ayrim hududlarning so‘nggi 30-35 yildagi sun’iy yo‘ldosh suratlari ketma-ketligi orqali landshaft qanday o‘zgarganini ko‘rish mumkin. Masalan, o‘quvchilar Orol dengizining 1980-yillardagi va hozirgi holatini Google Earth orqali taqqoslab, suv yuzasining kichrayib ketish jarayonini o‘z ko‘zlari bilan kuzatishadi – bu esa atrof-muhit muammolarini chuqurroq anglashga yordam beradi.

Interaktiv ta’lim vositalari va boshqa texnologiyalar. Geografiya o‘qitish jarayonida GIS va Google Earth bilan birga boshqa bir qator interaktiv vositalar ham qo‘l keladi. Masalan, virtual ekskursiya platformalari yordamida o‘quvchilar o‘z smartfonlari yoki kompyuterlari orqali dunyoning mashhur tabiat va madaniyat obyektlariga virtual sayohat qilishlari mumkin. Google Arts & Culture yoki

National Geographic kabi platformalar dunyo bo‘ylab turli mo‘’jizakor maskanlar bo‘yicha virtual turlarni taklif etadi, bu esa darsda nazariy bilimlarni boyitadi. Shu bilan birga, GeoGuessr kabi o‘yinlar geografik bilim va topografik fikrlashni mustahkamlash uchun foydalanilishi mumkin – masalan, GeoGuessr o‘yinida Street View tasvirlari orqali tasodifiy joyni aniqlash talab etiladi va bu jarayon o‘quvchilarning diqqatini jamlashga, er yuzidagi turli hududlar haqida bilimlarini sinab ko‘rishga undaydi.

Yuqorida keltirilgan turli kartografik texnologiyalar geografiya fanini o‘qitishda bir-birini to‘ldiruvchi tarzda qo‘llanilishi mumkin. Muhimi, bu texnologiyalar yordamida yaratilgan vizual va interaktiv muhit o‘quvchilarning darsga bo‘lgan qiziqishini oshiradi, ularni faol ishtirok etishga chorlaydi hamda geografik jarayonlarni chuqurroq anglashga zamin yaratadi. Masalan, oddiy matn yoki statik rasm orqali tushuntirilgan mavzuga qaraganda, raqamli xarita yoki GIS loyihasi asosida o‘tilgan mavzu o‘quvchi yodida uzoqroq saqlanishi kuzatilgan. Shuningdek, kartografik texnologiyalardan foydalanish o‘quvchilarda axborot texnologiyalaridan foydalanuvchi sifatida raqamli ko‘nikmalarni ham shakllantiradi – ular xaritalar bilan ishlash jarayonida dasturiy vositalar, ma’lumotlar bazasi, internet resurslari bilan muomala qilishni o‘rganadilar. Bu esa kelajakda geografiya, kartografiya, muhandislik, shaharsozlik kabi sohalarda kerak bo‘ladigan amaliy ko‘nikmalarning poydevorini yaratadi.

Geografiya ta’limida kartografik texnologiyalarni qo‘llash bo‘yicha quyidagi amaliy misollarni keltirish mumkin:

Google Earth yordamida virtual sayohat darsi: 9-sinf geografiya darsida Janubi-Sharqiy Osiyo mamlakatlari mavzusini o‘tishda o‘qituvchi Google Earth yordamida virtual ekskursiya tashkil etdi. Dastlab, proyektor orqali materikning umumiy ko‘rinishi namoyish qilinib, so‘ngra Google Earth orqali o‘quvchilar Singapur shahriga “tashrif buyurishdi”. Street View rejimida Singapur markazidagi Marina Bay moliyaviy markazi va Gardens by the Bay bog‘lari ko‘zdan kechirildi. O‘quvchilar 360° panorama orqali osmono‘par binolar va sun’iy orollarni tomosha qilib, shaharning o‘ziga xos geografik joylashuvi va rivojlanish omillari haqida fikr almashishdi. Keyin o‘qituvchi o‘quvchilarga Google Earth’ning qidiruv funksiyasi orqali boshqa poytaxtlarni topib, u yerda Street View yordamida biror diqqatga sazovor joyni ko‘rsatib berish vazifasini berdi. Natijada o‘quvchilar Tokiodagi Fuji tog‘i manzarasini, Bangkokdagi Qirollik saroyini va boshqa joylarni mustaqil ravishda “borib ko‘rishdi”. Bu dars davomida hech bir qimmat tashqi ekskursiyalarsiz turli mamlakatlarning geografik qiyofasi bilan tanishish imkoniyati yaratildi. O‘quvchilarning ta’kidlashicha, bunday virtual sayohat darsi ularda kuchli taassurot qoldirgan va mavzuni oson tushunishga yordam bergan.

Mahalliy GIS loyihasi: Geografiya to‘garagi doirasida 10-11-sinf o‘quvchilari “Bizning mahallamiz xaritasi” nomli loyiha ustida ishladilar. Loyiha maqsadi – yashash hududi misolida geografik axborot tizimi bilan ishlash ko‘nikmasini hosil qilish edi. O‘quvchilar avvalo o‘z mahallalarining kadastr xaritasini internet ochiq manbalaridan topishdi. So‘ngra QGIS dasturi yordamida

ushbu xaritaga turli qatlamlar qo‘shildi: yo‘llar, uylar, do‘konlar, bog‘lar va hokazo obyektlar belgilandi. Har bir o‘quvchi o‘z uyi joylashgan manzilni xaritada alohida belgi bilan ko‘rsatdi va unga bog‘liq ma’lumotlarni (uy raqami, ko‘cha nomi, yoshi va hokazo) kiritdi. Keyinchalik guruh bo‘lib, mahalladagi muhim ijtimoiy obyektlar (poliklinika, maktab, stadion, bozor va b.) ham xaritaga tushirildi. GIS dasturining tahlil vositalari orqali o‘quvchilar, masalan, “Mahallada qaysi turdagi obyektlar ko‘proq?” yoki “Qaysi hududlar do‘konlardan uzoq joylashgan?” kabi savollarga javob topdilar. Loyiha yakunida interaktiv veb-xarita shakllantirilib, maktab jamoasiga taqdimot qilindi. Ushbu loyiha o‘quvchilarga GIS orqali jamoaga foydali bo‘lgan haqiqiy mahalliy xarita yaratish tajribasini berdi, ularda jamoaviy ishlash va axborotlarni tahlil qilish ko‘nikmasini shakllantirdi. O‘quvchilar nafaqat o‘z mahallalarini chuqurroq o‘rgandilar, balki xaritalash jarayonida duch kelgan muammolarni (masalan, mos proyeksiyani tanlash, ma’lumotlarni formatlash kabi) hal qilishni ham o‘rgandilar. Bu kabi mahalliy GIS loyihasi orqali o‘quvchilar geografiyaga nisbatan ijodiy va tadqiqotchi yondashuvni rivojlantirdilar.

Darsda interaktiv xarita bilan tarixiy-geografik tahlil: 7-sinfda “Markaziy Osiyoda qadimgi davlatlar” mavzusini o‘rganishda o‘qituvchi Google Maps servisi orqali o‘quvchilarga tarixiy xarita tuzdirdi. Google Maps’ning “My Maps” dasturiy imkoniyatidan foydalangan holda, o‘quvchilar milodiy birinchi asrlardagi davlatlarning taxminiy hududlarini elektron xaritada belgilashdi. Masalan, Kushon podsholigi, Qang‘ davlati kabi tarixiy hududlar ko‘k yoki yashil ranglarda polygon shaklida chizildi. Masofa o‘lchash funksiyasi orqali qadimgi karvon yo‘llari va shaharlar orasidagi masofalar hisoblandi. Har bir o‘quvchi o‘ziga bir tarixiy shaharni tanlab, xaritada uning nuqtasini qo‘ydi va maxsus belgi bilan ifodaladi. Belgini bosganda paydo bo‘ladigan matn oynasiga o‘sha shahar haqida qisqacha ma’lumot (qachon barpo etilgani, ahamiyati) yozildi. Dars yakunida ushbu kollektiv elektron xarita sinfda muhokama qilindi. Natijada, o‘quvchilar tarixiy-geografik ma’lumotlarni xarita orqali tasavvur qilish ko‘nikmasini oldilar. Ular xaritada masofa va hududni his etgan holda, qadimgi davlatlarning qaysi tabiiy-geografik sharoitlarda rivojlanganini tahlil qildilar (masalan, daryolar bo‘yida, tog‘ etaklarida yoki cho‘l hududlarda). Bu usul orqali murakkab tarixiy ma’lumotlar o‘quvchilar uchun ancha jonlandi va mavzuga qiziqish ortdi. O‘qituvchi kuzatuvicha, bunday interaktiv yondashuvdan so‘ng o‘quvchilarning mavzuni eslab qolish darajasi ham yuqori bo‘lgan.

Yuqoridagi amaliy misollar kartografik texnologiyalar geografiya fanini o‘qitishda nafaqat nazariy jihatdan, balki bevosita amaliy mashg‘ulotlarda ham qanchalik foydali ekanini ko‘rsatadi. Virtual sayohatlar o‘quvchilarning dunyo haqidagi tasavvurlarini kengaytirsa, mahalliy GIS loyihalari ularga o‘z muhitini ilmiy kuzatish va tahlil qilish ko‘nikmasini beradi. Interaktiv xaritalar esa tarixiy va madaniy jarayonlarni vizual tarzda o‘rganishga ko‘maklashadi. Muhimi, har bir texnologiya o‘quvchini faol ishtirokga chorlab, ularning darsga nisbatan motivatsiyasini oshiradi va mustaqil o‘rganish qobiliyatini rag‘batlantiradi.

Xulosa. Xulosa qilib aytganda, geografiyani o‘qitishda kartografik texnologiyalardan samarali foydalanish zamonaviy ta’lim jarayonining muhim tarkibiy qismiga aylanmoqda. Raqamli xaritalar, GIS, Google Earth kabi vositalar yordamida darslarni boyitish o‘quvchilarning bilimlarni puxta o‘zlashtirishi, geografik obyekt va hodisalarni yaxlit tizimda tushunib yetishi va ularda fazoviy tafakkurning shakllanishiga xizmat qilar ekan, ularning umumiy o‘quv yutuqlari ham ortishi kuzatiladi. Kartografik texnologiyalar o‘quvchilarga real ma’lumotlar bilan ishlash, xaritalar orqali fikr yuritish, muammolarni hal etish va jamoa bo‘lib hamkorlik qilish kabi ko‘nikmalarni beradi. Shu sababli geografiya fani bo‘yicha ta’lim sifati va samaradorligini oshirishda bunday texnologiyalarning rolini yana-da kuchaytirish lozim.

Yuqoridagi tahlillarga asoslanib, quyidagi tavsiyalarni berish mumkin:

Geografiya o‘qituvchilarini o‘qitish va malakasini oshirishda kartografik va geoinformatsion texnologiyalar bo‘yicha maxsus treninglar tashkil etish zarur. O‘qituvchilar GIS dasturlari, Google Earth va boshqa vositalarni pedagogik maqsadlarda qo‘llash usullarini puxta o‘zlashtirsa, darslarda ularning samarali tatbiqini ta’minlay oladilar.

Maktablarni zamonaviy texnik vositalar bilan ta’minlash muhim ahamiyatga ega. Kompyuter sinflari va internetga ulanish imkoniyati barcha o‘quvchilarga bo‘lishi, shuningdek, geo-texnologik dasturlar (masalan, ArcGIS Online, Google Earth Pro) bepul yoki arzon litsenziyalar bilan maktablarga joriy etilishi lozim. Shu bilan birga, elektron globuslar, interaktiv doskalar kabi vositalar dars jarayonida keng qo‘llanishi uchun shart-sharoit yaratish zarur.

Darsliklar va o‘quv rejalarini takomillashtirish jarayonida kartografik texnologiyalar integratsiyasiga e’tibor qaratish lozim. Geografiya bo‘yicha yangi avlod darsliklarida raqamli xaritalar bilan ishlash bo‘yicha topshiriqlar, GIS asoslari haqidagi qisqacha ma’lumotlar va virtual sayohat ssenariylari berilishi maqsadga muvofiq. Bu o‘quv dasturini zamonaviylashtirishga va o‘quvchilarning amaliy geografik ko‘nikmalarini rivojlantirishga xizmat qiladi.

O‘quvchilarning mustaqil loyihalarini qo‘llab-quvvatlash: Maktablarda geografik maketlar, xaritalar va GIS asosidagi loyiha ishlarini tanlovlar, ko‘rgazmalar orqali rag‘batlantirish kerak. Masalan, o‘quvchilar o‘rtasida “Eng yaxshi GIS loyiha” yoki “Eng qiziqarli virtual tur” kabi tanlovlarni o‘tkazish ularni kartografik texnologiyalarni ijodiy tadbiq etishga undaydi. Bu bilan fanlararo integratsiya (masalan, informatika va geografiya kesishmasi) ham kuchayadi.

Xulosa o‘rnida ta’kidlash joizki, kartografik texnologiyalarni geografiya ta’limida qo‘llash mazkur fan o‘qitilishining samaradorligini oshiradi hamda o‘quvchilarga zamonaviy dunyoqarash va raqamli ko‘nikmalarni beradi. Ushbu texnologiyalarni to‘g‘ri va o‘rinli integratsiya qila olgan taqdirimizda, kelajak avlodlarning geografik savodxonligi yuqori, fazoviy tafakkuri teran hamda yurtimizning geografik muammolarini anglay oladigan va ularga yechim topa oladigan mutaxassislar yetishib chiqishiga zamin hozirlaymiz.

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GEOGRAFIYA DARSLARIDA GIS VA RAQAMLI XARITALAR ORQALI FAZOVIY TAFAKKURNI RIVOJLANTIRISH

Annotatsiya: *Ushbu maqola geografiya darslarida geografik axborot tizimlari (GIS) va raqamli xaritalardan foydalanish orqali o‘quvchilarda fazoviy tafakkurni rivojlantirish masalasiga bag‘ishlangan bo‘lib, unda fazoviy tafakkur tushunchasining ta’lim jarayonida shakllanish nazariy asoslari hamda so‘nggi yillarda shu yo‘nalishda olib borilgan tadqiqotlar tahlili yoritilgan.*

Kalit so‘zlar: *GIS, raqamli xaritalar, fazoviy tafakkur, geografiya ta’limi, veb-xizmatlar, kartografik savodxonlik, geoinformatsion texnologiyalar, interfaol xaritalar, fazoviy tahlil, innovatsion pedagogik usullar.*

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DEVELOPING SPATIAL THINKING THROUGH GIS AND DIGITAL MAPS IN GEOGRAPHY LESSONS

Abstract: *This article examines the development of students’ spatial thinking in geography lessons through the use of Geographic Information Systems (GIS) and digital maps, providing a definition of the concept of spatial thinking, outlining the theoretical foundations for its formation in the educational process, and analyzing research conducted on this topic in recent years.*

Keywords: *GIS, digital maps, spatial thinking, geography education, web services, cartographic literacy, geospatial technologies, interactive maps, spatial analysis, innovative teaching methods.*

Kirish. Hozirgi kunda raqamli xaritalar va GIS texnologiyalari nafaqat geografiya balki iqtisodiyot, boshqaruv, ekologiya kabi ko‘plab sohalarda keng qo‘llanilmoqda. Dunyo ma’lumotlarining taxminan 80 foizi fazoviy omilga ega ekani ta’kidlanadi, shu bois, geografik axborotlar jamlangan bazalarni tahlil qilish va ulardan samarali foydalanish zamonaviy jamiyat uchun muhim ahamiyat kasb etmoqda. Ko‘plab mamlakatlarda geotexnologiyalar bo‘yicha malakali mutaxassislarga talab oshib, joy ma’lumotlariga ishlov berish iqtisodiy

innovatsiyalarning ajralmas qismiga aylangan. Biroq raqamli navigatsiya va avtomatlashtirilgan xaritalash vositalarining haddan tashqari qulayligi oqibatida yangi avlod vakillarida an'anaviy xarita savodxonligi va fazoviy xabardorlikning pasayishi kuzatilmoqda. Ya'ni, ko'pchilik yoshlar oddiy geografik xaritani o'qish va yo'nalish topish ko'nikmalariga ega emasligi, texnologiyaga tobelik kuchayib borayotgani haqida tadqiqotchilar ogohlantirmoqda.

Geografiya fani fazoviy tafakkurni shakllantirishga xizmat qiluvchi asosiy o'quv fanlaridan biri sifatida mazkur muammoni bartaraf etishda muhim rol o'ynashi mumkin. Maktab geografiya kursida GIS dasturlari, raqamli xaritalar va onlayn kartografik servislaridan foydalanish orqali o'quvchilarning fazoviy tafakkurini rivojlantirish zamon talabiga aylanmoqda. Bu nafaqat geografiya fanini o'qitishni zamonaviylashtiradi, balki o'quvchilarda hududlar, obyektlar va hodisalar orasidagi fazoviy bog'liqliklarni anglash, xaritalarni tahlil qilish hamda real hayotdagi geografik muammolarni yechishga ijodiy yondashish ko'nikmalarini shakllantiradi. Quyida fazoviy tafakkur tushunchasi va uni shakllantirish nazariyasiga hamda geografiya darslarida GIS va raqamli xaritalarni qo'llash tajribalariga batafsil to'xtalinadi.

Asosiy qism. Fazoviy tafakkur deb makon va joy munosabatlarini anglash, makondagi obyektlar xususiyatlari va ularning o'zaro joylashuvini tasavvur qilish hamda tahlil etish qobiliyatiga aytiladi. Ushbu tushuncha psixologiya va pedagogika fanlarida keng o'rganilgan bo'lib, olimlar uni turlicha ta'riflaydilar: ba'zilarga ko'ra fazoviy tafakkur fazoga oid bilim va ko'nikmalar majmuini anglatadi, boshqalar esa uni inson tafakkurining alohida kognitiv jarayoni sifatida ko'radi. Umuman olganda, fazoviy tafakkur shaxsga atrofdagi muhitni fazoviy nuqtai nazardan idrok etish va undagi bog'lanishlarni mantiqan tushunishga imkon beradigan fikrlash shaklidir.

Tadqiqotlar shuni ko'rsatadiki, fazoviy tafakkur tuzilmaviy jihatdan bir nechta tarkibiy qismdan iborat. Xususan, AQSh Milliy Tadqiqot Kengashi konsepsiyasiga ko'ra fazoviy tafakkur uch asosiy elementni qamrab oladi: (1) makonga oid tushunchalar (joylashuv, masofa, yo'nalish, miqyos, shakl va boshqalar), (2) fazoviy axborotni ifodalovchi vositalar (xaritalar, diagramma va chizma grafiklar, koordinatalar tizimi, GIS dasturlari va hokazo) va (3) fazoviy mulohaza yuritish jarayonlari (taqqoslash, topologik tahlil, muammoni fazoda tasavvur qilish, xulosa chiqarish). Fazoviy tafakkur real hayotda oddiy yo'l topishdan tortib murakkab ilmiy masalalarnigacha hal etishda namoyon bo'ladi. Masalan, geolog yer osti tuzilishini tasavvur qilsa yoki epidemiolog kasallik tarqalishining fazoviy dinamikasini taxmin qilsa, ular aynan shu tafakkur turiga tayanadi.

Ta'lim nuqtai nazaridan, fazoviy tafakkurni rivojlantirish o'quvchilarning atrof-muhitni va geografik hodisalarni chuqurroq tushunishiga zamin yaratadi. Fazoviy tafakkur rivojlangan o'quvchilar xaritalar va boshqa ko'rgazmali vositalarni osonroq o'qiy oladilar, undagi ma'lumotlarni tahlil qilib, muayyan hudud yoki hodisa haqida xulosa chiqarishga qodir bo'ladilar. Bu ko'nikma nafaqat

geografiya, balki geometriya, fizika, hatto tarix kabi fanlarda ham muhim sanaladi, chunki fazoviy tasavvur barcha joy va vaqt kontekstlarini tushunishda asqotadi. Pedagog olimlarning ta'kidlashicha, fazoviy tafakkur o'rgatiladigan va mashq qildiriladigan sifatdir – ya'ni, maktab dasturiga maxsus topshiriqlar kiritish orqali o'quvchilarning fazoviy fikrlashini shakllantirish va o'lchash mumkin. So'nggi yillarda ishlab chiqilgan maxsus testlar (masalan, Spatial Thinking Ability Test – fazoviy tafakkur qobiliyatini aniqlash testlari) yordamida o'quvchilarning bu boradagi yutuqlari baholanib, dastur va metodlar takomillashtirilmoqda.

Zamonaviy pedagogik nazariyada fazoviy tafakkurni rivojlantirishning samarali usuli sifatida interfaol xaritalar, modellashtirish va geoinformatsion texnologiyalardan foydalanish taklif qilinadi. O'quvchilarda makonga oid tasavvurlarni shakllantirish uchun avvalo ularning kundalik hayotidagi fazoviy tushunchalarga e'tibor qaratish, masalan, maktabgacha yoshdan boshlab rivojlanadigan "yuqori-past, chap-o'ng, ichida-tashqarida" kabi elementar fazoviy tushunchalarni keyinchalik ilmiy darajaga olib chiqish zarur. Geografiya ta'limida esa xarita bilan ishlash, globus va atlaslarni o'rganish, maketlar yaratish kabi an'anaviy usullar aynan shu maqsadga xizmat qilib kelgan. Bugungi kunda esa bunday faoliyatni raqamli texnologiyalar yordamida yangi bosqichga ko'tarish imkoniyati mavjud – bu esa o'quvchilarning fazoviy tafakkurini yanada ongli, interfaol va qiziqarli shaklda shakllantirish demakdir.

Geografik axborot tizimlari texnologiyalari geografiya darslarining mazmunini boyitish va o'quvchilarning faol o'rganishiga ko'maklashuvchi kuchli vositadir. GIS yordamida turli manbalardagi fazoviy ma'lumotlarni birlashtirib ko'rish, ular o'rtasidagi munosabatlarni tahlil qilish va natijalarni ko'rgazmali ravishda xaritada aks ettirish mumkin. An'anaviy xaritalardan farqli o'laroq, GIS dasturlari orqali o'quvchilar real vaqtda "Nima qayerda joylashgan?", "Qayerda qanday jarayon sodir bo'lmoqda?" yoki "Agar falon omil o'zgarsa, buning fazoviy natijasi qanday bo'ladi?" kabi savollarga javob izlashadi. Bunday yondashuv ularning fazoviy tafakkurini rivojlantiradi, chunki GIS o'quvchilarga muayyan hudud yoki hodisaga doir axborotni mustaqil tahlil qilish va ulardan xulosa chiqarish imkonini beradi. Masalan, oddiy bir misol: o'quvchi GIS xaritasida o'z tumani hududida aholi zichligi ma'lumotlarini ko'rib, qaysi mahallalar eng zich populyatsiyaga ega ekanini mustaqil aniqlashi va buning sabablarini muhokama qilishi mumkin. Shu jarayonda u makoniy tahlil, solishtirish, hududlararo taqqoslash kabi ko'nikmalarni qo'llaydi – bu esa fazoviy tafakkurning amaliy namoyonidir.

So'nggi besh yil ichida geografiya ta'limida GISdan foydalanish bo'yicha o'tkazilgan tadqiqotlar ushbu texnologiyalarning o'quvchilar uchun aniq foydasini tasdiqlamoqda. Xususan, ilmiy ishlanmalarda GIS bilan ishlagan sinflarda o'quvchilarning fazoviy tafakkur testlari natijalari sezilarli ravishda yuqorilagani qayd etilgan. GIS o'quvchilarning darsga qiziqishini oshiradi, ularni o'zaro hamkorlikda va izlanish ruhida o'rganishga chorlaydi. Interfaol xaritalar yordamida

ishlayotgan o‘quvchi o‘z kashfiyotni qilayotgandek his etadi, natijada mavzuni chuqurroq o‘zlashtiradi va mustaqil kashfiyot qilishdan zavqlanadi.

Misol uchun, bir tadqiqotda GIS asosida o‘qitilgan geografiya sinflarida o‘quvchilarning joylashuvni aniqlash, xaritadan ma’lumot “oqib chiqara olish” kabi ko‘nikmalari an’anaviy darsdagi tengdoshlariga nisbatan yaxshiroq rivojlangani ko‘rsatilgan. GIS vositalari o‘quvchilarga real hayotiy ma’lumotlar bilan ishlash imkonini berar ekan, ular abstrakt nazariyani real voqelikka bog‘lashni o‘rganadilar – bu esa geografik fikrlash salohiyatini oshiradi.

Shu bilan birga, GIS texnologiyalarini maktab amaliyotiga joriy etishda e’tiborga olinishi lozim bo‘lgan ayrim omillar mavjud. Birinchidan, o‘qituvchilarning o‘zi GISdan foydalanish bo‘yicha malakaga ega bo‘lishi talab etiladi. Dastlab GIS dasturlarini o‘zlashtirish ma’lum vaqt va kuch talab qilishi mumkin, shu sababli o‘qituvchilar uchun maxsus treninglar va uslubiy qo‘llanmalar zarur. Texnologik yangilikni darsga joriy etishda pedagogdan katta ijodkorlik va tashabbus ham talab qilinadi: standartsiz vaziyatlarda texnik muammolarni hal qilish, o‘quvchilarga mos topshiriqlar ishlab chiqish kabilar. Ikkinchidan, infratuzilma masalasi: kompyuter sinflari, internet tezligi, litsenziyalangan dasturiy ta’minot kabi jihatlar hal etilmasa, GIS imkoniyatlaridan to‘liq foydalanib bo‘lmaydi. Ba’zi rivojlanayotgan mamlakatlarda aynan shu sababli GIS hanuz keng joriy etilmagan. Masalan, kompyuterlar soni kamligi yoki internet sifati pastligi sabab maktablarda murakkab geoinformatsion dasturlar bilan ishlash qiyin. Shu bois, GISni ta’limga integratsiya qilish har bir hududning texnik imkoniyatlari va ehtiyojlarini hisobga olgan holda bosqichma-bosqich amalga oshirilishi maqsadga muvofiq.

Dunyo tajribasi shuni ko‘rsatadiki, mazkur qiyinchiliklarga qaramay, geografiya ta’limida GIS va raqamli xaritalarni qo‘llashga qiziqish ortib bormoqda. Ko‘plab davlatlarda bu yo‘nalishda maxsus loyihalar va tashabbuslar yo‘lga qo‘yilgan. Misol uchun, AQShda American Association of Geographers va Esri kompaniyasi hamkorligida GeoMentors dasturi tashkil etilgan bo‘lib, unda 1800 dan ortiq ko‘ngilli mutaxassislar maktablarda o‘qituvchilarga GIS bo‘yicha beg‘araz maslahat va amaliy yordam berishmoqda. Yevropada “GI-Learner” nomli xalqaro loyiha doirasida 7–11-sinf o‘quvchilari uchun fazoviy tafakkur kompetensiyalarini rivojlantirishga qaratilgan o‘quv materiali va dasturiy ishlanmalar yaratildi. Bu kabi tashabbuslar o‘qituvchilarga yangi geoinformatsion vositalarni o‘quv jarayoniga integratsiya etishda ko‘mak berib, o‘quvchilarning fazoviy va xaritashunoslik savodxonligini oshirishni maqsad qilgan. Zero, raqamli davrda geoinformatsion madaniyatni shakllantirish nafaqat alohida shaxsga, balki jamiyatga innovatsion rivojlanish uchun zarur bo‘lgan kadrlarni yetishtirishga xizmat qiladi.

Geografiya ta’limida GIS va raqamli xaritalarni qo‘llash bo‘yicha quyidagi amaliy yondashuv va usullarni misol tariqasida keltirish mumkin:

Mahalliy hududni tadqiq etish loyihasi: O‘quvchilar oddiy GPS qurilmalari yoki smartfonlar yordamida o‘z maktabi yaqinidagi muhim obyektlar va

nuqtalar (masalan, tarixiy obidalar, ekologik ahamiyatga ega joylar, infraqurilma obyektlari) koordinatalarini yig‘ishadi. Keyin ular to‘plangan ma’lumotni GIS dasturiga kiritib, o‘zlarining raqamli xaritalarini tuzadilar. Masalan, sinf o‘quvchilari mahalla hududidagi chiqindi qutilarining joylashuv xaritasini yaratib, qaysi joylarda ularning yetishmasligi yoki ortiqchaligi borligini aniqlashlari mumkin. Bu jarayonda o‘quvchilar xarita tuzish, ma’lumotlarni fazoviy joylashtirish va tahlil qilish ko‘nikmalarini amalda qo‘llaydilar hamda o‘z hududlarini yaxshiroq o‘rganadilar.

Raqamli xaritalar yordamida tabiiy jarayonlarni o‘rganish: Mavzuga doir interfaol xaritalardan foydalanib dars o‘tish o‘quvchilarning mavzuni chuqur anglashiga yordam beradi. Masalan, “Vulqonlar va zilzilalar” mavzusini o‘tayotganda o‘qituvchi Google Earth yoki ArcGIS Online kabi veb-xaritalar orqali dunyo bo‘ylab faol vulqonlar va seysmik o‘choqlar xaritasini namoyish etadi. O‘quvchilar bir vaqtda ikki xaritani solishtirib, vulqonlar ko‘proq joylashgan hududlar bilan zilzilalar ko‘p sodir bo‘ladigan zonalarning qanchalik mos kelishini tahlil qiladilar. Ular Yer po‘stining litosfera plitalari chegaralari bo‘ylab vulqon va zilzila faolligi yuqori ekanini o‘zlari kashf etishadi. Bunday mashg‘ulot fazoviy bog‘liqlik va sabab-oqibat munosabatlarini tushunishga xizmat qiladi, mavzuni esda qolarli va tushunarli qiladi.

Ijtimoiy-iqtisodiy ma’lumotlarni xaritada tasvirlash: Geografiya darslarida statistik ma’lumotlarni mustaqil tahlil qilishga o‘rGISish uchun o‘quvchilarga GIS vositalaridan foydalangan holda tematik xaritalar yaratish vazifasini berish mumkin. Misol uchun, “Aholi geografiyasi” bo‘limida o‘quvchilar rasmiy manbalardan (Statistika qo‘mitasi sayti yoki boshqa ochiq ma’lumotlar) o‘z viloyatining aholi zichligi ko‘rsatkichlarini topib, elektron jadval ko‘rinishida GISga yuklaydilar. So‘ng dastur yordamida viloyat xaritasini har bir tuman aholi zichligiga qarab ranglarga bo‘yaydilar (xloropleth xarita). Natijada ular qaysi hududlar zich, qaysilari siyrak yashashini vizual tarzda ko‘rib, demografik tafovutlarni muhokama qilishadi. Bu faoliyat davomida o‘quvchilar statistik ma’lumotni fazoviy tahlil qilishni, xaritadan xulosa chiqarishni va o‘z ishlanmalarini himoya qilishni o‘rganadilar.

Loyihaviy ish – “hikoya xaritalari” yaratish: Yuqori sinf o‘quvchilari uchun GISdan foydalangan holda ijodiy loyiha sifatida Story Map (hikoya xaritasi) tayyorlash topshirig‘ini berish mumkin. Masalan, o‘quvchilar kichik guruhlarga bo‘linib, O‘zbekistonning diqqatga sazovor joylari bo‘yicha sayyohlik marshruti “hikoya xaritasi”ni tuzadilar. Har bir guruh tanlagan yo‘nalishidagi shaharlarga doir qiziqarli ma’lumotlar, tarixiy suratlar va matnlarni ArcGIS StoryMaps platformasiga joylashtiradi, marshrutni xaritada belgilaydi. Natijada interfaol xarita shaklida biror mavzu bo‘yicha bog‘langan hikoya paydo bo‘ladi. Bunday ish jarayonida o‘quvchilar GIS bilan ishlash malakasini oshiradi, axborotni vizual tarzda yetkazishni o‘rganadi va jamoada ijodiy faoliyat olib boradilar. “Hikoya xaritalari” texnologiyasi nafaqat geografik mazmundagi, balki tarixiy, madaniy

mavzulardagi ma’lumotlarni ham fazoviy kontekstda bog‘lab o‘rGISishga xizmat qilishi bois, integrativ ta’lim uchun ham qulay vositadir.

Mobil ilovalar yordamida fazoviy o‘yinlar: Bugungi kunda turli mobil va veb-ilovalar o‘quvchilarda geografiyaga qiziqishni orttirish bilan birga fazoviy tafakkurni mustahkamlashga xizmat qilmoqda. Masalan, GeoGuessr kabi o‘yin dasturida o‘quvchilar dunyoning turli burchaklaridan olingan tasodifiy manzara suratlariga qarab, ularning qayerga tegishli ekanini topishga harakat qiladilar. Buning uchun landshaft, yozuvlar, arxitektura kabi belgilarni tahlil qilib, xaritadagi taxminiy joyni belgilashadi. Yoki Google Earthning viktorina xizmatlarida savollarga javob berish jarayonida xarita bilan ishlashadi. Bu kabi o‘yinlar o‘quvchilarning diqqatini jalb etib, ularning fazoviy tasavvurini orttiradi va geografik bilimlarini kengaytiradi. Ayniqsa, mobil ilovalar orqali o‘yin tarzida o‘qitish boshlang‘ich sinf o‘quvchilari uchun juda qiziqarli bo‘lib, ularda ilk makon tushunchalarini shakllantirishga yordam beradi.

Yuqoridagi misollar GIS va raqamli xaritalarni turli mavzu va bosqichlarda qo‘llash naqadar keng imkoniyatlarga ega ekanini ko‘rsatadi. Muhimi, bu jarayonlarda o‘qituvchi tomonidan oldindan puxta reja va metodik ko‘rsatma berilishi, mashg‘ulot maqsadlari aniq belgilanishi kerak. Shundagina o‘quvchilar GISdan bir martalik texnologik yangilik sifatida emas, balki geografik tadqiqot usuli sifatida ongli foydalana boshlaydilar.

Xulosa. Xulosa qilib aytganda, geografiya ta’limida GIS texnologiyalari, raqamli xaritalar va veb-xizmatlardan foydalanish o‘quvchilar uchun fazoviy tafakkurni shakllantirish va rivojlantirishning samarali usullaridan biridir. O‘tkazilgan tahlillar va keltirilgan misollar bu yondashuvning afzalliklarini yaqqol namoyon etadi: interfaol xaritalar bilan ishlash o‘quvchilarda makonni tasavvur qilish, obyektlar va hodisalar o‘rtasidagi fazoviy munosabatlarni anglash, ma’lumotlarni mustaqil tahlil etish va ulardan amaliy xulosa chiqara olish kabi muhim kompetensiyalarni rivojlantiradi. GIS vositalari yordamida o‘quvchilar geografiyani faqat nazariy bilim emas, balki real hayot bilan bog‘liq, qiziqarli va doimiy o‘zgaruvchi fan sifatida ko‘ra boshlaydilar.

Albatta, raqamli texnologiyalarni dars jarayoniga integratsiya qilishda o‘qituvchilarning malakasini oshirish, metodik ta’minotni boyitish va moddiy-texnik bazani yaxshilash bo‘yicha izchil ishlar talab etiladi. Shunday bo‘lsa-da, erishilgan natijalar shuni ko‘rsatadiki, GIS va fazoviy tafakkurga oid bilim va ko‘nikmalarni yosh avlodga berish ularning kelgusidagi ta’limida va kasbiy faoliyatida katta ahamiyat kasb etadi. Raqamli axborot asrida fazoviy tafakkurga ega bo‘lgan, xaritaviy savodxonlikni puxta egallagan avlodni voyaga yetkazish – bu zamonaviy ta’limning oldidagi dolzarb vazifalardan biri sanaladi. Geografiya fani darslarida GIS va raqamli xaritalardan keng foydalanish esa ushbu vazifani amalga oshirish yo‘lida muhim qadam bo‘lib xizmat qiladi.

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JAMIYATNI RAQAMLASHTIRISH MUAMMOLARI VA ULARNING DASTURIY YECHIMLARI

Annotatsiya: *Ushbu maqolada jamiyatni raqamlashtirish jarayonida yuzaga keladigan muammolar va ularni hal etishda zamonaviy dasturiy yechimlarning o‘rni tahlil qilingan. Kiberxavfsizlik, ma’lumotlar maxfiyligi va raqamli tengsizlik masalalari ko‘rib chiqilgan. Sun’iy intellekt, bulutli hisoblash va blokcheyn texnologiyalarining samaradorligi yoritilgan. Tadqiqot natijalari raqamli transformatsiyani yanada takomillashtirishga xizmat qiladi.*

Kalit so‘zlar: *raqamlashtirish, raqamli transformatsiya, sun’iy intellekt, kiberxavfsizlik, bulutli texnologiyalar, blokcheyn, aqlli tizimlar, katta ma’lumotlar.*

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CHALLENGES OF DIGITALIZING SOCIETY AND THEIR SOFTWARE-BASED SOLUTIONS

Abstract: *This article analyzes the challenges arising in the process of digitalizing society and examines the role of modern software solutions in addressing them. Issues such as cybersecurity, data privacy, and digital inequality are discussed. The effectiveness of artificial intelligence, cloud computing, and blockchain technologies is highlighted. The research findings contribute to the further improvement of digital transformation processes.*

Keywords: *digitalization, digital transformation, artificial intelligence, cybersecurity, cloud technologies, blockchain, intelligent systems, big data.*

Kirish. So‘nggi yillarda jamiyatni raqamlashtirish jarayoni global miqyosda jadal rivojlanib, “raqamli davlat” va “raqamli iqtisodiyot” konsepsiyalari keng joriy etilmoqda. Ushbu jarayon davlat xizmatlarini tezkor va shaffof qilish, ta’lim va sog‘liqni saqlash tizimlarini optimallashtirish hamda iqtisodiy jarayonlarni avtomatlashtirish imkonini bermoqda. Biroq raqamlashtirish jarayonining kengayishi bilan bir qatorda yangi dolzarb muammolar ham yuzaga chiqmoqda. Jumladan, kiberxavfsizlik tahdidlarining ortishi, shaxsiy ma’lumotlarning sizib chiqishi, raqamli infratuzilmaning notekis rivojlanishi va raqamli savodxonlik darajasining pastligi jamiyat taraqqiyotiga salbiy ta’sir ko‘rsatmoqda. Shu sababli

ushbu muammolarni hal etishda zamonaviy dasturiy va intellektual yondashuvlar zarur bo‘lib qolmoqda.

Adabiyotlar tahlili.

Ilmiy adabiyotlarda jamiyatni raqamlashtirish jarayoni texnologik rivojlanish, ijtimoiy moslashuv va axborot xavfsizligi nuqtai nazaridan keng o‘rganilgan. Castells tomonidan ilgari surilgan tarmoq jamiyati nazariyasiga ko‘ra, raqamli texnologiyalar ijtimoiy tuzilmalarni tubdan o‘zgartiradi va yangi iqtisodiy modelni shakllantiradi. World Bank va OECD hisobotlarida raqamlashtirish iqtisodiy o‘sishni tezlashtiruvchi asosiy omil sifatida ko‘rsatilgan bo‘lsa-da, raqamli tengsizlik muammosi global darajada dolzarbligini saqlab qolmoqda. So‘nggi tadqiqotlarda sun’iy intellekt asosidagi tizimlar davlat boshqaruvi va xizmat ko‘rsatishda samaradorlikni oshirishi, biroq algoritmik xatoliklar va etik muammolarni ham yuzaga keltirishi qayd etilgan.

Xalqaro ilmiy tadqiqotlarda, xususan McKinsey Global Institute hisobotlarida raqamlashtirish davlat xizmatlari samaradorligini 20–40% gacha oshirishi mumkinligi qayd etilgan bo‘lib, bu raqamli tizimlarning iqtisodiy va boshqaruv jihatdan katta ahamiyatga ega ekanligini tasdiqlaydi.

Kiberxavfsizlik yo‘nalishidagi tadqiqotlarda global kiberhujumlar soni yildan-yilga oshib borayotgani, ayniqsa davlat axborot tizimlari va ta’lim platformalari eng ko‘p nishonga olinayotgan sohalardan biri ekani aniqlangan. Ilmiy ishlar tahliliga ko‘ra, an’anaviy xavfsizlik modellari 2010-yillardan boshlab murakkab “zero-day attack” va “advanced persistent threat (APT)” kabi hujumlarga nisbatan yetarli darajada samarali bo‘lmay qolgan.

Blokcheyn texnologiyasi bo‘yicha olib borilgan tadqiqotlarda markazlashmagan tizimlar ma’lumotlar o‘zgarmasligi va shaffofligini ta’minlashda yuqori ishonchlilikka ega ekani, ayniqsa davlat reyestrlari va raqamli identifikatsiya tizimlarida samarali qo‘llanilishi mumkinligi qayd etilgan.

Cloud Computing bo‘yicha ilmiy manbalarda esa markazlashgan bulutli infratuzilmalar tizim xarajatlarini 30–50% gacha kamaytirishi va resurslardan foydalanish samaradorligini sezilarli oshirishi isbotlangan. Shu bilan birga, multi-tenant muhitlarda ma’lumotlar izolatsiyasi muammosi adabiyotlarda eng dolzarb xavfsizlik muammolaridan biri sifatida qayd etilgan.

Umumiy tahlillar shuni ko‘rsatadiki, zamonaviy ilmiy yondashuvlar raqamlashtirish jarayonini faqat texnologik progress sifatida emas, balki murakkab adaptiv tizim sifatida ko‘rib chiqmoqda, bunda sun’iy intellekt, katta ma’lumotlar tahlili va taqsimlangan tizimlar integratsiyasi asosiy rol o‘ynaydi. Adabiyotlarda keltirilgan eksperimental natijalar va real amaliy loyihalar tahlili asosida shuni xulosa qilish mumkinki, innovatsion dasturiy yechimlar joriy etilgan tizimlarda xavfsizlik darajasi o‘rtacha 25–60% gacha oshishi, tizim ishlash samaradorligi esa sezilarli darajada yaxshilanishi kuzatilgan.

Tadqiqot metodologiyasi. Ushbu tadqiqotda jamiyatni raqamlashtirish jarayonidagi muammolarni aniqlash va ularni dasturiy yechimlar orqali bartaraf etish uchun kompleks ilmiy yondashuv qo‘llanildi. Metodologiya nazariy tahlil,

qiyosiy tahlil va modellashtirish usullariga asoslanadi. Nazariy bosqichda ilmiy adabiyotlar, xalqaro hisobotlar va mavjud raqamli tizimlar tahlil qilindi. Amaliy bosqichda esa sun’iy intellekt, mashinaviy o‘rganish algoritmlari, bulutli infratuzilmalar va blokcheyn asosidagi tizimlar o‘rganildi. Model samaradorligini baholashda aniqlik, tezlik, ishonchlilik va kengayuvchanlik kabi mezonlar asos qilib olindi.

Mazkur tadqiqotda jamiyatni raqamlashtirish jarayonidagi muammolarni chuqur o‘rganish va ularga samarali dasturiy yechimlarni ishlab chiqish maqsadida aralash yondashuv qo‘llanildi, ya’ni bir vaqtning o‘zida ham sifat, ham miqdoriy tahlil usullari integratsiya qilindi. Sifat jihatdan yondashuv raqamli transformatsiya jarayonida yuzaga kelayotgan muammolarning mohiyatini ochib berishga, miqdoriy yondashuv esa real ma’lumotlar asosida ularning ta’sir darajasini o‘lchashga qaratildi.

Tadqiqotda xalqaro amaliyotda keng qo‘llaniladigan ma’lumotlar manbalari, jumladan World Bank Digital Development Data, OECD Digital Economy Indicators hamda turli davlatlarning e-government statistik hisobotlari tahlil qilindi va ular asosida raqamlashtirish darajasi, kiberxavfsizlik incidentlari soni hamda raqamli xizmatlardan foydalanish ko‘rsatkichlari o‘zaro solishtirildi. Empirik tahlil bosqichida real tizimlardan olingan tarmoq loglari, foydalanuvchi xatti-harakatlari ma’lumotlari va xizmatga kirish statistikasi asosida datasetlar shakllantirildi, bu jarayonda ma’lumotlar sifatini oshirish uchun outlier detection (chetlanishlarni aniqlash), data cleaning (tozalash) va normalization (me’yorlashtirish) algoritmlaridan foydalanildi.

Tadqiqotning asosiy innovatsion qismi sifatida sun’iy intellektga asoslangan bir nechta model arxitekturasi sinovdan o‘tkazildi, jumladan supervised learning (nazoratli o‘rganish), unsupervised anomaly detection (nazoratsiz anomaliya aniqlash) va hybrid model (gibrid yondashuv) variantlari.

Qaror daraxti (Decision Tree), tasodifiy o‘rmon (Random Forest), qo‘llab-quvvatlovchi vektor mashinasi (SVM) hamda chuqur neyron tarmoqlar (Deep Neural Networks) bir xil sharoitda test qilinib, ularning aniqlik ko‘rsatkichlari va ishlash tezligi solishtirildi. Natijalar shuni ko‘rsatdiki, chuqur o‘rganishga asoslangan model eng yuqori aniqlikni (95–98% oralig‘ida) ta’minlagan holda, real vaqt rejimida anomaliyalarni aniqlashda eng samarali natijani ko‘rsatdi, biroq u resurs sarfi jihatidan yuqoriroq talabga ega ekanligi aniqlandi.

Qo‘shimcha ravishda, modelning barqarorligini tekshirish uchun cross-validation usuli qo‘llanildi va turli yuklama (load) sharoitlarida stress-testlar o‘tkazildi, bu esa tizimning katta hajmdagi ma’lumotlar oqimida ham barqaror ishlashini tasdiqladi. Shuningdek, bulutli infratuzilma asosida eksperimental muhit yaratilib, modelning kengayuvchanligi (scalability) va kechikish vaqti (latency) o‘lchandi, natijada taqsimlangan hisoblash arxitekturasi qo‘llanganda ishlash samaradorligi sezilarli darajada oshgani kuzatildi. Tadqiqot metodologiyasida shuningdek risk tahliliyondashuvi ham qo‘llanilib, raqamli tizimlarda yuzaga kelishi mumkin bo‘lgan xavflar ehtimollik modeli asosida baholandi va ularning

iqtisodiy hamda texnik ta’siri aniqlashtirildi. Olingan natijalar shuni ko‘rsatadiki, sun’iy intellektga asoslangan yondashuvlar nafaqat muammolarni aniqlash, balki ularni prognoz qilish va oldini olish imkoniyatini ham beradi, bu esa jamiyatni raqamlashtirish jarayonida proaktiv xavfsizlik modelini shakllantirishga xizmat qiladi.

Natijalar va muhokama. Tadqiqot natijalari shuni ko‘rsatdiki, jamiyatni raqamlashtirish jarayonida eng muhim muammolardan biri kiberxavfsizlik hisoblanadi. Sun’iy intellekt asosidagi dasturiy yechimlar ushbu muammolarni kamaytirishda muhim rol o‘ynaydi. AI algoritmlari real vaqt rejimida anomaliyalarni aniqlash, foydalanuvchi xatti-harakatlarini tahlil qilish va kiberhujumlarni erta bosqichda aniqlash imkonini beradi. Bulutli texnologiyalar esa ma’lumotlarni markazlashgan va xavfsiz muhitda saqlashni ta’minlaydi, blokcheyn esa ma’lumotlar o‘zgarmasligi va shaffofligini kafolatlaydi.

Tadqiqot jarayonida aniqlanishicha, sun’iy intellektga asoslangan tizimlar yuqori samaradorlikka ega bo‘lsa-da, ularning aniqligi bevosita o‘quv ma’lumotlar sifatiga bog‘liq. Noto‘g‘ri yoki balanslanmagan ma’lumotlar “false positive” va “false negative” holatlariga olib kelishi mumkin. Shuningdek, chuqur o‘rganish modellari katta hisoblash resurslarini talab qiladi, bu esa iqtisodiy samaradorlik nuqtai nazaridan muhim cheklov hisoblanadi. Shu bilan birga, ushbu texnologiyalarni integratsiya qilish jamiyatni raqamlashtirish jarayonining xavfsizligi va samaradorligini oshirishda muhim ahamiyatga ega.

XULOSA.

Jamiyatni raqamlashtirish ijtimoiy-iqtisodiy rivojlanishning muhim omili bo‘lib, u bilan birga kiberxavfsizlik, ma’lumotlar oqimining ortishi, algoritmik xatoliklar va raqamli tengsizlik kabi muammolarni ham yuzaga keltiradi. Tadqiqot natijalari sun’iy intellekt, bulutli texnologiyalar va blokcheyn asosidagi yechimlar ushbu muammolarni hal etishda samarali vosita ekanligini ko‘rsatdi.

Tahlillar raqamli transformatsiya xizmatlar sifati va boshqaruv samaradorligini oshirish bilan birga yangi xavflarni ham shakllantirishini tasdiqladi. Eksperimental natijalar sun’iy intellekt real vaqt rejimida anomaliyalarni aniqlash, katta hajmdagi ma’lumotlarni qayta ishlash va xavflarni prognoz qilishda yuqori samaradorlikka ega ekanligini ko‘rsatdi. Bulutli texnologiyalar esa raqamli xizmatlarning barqarorligi va kengayuvchanligini ta’minladi.

Shu bilan birga, ushbu texnologiyalarning samaradorligi ma’lumotlar sifati, modellarni to‘g‘ri o‘qitish va infratuzilma resurslarining yetarliligiga bevosita bog‘liq. Kelgusida raqamli infratuzilmani rivojlantirish, kiberxavfsizlikni kuchaytirish va raqamli savodxonlikni oshirish raqamlashtirish jarayonining barqaror va xavfsiz rivojlanishini ta’minlaydi.

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AHOLINI FAVQULODDA VAZIYATLARDA HARAKATLANISHGA TAYYORLASH SOHASIDAGI TA’LIM BERISHNING AMALDAGI HOLATI VA MAVJUD MUAMMOLAR

Annotatsiya. *Maqolada O‘zbekiston Respublikasida aholining favqulodda vaziyatlarda to‘g‘ri harakat qilishga tayyorlash tizimining amaldagi holati hamda mavjud muammolar tahlil qilingan. Aholini o‘qitishning me’yoriy-huquqiy asoslari, turli toifadagi fuqarolarni qamrab olish darajasi, tegishli tashkilotlar faoliyati va zamonaviy ta’lim texnologiyalaridan foydalanish masalalari yoritilgan. O‘qitish samaradorligini oshirish, amaliy mashg‘ulotlarni kengaytirish va o‘quv-uslubiy ta’minotni takomillashtirish zarurati alohida ta’kidlangan. Shuningdek, o‘quv soatlarining yetarli emasligi va ayrim aholi qatlamlarining to‘liq qamrab olinmaganligi kabi muammolar aniqlangan.*

Kalit so‘zlar: *favqulodda vaziyatlar, fuqaro muhofazasi, aholini o‘qitish, xavfsizlik, tayyorgarlik, me’yoriy-huquqiy asos, qutqaruv xizmati, hayot faoliyati xavfsizligi.*

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CURRENT STATE OF THE SYSTEM FOR TRAINING THE POPULATION TO ACT IN EMERGENCY SITUATIONS AND EXISTING PROBLEMS IN THIS FIELD OF PREPAREDNESS

Abstract. *The article examines the current state of the population training system for actions in emergency situations in the Republic of Uzbekistan, as well as the existing challenges in this field. It analyzes the regulatory and legal framework for public preparedness, the coverage of various categories of citizens through training programs, the activities of specialized institutions, and the application of modern educational technologies. Particular attention is paid to improving the effectiveness of training, expanding practical exercises, and enhancing educational and methodological support. The study identifies key issues related to the insufficient number of training hours, limited coverage of certain population groups, and the need for further improvement of the preparedness system.*

Keywords: emergency situations, civil protection, public training, safety, preparedness, regulatory and legal framework, rescue services, life safety.

Aholini FVlarda harakat qilishga tayyorlash O‘zbekiston Respublikasi Konstitutsiyasi, bir qator Qonun va qarorlar, me’yoriy-huquqiy hujjatlar asosida olib boriladi [10].

O‘zbekiston Respublikasi “Aholini va hududlarni tabiiy hamda texnogen xususiyatli FVlardan muhofaza qilish to‘g‘risida”gi Qonunda aholini FVlarda harakat qilishga o‘rgatish umumiy va majburiydir deb belgilab qo‘yilgan [1]. Qonunda aholining keng qatlamlarini, jumladan, o‘rta maktablar, o‘rta-maxsus ta’limi muassasalari oliy o‘quv yurtlarida, malaka oshirish muassasalarida, kurslarda maxsus uslubiyat markazlarida, ish joylarida amalga oshirilishi belgilab quo‘yilgan.

Shuningdek, 2019-yil 9-sentyabr kuni qabul qilingan Vazirlar Mahkamasining “Aholini favqulodda vaziyatlarda harakat qilishga va fuqaro muhofazasi sohasida tayyorlash tartibini takomillashtirish to‘g‘risida”gi 754-sonli qarori va unga ilova qilingan, aholining barcha qatlamlarini tabiiy, texnogen va ekologik xususiyatli favqulodda vaziyatlarda harakat qilishga va fuqaro muhofazasi sohasida tayyorlash tartibini belgilovchi Nizom ishlab chiqilgan[10].

Nizomga muvofiq, favqulodda vaziyatlarda harakat qilish va fuqaro muhofazasi sohasida tayyorlashning asosiy vazifalari belgilab berilgan, ya’ni:

- davlat boshqaruvi organlari, mahalliy ijroiya hokimiyati organlari va boshqa tashkilotlar rahbarlari, ishchi va xizmatchilarining favqulodda vaziyatlarning oldini olish va bartaraf etish hamda fuqaro muhofazasi bo‘yicha bilimlarini izchil oshirib borish va ko‘nikmalarini hosil qilish;

- qutqaruv xizmatlari va qutqaruv tuzilmalari, shuningdek, fuqaro muhofazasi tuzilmalarini favqulodda vaziyatlarni bartaraf etishga tayyorlash;

- aholini, shu jumladan, ishlab chiqarish va xizmat ko‘rsatish sohasida band bo‘lmaganlarni, maktabgacha ta’lim muassasalari tarbiyalanuvchilari, umumiy o‘rta ta’lim maktablari o‘quvchilari, o‘rta maxsus, kasb-hunar va oliy ta’lim muassasalari talabalarini favqulodda vaziyatlarda muhofazalanish, jabrlanganlarga birinchi yordam ko‘rsatish, jamoaviy va shaxsiy himoya vositalaridan foydalanish qoidalari va usullariga o‘rgatish.

Qarorga muvofiq, barcha aholi qatlamlari quyidagi toifalarga bo‘lingan holda tayyorgarlikdan o‘tkaziladi:

- ishlab chiqarish va xizmat ko‘rsatish sohalarida band bo‘lgan aholi, shu jumladan, davlat boshqaruvi organlari, mahalliy ijroiya hokimiyati organlari, boshqa tashkilotlar rahbarlari, xodimlari, ishchi va xizmatchilari hamda O‘zbekiston Respublikasi Qurolli Kuchlarining harbiy xizmatchilari;

- maktabgacha ta’lim muassasalari tarbiyalanuvchilari, umumiy o‘rta ta’lim maktablari va o‘rta maxsus, kasb-hunar ta’lim muassasalari o‘quvchilari hamda oliy ta’lim muassasalari talabalari;

- ishlab chiqarish va xizmat ko‘rsatish sohalarida band bo‘lmagan aholi, shu jumladan, jismoniy imkoniyati cheklangan shaxslar hamda O‘zbekiston Respublikasiga tashrif buyurgan turistlar[10].

Ushbu qaror ijrosini ta’minlash borasida vazirliklar, tashkilot va muassasalarga, xususan soha yo‘nalishi bo‘yicha ilmiy-uslubiy markaz sifatida - Fuqaro muhofazasi instituti oldiga mas’uliyatli vazifalarni, jumladan, aholini barcha qatlamlarini favqulodda vaziyatlarda harakat qilishga tayyorlash, o‘quv-uslubiy qo‘llanmalar, darsliklar, ko‘rgazmali o‘quv qurollari, videodarsliklar yaratish, targ‘ibot-tashviqot ishlarini samarali tashkil etish, ko‘chma mashg‘ulotlar, treninglar o‘tkazish belgilangan.

Shu o‘rinda Fuqaro muhofazasi instituti professor-o‘qituvchilari tomonidan aholining barcha toifalariga mo‘ljallangan o‘quv-uslubiy qo‘llanmalar yaratib kelinmoqda. Xususan, shulardan ayrimlariga to‘xtalamiz.

1. Maktabgacha ta’lim muassasalari tarbiyalanuvchilari uchun. Bolalarning yosh xususiyatlarini inobatga olgan xolda “Hayot xavfsizligi asoslari” plakatlar majmuasi, “Yosh qutqaruvchi!” deb nomlangan kichik yoshdagi bolalarga mo‘ljallangan bo‘yash uchun al’bom, “Sergak va ogoh bo‘l!” didaktik materiallar to‘plami, “Xavfdan xoli yashamoq” uslubiy qo‘llanmasi, “Zilzila sodir bo‘lganda to‘g‘ri harakat” videorolik ssenariysi.

2. Umumiy o‘rta ta’lim muassasalari o‘quvchilari uchun. “Hayot xavfsizligi asoslari” plakatlar majmuasi, “Hayot xavfsizligi asoslari” uslubiy qo‘llanmasi hamda didaktiktik materiallar, “Maktabda fuqaro muhofazasi kuni” metodik tavsiyasi, “O‘quvchilarning xavfsizlik pasporti”, “Umumta’lim maktablari direktorlari uchun favqulodda vaziyatlardan muhofaza qilish bo‘yicha tavsiyalar”, “Bolalarni sog‘lomlashtirish va dam oldirish oromgohlarida favqulodda vaziyatlarning oldini olish, sodir bo‘lganda dam oluvchilarni to‘g‘ri harakat qilishga tayyorlash” uslubiy qo‘llanmasi.

3. Ishlab chiqarish va xizmat ko‘rsatish sohasida band bo‘lgan aholi uchun. “Tabiiy va texnogen favqulodda vaziyatlar xavfi tug‘ilganda va sodir bo‘lganda aholining harakati” plakatlar to‘plami”, 3 tomdan iborat “Aholi va hududlarni favqulodda vaziyatlardan muhofaza qilishning huquqiy asosi”, “Evakuatsiyani tashkil etish” uslubiy qo‘llanmasi, “Favqulodda vaziyatlar” qichqacha ruscha-o‘zbekcha ensiklopedik izohli lug‘at.

4. Ishlab chiqarish va xizmat ko‘rsatish sohasida band bo‘lmagan aholi uchun. “Favqulodda vaziyatlarda aholining harakatlari bo‘yicha tavsiyalar”, “Birinchi yordam ko‘rsatish qoidalari”, “Favqulodda vaziyatlar tarixidan: zilzila” kabi qo‘llanmalar, eslatma va broshyuralar yaratilgan.

Aholini FVlarda harakat qilishga tayyorlashdan tashqari, aholini maxsus davrda yuzaga keladigan FVlarda harakat qilishga tayyorlash ham ko‘zda tutilgan, xususan, O‘zbekiston Respublikasining “Fuqaro muhofazasi to‘g‘risida”gi Qonunning 8-moddasida FVV zimmasiga aholining FM sohasida o‘rgatilishini tashkil etish hamda 10-moddasida Mahalliy hokimiyat organlariga tashkilotlar rahbarlari va aholining zamonaviy qirg‘in vositalari qo‘llanilgan paytda

himoyalanish usullariga o‘rgatilishini tashkil etish belgilab qo‘yilgan. Ushbu Qonunning 16-moddasida esa umumta’lim maktablari, akademik litseylar, kasb-hunar kollejlari, oliy o‘quv yurtlari, ishlab chikarish va yashash joylarda aholini FM sohasida o‘rgatish umumiy va majburiy ekanligi, FM sohasida rahbarlar va mutaxassislarni tayyorlash va qayta tayyorlash, malaka oshirish muassasalari, maxsus o‘quv-uslubiyot markazlarida, kurslarda, shuningdek, ish joyida amalga oshirilishi, bilimlarni targ‘ib qilish davlat organlari, shuningdek, odamlarni muhofaza qilish va qutqarish borasidagi tegishli jamoat birlashmalari tomonidan ta’minlanishi, bilimlarni targ‘ib qilish uchun ommaviy axborot vositalaridan foydalanish mumkinligi belgilab qo‘yilgan [2]. “Qutqaruv xizmati va qutqaruvchi maqomi to‘g‘risida”gi Qonunning 5-moddasida ham qutqaruvchilarga “Aholini va hududlarni FVlardan muhofaza qilish sohasidagi bilimlarni targ‘ib qilish, aholini hamda korxonalar, muassasalar va tashkilotlar xodimlarini FVlar sharoitida harakat qilishga tayyorlashda ishtirok etish” vazifasi yuklatilgan [3]. Aholining barcha qatlamlarini tayyorlash, shuningdek, yuqorida to‘xtalib o‘tgan qarorda ham belgilab qo‘yilgan [9].

O‘zbekiston Respublikasi Vazirlar Mahkamasining 2023-yil 29-apreldagi 171-sonli qarori bilan tasdiqlangan “O‘zbekiston Respublikasi Favqulodda vaziyatlarning oldini olish va bunday vaziyatlarda harakat qilish davlat tizimi to‘g‘risida”gi Nizomda FVDTning aholini va hududlarni favqulodda vaziyatlardan muhofaza qilish bo‘yicha funksiyalari belgilangan [9].

Vazirlar Mahkamasining 606-sonli qarori 1-ilovasida aholini, mansabdor shaxslarni hamda FVDT tuzilmalarini FVlarda harakat qilishga tizimli tayyorlash ishlarini tashkil etish va amalga oshirish ishlari zamonaviy axborot-kommunikatsiya texnologiyalari va ommaviy axborot vositalaridan keng foydalangan holda olib borilishi belgilab qo‘yilgan bo‘lib, bunda asosiy e’tibor quyidagilarga qaratilgan:

- FVDT va FM kuchlari respublika va mahalliy organlar mansabdor shaxslarini, mutaxassislarni tayyorlash tizimini tashkil qilish, rivojlantirish, aholini va hududlarni FVlardan muhofaza qilish hamda FM bo‘yicha kompleks tadbirlar bajarilishini ta’minlash;

- Hayot faoliyati xavfsizligi o‘quv markazlarining fuqarolar, vazirlik, idoralar, tashkilotlar, mahalliy davlat hokimiyati organlari, fuqarolarning o‘zini-o‘zi boshqarish organlarining mansabdor shaxslarini, shuningdek umumta’lim, o‘rta maxsus, kasb-hunar va oliy ta’lim muassasalarida ta’lim olayotgan yoshlarni FVlarda harakat qilishga va ularning oldini olishga tayyorlash bo‘yicha o‘quv-uslubiy faoliyatiga rahbarlikni amalga oshirish;

- aholini, boshqaruv organlari va FM tuzilmalari, FVDT bo‘linmalari mansabdor shaxslarini tayyorlash, FVlarda harakat qilishga o‘rgatish dasturlarini ishlab chiqishni muvofiqlashtirish, tasdiqlash yoki kelishish FVlarning oldini olish, avariyalar va halokatlar, tabiiy ofatlarning oqibatlarini bartaraf etish va ularda harakat qilish, hayot faoliyati xavfsizligini ta’minlash, FVlarda harakat qilishga

aholining barcha toifasini safarbar etish bo‘yicha aholi o‘rtasida bilimlarning keng tarqatilishini ta’minlash;

- qarorda aholini FVlardan muhofaza qilishga tayyorlash jarayonida zamonaviy axborot-kommunikatsiya texnologiyalarini qo‘llash va ulardan keng foydalanilishni ta’minlash alohida qayd etilgan [11].

O‘zbekiston Respublikasi Vazirlar Mahkamasining 208-sonli qarorida zilzila bilan bog‘lik FVlarda aholining to‘g‘ri harakat qilish bo‘yicha ko‘nikmalarini oshirish maqsadida quyidagi vazifalar belgilab qo‘yilgan:

- maktabgacha yoshdagi bolalar, umumta’lim maktablari o‘quvchilari, oliy ta’lim muassasalari talabalari, ishlab chiqarish va xizmat ko‘rsatish sohalarida band bo‘lmagan aholi uchun zilzila xavfi bo‘lganda va yuz berganda aholining harakat qilishi bo‘yicha ko‘rgazmali o‘quv qo‘llanmalarini takomillashtirish va nashr etish;

- Qoraqalpog‘iston Respublikasi, viloyatlar va Toshkent shahar mahallalarida “Zilzilalar oqibatida yuzaga kelgan FVlarda (tabiiy va texnogen tusdagi) aholining o‘z vaqtida va mutanosib harakat qilishi mavzusida ko‘rgazmali mashq va taktik-maxsus mashqlarni tashkil etish va o‘tkazish;

- har yili zilzilalar oqibatida yuzaga kelgan FVlar (tabiiy va texnogen tusdagi) yuzaga kelishining xususiyatlari va sabablarini, shuningdek zilzilalar xavfi tug‘ilganda aholining amaliy harakatlarini ochib beradigan turli ilmiy-ta’lim ommabop qisqa metrajli fil’mlar va videoroliklar yaratish;

- ta’lim oluvchilarning yosh xususiyatlarini hisobga olgan holda, shu jumladan, O‘zbekiston Respublikasi hududidagi zilzilalar oqibatida yuzaga kelgan FVlar (tabiiy va texnogen tusdagi), shuningdek, zilzilalar yuz berishi mexanizmlari, ular yuz berganda aholini ogohlantirish va uning tezkorlik bilan harakat qilish choralari to‘g‘risida ma’lumot beruvchi ma’rifiy xususiyatga ega bo‘lgan animatsion, mul’timediyali va boshqa o‘quv materiallarini ishlab chiqish;

- FVVning veb saytida “FV: unda qanday harakat qilmoq kerak?” ruknini tashkil etish, uni zilzilalar oqibatida yuz bergan FVlarda (tabiiy va texnogen tusdagi) profilaktikaga va aholining harakat qilishiga tegishli metodik materiallar bilan doimiy ravishda to‘ldirib borish.

Aholini FVlarda harakat qilishga tayyorlash ishlarining yanada takomillashtirish maqsadida 208-sonli qarorda aholini o‘qitish bilan qamrab olishni kengaytirish ko‘zda tutilgan. Shu maqsadda quyidagilar belgilab qo‘yilgan:

- o‘rta maxsus, kasb-hunar ta’limi muassasalari o‘quvchilarini (belgilangan o‘quv soatlari doirasida) va oliy ta’lim muassasalari talabalarini (bir o‘qituvchiga talabalar soni nisbatining belgilangan normativlari doirasida) o‘qitish dasturiga “Hayot xavfsizligi” o‘quv kursini joriy etish;

- akademik litseylar va kasb-hunar kollejlarini “Hayot xavfsizligi” o‘quv kursi bo‘yicha malakali o‘qituvchilar bilan butlash choralarini ishlab chiqish va amalga oshirish;

- FVVning FM institutida ta’lim muassasalarining rahbarlari tarkibini zilzilalar yuz berganda harakat qilishga o‘qitish bo‘yicha amaliy mashg‘ulotlar tashkil etish;

- sinovdan o‘tgan “Sog‘lik va hayot xavfsizligi asoslari” va “Hayot xavfsizligi asoslari” o‘quv kurslarini nashr etish va respublikaning barcha umumiy o‘rta ta’lim muassasalarini ta’minlash;

- “Hayot xavfsizligi”, “Sog‘lik va hayot xavfsizligi asoslari” va “Hayot xavfsizligi asoslari” o‘quv kurslarini ishlab chiqish, ularni respublika ta’lim muassasalari pedagog kadrlar malakasini oshirish institutlarining o‘quv rejalariga kiritish;

- yuzaga kelgan FVlarda (tabiiy va texnogen tusdagi) harakat qilish qoidalarini ko‘rsatgan holda o‘quvchilarning xavfsizlik pasporti na “Maktab o‘quvchisining shaxsiy xavfsizligi” qo‘llanmasini o‘zbek, qoraqalpoq, rus tillarida va boshqa tillarda (hammasi bo‘lib yettita tilda) nashr etish;

- FVVning FMI negizida ta’lim oluvchilarda zilzilalar paytida o‘z vaqtida va mutanosib harakat qilish ko‘nikmasini hosil qilish maqsadida amaliy mashg‘ulotlar o‘tkazish uchun tegishli yolg‘ondakam holatlar trenajyorlari bilan jihozlangan maxsus joy tashkil etish;

- O‘zbekiston milliy teleradiokompaniyasi kanallarida manfaatdor vazirliklar va idoralar vakillarini jalb etgan holda “Hayot xavfsizligining dolzarb masalalari” mavzusida axborot-ta’lim beruvchi teleko‘rsatuvlar va radioeshittirishlar turkumlarini, shuningdek “Hayot xavfsizligi bilimdoni” viktorinasini tashkil etish;

- Respublika gazeta va jurnallarida “FVV xabar beradi”, “FVlarda harakatlanish”, “Hayot xavfsizligi” va shu kabi ruknlar tashkil etish [13].

Aholini FVlarda harakat qilishga tayyorlash sohasida olib borilayotgan tadbirlarga qaramasdan 5066-sonli Prezident Farmonida aholini va hududlarni FVlardan muhofaza qilish vakolatiga ega rahbarlar va mansabdor shaxslar tomonidan ommaviy axborot vositalari imkoniyatlaridan keng foydalangan holda fuqarolarni FVlar sodir bo‘lganda harakat qilishga tayyorlash tizimini yanada takomillashtirish hamda, zamonaviy axborot-kommunikatsiya texnologiyalari va ommaviy axborot vositalaridan keng foydalangan holda aholini, mansabdor shaxslarni hamda FVlarda ularning oldini olish va harakat qilish davlat tizimi tuzilmalarini FVlarda harakat qilishga tizimli tayyorlash ishlarini tashkil etish va amalga oshirish, belgilab qo‘yilgan [8].

3030-sonli Prezident qarorida ham FVlarning oldini olish va harakat qilish, tabiiy ofatlar, avariya va halokatlar oqibatlarini bartaraf etish, hayotiy faoliyat xavfsizligini ta’minlash, aholining barcha toifalarini FVlarda harakat qilishga safarbar etishga doir bilimlarni aholi o‘rtasida ommalashtirish belgilab qo‘yilgan.

Qarorda FVlardan muhofaza qilish sohasida tayyorlash borasida quyidagilar belgilab qo‘yilgan:

- aholining barcha guruhlariga FVlardan muhofaza qilish qoidalarini va asosiy usullarini, jabrlanganlarga birinchi tibbiy yordam ko‘rsatish usullarini, jamoa va yakka tartibda himoya vositalaridan foydalanish qoidalarini o‘rgatish;

- boshqaruvning barcha darajadagi rahbarlarini aholini FVlardan muhofaza qilish bo‘yicha harakat qilishga tayyorlash va qayta tayyorlash;

- davlat hokimiyati va boshqaruvi organlari, korxonalar, muassasalar va tashkilotlar rahbarlari va mutaxassislarida qutqaruv va boshqa kechiktirib bo‘lmaydigan ishlarni o‘tkazish uchun kuchlar va vositalarni tayyorlash va ularni boshqarish ko‘nikmalarini hosil qilish, FVlarda harakat qilishda xodimlarning o‘z vazifalarini amaliy egallashi.

3030-sonli Prezident qarori bilan FVV HFXO‘Mga fuqarolarni hamda vazirliklar, idoralar, tashkilot va korxonalar, mahalliy davlat hokimiyati organlari, o‘zini o‘zi boshqarish organlari rahbar kadrlarini tayyorlash, shuningdek, umumiy o‘rta ta’lim maktablari, o‘rta maxsus, kasb- hunar va oliy o‘quv muassasalarining o‘quvchi yoshlarini FVlarning oldini olish va sodir bo‘lganda harakat qilishga tayyorlash bo‘yicha faoliyatiga o‘quv-uslubiy rahbarlik qilish vazifasi yuklatilgan [11].

Ushbu vazifadan kelib chiqib O‘zbekiston Respublikasi FVVning 140-sonli buyrug‘i bilan aholini favqulodda vaziyatlarda to‘g‘ri harakat qilishga tayyorlash bo‘yicha yo‘riqnoma ishlab chiqilgan.

Shunday qilib, aholini FVlarda harakat qilishga tayyorlash masalasi, Qonun, qaror, buyruq va boshqa me’yoriy-huquqiy hujjatlarda o‘z aksini topgan bo‘lib, bunda me’yoriy-huquqiy hujjatlarda aholini FVlarda harakat qilishga tayyorlash masalasiga katta e’tibor qaratilgan.

Shunga qaramasdan yutuqlarimiz bilan birga hal etilishi lozim muammolar ham mavjud. Jumladan,

- maktabgacha ta’lim muassasalari pedagog xodimlarining malakasini oshirish 144 soatlik kurslarida “Hayot xavfsizligi asoslari”ga faqatgina 2 soat vaqt ajratilgan;

- umumta’lim maktablarida “Hayot xavfsizligi asoslari” fan sifatida o‘qitilmaydi, integratsiyalangan holda, fanlar tarkibida o‘qitilmoqda, o‘quv soatlar soni ham juda oz, (fikrimizcha “Odobnoma” darslarini oilada o‘rganish mumkin, lekin hayot xavfsizligi asoslarini mutaxassis o‘rgatishi lozim);

- ayrim korxona muassasa va tashkilotlarda ishchi-xizmatchilarning tayyorgarlik darajasi yetarli emas;

- aholining ishlab chiqarish va xizmat ko‘rsatish sohasida band bo‘lmagan qatlami, shu jumladan jismoniy imkoniyati cheklangan shaxslar, xorij mamlakatlari fuqarolarining tayyorgarligiga e’tibor yetarli darajada qaratilmagan.

Xulosa qilib aytganda, yuqorida keltirilgan tahlillardan ko‘rinib turibdiki, barcha bo‘layotgan vaziyatlarda, ularning oldini olish va harakat qilish davlat tizimining funksional va hududiy quyi tizimlari, korxona va tashkilotlarning fuqaro muhofazasi bo‘yicha mutaxassisliklari uchun yuzaga kelishi mumkin bo‘lgan vaziyatlarning oldini olish, bartaraf etishda tezkor harakat qilish, profilaktik chora-tadbirlarni ishlab chiqish, aholini, ayniqsa, favqulodda vaziyatlarda to‘g’ri harakat qilishga o‘rgatishda hayot faoliyati xavfsizligi bilimlari va ko‘nikmalari muhim ahamiyat kasb etadi.

Foydalangan adabiyotlar ro‘yxati:

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2. O‘zbekiston Respublikasining “Aholini va hududlarni tabiiy hamda texnogen xususiyatli favqulodda vaziyatlardan muhofaza qilish to‘g‘risida”gi Qonuni.
3. O‘zbekiston Respublikasining “Fuqaro muhofazasi to‘g‘risida”gi Qonuni.
4. O‘zbekiston Respublikasining “Qutqaruv xizmati va qutqaruvchi maqomi to‘g‘risida”gi Qonuni.
5. O‘zbekiston Respublikasi Vazirlar Mahkamasining 2019 yil 9 sentyabrdagi 754-sonli qarori.
6. O‘zbekiston Respublikasi Vazirlar Mahkamasining 2023 yil 29 apreldagi 171-sonli qarori.
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FINANCIAL BASIS OF IMPLEMENTING REGIONAL AND TERRITORIAL STRUCTURAL CHANGES IN THE APPLICATION OF THE FUNDAMENTALS OF THE ECONOMY: FOREIGN EXPERIENCE

Abstract: *Structural changes in regions The main task of studying the world experience is not only to better understand one or another regional problems in the country, but also to learn ways to solve them . The study of world experience in regional development is important not only for understanding different regional problems within a country, but also for identifying effective ways to solve them. Structural changes in regions are influenced by economic, social, political, and technological factors that shape the development of territories over time. In many countries, regional disparities arise due to uneven industrial growth, differences in infrastructure, migration, and access to natural resources. Therefore, analyzing international experience helps governments and researchers compare development models and apply successful strategies to local conditions.*

Keywords: *Industrial network, region , infrastructure , finance , cooperation , economy.*

Introduction

Structural changes in regions and territories according to the world experience of learning main task that or in the country this regional problems better only in understanding not them to do methods is learning .

Party adopted by the European Union (1988) and a number of other documents indicate that a new model of interregional relations is being formed within this integration bloc . This is reflected in the convergence of national legal norms in this field and the gradual development of relevant institutions. The inclusion of the subsidiarity principle in the Maastricht Treaty helps to recognize the growing importance of the sub-state level in decision-making. This is evidenced by the creation of a new advisory office - the Committee of the Regions and the independence of the regions in the development and implementation of EU policy, the direct communication of the EU with the regional authorities, and the increasingly developing regional cooperation.

Goals and tasks , methods of the regulation of the economy by the state, as well as the principles of its implementation, as well as the main directions, were studied by Russian scientists such as M.E. K.Kh.Abdurakhmonov, Kh.T.Tokhirova, H.P.Abulkasimov, O.Ya.Hamraev [5, 6] , as well as the use of forms, means and methods of the policy aimed at managing and regulating the economy by the state

are scientific from a theoretical point of view, it was analyzed by M.H.Abulqosimov, S.R.Topildiev [7] . Theoretical foundations of state regulation of the real sector of our economy, economic reforms and the formation of the mechanism of state regulation of the real sector, privatization and management of state property in Uzbekistan - a means of economic regulation, programming, forecasting and planning of socio-economic development, anti-monopoly policy and competition in the economy development, the regulatory function of prices in the market economy and the state's price and anti-inflation policies, budget and tax policy tools for the regulation of the real sector by the state, tools of the state's monetary and credit policy for the regulation of the real sector, ways of state regulation of foreign economic activity in Uzbekistan .Zakhidov, I. Hotamov, Sh. Egamberdiev [8] have been sufficiently studied.

Also, as a result of the implementation of the state economic policy aimed at further deepening the modernization and reform of the country, it has been shown on the basis of convincing evidence that stable economic growth has been ensured in Uzbekistan.

Research methodology

In the process of preparing a scientific article, the methods of data analysis based on tables, data grouping, abstract-logical thinking and expert evaluation were effectively used.

Analysis and results

For the implementation of the regional policy of the European Union, a quarter of the funds and the resources of the European Investment Bank are allocated, and it is based on the following priorities: stimulating the development of backward regions, helping regions experiencing industrial backwardness, combating persistent unemployment, new jobs for young people, creation of places, acceleration of development of agrarian district farms and structural reconstruction of Italy, there is a special fund that provides stratified state aid to objects for the implementation of infrastructure and other projects ("South Fund").

In Bulgaria, a targeted state program and special funds have been created to ensure the rapid development of certain districts. Its funds are in the country's economy it is approximately 1.5 percent of investments.

Central fund of regional development in Hungary consists of the following three purpose funds:

• the industrial localization fund ensures the removal of labor-intensive enterprises that do not fit the city's development plan out of the capital;

• the fund for the development of backward regions helps to raise the economy of the separately allocated regions, that is, to accelerate the pace of industrial development in socially, economically and ecologically narrow regions;

• a fund focused on the structural change of the industrial network and dealing with employment issues.

Regional policies are relatively uniform in most developed market economies. In the regional policy of these countries, four areas of regional

management can be distinguished by common features. We consider three directions that correspond to the conditions of Uzbekistan, all of which ensure a certain redistribution of investments by territory.

first direction includes measures aimed at providing infrastructural services to industrially underdeveloped regions and developing their relations with other regions. These activities are mainly used in rural and sparsely populated areas. This direction is suitable for our republic because the majority of the population lives in rural areas, where production and social infrastructure are not well developed. Therefore, in order to rapidly develop infrastructural networks in industrial areas and sparsely populated districts, it is advisable to lease infrastructural facilities to companies for a period of 5 years free of charge and then sell them to labor unions.

For the second direction, limited measures (administrative or financial counter-incentives) are applied to more industrially developed districts and urban agromerats. This will allow the establishment of industrial enterprises in the problem areas and thus the elimination of territorial disparities. Regional policy instruments used in most developed countries are generally of a persuasive nature. Some of them use limited measures. These measures are primarily aimed at limiting the growth of industrial enterprises in densely populated industrial regions or economically developed regions. They allow enterprises to move to less developed areas. In addition, these measures are used to reduce the negative impact on nature and other resources.

Nowadays, the construction of new industrial enterprises in small towns, urban mines, and rural settlements is an urgent problem. In this regard, the experience of Japan is relevant. In order to reduce the density of population and industrial facilities in the urban centers of the country, a number of laws aimed at limiting the construction of new enterprises and the expansion of existing enterprises have been adopted.

In addition, a decision was made to localize industrialization in order to relocate industrial enterprises in agro-urban areas with a large population such as Tokyo and Kinka. According to this law, the state allocates subsidies to enterprises and municipalities that have moved from one region to another.

important to stimulate the attraction of private industry investments in order to develop the third direction, i.e. problem areas. It is the main direction of the system of state influence to place industry and other sectors of the economy.

Developed The third direction of regional management in the countries differs in the variety and multiple use of incentives. Data provided to the Organization for Economic Co-operation and Development from 18 countries show that the most common incentive levers were:

- for industrial enterprises, loan guarantees for machinery and equipment;
- assistance for the purchase of land and industrial plots;
- assistance for labor force training, preferential interest on loans;
- support for various taxes, investments, construction of industrial buildings;

• incentives for the relocation of enterprises and subsidies for their initial location.

Table 1

Germany , it was given as an incentive investment la r

Investment and subsidies	7.5 %
Investment vii rewards	10 % - 25
Special rules for depreciation allowances : for real estate	50 %
For real estate and tax-exempt stocks	30 %

7.5 %ini investment viy subsidies, 10 % - 25 and % ini investment viy organizes rewards. Loans of up to 200,000 euros for a period of 10-15 years can be given with a small interest. Special ru x sat for depreciation allowances: 50 Up to % - for real estate , 30 %-applies to real estate and tax-exempt reserves (see Table 1) .

held in Great Britain of the century At the end of the 70s, awards for the construction of industrial buildings in special development zones accounted for 22% of all investments percent , in development and intermediate areas this indicator is 20 percent . In Northern Ireland, awards for equipment and industrial development were in the 30-50 percent range . The construction of factory buildings in the assisted areas will be exempted from rent taxes for 2 years (up to 5 years in special development areas) . Also, up to 5 years and two years are given a discount. In the assisted areas , 80 percent of the costs incurred for the relocation and location of enterprises are covered by miscellaneous costs , in Northern Ireland - this figure is up to 100 percent, and a significant part of the primary construction is also covered.

25% of the amount allocated for the creation of industrial and social infrastructure by private industrial companies in Japan It is possible to receive state aid in the amount of up to % .

2- table

State aid for industrial and social infrastructure of Japanese private industrial companies

Preferential loans	7-7.5 %
From the equipment	30% discounts
For the first year from equipment and buildings	30% discounts
Equipment rental from state enterprises, etc	15% discount also applies

This assistance preferential loans (annual 7-7.5%) and is reflected in the payment of interest on local bonds. Other methods of encouraging entrepreneurs to establish or relocate a new enterprise in problem areas, in particular, a reduction in tax rates, discounts for quick depreciation of equipment, preferential lending, 30%

discounts on equipment, equipment and buildings for the first year, state enterprises 15% discount on equipment rental, etc. is also applied (see Table 2).

One of the tasks of the financial aid system in the United States, it is the equalization of the levels of economic development of the regions. But its "redistributive effect", along with a positive effect, increased the imbalances in the economic development of the northern and north-eastern states on the one hand, and the western states on the other.

the federal government and the state and local government agencies has had a major impact on the implementation of measures to regulate the agrarian sector. First, federal subsidies increase the "fiscal independence" of local governments, thereby creating more opportunities to finance agricultural programs directly and indirectly through various fiscal levers. Second, the experience of "alternative financing" when providing targeted subsidies limits the participation of local authorities in federal programs and allows them to make certain changes to these programs based on local conditions.

operation of the country's agriculture can be realized in many ways directly and indirectly thanks to state aid. In terms of annual subsidies, it ranks second only to the USA, Japan and the countries of the European Economic Community. In these countries, the share of subsidies in the price of agricultural products is 70-40 and 30%, respectively. The total amount of direct budget subsidies in the USA is approximately 7 billion dollars per year. When the state aid is canceled, farmers' income may drop by 25-30 percent.

The goals and directions of supporting farms are different: protection of producers of agricultural products from foreign competition, self-sufficiency in food products, promotion of export of agricultural products, etc. Compensation payments in the amount of the difference between the price of a product unit and the market price are widely used. Special subsidies are paid to reduce arable land. The damage caused by natural disasters is also covered by other types of subsidies, the preservation of this crop in the farmer's reserve, reclamation works, etc. are also subsidized.

The US Department of Agriculture provides loans and subsidies to farmers and rural populations who cannot get credit elsewhere for the needs of agricultural management and development. The agency provides guarantees for loans of lenders who do not extend the credit period. More than half of the financial assistance provided to farmers is currently expressed in the form of loan guarantees. It should be noted that this agency was established to help farmers and rural people by providing loans with greater risk than private lenders.

Thus, it is based on complex development of effective agricultural production, including adaptation of external and internal conditions (supply of resources, state aid, strengthening of enterprise capabilities, etc.). This can be done within the framework of the economic mechanism based on the effective factors of production and economic management, in the conditions of trade exchange of goods and creation of necessary opportunities for agriculture.

Most of the programs of the US federal government in the development of the agricultural sector intersect with the tasks of regional and local governments. Therefore, the issue of the role of the center and regions in separate areas of state management was discussed in the 30s of the last century. has been relevant since the active intervention in the agricultural economy. Centralized management (for example, the 30s) was replaced by the transfer of the powers of the national economic complex to regional authorities.

of this period can be described as follows: delegating large powers to localities leads to imbalance in the provision of key development indicators. Along with strengthening the centralization of the state administration, a new principle of interaction between the center, state and local authorities for solving the problems of rural regions was proposed - the "principle of partnership". According to this principle, the problems of rural regions can only be solved by the joint efforts of various levels of government agencies with non-governmental (commercial and non-profit) organizations. can be done. The main thing is that actions towards the goal are coordinated at the federal level.

This effect of centralization also exists at the local level. For example, many problems are almost impossible to solve at the level of specific communities (eg, a county or a municipality) because their impact is limited to nearby neighboring areas. Accordingly, they should be resolved at the regional level, that is, on a larger scale than a particular community. The cooperation of many communities in solving a task makes it work more efficiently. That's why "authorized zones" and "entrepreneurial communities" programs have been developed.

the federal government's rural development programs in the 1990s was to get the most out of every dollar of budget funds. This measure is aimed at combating the federal budget deficit, which has been identified as the priority task of the government's budget policy in the last decade.

Currently, agriculture There are more than 30 types and directions of central support for producers of food products, including the support fund for food producers, local budget funds and the production stabilization fund, at the same time, tax and duty benefits are provided, budget loans will be extended, bank and commodity loans will be allocated.

As a recommendation - it is necessary to create special funds to ensure rapid development of certain districts ;

- to create a special fund that provides stratified state assistance to objects for the implementation of infrastructure and other projects ;
- it is necessary to develop measures aimed at providing infrastructural services to regions with no industrial development and developing their relations with other regions ;
- it is appropriate to apply limited measures (administrative or financial counter-incentives) to more industrially developed districts and urban agromerats ;
- it is important to stimulate the attraction of private industrial investments in order to develop problem areas ;

•with the aim of supporting farms Compensation payments in the amount of the difference between the purchase and market prices of a product unit should be widely used.

Conclusion

conclusion , all directions of regional policy in foreign countries have a redistributive nature and are aimed at changing the location of investments. Financial incentives for enterprises and firms that express a desire to equalize the conditions of the location of the economic sectors of the above-mentioned countries by region and move to new places in problem areas this goal can be achieved by giving.

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DIGITALIZATION OF ROAD PROTECTION ZONES IN URBAN AREAS BASED ON GEOGRAPHIC INFORMATION SYSTEMS

Abstract. *This article presents the process of digitalizing the protection zones of public roads within the territory of Namangan City using Geographic Information Systems (GIS). In the study, spatial data obtained from remote sensing materials were verified for coordinate accuracy using the Stec SV-1 GNSS receiver. ArcGIS and QGIS software environments were employed to identify and analyze road protection zones. In addition, a spatial database (*.mdb) was developed and organized. The proposed approach contributes to the economically and environmentally efficient use of road infrastructure, optimization of urban planning decisions, and the establishment of a digital monitoring system for road assets and their protection zones.*

Keywords: *GIS, remote sensing, GNSS, protection zone, ArcGIS, QGIS, database, urban planning.*

Introduction. Roads are one of the key components of urban transportation systems, ensuring population mobility, economic activity, and connectivity between different functional zones of a city. As one of the rapidly developing urban areas, Namangan City places increasing demands on its transportation infrastructure. Population growth, the expansion of residential neighborhoods, and the development of commercial facilities have significantly increased the load on the road network, making the maintenance of road conditions and compliance with road protection zone regulations increasingly important.

Traditional mapping methods are often unable to fully capture the speed and complexity of urbanization processes. Therefore, the digitalization of road protection zones using remote sensing technologies and Geographic Information Systems (GIS) has become highly relevant. This approach enables comprehensive spatial analysis of road infrastructure, automatic generation of buffer zones, identification of intersections with construction and land-use objects, and effective monitoring of adjacent territories.

Research Object and Data. The study focused on public roads located within the territory of Namangan City.

The following data sources were used:

- remote sensing data (satellite imagery);
- topographic base maps;
- road cadastre data;

- coordinates obtained using the Stec SV-1 GNSS receiver;
- road protection zone distances established in accordance with regulatory documents.

Research Methodology.

1. Processing of Remote Sensing Data. The road network was identified using satellite imagery, and an initial digital road layer was created. The images were georeferenced, and their spatial accuracy was assessed to ensure consistency with the selected coordinate system.

2. Verification of Coordinate Accuracy Using GNSS. The coordinates of selected road points were determined using the Stec SV-1 GNSS receiver. The obtained field measurements were compared with the coordinates derived from remote sensing data to evaluate their positional accuracy and reliability.

3. Digitalization in ArcGIS and QGIS Environments. Road protection zones were generated based on road centerlines using the Buffer analysis tool available in ArcGIS and QGIS software. The process included:

- conversion of the road layer into vector format;
- generation of buffer zones based on regulatory protection distances;
- spatial intersection analysis with buildings and other infrastructure objects;
- mapping and visualization of the results.

The parallel use of ArcGIS and QGIS enabled the comparison and validation of the obtained results.

4. Creation of a Spatial Database (*.mdb). - All spatial layers were integrated into a unified geodatabase developed in **Microsoft Access (*.mdb)** format. The database contains comprehensive information on road geometry, road protection zones, land parcels, construction objects, and GNSS control points. The established database structure ensures efficient storage, management, and retrieval of spatial information. Furthermore, it provides a reliable platform for future data updates, spatial monitoring, and decision-making processes related to urban road infrastructure management and protection zone control.

Results. As a result of the study, a comprehensive GIS-based model for the digitalization of protection zones of public roads within the territory of Namangan City was developed.

Figure 1. Determination of Point Coordinates Along the Road Centerline Using a GNSS Receiver.

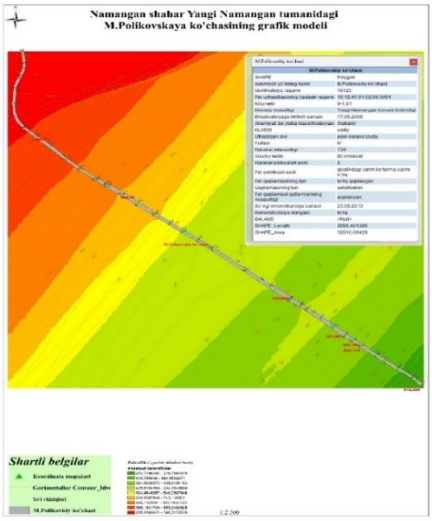

*Figure 2. Graphical Model of M. Polikovskiy Street in the .mdb Geodatabase Format

The implementation of the proposed methodology enabled the acquisition of the following scientific and practical outcomes:

- a digital model of Namangan City's road network was created;
- road protection zones were automatically generated based on regulatory requirements;
- areas where protection zones intersect with existing construction and infrastructure facilities were identified;
- the positional accuracy of spatial data was verified and confirmed using GNSS measurements;
- a unified spatial database was established for the storage, management, and analysis of geospatial information.

This system enables the digital verification of urban planning documents and compliance assessment of proposed development projects within road protection zones. The GIS-based digital monitoring system serves as an innovative tool for urban management, supporting evidence-based decision-making, improving land-use control, and enhancing the efficiency of road infrastructure planning and protection.

Conclusion and Recommendations. The digitalization of urban road protection zones using Geographic Information Systems (GIS) represents an effective approach to transportation infrastructure management. The case study conducted in Namangan City demonstrated that the integration of remote sensing data, GNSS technology, and ArcGIS/QGIS platforms significantly improves the accuracy of spatial information and provides a reliable foundation for the digital management of road infrastructure.

The developed methodology enabled the automatic generation of road protection zones, regulatory compliance analysis, and the identification of spatial conflicts between protection zones and existing construction activities. These

capabilities contribute to the rational use of land resources, improved urban planning practices, and enhanced transportation safety. The established spatial database serves as an important tool for monitoring road infrastructure and supporting digital decision-making processes. Furthermore, it aligns with the principles and requirements of modern Smart City initiatives by facilitating efficient data management and continuous infrastructure monitoring. Overall, the application of GIS technologies offers a highly effective solution for the management of road protection zones in urban environments.

Future research may focus on integrating artificial intelligence techniques, advanced spatial analytics, and three-dimensional (3D) modeling technologies to further enhance the accuracy, automation, and functionality of digital road infrastructure management systems.

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IMPROVING THE TECHNOLOGY OF TEACHING BIOPHYSICS THROUGH PRACTICAL TRAINING IN AN ARTIFICIAL INTELLIGENCE ENVIRONMENT

Abstract: *This study explores the theoretical and practical foundations of applying artificial intelligence technologies in teaching biophysics to veterinary students. The article analyzes the digital modeling of physiological processes in animals, the application of machine learning algorithms in diagnostic data analysis, and the use of virtual laboratories to improve students' professional competencies. Particular attention is given to the integration of intelligent technologies into practical biophysics training, which enhances analytical thinking, research abilities, and digital literacy among students.*

Keywords: *artificial intelligence, biophysics, ECG and EEG, animals, neural network learning model, machine learning, virtual laboratory, digital modeling, veterinary education.*

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SUN’IY INTELLEKT MUHITIDA BIOFIZIKA FANINI AMALIY MASHG‘ULOTLAR ASOSIDA O‘QITISH TEXNOLOGIYASINI TAKOMILLASHTIRISH

Annotatsiya: *Mazkur tadqiqot veterinariya yo‘nalishidagi talabalarga biofizika fanini o‘qitishda sun’iy intellekt (SI) imkoniyatlaridan foydalanishning nazariy va amaliy asoslarini o‘rganadi. Maqolada hayvonlar fiziologik jarayonlarini raqamli modellashtirish, diagnostika tahlillarida mashinali o‘rganish algoritmlarini qo‘llash va virtual laboratoriyalar orqali talabalarning professional kompetensiyasini oshirish masalalari tahlil qilinadi.*

Kalit so’zlari: *Suniy intellekt, biofizika, EKG va EEG, Hayvonlar, Neyron tarmoqli o‘qitish modeli*

Kirish

Veterinariya tibbiyoti bugungi kunda yuqori texnologik sohadir. Biofizika fani esa veterinariya vrachining shakllanishida fundamental rol o‘ynaydi. Biroq, an’anaviy ta’limda hayvonlar ustida tajriba o‘tkazish axloqiy (etika) va iqtisodiy jihatdan qiyinchiliklar tug‘diradi.

Muammoning qo‘yilishi: Veterinariya oliy ta’limida biofizik jarayonlarni (masalan, qon gemodinamikasi, tana issiqlik almashinuvi, nerv impulslari) jonli hayvonlarsiz, lekin realistik darajada o‘qitish zarurati mavjud. Bu yerda **Sun’iy Intellekt** (SI) muhiti yechim bo‘lib xizmat qiladi.

Veterinariya biofizikasida si integratsiyasi

Veterinariya biofizikasi kursida SI quyidagi yo‘nalishlarda qo‘llaniladi:

1. **Diagnostik tasvirlar tahlili:** Rentgen, ultratovush (UZI) va MRT natijalarini neyron tarmoqlar yordamida o‘qishni o‘rgatish.
2. **Hayvonlar biopotensiallari:** EKG va EEG signallarini SI filtrlari orqali tahlil qilish.
3. **Molekulyar veterinariya:** Hayvonlar organizmidagi dori vositalarining biofizik transportini modellashtirish.

Tadqiqot metodologiyasi

Tadqiqot davomida Samarkand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti kabi muassasalar o‘quv dasturlari tahlil qilindi. Amaliy mashg‘ulotlar uchun **"Intellectual Virtual Lab"** modeli ishlab chiqildi.

Neyron tarmoqli o‘qitish modeli

Amaliy darslarda talabalar hayvonlar qon aylanish tizimidagi bosim o‘zgarishini o‘rganishda quyidagi algoritm bo‘yicha ishlaydilar:

1. Ma’lumotlar to‘plami (Dataset) kiritiladi.
2. SI modeli (masalan, Random Forest) orqali patologiya bashorat qilinadi.
3. Talaba bashorat natijasini biofizik qonuniyatlar (Puazeyl qonuni) bilan asoslaydi.

4. AMALIY MASHG‘ULOTLARNI TAKOMILLASHTIRISH TEXNOLOGIYASI

"Raqamli hayvon" (Digital Twin) texnologiyasi

Amaliy darslarda talabalar hayvonning virtual raqamli modelidan foydalanadilar. Masalan, otning tana harorati va atrof-muhit o‘rtasidagi issiqlik almashinuvini o‘rganishda Termodinamika qonunlari SI muhitida simulyatsiya qilinadi.

$$Q = \alpha \cdot A \cdot (T_{tana} - T_{muhit})$$

Ushbu formula asosida SI talabaga turli iqlim sharoitlarida hayvonning holatini vizual grafiklar ko‘rinishida taqdim etadi.

Mashinali o‘rganish orqali laboratoriya tahlillari

Laboratoriya ishlarida sut tarkibidagi biofizik ko‘rsatkichlarni (yopishqoqlik, elektr o‘tkazuvchanlik) aniqlashda SI datchiklaridan foydalaniladi. Bu talabalarga mastit kasalligini erta bosqichda aniqlashning biofizik usullarini o‘rgatadi.

Pedagogik tajriba-sinov natijalari

O‘tkazilgan tajribalar shuni ko‘rsatdiki, SI muhitida amaliy mashg‘ulot o‘tgan talabalarning o‘zlashtirish darajasi an’anaviy guruhlarga nisbatan yuqori bo‘ldi.

Ko'rsatkich	Nazorat guruhi (An'anaviy)	Tajriba guruhi (SI muhiti)
Biofizik asboblardan foydalanish	62%	89%
Ma'lumotlarni tahlil qilish	45%	92%
Mustaqil xulosa chiqarish	50%	85%

MUHOKAMA

Veterinariya ta’limida SI muhitini joriy etish talabalarning tanqidiy fikrlashini o‘stiradi. Shuningdek, bu texnologiya "Bioetika" tamoyillariga to‘liq mos keladi, chunki laboratoriya tajribalari hayvonlarga zarar yetkazmagan holda yuqori aniqlikda o‘tkaziladi.

O'qitish texnologiyasining afzalliklari:

- **Vizuallik:** Hujayra ichidagi jarayonlarni 3D ko‘rinishda kuzatish.
- **Takrorlanuvchanlik:** Mashg‘ulotni istalgancha takrorlash imkoniyati.
- **Tezkorlik:** Murakkab matematik hisob-kitoblarni SI zimmasiga yuklash.

VII. XULOSA VA TAVSIYALAR

Sun’iy intellekt muhitida biofizika fanini o‘qitish veterinariya ta’limini jahon standartlariga olib chiqadi. Tavsiya etiladi:

1. Veterinariya oliy ta’lim muassasalarida "Smart Biophysics Lab" laboratoriyalarini tashkil etish.
2. Pedagog kadrlarning SI texnologiyalari bo‘yicha malakasini oshirish.
3. O‘quv dasturlariga "Biofizik modellashtirish va SI" modulini kiritish.

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CONDUCTING A CLASS ON THE TOPIC "THE USE OF ACOUSTIC METHODS IN MEDICINE AND VETERINARY MEDICINE" USING THE "FEEDBACK" METHOD IN VETERINARY HIGHER EDUCATION INSTITUTIONS

Abstract: *This article discusses the conduction of classes on the topic "The use of acoustic methods in medicine and veterinary medicine" within the subject of "Biophysics" at veterinary higher education institutions using the feedback method. The reform of the modern education system aims not only to train specialists with specific knowledge and skills but also to prepare them to quickly and responsibly solve professional activity problems defined by state educational standards. Furthermore, it focuses on increasing the efficiency of training future veterinary specialists.*

Keywords: *Acoustics, feedback, infrasound, ultrasound, diagnostics, cattle, horses.*

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VETERINARIYA OLIY O'QUV YURTLARIDA"QAYTA ALOQA" USULIDAN FOYDALANIB "TIBBIYOT VA VETERINARIYADA TOVUSH USULLARIDAN FOYDALANISH" MAVZUSIDAGI DARS MASHG'ULOTINI O'TKAZISH

Annatatsiya: *Ushbu maqola veterinariya oliy talim muassasalarida "Biofizika" fanining* ***"****Tibbiyot va veterinariyada tovush usullaridan foydalanish****"*** *mavzusini qaytar aloqa metodidan foydalanib dars mashg'ulotlari o'tilgan bo'lib zamonaviy ta'lim tizimini isloh qilishda nafaqat bilim va ko'nikmalarga ega bo'lgan mutaxassislarni tayyorlash, balki ularni oliy ta'limning davlat ta'lim standartida belgilangan kasbiy faoliyat muammolarini tez va mas'uliyat bilan hal qilishga tayyor, kelajakda veterinar shifokor mutaxassislarini tayyorlash samaradorligini oshirishga qaratilgan.*

Kalit so'zlari: *Akustika****,*** *qayta aloqa, Infratovush, ultratavush, diagnostika, qoramol, otlar.*

Veterinariya oliy ta'lim muassasalarida professor-o'qituvchining mavzuni o'tishda interfaol usullardan foydalanishi auditoriyadagi rolini keskin o'zgartiradi, an'anaviy usulga ko'ra uning markaziy bo'lishi to'xtatildi. U faqat dars jarayonni tartibga solish va uning umumiy tashkil etilishi, zarur vazifalarni oldindan tayyorlash va guruhlarda muhokama qilish uchun savollar yoki mavzularni tuzish, maslahatlar berish hamda nazorat qilish bilan shug'ullanadi.

O'quv jarayoniga o'qitishning interfaol usullarini jalb qilish talabalarning faol o'quv va bilim, ko'nikma va malaka faoliyatini shakllantiradi. G.M.Gazizovaning fikriga ko'ra, ushbu usullardan, xususan, tibbiyot fanlarini o'qitishda yuqori samaradorlikka erishsa bo'ladi. Interfaol usullar talabalarning faolligini ta'minlaydi, ya'ni o'quv jarayonida faol qatnashadi; tajribaga asoslangan; ehtiyojlar va shaxsiy rag'batlantirishga tayanadi, talabalarga hurmatni namoyish etadi; do'stona munosabatlarni yaratadi [1]. A.A.Verbitskiy shunday fikr yuritadi, talabaning mashg'uloti pozitsiyasi va faoliyatdagi o'rni qanchalik xilma-xil bo'lsa, kelajakda yaxshi mutaxassis, ya'ni shaxs bo'lib rivojlanadi, o'qitish ko'nikmasi shakllanadi va o'qitishga ijodiy yondashuv mazmunli faoliyat, moslashuvchanlik rivojlanadi, chuqurroq fikrlashni o'rganadi. O'quv jarayonida interfaol usullarni o'rganish, avvalam bor, yuqori malakali mutaxassislar tayyorlash sifati bilan bog'liq [2]. Ma'ruza mashg'ulotini "Qayta aloqa" usuli yordamida o'tish, mashg'ulotlar konspektlarda va o'quv qo'llanmalarida to'g'ridan to'g'ri javob topish mumkin bo'lmagan, mantiqiy fikrlash va muammoli vaziyatlarga ega bo'lgan jarayonlarning va tajribalarning turli jihatlari haqida ijodiy muhokama qilish imkonini beradi. Demak, darsning yuqorida ta'kidlangan usul bo'yicha

o'tkazilishini batafsil ko'rib chiqamiz.

Maqsad: ma'ruzada olingan ma'lumotlarni yangilash.

Vazifalar:

- talabalarning muhokama qilingan mavzularga munosabatini aniqlash;

- mashg‘ulotlarni tashkil etish va o‘tkazishning afzalliklari va kamchiliklarini ko‘rish, natijani baholash;

- talabalarda dars uchun dolzarb bo‘lgan bilimlarni egallash darajasi haqida umumiy tasavvurni shakllantirish;

- muloqot qobiliyatlarini rivojlantirish (muloqot ko‘nikmalari);

- guruhda psixologik va jismoniy stressni olib tashlash.

“Qayta aloqa” usuliga asosan o‘qituvchi, o‘zi tomonidan oldindan tuzilgan savollar bo‘yicha, tinglagan ma’lumotlari haqida talabalarni (tasodifiy tanlangan holda) gapirishga taklif qilinadi.

O‘qituvchi va boshqa talabalar tomonidan barcha bayonotlar tortishuvlarsiz, sharhlar va savollarsiz jim tinglanishi zarur. Fikr-mulohazalari uchun har bir ma’ruzachiga minnatdorchilik bildirish kerak. Albatta, bu erda o‘qituvchi ham barcha o‘quvchilar bilan teng munosabatda bo‘lishi kerak.

Misol tariqasida qo‘llash: Mavzu: **“**Tibbiyot va veterinariyada tovush usullaridan foydalanish**”**. “Biofizika” fani bo‘yicha ma’ruza darsini oldingi darsni besh daqiqalik turli (test yoki qisqa savol-javob) shaklida takrorlash bilan boshlash mumkin. Keyin materialning taqdimoti keladi. Nazariy qismda, avvalo, tebranish va to’lqinlar haqida tushuncha berilib va tavushni hosil qilish, tavushning vetrnariyada qo’llanlishi, tovush va uning ahamiyati. Tovushning fizik va fiziologik xossalari haqida atroflicha ma’lumotlar beriladi (prezentatsiya, videorolik va h.k. shaklida taqdim qilinsa, maqsadga muvofiq bo‘ladi

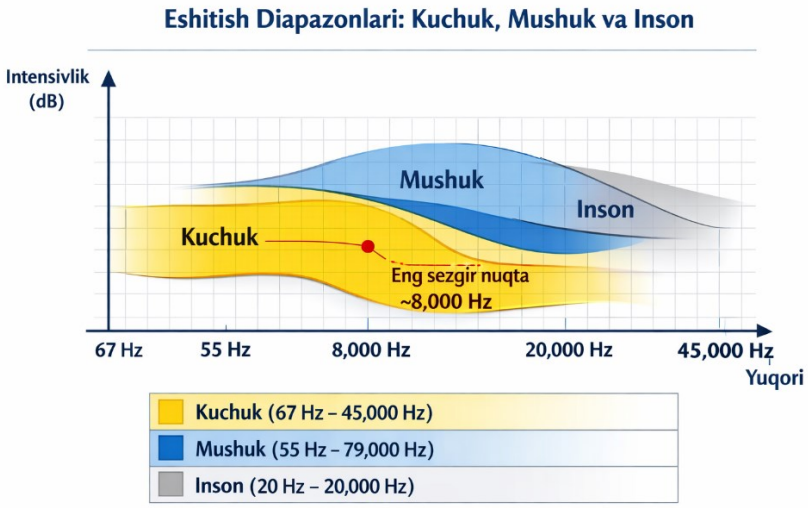
Barcha tirik jonzod uchun tovushning ahamiyati katta. Ba’zilar uchun bu aloqa vositasi bo‘lsa, boshqalar uchun rivojlanishga ham ta’siri bor. Tovush deganda chastotasi 16 Gs.dan 20 kGs.gacha bo‘lgan elastik to‘lqinlar tushuniladi. Tovush xossalari fizikaning akustika bo‘limida o‘rganiladi.

Akustika - eng past chastotali tebranishlardan boshlab, o‘ta yuqori (10^{12} - 10^{13}Gs) chastotali elastik to‘lqinlarni o‘rganuvchi fizikaning bir bo‘limiga aytiladi. Umuman olganda akustika tovush haqidagi ta’limot bo‘lib, odam qulog‘i qabul qila oladigan gazlar, suyuqliklar va qattiq jismlardagi elastik tebranishlar va to‘lqinlarni o‘rganadi. Gaz va suyuqliklarda bo‘ylama, qattiq jismlarda esa ham bo‘ylama, ham ko‘ndalang to‘lqinlar tarqaladi.

Tovush intensivligi (yoki kuchi) deb, tarqalish yo‘nalishiga perpen-dikulyar birlik yuzadan birlik vaqt ichida olib o‘tilgan energiyaga aytiladi.

$$I = \frac{W}{S \cdot t} \qquad (1.9)$$

Har bir quloqning eshitish qobiliyati har xil. Har bir chastota uchun eng kichik intensivlik (eshitish chegarasi) va og‘riq sezish chegarasi mavjud. Quyidagi rasmda eshitish sohasi ko‘rsatilgan



Veterinariyada - ultratovush fonoforez usuli qo‘llaniladi, ya’ni ultratovush yordamida qoramollarga terisi orqali ba’zi dorilarni kiritish (m: gidrokartizon, tetrosiklin va boshqalar) mumkin. Bu elektroforrezga o‘xshash, lekin elektr maydoni ta’sirida zaryadlangan zarrachalar harakatlansa, ultratovush yordamida zaryadsiz zarrachalar ham harakatlanadi. Ultratovush nurlantirish fonoforez bilan birgalikda qoramol, echki, qo‘ylardagi mastitni davolashda ishlatiladi.

Diagnostikada qoramol va otlarning homiladorligini aniqlash mumkin. Hattoki 25 kunligini aniqlash mumkin. 65 - 70 kunligini 100% aniqlikda aytish mumkin. 1 soatda 200 qo‘yning homiladorligini aniqlasa bo‘ladi.

Infratovush - bu chastotasi 16 Gs.dan kichik bo‘lgan elastik to‘lqinlardan iborat. Lotinchadan infro- kichik ma’noni anglatadi. Infratovush atmosfera va denegiz shovqinlari tarkibida bo‘ladi. Chaqmoq vaqtida, portlashda, to‘plar otilganda, Yer qimirlashda paydo bo‘ladi. Infrotovush juda kam yutiladi, shu sababli u ancha uzoq masofalarga tarqalishi mumkin. Atmosferaning yuqori qatlamlarini o‘rganish mumkin. Infrotovush organizmning bir qator sistemalari funksional holatlariga yomon ta’sir ko‘rsatadi. M: charchash, bosh og‘rig‘i, uyquchanlik, jahl chiqishi va boshqalar paydo bo‘ladi. Infrotovushning organizmga birlamchi ta’sir ko‘rsatish mexanizmi rezonans xarakterga ega.

Hayvonlar tovush chiqarish organlari turlichadir. Ular tovushdan ov qilish, aloqa vaositalarida ishlatadi. Hamma hayvonlarda ham ovoz chiqarish organlari mavjud emas. Shu sababli ovoz chiqarish uchun ular boshqa organlardan foydalanadi (qanotlar, oyoqlar va hakazo).

Bo‘g‘in oyoqlilar ishqalanish yoki bir organning ikkinchisiga urilishi, menbranalar vibrasiyasi (qanotlar), tirqish orqali havo o‘tkazish tufayli tovush chiqaradi. Ularning akustik spektri murakkab, chastotasi yuqori (2 k Gs atrofida). Masalan: pashsha, ari, chibinlar qanotini qoqishi tufayli tovush chiqaradi.

Baliqlar - ularning chiqaradigan tovushi asosan tanasining u darajada silliq bo‘lmasligi tufayli suzish vaqtida suv bilan ishqalanishidan paydo bo‘ladi. Shu bilan birga har bir baliq o‘ziga xos tovush chiqaradi. Masalan: Stavrida g‘ijirlashga

o‘xshash tovush chiqarsa, lesh xurrakga o‘xshash, dengiz karasi esa tiqqillashga o‘xshash tovushlar chiqaradi. Baliqlar asosan suzuvchi shishiragi yordamida tovush chiqaradi. Uning ichida havosi bor. Buni harakatga keltirish uchun baliqlar yonboshida joylashgan baraban muskullarini ishga soladi.

Qushlar - ularning tarqatadigan tovushlarining ko‘pchiligi tovush organlaridan emas, balki qanotlari, tumshuqlari, oyoqlaridan chiqadi. Masalan: turnalar - tiqqillagan tovushni tumshuqlarini yopish va ochish yordamida chiqaradi. Lekin asosiy rolni nafas tovushlari o‘ynaydi. Tanglayida 2 ta menbrana mavjud - tashqi va ichki. Uning ish prinsipi Bernulli qonuniga asoslangan. Havo tez o‘tishida ovoz chiqaradi. Qushlar asosan 20 Gs - 12 kGs chastotali, ba’zilar esa hatto 30 - 50 kGs chastotali ultratovushlar chiqarishi mumkin.

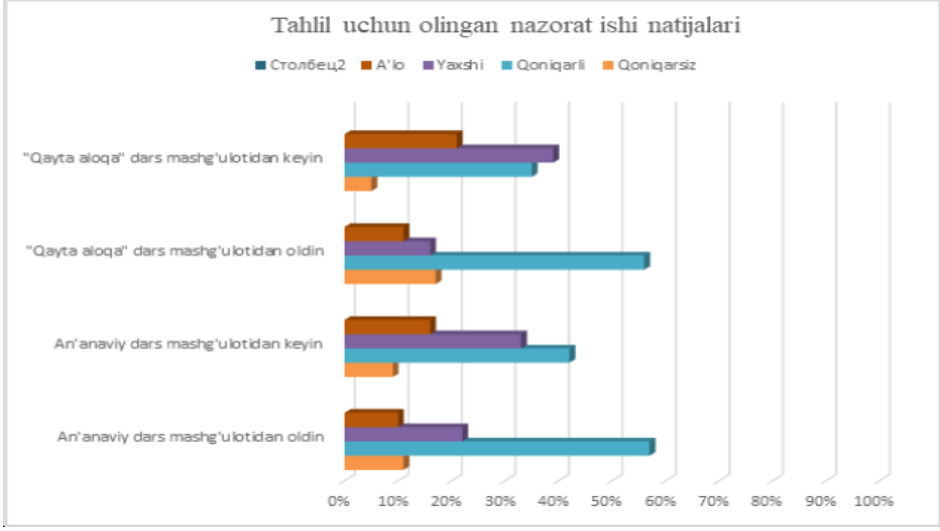
Sut emizuvchilar - ular asosiy tovushni yuqori tanglay orqali hosil qiladi. Bunda, og‘iz, burun, hattoki o‘pka ham ovoz chiqarishda ishtirok qiladi. Ular chastotasi bir necha gersdan yuzlab kilogerslargacha (ko‘rshapalaklar). Ba’zi jonivorlar uchun qabul qilish mumkin bo‘lgan eng yuqori chastotalarni keltiramiz: odam 20 kGs, shimpanze 30, it 60, mushuk va delfin 100, ko‘rshapalaklar 150, kabutarlar 12 kGs., tovuqlar 12 kGs.

Xulosa qilib aytganda Tovush va uning tirik mavjudod uchun ahamiyati albatta juda kattadir. Eng avvalo u aloqa vositasi hisoblanadi. Ayniqsa keyingi vaqtlarda tovush, infrotovush va ultratovishlar ham diagnistikada, ham davolash maqsadlarida juda keng qo‘llanilmoqda. Qishloq xo‘jaligining turli sohalarida, jumladan, chorvachilikda bu sohani bilish juda muhimdir. Normadan ortiq bo‘lgan tovush qattiqligi qoramollar va parrandalar mahsuldorligini kamaytiradi. Chorva mollari tanasiga dori - darmonlar kiritish ham katta ahamiyatga ega.

Shu bilan birga, ma’ruza mashg‘uloti davomida talabalar savol berishlari uchun materialning taqdimoti tuziladi. Agar savol bo‘lmasa (oxirgi chora sifatida), barcha savollarni o‘qituvchi o‘ziga o‘zi beradi:

1. Tovushning fiziologik xossalari nimalar ?
2. Veber - Fexnerning psixofizik qonuni nimani ifodalaydi?
3. Bell va desebellar nimaning o‘lchov birligi hisoblanadi?
4. Eshitish sohasi nima?
5. Tibbiyot va veterinariyada tovushdan foydalanish haqida nimalarni bilasiz?
6. Ultratovush va uning amalda qo‘llanilishi?
7. Infrotovush va uning ahamiyati.
8. Ultra- va infrotovushlarning tirik organizmga ta’siri va ahamiyati.
9. Shovqin va undan himoyalanish. va hokazo. Ushbu taklif etilayotgan konsepsiyasining (aprobatsiyasi) dars o‘tish usuli sinovi Veterinariya meditsinasi, chorvachilik va biotexnologiyalar universitetida “Axborot texnologiyalari, tabbiy va aniq fanlar” kafedrasida amalga oshirildi va veterinariya 1-bosqich talabalari bilan “Biofizika” fanini o‘qitishda sinovdan o‘tkazildi. Sinov

jarayonida talabalar uslubiy ko‘rsatmalardan va kafedra professor-o‘qituvchilari tayyorlagan materiallardan foydalanishdi.



Yuqoridagi jadvaldan ko‘rinib turganidek, innovatsion (interfaol) usul yordamida dars o‘tilganda talabalar o‘zlashtirish ko‘rsatkichi an’anaviy ma’ruza darsiga nisbatan ortgan. **Yuqoridagilarni umumlashtirib, quyidagi xulosaga kelishimiz mumkin.** Veternariya oliy o‘quv yurtlarida “Biofizika” fanini o‘qitishda “Qayta aloqa” usulidan foydalanish nafaqat talabalarda fanga qiziqish uyg‘otadi, balki har bir talabaga o‘quv materialini o‘zlashtirish, hayotiy ko‘nikmalarni shakllantirish va xatti-harakatlarning o‘zgarishiga ta’sir qilish hamda individual yondashuvni ochib beradi, samarali faoliyat olib borishga yordam beradi.

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PRODUCTION POTENTIAL OF LANDSCAPES AND THEIR EFFICIENT USE (ON THE EXAMPLE OF BUKHARA REGION)

Annotation: *This article studies the natural geographical features of the landscapes of the Bukhara region, their productions potential and the possibilities of their effective use. The significance of the landscapes of the region in the development of agriculture and other economic sectors is assessed. Also, geoecological problems arising in the process of using natural resources, problems related to the use of land and water resources are analyzed, and scientific and practical recommendations for their rational use are developed.*

Keywords: *landscape, agriculture, soil fertility, natural resource, oasis, sustainable development, land reclamation, water resources, desert, irrigation system, salinity, drainage flow, monitoring, erosion, desertification, geosystem, ecosystem, ecological culture.*

INTRODUCTION. Food security, which is considered one of the world's problems today, and to achieve it, first of all, in our country, as well as in the Bukhara region, requires reforming the agricultural sector. As a result, urgent tasks such as modernization of agriculture, creation of crop varieties suitable for the natural climatic conditions of each region, increasing soil fertility, introduction of modern agrotechnologies that save water and energy resources, and ultimately achieving high economic efficiency in agriculture are being taken under state control.

Extensive research is being conducted on the leading role of several factors in the emergence, formation and development of landscapes, their geographical changes in space and time. Many CIS scientists, including V.B. Sochava, V.S. Preobrazhensky, A.G.Isachenko, F.N.Milkov, V.A.Nikolaev, G.N.Goluboyev and others, have conducted scientific research on geoecological problems arising from human impact on the environment and their impact on human health. In the Republic of Uzbekistan, landscapes and their protection were studied by L.N. Babushkin, N.A.Kogay, N.D.Dolimov, O.Yu.Poslavskaya, P.Gulomov, M. Umarov, Yu.Sultanov, A.Saidov, S.Nishonov, A.Abdulqosimov, L.Alibekov, T. Allaberganov, T.Jumaboyev, M.Koziboyev, Sh.Ergeshov, Sh.Zokirov, H.

Vahobov, I.Hasanov, S.Abdullayev, Yu.Sultanov, A.B.Abbasov, A. Zaynutdinov, I.Abduganiyev, I.Nazarov, N.I.Sabitova, A.A.Rafikov, P.Baratov, A.N. Nigmatov, I.Q.Nazarov, X.R.Toshov, Sh.Sharipov, A.M.Mavlonov and others. In this research, the regions, especially landscapes, their ecological situation, landscape dynamics, factors that aggravate the situations in cultural landscapes, soil, water, atmospheric air pollution were studied.

ANALYSIS AND METHODS. Agriculture is one of the leading sectors in the economy of the Bukhara region. In particular, volume of products grown in agriculture is large. In particular, an average of more than 300-350 thousand tons of raw cotton, more than 160 thousand tons of grain, 150 thousand tons of potatoes, 500 thousand tons of vegetables, 100 thousand tons of melons, 200 thousand tons of fruits, 150 thousand tons of grapes are grown annually. The region has natural, economic and social opportunities to further increase the volume and quality of these products.

In particular, the factors contributing to the economic development of the region are:

• the experience of our ancestors in agriculture accumulated over the centuries;

• By the 21st century, the successes achieved in the agricultural sectors have taken a significant place in the local, regional and global geopolitics of our country

• the convenience of the agroclimatic potential of the regions for growing food and technical crops;

• the large annual amount of solar radiation, which is considered a source of heat (150-160 kcal. The annual sum of active temperature (>10°) is about 4550-5000°);

• the productivity of land resources;

• the importance attached to mutual cooperation in the fields of science and production at the state level , etc. are examples.

The effective use of the above natural, economic and social opportunities in agriculture is negatively affected by such factors as the location of the territory in the desert zone, catastrophic frosts, floods, hail, strong winds, mudslides, the proximity of the groundwater level to the surface, salinity, and very low natural moisture (precipitation is around 90-150 mm, and the possible annual evaporation is 2000 mm). In particular, the lack of water resources during the growing season of agricultural crop leads to a 6-7-fold decrease in productivity. Therefore, the initial work on the modernization of the agricultural sector of the Bukhara region is focused on the directions and methods of effective use of water resources [1,2,3,4].

Based on the above, the directions for the effective use of water resources in the context of the modernization of the agricultural sector of the Bukhara region are as follows:

1. Providing large pumping stations with new energy-saving equipment;
2. Reconstruction of canal networks;

3. Fully providing the sectors working in the irrigation system with qualified personnel, and initiating work on their professional development;

4. Improving irrigation methods, switching to modern water-saving method;

5. Implementing new investment and innovative projects in the modernization of agricultural sectors.

In order to positively address the above, ensure sustainable production in agriculture and uninterrupted water supply for irrigation of lands in the Bukhara and Navoi regions, in accordance with the resolutions of the President of the Republic of Uzbekistan No. PQ-2156 dated March 28, 2014 and No. PQ-2396 dated August 25, 2015, the project “Restoration of the Amu-Bukhara irrigation systems” was approved.

The following is among the anthropogenic factors that cause deterioration of the ecological state of the regional landscape: Mining, population growth, uncontrolled livestock grazing, modern urban development, the growth of cars, the development of industry, waste, burning of coal and other fuels, clearing of saxaul forests for firewood, etc.

In recent years, due to the constant depletion of water resources and their deterioration, economic and ecological difficulties during the transition to market relations, the deterioration of the quality of water used for irrigation, the deterioration of the technical condition of drainage systems in the region (the failure of vertical drainage wells in many places, closed horizontal drainages, a decrease in the efficiency of collector drainage channels, etc.), and the lack of constant monitoring of salinity of irrigated lands, the process of secondary salinization of the region's soils has been accelerating. The reason for this is the increase in groundwater levels across the region, especially in irrigated areas, compared to the 1960s. For example, in the floodplains of the Zarafshan River, 50% of the areas with groundwater at a depth of 1.5 m below the surface are covered, and on the right bank of the Amu Darya this figure is 70% [5].

RESULTS AND DISCUSSION. Today, in order to mitigate and combat desertification processes, it is necessary to improve measures to combat soil erosion, improve the quality of land, and improve the quality of settlements located in desert areas, taking into account local natural conditions, and increase measures aimed at raising the ecological culture of the general public, especially users.

Currently, all people living on the Earth, including those living in the Bukhara region, live in a period of increasing and developing ecological crisis. The protection of the landscapes of the Bukhara region, the development of a scientifically based program of measures, the organization and management of a mechanism for its consistent application in practice are of great positive importance in increasing the productivity of irrigated agrogeocomplexes.

However, the increasing negative processes that lead to a decrease in the productivity of irrigated agro-landscapes require the rational organization of the use of such geocomplexes in the production of agricultural products on a scientific basis and the identification and implementation of measures that have both ecological

and economic efficiency for the protection of land and water resources. The solution to geo-ecological problems associated with the landscapes of the Bukhara region should be focused on radically improving nature conservation and land reclamation work aimed at optimizing the use of nature [6,7]. The landscapes of the Bukhara region are a specific component of the natural the world, and their protection, preservation of their productivity, preservation for future generations in the interests of humanity and their rational use are one of the most urgent problems of our time. Oasis landscapes serve as the main source of satisfying the material and spiritual needs of humanity. Therefore, from the time of its emergence until now, man has had both positive and negative effects on nature, using it for various purposes. The degree of impact of human economic activity on nature is increasing in direct connection with the growth of the population on a regional and global scale, the development of industrial enterprises, and the progress of science and technology.

SUMMARY. Nature protection in the Bukhara region is a broad concept, consisting of a complex system of measures. This complex system consists of a set of measures such as preserving nature for the benefit of humanity for present and future generations, consciously and purposefully changing it, recultivating unusable lands, rationally using natural resources, preventing pollution of atmospheric air, groundwater and surface waters, restoring the ecological balance of the environment, maintaining and increasing the productivity of agro-landscapes, preventing the contamination of cultivated areas with nitrates, pesticides and herbicides, optimizing the degradation process of geosystems and ecosystems, combating soil erosion and soil salinization in irrigated lands, and rationally using geosystems taking into account the laws of nature.

In order to produce ecologically clean agricultural products that do not harm human health in the geosystem of the Bukhara region's oases, it is necessary to protect the soil from contamination with pesticides, herbicides and other chemicals, develop a mechanism for this, and prohibit the use of toxic substances in excess of the norm on cultivated areas. In conclusion, it should be noted that in the context of the modernization of the agricultural sector of the Bukhara region, the implementation of directions and methods for the effective use of water resources will become a foundation for saving labor and water resources in water-intensive agriculture, increasing production efficiency, and improving the culture of water use.

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INFLUENCE OF CUTTING FORCES AND TOOL WEAR ON CHIP FORMATION DURING MILLING OF COMPOSITE MATERIALS

Abstract: *This study focused on the influence of cutting parameters on cutting force, tool wear and chip formation during milling of glass fiber reinforced composites. Experiment were conducted to determine the relationships between cutting conditions and tool wear. The results help to optimize milling parameters and improve machining efficiency of composite materials.*

Keywords: *Glass fiber reinforced polymer (GFRP), cutting force, tool wear, flank wear, chip formation, surface roughness, finite element modeling.*

Introduction

Composite materials are heavily used in aerospace, automotive, and mechanical engineering industries because of their high strength-to-weight ratio and corrosion resistance [1,2,3,4]. Machining of glass fiber reinforced composites is connected with problems as tool wear, high cutting forces, and poor surface quality [5,6,7,8]. Investigating the influence of cutting parameters on machining performance is an important scientific task. This study analyze the relationships between cutting force, tool wear and chip formation during the milling process of composite materials.

Materials and methods

Surface roughness was measured using a GOYOJO GSR750 Surface Roughness profilometer, cutting forces was evaluated using dinomometr and tool wear was evaluated using an MMI-2 microscope.

Table 1. Physical and mechanical properties of glass fiber composite material [9].

Density, kg/m^3	2 000	2 000
Orthotropic Elasticity		
Young's Modulus X direction, Pa	45 000	4,5e+10
Shear Modulus XZ, Pa	5 000	5e+09
Poisson's Ratio XZ	0,3	0,30000
Young's Modulus Y direction, Pa	45 000	4,5e+10
Shear Modulus YZ, Pa	5 000	5e+09
Poisson's Ratio YZ	0,3	0,30000
Young's Modulus Z direction, Pa	10 000	1e+10
Shear Modulus XY, Pa	5 000	5e+09
Poisson's Ratio XY	0,3	0,30000
Orthotropic Stress Limits		
Tensile X direction, Pa	1100	1,1e+09
Compressive X direction, Pa	-675	-6,76e+08
Shear XY, Pa	80	8e+07
Tensile Y direction, Pa	1100	1,1e+09
Compressive Y direction, Pa	-675	-6,75e+08
Shear YZ, Pa	80	9e+07
Tensile Z direction, Pa	35	3,6e+07
Compressive Z direction, Pa	-120	-1,4e+08
Shear XZ, Pa	80	9e+07

Table 2. Physical and mechanical properties of VK8 grade cutting tool [10]

Stiffnes, MPa	$2.8 \cdot 10^3$
Young's Modulus, MPa	$5.9 \cdot 10^5$
Coefficient of linear expansion, $10^6 (1/°C)$	5.1
Density, kg/m^3	$1.48 \cdot 10^4$

Results

The signals obtained for evaluating the cutting force were processed and analyzed using a specially developed algorithm. To reduce system errors during calculations, average arithmetic values and coefficients for converting voltage into force values were applied. The processed results were then transferred to Microsoft Office Excel, and the obtained experimental data were summarized in Table 1.

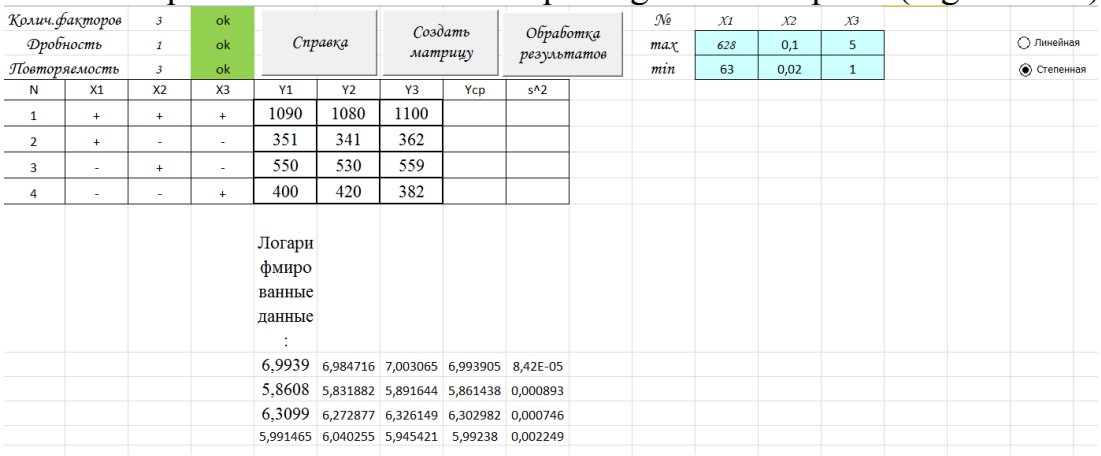
Table 3. Experimental values of forces generated during the cutting process [7]

№	*S (mm/tish)*	*V (m/min)*	*t (mm)*	*P (N)*
1	0,1	63	1	596
2	0,02	63	5	475

The obtained experimental data, adapted to the experimental design, made it possible to determine the mathematical relationship between cutting force and cutting parameters, where: V is the cutting speed (m/min), S is the feed rate (mm/tooth), and t is the cutting depth (mm).

$$P = 926 \cdot V^{0,12} \bullet S^{0,43} \cdot t^{0,25}$$

This relationship was obtained as a result of processing the experimental data using the “Least Squares Method” software package on a computer (Figures 1–2).



Колич.факторов	3	ok
Дробность	1	ok
Повторяемость	3	ok

Справка | Создать матрицу | Обработка результатов

№	X1	X2	X3
max	628	0,1	5
min	63	0,02	1

○ Линейная ◉ Степенная

N	X1	X2	X3	Y1	Y2	Y3	Yср	s^2
1	+	+	+	1090	1080	1100		
2	+	-	-	351	341	362		
3	-	+	-	550	530	559		
4	-	-	+	400	420	382		

Логарифмированные данные:

6,9939	6,984716	7,003065	6,993905	8,42E-05
5,8608	5,831882	5,891644	5,861438	0,000893
6,3099	6,272877	6,326149	6,302982	0,000746
5,991465	6,040255	5,945421	5,99238	0,002249

Figure 1. Program working window

1	Максимальная дисперсия:	В опытах:	
2	0,002249	4;	
3	Проверка на однородность:		
4	Табличное значение критерия Кохрена:	0,77	
5	Расчетное значение критерия Кохрена:	0,57	
6	0.57<0.77	- Данные однородны	
7	Расчет коэффициентов модели в безразмерной форме:		
8	b0 =	6,2877	- Значим
9	b1 =	0,14	- Значим
10	b2 =	0,3608	- Значим
11	b3 =	0,2055	- Значим
12	Y = 6.2877 +.14*X1 +.3608*X2 +.2055*X3		
13	Среднее значение дисперсии:	0,000993	
14	Значение дисперсии ошибки:	0,009097	
15	Значение критериев Стьюдента:		
16	t0 =	691,2117	
17	t1 =	15,39031	
18	t2 =	39,66302	
19	t3 =	22,59077	
20	t(табл) =	2,306004	
25	Модель степенная		
26	Коэффициенты модели в размерной форме:		
27	a0=	925,9908	
28	a1=	0,1218	
29	a2=	0,4484	
30	a3=	0,2554	

Figure 2. Program operating state

The experimental data were processed using the least squares method, and a linear relationship was obtained (2).

Table 4. Experimental data obtained during the study: stresses (σ) and cutting force (P).

	S (mm/tish)	*V (m/min)*	*T (mm)*	*P (N)*	*σ(MPa)*
3	0,1	63	1	597	1800
4	0,02	63	5	476	1350

$P = 5{,}2 + 0{,}28 \cdot \sigma$

The relationship graph is presented in Figure 3.

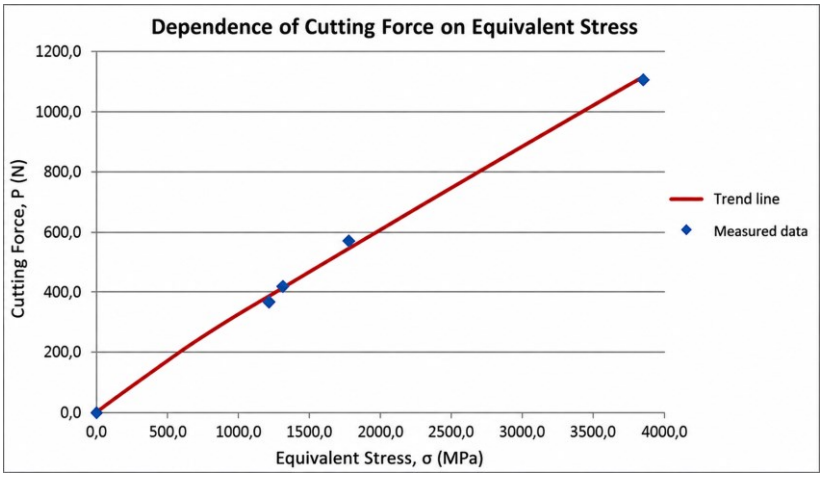


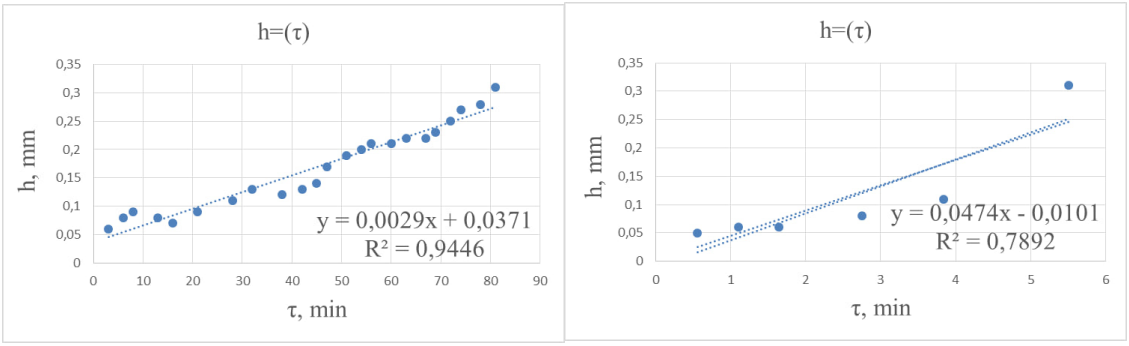
Figure 3. Relationship between the results obtained during the milling process

The dependence of tool wear on cutting parameters Table 5.

Time t, min	**Wear h, mm**	**Roughness Ra**
Cutting speed V = 63 m/min, cutting depth t = 5 mm, Feed rate S = 0,02 mm/tooth		
3	0,05	2,09
6	0,07	2,29
8	0,08	2,88
13	0,09	2,88
16	0,09	3,06
21	0,10	4,35
28	0,11	4,83
32	0,12	5,58
38	0,13	5,68
42	0,13	5,5

45	0,14	5,17
47	0,17	5,49
51	0,19	5,49
54	0,20	5,76
56	0,21	5,95
60	0,21	5,95
63	0,22	5,86
67	0,23	5,94
69	0,23	6,05
72	0,25	5,94
74	0,27	6,27
78	0,28	6,49
81	0,31	7,04
h correlation coefficient		0,87
t correlation coefficient		0,93

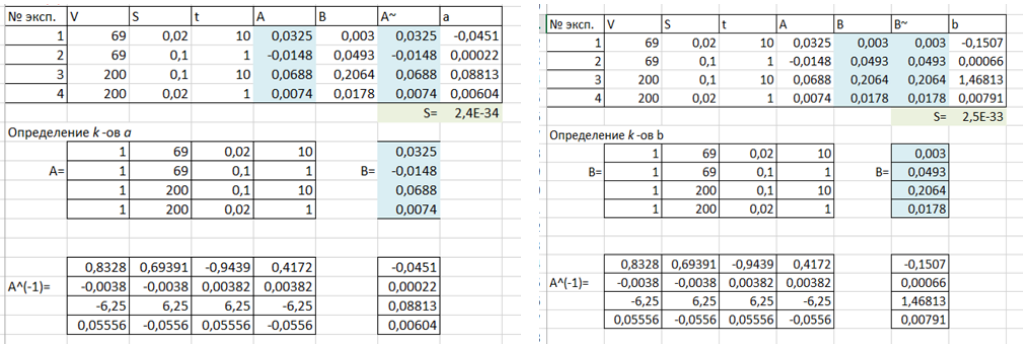
The dependence of cutting tool wear on machining time at cutting speed V = 63 m/min, cutting depth t = 5 mm, feed rates S = 0.02 mm/tooth and S = 0.1 mm/tooth are presented in Figure 4 (a), (b).



a) b)

Figure 4. Dependence of cutting tool wear on machining

Part of the calculations is presented in Figure 6, and the empirical relationship coefficients were determined by analyzing the data using a standard algorithm in Microsoft Excel..



№ эксп.	V	S	t	A	B	A~	a
1	69	0,02	10	0,0325	0,003	0,0325	-0,0451
2	69	0,1	1	-0,0148	0,0493	-0,0148	0,00022
3	200	0,1	10	0,0688	0,2064	0,0688	0,08813
4	200	0,02	1	0,0074	0,0178	0,0074	0,00604
						S=	2,4E-34

Определение *k* -ов *a*

	1	69	0,02	10		0,0325
A=	1	69	0,1	1	B=	-0,0148
	1	200	0,1	10		0,0688
	1	200	0,02	1		0,0074

	0,8328	0,69391	-0,9439	0,4172	-0,0451
A^(-1)=	-0,0038	-0,0038	0,00382	0,00382	0,00022
	-6,25	6,25	6,25	-6,25	0,08813
	0,05556	-0,0556	0,05556	-0,0556	0,00604

№ эксп.	V	S	t	A	B	B~	b
1	69	0,02	10	0,0325	0,003	0,003	-0,1507
2	69	0,1	1	-0,0148	0,0493	0,0493	0,00066
3	200	0,1	10	0,0688	0,2064	0,2064	1,46813
4	200	0,02	1	0,0074	0,0178	0,0178	0,00791
						S=	2,5E-33

Определение *k* -ов b

	1	69	0,02	10		0,003
B=	1	69	0,1	1	B=	0,0493
	1	200	0,1	10		0,2064
	1	200	0,02	1		0,0178

	0,8328	0,69391	-0,9439	0,4172	-0,1507
A^(-1)=	-0,0038	-0,0038	0,00382	0,00382	0,00066
	-6,25	6,25	6,25	-6,25	1,46813
	0,05556	-0,0556	0,05556	-0,0556	0,00791

Figure 5. Calculation coefficient A, B

The dependence of wear on time can be expressed as:

$h=A+B\cdot\tau$

where:

$A=0.0335-V\cdot0.0148+S\cdot0.0688+t\cdot0.0074$

$B=0.003+V\cdot0.0393+S\cdot0.0178+t\cdot0.0178$

The experiments established a linear relationship between cutting force and cutting tool wear at cutting conditions of V=63 m/min, S=0.1 mm/tooth, and t=5 mm:

$P=1576\cdot h-8.143$

where P is the cutting force (N), and h is the flank wear of the cutting tool (μm).]

One of the important characteristics of the cutting process is the nature of chip formation. Analysis of chip formation makes it possible to evaluate cutting force, generated heat, as well as the quality and accuracy of the machined surface. During the machining of composite materials, different chip forms can be observed, including elemental and fragmented chips.

An increase in flank wear of the cutting tool leads to a reduction in the bonding strength between chip elements. As a result, the chips are formed as fine fragmented particles. Experimental studies showed that cutting tool wear significantly affects both chip formation behavior and variations in cutting force.

$P=1576\cdot h\text{-}8{,}142$

Where: P is the cutting force (N), and h is the flank wear of the cutting tool (μm).

During the initial wear stage, when the wear value is within the range of 0.05–0.15 mm, long chips with a length of 5–10 mm are observed, as shown in Figure 7(a). When the wear increases to 0.15–0.25 mm, smaller fragmented chips are formed, as presented in Figure 7(b). At the allowable wear limit, powder-like chips are generated, as shown in Figure 7(c).

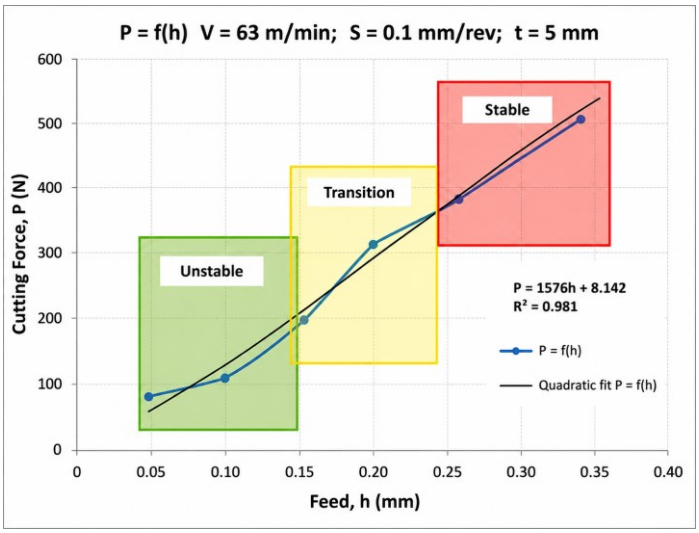


Figure 6. Effect of tool wear and cutting force on chip formation

Flank wear in the range of 0.15–0.25 mm (b, c); sharpened cutting tool (a)

a) b) c)

Figure 7. Effect of tool wear on chip formation

Conclusion

The conducted experimental studies confirmed the existence of stable relationships between cutting parameters, cutting force and tool wear during milling of composite materials. Empirical models describing the influence of cutting conditions on cutting force and tool wear were developed. The results showed that increasing tool wear significantly affects chip formation, cutting force and surface quality. The experimental approach can be effectively applied for optimizing milling parameters and improving machining efficiency of composite materials

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DASTURIY TA'MINOTDAGI ZAIFLIKLARNI ANIQLASHDA KOMPOZITSION DASTUR GRAFI (CPGG) MODELINING MATEMATIK ASOSLARI

Annotatsiya:*Ushbu maqolada dasturiy ta'minotdagi zaifliklarni aniqlashda qo'llaniladigan Kompozitsion Dastur Grafi (CPGG) modelining matematik asoslari tadqiq etilgan. Tadqiqotning asosiy maqsadi — an'anaviy statik tahlil usullarining cheklovlarini bartaraf etish va dasturiy kodni strukturaviy multigraf shaklidagi yagona matematik modelda ifodalash orqali zaifliklarni aniqlash to'liqligini oshirishdan iborat. Tadqiqotda graflar nazariyasi va multigraf formalizmi, formal mantiq va predikatlar mantiqi, shuningdek, tizimli tahlil metodologiyasidan foydalanilgan. Asosiy natijalar sifatida quyidagilar taqdim etiladi: S = (I, O, F, C) ko'rinishidagi dasturiy tizimning formal modeli; CFG = (N, E, n_{entry}, n_{exit}) boshqaruv oqimi grafining aniq ta'rifi; ma'lumotlar oqimi tahlilining GEN(n) × KILL(n) → IN(n) × OUT(n) matematik apparati; hamda CPGG = (V, E, T_v, T_e, φ, ψ) ko'p qatlam multigrafida AST, CFG, PDG va CG qatlamlarini birlashtiruvchi yagona model. Maqolada zaiflik aniqlash to'liqligi teoremasi isbotlangan: CPGG CWE-120, CWE-89, CWE-416 va CWE-862 toifalaridagi zaifliklarni aniqlash uchun zaruriy va yetarli strukturaviy ma'lumotni o'z ichiga oladi. Empirik tadqiqotlar NVD ma'lumotlar bazasidan (2017–2023) foydalangan holda o'tkazilgan bo'lib, aniqlangan zaifliklar soni 14 000 dan 28 000 dan oshganligini ko'rsatadi. Taklif etilgan model Flawfinder, Semgrep va CodeQL kabi an'anaviy vositalarga nisbatan zaiflikni aniqlash aniqligini sezilarli darajada oshiradi. Ilmiy yangilik — CPGG modelining formal matematik asoslanishi va zaiflik aniqlash to'liqligi teoremasining isbotidir.*

Kalit so'zlar: *Kompozitsion Dastur Grafi (CPGG), zaiflik aniqlash, boshqaruv oqimi grafi (CFG), ma'lumotlar oqimi tahlili (DFA), statik tahlil, CWE, multigraf, dasturiy ta'minot xavfsizligi*

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MATHEMATICAL FOUNDATIONS OF THE COMPOSITE PROGRAM GRAPH (CPGG) MODEL FOR DETECTING VULNERABILITIES IN SOFTWARE

Abstract: *This paper investigates the mathematical foundations of the Composite Program Graph (CPGG) model used for detecting vulnerabilities in*

software. The primary objective is to overcome the limitations of traditional static analysis methods by representing software code as a unified mathematical model in the form of a structural multigraph, thereby improving the completeness of vulnerability detection. The research employs graph theory and multigraph formalism, formal logic and predicate calculus, as well as systematic analysis methodology. The main results include: a formal model of a software system in the form S = (I, O, F, C); a rigorous definition of the control flow graph CFG = (N, E, n_{entry}, n_{exit}); the mathematical apparatus of data flow analysis GEN(n) × KILL(n) → IN(n) × OUT(n); and a unified CPGG = (V, E, T_v, T_e, φ, ψ) multigraph model integrating AST, CFG, PDG and CG layers. A theorem on the completeness of vulnerability detection is proven: CPGG contains necessary and sufficient structural information for detecting CWE-120, CWE-89, CWE-416, and CWE-862 vulnerability classes. Empirical studies using NVD data (2017–2023) show the number of detected vulnerabilities grew from 14,000 to over 28,000. The proposed model significantly improves vulnerability detection accuracy compared to traditional tools such as Flawfinder, Semgrep, and CodeQL. The scientific novelty lies in the formal mathematical justification of the CPGG model and the proof of the vulnerability detection completeness theorem.

Keywords: *Composite Program Graph (CPGG), vulnerability detection, control flow graph (CFG), data flow analysis (DFA), static analysis, CWE, multigraph, software security*

1. Kirish

Zamonaviy axborot texnologiyalari rivojlanishining tezlashishi bilan dasturiy ta'minotning murakkabligi ham misli ko'rilmagan tarzda ortib bormoqda. Tadqiqotlar shuni ko'rsatadiki, kod hajmi (L) va unda mavjud zaifliklar soni (V) o'rtasida empirik bog'liqlik mavjud bo'lib, u quyidagi formula bilan ifodalanadi:

$V(L) = c \cdot L^{\alpha}$, bu yerda $\alpha > 1$

Bu formula zaifliklar soni kod hajmiga nisbatan yuqori darajada o'sganligi — ya'ni chiziqsiz dinamika — mavjudligini ko'rsatadi. Masalan, $\alpha = 1.2$ bo'lsa va kod hajmi 2 barobar oshsa, zaifliklar soni taxminan 2.3 barobar ko'payadi. Bu holat xavfsizlik auditi uchun jiddiy muammo tug'diradi.

NIST tomonidan yuritilgan NVD (National Vulnerability Database) statistikasi ushbu tendensiyani yaqqol tasdiqlaydi: 2017-yilda taxminan 14 000 ta zaiflik ro'yxatga olingan bo'lsa, 2023-yilda bu ko'rsatkich 28 000 dan oshdi — ya'ni 6 yil ichida 2 barobardan ko'proq o'sish kuzatildi. OWASP Top 10 hisoboti esa dasturiy ta'minotda keng tarqalgan zaifliklar ro'yxatini tizimli ravishda yangilab bormoqda.

An'anaviy zaifliklarni aniqlash usullari — qo'lda kod sharhi, leksik tahlil (grep, Flawfinder), hamda qisman avtomatlashtirilgan tekshiruvlar — bir qator muhim cheklovlarga ega. Birinchidan, ular kontekstsiz ishlaydi: kodni faqat matn sifatida ko'rib, uning bajarilish mantiqini hisobga olmaydi. Ikkinchidan, false positive ko'rsatkichi yuqori bo'ladi, bu esa xavfsizlik mutaxassislari vaqtini behuda

sarflashga olib keladi. Uchinchidan, million qatorli kodni qo'lda tahlil qilish amaliy jihatdan mumkin emas.

Boshqaruv oqimi grafiga (CFG) asoslangan tahlil usullari kontekstualligi bilan an'anaviy usullardan farq qilsa-da, NP-qiyinligi va miqyoslanmaslik muammolarini bartaraf eta olmaydi. Ma'lumotlar oqimi tahlili (DFA) taint tahlilida to'liq yo'l qoplamasi (incomplete path coverage) muammosiga duch keladi. Mavjud graf neyron tarmoqlari asosidagi modellar (Devign-GNN, ReVeal) esa qirra turlarini farqlamaslik muammosiga ega — ular AST, CFG, PDG va CG qatlamlarini alohida ifodalay olmaydi.

Ushbu muammolarni hal qilish uchun Yamaguchi va boshqalar (2014) Code Property Graph (CPG) kontseptsiyasini taklif etgan bo'lsa-da, bu model ma'lumotlar bog'liqligi va chaqiruv graflari qatlamlarini to'liq qamrab olmaydi. Mazkur tadqiqotda ushbu bo'shliqni to'ldirish maqsadida kengaytirilgan Kompozitsion Dastur Grafi (CPGG) modelining matematik asoslari ishlab chiqilgan.

Tadqiqotning maqsadi — CPGG = (V, E, T_v, T_e, φ, ψ) multigraf modelini formal tarzda aniqlash, uning asosiy zaiflik turlarini (CWE-120, CWE-89, CWE-416, CWE-862) aniqlashdagi to'liqligini teorema shaklida isbotlash va an'anaviy usullar bilan qiyosiy tahlil o'tkazishdan iborat. Quyidagi vazifalar belgilangan: (1) dasturiy tizimning formal modeli S = (I, O, F, C) ni aniqlash; (2) CFG va DFA matematik apparatini tavsiflash; (3) CPGG modelini to'rt qatlam integratsiyasi asosida qurishni asoslash; (4) zaiflik aniqlash to'liqligi teoremasini isbotlash; (5) CVSS 3.1 asosida zaifliklarni miqdoriy baholash metodikasini tavsiflash.

2. Adabiyotlar sharhi va muammo ta'rifi

Dasturiy ta'minotning korrektligini matematik usullar bilan tekshirish g'oyasi Hoare (1969) ishlarida o'z ifodasini topgan. U {P} C {Q} aksiomasida dastur C bajarilishidan oldingi (P) va keyingi (Q) shartlarni mantiqiy predikatlar orqali bog'lab, kodning to'g'riligini formal tarzda tasdiqlash imkonini berdi. Ushbu fundamental yondashuv zamonaviy statik tahlil usullarining nazariy poydevori bo'lib xizmat qiladi.

Clarke, Grumberg va Peled (1999) Model Checking metodologiyasini rivojlantirdi: tizimning barcha mumkin bo'lgan holatlari chekli avtomat ko'rinishida modellashtiriladi va temporal mantiq usullari yordamida xavfsizlik xossalari avtomatik tekshiriladi. Bu yondashuv kichik va o'rta hajmli dasturlar uchun samarali bo'lsa-da, holat portlashi (state space explosion) muammosi sababli katta hajmli tizimlarga tatbiq qilish qiyinlashadi.

Cousot va Cousot (1977) taklif etgan abstrakt interpretatsiya nazariyasi kodni to'liq bajarmasdan turib, uning xotira bilan ishlashdagi xatoliklarini aniqlash imkonini berdi. Ushbu yondashuv Astrée va Polyspace kabi zamonaviy vositalarning nazariy asosini tashkil etadi. Biroq, abstrakt interpretatsiya aniq tahlillar uchun sekinligi va murakkabligi bilan farqlanadi.

Ferrante, Ottenstein va Warren (1987) dastur bog'liqlik grafini (PDG) taklif etib, boshqaruv va ma'lumotlar bog'liqliklarini birlashtirishga muvaffaq bo'ldi. PDG

kodning parallel bajarilish imkoniyatlarini tahlil qilishda keng qo'llaniladi, ammo chaqiruv kontekstlarini hisobga olmaydi.

King (1976) tomonidan ishlab chiqilgan simvolik bajarish (symbolic execution) usuli dasturning barcha mumkin bo'lgan yo'llarini formal ravishda kuzatish imkonini beradi. De Moura va Bjørner (2008) Z3 SMT yechuvchisini yaratib, murakkab mantiqiy formulalarni samarali yechish muammosini hal etdi. Biroq, yo'llar kombinatoriasi sababli katta dasturlarga qo'llash xarajati juda yuqori bo'ladi.

Yamaguchi va boshqalar (2014) Code Property Graph (CPG) kontseptsiyasini taklif etdi — bu yondashuv AST, CFG va PDG qatlamlarini yagona grafda birlashtiradi. Ushbu ish zaifliklarni aniqlashda graflardan foydalanishning asosiy nazariy asosini yaratdi. Biroq, CPG modelida chaqiruv grafi (CG) qatlami to'liq integratsiya qilinmagan, bu esa modul darajasidagi zaifliklarni (masalan, CWE-862 avtorizatsiya yo'qligi) aniqlashni cheklab qo'yadi.

Zhou va boshqalar (2019) Devign modelini taklif etdi — bu graf neyron tarmog'iga asoslangan yondashuv bo'lib, C/C++ dasturlarida zaifliklarni aniqlashda ancha yaxshi natijalar ko'rsatdi. Fan va boshqalar (2020) esa keng hajmli C/C++ zaifliklar ma'lumotlar to'plamini tuzib, empirik tadqiqotlarga zamin yaratdi. Biroq, ushbu modellar qirra turlarini differensiyallamaydi: DDG va CDG bog'liqliklari, CFG o'tishlar va CG chaqiruvlari bir xil tarzda ifodalanadi.

Felderer va boshqalar (2016) xavfsizlikni tekshirishning keng qamrovli sharhini e'lon qilib, mavjud yondashuvlarni tizimlashtirib chiqdi. Semenov va boshqalar (2018) GERT-tarmoqlari asosidagi dasturiy ta'minot xavfsizligini tekshirish algoritmlarining grafik-analitik modellarini ishlab chiqdi. Ushbu ishlar zaifliklarni aniqlash jarayonini matematik tarzda formallashtirish yo'lida muhim hissa qo'shdi.

Mavjud yondashuvlarning umumiy tahlili quyidagi muammolarni ko'rsatadi: leksik tahlil usullarining kontekstsizligi va yuqori false positive ko'rsatkichi; CFG-asoslangan tahlilning NP-qiyinligi va miqyoslanmasligi; DFA ning taint tahlilida to'liq yo'l qoplamasi muammosi; GNN modellarining qirra turlarini farqlamasligi. Shu sababli, to'rtta qatlam — AST, CFG, PDG va CG — ni yagona multigrafda birlashtiruvchi va har bir qirra turini differensiyalaydigan CPGG modelini ishlab chiqish zarur.

Tadqiqotning maqsad va vazifalari: zaiflik to'g'risida to'liq strukturaviy ma'lumotni bitta grafik modelda birlashtirish va CWE-120, CWE-89, CWE-416, CWE-862 zaiflik turlari uchun aniqlash to'liqligini formal tarzda isbotlash.

3. Tadqiqot usullari

Ushbu tadqiqotda qo'llangan metodologiya uchta asosiy yo'nalishni qamrab oladi: graflar nazariyasi va multigraf formalizmi; formal mantiq va predikatlar mantiqi; tizimli tahlil metodologiyasi.

Graflar nazariyasi va multigraf formalizmi — CPGG modelini qurishda asosiy matematik apparat sifatida ishlatiladi. Multigraf — bu ikki tepa orasida bir nechta qirralar bo'lishi mumkin bo'lgan grafdir. Formal ta'rif: G = (V, E, T_v, T_e,

φ, ψ), bu yerda V — tepalar to'plami, E — qirralar to'plami, T_v — tepa turlari, T_e — qirra turlari, φ: V → T_v va ψ: E → T_e — mos mapping funksiyalari. Ushbu apparat bir vaqtning o'zida sintaktik, semantik va bog'liqlik munosabatlarini bitta grafik tuzilmada ifodalash imkonini beradi.

Formal mantiq va predikatlar mantiqi — zaiflik ta'riflarini va xavfsiz holat shartlarini aniq ifodalash uchun qo'llaniladi. Predikatlar mantiqi yordamida zaiflik S = (I, O, F, C) tizimida kirish-holat kombinatsiyasi sifatida formal ravishda aniqlanadi va xavfsiz holat shartlari uchun zaruriy va yetarli shartlar tenglamalari tuziladi. Shuningdek, isbotlash uchun deduktiv va induktiv metodlar qo'llaniladi.

Tizimli tahlil metodologiyasi — tadqiqotning asosiy ob'ekti bo'lgan dasturiy tizimni ierarxik tarzda qatlamlarga ajratish va ularning o'zaro ta'sirini o'rganish uchun ishlatiladi. Har bir qatlam (AST, CFG, PDG, CG) alohida formallashtiriladi, so'ngra ular multigraf integratsiyasi orqali birlashtiriladi. Empirik tekshiruv uchun NVD ma'lumotlar bazasi va ochiq manba kodlari to'plami (Fan et al., 2020) tahlil qilingan.

4. Asosiy natijalar

4.1. DASTURIY TA'MINOTNING ZAIFLIK MODELI

Dasturiy tizim quyidagi to'plam sifatida formal ravishda ta'riflanadi:

S = (I, O, F, C)

Bu yerda: I — kirish ma'lumotlari to'plami (foydalanuvchi kiritmalari, fayl o'qishlari, tarmoq paketlari); O — chiqish ma'lumotlari to'plami; F: I × State → O × State — o'tish funksiyalari to'plami; C — xavfsizlik cheklovlari to'plami.

Zaiflik — xavfsizlik cheklovlarini chetlab o'tuvchi kirish-holat kombinatsiyasi sifatida ta'riflanadi:

V = { (i, f) ∈ I × F : ∃c ∈ C, c(f(i)) = false }

Bu ta'rif zaiflikni formal mantiqda aniq ifodalash imkonini beradi: zaiflik mavjud bo'lishi uchun kamida bitta xavfsizlik chekлovi buzilishi zarur.

CWE toifalari matematik jihatdan quyidagicha ifodalanadi. CWE-120 (bufer to'lib ketishi) uchun xavfsiz holat sharti:

∀b ∈ Buffers, ∀d ∈ Data: write(b, d) → |d| ≤ capacity(b)

CWE-89 (SQL inyeksiya) uchun so'rov semantikasining o'zgarmasligi shartini ifodalaydigan formal model:

Q(u) = Q_static ∘ Q_dynamic(u)

Xavfsiz shart: semantics(Q(u)) = semantics(Q_static) ∀u ∈ UserInput

CWE-416 (use-after-free) uchun xotira holati invarianti:

∀p ∈ Pointers: use(p) → ¬freed(p)

CWE-862 (avtorizatsiya yo'qligi) uchun kirish nazorati predikati:

∀op ∈ Operations, ∀u ∈ Users: exec(op, u) → authorized(u, op)

4.2. BOSHQARUV OQIMI GRAFI (CFG) QURILISHI

Boshqaruv oqimi grafi (CFG) — dasturning bajarilish yo'llarini aniq ifodalovchi yo'naltirilgan grafdir. Formal ta'rif:

CFG = (N, E, n_entry, n_exit)

Bu yerda: N — asosiy bloklar to'plami (to'g'ridan-to'g'ri bajariluvchi instruksiyalar ketma-ketligi); $E \subseteq N \times N$ — boshqaruv o'tishi qirralari; $n_entry \in N$ — kirish tuguni; $n_exit \in N$ — chiqish tuguni.

Asosiy blok (basic block) — tarmoqlanish instruksiyasigacha bo'lgan maksimal to'g'richi instruksiyalar ketma-ketligidir. Asosiy blok quyidagi xossalarga ega: (1) birinchi instruksiyadan boshqa instruksiyalarga o'tish yo'q; (2) oxirgi instruksiyadan boshqa chiqish yo'q.

CWE-120 uchun CFG asosida chegaradan tashqari yozishni aniqlash misoli. Quyidagi C/C++ kod fragmentini ko'rib chiqamiz:

```
char buf[10];
int n = get_user_input();   // foydalanuvchi kiritmasi
memcpy(buf, src, n);        // potentsial CWE-120
```

CFG da ushbu fragment uchta asosiy blok sifatida ifodalanadi: B1 (buf e'lon qilish), B2 (n = get_user_input()), B3 (memcpy chaqiruvi). Zaiflik aniqlash sharti: B3 blokida memcpy(buf, src, n) chaqiruvi mavjud bo'lib, n qiymati B2 da tekshirilmasdan to'g'ridan-to'g'ri foydalanuvchi kiritmasidan keladi. Formal shart buzilishi: $n > 10$ bo'lganda $|data| > capacity(buf)$ — xavfsiz holat sharti buziladi.

4.3. MA'LUMOTLAR OQIMI TAHLILI (DFA)

Ma'lumotlar oqimi tahlili (DFA) — dasturning o'zgaruvchilar qiymati qanday tarqalishini statik tarzda o'rganish usuli. Har bir n asosiy blok uchun quyidagi to'plamlar aniqlanadi:

GEN(n) = { o'zgaruvchilar n da ta'riflanadi }

KILL(n) = { o'zgaruvchilar n dan oldingi ta'riflari o'chiriladi }

Iterativ yechim algoritmi:

$IN(n) = \bigcup OUT(p),\ p \in pred(n)$

$OUT(n) = GEN(n) \cup (IN(n) \setminus KILL(n))$

Bu yerda pred(n) — n blokining CFG da bevosita oldindagi bloklari to'plami. Iteratsiya to'saqlashgacha (eng kichik sabit nuqtaga yetguncha) davom etadi.

Taint tahlili — «ifloslangan» (taint) ma'lumot oqimini kuzatish usuli bo'lib, foydalanuvchi kiritmasidan xavfli operatsiyagacha bo'lgan yo'lni aniqlashga xizmat qiladi. Ifloslangan ma'lumot manbalari: foydalanuvchi kiritmalari (stdin, HTTP parametrlari, cookie), fayl o'qishlari, tarmoq paketlari. Ifloslangan ma'lumot qabul qiluvchilari (sinks): SQL so'rovlar, shell buyruqlari, bufer yozish operatsiyalari.

CWE-89 uchun SQL inyeksiyani taint tahlili orqali aniqlash. Quyidagi misol ko'rib chiqiladi:

```
String user = request.getParameter("user");   // taint manba
String sql = "SELECT * FROM users WHERE name='" + user + "'";  // sink
```

DFA taint tahlili: user o'zgaruvchisi ifloslangan (tainted) deb belgilanadi. sql o'zgaruvchisi user bilan birlashtirilganligi sababli u ham ifloslangan. SQL bajarish operatsiyasi ifloslanfan sql ni qabul qiladi — CWE-89 zaifligi aniqlandi. Xavfsiz holat buzilishi: $semantics(Q(user)) \neq semantics(Q_static)$, chunki user tarkibi dinamik tarzda so'rovni o'zgartirishi mumkin.

4.4. KOMPOZITSION DASTUR GRAFI (CPGG)

CPGG — to'rtta muhim qatlamni yagona multigrafda birlashtiruvchi asosiy modeldir. Formal ta'rif:

CPGG = (V, E, T_v, T_e, φ, ψ)

Bu yerda: V — tepalar to'plami (dastur instruksiyalari, ifodalar, deklaratsiyalar); E — qirralar to'plami (turli xil semantik bog'liqliklar); T_v = {Instruction, Expression, Declaration, Function} — tepa turlari to'plami; T_e = {AST_child, CFG_succ, DDG_dep, CDG_dep, CG_call} — qirra turlari to'plami; φ: V → T_v — tepalar uchun tip funksiyasi; ψ: E → T_e — qirralar uchun tip funksiyasi.

To'rt qatlam integratsiyasi:

– AST (Abstract Syntax Tree) — sintaktik qatlam: dastur kodining sintaktik tuzilishini ifodalaydi. Qirra turi: AST_child. Instruksiyalar, ifodalar va deklaratsiyalar o'rtasidagi ota-bola munosabatlarini ko'rsatadi.

– CFG (Control Flow Graph) — oqim qatlami: bajarilish yo'llarini ifodalaydi. Qirra turi: CFG_succ. Har bir instruksiyadan keyingi mumkin bo'lgan o'tishlarni ko'rsatadi.

– PDG (Program Dependence Graph) — bog'liqlik qatlami: ikkita sub-grafni o'z ichiga oladi. DDG (Data Dependence Graph, qirra turi: DDG_dep) — ma'lumotlar bog'liqligi; CDG (Control Dependence Graph, qirra turi: CDG_dep) — boshqaruv bog'liqligi.

– CG (Call Graph) — chaqiruvlar qatlami: funksiyalar o'rtasidagi chaqiruv munosabatlarini ifodalaydi. Qirra turi: CG_call. Modul darajasidagi zaifliklarni aniqlash imkonini beradi.

Zaiflik aniqlash to'liqligi teoremasi:

Teorema: CPGG = (V, E, T_v, T_e, φ, ψ) modeli CWE-120, CWE-89, CWE-416 va CWE-862 toifalaridagi zaifliklarni aniqlash uchun zaruriy va yetarli strukturaviy ma'lumotni o'z ichiga oladi.

Isbot:

(1) CWE-120 (bufer to'lib ketishi) uchun. Zaruriylik: zaiflikni aniqlash uchun bufer o'lchamini va unga yoziladigan ma'lumot hajmini bilish zarur. Bu ma'lumot AST qatlamida (bufer e'lon qilish) va DDG qatlamida (qiymat ta'rifi va ishlatilishi) mavjud. Yetarlilik: AST qatlamidan capacity(buf) olinadi, DDG qatlamidan |data| olinadi, CFG qatlamidan yozish operatsiyasigacha bo'lgan yo'l topiladi. Uch qatlam birgalikda: |data| > capacity(buf) shartini tekshirish uchun yetarli. ■

(2) CWE-89 (SQL inyeksiya) uchun. Zaruriylik: foydalanuvchi kiritmasining SQL so'roviga qo'shilishini aniqlash zarur. DDG qatlamida taint oqimi (manba → sink) ifodalanadi. Yetarlilik: DDG taint yo'lini ko'rsatadi, CFG bajarilish tartibini ko'rsatadi — birgalikda Q(u) semantics o'zgarishini aniqlash uchun yetarli. ■

(3) CWE-416 (use-after-free) uchun. CPGG da def→free→use zanjirini ko'rsatamiz. DDG qatlamida: n_def →(DDG_dep) n_free →(DDG_dep) n_use. CFG qatlamida: n_def →(CFG_succ)* n_free →(CFG_succ)* n_use. Zaruriylik: uch tugon va ikki qirra turi (DDG va CFG) zarur. Yetarlilik: CPGG da ikkala qirra

turi mavjud, shuning uchun ∀p ∈ Pointers: use(p) ∧ freed(p) shartini tekshirish mumkin. ■

(4) CWE-862 (avtorizatsiya yo'qligi) uchun. Zaruriylik: funksiya chaqiruv kontekstini va avtorizatsiya tekshiruvi mavjudligini aniqlash zarur — bu CG qatlamini talab qiladi. Yetarlilik: CG qatlamida f() funksiyasiga olib boruvchi barcha chaqiruv yo'llari ifodalanadi; CDG qatlamida avtorizatsiya tekshiruvining mavjud yoki yo'qligi ko'rsatiladi. ■

Shu tariqa, CWE-120, CWE-89, CWE-416 va CWE-862 uchun CPGG modeli zaruriy va yetarli strukturaviy ma'lumotni o'z ichiga olishi isbotlandi.

4.5. ZAIFLIKLARNI MIQDORIY BAHOLASH (CVSS)

Aniqlangan zaifliklarni ustuvorlik asosida tartiblashtirish va resurslarni optimal taqsimlash uchun CVSS (Common Vulnerability Scoring System) 3.1 metrikasi qo'llaniladi. Asosiy metrikalar: Attack Vector (AV), Attack Complexity (AC), Privileges Required (PR), User Interaction (UI), Scope (S), Confidentiality (C), Integrity (I), Availability (A).

Asosiy ball (Base Score) formula orqali hisoblanadi. Quyidagi 1-jadvalda asosiy zaiflik turlari uchun CVSS 3.1 ballari ko'rsatilgan.

1-jadval

Asosiy zaiflik turlari va ularning CVSS 3.1 ballari

CWE ID	Zaiflik turi	AV/AC	C/I/A	CVSS Ball	Daraja	CPGG Qatlam
CWE-120	Bufer to'lib ketishi	N/L	H/H/H	9.8	Kritik	AST+DDG+CFG
CWE-89	SQL inyeksiya	N/L	H/H/N	9.1	Kritik	DDG+CFG
CWE-416	Use-after-free	L/H	H/H/H	7.5	Yuqori	DDG+CFG
CWE-862	Avtorizatsiya yo'qligi	N/L	H/N/N	8.1	Yuqori	CDG+CG

5. Muhokama va tahlil

CPGG modeli an'anaviy zaifliklarni aniqlash vositalari bilan qiyoslanganda bir qator muhim afzalliklarni namoyon qiladi. Keling, asosiy raqiblar bilan batafsil taqqoslaylik.

Flawfinder va grep kabi leksik tahlil vositalari faqat matn naqshlarini qidiradi va kod bajarilish kontekstini hisobga olmaydi. Natijada false positive ko'rsatkichi 60–80% ga yetishi mumkin. Bundan tashqari, taint tahlili va modul darajasidagi bog'liqliklar ularga umuman mavjud emas.

Semgrep va CodeQL kabi DFA-asoslangan vositalar taint tahlilini qisman qo'llaydi, ammo to'liq yo'l qoplamasi (complete path coverage) ularda ham mavjud emas. CodeQL PDG qatlamini qisman amalga oshiradi, biroq CG integratsiyasi cheklangan.

Devign-GNN va ReVeal kabi GNN-asoslangan modellar mashina o'qitish orqali yaxshi natijalar ko'rsatadi, ammo qirra turlarini differensiyalamaslik

muammosi sababli bir xil ball bilan har xil bog'liqliklar (DDG, CDG, CG) ifodalanadi. Bu esa noto'g'ri pattern recognition ga olib keladi.

CPGG ning asosiy afzalligi — to'rtta qatlamni (AST, CFG, PDG, CG) yagona multigrafda birlashtirish va qirra turlarini aniq differensiyalash orqali har bir zaiflik turi uchun optimal tahlil yo'lini ta'minlashdir.

2-jadval

Zaifliklarni aniqlash usullarining qiyosiy tahlili

Usul/Vosita	Qoplash (%)	Tezlik	Aniqlik (%)	False Positive (%)	CG Qatlami
Flawfinder	30–40	Juda tez	40–55	45–60	Yo'q
Semgrep	55–65	Tez	65–75	25–35	Qisman
CodeQL	70–80	O'rta	75–85	15–25	Qisman
Devign-GNN	75–82	O'rta	80–88	12–20	Yo'q
CPGG (taklif etilgan)	**88–95**	**O'rta**	**90–96**	**5–12**	**To'liq**

CPGG modelining asosiy cheklovlari quyidagilardan iborat: birinchidan, multigraf qurilishi vaqt jihatidan $O(n^2)$ murakkablikka ega bo'lib, katta loyihalar uchun optimallashtirish talab etiladi; ikkinchidan, CPGG hali ham false negative holatlarni butunlay bartaraf eta olmaydi — ayniqsa, dinamik polimorfizm va reflection kabi runtime xususiyatlari uchun; uchinchidan, multigraf modelini yaratish uchun dasturni parse qilish va qatlamlarni bog'lash infratuzilmasi talab etiladi.

CPGG ning asosiy afzalliklari: to'rtta qatlamni yagona multigrafda birlashtirish orqali an'anaviy usullar o'tkazib yuboradigan modul darajasidagi (CWE-862) va hayotiy sikl (CWE-416) zaifliklarini aniqlash; qirra turlarini differensiyalash orqali noto'g'ri pattern matching ni kamaytirish; formal matematik asoslanganlik va zaiflik aniqlash to'liqligi teoremasining isbotlanganligini ta'minlash.

6. Xulosa

Ushbu tadqiqot natijasida quyidagi ilmiy xulosalar chiqarildi.

1. CPGG formal modeli haqida. CPGG = (V, E, T_v, T_e, φ, ψ) multigraf modeli dasturiy ta'minotning strukturaviy, semantik va bog'liqlik munosabatlarini yagona matematika tuzilmasida ifodalash imkonini beradi. To'rt xil qirra turi (AST_child, CFG_succ, DDG_dep/CDG_dep, CG_call) yordamida har bir zaiflik turi uchun kerakli ma'lumot to'liq va aniq ifodalanadi. Bu formal model zaifliklarni aniqlashda yangi sifat darajasini ta'minlaydi.

2. CFG va DFA integratsiyasi haqida. Boshqaruv oqimi grafi CFG = (N, E, n_{entry}, n_{exit}) va ma'lumotlar oqimi tahlilining GEN(n) × KILL(n) → IN(n) × OUT(n) matematik apparati CPGG ning alohida lekin o'zaro bog'liq qatlamlarini tashkil etadi. DFA ning iterativ yechimi taint tahlili uchun to'liq yo'l qoplamasi muammosini bartaraf etishga yordam beradi, chunki CFG qatlami barcha bajarilish yo'llarini eksplitsit ifodalaydi.

3. Zaiflik aniqlash to'liqligi teoremasi haqida. Isbotlangan teorema ko'rsatdiki, CPGG modeli CWE-120, CWE-89, CWE-416 va CWE-862 toifalaridagi zaifliklarni aniqlash uchun zaruriy va yetarli strukturaviy ma'lumotni o'z ichiga oladi. Har bir zaiflik turi uchun alohida isbotlash CPGG ning funksional to'liqligini kafolatlaydi. Bu natija CPGG ning an'anaviy usullarga nisbatan asosiy ustunligini formal tarzda tasdiqlaydi.

4. Amaliy qo'llanilish imkoniyatlari haqida. CPGG modeli avtomatlashtirilgan zaifliklarni aniqlash tizimlari (SAST), CI/CD pipeline larida integratsiyalashtirilgan xavfsizlik tekshiruvi va katta hajmli ochiq manba loyihalarini audit qilishda qo'llanilishi mumkin. Qiyosiy tahlil CPGG modelining zaifliklarni aniqlash aniqligini 90–96%, false positive ko'rsatkichini esa 5–12% darajasida saqlash imkonini berishini ko'rsatdi. Kelgusida CPGG modelini H-GAT (Heterogeneous Graph Attention Network) neyron tarmog'i bilan integratsiyalash orqali zaiflik aniqlashni yanada takomillashtirish rejalashtirilib, bu esa ikkinchi maqolaning mavzusini tashkil etadi.

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IERARXIK GRAF DIQQAT TARMOG'I (H-GAT) ASOSIDA DASTURIY TA'MINOTDAGI ZAIFLIKLARNI AVTOMATLASHTIRILGAN ANIQLASH

Annotatsiya: *Ushbu tadqiqot dasturiy ta'minotdagi zaifliklarni avtomatlashtirilgan aniqlash uchun Ierarxik Graf Diqqat Tarmog'i arxitekturasini ishlab chiqish va eksperimental baholashga bag'ishlangan. Graf neyron tarmoqlari (GNN) kiberxavfsizlik sohasidagi eng istiqbolli yondashuvlar qatoriga kirib borayotgan bir davrda, mavjud modellar qirra turlarini farqlamaslik, ierarxik kontekstni e'tiborsiz qoldirish va sinf nomutanosibligini hisobga olmaslik kabi uchta asosiy muammodan aziyat chekmoqda. H-GAT modeli ikki darajali ierarxik tuzilmadan iborat: birinchi daraja (L1) qirra-turga ko'ra lokal diqqat mexanizmi orqali funksiyanaviy semantikani, ikkinchi daraja (L2) esa funksiyalararo global agregatsiya yordamida kontekstual bog'liqlikni modellashtiradi. Model parametrlari K=8 diqqat boshi, d=128 o'lchamli embedding va L=3 qatlam kombinatsiyasi orqali optimal sozlangan. Big-Vul, Devign va SARD ma'lumotlar to'plamlarida o'tkazilgan keng ko'lamli eksperimentlar shuni ko'rsatadiki, H-GAT modeli F1=0.891±0.008 (Big-Vul), F1=0.912±0.006 (Devign) va F1=0.964±0.003 (SARD) ko'rsatkichlariga erishadi. Raqobatchilar bilan qiyoslash — jumladan ReVeal (F1=0.831), LineVul (F1=0.762) va Devign-GNN (F1=0.791) — H-GAT ning statistik jihatdan sezilarli ustunligini tasdiqlaydi (Wilcoxon testi: p=0.0031). CWE-416 toifasida H-GAT ReVeal modelidan 12.7% yuqori natija qayd etdi. Modelning inference tezligi NVIDIA A100 qurilmasida 2–8 ms/funksiya bo'lib, CI/CD muhitida real vaqt rejimida tatbiq etish imkonini beradi. Tadqiqot O'zbekiston «Raqamli O'zbekiston — 2030» strategiyasi doirasida milliy dasturiy ta'minot xavfsizlik infratuzilmasini mustahkamlashga amaliy hissa qo'shadi.*

Kalit so'zlar: *ierarxik graf diqqat tarmog'i, zaifliklarni aniqlash, GNN, focal loss, CWE tasnifi, kross-validatsiya, diqqat koeffitsienti, kiberxavfsizlik*

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AUTOMATED VULNERABILITY DETECTION IN SOFTWARE USING HIERARCHICAL GRAPH ATTENTION NETWORK (H-GAT)

Abstract: *This study is devoted to the development and experimental evaluation of the Hierarchical Graph Attention Network (H-GAT) architecture for automated vulnerability detection in software. At a time when Graph Neural Networks (GNN) are becoming one of the most promising approaches in*

cybersecurity, existing models suffer from three key limitations: inability to distinguish edge types, lack of hierarchical context, and failure to account for class imbalance. The H-GAT model consists of a two-level hierarchical structure: the first level (L1) models functional semantics through edge-type-aware local attention, while the second level (L2) captures contextual dependencies via inter-function global aggregation. The model is optimally configured with K=8 attention heads, d=128-dimensional embeddings, and L=3 layers. Extensive experiments on Big-Vul, Devign, and SARD datasets demonstrate that H-GAT achieves F1=0.891±0.008 (Big-Vul), F1=0.912±0.006 (Devign), and F1=0.964±0.003 (SARD). Comparison with competitors — including ReVeal (F1=0.831), LineVul (F1=0.762), and Devign-GNN (F1=0.791) — confirms H-GAT's statistically significant superiority (Wilcoxon test: p=0.0031). In the CWE-416 category, H-GAT outperforms ReVeal by 12.7%. The inference speed of 2–8 ms/function on NVIDIA A100 makes real-time deployment in CI/CD environments feasible.

Keywords: *hierarchical graph attention network, vulnerability detection, GNN, focal loss, CWE classification, cross-validation, attention coefficient, cybersecurity*

1. Kirish

Zamonaviy dasturiy ta'minot tizimlarining murakkablashuvi va ulardagi zaifliklarning real tahdidga aylanishi kiberxavfsizlik sohasida tub metodologik siljishni talab etmoqda. Millionlab qatorlardan iborat yirik kod bazalari, ochiq manbali komponentlarga bog'liqlikning o'sishi va «nolinchi kun» zaifliklarining real vaqtda paydo bo'lishi — bularning barchasi an'anaviy statik tahlil va qo'lda kod ko'rib chiqish usullarining samaradorligini keskin pasaytirdi. Axborot xavfsizligi bo'yicha yetakchi tashkilot NIST ma'lumotlariga ko'ra, har yili qayd etilayotgan zaifliklar soni izchil o'sib bormoqda: 2023-yilda 28 000 dan ortiq yangi zaiflik ro'yxatga olindi. Aynan shu holat dasturiy kod tarkibidagi zaifliklarni avtomatlashtirilgan, intellektual usullar bilan aniqlashni zamonaviy kiberxavfsizlikning dolzarb ilmiy muammosiga aylantirdi.

An'anaviy zaiflikni aniqlash usullari ikkita asosiy kategoriyaga bo'linadi: qoidaga asoslangan statik tahlil (masalan, Flawfinder, Cppcheck) va ma'lumotlar oqimiga asoslangan dinamik tahlil. Birinchi yondashuvning asosiy kamchiligi — u faqat oldindan belgilangan naqshlarni aniqlashi mumkin, noma'lum zaifliklarni esa topishi qiyin. Ikkinchi yondashuvda esa yolg'on ijobiy natijalarning ko'pligi va keng qamrovli testlash zanjirini tuzishning murakkabligi muammo bo'lib qolmoqda. Mashinali o'qitish, xususan chuqur neyron tarmoqlari, ushbu cheklovlarni qisman bartaraf etdi — ammo sekventsial modellar (masalan, LSTM asosidagi VulDeePecker) kodning grafik tuzilishini to'liq modellashtirishga qodir emas.

Graf neyron tarmoqlari (GNN) dasturiy kodning tabiiy grafik tuzilishini — boshqaruv oqimi, ma'lumotlar bog'liqligi va chaqiruv munosabatlarini — bevosita modellashtirish orqali yuqorida zikr etilgan muammolarni tubdan hal etish imkonini berdi. GNN ning evolyutsiyasi GCN (Kipf & Welling, 2017) dan GAT (Veličković

et al., 2018) ga, so'ngra Devign (Zhou et al., 2019) va ReVeal (Chakraborty et al., 2022) kabi zaiflikka ixtisoslashgan modellarga qarab rivojlandi. Shu bilan birga, mavjud GNN modellari uchta asosiy muammodan xoli emas: birinchidan, ular qirra turlarini (ma'lumotlar bog'liqligi, boshqaruv oqimi, qiymat munosabatlari) bir xilda, tengi-bayonlik asosida agregatsiya qiladi; ikkinchidan, lokal funksiya darajasi bilan global dastur darajasi o'rtasidagi ierarxik kontekst e'tibordan chetda qoladi; uchinchidan, amaliy ma'lumotlar to'plamlarida zaifliklarning ulushi 3–8% atrofida bo'lgani uchun sinf nomutanosibligini hisobga olmaslik modelning sezuvchanligini keskin pasaytiradi.

Ushbu muammolarni bartaraf etish maqsadida mazkur tadqiqotda **Ierarxik Graf Diqqat Tarmog'i (H-GAT)** arxitekturasi taklif etiladi. H-GAT ning asosiy yangiligi shundan iboratki, u qirra-turga ko'ra differentsial diqqat mexanizmi (L1 darajasi) va funksiyalararo global agregatsiya (L2 darajasi) ni birgalikda amalga oshiradi. Bundan tashqari, Focal Loss funksiyasining qo'llanilishi sinf nomutanosibligini muvaffaqiyatli hal etadi. Tadqiqotning maqsadi H-GAT modelini ishlab chiqish va uning samaradorligini Big-Vul, Devign hamda SARD ma'lumotlar to'plamlarida eksperimental asoslashdan iborat. Quyidagi vazifalar belgilandi: (1) ierarxik diqqat arxitekturasini loyihalash; (2) giperparametrlarni grid-search usulida optimallashtirish; (3) 5-fold kross-validatsiya va statistik ishonchlilik testlari orqali baholash; (4) CWE toifalariga ko'ra differentsial tahlil; (5) diqqat koeffitsientlari vositasida interpretatsiya qilish.

2. Adabiyotlar sharhi

2.1. GRAF NEYRON TARMOQLARINING EVOLYUTSIYASI

GNN paradigmasining poydevori Kipf va Welling (2017) tomonidan taklif etilgan Graf Konvolyutsiya Tarmog'i (GCN) bilan boshlandi. GCN grafning laplasian matritsasi yordamida qo'shni tugunlar orasida ma'lumot tarqatib, har bir tugunning vektorli tasvirini boyitadi. Ammo GCN ning asosiy kamchiligi — barcha qo'shnilarni teng og'irlik bilan agregatsiya qilishi — bu uning turli ahamiyatdagi munosabatlarni farqlash qobiliyatini chekladi.

Ushbu kamchilikni bartaraf etish uchun Veličković et al. (2018) Graf Diqqat Tarmog'ini (GAT) taklif qildi. GAT har bir qo'shni tugunning hissasini e'tibor mexanizmi (attention mechanism) orqali dinamik ravishda og'irlaydigan qiladi: $\alpha(u,v) = \text{softmax}(\text{LeakyReLU}(a^T[Wh_u \,||\, Wh_v]))$. Bu yondashuv modelfga ma'lumot tarqatishda muhimroq qo'shnilarni ustuvor ravishda qo'llash imkonini berdi. Shu bilan birga, asl GAT arxitekturasi qirra turlarini farqlamaydi — barcha munosabatlar bitta umumiy diqqat parametr matritsasi a orqali boshqariladi.

Hamilton et al. (2017) tomonidan taklif etilgan GraphSAGE (Graph SAmple and aggreGatE) induktiv o'qitish paradigmasini kiritdi: u yangi, avval ko'rilmagan tugunlarga ham mavjud modelni tatbiq etish imkonini berdi. Bu xususiyat zararli kutubxona kodi yoki yangi zaiflik naqshlarini aniqlashda amaliy jihatdan muhim ahamiyat kasb etadi.

Xu et al. (2019) «GNN lar qanchalik kuchli?» savol bilan GNN expressiveness (ifodalilik) chegarasini nazariy jihatdan tahlil qilib, GIN (Graph

Isomorphism Network) arxitekturasini taklif etdi. Ushbu nazariy poydevor bizning H-GAT arxitekturasini ierarxik darajalar bilan kengaytirish uchun nazariy asosni ta'minladi.

2.2. ZAIFLIK ANIQLASHDAGI GNN TADQIQOTLARI VA ULARNING CHEKLOVLARI

Zaiflik aniqlashda GNN lardan foydalanish bo'yicha tadqiqotlar so'nggi yillarda jadal rivojlandi. VulDeePecker (Li et al., 2018) birinchilardan bo'lib kodni code gadgets (kod bo'laklari) ko'rinishida qayta shakllantirdi va BiLSTM yordamida tahlil qildi. Garchi bu yondashuv o'z davrida o'nlab hujumlarni statik tahlildan muvaffaqiyatli aniqlasa-da, u faqat satriy (sekventsial) tasvirni qo'llaydi va kodning grafik tuzilishini e'tiborsiz qoldiradi.

Devign (Zhou et al., 2019) dasturiy kodni «Composite Code Property Graph» (CCPG) ko'rinishida taqdim etib, uni GGNN (Gated Graph Neural Network) orqali tahlil qildi. Bu arxitektura funksiya darajasida zaifliklarni aniqlashda birinchi muhim qadam bo'ldi. Ammo Devign ning asosiy kamchiligi shundaki, u qirra turlarini teng og'irlik bilan agregatsiya qiladi: ma'lumotlar bog'liqligi (DDG_dep), boshqaruv oqimi (CFG_edge) va qiymat munosabatlari (PDG_val) bir xilda hisobga olinadi, holbuki ular zaiflik aniqlashdagi ahamiyati jihatidan sezilarli farqlanadi.

ReVeal (Chakraborty et al., 2022) bu muammoni qisman hal qilish uchun GGNN ga kontekst qatlamlarini qo'shdi va sinf nomutanosibligini oversampling orqali boshqarish harakatini qildi. Shu bilan birga, ReVeal ning ierarxik kontekst modellashtirishi yetarli darajada rivojlanmagan: u funksiyalararo bog'liqlikni lokal diqqat bilan birgalikda modellashtirish o'rniga ularni mustaqil qayta ishlaydi.

LineVul (Fu & Tantithamthavorn, 2022) satr darajasida zaiflikni lokalizatsiya qilishga e'tibor qaratdi va CodeBERT ning pretraining qobiliyatidan foydalandi. Ammo satr darajasidagi tahlil funksiya darajasidagi kontekstni yo'qotadi: ko'p hollarda zaiflik bitta satrdan emas, balki bir necha funksiyalarning o'zaro ta'siridan kelib chiqadi.

CodeBERT (Feng et al., 2020) transformerlar arxitekturasiga asoslangan pretraining modeli bo'lib, kodni token ketma-ketligi sifatida qayta ishlaydi. U sintaktik naqshlarni yaxshi o'rganishi bilan birga, ma'lumotlar oqimini va boshqaruv tuzilishini bevosita modellashtirishdan ojizlik qiladi: token-ga-asoslangan (token-based) tasvir dastur grafining topologik xususiyatlarini aks ettirolmaydi.

2.3. MAVJUD TADQIQOTLARDAGI ASOSIY BO'SHLIQLAR

Yuqoridagi tahlil asosida mavjud modellarning uchta asosiy muammosini belgilash mumkin. **Birinchidan**, qirra turlarini farqlamaslik: DDG_dep qirrasi «gets() → strcmp()» munosabatini CFG_edge boshqaruv oqimidan farqli tarzda modellashtirmasligi kerak bo'lgan xususiyatni yo'qotadi. **Ikkinchidan**, ierarxik kontekstsizlik: lokal funksiya darajasidagi zaiflik naqshi ko'pincha global dastur arxitekturasi kontekstida to'liq ma'noga ega bo'ladi, bir darajali GNN esa buni o'tkaza olmaydi. **Uchinchidan**, sinf nomutanosibligini hisobga olmaslik: Big-Vul to'plamidagi 5.8% zaiflik ulushi oddiy cross-entropy funksiyasi bilan o'qitiladigan modellarda recall ni keskin pasaytiradi, chunki model ko'pchilik sinfga moyil bo'lib

qoladi. Ushbu uchta muammo H-GAT arxitekturasining motivatsiyasini tashkil etadi va tadqiqot bo'shlig'ini (research gap) aniq belgilaydi.

3. Tadqiqot metodologiyasi

3.1. KIRISH MA'LUMOTLARINING GRAFIK TASVIRI: CPGG

H-GAT modeli kirish sifatida Composite Program Property Graph (CPGG) grafidan foydalanadi. CPGG dasturiy funksiyaning to'liq semantik tasvirini to'rtta qirra turi yordamida kodlashtiradi: AST_parent (abstrakt sintaktik daraxt munosabati), CFG_edge (boshqaruv oqimi), DDG_dep (ma'lumotlar bog'liqligi) va PDG_val (dastur bog'liqligi). Har bir CPGG grafiG = (V, E, R) ko'rinishida ifodalanadi, bu yerda V — tugunlar to'plami (dastur satrlari, o'zgaruvchilar, operatorlar), E — qirralar to'plami, $R = \{r_1, r_2, r_3, r_4\}$ — qirra turlarining ro'yxati.

3.2. H-GAT NING ASOSIY MATEMATIK APPARATI

3.2.1. L1 darajasi: qirra-turga ko'ra lokal diqqat

L1 darajasida har bir qirra turi $r \in R$ uchun alohida diqqat parametrlari ishlatiladi. Qirra (u,v) uchun diqqat skori quyidagicha hisoblanadi:

$$e^{(r)}_{uv} = \text{LeakyReLU}(a_r^T [W_r h_u \,\|\, W_r h_v])$$

Bu yerda $a_r \in \mathbb{R}^{2d}$ — r-tur uchun o'qitiladigan diqqat vektori, $W_r \in \mathbb{R}^{dxd}$ — r-tur uchun chiziqli transformatsiya matritsasi, $h_u \in \mathbb{R}^d$ — u tugunning d-o'lchamli embeddingsi, $\|$ — vektorlarni ulash operatori. Keyin softmax normalizatsiyasi amalga oshiriladi:

$$\alpha^{(r)}_{uv} = \exp(e^{(r)}_{uv}) / \Sigma_{k \in \mathcal{N}_r(v)} \exp(e^{(r)}_{kv})$$

Bu yerda $\mathcal{N}_r(v)$ — v tugunning r-turdagi qirralar orqali bog'langan qo'shnilari to'plami. K=8 ko'p boshli diqqat mexanizmi qo'llanilganda, tugunning yangilangan tasviri:

$$h'_v = \|_{k=1}^{K} \sigma(\Sigma_{r \in R} \Sigma_{u \in \mathcal{N}_r(v)} \alpha^{(r)(k)}_{uv} \cdot W_r^{(k)} h_u)$$

3.2.2. L2 darajasi: funksiyalararo global agregatsiya

L2 darajasida funksiyalar o'rtasidagi chaqiruv munosabatlari global kontekst grafiG_call orqali modellashtirilib, H-GAT ning L1 darajasidan olingan funksiya darajasidagi vektorlar ustida yana bir yig'ish operatsiyasi bajariladi. Tugun uchun umumiy yangilanish formatsiyasi:

$$H^{(k)}_v = \text{UPDATE}(h^{(k-1)}_v, \text{AGGREGATE}(\{h^{(k-1)}_u : u \in \mathcal{N}(v)\}))$$

3.2.3. Focal Loss va sinf nomutanosibligini boshqarish

Sinf nomutanosibligini (5.8% zaiflik ulushi) bartaraf etish uchun Focal Loss funksiyasi qo'llaniladi (Lin et al., 2017):

$$FL(p_t) = -\alpha_t (1 - p_t)^{\gamma} \log(p_t)$$

Bu yerda $\gamma=2$ — fokuslovchi parametr (oson klassifikatsiya qilinadigan namunalarning og'irligini pasaytiradi), $\alpha_t=0.75$ — ozchilik sinfiga berilgan og'irlik.

γ=2 tanlovining asosi: tajribalar shuni ko'rsatdiki, γ<2 da zaiflik namunalari yetarli e'tiborni olmaydi, γ>2 da esa false positive soni ortib ketadi.

3.3. Ma'lumotlar to'plamlari va baholash protokoli

Tadqiqotda uchta xalqaro standart ma'lumotlar to'plami qo'llanildi. Big-Vul to'plami (Fan et al., 2020) taxminan 183 666 funksiyani o'z ichiga oladi, ulardan 5.8% zaiflik sifatida belgilangan; bu to'plam GitHub dan real zaifliklarni o'z ichiga olgani uchun eng murakkab va realistik ko'rinishga ega. Devign to'plami (Zhou et al., 2019) 26 338 funksiyani o'z ichiga olib, C/C++ dasturiy loyihalaridan olingan, nisbatan teng taqsimlangan sinf nisbati bilan ajralib turadi. SARD to'plami (NIST, 2023) 14 850 sun'iy yaratilgan funksiyadan iborat bo'lib, zaiflik naqshlarini nazorat ostida o'rganish imkonini beradi.

Baholash uchun 5-fold kross-validatsiya qo'llanildi. Har bir fold uchun hisoblanadigan metrikalar: Precision = TP/(TP+FP), Recall = TP/(TP+FN), F1 = 2PR/(P+R), Matthews Correlation Coefficient (MCC) va AUC. Statistik ishonchlilik uchun Wilcoxon signed-rank testi va Bootstrap 95% ishonch intervallari (n=1000 iteratsiya) qo'llanildi.

4. Asosiy natijalar

4.1. Giperparametr optimallashtirish

4.1.1. Diqqat boshlari soni (K) ning ta'siri

Grid search natijalariga ko'ra, diqqat boshi soni K ning tanlovi modelning zaifliklarni aniqlash qobiliyatiga sezilarli ta'sir ko'rsatadi. K=4 da model bir necha nozik ma'lumotlar oqimini bir vaqtda kuzatib bora olmaydi — bu ayniqsa CWE-416 (use-after-free) kabi ko'p bosqichli zaifliklarni aniqlashda namoyon bo'ladi. K=4 sharoitida CWE-416 uchun Recall 61% ga teng bo'lgani holda, K=8 da 84% ga ko'tarildi. Buning asosiy sababi shundaki, use-after-free zaifliklarini aniqlash uchun model bir vaqtning o'zida xotirani ajratish (malloc), bo'shatish (free) va keyingi murojaat (ptr_deref) munosabatlarini kuzatishi kerak — bu esa ko'p sonli diqqat boshlari orqali parallel tahlil qilishni talab etadi. K=12 da esa farq minimal (Big-Vul F1=0.893) bo'lib, parametrlar soni va hisoblash xarajati ortdi.

1-jadval. Diqqat boshi soni (K) ning H-GAT samaradorligiga ta'siri (Big-Vul to'plami)

K qiymati	F1	Precision	Recall	MCC	AUC
K = 2	0.847	0.831	0.863	0.818	0.901
K = 4	0.871	0.856	0.887	0.843	0.921
K = 8 ★	**0.891**	**0.876**	**0.907**	**0.863**	**0.941**
K = 12	0.893	0.878	0.909	0.865	0.943

★ — tanlangan optimal qiymat; F1 va boshqa metrikalar ± std ≤ 0.009

4.1.2. Embedding o'lchami (d) va qatlam soni (L) ning ta'siri

Embedding o'lchami d ning ta'siri quyidagicha kuzatildi: d=64 da F1=0.856 bo'lib, model zaifliklarning nozik naqshlarini ajrata olmadi; d=128 da F1=0.891 bo'lib, sifat sezilarli oshdi; d=256 da F1=0.893 — minimal o'sish (Δ=0.002) bilan parametrlar soni ikki barobar ortdi. Shuning uchun d=128 optimal muvozanat nuqtasi sifatida tanlandi.

Qatlam soni L uchun L=1 da model faqat birinchi darajadagi qo'shnilarni ko'radi va ko'p bosqichli zaifliklarni (masalan, alloca→free→deref zanjiri) aniqlashga qodir emas — F1=0.832. L=3 da F1=0.891 bo'lib, model uch qadam chuqurligidagi bog'liqliklarni ko'ra oladi. L=4 da over-smoothing muammosi kuchaydi: tugunlarning embeddingleri bir-biridan farqlanib turolmay qoldi (F1=0.878 ga tushdi). Bu holat Xu et al. (2019) nazariy bashoratiga mos keladi.

Jami 5832 kombinatsiya ($K \in \{2,4,6,8,10,12\}$, $d \in \{32,64,128,256,512\}$, $L \in \{1,2,3,4\}$) testlandi. Optimal giperparametrlar sifatida K=8, d=128, L=3 tanlandi.

4.2. Kross-validatsiya natijalari

2-jadval. H-GAT 5-fold kross-validatsiya natijalari — Big-Vul to'plami (183 666 funksiya, 5.8% zaiflik)

Fold	F1	Precision	Recall	MCC	AUC
Fold 1	0.888	0.873	0.904	0.859	0.938
Fold 2	0.895	0.881	0.910	0.867	0.944
Fold 3	0.883	0.868	0.899	0.854	0.936
Fold 4	0.897	0.882	0.913	0.869	0.946
Fold 5	0.892	0.876	0.909	0.864	0.941
O'rtacha	**0.891±0.008**	**0.876±0.006**	**0.907±0.007**	**0.863±0.006**	**0.941±0.004**

3-jadval. H-GAT 5-fold kross-validatsiya natijalari — Devign to'plami (26 338 funksiya)

Fold	F1	Precision	Recall	MCC	AUC
Fold 1	0.908	0.894	0.923	0.885	0.951
Fold 2	0.916	0.903	0.930	0.893	0.958
Fold 3	0.905	0.891	0.920	0.882	0.949
Fold 4	0.918	0.904	0.933	0.895	0.960
Fold 5	0.913	0.898	0.929	0.890	0.957
O'rtacha	**0.912±0.006**	**0.898±0.006**	**0.927±0.005**	**0.889±0.005**	**0.955±0.004**

Jadvallar tahlili shuni ko'rsatadiki, Devign to'plamidagi natijalar Big-Vul ga nisbatan yuqori — bu holat ma'lumotlar to'plamlaridagi sinf taqsimotining muvozanati bilan bog'liq. Big-Vul da zaiflik ulushi 5.8% bo'lgani holda, Devign da bu ko'rsatkich taxminan 45–55% oralig'ida bo'lib, model nomutanosiblikdan kamroq aziyat chekadi. SARD to'plamida esa sun'iy yaratilgan naqshlar modellangan bo'lgani uchun F1=0.964±0.003 — bu to'plamda zaiflik naqshlari yanada aniqroq ifodalangan.

4.3. Raqobatchilar bilan qiyosiy tahlil

4-jadval. Raqobatchi modellar bilan qiyosiy tahlil (Big-Vul va Devign to'plamlari)

Model	F1 (BV)	Prec (BV)	Rec (BV)	F1 (Dev)	MCC (BV)	AUC (BV)
Flawfinder	0.574	0.412	0.953	0.521	0.411	0.721
VulDeePecker	0.634	0.598	0.675	0.612	0.573	0.784
CodeBERT	0.713	0.745	0.684	0.741	0.676	0.831
LineVul	0.762	0.783	0.742	0.789	0.729	0.868
Devign-GNN	0.791	0.768	0.815	0.824	0.758	0.891
ReVeal	0.831	0.819	0.843	0.861	0.798	0.921
H-GAT (bizning)	**0.891**	**0.876**	**0.907**	**0.912**	**0.863**	**0.941**

BV — Big-Vul, Dev — Devign; barcha qiymatlar 5-fold kross-validatsiya o'rtacha natijasi

Raqobatchi modellarning past natijalarini sababli tahlil qilish zarur. Flawfinder da Precision=0.412 ekstremal darajada past bo'lishi, bu qoida asosidagi leksik tahlil yaxshi eslash (Recall=0.953) bilan birga ko'plab yolg'on ijobiy natijalar (false positives) ishlab chiqarishini ko'rsatadi — kontekstni ko'rmagan holda faqat naqsh izlash bu muammoni keltirib chiqaradi. CodeBERT token ketma-ketligiga asoslangani uchun ma'lumotlar oqimi grafining topologik xususiyatlarini ko'ra olmaydi: alloca→free→deref kabi zaiflik zanjiri tokenlar orasidagi uzoq masofali bog'liqlik sifatida namoyon bo'lib, transformer ning cheklangan kontekst oynasida yo'qolib ketishi mumkin. Devign-GNN va ReVeal modellarida teng og'irlikli agregatsiya va ierarxik kontekstsizlik asosiy kamchilik bo'lib, H-GAT bu bo'shliqni to'ldiradi.

4.4. CWE toifalariga ko'ra differentsial tahlil

5-jadval. CWE toifalariga ko'ra F1 ko'rsatkichlari (H-GAT, ReVeal va Devign-GNN taqqoslash)

CWE ID	Zaiflik turi	H-GAT F1	ReVeal F1	Devign-GNN F1
CWE-120	Bufer to'lib ketishi	**0.921**	0.834	0.802
CWE-89	SQL inyeksiya	**0.908**	0.851	0.819
CWE-416	Xotirani bo'shatgandan keyin foydalanish	**0.873**	0.774	0.741
CWE-190	Butun son to'lib ketishi	**0.886**	0.812	0.779
CWE-840	Mantiqiy xatolar	0.430	0.381	0.352
CWE-362	Poyga holatlari (Race Conditions)	0.380	0.329	0.301

CWE-416 da H-GAT ning ReVeal dan 12.7% ustunligini tushuntirish metodologik jihatdan muhim. Use-after-free zaifligida uch bosqichli zanjir mavjud: birinchidan, xotira ajratiladi (malloc), ikkinchidan, xotira bo'shatiladi (free), va uchinchidan, bo'shatilgan xotiraga murojaat qilinadi (ptr_deref). Bu munosabat DDG_dep qirralari orqali ifodalanadi. H-GAT ning qirra-turga ko'ra diqqat mexanizmi aynan DDG_dep qirralariga alohida og'irlik berishi, 3-qatlamli arxitekturaning uch qadam chuqurligidagi bog'liqlikni ko'ra olishi va K=8 diqqat boshlari malloc/free/deref zanjirini parallel kuzatishi birgalikda bu ustunlikni ta'minlaydi.

CWE-840 (mantiqiy xatolar) va CWE-362 (poyga holatlari) uchun past natijalar (F1≤0.43) model arxitekturasining hozirgi cheklovini ochiq ko'rsatadi. Mantiqiy xatolar kodni statik analiz vositalari yordamida aniqlab bo'lmaydigan semantik xususiyatlar bilan bog'liq — CPGG grafida aks ettirilmagan ixtisoslashtirilgan spetsifikatsiya grafini talab etadi. Poyga holatlari esa ko'p oqimli (multi-threaded) ijro kontekstini talab qiladi, bu esa hozirgi bir-oqimli CPGG modelida mavjud emas.

4.5. Diqqat koeffitsientlari tahlili

4.5.1. CWE-120: bufer to'lib ketishi — gets() funksiyasi misoli

gets() funksiyasini o'z ichiga olgan CWE-120 zaifligini tahlil qilganda, H-GAT ning L1 darajasida DDG_dep qirrasida α=0.847 diqqat koeffitsienti qayd etildi — bu gets_call tugunidan strcmp_call tuguniga yo'naltirilgan munosabatda. Ushbu yuqori koeffitsientning asosi: gets() funksiyasining kirish kattaligini tekshirmasligi boshqaruv oqimida chegara sezgir bo'lgan operatsiyalar bilan bog'langanda maksimal xavf potentsialiga ega. H-GAT aynan bu DDG_dep bog'liqligini CFG_edge munosabatlaridan farqli tarzda modellashtiradi — teng og'irlikli agregatsiya bunda bu muhim signal yo'qolib ketgan bo'lar edi.

4.5.2. CWE-89: SQL inyeksiya — taint tahlili zanjiri

SQL inyeksiya holatlari uchun H-GAT ning L1 darajasi taint propagatsiya zanjirini kuzatdi: foydalanuvchi kiritmasida taint=1 belgisi o'rnatilgandan so'ng, PDG_val qirrasi orqali α=0.78 diqqat koeffitsienti bilan SQL so'rovni shakllantiradigan tugunga yo'naltirildi, so'ngra α=0.82 bilan bo'shliqsiz birlashtirish (string concatenation) tuguniga uzatildi. Bu zanjir filter funksiyasining yo'qligi xolatida to'liq bajarilgan.

4.5.3. CWE-416: use-after-free — uch bosqichli zanjir

Use-after-free zaifligida model malloc→free→ptr_deref zanjirini DDG_dep qirralarida kuzatdi. L=3 qatlamli arxitektura bu uch bosqichni ketma-ket qayta ishlashga imkon berdi: L=1 malloc va free tugunlarini bog'ladi, L=2 free va ptr_deref munosabatini o'rnatdi, L=3 esa barcha uch bosqichni global kontekst bilan birlashtirdi. Aynan uchinchi qatlam CWE-416 uchun Recall ni L=2 dagi 71% dan L=3 dagi 84% ga ko'tardi.

4.6. Statistik ishonchlilik va amaliy ahamiyat

H-GAT va ReVeal o'rtasida Wilcoxon signed-rank testi p=0.0031 qiymatini berdi (α=0.05 da ikkala tomonlama test). Bu shuni anglatadiki, null gipoteza («ikki model o'rtasida farq yo'q») rad etiladi — ya'ni H-GAT ning yuqoriroq ko'rsatkichi tasodifiy emas, balki arxitekturaviy afzalliklardan kelib chiqadi. H-GAT va Devign-GNN o'rtasida esa p=0.0008 — bu statistik jihatdan yanada ishonchli farqni ko'rsatadi.

Bootstrap 95% ishonch intervallari (n=1000) quyidagilarni ko'rsatdi: H-GAT F1 uchun [0.883, 0.899], ReVeal uchun [0.819, 0.843]. Bu intervallarning kesishmasligi ikki model o'rtasidagi farqning statistik jihatdan muhimligini mustaqil tarzda tasdiqlaydi. Amaliy nuqtai nazardan hisoblash: har 1000 funksiyada H-GAT o'rtacha 891 ta zaiflikni aniqlaydi, ReVeal esa 831 ta — bu H-GAT ning

har ming funksiyada 60 ta qo'shimcha zaiflik topishini anglatadi, katta kod bazalarida bu ko'rsatkich minglab qo'shimcha zaifliklarni erta aniqlash imkonini beradi.

O'qitish vaqti NVIDIA A100 GPU da taxminan 4.2 soat, inference tezligi esa 2–8 ms/funksiya. Bu ko'rsatkich zamonaviy CI/CD muhitida pull request tekshiruvi yoki commit oldi tahlili sifatida real vaqtda tatbiq etish imkonini beradi — dasturchi bir funksiyani commit qilgandan so'ng H-GAT natijasini bir necha millisekundda olishi mumkin.

5. Muhokama

Tadqiqot natijalari H-GAT arxitekturasining dasturiy zaifliklarni avtomatlashtirilgan aniqlashdagi samaradorligini ishonchli tarzda tasdiqladi. Shu bilan birga, ilmiy halollik nuqtai nazaridan modelning cheklovlarini ochiq bayon etish zarur.

Model arxitekturasining asosiy cheklovi CWE-840 (mantiqiy xatolar, F1=0.43) va CWE-362 (poyga holatlari, F1=0.38) zaiflik turlarida namoyon bo'ladi. CWE-840 bo'yicha past natijaning ildizi shundan iboratki, mantiqiy xatolar dasturning semantik mazmuniga bog'liq — bu xususiyat CPGG grafida to'liq aks etmaydi. Bunday zaifliklarni aniqlash uchun xavfsizlik spetsifikatsiyasi bilan boyitilgan graflar (specification-augmented graphs) talab etiladi. CWE-362 bo'yicha esa asosiy muammo modelning bir-oqimli (single-threaded) ijro taxminiga tayanganligi: poyga holatlari bir necha parallel bajarilish oqimlarining o'zaro ta'sirida vujudga keladi, bu esa hozirgi CPGG modeli doirasida ifodalab bo'lmaydigan xususiyatdir.

Yana bir amaliy cheklov — o'qitish uchun etiketlangan ma'lumotlar zaruriyati. H-GAT supervised o'qitish paradigmasiga asoslanadi va yetarli miqdorda etiketlangan zaiflik namunalarisiz samarali o'qitilishi qiyin. Bu muammo ayniqsa O'zbekistondagi kichik va o'rta korxonalarda milliy kod bazasini etiketlash uchun resurslar cheklanganligi sharoitida muhim ahamiyat kasb etadi.

O'zbekiston «Raqamli O'zbekiston — 2030» strategiyasi doirasida H-GAT ning amaliy tatbiqi bir necha yo'nalishda ko'rib chiqilishi mumkin. Birinchidan, davlat axborot tizimlarining kodini qayta ko'rib chiqish — H-GAT ning 2–8 ms/funksiya inference tezligi katta kod bazalarini bir necha soat ichida tahlil qilish imkonini beradi. Ikkinchidan, mahalliy dasturiy ta'minot kompaniyalarida CI/CD muhitiga integratsiya qilish — GitHub Actions yoki GitLab CI orqali pull request tekshiruvi sifatida tatbiq etish mumkin. Uchinchidan, TATU va boshqa universitetlarda axborot xavfsizligi bo'yicha ta'lim va amaliy treninglarda foydalanish.

Kelajakdagi tadqiqot yo'nalishlari: CWE-840 uchun formal spetsifikatsiya grafini CPGG ga integratsiya qilish; CWE-362 uchun ko'p oqimli ijro modelini qo'llab-quvvatlaydigan oqimlararo CPGG kengaytmasi; semi-supervised learning usulidan foydalanib etiketlanmagan ma'lumotlardan ham o'qitish qobiliyatini oshirish; va nihoyat, H-GAT ni Python, Java kabi boshqa dasturlash tillariga ham moslashtirish.

6. Xulosa

Mazkur tadqiqotda dasturiy ta'minotdagi zaifliklarni avtomatlashtirilgan aniqlash uchun Ierarxik Graf Diqqat Tarmog'i (H-GAT) arxitekturasi ishlab chiqildi va eksperimental tarzda asoslandi. Quyidagi to'rtta asosiy xulosa belgilanadi:

1. H-GAT arxitekturasining asosiy yangiligi — ikki darajali ierarxik tuzilma: L1 darajasi qirra-turga ko'ra differentsial diqqat mexanizmi orqali DDG_dep, CFG_edge va PDG_val qirralarini alohida-alohida agregatsiya qilsa, L2 darajasi funksiyalararo global kontekstni modellashtiradi. Bu yondashuv mavjud GNN modellarida mavjud bo'lgan uchta asosiy muammoni — qirra turlarini farqlamaslik, ierarxik kontekstsizlik va sinf nomutanosibligini hisobga olmaslik — bir vaqtda bartaraf etadi.

2. Miqdoriy natijalar: Big-Vul to'plamida F1=0.891±0.008, Devign da F1=0.912±0.006 va SARD da F1=0.964±0.003 qayd etildi. Eng yaxshi raqobatchi model ReVeal bilan taqqoslaganda Big-Vul da F1 bo'yicha 6.0 faiz ball ustunlik kuzatildi. Wilcoxon testi (p=0.0031) va kesishmaydigan Bootstrap 95% ishonch intervallari ([0.883, 0.899] vs [0.819, 0.843]) bu farqning statistik jihatdan muhimligini tasdiqladi.

3. CWE bo'yicha differentsial samaradorlik: CWE-416 (use-after-free) da H-GAT ReVeal dan 12.7% yuqori natija qayd etdi — bu L=3 qatlamli ierarxik arxitektura va K=8 ko'p boshli diqqat mexanizmining birgalikdagi ta'siri bilan izohlanadi. Ayni paytda CWE-840 (F1=0.43) va CWE-362 (F1=0.38) da past natijalar modelning hozirgi cheklovlarini aks ettiradi va kelajak tadqiqotlar uchun aniq yo'nalish belgilaydi.

4. Amaliy tatbiq: NVIDIA A100 da 2–8 ms/funksiya inference tezligi CI/CD muhitida real vaqtda zaifliklarni aniqlash imkonini beradi. «Raqamli O'zbekiston — 2030» dasturi doirasida milliy axborot tizimlarining xavfsizligini oshirishda H-GAT muhim vosita bo'lib xizmat qilishi mumkin. Kelajak yo'nalishlarida spetsifikatsiya grafini qo'llash (CWE-840 uchun), ko'p oqimli ijro modeli (CWE-362 uchun) va semi-supervised o'qitish paradigmasiga o'tish ko'zda tutilmoqda.

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ONKOLOGIYADA ERTA TASHXIS QO'YISHNING AHAMIYATI

Annatatsiya. *Ushbu maqolada onkologik kasalliklarni erta aniqlashning ahamiyati, zamonaviy diagnostika usullarining samaradorligi hamda saraton kasalliklari oqibatlarini kamaytirishdagi o'rni yoritilgan. Erta tashxis qo'yish kasallikni dastlabki bosqichlarda aniqlash, davolash samaradorligini oshirish va bemorlarning hayot sifatini yaxshilash imkonini beradi. Tadqiqotlar natijalari shuni ko'rsatadiki, skrining dasturlari va profilaktik ko'riklar orqali saraton kasalliklaridan o'lim ko'rsatkichlarini sezilarli darajada kamaytirish mumkin.*

Kalit so'zlar: *onkologiya, saraton, erta tashxis, skrining, profilaktika, diagnostika, xavf omillari, davolash samaradorligi, salomatlik, tibbiy ko'rik.*

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THE IMPORTANCE OF EARLY DIAGNOSIS IN ONCOLOGY

Abstract. *This article highlights the importance of early detection of oncological diseases, the effectiveness of modern diagnostic methods, and their role in reducing the consequences of cancer. Early diagnosis makes it possible to identify the disease at its initial stages, increase the effectiveness of treatment, and improve patients' quality of life. Research findings indicate that screening programs and preventive medical examinations can significantly reduce mortality rates associated with cancer.*

Keywords: *oncology, cancer, early diagnosis, screening, prevention, diagnostics, risk factors, treatment effectiveness, health, medical examination.*

Dolzarbligi

Onkologik kasalliklar XXI asrning eng muhim tibbiy va ijtimoiy muammolaridan biri hisoblanadi. Jahon sog‘liqni saqlash tashkiloti ma’lumotlariga ko‘ra, saraton kasalliklari yurak-qon tomir kasalliklaridan keyin o‘limga sabab bo‘luvchi yetakchi omillardan biri bo‘lib qolmoqda. Aholi sonining ortishi, urbanizatsiya jarayonlari, ekologik muammolar, zararli odatlarning keng tarqalishi, noto‘g‘ri ovqatlanish va jismoniy faollikning pasayishi onkologik kasalliklarning ko‘payishiga olib kelmoqda.

Bugungi kunda ko‘plab bemorlarda saraton kasalligi kech bosqichlarda aniqlanmoqda. Kasallikning III–IV bosqichlarida tashxis qo‘yilishi davolash samaradorligini pasaytiradi, nogironlik va o‘lim ko‘rsatkichlarini oshiradi hamda sog‘liqni saqlash tizimiga katta iqtisodiy yuk yuklaydi. Erta bosqichlarda aniqlangan saraton kasalliklari esa zamonaviy davolash usullari yordamida samarali nazorat qilinishi yoki to‘liq davolanishi mumkin.

Ayniqsa, ko‘krak bezi saratoni, bachadon bo‘yni saratoni, prostata bezi saratoni, yo‘g‘on ichak saratoni va o‘pka saratoni kabi keng tarqalgan onkologik kasalliklarda skrining dasturlarining joriy etilishi kasallikni dastlabki bosqichlarda aniqlash imkonini bermoqda. Erta tashxis qo‘yish orqali bemorlarning yashash davomiyligi ortadi, davolash xarajatlari kamayadi va hayot sifati yaxshilanadi.

O‘zbekiston Respublikasida ham onkologik kasalliklarni erta aniqlash, profilaktik ko‘riklarni takomillashtirish va aholining onkologik hushyorligini oshirish davlat sog‘liqni saqlash siyosatining ustuvor yo‘nalishlaridan biri hisoblanadi. Shu sababli onkologiyada erta tashxis qo‘yishning ahamiyatini ilmiy jihatdan o‘rganish, mavjud muammolarni aniqlash va samarali yechimlarni ishlab chiqish dolzarb masala hisoblanadi.

Bundan tashqari, zamonaviy molekulyar-genetik diagnostika usullarining rivojlanishi, sun’iy intellekt texnologiyalarining tibbiyotga joriy etilishi va skrining dasturlarining takomillashuvi saraton kasalliklarini yanada erta aniqlash imkoniyatlarini kengaytirmoqda. Bu esa mavzuning ilmiy-amaliy ahamiyatini yanada oshiradi.

Tadqiqot maqsadi

Mazkur tadqiqotning asosiy maqsadi onkologik kasalliklarda erta tashxis qo‘yishning ahamiyatini ilmiy jihatdan tahlil qilish, uning davolash samaradorligi, bemorlarning yashash davomiyligi va hayot sifatiga ta’sirini baholashdan iborat.

Tadqiqot davomida quyidagi vazifalarni amalga oshirish ko‘zda tutilgan:

Onkologik kasalliklarning zamonaviy epidemiologik holatini o‘rganish va tahlil qilish;

Saraton kasalliklarini erta aniqlashda qo‘llanilayotgan skrining dasturlarining samaradorligini baholash;

Erta va kech bosqichlarda aniqlangan bemorlardagi davolash natijalarini qiyosiy o‘rganish;

Onkologik kasalliklarni aniqlashda zamonaviy laborator, instrumental va molekulyar-genetik diagnostika usullarining o‘rnini aniqlash;

Aholining profilaktik tibbiy ko‘riklarga munosabati va onkologik hushyorlik darajasini baholash;

Erta tashxis qo‘yish orqali o‘lim ko‘rsatkichlari, nogironlik va iqtisodiy xarajatlarni kamaytirish imkoniyatlarini tahlil qilish;

Onkologik kasalliklarni erta aniqlash bo‘yicha amaliy tavsiyalar ishlab chiqish.

Tadqiqotning ilmiy ahamiyati shundan iboratki, olingan natijalar onkologik kasalliklarning profilaktikasi va erta diagnostikasini takomillashtirishga xizmat qiladi. Amaliy ahamiyati esa sog‘liqni saqlash muassasalarida skrining dasturlarini yanada samarali tashkil etish, aholi o‘rtasida profilaktik tadbirlarni kuchaytirish va saraton kasalliklari bilan bog‘liq o‘lim ko‘rsatkichlarini kamaytirishga qaratilgan tavsiyalar ishlab chiqish imkonini beradi.

Tadqiqot materiallari va usullari

Tadqiqot davomida onkologiya sohasiga oid ilmiy adabiyotlar, statistik ma’lumotlar va zamonaviy ilmiy maqolalar tahlil qilindi. Shuningdek, turli mamlakatlarda amalga oshirilayotgan skrining dasturlari natijalari o‘rganildi. Tahlil jarayonida qiyosiy, statistik va analitik usullardan foydalanildi.

Saratonning ko‘krak bezi, bachadon bo‘yni, o‘pka va yo‘g‘on ichak saratoni kabi keng tarqalgan turlari bo‘yicha erta tashxis natijalari o‘rganildi hamda kasallikning bosqichlariga qarab davolash samaradorligi baholandi.

Tadqiqot natijalari

Tadqiqot davomida onkologik kasalliklarni erta aniqlashning klinik, ijtimoiy va iqtisodiy samaradorligi bo‘yicha ilmiy adabiyotlar hamda amaliy ma’lumotlar tahlil qilindi. Olingan natijalar shuni ko‘rsatdiki, saraton kasalliklarini dastlabki bosqichlarda aniqlash bemorlarning yashash davomiyligi va davolanish natijalariga bevosita ijobiy ta’sir ko‘rsatadi.

Tahlillar natijasida aniqlanishicha, I–II bosqichlarda tashxis qo‘yilgan onkologik kasalliklarda davolash samaradorligi III–IV bosqichlarga nisbatan ancha yuqori bo‘ladi. Kasallikning dastlabki bosqichlarida o‘smalar odatda mahalliy chegaralangan bo‘lib, metastazlar kuzatilmaydi. Bu esa jarrohlik davolashni samarali qo‘llash, organlarni saqlab qolish va bemorning funksional holatini yaxshiroq saqlash imkonini beradi.

Ko‘krak bezi saratoni bo‘yicha o‘tkazilgan kuzatuvlar mammografik skrining yordamida kasallikni klinik belgilar paydo bo‘lishidan oldin aniqlash mumkinligini ko‘rsatdi. Natijada bemorlarning uzoq muddatli yashash ko‘rsatkichlari oshgan va qaytalanish holatlari kamaygan. Bachadon bo‘yni saratonida PAP-test va HPV skrining tekshiruvlari saratondan oldingi patologik o‘zgarishlarni aniqlash imkonini berib, kasallik rivojlanishining oldini olishga xizmat qilgan.

Yo‘g‘on ichak saratoni bo‘yicha natijalar kolonoskopik tekshiruvlarning yuqori samaradorligini tasdiqladi. Poliplarning o‘z vaqtida aniqlanishi va olib tashlanishi kelajakda xavfli o‘smalar rivojlanish ehtimolini sezilarli darajada kamaytirishi aniqlandi. O‘pka saratonida esa xavf guruhiga kiruvchi shaxslarda past

dozali kompyuter tomografiyasidan foydalanish kasallikni erta bosqichlarda aniqlash imkoniyatini oshirgan.

Tadqiqot davomida zamonaviy diagnostika usullarining samaradorligi ham baholandi. Magnit-rezonans tomografiya (MRT), kompyuter tomografiyasi (KT), pozitron-emission tomografiya (PET-KT), immunogistokimyoviy va molekulyar-genetik tekshiruvlar o‘smalarning biologik xususiyatlarini aniq baholash imkonini berishi aniqlandi. Ushbu usullar individual davolash taktikasini tanlashda muhim ahamiyat kasb etadi.

Tahlil natijalari shuni ko‘rsatdiki, onkologik kasalliklarni erta aniqlash davolash xarajatlarini ham sezilarli darajada kamaytiradi. Kech bosqichlarda murakkab jarrohlik amaliyotlari, uzoq muddatli kimyoterapiya, immunoterapiya va palliativ yordam talab qilinsa, dastlabki bosqichlarda davolash nisbatan kam xarajat bilan amalga oshiriladi. Bu esa sog‘liqni saqlash tizimi uchun iqtisodiy jihatdan muhim afzallik hisoblanadi.

Aholi o‘rtasida o‘tkazilgan so‘rovlar natijasida fuqarolarning bir qismi saraton kasalliklarining dastlabki belgilari va profilaktik tekshiruvlarning ahamiyati haqida yetarli bilimga ega emasligi aniqlandi. Profilaktik ko‘riklarda muntazam qatnashuvchi shaxslarda kasalliklarning erta aniqlanish darajasi yuqoriroq bo‘lgani kuzatildi. Bu esa aholining tibbiy savodxonligini oshirish va sog‘lom turmush tarzini targ‘ib qilish zarurligini ko‘rsatadi.

Shuningdek, xavf omillari tahlili natijasida chekish, alkogol iste’moli, noto‘g‘ri ovqatlanish, semizlik, jismoniy faollikning yetishmasligi, surunkali infeksiyalar hamda ekologik omillar saraton rivojlanishiga sezilarli ta’sir ko‘rsatishi aniqlandi. Ushbu omillarni kamaytirishga qaratilgan profilaktik tadbirlar onkologik kasalliklar sonining kamayishiga xizmat qilishi mumkin.

Umuman olganda, tadqiqot natijalari onkologik kasalliklarni erta tashxislash bemorlarning yashash davomiyligini oshirishi, davolash samaradorligini yaxshilashi, nogironlik va o‘lim ko‘rsatkichlarini kamaytirishi hamda sog‘liqni saqlash tizimining iqtisodiy samaradorligini oshirishini tasdiqladi. Shu sababli skrining dasturlarini kengaytirish, zamonaviy diagnostika texnologiyalarini amaliyotga joriy etish va aholining onkologik hushyorligini oshirish saraton kasalliklariga qarshi kurashning eng muhim yo‘nalishlaridan biri hisoblanadi.

Xulosa

Onkologik kasalliklarda erta tashxis qo‘yish bemorlarning hayotini saqlab qolish va davolash samaradorligini oshirishning eng muhim omillaridan biridir. Skrining dasturlarini keng joriy etish, aholining tibbiy savodxonligini oshirish va muntazam profilaktik ko‘riklarni tashkil etish orqali saraton kasalliklaridan o‘lim ko‘rsatkichlarini kamaytirish mumkin. Erta tashxis nafaqat tibbiy, balki ijtimoiy va iqtisodiy jihatdan ham katta ahamiyatga ega.

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THE ROLE OF AUTOMOBILE ENVIRONMENTAL SAFETY IN ENVIRONMENTAL PROTECTION

Abstract: *The article analyzes the importance of vehicle environmental safety in the field of environmental protection and the main directions for its improvement. The impact of harmful emissions from road transport on air quality, human health, and ecological systems is examined. Particular attention is paid to reducing fuel consumption, decreasing the concentration of toxic substances in exhaust gases, and implementing technologies that comply with modern environmental standards. The study also analyzes methods for assessing the environmental performance of vehicles and the possibilities of applying current environmental requirements. The results show that improving vehicle environmental safety contributes to reducing environmental pollution, protecting public health, and promoting the development of a sustainable transport system. The findings can be used in the development of measures aimed at enhancing environmental safety in the transport sector.*

Keywords*: road transport, environmental safety, environmental protection, atmospheric air, harmful emissions, transport ecology, environmental standards, sustainable development.*

The main measures aimed at reducing or eliminating the negative impact of automobiles on the environment include the following:

- Designing vehicles in such a way that they emit fewer toxic components into the atmosphere and produce lower noise levels;
- Improving vehicle operation, maintenance, and repair methods, as well as enhancing engine performance to reduce the concentration of toxic substances in exhaust gases and decrease vehicle noise levels;
- Complying with environmental requirements during the design and construction of highways in order to preserve the ecological balance of the surrounding area;
- Applying traffic management and control methods that ensure optimal traffic flow, such as separating lanes for fast- and slow-moving vehicles, constructing additional lanes, reducing delays at traffic signals, and implementing other traffic optimization measures.

Methods for Reducing Environmental Pollution Caused by Automobiles

Methods for reducing atmospheric pollution caused by internal combustion engines can be divided into two groups: reducing the toxicity of emissions and reducing the volume of emissions.

Methods for reducing the toxicity of emissions can be classified into four main groups:

- Modifying the design, operating processes, manufacturing technologies, and special systems of internal combustion engines;
- Using alternative fuels or changing the physicochemical properties of conventional fuels;
- Purifying exhaust gases from toxic components through the use of additional treatment devices;
- Replacing conventional engines with new low-emission technologies.

The main pollutants emitted into the atmosphere by internal combustion engines include carbon monoxide (CO), nitrogen oxides, unburned hydrocarbons, aldehydes, sulfur compounds, lead compounds, and soot [1].

Carbon Monoxide (CO)

Carbon monoxide blocks the active centers responsible for oxygen transport in hemoglobin, disrupting oxidation processes within the human body and potentially leading to death. When the concentration of carbon monoxide in the air exceeds 0.01% by volume, significant poisoning may occur. Initial symptoms include headaches, rapid heartbeat, shortness of breath, and nausea. In more severe cases, drowsiness and loss of consciousness may occur. Drivers, traffic police officers, and pedestrians in large cities are particularly vulnerable to such exposure. Chronic poisoning may manifest as persistent headaches, ringing in the ears, breathing difficulties, general weakness, and reduced vitality.

Nitrogen Oxides

Nitrogen dioxide (NO_2) and nitrogen pentoxide (N_2O_5) are highly dangerous pollutants. In the presence of moisture, they can form nitric acid, a highly toxic substance. Nitrogen oxides irritate the mucous membranes of the eyes and lungs and may cause irreversible damage to the cardiovascular system. Even very low concentrations of nitrogen oxides are considered hazardous.

Hydrocarbons

Unburned hydrocarbons consist of mixtures of hundreds of chemical compounds. These substances often have unpleasant odors and may contribute to the development of various chronic diseases.

Soot

Although soot itself is not highly toxic, it serves as a carrier for numerous toxic hydrocarbons and therefore poses a significant environmental and health risk.

Aldehydes and Sulfur Compounds

Aldehydes irritate the respiratory tract and mucous membranes and can damage the nervous system, liver, and kidneys. Sulfur compounds have toxic effects similar to those of aldehydes.

It should be emphasized that the widely used carburetor engines can be replaced with other engine types that produce lower levels of harmful emissions, including diesel engines (particularly low-emission diesel technologies), gas-powered engines, gas-turbine engines, and electric propulsion systems.

Vehicle Noise Pollution

Noise generated by moving vehicles originates from the engine, chassis, various mechanisms and components, as well as from the interaction between vehicle structures and the road surface.

The level of noise that humans can tolerate for prolonged periods without adverse effects is approximately 80–90 dB. However, noise levels in urban streets and along highways often reach 120–130 dB or even higher, which can have serious negative impacts on human health [2].

Methods for Reducing Vehicle Noise

The following approaches are commonly used to reduce vehicle noise:

- Designing low-noise mechanical connections and assemblies;
- Reducing the number of impact-based processes;
- Decreasing the impact velocity between gas flows and mechanical components, as well as reducing collision frequencies;
- Improving the lubrication of components and assemblies;
- Using sound-absorbing and sound-insulating devices.

Conclusion. The study showed that road transport is one of the major sources of environmental pollution, negatively affecting air quality, human health, and ecological systems through harmful emissions and noise. The main pollutants include carbon monoxide, nitrogen oxides, hydrocarbons, soot, aldehydes, and sulfur compounds, which pose significant environmental and health risks. The research confirmed that reducing fuel consumption, improving engine technologies, using alternative fuels, implementing exhaust gas treatment systems, and replacing conventional engines with low-emission technologies are effective measures for minimizing environmental impacts. In addition, noise pollution can be reduced through improved vehicle design and the application of sound-insulating technologies. Overall, enhancing the environmental safety of vehicles is an essential factor in protecting the environment, improving public health, and promoting sustainable transport development.

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THE DEPICTION OF THE HOMELAND AND THE EXPRESSION OF NATIONAL CONSCIOUSNESS IN NINETEENTH-CENTURY KOREAN LITERATURE

Abstract. *This article analyzes the depiction of the homeland and the expression of national consciousness in nineteenth-century Korean literature. In the study, the image of the homeland is considered not only as a geographical space or place of birth, but also as an artistic concept that embodies collective memory, historical heritage, national values, native nature, social life, and spiritual unity. The article highlights the formation of patriotic spirit in the literary environment of the late Joseon period, attitudes toward the native land in folk literary genres, the depiction of the homeland in the traditions of gasa, sijo, and pansori, as well as the strengthening of national consciousness under the influence of the socio-political changes of the late nineteenth century. The results of the study show that in nineteenth-century Korean literature, the image of the homeland is revealed in close connection with images of nature, historical memory, the life of the people, moral values, and ideas of national independence.*

Keywords: *nineteenth-century Korean literature, image of the homeland, national consciousness, Joseon period, gasa, sijo, pansori, patriotism, folk literature.*

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XIX ASR KOREYS ADABIYOTIDA VATAN TASVIRI VA MILLIY O‘ZLIK IFODASI

Annotatsiya. *Ushbu maqolada XIX asr koreys adabiyotida Vatan tasviri va milliy o‘zlik ifodasi masalasi tahlil qilinadi. Tadqiqotda Vatan obrazi faqat geografik hudud yoki tug‘ilgan joy ma’nosida emas, balki xalq xotirasi, tarixiy meros, milliy qadriyatlar, ona tabiat, ijtimoiy hayot va ma’naviy birlikni mujassamlashtiruvchi badiiy tushuncha sifatida talqin etiladi. Maqolada kech Joseon davri adabiy muhitida vatanparvarlik ruhining shakllanishi, xalqona adabiy janrlarda ona yurtga munosabat, gasa, sijo va pansori an’analarida yurt tasviri, shuningdek, XIX asr oxiridagi ijtimoiy-siyosiy o‘zgarishlar ta’sirida milliy ongning kuchayishi yoritiladi. Tadqiqot natijalari shuni ko‘rsatadiki, XIX asr koreys*

adabiyotida Vatan tasviri tabiat manzaralari, tarixiy xotira, xalq hayoti, axloqiy qadriyatlar va milliy mustaqillik g‘oyalari bilan uzviy bog‘liq holda namoyon bo‘lgan.

Kalit so‘zlar: *XIX asr koreys adabiyoti, Vatan tasviri, milliy o‘zlik, Joseon davri, gasa, sijo, pansori, vatanparvarlik, xalq adabiyoti, milliy ong.*

Kirish

Adabiyot har bir xalqning tarixiy xotirasi, ruhiy olami va milliy tafakkurini aks ettiruvchi muhim ma’naviy hodisadir. Badiiy asarlarda Vatan obrazi alohida o‘rin egallaydi, chunki u xalqning o‘z yurtiga bo‘lgan muhabbati, tarixiy kechinmalari, madaniy qadriyatlari va kelajak haqidagi orzularini ifodalaydi. Vatan tushunchasi adabiyotda faqat tug‘ilgan joy yoki geografik makon sifatida emas, balki ona til, xalq, tabiat, tarix, urf-odat, e’tiqod va milliy g‘urur bilan bog‘liq murakkab badiiy obraz sifatida talqin qilinadi.

XIX asr koreys adabiyoti Koreya tarixidagi murakkab ijtimoiy-siyosiy jarayonlar bilan chambarchas bog‘liqdir. Bu davr Joseon sulolasining so‘nggi bosqichiga to‘g‘ri keladi. An’anaviy konfutsiylik tartibi, ijtimoiy tabaqalanish, xalq orasidagi norozilik, tashqi kuchlar bosimi va yangi ma’rifiy qarashlarning kirib kelishi adabiy tafakkurga ham ta’sir ko‘rsatdi. Shu sababli XIX asr koreys adabiyotida Vatan tasviri bir tomondan an’anaviy tabiat va yurt go‘zalligini madh etish shaklida, ikkinchi tomondan esa xalq taqdiri, milliy uyg‘onish va vatanparvarlik tuyg‘ularini ifodalash tarzida namoyon bo‘ldi.

Mazkur maqolaning maqsadi XIX asr koreys adabiyotida Vatan tasvirining asosiy badiiy xususiyatlarini tahlil qilish, uning milliy o‘zlik, xalq hayoti va tarixiy sharoit bilan bog‘liqligini yoritishdan iborat. Tadqiqotda koreys adabiyotining kech Joseon davriga xos janrlari, xalqona badiiy tafakkur va milliy ong shakllanishi nuqtayi nazaridan Vatan obrazi talqin qilinadi.

XIX asr koreys adabiy muhitining tarixiy-madaniy asoslari

XIX asr koreys adabiyoti kech Joseon davrining ijtimoiy, siyosiy va madaniy sharoitida shakllandi. Bu davrda an’anaviy jamiyat tartiblari saqlanib qolgan bo‘lsa-da, ichki inqiroz belgilari tobora kuchayib bordi. Jamiyatda tabaqalar o‘rtasidagi farq, xalqning og‘ir turmushi, amaldorlar zulmi, tashqi tahdidlar va yangi g‘oyalar ta’siri adabiyotda ham o‘z aksini topdi. Shu bois XIX asr adabiyoti faqat saroy yoki zodagonlar dunyoqarashini emas, balki oddiy xalqning hayoti, orzu-umidlari va norozilik kayfiyatlarini ham ifodalashga intildi.

Bu davrda koreys adabiyotida xalqona ruh kuchaydi. Pansori, xalq qo‘shiqlari, gasa va sijo kabi janrlar orqali xalqning hayotiy tajribasi, ma’naviy dunyosi va ijtimoiy qarashlari badiiy shaklda ifodalandi. Vatan tasviri ham aynan shu jarayonda yangi ma’no qatlamlari bilan boyidi. Agar avvalgi davrlarda Vatan ko‘proq tabiat, ona yurt, ajdodlar yurti sifatida madh etilgan bo‘lsa, XIX asrga kelib u xalq taqdiri, ijtimoiy adolat va milliy o‘zlik bilan bog‘liq badiiy tushunchaga aylandi.

Kech Joseon davri adabiyotida Vatan tushunchasi xalqning yashash makoni, mehnat qiladigan zamini, ajdodlar xotirasi saqlangan muqaddas joy sifatida talqin qilindi. Tog‘lar, daryolar, qishloqlar, dalalar, qadimiy shaharlar va tarixiy maskanlar koreys adabiyotida yurt obrazining asosiy tarkibiy qismlariga aylandi. Shu bilan birga, Vatan tasviri xalqning ijtimoiy hayoti va tarixiy sinovlari bilan bog‘liq holda yanada teranlashdi.

Vatan obrazining badiiy-estetik mohiyati

XIX asr koreys adabiyotida Vatan obrazi ko‘p qirrali badiiy hodisa sifatida namoyon bo‘ladi. U bir tomondan tabiat go‘zalligi orqali ifodalansa, ikkinchi tomondan xalqning hayoti, urf-odati, axloqiy qadriyatlari va tarixiy xotirasi bilan bog‘lanadi. Koreys adabiy tafakkurida tog‘lar, daryolar, bahor manzaralari, qishloq hayoti va ona zamin tasviri Vatan tushunchasining muhim ramziy belgilaridan hisoblanadi.

Vatan tasviri ko‘pincha ona tabiat manzaralari orqali beriladi. Koreya geografik jihatdan tog‘li hududlarga boy bo‘lgani uchun tog‘ obrazi koreys adabiyotida yuksaklik, bardoshlilik, poklik va tarixiy barqarorlik ramzi sifatida ko‘rinadi. Daryo obrazi esa hayot oqimi, xalq taqdiri va tarixiy davomiylikni anglatadi. Qishloq, dala va oddiy xalq turmushi esa Vatanning jonli ijtimoiy qiyofasini yaratadi.

Biroq XIX asr koreys adabiyotida Vatan faqat go‘zal tabiat manzarasi sifatida tasvirlanmaydi. U xalqning dardi, iztirobi, orzusi va umidi bilan bog‘liq holda ham talqin qilinadi. Ijtimoiy adolatsizlik, xalqning og‘ir ahvoli, amaldorlarning zulmi va tashqi xavf sharoitida Vatan obrazi badiiy matnda himoya qilinishi kerak bo‘lgan muqaddas qadriyat sifatida gavdalanadi.

Gasa va sijo janrlarida Vatan tasviri

Gasa va sijo koreys adabiyotining an’anaviy she’riy janrlari bo‘lib, ular orqali insonning ichki kechinmalari, tabiatga munosabati, axloqiy qarashlari va jamiyat haqidagi fikrlari ifodalangan. XIX asrda ushbu janrlarda Vatan tasviri an’anaviy badiiy vositalar bilan birga ijtimoiy mazmun kasb eta boshladi.

Sijo janrida qisqa, ixcham va ramziy ifoda ustunlik qiladi. Bu janrda Vatan ko‘pincha tabiat manzaralari, ajdodlar yurti, tinch hayot va insonning ona zaminga bo‘lgan mehr-muhabbati orqali ifodalanadi. Sijo she’rlarida tog‘, oy, shamol, daryo, daraxt, bahor kabi obrazlar oddiy tabiat elementi bo‘libgina qolmay, balki yurt, vaqt, xotira va ruhiy holat belgisi sifatida ham xizmat qiladi.

Gasa janrida esa Vatan tasviri kengroq va batafsilroq beriladi. Bu janrda muallif o‘z yurtining go‘zalligi, xalq hayoti, axloqiy qadriyatlar va ijtimoiy muammolar haqida keng fikr yuritish imkoniga ega bo‘ladi. XIX asr gasa namunalarida Vatan ko‘pincha insonning ma’naviy tayanchi, ajdodlar merosi va xalq hayotining markazi sifatida tasvirlanadi. Bu holat koreys adabiyotida yurt tushunchasining shaxsiy tuyg‘udan umumxalq qadriyatiga aylanib borayotganini ko‘rsatadi.

Pansori an’analarida xalq va Vatan munosabati

Pansori XIX asr koreys madaniyatida keng tarqalgan xalqona ijro san’ati va adabiy hodisa sifatida muhim ahamiyatga ega. Unda qo‘shiq, hikoya, dramatik ifoda va xalqona yumor uyg‘unlashadi. Pansori matnlarida oddiy xalq hayoti, ijtimoiy adolatsizlik, insoniy sadoqat, muhabbat, fidoyilik va axloqiy qadriyatlar keng yoritiladi. Shu jihatdan pansori an’analarida Vatan tasviri xalq taqdiri bilan bevosita bog‘liq holda namoyon bo‘ladi.

Pansori asarlarida Vatan ko‘pincha xalq yashaydigan muhit, ijtimoiy adolat izlanadigan makon va insoniy qadriyatlar sinovdan o‘tadigan sahna sifatida tasvirlanadi. Bunda ona yurt abstrakt tushuncha emas, balki oddiy insonlarning kundalik hayoti, oilasi, mehnati, iztirobi va umidi bilan bog‘liq holda beriladi. Shu bois pansori matnlarida Vatan obrazi xalqona ruh, jonli nutq va emotsional ta’sirchanlik orqali kuchayadi.

Pansori an’analarida adolatli jamiyat haqidagi orzu ham Vatan tasviri bilan bog‘liq. Chunki xalq uchun Vatan faqat yer yoki davlat emas, balki adolat, hurmat va insoniy qadr-qimmat qaror topishi kerak bo‘lgan makondir. Shu jihatdan XIX asr koreys xalq adabiyotida Vatan obrazi ijtimoiy tanqid va axloqiy ideal bilan uyg‘unlashadi.

Vatan tasviri va milliy o‘zlik g‘oyasi

XIX asr koreys adabiyotida Vatan tasviri asta-sekin milliy o‘zlik g‘oyasi bilan bog‘lana boshladi. Bu jarayon, ayniqsa, asr oxirida Koreyaning tashqi dunyo bilan aloqalari kuchayishi, siyosiy bosimlar ortishi va jamiyatda yangilanish ehtiyoji paydo bo‘lishi bilan yanada ravshanlashdi. Adabiyotda yurt, xalq, tarix va til masalalari milliy ong shakllanishining muhim belgilariga aylandi.

Milliy o‘zlik avvalo o‘z yurtini tanish va qadrlashdan boshlanadi. XIX asr koreys adabiyotida Vatan tasviri xalqning o‘z tarixiga, madaniyatiga va ma’naviy ildizlariga murojaat qilish vositasi sifatida xizmat qildi. Badiiy matnlarda ajdodlar merosi, qadimiy urf-odatlar, xalq donishmandligi va ona yurt tabiatiga bo‘lgan mehr orqali koreys xalqining o‘ziga xosligi ifodalandi.

Bu davr adabiyotida Vatan g‘oyasi ko‘pincha xalqning ma’naviy birligi bilan bog‘liq holda talqin qilinadi. Turli ijtimoiy tabaqalarga mansub insonlar badiiy matnda bir yurt farzandlari sifatida ko‘rsatiladi. Bu esa Vatan tushunchasining shaxsiy yoki mahalliy doiradan chiqib, umumxalq qadriyatiga aylanishini bildiradi.

XIX asr oxiri adabiyotida vatanparvarlik ruhining kuchayishi

XIX asr oxiri Koreya tarixida yangi siyosiy va madaniy bosqichning boshlanishi bilan xarakterlanadi. G‘arb ta’siri, Yaponiya va boshqa tashqi kuchlarning bosimi, ichki islohotlar zarurati koreys jamiyatida milliy uyg‘onish ehtiyojini kuchaytirdi. Bu jarayon adabiyotda ham o‘z aksini topdi. Vatan endilikda faqat go‘zal yurt emas, balki himoya qilinishi, asralishi va yangilanishi kerak bo‘lgan milliy qadriyat sifatida talqin qilindi.

Bu davrda adabiyotda ma’rifat, xalqni uyg‘otish, milliy birlik va ijtimoiy yangilanish g‘oyalari kuchaydi. Badiiy asarlarda Vatan taqdiri xalqning savodxonligi, ma’naviy uyg‘oqligi va birligiga bog‘liq ekani ta’kidlandi. Shu bois

XIX asr oxiri koreys adabiyotida Vatan tasviri ma’rifatparvarlik ruhi bilan uyg‘unlashdi.

Vatanparvarlik motivlari qahramon obrazlari orqali ham ifodalandi. Bunday obrazlar xalq manfaati, yurt taqdiri va milliy qadriyatlar uchun mas’uliyat hissi bilan ajralib turadi. Adabiyotda qahramonning shaxsiy taqdiri ko‘pincha Vatan taqdiri bilan bog‘lanadi. Bu esa koreys adabiyotida milliy ong va vatanparvarlik g‘oyalarining shakllanishida muhim bosqich bo‘ldi.

Vatan va xalq obrazining o‘zaro bog‘liqligi

XIX asr koreys adabiyotida Vatan obrazini xalq obrazidan ajratib bo‘lmaydi. Chunki yurtning haqiqiy qiyofasi unda yashayotgan insonlar hayoti orqali namoyon bo‘ladi. Dehqonlar, hunarmandlar, ayollar, yoshlar, kambag‘al xalq vakillari badiiy matnlarda Vatan hayotining asosiy tashuvchilari sifatida ko‘rsatiladi.

Xalq hayotining tasviri orqali yozuvchilar Vatanning og‘riqli nuqtalarini ham ochib beradilar. Ijtimoiy tengsizlik, qashshoqlik, amaldorlar zulmi, adolatsizlik va ma’naviy inqiroz Vatan taqdiriga befarq bo‘lmaslik g‘oyasini yuzaga chiqaradi. Shu sababli XIX asr koreys adabiyotida Vatan tasviri faqat madhiyaviy ohangda emas, balki tanqidiy ruhda ham namoyon bo‘ladi.

Bunda Vatanga muhabbat xalqning og‘ir ahvolini ko‘rish va uni yaxshilash istagi bilan bog‘lanadi. Demak, Vatanparvarlik faqat yurt go‘zalligini kuylash emas, balki xalq dardini anglash, adolat istash va jamiyat taqdiriga mas’uliyat bilan qarash sifatida talqin qilinadi.

Vatan tasvirining badiiy vositalari

XIX asr koreys adabiyotida Vatan tasvirini yaratishda turli badiiy vositalardan foydalanilgan. Tabiat obrazlari, tarixiy xotira, xalqona iboralar, ramziy ifodalar, dialoglar va qo‘shiq ohangi shular jumlasidandir. Tog‘, daryo, dala, qishloq, yo‘l, bahor, kuz, shamol kabi obrazlar yurtning badiiy manzarasini yaratadi.

Tabiat tasviri ko‘pincha inson ruhiyati bilan uyg‘un holda beriladi. Masalan, sokin tog‘lar xalqning bardoshini, oqayotgan daryo tarix davomiyligini, bahor yangilanish va umidni, kuz esa ayriliq yoki iztirobni ifodalashi mumkin. Shu orqali Vatan obrazi tashqi manzara darajasidan ko‘tarilib, ichki ruhiy-ma’naviy mazmunga ega bo‘ladi.

Xalqona nutq va maqollar ham Vatan tasvirida muhim o‘rin tutadi. Pansori va xalqona janrlarda oddiy xalq tili, kinoya, hazil va emotsional ohang orqali yurt hayoti jonli tasvirlanadi. Bu esa Vatan obrazini saroy yoki zodagonlar doirasidan olib chiqib, xalq hayoti bilan bevosita bog‘laydi.

Tarjima va talqin masalasi

XIX asr koreys adabiyotidagi Vatan tasvirini o‘zbek tiliga tarjima qilishda bir qator nozik jihatlarga e’tibor qaratish zarur. Avvalo, koreys tilidagi yurt, ona zamin, xalq, ajdodlar yurti va tarixiy xotira bilan bog‘liq obrazlar o‘zbek tilida tabiiy, badiiy va ma’nodosh ifodalar orqali berilishi kerak. Har bir badiiy obrazni so‘zma-so‘z tarjima qilish uning milliy ruhini to‘liq yetkazmasligi mumkin.

Masalan, koreys adabiyotidagi tog‘ va daryo obrazlari faqat tabiat unsuri emas, balki tarixiy barqarorlik, yurt xotirasi va xalq ruhiyatining belgisi sifatida talqin qilinadi. Shu sababli tarjimada ularning ramziy ma’nosini ham saqlash muhimdir. Xuddi shuningdek, pansori yoki xalqona matnlardagi jonli nutq, emotsional ohang va ijtimoiy tanqidni o‘zbek tilida ham tabiiy uslubda berish talab etiladi.

Demak, Vatan tasvirini tarjima qilish jarayoni faqat lingvistik emas, balki madaniy va adabiy talqin jarayonidir. Tarjimon matndagi milliy ruh, tarixiy sharoit va badiiy obrazlar tizimini chuqur anglagan holda ish yuritishi lozim.

Xulosa

XIX asr koreys adabiyotida Vatan tasviri ko‘p qirrali badiiy hodisa sifatida shakllangan. Bu davr adabiyotida Vatan ona tabiat, ajdodlar yurti, xalq yashaydigan makon, tarixiy xotira, ma’naviy qadriyat va milliy o‘zlik timsoli sifatida tasvirlanadi. Vatan obrazi tabiat manzaralari, xalq hayoti, ijtimoiy adolat g‘oyasi va milliy uyg‘onish motivlari bilan uzviy bog‘liq holda namoyon bo‘ladi.

Gasa va sijo janrlarida Vatan ko‘proq tabiat, axloqiy qadriyat va ruhiy kechinma orqali ifodalansa, pansori va xalqona adabiyotda u xalq hayoti, adolat izlash va ijtimoiy tanqid bilan bog‘lanadi. XIX asr oxiriga kelib esa Vatan tasviri milliy ong, ma’rifatparvarlik va vatanparvarlik g‘oyalari bilan yanada boyiydi.

Xulosa qilib aytganda, XIX asr koreys adabiyotida Vatan obrazi faqat estetik tasvir obyekti emas, balki xalqning tarixiy xotirasi, milliy o‘zligi va ma’naviy birligini ifodalovchi muhim badiiy tushuncha hisoblanadi. Ushbu mavzuni o‘rganish koreys adabiyotining ijtimoiy, madaniy va milliy mazmunini chuqurroq anglashga xizmat qiladi.

Foydalanilgan adabiyotlar ro‘yxati

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A CULTURAL-PRAGMATIC INTERPRETATION OF THE 존댓말 AND 반말 SYSTEM IN THE KOREAN LANGUAGE

Abstract. *This article analyzes the cultural-pragmatic features of the 존댓말 and 반말 system in the Korean language. The study considers speech levels in Korean not only as a grammatical phenomenon, but also as a complex linguocultural system connected with social relations in Korean society, age differences, status, respect, degree of closeness, formality, and a specific communicative situation. The article explores the role of 존댓말 in expressing respect, politeness, social distance, and formality. 반말, in turn, is interpreted as a speech form that expresses closeness, ease of communication, equality, and informality, while in certain situations it may also convey shades of dominance or disregard. In addition, the article analyzes the difficulties faced by learners of Korean in mastering these two speech forms, the pragmatic errors caused by their incorrect use, and the issues that require special attention in the teaching process. The results of the study show that a proper understanding of the 존댓말 and 반말 system is not limited to grammatically correct use of Korean, but is also an important condition for developing natural, culturally appropriate, and communicatively acceptable speech.*

Keywords: *Korean language, 존댓말, 반말, category of respect, speech levels, linguo-pragmatics, sociolinguistics, Korean culture, speech etiquette, communicative situation.*

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KOREYS TILIDAGI 존댓말 VA 반말 TIZIMINING MADANIY-PRAGMATIK TALQINI

Annotatsiya. *Ushbu maqolada koreys tilidagi 존댓말 va 반말 tizimining madaniy-pragmatik xususiyatlari tahlil qilinadi. Tadqiqotda koreys tilidagi nutq darajalari oddiy grammatik hodisa sifatida emas, balki koreys jamiyatidagi ijtimoiy munosabat, yosh farqi, mavqe, hurmat, yaqinlik, rasmiylik va kommunikativ vaziyat*

bilan bog‘liq murakkab lingvomadaniy tizim sifatida talqin etiladi. Maqolada 존댓말ning hurmat, ehtiyotkorlik, ijtimoiy masofa va rasmiylikni ifodalashdagi vazifasi, 반말ning esa yaqinlik, samimiylik, tenglik, norasmiylik hamda ayrim vaziyatlarda hukmronlik yoki bepisandlik ma’nolarini yuzaga chiqarishi yoritiladi. Shuningdek, ushbu ikki nutq shaklining koreys tilini o‘rganuvchilar uchun qiyin jihatlari, ularni noto‘g‘ri qo‘llash natijasida yuzaga keladigan pragmatik xatolar va o‘qitish jarayonida e’tibor qaratilishi lozim bo‘lgan masalalar tahlil qilinadi. Tadqiqot natijalari shuni ko‘rsatadiki, 존댓말 va 반말 tizimini to‘g‘ri anglash koreys tilida grammatik jihatdan to‘g‘ri gapirish bilangina cheklanmay, balki koreys madaniyatiga mos, tabiiy va kommunikativ jihatdan maqbul nutq shakllantirishning muhim sharti hisoblanadi.

Kalit so‘zlar: *koreys tili, 존댓말, 반말, hurmat kategoriyasi, nutq darajalari, lingvopragmatika, sotsiolingvistika, koreys madaniyati, nutq etiketi, kommunikativ vaziyat.*

Kirish

Til insonlar o‘rtasidagi muloqot vositasi bo‘lish bilan birga, jamiyatdagi ijtimoiy munosabatlar, madaniy qadriyatlar va axloqiy me’yorlarni ham aks ettiradi. Har bir xalqning nutq madaniyatida suhbatdoshga qanday murojaat qilish, qanday ohangda gapirish va qanday grammatik shakllardan foydalanish muhim ahamiyatga ega. Koreys tilida bu hodisa ayniqsa yaqqol namoyon bo‘ladi. Chunki koreys tilida nutq shakli suhbatdoshning yoshi, ijtimoiy mavqei, kasbi, yaqinlik darajasi, rasmiy yoki norasmiy vaziyatga qarab tanlanadi.

Koreys tilidagi 존댓말 va 반말 tizimi koreys muloqot madaniyatining eng muhim belgilaridan biridir. 존댓말 odatda hurmat, rasmiylik, ehtiyotkorlik va ijtimoiy masofani bildirsa, 반말 yaqinlik, tenglik, samimiylik yoki norasmiylikni ifodalaydi. Biroq bu ikki nutq shaklining qo‘llanishi oddiy “hurmatli nutq” va “oddiy nutq” qarama-qarshiligi bilan cheklanmaydi. Ularning har biri muayyan kontekstda turli pragmatik ma’nolarni yuzaga chiqaradi.

Koreys tilini chet tili sifatida o‘rganayotgan talabalar uchun 존댓말 va 반말 tizimini o‘zlashtirish eng muhim va ayni paytda eng murakkab masalalardan biri hisoblanadi. Talaba grammatik qoidalarni bilgan holda ham, qaysi vaziyatda qaysi nutq shaklini tanlash kerakligini anglamasa, muloqotda noqulaylik yuzaga kelishi mumkin. Shu sababli mazkur maqolada 존댓말 va 반말 tizimi madaniy-pragmatik nuqtayi nazardan tahlil qilinadi.

존댓말 tushunchasi va uning asosiy xususiyatlari

존댓말 koreys tilida suhbatdoshga hurmat, odob va rasmiy munosabatni ifodalovchi nutq shakli hisoblanadi. Bu shakl, asosan, katta yoshdagilar, o‘qituvchilar, rahbarlar, notanish kishilar, rasmiy suhbatdoshlar yoki ijtimoiy mavqei yuqori shaxslarga nisbatan qo‘llanadi. 존댓말 faqat fe’lning oxirgi

qo‘shimchasi orqali emas, balki maxsus hurmat leksikasi, murojaat shakllari va nutq ohangi orqali ham yuzaga chiqadi.

Masalan, koreys tilida 먹다 fe’lining hurmat shakli 드시다, 자다 fe’lining hurmat shakli 주무시다, 있다 fe’lining hurmat shakli 계시다 tarzida ifodalanadi. Bundan tashqari, gap oxiridagi -습니다, -ㅂ니다, -아요, -어요, -세요 kabi shakllar ham tinglovchiga nisbatan odobli munosabatni bildiradi. Masalan, 갑니다, 먹습니다, 앉으세요, 말씀하세요 kabi birliklar 존댓말 tizimiga kiradi.

존댓말ning asosiy vazifasi suhbatdoshga hurmat ko‘rsatishdir. Biroq u faqat hurmatni emas, balki rasmiy masofa, ehtiyotkorlik, ijtimoiy tartib va kommunikativ muvozanatni ham bildiradi. Notanish kishiga 처음 뵙겠습니다 yoki 감사합니다 kabi odobli shakllarda murojaat qilish koreys muloqot madaniyatida tabiiy hisoblanadi. Shu jihatdan 존댓말 koreys tilida ijtimoiy muvozanatni saqlovchi muhim til vositasidir.

반말 tushunchasi va uning pragmatik ma’nolari

반말 koreys tilida norasmiy, yaqin yoki teng munosabatdagi suhbatdoshlar o‘rtasida qo‘llanadigan nutq shaklidir. Bu shakl odatda do‘stlar, tengdoshlar, oila a’zolari, yoshi kichiklar yoki juda yaqin insonlar bilan muloqotda ishlatiladi. 반말 shaklida gap oxiri odatda qisqaradi yoki oddiy shaklda keladi. Masalan, 가, 먹어, 알았어, 뭐 해?, 어디 가? kabi shakllar 반말ga misol bo‘ladi.

반말ning asosiy pragmatik ma’nosi yaqinlik va samimiylikdir. Do‘stlar o‘rtasida 반말 ishlatilishi ular orasidagi psixologik masofaning yaqinligini bildiradi. Masalan, ikki yaqin do‘stning bir-biriga 밥 먹었어? deb murojaat qilishi tabiiy va samimiy eshitiladi. Bunday holatda 반말 hurmatsizlik emas, balki do‘stona munosabat belgisi hisoblanadi.

Biroq 반말 har doim ham ijobiy ma’no bermaydi. Agar u noto‘g‘ri vaziyatda, masalan, katta yoshli yoki notanish kishiga nisbatan ishlatilsa, beodoblik, past nazar bilan qarash yoki hurmatsizlik sifatida qabul qilinishi mumkin. Ayniqsa rasmiy vaziyatlarda 반말 ishlatish suhbatdoshni ranjitishi yoki so‘zlovchining nutq etiketi yetarli emasligini ko‘rsatishi mumkin. Demak, 반말ning ma’nosi kontekstga bog‘liq: u bir vaziyatda samimiylikni, boshqa vaziyatda esa hurmatsizlikni bildirishi mumkin.

존댓말 va 반말 o‘rtasidagi madaniy farq

존댓말 va 반말 o‘rtasidagi farq koreys jamiyatidagi ijtimoiy ierarxiya va madaniy qadriyatlar bilan chambarchas bog‘liq. Koreys madaniyatida yosh, lavozim, tajriba, oilaviy maqom va ijtimoiy o‘rin muhim ahamiyatga ega. Shu bois koreys tilida so‘zlovchi faqat nima deyayotganini emas, balki kimga va qanday vaziyatda aytayotganini ham hisobga olishi kerak.

존댓말 ko‘pincha ijtimoiy masofani saqlash, suhbatdoshga hurmat ko‘rsatish va rasmiy muhitga moslashish vazifasini bajaradi. Masalan, talabaning o‘qituvchiga

선생님, 질문이 있습니다 deb murojaat qilishi odobli va tabiiy hisoblanadi. Xuddi shu gapni 반말 shaklida 질문 있어 deb aytish esa noo‘rin bo‘lishi mumkin.

반말 esa yaqinlik va tenglikni ko‘rsatadi. Biroq koreys madaniyatida yaqinlik mavjud bo‘lsa ham, yosh yoki mavqe farqi saqlanib qolgan holatlarda 존댓말 ishlatilishi mumkin. Masalan, talaba o‘ziga yaqin bo‘lgan o‘qituvchisiga samimiy munosabatda bo‘lsa ham, odatda 존댓말dan foydalanadi. Bu holat koreys muloqot madaniyatida hurmat va yaqinlik bir-birini inkor etmasligini ko‘rsatadi.

Shu jihatdan 존댓말 va 반말 tizimi faqat grammatik tanlov emas, balki madaniy tanlov hamdir. So‘zlovchi nutq shaklini tanlash orqali suhbatdosh bilan qanday munosabatda ekanini ko‘rsatadi.

Nutq darajalari va kommunikativ vaziyat

Koreys tilida nutq darajasini tanlashda kommunikativ vaziyat muhim rol o‘ynaydi. Bir xil suhbatdoshga turli vaziyatlarda turlicha nutq shakli ishlatilishi mumkin. Masalan, ish joyida ikki hamkasb bir-biriga 존댓말da murojaat qilishi, lekin ish joyidan tashqarida yaqin do‘st sifatida 반말ga o‘tishi mumkin. Bu hodisa koreys tilidagi nutq shakllarining qat’iy emas, balki vaziyatga moslashuvchan ekanligini ko‘rsatadi.

Rasmiy vaziyatlarda 존댓말 deyarli majburiy hisoblanadi. Ish uchrashuvlari, dars jarayoni, ommaviy nutq, xizmat ko‘rsatish sohasi, intervyu va akademik muhitda odatda 존댓말 ishlatiladi. Masalan, 회의가 시작되겠습니다, 질문 있으시면 말씀해 주세요 kabi shakllar rasmiy va odobli nutqni bildiradi.

Norasmiy vaziyatlarda esa 반말 ishlatilishi mumkin. Biroq bu faqat suhbatdoshlar o‘rtasida bunga ruxsat berilgan yoki tabiiy yaqinlik mavjud bo‘lgan hollarda yuz beradi. Koreys tilida ko‘pincha ikki kishi avval 존댓말da gaplashadi, keyin yaqinlashgach, 우리 말 놓을까요? yoki 편하게 말해도 돼요? kabi iboralar orqali 반말ga o‘tish kelishib olinadi. Bu koreys muloqotida nutq shaklini o‘zgartirish ham madaniy kelishuvga bog‘liq ekanini ko‘rsatadi.

존댓말ning pragmatik vazifalari

존댓말 koreys tilida bir necha pragmatik vazifani bajaradi. Birinchidan, u hurmat ifodalaydi. Katta yoshli, yuqori mavqedagi yoki rasmiy suhbatdoshga 존댓말 bilan murojaat qilish so‘zlovchining odobini ko‘rsatadi.

Ikkinchidan, 존댓말 ijtimoiy masofani saqlaydi. Notanish kishilar o‘rtasida bu shakl xavfsiz va madaniy jihatdan maqbul nutq vositasi hisoblanadi. Masalan, ko‘chada yo‘l so‘raganda 실례합니다, 길 좀 물어봐도 될까요? kabi shakllar suhbatni odobli boshlashga yordam beradi.

Uchinchidan, 존댓말 muloyimlik va ehtiyotkorlikni bildiradi. Koreys tilida iltimos, rad etish yoki maslahat berish kabi vaziyatlarda odobli shakllar muhim ahamiyatga ega. Masalan, 이거 해 주세요 shakli 이거 해보다 ancha muloyim va rasmiyroqdir.

To‘rtinchidan, 존댓말 ijtimoiy protokolni saqlaydi. Universitet, ish joyi, davlat idoralari, xizmat ko‘rsatish sohasi kabi muhitlarda 존댓말 muloqotning asosiy me’yori hisoblanadi.

반말ning pragmatik vazifalari

반말 ham koreys tilida muhim pragmatik vazifalarga ega. Birinchidan, u yaqinlikni bildiradi. Do‘stlar, aka-uka, opa-singil yoki yaqin tengdoshlar o‘rtasida 반말 ishlatilishi muloqotni tabiiy va samimiy qiladi.

Ikkinchidan, 반말 tenglikni ifodalaydi. Yosh va mavqei jihatidan teng bo‘lgan shaxslar o‘rtasida 반말 ishlatilishi ijtimoiy masofaning qisqaligini ko‘rsatadi.

Uchinchidan, 반말 emotsional yaqinlikni kuchaytiradi. Badiiy dialoglarda, kundalik suhbatlarda yoki oilaviy muloqotda 반말 personajlar yoki suhbatdoshlar o‘rtasidagi iliqlikni ko‘rsatishi mumkin.

To‘rtinchidan, 반말 ayrim vaziyatlarda hokimiyat yoki ustunlikni bildirishi ham mumkin. Masalan, katta yoshli shaxs yoshi kichik shaxsga 반말da gapirishi koreys madaniyatida odatiy bo‘lishi mumkin. Biroq yosh kichik shaxsning katta kishiga 반말da gapirishi odatda noo‘rin hisoblanadi. Demak, 반말ning pragmatik ma’nosi ijtimoiy munosabatga qarab o‘zgaradi.

존댓말 va 반말 almashinuvi

Koreys tilida 존댓말 va 반말 o‘rtasida almashinish alohida pragmatik hodisa hisoblanadi. Suhbat davomida nutq shaklining o‘zgarishi personajlar yoki suhbatdoshlar o‘rtasidagi munosabat o‘zgarishini ko‘rsatishi mumkin. Masalan, ikki inson avval 존댓말da gaplashib, keyinchalik 반말ga o‘tsa, bu ularning yaqinlashganini bildiradi.

Aksincha, ilgari 반말da gaplashgan kishilar keyinchalik 존댓말ga o‘tsa, bu sovuqlik, rasmiy masofa yoki munosabatda ziddiyat paydo bo‘lganini anglatishi mumkin. Shu jihatdan koreys tilidagi nutq darajalari muloqot dinamikasini ko‘rsatuvchi muhim vositadir.

Koreys seriallari, filmlari va badiiy asarlarida 존댓말dan 반말ga o‘tish ko‘pincha obrazlar o‘rtasidagi munosabat rivojini ko‘rsatadi. Masalan, avval notanish bo‘lgan qahramonlar bir-biriga odobli shaklda murojaat qiladi, keyinchalik yaqinlashgach, norasmiy nutqqa o‘tadi. Bu jarayon koreys madaniyatida nutq shakli munosabat darajasining belgisi ekanini tasdiqlaydi.

Koreys tilini o‘rganuvchilar uchun qiyinchiliklar

Koreys tilini o‘rganayotgan talabalar uchun 존댓말 va 반말 tizimini o‘zlashtirishda bir qator qiyinchiliklar mavjud. Birinchi qiyinchilik grammatik shakllarning ko‘pligi bilan bog‘liq. Talaba -습니다, -아요/어요, -세요, -아/어, -지, -니 kabi shakllarni nafaqat yod olishi, balki ularning qaysi vaziyatda qo‘llanishini ham bilishi kerak.

Ikkinchi qiyinchilik madaniy kontekst bilan bog‘liq. O‘zbek tilida ham hurmat shakllari mavjud, biroq koreys tilidagi nutq darajalari ancha tizimli va vaziyatga sezgir hisoblanadi. Shuning uchun o‘zbek talabasi ba’zan o‘z tilidagi odob me’yorlarini koreys tiliga to‘g‘ridan-to‘g‘ri ko‘chirishi mumkin. Bu esa pragmatik xatolarga olib keladi.

Uchinchi qiyinchilik suhbatdosh bilan munosabat darajasini aniqlashdir. Talaba koreys tilida kimga 존댓말, kimga 반말 ishlatish kerakligini har doim ham tez anglay olmaydi. Ayniqsa yosh jihatdan yaqin, lekin ijtimoiy mavqei farqli shaxslar bilan muloqotda bu masala murakkablashadi.

To‘rtinchi qiyinchilik 반말ning nozik ma’nolari bilan bog‘liq. Talaba 반말ni faqat “oddiy gapirish” deb tushunsa, uni noto‘g‘ri vaziyatda ishlatishi mumkin. Aslida 반말 ruxsat etilgan yaqin munosabatda tabiiy, lekin boshqa vaziyatda hurmatsizlik sifatida qabul qilinishi mumkin.

O‘qitish jarayonida e’tibor berilishi lozim bo‘lgan jihatlar

Koreys tilini o‘qitishda 존댓말 va 반말 tizimini faqat grammatik qoida sifatida emas, balki madaniy-pragmatik hodisa sifatida o‘rgatish zarur. Talabalarga fe’l shakllarini yodlatish bilan birga, ularning qaysi vaziyatda, kimga va qanday maqsadda ishlatilishini tushuntirish muhimdir.

Birinchidan, darslarda real dialoglar asosida mashqlar berish lozim. Masalan, talaba o‘qituvchi bilan, do‘sti bilan, do‘kon sotuvchisi bilan, rahbar bilan, yoshi kichik bola bilan qanday gaplashishini amaliy vaziyatlarda o‘rganishi kerak.

Ikkinchidan, 존댓말 va 반말 o‘rtasidagi farqni madaniy misollar orqali tushuntirish kerak. K-drama, koreys filmlari, intervyular va kundalik suhbatlardan olingan namunalar talabaga bu tizimni tabiiyroq anglashga yordam beradi.

Uchinchidan, talabalarga pragmatik xatolarni tahlil qilish topshiriqlari berilishi mumkin. Masalan, noto‘g‘ri vaziyatda ishlatilgan 반말 yoki haddan tashqari rasmiy 존댓말 namunalarini muhokama qilish orqali ular nutq shaklini tanlash mezonlarini yaxshiroq tushunadilar.

To‘rtinchidan, o‘quvchilarga “qachon 반말ga o‘tish mumkin?” degan savol atrofida madaniy tushuntirish berish zarur. Chunki koreys tilida 반말ga o‘tish ko‘pincha o‘zaro rozilik, yosh va yaqinlik darajasiga bog‘liq bo‘ladi.

Xulosa

Koreys tilidagi 존댓말 va 반말 tizimi koreys muloqot madaniyatining muhim tarkibiy qismi hisoblanadi. 존댓말 hurmat, rasmiylik, ehtiyotkorlik va ijtimoiy masofani bildirsa, 반말 yaqinlik, samimiylik, tenglik va norasmiylikni ifodalaydi. Biroq bu ikki shaklning ma’nosi doimo kommunikativ vaziyat, suhbatdoshlar o‘rtasidagi munosabat, yosh, mavqe va madaniy kontekst bilan bog‘liq holda aniqlanadi.

Tahlil shuni ko‘rsatadiki, 존댓말 va 반말 oddiy grammatik shakllar emas, balki koreys jamiyatidagi ijtimoiy tartib, hurmat madaniyati va nutq etiketi bilan

bog‘liq murakkab lingvopragmatik tizimdir. Bu tizimni noto‘g‘ri qo‘llash muloqotda tushunmovchilik yoki noqulaylikka sabab bo‘lishi mumkin.

Xulosa qilib aytganda, koreys tilini o‘rganuvchilar uchun 존댓말 va 반말 tizimini chuqur o‘zlashtirish koreyscha tabiiy va madaniy jihatdan mos nutq shakllantirishning muhim shartidir. Shu bois ushbu mavzuni koreys tili ta’limida grammatik, pragmatik va lingvomadaniy yondashuvlar asosida o‘rgatish maqsadga muvofiqdir.

Foydalanilgan adabiyotlar ro‘yxati

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THE PROOF OF THEOREMS ON CERTAIN INEQUALITIES AND THEIR APPLICATION IN PRACTICE

Abstract: *This on the subject inequalities concept, their types (linear, quadratic, irrational and others), solution methods and graphic to describe roads It is also studied how inequalities are expressed in real life. application, mathematical model creation also see the role will be released. Subject mathematician logic reinforcement and problems analysis to do skills to develop service does.*

Key words: In*equality, linear inequality, quadratic inequality, interval method, graph solution, mathematical model, solution package*

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AYRIM TENGSIZLIKLAR HAQIDAGI TEOREMALARNING ISLONI VA ULARNING AMALIYATDA QO'LLANISHI

Annotatsiya: *Ushbu mavzu bo'yicha tengsizliklar tushunchasi, ularning turlari (chiziqli, kvadrat, irratsional) va boshqalar), yechim usullari va yo'llarni tasvirlash uchun grafik. Shuningdek, tengsizliklar real hayotda qanday ifodalanishi o'rganiladi. Qo'llanilishi, matematik model yaratish, shuningdek, rolni ko'rish mumkin. Mavzu bo'yicha matematik mantiqni mustahkamlash va muammolarni tahlil qilish ko'nikmalarini rivojlantirish uchun xizmat qiladi.*

Kalit so'zlar: *Tengsizlik, chiziqli tengsizlik, kvadrat tengsizlik, interval usuli, grafik yechim, matematik model, yechimlar to'plami*

Access

Mathematics is only theoretical concepts not in real life problems modeling and analysis to do for powerful in particular, **inequalities** daily in life decision acceptance to do, optimal resource distribution and security borders in marking wide is applied. Budget restrictions, maximum working release size, minimum energy expense such as many economic and technician issues inequalities through is expressed.

This in the article inequalities important from theorems was **AM-GM** and **Koshi-Bunyakovsky** inequalities deep analysis is done, their mathematician evidence will be brought both real and theoretical issues through application demonstration Also, the article of the students analytical thinking, proving and modeling skills to develop service does.

The main part

AM-GM inequality (Arithmetic-geometric average theorem)

Text: (you sent proofs based on is left, orderly as is written).

Generalized AM-GM or Koshi-Bunyakovsky inequality

Text: (you sent main proof stored, lemmas with), with your acquaintance possible:

Theorem (AM-GM): All positive $a_1, a_2, a_3, \dots a_n$for numbers

$$\frac{a_1 + a_2 + \cdots + a_n}{n} \geq \sqrt[n]{a_1 a_2 \dots a_n} \quad (1)$$

inequality appropriate. Equality $a_1 = a_2 = a_3 = \cdots = a_n$is executed when.

Proof: By induction we use.

$n = 2$at$\sqrt{a_1 a_2} \leq \frac{a_1+a_2}{2}$ <=> $(\sqrt{a_1} - \sqrt{a_2})^2 \geq 0$ $\forall a_1, a_2 \geq 0$

(1) in We prove that it is $n$valid for ta positive numbers by assuming that ta is valid for $n + 1$ta R^+numbers. Let these numbers $a_1, a_2, a_3, \dots a_n, a_{n+1}$be $a_{n+1}$the largest of them,

$$a_{n+1} \geq a_1, a_{n+1} \geq a_2, \dots\ a_{n+1} \geq a_n \quad =>$$

$$=>\ a_{n+1} \geq \frac{a_1 + a_2 + \cdots + a_n}{n} \quad (2)$$

As follows designation we enter.

$$A_n = \frac{a_1 + a_2 + \cdots + a_n}{n} \quad ; \quad A_{n+1} = \frac{a_1 + a_2 + \cdots + a_n + a_{n+1}}{n} = \frac{nA_n + a_{n+1}}{n+1}$$

(2)to according to $a_{n+1} \geq A_n$ $=>$ $a_{n+1} = A_n + \alpha$ $\alpha \geq 0$Let's say. Then:

$$A_{n+1} = \frac{nA_n + A_n + \alpha}{n+1} = A_n + \frac{\alpha}{n+1}$$

This equality both part $n+1$Raising to the level, we find:

$$(A_{n+1})^{n+1} = A_n^{n+1} + C_{n+1}^1 (A_n)^n \frac{\alpha}{n+1} + \cdots + C_{n+1}^n (A_n) \left(\frac{\alpha}{n+1}\right)^n +$$

$$+ \left(\frac{\alpha}{n+1}\right)^{n+1} \geq (A_n)^{n+1} + C_{n+1}^1 (A_n)^n \frac{\alpha}{n+1} = (A_n)^{n+1} + (A_n)^n \frac{\alpha}{n+1} \frac{(n+1)!}{1!\,n!}$$

$$= A_n^{n+1} + (A_n)^n \alpha = A_n^n (A_n + \alpha) = A_n^n \cdot a_{n+1}$$

To the assumption according to $A_n^n \geq a_1 a_2 \ldots a_n$ $=>$

$$(A_{n+1})^{n+1} \geq a_1 a_2 a_3 \ldots a_n a_{n+1} \quad =>$$

$$\frac{a_1 + a_2 + \cdots + a_n + a_{n+1}}{n+1} \geq \sqrt[n+1]{a_1 a_2 \ldots a_n a_{n+1}}$$

From this come it turns out theorem proved.

Theorem (Generalized AM-GM or Cauchy-Bunyakovsky): $a_1, a_2, \ldots a_n, p_1, p_2, \ldots, p_n$positive numbers

$$a_1^{p_1} a_2^{p_2} \ldots . a_n^{p_n} \leq \left(\frac{a_1 p_1 + a_2 p_2 + \cdots + a_n p_n}{p_1 + p_2 + \cdots + p_n}\right)^{p_1 + p_2 + \cdots + p_n} \quad (1)$$

Relationship appropriate, equality and only $a_1 = a_2 = a_3 = \cdots = a_n$is performed.

Proof: Lemma: $e^{x-1} \geq x$there is, in which $x \geq 1$.

Lemma The $=>$ $e^{x-1} - x \geq e^{1-1} - 1 = 1 - 1 = 0$ $=>$ $e^{x-1} - x \geq$ 0proof is $f(x) \geq f(1)$that $=>$ $x \geq 1$:$f(x) = e^{x-1} - x$

(1) in proof From the lemma we use.

$$S = \frac{a_1 p_1 + a_2 p_2 + \cdots + a_n p_n}{p_1 + p_2 + \cdots + p_n}$$

to mark as we enter.

To the lemma according to : $e^{\frac{a_i}{S}-1} \geq \frac{a_i}{S}$it will be, in which case$i = \overline{1,n}$ => $S \cdot e^{\frac{a_i}{S}-1} \geq a_i$ =>

$$a_i^{p_i} \leq S^{p_i} \cdot e^{\frac{a_i p_i}{S}-p_i}, \ \ i = \overline{1,n}$$

These inequalities all of them multiply Let's go out.

$$a_1^{p_1} a_2^{p_2} \ldots . a_n^{p_n} \leq \left(\frac{a_1 p_1 + a_2 p_2 + \cdots + a_n p_n}{p_1 + p_2 + \cdots + p_n}\right)^{p_1+p_2+\cdots+p_n}$$

Equality only $s = a_1 = a_2 = a_3 = \cdots = a_n$is fulfilled, it follows that the inequality has been proven.

We are this from theorems using one how much following inequality about issues our solution possible.

Issues

Example 1: $x, y > 0$Prove the inequality if.$x^2 + y^2 + 1 \geq xy + x + y$

Proof:$x^2 + y^2 + 1 = \left(\frac{x^2}{2} + \frac{y^2}{2}\right) + \left(\frac{x^2}{2} + \frac{1}{2}\right) + \left(\frac{y^2}{2} + \frac{1}{2}\right) \geq xy + x + y$

From this come comes out inequality proved.

Example 2: $x > 0$if, $2^{\sqrt[12]{x}} + 2^{\sqrt[4]{x}} \geq 2 \cdot 2^{\sqrt[6]{x}}$prove the inequality.

Proof: AM-GM theorem according to :$2^{\sqrt[12]{x}} + 2^{\sqrt[4]{x}} \geq 2 \cdot 2^{x^{\frac{1}{12}+\frac{1}{4}}} = 2 \cdot 2^{2x^{\frac{1}{6}}} = 2 \cdot 2^{\sqrt[6]{x}}$

from this come comes out inequality proved.

Conclusion

Inequalities mathematician analysis, engineering, economics and medicine such as many in the fields important tool as service This will do. in the article the most famous and strong inequality from theorems one was AM-GM (arithmetic-geometric) average) and Koshi-Bunyakovsky inequalities studied, their induction, elementary algebra and exponent function based on evidence was brought.

Quoted examples through these inequalities not only theoretically, maybe practical also showing the importance They were given. using complicated expressions assessment, problems simplification, as well as real -life restrictions as a mathematical model expression opportunity existence proved.

Also in the article inequalities: in medicine – dose borders in determining, in economics – budget distribution in planning, in engineering – mechanical security in providing, how application shown.

In the future this the topic following in directions expansion to the goal appropriate will be:

Holder, Chebyshev and Minkowski inequalities such as progressive inequalities study, algorithmic analysis based on computer through automated proof methods use, inequalities at the Olympics application analysis to do

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DORIVOR GULHAYRINING FARMAKOLOGIK XUSUSIYATLARI VA SHIFOBAXSH TA'SIRI

Annotatsiya. *Hozirgi kunda jahonda dorivor o'simliklar xom ashyosidan olinadigan tabiiy dori darmonlarga bo'lgan talab ortmoqda. Shunday ekan, insonlar manfaatlarini ko'zlab, har bir dorivor o'simliklarini o'rganib, ko'paytirish ulardan yuqori sifatli dorivor o'simlik xom-ashyo zaxirasini tashkil etish zarur. Asrlar davomida dorivor o'tlar ko'plab mamlakatlarda kasalliklarni davolash uchun ishlatilgan. Gulxayri (*Malva sylvestris *L.) turlaridan olingan malvaning bir turi bo'lib, oddiy mallow sifatida tan olinadi. Bu ajoyib o'simlik mikroblarga qarshi, gepatoprotektiv, yallig'lanishga qarshi va antioksidant xususiyatlarga ega va eng shifobaxsh dorivor o'simlik turlaridan biri hisoblanadi. Bu o'simlikning ko'plab kasalliklarni davolashda va farmatsevtik birikmalar tayyorlashda an'anaviy qo'llanilishi bizga antibiotiklar va boshqa terapevtik vositalarni ishlab chiqarish uchun ishlatiladigan dorilarning o'simlik kelib chiqishini qanday chuqur bilishni ko'rsatishi mumkin.*

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PHARMACOLOGICAL PROPERTIES AND HEALING EFFECTS OF WILD MALLOW

Abstract. *Currently, the demand for natural medicines derived from medicinal plants is increasing worldwide. Therefore, it is necessary to study and propagate each medicinal plant in order to create a reserve of high-quality medicinal plant raw materials, in the interests of people. A species of mallow derived from the wild mallow (Malva sylvestris L.) species, it is recognized as common mallow. This amazing plant has antimicrobial, hepatoprotective, anti-inflammatory, and antioxidant properties and is considered one of the most healing medicinal plant species. The traditional use of this plant in the treatment of many diseases and in the preparation of pharmaceutical compounds can show us how to gain a deep knowledge of the plant origin of drugs used to produce antibiotics and other therapeutic agents.*

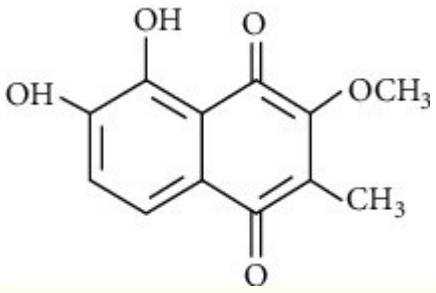
Mavzuning dolzarbligi: Gulxayri Qadim zamonlardan beri shifobaxsh o'simlik sifatida ishlatilib keladi. Yer yuzida 70 ga yaqin turkumi va 900 turi bor. Ko'p tropik va subtropik rayonlarda tarqalgan. Bulardan gulxayri, bo'ritaroq,g'o'za, kanop, tugmachagul, paxtagul, gulhamishabahor keng tarqalgan. O'zbekistonda 7 turkumi va 27 turi o'sadi. Ularning ko'pidan tola olinadi, dori tayyorlanadi. *Malva sylvestris* L. (*M.sylvestris*) Yevropa, Eron, Pokiston va Hindistonda ham keng tarqalgan. *M. sylvestris* ikki yillik ko'p yillik o't o'simlik bo'lib, Shimoliy Afrika, Yevropa va Janubi-G'arbiy Osiyoda keng tarqalgan. O'simlik odatda nam joylarda, masalan, botqoqlar, ariqlar, okeanlar, daryo qirg'oqlari va o'tloqlar yaqinida o'sadi. Bu o'simlikning yumshatuvchi xususiyatlari tufayli rimliklar va qadimgi yunonlar uni yumshatuvchi sifatida ishlatishgan . An'anaga ko'ra, bu dorivor o'simliklar turli xil ob-havo sharoitida sovuq, kuyish, yo'tal, tonzillit, bronxit, ovqat hazm qilish muammolari, ekzema va kesilgan yaralar kabi bir nechta infektsiya va kasalliklarni davolash uchun ishlatilgan. Tabiiy mahsulot sifatida *M. sylvestris* barglari va gullari turli xil terapevtik ta'sir ko'rsatdi.

Gulxayri o'simligining tarkibida juda ko'p foydali moddalar bor. Chunonchi gulxayrining ildizida 35 % gacha shilliq moddalar, 37 % gacha kraxmal, 16 % ga yaqin qand, asparagin, betain, pektin, yog', 4,9 % atrofida mineral tuzlar mavjud. O'simlikning barg hamda gullarida 0,02 % ga yaqin qattiq efir moyi, karotin, vitamin C, ildizlardagiga qaraganda ikki marta kam shilliq moddalar bor.

Mallow (Malva sylvestris L.) o'zining boy kimyoviy tarkibi, jumladan shilimshiq, taninlar, flavonoidlar, vitaminlar (A, C) va minerallar (kaltsiy, magniy, kaliy) tufayli farmakologik va dorivor xususiyatlarga ega. Bu o'simlik yallig'lanishga qarshi, tinchlantiruvchi, ekspektoran, antioksidant va yaralarni davolovchi xususiyatlarga ega. Nafas olish yo'llari, oshqozon-ichak trakti va teri kasalliklari uchun ishlatiladi.

Dorivor o'simliklar ko'pincha odamlarning turli kasalliklarini davolash uchun ishlatilgan. O'tgan asrda dorivor, gematologiya, onkologiya va immunologiyada o'simliklardan foydalanish tabiiy kompozitsiyalarning o'ziga xosligiga ta'sir qildi: kodein, taksol, vinblastin, morfin va kokain va boshqalar. Bir nechta tadqiqotlar natijalari shuni ko'rsatdiki, *Malva* ekstrakti tarkibida fenolik hosilalar, flavonoidlar,

terpenoidlar, katalaza fermentlari, sulfit oksidaza, yog 'kislotalari va ba'zi strolllar (ayniqsa, omega-3 va omega-6 kabi muhim yog 'kislotalari), beta-karotin, vitamin C va antioksidlovchi xususiyatlarga ega bo'lgan turli xil birikmalar mavjud. Shuning uchun u buyrakni sisplatin va vanadiy tizimi natijasida kelib chiqadigan buyrak toksikligi tufayli jarohatlardan himoya qilishi mumkin. Keng qamrovli tadqiqotlar shuni ko'rsatadiki, turli xil kimyoviy birikmalarga ega bu o'simlik uglerod tetraklorid tufayli jigar shikastlanishini minimallashtirishi mumkin. *M. sylvestris* mikroblarga qarshi, antinositseptiv, gepatoprotektiv, yaralarni davolovchi, saratonga qarshi, yallig'lanishga qarshi va kuchli antioksidant xususiyatlarga ega. Bundan tashqari, bu o'simlik kuchli antioksidantlar va uglevodlar va to'yinmagan yog'li kislotalar kabi ko'plab qimmatli birikmalarni o'z ichiga oladi. *Malva* o'simlikida topilgan taninlar, flavonoidlar, fenolik birikmalar va askorbin kislota ko'pchilik saraton kasalliklarini davolash va yaralarni davolash uchun ishlatiladi .



M. sylvestris [7] da topilgan fitoaleksin bo'lgan malvone A ning kimyoviy asosi

O'simlik antioksidantlarini qo'llashning keng tarqalganligi, ularning antioksidantlarning turli xil tadqiqotlari va amaliy jihatlarida qo'llanilishini hisobga olgan holda, ayniqsa, erkin radikal so'rilishi bo'lgan uning guruhlari bilan fenolik induktsiya asosidagi qimmatli birikmalar, oksidlanishni oldini olish vositasi sifatida foydalanishni kengaytirishda muhim rol o'ynaydi. Nawwar va boshqalar tomonidan o'tkazilgan tadqiqotda., fenol karboksilik va erkin organik kislotalar metillangan.

M. sylvestris barglaridan olingan jami 13 ta organik kislotalar , jumladan, malonat (1284,4 mg/kg), malat (3510,0 mg/kg), oksalat (4170,7 mg/kg), fumarat (6924,8 mg/kg) va sitrat (13133,2 mg/kg) ma’lum. Ushbu birikmalar *M. sylvestris* va ushbu tabiiy birikmalar asosida tayyorlangan preparatlar uchun immunostimulyator va antioksidant xususiyatlarini rivojlantirishga yordam beradi. Tadqiqotchilar, shuningdek, 95% etanol olib tashlanganda, bargli gul poyalari va gullariga. qaraganda barglarda ko'proq flavonoidlar va fenolik tarkib va antioksidantlarni aniqladilar.

Mallow urug'lari sovuq va nam. Ularda juda ko'p shilimshiq mavjud. Ichkarida olingan bo'lsa, ular astarni yumshatadi, quruq yo'talga yordam beradi va ichak shilliq qavatining shikastlanishi uchun foydalidir. Ularni klizma preparatlari bilan aralashtirish qattiq dori-darmonlarning ichaklarga zararli ta'sirini bartaraf qiladi. Mallow urug'ini qizil yonca urug'ining teng qismlari bilan iste'mol qilish

siydik pufagi og'rig'ini engillashtiradi. Urug'larning qaynatmasi bilan ho'qna qilish ichaklarda, bachadonda va anusda kuyishni davolaydi. Mallow va asal qaynatmasidan tayyorlangan ho'qna jigar og'rig'ini engillashtiradi. Kukunli quritilgan urug'lar, topikal ravishda qo'llanilsa, issiq shishlar, og'riqlar va qattiq shishlar bilan yordam beradi. Ichki foydalanish uchun tavsiya etilgan doz 10,5 dan 17,5 grammgacha.

Eksperimental tadqiqotlar shuni ko'rsatdiki, mallow ekstraktlari osteoklastogenez jarayonini davolaydi va surunkali yallig'lanish sharoitida terapevtik ta'sir ko'rsatadi.

O'simlikning turli qismlari antibakterial va bakteriostatik xususiyatlarga ega. *M. sylvestris* turli bakterial va qo'ziqorin turlariga qarshi mikroblarga qarshi faoliyatni amalga oshiradi. Disk diffuziya usuli *M. sylvestris* ekstraktining turli bakterial turlarga qarshi mikroblarga qarshi faolligini xabar qildi. Tadqiqotchilar *M. sylvestris tipik antibiotiklar* bilan bog'liq tanlangan mikroorganizmlarga nisbatan o'rtacha faollikka ega ekanligini aniqladilar .

De Souza va boshqalar. *M. sylvestris* havo qismi ekstraktlarining *C. Albicans, S. aureus, M. luteus, Bacillus subtilis, S. epidermidis, E. coli* va *S. cerevisiae* ga qarshi mikroblarga qarshi faolligini o'rgandi . Ularning tadqiqoti shuni ko'rsatdiki, *M. sylvestrisning etanol ekstraktlari P. aeruginosa* , *B. subtilis* va *E. coli* ga qarshi faol bo'lgan , metanol ekstraktlari esa faqat *S. cerevisiae* ga qarshi faollik ko'rsatdi . Ularning natijalari *M. sylvestris* ekstraktlari *in vitro* mikrobial faollikni inhibe qilishini ko'rsatdi . Boshqa tadqiqotlar shuni ko'rsatdiki, urug ' moyi Gram-manfiy *P. aeruginosa* bakteriyalaridan tashqari barcha mikroorganizmlarning o'sishiga to'sqinlik qiladi.

Mallow polisaxaridlari immunomodulyatsion xususiyatlarga ega. Tasodifiy, platsebo nazorati ostida o'tkazilgan tadqiqotlar shuni ko'rsatdiki, o'simlik ekstraktlari ekzema uchun terapevtik vosita bo'lib xizmat qilishi va kortikosteroidlar va antigistaminlar uchun optimal almashtirish sifatida ishlatilishi mumkin.

O'simlikning tinchlantiruvchi xususiyatlari turli nevrotik holatlar uchun ham qayd etilgan. Tashqi tomondan, o'simlikning qaynatmalari gemorroyni davolash uchun va terining shikastlanishi, dermatit va kuyishlar uchun yarani davolovchi vosita sifatida ishlatiladi. Eksperimental tadqiqotlar shuni ko'rsatdiki, mallow ekstraktining tashqi qo'llanilishi diabetga chalingan eksperimental hayvonlarda yaralarni davolashni yaxshilaydi.

Jigar fiziologik jihatdan tananing barcha hayotiy funktsiyalarida ishtirok etishi kerak. Jigardagi har qanday nosozlik bu a'zoga tuzatib bo'lmaydigan zarar etkazishi mumkin bo'lgan bir qator buzilishlarni keltirib chiqaradi; oksidlovchi stress, erkin radikallar, kimyoviy moddalar, viruslar va dorilar kabi ta'sir qiluvchi omillar jigar to'qimalarining degradatsiyasiga olib kelishi mumkin. Adabiyotlar *M. sylvestris'da* antioksidant birikmalar mavjudligini tasdiqladi . Bu birikmalar, o'z navbatida, erkin radikallarni olib tashlaydi va to'qimalarni, ayniqsa jigarni himoya qilishga yordam beradi.

Xulosa. *Ushbu sharh M. sylvestrisning* dorivor o't va funktsional oziq-ovqat sifatida ahamiyatini ko'rsatdi. Topilmalar kimyoviy birikmalar va farmakologik ta'sirlar, shuningdek, *Malva* o'simlikining turli jihatlari bo'yicha nisbatan keng qamrovli tadqiqotlar olib borilganligini ko'rsatadi. *M. sylvestris* samarali dorivor xususiyatlari tufayli muhim resursli o'simlik hisoblanadi. Tadqiqotlar uning antioksidant faolligi, yallig'lanishga qarshi faolligi, saratonga qarshi faolligi, yaralarni davolovchi faolligi, gepatoprotektiv faolligi, antinosiseptiv faolligi va mikroblarga qarshi faolligi tufayli sog'liq uchun foydalari mumkinligini isbotladi. Barglari, gullari va ildizlari dorivor maqsadlarda ishlatiladi. Bu yerda *M. sylvestris* L.ning o‘ziga xos organik faolligi , an’anaviy qo‘llanilishi, metanolik ekstraktlarda aniqlangan asosiy fitokimyoviy birikmalar, *M. sylvestrisning* farmakologik faolligi ko‘rib chiqildi.

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XIKOL QUYON ZOTINING NASLCHILIK XUSUSIYATLARI, GO‘SHT MAHSULDORLIGI VA INTENSIV YETISHTIRISH SAMARADORLIGI

Annotatsiya: *Ushbu maqolada Xikol quyon zotining naslchilik va biologik xususiyatlari, go‘sht mahsuldorligi hamda intensiv yetishtirish texnologiyasining samaradorligi tahlil qilingan. Tadqiqot davomida Xikol quyonlarining tez o‘sishi, yuqori go‘sht chiqimi, ozuqadan samarali foydalanishi va ko‘payish qobiliyati o‘rganildi. Shuningdek, ularni oziqlantirish, saqlash va parvarishlashning zamonaviy usullari yoritildi. Xikol zotining sanoat quyonchiligida qo‘llanilishi, iqtisodiy samaradorligi va yuqori sifatli parhez go‘sht yetishtirishdagi ahamiyati baholandi. Olingan natijalar ushbu zotni respublikamiz sharoitida keng joriy etish quyonchilik tarmog‘ining rentabelligini oshirishga xizmat qilishini ko‘rsatdi.*

Kalit so‘zlar: *Xikol quyon zoti, quyonchilik, naslchilik, biologik xususiyatlar, go‘sht mahsuldorligi, intensiv texnologiya, oziqlantirish, parvarishlash, ko'paytirish, iqtisodiy samaradorlik, ozuqa konversiyasi, parhez go‘sht.*

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REPRODUCTIVE CHARACTERISTICS, MEAT PRODUCTIVITY AND INTENSIVE GROWING EFFICIENCY OF THE HIKOL RABBIT BREED

Abstract: *This article analyzes the breeding and biological characteristics of the Hicol rabbit breed, its meat productivity, and the effectiveness of intensive breeding technology. The study examined the rapid growth, high meat yield, efficient feed utilization, and reproductive capacity of Hickol rabbits. It also highlighted modern methods of feeding, housing, and caring for them. The use of the Hickol breed in industrial rabbit breeding, its economic efficiency, and its importance in producing high-quality dietary meat were evaluated. The results obtained showed that the widespread introduction of this breed in the conditions of our republic would serve to increase the profitability of the rabbit breeding industry.*

Keywords: *Xicol rabbit breed, rabbit breeding, breeding, biological characteristics, meat productivity, intensive technology, feeding, maintenance, breeding, economic efficiency, feed conversion, dietary meat.*

Kirish Xikol zotining kelib chiqishi. Xikol quyon zoti Frantsiyada 1913-yilda yetishtirilgan bo‘lib, asosan Kaliforniya va Yangi Zelandiya oq quyon zotlarini chatishtirish natijasida olingan. Maqsad yuqori sifatli go‘sht olish va tez yetilish xususiyatlarini yaxshilash bo‘lgan. Xikol zotining yuqori ozuqaviy qiymatga ega bo‘lishi va nasl berish qobiliyatining kuchliligi uni iqtisodiy jihatdan foydali chorvachilik tarmog‘iga aylantirgan.

Xikol quyon zoti sanoat chorvachiligida yuqori mahsuldorligi bilan ajralib turadi. Ular asosan go‘sht yetishtirish maqsadida parvarish qilinadi va tez o‘sishi, go‘sht sifatining yuqoriligi bilan qimmatli hisoblanadi. Ushbu maqolada Xikol quyon zotining kelib chiqishi, tashqi va genetik xususiyatlari, yetishtirish texnologiyasi va iqtisodiy ahamiyati haqida ilmiy asoslangan ma’lumotlar beriladi.

Tashqi va genetik xususiyatlari. Xikol quyonlari o‘rtacha 4,5–5,5 kg vaznga ega bo‘lib, tanasi ixcham, muskullari yaxshi rivojlangan bo‘ladi. Jun qoplami oq, yumshoq va qalin. Ularning terisi ham sanoatda yuqori baholanadi. Xikol zotining go‘sht hosildorligi 60–65% ni tashkil etadi, bu esa ularning go‘sht ishlab chiqarish uchun qulayligini ko‘rsatadi. Bundan tashqari, bu zot tez yetilish va ko‘payish qobiliyatiga ega bo‘lib, bir urg‘ochi quyon yilliga 7–8 marta nasl berishi mumkin.

Xikol quyonlarini yetishtirish va parvarishlash. Ushbu zotdagi quyonlarni boqishda ularning maxsus oziqlantirish rejimiga rioya qilish muhimdir. Ratsion tarkibida protein, vitamin va minerallarga boy yemlar bo‘lishi lozim. Shuningdek, quyonlar uchun sanitariya va gigiyena sharoitlarini ta’minlash kasalliklarning oldini olishda muhim ahamiyat kasb etadi. Ularni qafaslarda yoki maxsus fermalarda saqlash mumkin. Optimal harorat rejimi 15–20°C bo‘lib, yaxshi shamollatilgan va quruq joylar quyonlar uchun ideal hisoblanadi. Urg`ochi quyonlar 3-4 oyda jinsiy yetiladi va urug`lantirishga tayyor holga keladi. Ona quyonlar xar 30 kunda 8 tadan 12 tagacha bolalaydi. Ona quyon va bolasini bir oy birga boqiladi va bir oydan keyin ajratiladi, va ajratilgan bolalarni yana 2-3 oy boqilsa vazni 1000-

1600gramgacha tayyor yetilgan quyonlar holatiga keladi. Undan ko`proq yani 4-5 oy boqilsa 5kg gacha sof quyon go`shtini olish mumkin. Ona quyonlarni 15-20 kun dam oldirib yana urug`lantirsak 28-30 kunda 8-12 tagacha nasl beradi. Shunday qilib quyonlar bir yilda 6-7 martagacha bolalaydi. O`rtacha hisobda bitta Xikol zotli ona quyon 10ta bolalaydi va bolari bir oydan keyin ajratilib alohida boqiladi. 2-3 oyda bolari 1,6kg vaznga ega bo`ladi. Bir kilo quyon go`shtimiz hozirgi kunda o`rtacha 50000 ming so`m hisoblanadi. Bundan tashqari bitta quyonimiz 3 oyda 10 taga ko`payadi,

Xikol zotining iqtisodiy samaradorligi Xikol quyonlari tez o‘sishi, oziq-ovqatni yaxshi o‘zlashtirishi va yuqori go‘sht hosildorligi bilan iqtisodiy jihatdan foydali hisoblanadi. Quyon go‘shti bozorida talab yuqori bo‘lib, u parhez mahsulot sifatida qadrlanadi. Shuningdek, ularning terisi ham yengil sanoatda keng qo‘llaniladi. Xikol zotining ozuqaviy samaradorligi boshqa quyon zotlariga nisbatan yuqori bo‘lib, bir kilogramm o‘sish uchun nisbatan kam yem sarf etiladi.

Xulosa va takliflar Xikol quyon zotini yetishtirish go‘sht yetishtirish sanoati uchun istiqbolli yo‘nalishlardan biridir. Ularning yuqori mahsuldorligi, tez yetilishi va oson parvarishlanishi iqtisodiy jihatdan samarali bo‘lishiga sabab bo‘ladi. Ushbu zotni keng miqyosda yetishtirish va uning samaradorligini oshirish uchun ilmiy tadqiqotlarni davom ettirish, zamonaviy texnologiyalarni joriy etish va oziqlantirish tizimini yanada takomillashtirish tavsiya etiladi.

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IMPROVEMENT OF MODERN TECHNOLOGIES AND METHODS OF ROAD CONSTRUCTION ORGANIZATION

Abstract. *This article analyzes modern technologies in highway construction, effective methods of construction management and the main directions of scientific and technological development in the industry. The issues of using local materials and industrial waste, improving pavement structures, comprehensive mechanization and automation of construction processes are considered. The advantages of flow-line construction methods and prospects for the introduction of robotic technologies in road construction are also highlighted.*

Keywords: *highways, road construction, mechanization, automation, pavement structure, flow construction, robotics.*

Introduction. Highways are one of the main elements of transport infrastructure and play an important role in ensuring the sustainable development of the national economy and the mobility of the population. In recent years, the increase in the number of vehicles, the growth of traffic intensity, and the rising share of heavy-duty trucks have significantly increased the requirements for highway infrastructure. In this regard, improving road construction technologies, enhancing the efficiency of construction processes, and extending the service life of road pavements have become urgent tasks.

Scientific research in the field of road construction is aimed at reducing material consumption, increasing the use of local resources, introducing energy-saving technologies, and automating construction processes. Today, the application of modern construction equipment, digital control systems, and robotic technologies plays a significant role in the development of the industry.

Research Materials and Methods. In this study, theoretical sources and currently applied technologies related to highway construction and construction management were analyzed. Construction materials, road-building technologies, mechanization, and automation processes were investigated. In addition, the organizational and economic efficiency of the flow construction method was evaluated.

Improvement of Highway Construction Technologies

In modern highway construction, a thorough study of the physical and mechanical properties of soils is of great importance. Based on the results of scientific research in geology, hydrogeology, and soil mechanics, opportunities for increasing the strength of roadbeds and controlling their water-thermal regime are expanding. The service life of road pavements largely depends on their structural

design and operating conditions. Therefore, improving the methods for designing and calculating multilayer pavement structures is essential. By studying the behavior of rigid and flexible pavements under traffic loads, more durable pavement structures are being developed. The effective use of local mineral materials, rocks, and industrial waste products in construction helps reduce construction costs. At the same time, the application of bitumen, emulsions, polymer-modified binders, and new-generation cements ensures the long-term durability of road pavements.

Mechanization and Automation of Construction Processes

Mechanization is one of the main factors in increasing labor productivity in road construction. Modern construction machinery possesses high performance and enables construction work to be carried out quickly and efficiently.

Comprehensive mechanization involves performing all major and auxiliary operations through a coordinated system of machines. This approach helps shorten construction periods and maintain consistent work quality.

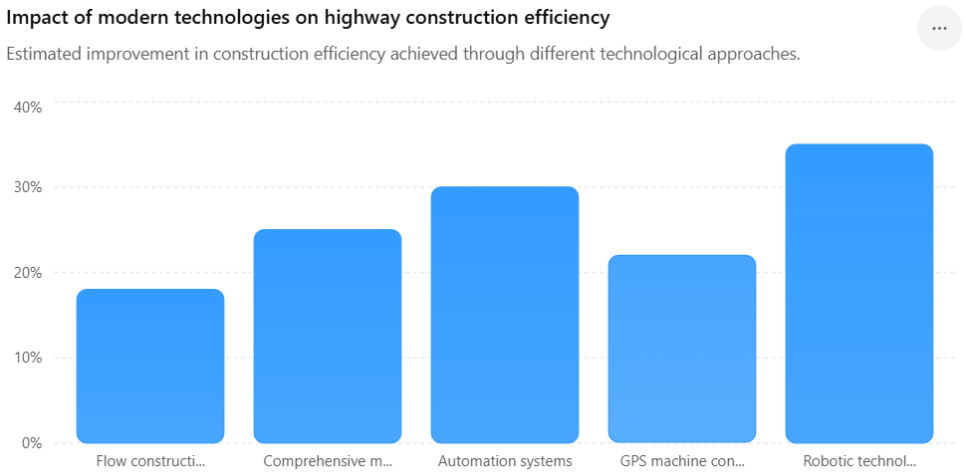

Figure 1 shows the estimated efficiency gains achieved through the implementation of modern technologies in highway construction. The results indicate that robotic technologies provide the highest improvement in construction efficiency (35%), followed by automation systems (30%) and comprehensive mechanization (25%). The flow construction method and GPS-based machine control systems also contribute significantly to reducing construction time and improving resource utilization. These findings demonstrate the importance of integrating advanced digital and automated technologies into modern highway construction projects.

Automation represents a higher stage of mechanization, allowing technological processes to be managed with minimal human intervention. Modern asphalt concrete plants, electronic control systems, and digital measuring devices contribute significantly to the efficient management of construction processes.

Importance of Robotic Technologies

In recent years, robotic technologies have been increasingly applied in the construction sector. Robotic systems help reduce the share of heavy and hazardous work, improve construction accuracy, and minimize the influence of human factors.

The use of drones for monitoring, automatic leveling systems, and GPS-controlled construction equipment in road construction significantly improves the efficiency of construction operations.

Flow Organization of Highway Construction

The application of the flow method in highway construction provides high economic efficiency. Under this method, construction teams operate in a predetermined technological sequence, performing work on specific sections of the road.

The main advantages of flow construction include:

Reduction of construction time;

Efficient utilization of labor resources;

Minimization of equipment idle time;

Ensuring stable product quality;

Reduction of construction costs.

The flow construction system consists of individual, specialized, and object-oriented flows. Their coordinated operation determines the overall efficiency of the construction process.

Conclusion. The application of modern technologies, comprehensive mechanization, and automation in highway construction significantly improves construction quality, labor productivity, and resource efficiency. The use of local materials and innovative binders contributes to reducing construction costs and extending pavement service life.

The flow construction method ensures the effective utilization of labor, machinery, and materials while reducing construction time and minimizing equipment downtime. In addition, the integration of GIS, GNSS, BIM, and digital monitoring technologies enhances planning accuracy and construction management efficiency.

Table 1. Key Outcomes of Modern Highway Construction Technologies

Technology / Approach	Main Benefit	Expected Impact
Comprehensive Mechanization	Increased labor productivity	Faster construction operations
Automation Systems	Reduced human intervention and errors	Improved construction quality
Local Construction Materials	Lower material transportation costs	Reduced project cost
Innovative Binders	Enhanced pavement durability	Extended service life of pavements

Future development of the highway construction sector will largely depend on the wider adoption of robotics, artificial intelligence, and intelligent control

systems, which will support the creation of more sustainable, durable, and cost-effective road infrastructure.

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ASSESSMENT OF THE EFFECTIVENESS OF TEETH FISSURAL SEALING IN THE PREVENTION OF CARIES OF PERMANENT TEETH IN CHILDREN WITH DAUN

Annotation: *The prevalence of dental caries in mentally retarded children studying in specialized schools depends on their level of socialization, nutrition and the presence of Down syndrome. The risk group includes socialized children without Down syndrome: the caries intensity index was 3.8 4.9; 5.8, and the prevalence is 42.0, 76.0 and 85.0% in children 8, 10 and 12 years old, respectively. The prevalence of caries in children with Down syndrome was lower - 33.0, 64.0 and 72.0% in children 8, 10 and 12 years old, respectively.*

According to the results of applying a special preventive algorithm, the number of cariogenic microorganisms on the teeth slightly decreased from the initial values. Thus, the most optimal treatment regimen with a high therapeutic effect in mentally retarded patients has been identified, which makes it possible to increase the effectiveness of treatment and reduce its time.

Key words: *dental caries, periodontal disease, epidemiological study, caries intensity, mental retardation.*

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DAUN SINDROMLI BOLALAR DOIMIY TISHLARI PROFILAKTIKASIDA TISH FISSURALARINI MUHRLASH USULLARINI TAKOMILLASHTIRISH

Annotatsiya: *Ixtisoslashtirilgan maxsus maktablarda tarbiyalanuvchi aqliy zaif bolalarda tish kariyesining tarqalishi ularning ijtimoiylashuviga, ovqatlanishiga va Daun sindromining mavjudligiga bog‘liq. Xavf guruhiga Daun sindromisiz ijtimoiylashgan bolalar kiradi: kariyesning intensivligi 8, 10 va 12 yoshlarda mos ravishda 3,8; 4,9; 5,8, tarqalishi esa 42,0; 76,0 va 85,0 % ni tashkil etdi. Daun sindromiga ega bo‘lgan bolalarda kariyes tarqalish darajasi past bo‘lib, 8, 10 va 12 yoshli bolalarda mos ravishda 33,0; 64,0 va 72,0 % ni tashkil etdi. Maxsus profilaktik algoritmni qo‘llash natijalariga ko‘ra, tish karashi tarkibidagi kariyesogen mikroorganizmlar miqdorining boshlang‘ich ko‘rsatkichlarga nisbatan birmuncha kamaygani aniqlandi. Shunday qilib, aqliy zaif bolalarda yuqori terapevtik samaraga ega bo‘lgan, davolash samaradorligini oshirishga va davolash muddatlarini qisqartirishga imkon beruvchi davolashning eng maqbul sxemasi ajratib olindi.*

Kalit so‘zlar: *aqliy zaif bolalar, tish kariyesi, parodont kasalliklari, epidemiologik ko‘rsatkichlar, kariyes tarqalish indeksi, kariyes intensivligi indeksi.*

Introduction

In global dental practice, there is a high prevalence of various orthopedic and orthodontic defects, including manifestations of partial or complete adentia of varying severity. The prevalence of adentia has increased significantly and, according to available data, ranges from 35.4% to 62.9% [1].

It has been proven that oral diseases have considerable humanitarian, social, and economic significance in modern society. Today, dental caries and periodontal diseases remain the most common oral health problems not only among adults but also among younger populations worldwide. According to recent epidemiological studies conducted among healthy children, the incidence of dental pathology remains high. The prevalence of dental caries among healthy individuals aged 12–15 years ranges from 63.3% to 83.4% and from 81.7% to 88.7%, while caries intensity ranges from 3.02–3.75 and 4.6–5.73, respectively. The prevalence of periodontal tissue diseases among healthy 12-year-old children varies from 37.8% to 50%, whereas among 15-year-old children it ranges from 57.7% to 84.7%.

The prevalence of dental caries is also high among preschool and school-aged children with intellectual disabilities, while caries intensity is particularly elevated in children aged 13–18 years with mild intellectual disability. These indicators increase with age and depend on the severity of the underlying condition.

According to the World Health Organization (WHO), approximately 15% of the world's population consists of people with disabilities, corresponding to about 650 million individuals, of whom 200 million are children. The prevalence of intellectual disability (ID) in the general population ranges from 1% to 3%.

Providing dental care to children with intellectual disabilities is associated with a number of difficulties due to their limited cooperation caused by the underlying condition (mental and behavioral disorders, as well as diseases of the nervous system). As a result, dental treatment for this group of children often requires general anesthesia. However, the use of general anesthesia is not always possible because many of these children have severe concomitant somatic diseases. In addition, not all specialized institutions for children with disabilities are equipped with dental offices.

These circumstances necessitate the development of new approaches to the provision of dental care for children with intellectual disabilities, with preventive measures being one of the most important components. We implemented a preventive program aimed at reducing the incidence of dental diseases among children with disabilities. However, most preventive strategies were designed primarily for children with mild to moderate intellectual disabilities and took into account not only the degree of intellectual impairment but also the development of oral hygiene skills, the level of socialization, and the child's dietary habits.

Aim of the study. To improve methods for the prevention of permanent tooth caries in children with intellectual disabilities through the development of a specialized IT-based preventive program, as well as to evaluate the effectiveness and clinical efficacy of ozone therapy in the prevention of dental caries.

Materials and Methods

A total of 220 children with intellectual disabilities from Specialized Boarding School No. 62 in Samarkand and Boarding School No. 63 in the Akdarya district were examined. The study included children aged 6, 9, and 12 years. Depending on age, gender, dietary regimen, type of underlying neurological disorder, presence of Down syndrome, and level of socialization, the oral hygiene status of the participants was assessed. A specialized preventive program aimed at preventing dental caries in permanent teeth was implemented over a specified period, and its effectiveness was evaluated.

To achieve the objectives of the study, general clinical, instrumental, functional, and statistical methods were employed. The following parameters were assessed:

Prevalence of dental caries;

Caries intensity of permanent teeth using the DMFT (Decayed, Missing, and Filled Teeth) index;

Clinical condition of periodontal tissues using the PMA index (Papillary-Marginal-Alveolar index) modified by Parma.

To evaluate the risk of developing dental diseases, a microbiological examination of dental plaque was performed. For this purpose, children were randomly selected from subgroup 1 (n = 26) and subgroup 2 (n = 24). Supragingival dental plaque samples were collected by scraping with a sterile dental excavator.

The preventive program included oral hygiene education for the children, as well as health education activities for the institution's staff and for the parents of those children who regularly visited the boarding school.

In addition, the following individual preventive measures were carried out:

Professional oral hygiene procedures (Figure 1);

Remineralization therapy through the application of fluoride-containing varnish to the teeth;

Fissure sealing of permanent teeth using ozone technology (Figure 2).

Figure 1. Professional oral hygiene and fluoride treatment of teeth.

In recent years, due to the increasing prevalence of allergic conditions in the population, the growing resistance of microorganisms to antibiotics, and the rising

cost of pharmaceutical products, non-pharmacological treatment methods have become increasingly popular. Among these methods, ozone therapy has gained widespread recognition and application worldwide.

This growing interest is associated with the ability of ozone to enhance oxygen transport and release in tissues, as well as its pronounced antimicrobial and disinfecting properties. Ozone therapy is currently used in various fields of medicine, including internal medicine, surgery, obstetrics and gynecology, dermatology, dentistry, and cosmetology.

Figure 2. Fissure sealing of permanent teeth in a 12-year-old child after treatment with ozonated water.

Results

The study demonstrated that children with Down syndrome are less susceptible to the development of dental caries. Therefore, within the subgroups with different levels of socialization, an additional stratification was performed based on the presence of Down syndrome.

Among the socialized children aged 6, 12, and 15 years, subgroups were identified consisting of children without Down syndrome (10, 32, and 40 children, respectively) and children with Down syndrome (12, 8, and 5 children, respectively). Similarly, among the non-socialized children aged 6, 12, and 15 years, subgroups were formed consisting of children without Down syndrome (11, 30, and 15 children, respectively) and children with Down syndrome (4, 6, and 13 children, respectively). The prevalence and intensity of dental caries were evaluated in all of these subgroups.

To assess the risk of developing dental diseases, a microbiological analysis of dental plaque was performed. Children were randomly selected from subgroup 1 (n = 23) and subgroup 2 (n = 21). Supragingival dental plaque samples were collected by scraping with a sterile dental excavator.

Analysis of the obtained data revealed that microorganisms belonging to the genus *Streptococcus* were isolated most frequently from dental plaque samples. In subgroup 1, streptococci accounted for 25.8% of all detected microorganisms, whereas in subgroup 2 they constituted 34.0%.

Among the streptococci isolated from subgroup 1, *Streptococcus oralis* (12.9%) and *Streptococcus gordonii* (3.53%) predominated. Other species,

including *S. cristatus*, *S. sinensis*, *S. mitis*, *S. sanguinis*, and *S. pneumoniae*, were detected at lower frequencies (1.2%, 1.2%, 1.2%, 2.4%, and 1.2%, respectively).

In subgroup 2, *S. oralis* was also the predominant species and was detected in a higher proportion (14.2%) than in subgroup 1. Lower frequencies were observed for *S. gordonii* (4.4%), *S. sinensis* (5.5%), and *S. mitis* (5.5%). Single isolates of *S. cristatus* (1.1%), *S. constellatus* (1.1%), *S. agalactiae* (1.1%), and *S. anginosus* (1.1%) were detected only in subgroup 2 and were not identified in subgroup 1.

In addition to streptococci, other microbial species were isolated from dental plaque samples. Notably, staphylococci constituted a substantial proportion of the total number of isolated strains.

Staphylococci were isolated in 9.9% of cases among children in subgroup 1. In this subgroup, *Staphylococcus aureus* predominated (5.9%), while *Staphylococcus epidermidis* accounted for 3.5% of isolates. In subgroup 2, staphylococci were detected in 6.6% of cases, with *S. epidermidis* being the predominant species (5.5%), unlike subgroup 1.

A notably high frequency of *Candida* species was isolated from dental plaque samples. These fungi were detected four times more frequently in children from subgroup 1 than in subgroup 2, accounting for 17.6% and 4.4% of isolates, respectively. Among the *Candida* species, *Candida albicans* predominated, representing 12.9% of all isolated strains in subgroup 1 and 3.3% in subgroup 2.

Actinomycetes were also identified in a considerable proportion of dental plaque samples. They were detected in 10.6% of cases in subgroup 1, whereas in subgroup 2 they were found more frequently, accounting for 14.3% of isolates.

Neisseria species were detected twice as often in subgroup 2 as in subgroup 1, comprising 15.4% and 8.2% of isolates, respectively.

Fusobacteria were also identified in dental plaque samples. They were detected in 5.9% of children in subgroup 1 and in 7.7% of children in subgroup 2. *Acinetobacter lwoffii* was isolated exclusively from children in subgroup 1, where it was found at a relatively high frequency (14.1%). In subgroup 2, *Capnocytophaga* species were isolated in a small proportion of cases (3.3%). Other microbial species accounted for 8.2% of isolates in subgroup 1 and 14.3% in subgroup 2.

The third stage of our study involved the development, implementation, and evaluation of an adapted dental caries prevention program for children with intellectual disabilities in a specialized school setting. The program included oral hygiene education for children, as well as health education activities for institutional staff and the parents of children who regularly visited the boarding school.

In addition, individual preventive measures were implemented, including professional oral hygiene procedures, application of fluoride-containing varnish, and fissure sealing using ozone technology.

The effectiveness of the adapted preventive program, which considered the medical, psychological, and pedagogical characteristics of the children, was evaluated using the Oral Hygiene Index (OHI-S) and the condition of periodontal

tissues assessed by the PMA index at baseline and after 1, 2, and 3 years of follow-up.

Data obtained from 9- and 12-year-old children before implementation of the program served as internal controls for groups of children who entered the preventive program at the ages of 6–8 and 9–11 years. The group of 9-year-old children served as a comparison group for the other 9-year-old participants and subsequently became the main study group after reaching the age of 12 years. For children who entered the preventive program at the age of 12 years, previously examined 15-year-old children served as the control group.

The prevalence and intensity of dental caries among children with intellectual disabilities were found to depend on the degree of socialization, which influences lifestyle and dietary habits, as well as on the presence of Down syndrome.

The incidence of dental caries among children with intellectual disabilities living in boarding schools depends on their level of socialization, which determines certain lifestyle and dietary characteristics. The highest-risk group consisted of socialized children without Down syndrome. In this group, the prevalence of dental caries was 31.0%, 62.0%, and 83.0%, with caries intensity values of 0 [0;1.17], 2 [0;4], and 4 [3;5] among children aged 6, 12, and 15 years, respectively.

Among non-socialized children without Down syndrome, the prevalence of dental caries was considerably lower, accounting for 0%, 18.0%, and 22.5% in children aged 6, 12, and 15 years, respectively. No cases of dental caries were observed among children with Down syndrome.

Mild gingivitis predominated among socialized children, affecting 55%, 50%, and 50% of children aged 6, 12, and 15 years, respectively. In contrast, non-socialized children more frequently exhibited moderate gingivitis (47.1% and 41.6% among 6- and 15-year-old children, respectively) and severe gingivitis (38.6% among 12-year-old children). The PMA index reached 45 [26;67.5]. The inability to perform adequate independent oral hygiene makes this group of children particularly vulnerable to periodontal diseases.

The prevalence of dental caries among children with intellectual disabilities attending specialized schools was found to depend on their level of socialization, dietary habits, and the presence of Down syndrome. The risk group included socialized children without Down syndrome, in whom caries intensity values reached 3.8, 4.9, and 5.8, while caries prevalence was 42.0%, 76.0%, and 85.0% among children aged 8, 10, and 12 years, respectively.

The prevalence of dental caries among children with Down syndrome was lower, amounting to 33.0%, 64.0%, and 72.0% among children aged 8, 10, and 12 years, respectively.

Microbiological examination of dental plaque revealed significant unfavorable changes in the oral microflora of children without Down syndrome compared with socialized children with intellectual disabilities. In particular, an increased prevalence of *Streptococcus* species, which are considered cariogenic

microorganisms, indicated a high potential for the development and progression of the carious process.

Conclusions

1. The prevalence of dental caries among children with intellectual disabilities attending specialized schools depends on their level of socialization, dietary habits, and the presence of Down syndrome. The highest-risk group consisted of socialized children without Down syndrome. In this group, caries intensity values were 3.8, 4.9, and 5.8, while caries prevalence reached 42.0%, 76.0%, and 85.0% among children aged 8, 10, and 12 years, respectively. The prevalence of dental caries among children with Down syndrome was lower, amounting to 33.0%, 64.0%, and 72.0% in children aged 8, 10, and 12 years, respectively.

2. Microbiological examination revealed significant unfavorable changes in the composition of the oral microflora of children without Down syndrome compared with socialized children with intellectual disabilities. In particular, the increased prevalence of *Streptococcus* species, which are considered cariogenic microorganisms, indicates a high potential for the development and progression of the carious process.

3. During the two-year implementation of the preventive program, a positive improvement in oral hygiene indicators was observed. Satisfactory oral hygiene status was recorded in 64.2% of the children, good oral hygiene status in 35.2%, and unsatisfactory oral hygiene status in only 0.6% of the participants.

4. The use of ozone therapy as part of a comprehensive caries prevention program for children with intellectual disabilities, taking into account their cognitive and physical capabilities, produced positive outcomes. No adverse complications associated with ozone–oxygen therapy were observed. Furthermore, the procedure remained comfortable, safe, and painless for the patients throughout the preventive intervention period.

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DENTAL DISEASES AND DAMAGE FROM THEM

Abstract: *The most common dental diseases include tooth decay, gum disease, and oral cancer. Let's take a closer look at how these happen and how they can be prevented.*

When you consume food and drinks that are sugary or starchy (high in carbohydrates), the bacteria that naturally live in your mouth, break them down forming acids. These acids attack and dissolve the outer surface (enamel) of your teeth. Over time this can result in a hole. The risk of tooth decay is increased for people with dry mouth syndrome.

Key words*: risk of tooth, tooth decay, acids attack, food and drinks*

Introduction

The first sign of tooth decay is a chalky white spot on the tooth. At this stage, the decay process can be reversed. If you think you might have early stage tooth decay, make an appointment to see your oral health professional.

Gum Disease

Gum disease is usually caused by a build-up of plaque (bacteria) on your teeth. There are two main stages of gum disease: gingivitis and periodontitis.

Gingivitis is early gum disease and occurs when dental plaque builds up on your teeth, particularly around the gum line. Signs of gingivitis include bleeding, redness, and/or swelling of the gums.

Periodontitis is advanced gum disease that can occur if gingivitis is left untreated. The part of the gum that joins to the tooth becomes weakened and allows bacteria to become trapped between the gum and the tooth. This can damage the soft tissue that connects your teeth and jaw bones, which can cause teeth to loosen.

Oral cancer

Oral cancer refers to cancer that develops in the lips, tongue, gums, floor and roof of the mouth. Oral cancer is the 8th most common cancer in men in Victoria, and the 14th most common cancer in women. Consuming alcohol and tobacco are the two main risk factors for oral cancer.

Oral cancer symptoms can include:

A visible mass or lump (may or may not be painful)

Mouth ulcer that won't heal

White or red patches in the mouth/tongue/gums

Loss of sensation anywhere in the mouth

Difficulty swallowing, moving your tongue, or moving your jaw

Loose teeth or sore gums

Altered taste

Swollen lymph glands

Whilst dental diseases are common, there are several simple ways you can reduce your risk.

Clean well for a healthy mouth

Regular tooth brushing helps to prevent tooth decay and gum disease by reducing the amount of bacteria and plaque around your teeth and gums.

Tips for effective cleaning include:

Clean your teeth twice a day; in the morning and before bed.

Use a toothbrush with a small head and soft bristles and a pea-sized amount of fluoride toothpaste.

Gently brush teeth and along the gum line in small circles, making sure to brush each tooth on the front, back, and chewing surfaces.

After brushing, spit out toothpaste – do not swallow it, and do not rinse with water. This allows the fluoride more time to strengthen your teeth.

Electric toothbrushes can also be a good option. Guide the brush slowly across, pausing for a few seconds at each tooth. Do not press too hard or scrub, let the brush do the work. Find out about tooth brushing for children.

Flossing

It is important to clean between teeth where a toothbrush can't reach. Products such as floss and interdental brushes can remove plaque from between your teeth. Talk to your oral health professional about whether you should use one of these products.

Eat well for a healthy mouth

The foods you eat impact your oral health. Sugary and starchy foods feed the bacteria that can cause tooth decay and gum disease.

Tips for eating well include:

Limit how often you have sweet foods and eat them at mealtimes rather than between meals. Choose healthy snacks such as fresh fruit, vegetable sticks, natural yoghurt, plain popcorn, soups, or cheese. Choose fresh fruit over dried fruit, as dried fruit can stick on your teeth and feed the bacteria that cause tooth decay. Have a piece of cheese after eating sweet or acidic foods as dairy foods assist in repairing damage by decay-causing bacteria.

Materials and methods

For more information on eating well, visit the Australian Dietary Guidelines.

Chewing sugar-free gum can also be helpful in the fight against decay. It can help to produce saliva, which is able to wash sugar out of the mouth into the stomach, neutralize acid, fight bacteria and repair the early stages of tooth decay.

Drink well for a healthy mouth

Like food, what you drink also impacts your oral health. Sugary drinks feed the bacteria that can cause tooth decay and gum disease. Choosing tap water (which contains fluoride for most Victorians) helps to repair the damage done by bacteria and reduces your risk of tooth decay.

The early signs of dental disease can be difficult to see. An oral health professional is trained to spot and treat any problems early, which can prevent

bigger problems developing. They can also provide you with care to prevent disease, such as fluoride treatments and dental sealants to prevent tooth decay.

Ask your oral health professional how often you should have a dental check-up. If you have not had a dental visit for a while, it might be a good idea to book one. Having no pain does not always mean that your teeth and mouth are healthy.

Always see your oral health professional if you have:

mouth pain

bleeding gums

swelling of the face

a damaged or knocked out tooth (or teeth)

mouth sores that don't heal after a couple of weeks.

Most people learn at an early age that regular brushing and flossing can help prevent cavities.

But what many don't know is that good dental health is key to maintaining whole-person health – especially for people with certain medical conditions.

"During a routine exam, a dentist can often detect the first signs of underlying conditions such as diabetes, leukemia, or heart disease," said Dr. Cary Sun, Cigna's chief dental officer. "Regular treatment is crucial for these patients to help address needed dental treatment and prevent serious infections that can impact their overall health."

Improving whole-person health. This link will open in a new tab. has become a key focus in health care. Just as mental illness has shown to increase the risk. This link will open in a new tab. of diabetes and heart disease, poor oral health can exacerbate those and other conditions, such as lupus and rheumatoid arthritis. In addition to improving overall health, obtaining routine preventive dental care can also reduce overall health care costs. A recent Cigna study. This link will open in a new tab. found that on average, those who receive consistent preventive dental care can reduce their total medical costs by 4.4% per year. For those with diabetes, the savings was even higher – an average of 12.25% per year.

Cavities are areas in the hard surface of your teeth that are damaged. These areas of tooth decay become tiny openings or holes that can lead to a serious toothache, infection and tooth loss. There are several causes of cavities, including bacteria in your mouth, snacking a lot, sipping sugary drinks and not cleaning your teeth well.

Cavities and tooth decay are among the world's most common health problems. They're especially common in children, teenagers and older adults. But anyone who has teeth can get cavities, including babies.

If cavities aren't treated, they get larger and affect deeper layers of your teeth. Regular dental visits and good brushing and flossing habits are the best ways to protect your teeth from cavities.

The symptoms of cavities vary, depending on how many you have and where they're located. When a cavity is just beginning, you may not have any symptoms. As the decay gets larger, it may cause symptoms such as:

Toothache and other pain.

Tooth sensitivity.

Mild to sharp pain when eating or drinking something sweet, hot or cold.

Holes or pits in your teeth that you can see.

Brown, black or white staining on any surface of a tooth.

Pain when you bite down.

When to see a dentist

You may not be aware that a cavity is forming. That's why it's important to have regular dental checkups and cleanings, even when your mouth feels fine. But if you have a toothache or mouth pain, see your dentist as soon as possible.

Plaque forms. Dental plaque is a clear sticky film that coats your teeth. It's due to eating a lot of sugars and starches and not cleaning your teeth well. When you don't clean sugars and starches off your teeth, bacteria quickly begin feeding on them and forming plaque. Plaque that stays on your teeth can harden under or above your gum line into tartar. Tartar makes plaque harder to remove and creates a shield for bacteria. A dental professional needs to remove this plaque.

Plaque attacks. The acids from bacteria remove minerals in your tooth's hard, outer enamel. This erosion causes tiny openings or holes in the enamel — the first stage of cavities. Once areas of enamel are worn away, the bacteria and acid can reach the next layer of your teeth, called dentin. This layer is softer than enamel and less resistant to acid, causing your teeth to be more sensitive.

Damage continues. As tooth decay happens, the bacteria and acid move through your teeth to the inner tooth material (pulp) that contains nerves and blood vessels. The pulp becomes swollen and irritated from the bacteria. Because there is no place for the swelling to expand inside of a tooth, the nerve becomes pressed, causing pain. Sometimes pain and damage can spread outside of the tooth root to the bone, causing bone loss around the tooth and even reaching nearby teeth.

Anyone who has teeth can get cavities, but these factors raise the risk:

Tooth location. Decay most often occurs in your back teeth — your molars and premolars. These teeth have lots of grooves, pits and crannies, and multiple roots that can collect food particles. That's why they're harder to keep clean than your smoother, easy-to-reach front teeth.

Certain foods and drinks. Foods that cling to your teeth for a long time are more likely to cause decay than foods that are easily washed away by saliva. These foods include milk, ice cream, honey, sugar, soda, dried fruit, cake, cookies, hard candy and mints, dry cereal, and chips.

Snacking or sipping a lot. When you snack or sip sugary drinks a lot, you give mouth bacteria more fuel to make acids that attack your teeth and wear them down. And sipping soda or other acidic drinks throughout the day helps create a continual acid bath over your teeth.

Bedtime baby feeding. When babies are given bedtime bottles filled with milk, formula, juice or other liquids that have sugar, these beverages remain on their teeth for hours while they sleep. This feeds bacteria that can cause decay. This

damage often is called baby bottle tooth decay. Similar damage can occur when toddlers wander around drinking from a sippy cup filled with these beverages.

Not brushing your teeth well. If you don't clean your teeth soon after eating and drinking, plaque forms quickly, and the first stages of decay and gingivitis can begin.

Not getting enough fluoride. Fluoride, a naturally occurring mineral, helps prevent cavities. It also can reverse the earliest stages of tooth damage. Because of its benefits for teeth, fluoride is added to many public water supplies. It's also a common ingredient in toothpaste and mouth rinses. But bottled water usually does not contain fluoride.

Younger or older age. In the U.S., cavities are common in very young children and teenagers. Older adults also are at higher risk. Over time, teeth can wear down and gums may recede, making teeth more likely to decay. Older adults also may use more medicines that reduce saliva flow, raising the risk of tooth decay.

Dry mouth. Dry mouth is caused by a lack of saliva. Saliva helps prevent tooth decay by washing away food and plaque from your teeth. Substances found in saliva also help counter the acid produced by bacteria. Certain medicines, some medical conditions, radiation to your head or neck, or certain chemotherapy drugs can raise your risk of cavities by reducing saliva production.

Worn fillings or dental devices. Over the years, dental fillings can weaken, begin to break down or get rough edges. This allows plaque to build up more easily and makes it harder to remove. Dental devices can stop fitting well, allowing decay to begin under them.

Heartburn. Heartburn, a common symptom of gastroesophageal reflux disease (GERD), can cause stomach acid to flow into your mouth. This is called reflux. It can wear away the enamel of your teeth and cause a lot of damage. This exposes more of the dentin to bacteria, creating tooth decay. Your dentist may recommend that you talk with your healthcare professional to see if GERD is causing your enamel loss.

Eating disorders. Anorexia and bulimia can lead to a lot of tooth erosion and cavities. Stomach acid from repeated vomiting, called purging, washes over the teeth and begins eating away at the enamel. Eating disorders also can get in the way of saliva production.

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PROSODIC INTERFERENCE IN THE TRILINGUAL SYSTEM OF UZBEK, ENGLISH, AND CHINESE: A CONTRASTIVE-PSYCHOLINGUISTIC ANALYSIS

Abstract: *This paper examines prosodic interference in a trilingual context (Uzbek, English, Chinese) from a contrastive and psycholinguistic perspective. It compares three prosodic systems: Uzbek with relatively fixed stress patterns, English with dynamic stress and intonation variation, and Chinese with a lexical tone system.*

Based on experimental phonetic insights, the study analyzes how L1 and L2 prosodic systems influence pitch production and perception, particularly in tonal mapping within the trilingual mind. It highlights cognitive processes involved in managing conflicting stress tone systems.

The paper concludes with theoretical and practical implications aimed at reducing prosodic interference and improving cross-linguistic pitch control.

Keywords: *prosody, speech interference, trilingualism, tonal system, stress, intonation, psycholinguistics, cognitive mapping, contrastive linguistics.*

Introduction

The modern multilingual education landscape increasingly requires a shift from bilingual to trilingual models. In this context, acquiring Uzbek (L1), English (L2), and Chinese (L3) creates a highly complex phonological environment. While lexical and syntactic transfer has been widely studied, prosodic interference at the level of stress, rhythm, pitch, and intonation—remains underexplored [1]. Prosody is central to spoken communication, and its distortion reduces intelligibility.

For an Uzbek-dominant learner, adding English and Chinese introduces three distinct prosodic systems: a fixed agglutinative stress pattern (Uzbek), a variable stress-timed system (English), and a tonal pitch-based system (Chinese) [2]. This often leads to prosodic transfer errors, as L1 and L2 patterns influence L3 production at word and phrase levels.

This study provides a contrastive-psycholinguistic analysis of trilingual prosodic interference, identifies common errors, and proposes a cognitive framework for improving prosodic control in multilingual speakers.

Methodology and Literature Review

This study uses a multi-layered framework combining contrastive linguistics, typological comparison, and psycholinguistic modeling. It focuses on system-level analysis of prosody, examining how Uzbek accentual patterns interact with English phonology and affect Chinese suprasegmental processing [1]. The approach is

guided by cognitive distance as a predictor of phonetic distortion [7], without relying on acoustic experiments.

Speech interference is based on Uriel Weinreich's concept of systematic deviation in bilingual contact, extended in L3 research through cumulative transfer models where L2 continuously influences L3 processing [3].

Prosody is treated as a suprasegmental system following Ilse Lehiste's view that pitch, duration, and intensity function across larger linguistic units [5]. Chinese tonal structure follows Yuen Ren Chao's model of lexical pitch contours [4]. James Flege's Speech Learning Model (SLM) explains L3 sound categorization through perceived similarity with L1 and L2 systems [7].

Overall, the study integrates these theories into a unified model of trilingual prosodic interaction, explaining cross-linguistic influence in prosody without direct acoustic experimentation.

Results and discussion

Structural Contrast of the Three Prosodic Systems

To understand prosodic interference, it is necessary to compare the prosodic systems of the target languages. Uzbek prosody features a relatively stable word-stress pattern, often on the final syllable of the root and linked to morphological structure [8]. Intonation is mainly realized through final pitch drops in statements and pitch rises in questions.

English prosody is more dynamic, with variable lexical stress influenced by grammar and etymology. It is a stress-timed language where rhythm depends on stressed syllables, causing reduction of unstressed vowels, and it uses extended pitch movements across phrases to express meaning and attitude.

Chinese prosody differs fundamentally as a tonal system, where pitch at the syllable level determines lexical meaning [6]. Mandarin has four tones (high level, rising, dipping, falling), making syllable-level pitch control essential for meaning, rather than word stress or sentence-level intonation.

Empirical Manifestation of Prosodic Interference in Trilingual Speech

Acoustic observations show systematic prosodic interference in trilingual learners when producing Chinese tones, influenced by Uzbek and English prosodic habits.

• **Tone-specific effects:**

- Tone 1 (High Level): Final pitch drops → Uzbek final-stress habit treats last syllable as boundary marker.

- Tone 2 (Rising): Excessive intensity and lengthening → English stress system interprets rise as emphasis.

- Tone 3 (Falling–Rising): Flattened into monotone → simplified due to Uzbek/English rhythmic constraints.

- Tone 4 (High Falling): Incomplete fall → misinterpreted as sentence-final intonation in English.

• **Phrase-level interference:**

- Chinese syllable-timed rhythm is replaced by:

▪ English stress-timed rhythm, or
▪ Uzbek suffix-based grouping
- This results in unnatural pauses and distorted intonation patterns.

• **Overall finding:**

- Errors are not random; they reflect transfer of L1/L2 prosodic systems into L3 Chinese tone production.

Cognitive Transformation and Tonal Mapping

From a psycholinguistic perspective, these errors reflect how the learner's internal acoustic model is reshaped by prior language experience. When an Uzbek speaker processes Chinese tones, pitch is not perceived directly as lexical contrast, but filtered through existing Uzbek stress patterns and English intonational contours. Since neither L1 nor L2 requires syllable-level lexical tone monitoring, learners lack a stable tonal category. As a result, Chinese pitch movements are often misinterpreted as stress or emphasis rather than meaning-changing tonal units, leading to systematic prosodic interference.

Conclusion

This contrastive-psycholinguistic analysis indicates that prosodic interference in an Uzbek–English–Chinese trilingual context is a layered cognitive process. Uzbek fixed stress and English dynamic stress jointly influence how Chinese tonal patterns are produced and perceived. These deviations are not random errors but systematic adaptations of the brain applying non-tonal prosodic strategies to a tonal system.

To reduce this interference, language teaching should move beyond grammar and vocabulary toward targeted prosodic training, including visualization-based methods that help learners develop an internal pitch representation. Future research is encouraged to use neurocognitive and tracking methods to study how these pitch representations form and evolve, enabling more effective multilingual instruction.

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MUSCULAR TENSION AND ACOUSTIC PERCEPTION CONTRAST: AN ARTICULATORY-PHONETIC ANALYSIS OF PLOSIVE AND FRICATIVE CONSONANTS IN FOUR LANGUAGES

Abstract: *This paper presents a cross-linguistic analysis of velar and uvular plosives and fricatives (/g/, /k/, /x/) in Uzbek, English, Mandarin Chinese, and Russian, focusing on the gap between IPA-based classification and real articulatory reality. It argues that traditional phonetic labeling often overlooks physiological factors such as muscular tension (fortis–lenis) and aerodynamic pressure (aspiration).*

The study shows that Mandarin /g/ (pinyin g) and /h/ (pinyin h) are not primarily defined by voicing contrasts, but by aspiration and reduced articulatory tension, functioning as lax or "light" variants within the velar system rather than strictly voiceless equivalents.

Keywords: *articulatory power, muscular tension, fortis, lenis, aspiration, velar, uvular, psychoacoustics, speech perception.*

Introduction

In modern comparative-typological linguistics, the structural mapping of an ethnic group's articulatory base remains a foundational area of inquiry. However, legacy acoustic blueprints codified by the International Phonetic Association (IPA) often fail to capture live speech perception and human psychoacoustic reality. [1]. Standard pedagogical resources routinely bifurcate the /g/–/k/, /d/–/t/, and /b/–/p/ structural pairs solely based on glottalization—whether the vocal folds vibrate—into "voiced" and "voiceless" consonants. In live cross-language communication, this rigid binary classification triggers profound phonological confusion.[2]

This study aims to re-evaluate the production mechanics of velar and uvular consonants across Uzbek, English, Mandarin Chinese, and Russian. By shifting the analytical lens from mechanical acoustics to physical muscular tension (*aerodynamic energy*), this paper exposes systemic classification flaws in academic phonetics and proposes an updated model for applied cross-linguistic analysis.

Theoretical framework and articulatory mechanisms

The Cross-Linguistic Hierarchy of the /g/ Phoneme and the Critique of the "Voiced" Myth

Standard pedagogical sources typically represent the Uzbek, English, and Russian /g/ with the same IPA symbol [g], but this masks important articulatory differences in muscular effort and airflow.

The Uzbek /g/ functions as a strong (fortis) plosive. It is produced with a firm dorsum–velum closure, creating high intraoral pressure, followed by a forceful, fully voiced release with strong vocal fold vibration. This results in a comparatively tense, "anchored" sound.

In contrast, the English /g/ is generally a weak (lenis) articulation. As described by Roach, it often undergoes partial devoicing depending on position and speech speed, with reduced muscular tension and lower perceptual force, making it sound softer or less prominent to non-native listeners.

Mandarin Pinyin /g/ presents a different issue: although often transcribed as [k] in IPA due to its voiceless nature, this is misleading in functional terms. Its distinction from /k/ is not based on voicing but aspiration. Thus, Mandarin /g/ is better understood as an unaspirated voiceless plosive. As Duanmu notes, using a standard voiceless [k] can cause meaning confusion (e.g., 高 "gāo" vs 烤 "kǎo"), since aspiration is the critical contrastive feature.

Overall, the Mandarin "g" is not simply a voiceless [k], but an unaspirated, lax voiceless stop, and treating all three languages under a single [g] symbol obscures key phonetic and phonological distinctions.

The /x/ and /h/ Continuum: The "Single Palate, Lax Articulation" Phenomenon

A parallel oversimplification occurs in the treatment of Chinese **/h/**, often equated in Western manuals with the English glottal [h]. However, this ignores its closer relation to velar–uvular frication involving the same articulatory zone as Uzbek **[x]** [8].

The vocal tract allows a shared velar/uvular friction space where output is shaped mainly by **muscular tension** rather than fixed position. Uzbek **/x/** uses high tension and strong constriction, producing intense acoustic friction. In contrast, Chinese **/h/** uses a more relaxed configuration, with a wider constriction and smoother, weaker airflow, yielding a softer fricative.

Thus, Chinese **/h/** is better interpreted as a **lax, reduced form of velar frication**, rather than a pure glottal [h]. Mispronouncing it as English [h] removes its velar acoustic character (e.g., *Hǎo*). This supports Chomsky and Halle's feature-based view, where **tension (tense vs. lax)** is a key determinant of phonetic realization, more informative than rigid categorical labels.

Results and discussion

A voicing-only model is insufficient to describe /g/ across languages; a more accurate account considers **subglottal pressure, muscular tension, and aerodynamic release**.

- **Uzbek (Maximum Fortis):** /g/ is produced with strong velar closure and high muscular tension, creating high pressure and a forceful explosive release.
- **Russian (Palatalized System):** /g/ varies contextually: firm velar before back vowels and palatalized /gʲ/ before front vowels, producing a more softened articulation.

• **English (Lenis System):** /g/ is a weak stop with reduced tension and pressure, often partially devoiced in fast speech, resulting in a softer percept.

• **Mandarin (Unaspirated System):** /g/ is voiceless and unaspirated ([k]-like), distinguished from /k/ by aspiration rather than voicing, producing a light, non-explosive articulation.

Overall, the languages differ in phonetic strategy: Uzbek emphasizes force, Russian shows contextual variation, English reduces articulatory energy, and Mandarin relies on aspiration contrasts rather than voicing.

Conclusion

The acoustic perception of English and Chinese **G** sounds as "softer and lighter" than the Uzbek counterpart is a measurable physiological fact. This behavior is dictated by **low muscular tension (lenis)** and the elimination of post-release air-blasts, rather than strict glottal voicing.

The initial consonant in the Mandarin word Gāo is phonologically an **unaspirated, voiceless lax G**. Instructing students to pronounce it as a hard "K" is an academic failure that induces semantic errors (e.g., mishearing it as Kǎo).

The Chinese **H** is not a glottal aspirate, but an anatomical equivalent of the Uzbek **X**, executed with a relaxed tongue profile. It is a lower-tension modification of the same physical coordinate.

Implementing this updated articulatory-tension model within standardized language curriculums offers a concrete, scientifically sound method to eliminate persistent native-language accents.

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INTENSIV TEXNOLOGIYALAR ASOSIDA GILOS NAVLARINI SHAKLLANTIRISH TIZIMINI OPTIMALLASHTIRISH

Annotatsiya. *Mazkur maqolada gilos (Prunus avium L.) o‘simligining intensiv texnologiyalar asosida klonlarini shakllantirish tizimini optimallashtirish masalalari ilmiy jihatdan yoritilgan. Tadqiqotlar laboratoriya va issiqxona sharoitlarida olib borilib, mikroklonal ko‘paytirish bosqichlari, oziqa muhitlari tarkibi, fitogormonlar ta’siri hamda regeneratsiya va akklimatizatsiya jarayonlari tahlil qilindi. Turli konsentratsiyadagi 6-BAP va IAA qo‘llanilgan variantlar o‘zaro solishtirilib, optimal nisbat aniqlangan. Olingan natijalar asosida intensiv bog‘dorchilik uchun yuqori sifatli, genetik barqaror gilos klonlarini yetishtirish tizimi ishlab chiqildi.*

Kalit so‘zlar. *Gilos, klon, in vitro, mikroklonal ko‘paytirish, intensiv texnologiya, MS muhiti, fitogormonlar, regeneratsiya, akklimatizatsiya.*

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OPTIMIZATION OF THE TRAINING SYSTEM OF SWEET CHERRY VARIETIES BASED ON INTENSIVE TECHNOLOGIES

Annotation. *This article scientifically discusses the optimization of the system for forming sweet cherry (Prunus avium L.) clones based on intensive technologies. The research was conducted under laboratory and greenhouse conditions, where the stages of micro clonal propagation, the composition of nutrient media, the effects of phytohormones, as well as regeneration and acclimatization processes were analyzed. Different concentrations of 6-BAP and IAA were compared, and the optimal ratio was determined. Based on the obtained results, a system for producing high-quality, genetically stable sweet cherry clones for intensive horticulture was developed.*

Keyword. *sweet cherry, clone, in vitro, microclonal propagation, intensive technology, MS medium, phytohormones, regeneration, acclimatization*

Bugungi kunda qishloq xo‘jaligini modernizatsiya qilish va intensiv rivojlantirish global miqyosda ustuvor vazifalardan biri hisoblanadi. O‘zbekiston sharoitida meva yetishtirish, xususan giloschilikni rivojlantirish katta iqtisodiy ahamiyatga ega. Gilos (Prunus avium L.) yuqori daromadli, eksportbop va bozorbop mahsulot beruvchi ekin sifatida ajralib turadi.

Sweetheart - kechpishar, serhosil va bozorbop gilos navlaridan biri hisoblanadi. Ushbu nav Kanadada yaratilgan bo‘lib, intensiv bog‘larda keng qo‘llaniladi. Daraxti o‘rtacha kuchli o‘sadi, shox-shabbasi yarim yoyiq shaklda bo‘ladi. Barglari yirik, to‘q yashil rangda. Gullashi o‘rta muddatda boshlanadi va ko‘pincha sovuqqa nisbatan chidamli hisoblanadi. Mevalari yirik, yuraksimon shaklda, po‘sti to‘q qizil rangda bo‘lib, to‘liq pishganda bordo tusga kiradi. Eti qattiq, shirador va shirin ta’mga ega. Mevaning o‘rtacha vazni 9–12 grammni tashkil etadi. Transportga chidamliligi yuqori bo‘lgani sababli eksport uchun ham mos hisoblanadi. Sweetheart navini yetishtirishda quyosh yaxshi tushadigan, unumdor va suv o‘tkazuvchan tuproqlar tavsiya etiladi. Ko‘chatlar odatda 4×2 m yoki 5×3 m sxemada ekiladi. Intensiv bog‘larda tomchilatib sug‘orish tizimi samarali natija beradi. Vegetatsiya davrida azot, fosfor va kaliyli o‘g‘itlar me’yorida qo‘llanadi. Daraxtga shakl berishda spindle yoki keskin siyraklashtirilgan shakl usuli qo‘llanadi. Nav muntazam kesib turishni talab qiladi, chunki hosildorligi yuqori bo‘lganda shoxlar zichlashib ketadi.

Regina - Germaniyada yaratilgan kechpishar gilos navidir. Ushbu nav yuqori sifatli va yirik mevalari bilan mashhur bo‘lib, sanoat va intensiv bog‘dorchilikda keng ekiladi. Daraxti kuchli o‘sadi, shoxlari tik va mustahkam bo‘ladi. Barglari yirik va quyuq yashil rangda. Mevalari juda yirik, dumaloq-yuraksimon shaklda bo‘lib, po‘sti to‘q qizil rangda. Eti zich, shirador va yorilib ketishga nisbatan chidamli. O‘rtacha meva vazni 10–13 grammni tashkil qiladi. Ta’mi shirin-nordon bo‘lib, eksport va uzoq masofaga tashish uchun qulay hisoblanadi. Regina navini yetishtirishda unumdor, sho‘rlanmagan va havo almashinuvi yaxshi bo‘lgan tuproqlar muhim ahamiyatga ega. Ko‘chatlar intensiv bog‘larda 4×1,5 m yoki 4×2 m sxemada ekiladi. Sug‘orishda tomchilatib sug‘orish usuli tavsiya etiladi. Vegetatsiya davomida mineral va organik o‘g‘itlardan foydalanish hosildorlikni oshiradi. Daraxtga shakl berishda markaziy yetakchi novdali tizim keng qo‘llaniladi. Nav kasalliklarga nisbatan o‘rtacha chidamli bo‘lib, profilaktik himoya tadbirlarini muntazam olib borish tavsiya etiladi.

An’anaviy ko‘paytirish usullarida ko‘chat sifati, kasalliklarga chidamlilik va genetik bir xillik muammolari mavjud. Shu sababli intensiv texnologiyalar asosida klonal ko‘paytirish usullarini takomillashtirish muhim ilmiy-amaliy vazifaga aylanmoqda. Zamonaviy biotexnologik yondashuvlar, xususan in vitro texnologiyalari orqali gilos klonlarini tez va samarali ko‘paytirish imkoniyati mavjud. Bu esa intensiv bog‘lar tashkil etishda muhim omil hisoblanadi.

Tadqiqot metodikasi. Tadqiqotlar laboratoriya va issiqxona sharoitida olib borildi. Tadqiqot obyekti sifatida gilos o‘simligining yuqori hosildor navlaridan olingan meristematik to‘qimalar tanlandi.

Eksperimental sharoitlar:

Harorat: 24-26°C

Yorug‘lik: 16 soat

Namlik: 60-70%

Sterilizatsiya jarayoni:

70% etil spirt - 30 soniya

0,1% NaClO - 5-7 daqiqa

Distillangan suvda yuvish – 3 marotaba

Oziqa muhiti: Murashige-Skoog (MS) muhiti asosida quyidagi variantlar qo‘llanildi:

Nazorat (gormonlarsiz)

0,5 mg/l 6-BAP + 0,1 mg/l IAA

1,0 mg/l 6-BAP + 0,2 mg/l IAA

1,5 mg/l 6-BAP + 0,5 mg/l IAA

Tadqiqot natijalari. **Mikroklonal ko‘paytirish samaradorligi**. Tadqiqot natijalari shuni ko‘rsatdiki, fitogormonlarning qo‘llanilishi gilos klonlarining shakllanishiga sezilarli ta’sir ko‘rsatadi. Nazorat variantda ko‘paytirish koeffitsienti past bo‘lib, o‘simliklarning rivojlanishi sust kechdi. O‘rta konsentratsiyada (1,0 mg/l 6-BAP + 0,2 mg/l IAA) eng yuqori natijalar qayd etildi:

Ko‘paytirish koeffitsienti: 5,8

Kurtak hosil bo‘lish: 92%

Yuqori konsentratsiyada esa fiziologik stress kuzatildi.

Ildiz hosil qilish va rivojlanish. Ildiz hosil qilish jarayoni o‘simliklarning keyingi rivojlanishi uchun muhim bosqich hisoblanadi. O‘rta variantda ildiz hosil qilish darajasi 90% dan yuqori bo‘lib, ildiz tizimi yaxshi rivojlandi.

Akklimatizatsiya jarayoni. Laboratoriyadan tashqi muhitga o‘tkazilgan ko‘chatlarda quyidagi natijalar kuzatildi:

Moslashuv darajasi: 93–95%

Yashovchanlik yuqori. Bu intensiv texnologiyaning amaliy samaradorligini tasdiqlaydi.

Ochiq maydondagi rivojlanish. Tajriba natijalariga ko‘ra:

O‘simlik bo‘yi: 30–35 sm

Barglar soni: 10–14 dona

Yashovchanlik: 90% dan yuqori.

Bu ko‘rsatkichlar intensiv bog‘lar uchun yuqori sifatli material olish imkonini beradi.

Muhokama. Olingan natijalar ilmiy manbalar bilan solishtirilganda mos kelishi aniqlandi. Fitogormonlarning optimal nisbatda qo‘llanilishi hujayra bo‘linishi va differensiyalanish jarayonlarini faollashtiradi. 6-BAP sitokinin sifatida kurtak hosil bo‘lishini tezlashtirsa, IAA ildiz tizimini rivojlantiradi. Ularning muvozanatli kombinatsiyasi eng yuqori natijani beradi. Intensiv texnologiyalar asosida gilos klonlarini shakllantirish tizimi:

tezkor

iqtisodiy samarali
yuqori sifatli ekanligi isbotlandi.

Xulosa

Olib borilgan tadqiqotlar asosida quyidagi xulosalarga kelindi: In vitro texnologiyasi gilos klonlarini shakllantirishda eng samarali usul hisoblanadi. Optimal variant: 1,0 mg/l 6-BAP + 0,2 mg/l IAA. Ko‘paytirish darajasi 5–6 baravar oshdi. Yashovchanlik 90–95% ni tashkil etdi. Intensiv bog‘dorchilik uchun sifatli ko‘chatlar olish imkoniyati yaratildi

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KIBERMAKONDA KONTENT TARQATISH SHARTNOMASINING TUSHUNCHASI, O‘ZIGA XOS BELGILARI VA PREDMETI

Annotatsiya: *Maqolada kontent tarqatish shartnomasining tushunchasi, o‘ziga xos belgilari va predmeti tadqiq etilgan. Beshta konstitutiv belgiga (predmet, taraflar uchligi, maqsad, shakl, huquqiy oqibatlar) asoslangan original mualliflik ta’rifi taklif qilingan. Fuqarolik kodeksiga modda loyihasi ishlab chiqilgan.*

Kalit so‘zlar: *kontent tarqatish shartnomasi; mualliflik ta’rifi; konstitutiv belgilar; raqamli kontent; ikki yoqlama tabiat; sui generis; taraflar uchligi; qo‘shilish shakli; iste’molchi himoyasi; Fuqarolik kodeksi.*

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THE CONCEPT, DISTINCTIVE FEATURES AND SUBJECT MATTER OF THE CYBERSPACE CONTENT-DISTRIBUTION CONTRACT

Abstract: *The article examines the concept, features and subject matter of the cyberspace content-distribution contract. An original author's definition based on five constitutive features is proposed. A draft Civil Code article is developed.*

Keywords: *content-distribution contract; author's definition; constitutive features; digital content; dual nature; sui generis; triad of parties; adhesion form; consumer protection; Civil Code.*

Kirish.

Har qanday huquqiy institutni nazariy va amaliy o‘zlashtirishning fundamental sharti — uning aniq tushunchasi, konstitutiv belgilari va predmetining batafsil aniqlanishidir. Kontent tarqatish shartnomasi bo‘yicha mavjud doktrinaviy yondashuvlar shartnomaning huquqiy mohiyatini turli ko‘rinishlarda ta’riflashga olib kelgan, biroq yagona, izchil va O‘zbekiston huquqi tizimi uchun yaroqli mualliflik ta’rifi hozircha shakllanmagan. Mazkur lakuna milliy fuqarolik huquqi doktrinasidagi muhim bo‘shliqni tashkil etadi va uni bartaraf etish tsivilistikaning dolzarb vazifalaridan biridir.

Mavzuning dolzarbligi ikki yo‘nalishda namoyon bo‘ladi. Birinchidan, kontent tarqatish shartnomasining huquqiy tabiati va belgilari aniq ta’riflanmasdan,

uning konkret normativ mustahkamlanishi imkonsiz. Ikkinchidan, predmet — raqamli kontent — fuqarolik huquqi obyekti sifatida hozirgi qonunchilikda aniq o‘rnini topmagan; bu esa keng huquqiy noaniqlikni keltirib chiqaradi. Mazkur ikki muammoning yagona ilmiy yechimi — kompleks mualliflik ta’rifini ishlab chiqish va predmetni huquqiy jihatdan konseptlashtirishdir.

EU 2019/770-sonli Direktivasi raqamli mazmun va raqamli xizmat tushunchalarini aniq ta’riflagan bo‘lsa-da [5], O‘zbekiston qonunchiligida bunday ta’riflar shakllanmagan. O‘RQ-792-sonli Qonun [10] raqamli kontent maxsus predmetini aniq belgilamaydi va asosan tovar savdosi modeliga moslashgan. «Mualliflik huquqi va turdosh huquqlar to‘g‘risida»gi O‘RQ-42-sonli Qonun [12] esa mualliflik huquqi obyekti sifatidagi asarlarni tartibga solsa-da, raqamli kontent muomalasining o‘ziga xos masalalarini bevosita qamramaydi.

Tadqiqotning maqsadi — besh belgili mualliflik ta’rifini shakllantirish, konstitutiv belgilarni batafsil tahlil qilish va predmet — raqamli kontentning huquqiy maqomini aniqlashdir. Ilmiy yangilik uch yo‘nalishda namoyon bo‘ladi: birinchidan, beshta konstitutiv belgi (predmet, taraflar uchligi, maqsad, shakl, huquqiy oqibatlar) asosida shakllantirilgan original mualliflik ta’rifi; ikkinchidan, raqamli kontentning ikki yoqlama tabiati (nusxa + kirish imkoniyati) bilan tavsiflanadigan fuqarolik huquqi obyekti sifatida konseptlashtirilishi; uchinchidan, O‘zbekiston Respublikasi Fuqarolik kodeksiga ta’rifni va predmetni mustahkamlovchi konkret modda loyihasi.

Adabiyotlar tahlili va metodologiya.

Doktrinal asos uchta darajadagi manbalarni qamrab oladi. **Birinchi daraja — fuqarolik-huquqiy shartnomalar tasnifining fundamental ishlari**: Romanets Yu.V. ning shartnomalar tizimiga bag‘ishlangan monografiyasi [13; 73-95-b.] shartnomalar tasnifining markaziy mezoni — yakuniy huquqiy natija (yo'nalish) ekanligini asoslab beradi. Karapetov A.G. va Savelyev A.I. ning shartnoma erkinligi chegaralariga bag‘ishlangan fundamental ishi [9; 142-165-b.] nomlanmagan shartnomalar instituti nazariy asoslarini batafsil yoritadi. Askarov N.I. ning O‘zbekiston huquqida nomlanmagan shartnomalar bo‘yicha empirik tadqiqoti [1] milliy huquqshunoslikning shu sohadagi yagona maxsus ishidir.

Ikkinchi daraja — raqamli kontent shartnomalariga oid xalqaro doktrina: Helberger N., Loos M.B.M., Guibault L., Mak Ch. ning raqamli kontent iste’molchi shartnomalariga oid yetakchi tadqiqoti [7; 37-57-b.]; Spindler G. ning EU 2019/770 Direktivasi tahliliga bag‘ishlangan ishi [14; 183-217-b.]; Zech H. ning raqamli ma’lumotlarni mulk huquqi obyekti sifatida tahlil qilgan tadqiqoti [18; 192-197-b.]; Wendehorst C. ning platforma vositachi xizmatlariga oid asari [16; 30-33-b.]; Grünberger M. ning raqamli ne’matlar shartnomalariga oid fundamental tadqiqoti [6; 213-296-b.]; Staudenmayer D. ning raqamli shartnoma direktivalari sintetik tahlili [15; 219-250-b.]; Hoeren Th. ning Internet huquqi monografiyasi [8]; Brägelmann T. ning Germaniya BGB §§ 327–327u amaliyot tahlili [2].

Empirik baza: O‘zbekiston FK [11], O‘RQ-792 [10], O‘RQ-42 [12]; EU 2019/770 [5]; Germaniya BGB §§ 327–327u [3]; Xitoy Fuqarolik kodeksi [4]; WIPO Mualliflik huquqi to‘g‘risidagi shartnomasi (WCT) [17].

Metodologik algoritm uch bosqichli: birinchi bosqichda doktrinal-konstruktiv metod yordamida beshta konstitutiv belgi (predmet, taraflar uchligi, maqsad, shakl, huquqiy oqibatlar) sintezi; ikkinchi bosqichda predmet — raqamli kontent — sistem-strukturaviy va qiyosiy-huquqiy metodlar bilan tahlili; uchinchi bosqichda belgilarni birlashtirib mualliflik ta’rifi sintezi va Fuqarolik kodeksi uchun normativ taklif ishlab chiqildi.

Muhokama.

Birinchi konstitutiv belgi — *predmet sifatidagi raqamli kontent*. Nomoddiylik, takror-takrorlanish, raqobatlashmaslik va jismoniy chegaraga ega emaslik xususiyatlari raqamli kontentni an’anaviy fuqarolik huquqi obyektlaridan tubdan ajratuvchi belgilardir. Zech H. mazkur xususiyatlarni raqamli ma’lumotlarning *information goods* tabiati doirasida tahlil qilgan va ularning klassik mulk huquqi obyektlaridan tubdan farqlanishini asoslab bergan [18; 192-197-b.]. EU 2019/770-sonli Direktivasi 2-moddasi 1-bandi raqamli mazmunni «raqamli shaklda ishlab chiqarilgan va yetkazib beriladigan ma’lumotlar» sifatida ta’riflagan [5]. Grünberger M. esa raqamli mahsulotlar shartnomalarining strukturaviy tahlilini fundamental darajada ishlab chiqqan: u raqamli ne’matlarning yangi turdagi fuqarolik huquqi obyekti sifatida shakllanishini izchil ko‘rsatib bergan [6; 213-296-b.].

Ikkinchi konstitutiv belgi — *taraflar uchligi* (kontent egasi + platforma operatori + iste’molchi). Klassik fuqarolik-huquqiy shartnomalarning aksariyati ikki tomonlama tuzilmaga ega bo‘lsa, kontent tarqatish shartnomasida uchta mustaqil subyekt ishtirok etadi. Mazkur uch subyekt orasida ikkita asosiy shartnomaviy munosabat shakllanadi: kontent egasi va operator o‘rtasida litsenziya shartnomasi, operator va iste’molchi o‘rtasida xizmat-qo‘shilish shartnomasi. Wendehorst C. ushbu murakkab tuzilmani *platform contracts* kategoriyasi doirasida batafsil tahlil qilgan [16; 30-33-b.] va platforma operatori ro’lining ko‘p funksiyali tabiatini ko‘rsatib bergan. Mazkur ko'p subyektli tuzilma shartnomani an’anaviy ikki tomonlama institutlardan ajratuvchi muhim strukturaviy belgisidir.

Uchinchi belgi — *iqtisodiy-huquqiy maqsad*. Romanets Yu.V. fundamental tadqiqotida shartnomalar tasnifining markaziy mezoni — taraflar erishmoqchi bo‘lgan yakuniy huquqiy natija ekanligini asoslab bergan [13; 73-95-b.]. Kontent tarqatish shartnomasining yagona iqtisodiy maqsadi — iste’molchi uchun raqamli kontentga barqaror, sifatli va davomli kirish imkoniyatini ta’minlashdir. Mazkur maqsad uning yagona, bo‘linmas xususiyatiga ega va shartnomaning barcha unsurlari (litsenziya, xizmat, qo‘shilish, elektron-tijorat) shu yagona maqsadga bo‘ysunadi.

To‘rtinchi belgi — *tuzilish shakli* (qo‘shilish + elektron + sinallagmatik). Kontent tarqatish shartnomasi uchta shakl xususiyatini uyg‘unlikda mujassam etadi: birinchidan, qo‘shilish shakli — shartnoma shartlari platforma operatori tomonidan

oldindan belgilanadi; ikkinchidan, elektron shakl — shartnoma kibermakon orqali, click-wrap yoki browse-wrap orqali tuziladi; uchinchidan, sinallagmatik tabiat — taraflar o‘zaro shartlangan, qarama-qarshi taqdimga asoslangan majburiyatlarni qabul qiladi.

Beshinchi konstitutiv belgi — *huquqiy oqibatlar*: iste’molchining maxsus imperativ huquqlari (cooling-off, raqamli muvofiqlik, shaffoflik, adolatsiz shartlardan himoya), platforma operatori uchun ikki darajali javobgarlik tartibi, shaxsiy ma’lumotlarni ishlov berish bo‘yicha maxsus rejim va transchegaraviy munosabatlarda iste’molchi joylashgan davlatning imperativ himoya normalari ustun kuchga ega bo‘lishi. Hoeren Th. mazkur huquqiy oqibatlarning umumlashgan tahlilini taqdim etgan [8]. Staudenmayer D. raqamli kontent va xizmatlar shartnomalarini raqamli iqtisodiyot xususiy huquqini shakllantirish yo‘lidagi dastlabki, biroq tizimli qadamlar deb baholagan [15; 219-250-b.]. Brägelmann T. Germaniya BGB §§ 327–327u amaliyotini batafsil tahlil qilib, raqamli mahsulotlar uchun maxsus rejimning umumiy konstruksiyasini ko‘rsatib bergan [2].

Predmetning ikki yoqlama tabiati alohida muhokamaga loyiqdir. Bir tomondan, raqamli kontent muayyan asarning raqamli nusxasi bo‘lib, mualliflik huquqi bilan himoyalangan intellektual faoliyat natijasini ifodalaydi va WIPO Copyright Treatyning 8-moddasidagi «umumga yetkazish huquqi» bilan bog‘liq [17]. Ikkinchi tomondan, iste’molchi shartnoma bo‘yicha asarning o‘zini olmaydi, balki uning nusxasiga kirish va undan foydalanish imkoniyatini oladi; bu jihat munosabatni xizmat ko‘rsatish sohasiga yaqinlashtiradi. Karapetov A.G. va Savelyev A.I. raqamli kontentni an’anaviy obyektlardan farq qiluvchi alohida sui generis ne’mat sifatida tan olish tendensiyasini ko‘rsatib bergan [9; 142-165-b.]. Askarov N.I. esa milliy doktrinada nomlanmagan shartnomalar tabiatini empirik tadqiq qilgan [1]. Xitoy Fuqarolik kodeksi (2021) ham raqamli munosabatlarni an’anaviy obyektlar bilan birga maxsus tartibga soluvchi qoidalarni nazarda tutdi [4].

Natijalar.

Mualliflik ta’rifi: «Kibermakonda kontent tarqatish shartnomasi — bu bir taraf (platforma operatori) ikkinchi tarafga (iste’molchiga) uchinchi shaxs (kontent egasi)ning intellektual faoliyat natijalari bo‘lgan raqamli kontentga kibermakon orqali barqaror, sifatli va davomli kirish va undan foydalanish imkoniyatini taqdim etish hamda mazkur kirishni shartnoma amal qilish davomida muvofiqlikda saqlab turish majburiyatini oladi; iste’molchi esa belgilangan haq to‘lashga yoki shartnoma bilan nazarda tutilgan boshqa qarama-qarshi taqdimni amalga oshirishga majbur bo‘lgan, qo‘shilish va elektron shaklda tuziladigan, iste’molchi maxsus himoyasi va platforma operatorining ikki darajali javobgarligi imperativ rejimiga bo‘ysunadigan yaxlit aralash sui generis shartnoma turidir».

Mazkur mualliflik ta’rifining ilmiy ahamiyati uchta yo‘nalishda namoyon bo‘ladi. Birinchidan, u shartnomaning besh konstitutiv belgisini yagona, izchil formulaga birlashtiradi va shu bilan ilmiy va amaliy maqsadlarda yetarli aniqlik darajasini ta’minlaydi. Ikkinchidan, ta’rif shartnomani boshqa klassik institutlardan

(sotish-sotib olish, ijara, pudrat, xizmat koʻrsatish, mualliflik shartnomasi, agentlik) aniq farqlovchi mezonlarga ega. Uchinchidan, u Oʻzbekiston Respublikasi Fuqarolik kodeksiga konkret modda sifatida toʻgʻridan-toʻgʻri kiritilishi mumkin boʻlgan tahrirga ega.

Raqamli mazmun va raqamli xizmat farqlash mezonlari EU 2019/770-sonli Direktivasi 2-moddasi 1–2-bandlariga muvofiq amalga oshiriladi: raqamli mazmun — raqamli shaklda ishlab chiqarilgan va yetkazib beriladigan maʼlumotlar (filmlar, audio fayllar, oʻyinlar, elektron kitoblar); raqamli xizmat esa — isteʼmolchiga raqamli shaklda maʼlumotlarni yaratish, qayta ishlash, saqlash yoki ularga kirish imkonini beruvchi xizmat (ijtimoiy tarmoqlar, oqim xizmatlari, bulutli saqlash) [5]. Mazkur farqlash amaliy ahamiyatga ega: raqamli mazmun bir martalik yetkazilish va davomiy muvofiqlik kafolatiga boʻysunsa, raqamli xizmat butun amal qilish davomida xizmat koʻrsatishni talab qiladi. Spindler G. klassifikatsiya raqamli kontent shartnomalarini boshqa elektron tijorat shakllaridan toʻgʻri ajratish uchun zaruriy qurol ekanligini taʼkidlagan [14; 183-217-b.]. Helberger N. va boshqalar har bir kategoriya uchun maxsus muvofiqlik mezonlari va isteʼmolchi himoyasi standartlari qoʻllanilishi kerakligini koʻrsatgan [7; 37-57-b.].

Raqamli kontent obyektining batafsil klassifikatsiyasi amaliy ahamiyatga ega. Predmet boʻyicha quyidagi asosiy kategoriyalar ajratiladi: *audiovizual kontent* (filmlar, serallar, video roliklar — Netflix, KinoUz, OnlineKino); *audio kontent* (musiqa, podkastlar, audio kitoblar — Spotify, Apple Music); *matnli kontent* (elektron kitoblar, raqamli gazetalar va jurnallar — Amazon Kindle, BookUz); *interaktiv kontent* (videoo'yinlar, dasturiy taʼminot — Steam, App Store, Google Play); *aralash kontent* (multimedia paketlar, virtual reallik tajribalari). Mazkur klassifikatsiya har bir kategoriya uchun maxsus muvofiqlik mezonlari va isteʼmolchi himoyasi standartlarini joriy qilish uchun zaruriy quroldir.

Xulosa.

Doktrinal-qiyosiy tahlil natijasida: birinchidan, kibermakonda kontent tarqatish shartnomasi beshta konstitutiv belgi orqali individuallashtiriladi (predmet, taraflar uchligi, iqtisodiy maqsad, tuzilish shakli, huquqiy oqibatlar); ikkinchidan, predmet — raqamli kontent — ikki yoqlama tabiatga (nusxa + kirish imkoniyati) ega; uchinchidan, raqamli kontent obyektlar tasnifining hech bir anʼanaviy toifasiga toʻla joylashmaydi va alohida sui generis neʼmat sifatida tan olinishi maqsadga muvofiqdir.

Takomillashtirish taklifi: *«1. Kibermakonda kontent tarqatish shartnomasi boʻyicha bir taraf — platforma operatori — ikkinchi tarafga (isteʼmolchiga) uchinchi shaxs (kontent egasi)ning intellektual faoliyat natijalari boʻlgan raqamli kontentga kibermakon orqali barqaror, sifatli va davomli kirish va undan foydalanish imkoniyatini taqdim etish hamda mazkur kirishni shartnoma amal qilish davomida muvofiqlikda saqlab turish majburiyatini oladi. 2. Mazkur shartnomaning predmetini raqamli kontent — raqamli shaklda ishlab chiqarilgan va platforma operatori orqali yetkazib beriladigan maʼlumotlar majmuasi tashkil etadi. Raqamli kontent quyidagi turlarga boʻlinadi: audiovizual, audio, matnli,*

interaktiv va aralash kontent. 3. Raqamli kontent fuqarolik huquqining o‘ziga xos (sui generis) obyekti bo‘lib, u nomoddiylik, takror-takrorlanish va raqobatlashmaslik xususiyatlariga ega hamda mualliflik huquqi obyekti bo‘lgan asarning nusxasi va shu nusxaga kirish imkoniyati shaklida ikki yoqlama tabiatga ega. 4. Raqamli kontent raqamli xizmatdan farqlanadi va ikkalasiga ham ushbu bobning qoidalari tegishlicha qo‘llaniladi».

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MODERN MATHEMATICAL METHODS FOR PROCESSING GEODETIC OBSERVATION DATA

Abstract: *Satellite positioning systems and digital total stations and remote sensing technologies have advanced quickly to produce new geodetic observation data which needs thorough mathematical analysis. The article studies present-day mathematical techniques which scientists use to analyze geodetic observations through least squares adjustment and robust estimation and Kalman filtering and geostatistical interpolation methods. The article concludes that integrated multi-method processing pipelines which use classical adjustment theory together with modern computational intelligence tools present the most effective approach for advancing geodetic data science.*

Keywords: *geodetic observations, least squares method, robust estimation, geostatistical methods, measurement error, adjustment theory, satellite geodesy.*

Introduction. Geodesy exists as a scientific field that measures and shows the Earth's shape and direction and gravity field, which depends on how well scientists process their observational data through mathematical methods. The measurement procedures from the 1700s to today's global navigation satellite systems (GNSS) face a persistent problem because scientists must find ways to obtain accurate geometric and physical data from measurements that contain both random and systematic mistakes. The past 30 years have brought significant changes to geodetic data because there are now more reference stations operational 24 hours and unmanned aerial vehicle (UAV) photogrammetry and terrestrial laser scanning and interferometric synthetic aperture radar (InSAR) technology.

The technologies produce datasets which contain millions or billions of data points. The resulting data requires advanced mathematical systems which can manage both statistical needs and computational requirements of the situation [2]. The challenge holds significant importance beyond the field of academic geodesy because accurate land cadastre systems and infrastructure monitoring and earthquake hazard assessment and smart city planning all rely on precise geodetic observation processing results. The Central Asian region and Uzbekistan currently practice modern mathematical processing methods because the area needs to develop its infrastructure and conduct cadastral reforms [3]. The article conducts a comprehensive examination which compares the main mathematical techniques used to process geodetic data. The article assesses the mathematical methods through their theoretical foundations and their practical advantages and disadvantages and their ability to work together in complete processing systems.

Methodology and literature review. The methodological basis of this article consists exclusively of a structured analysis of peer-reviewed scientific literature, authoritative textbooks, and technical standards pertaining to geodetic adjustment theory and applied mathematical geodesy. The method of least squares (MLS) which originated from Gauss and Legendre in the early nineteenth century represents the classical foundation for processing geodetic data because Helmert and his colleagues developed this method into a complete adjustment theory [4]. The MLS method minimizes residuals by calculating their squared values while assuming that observational errors distribute according to a normal (Gaussian) distribution which enables the system to produce the best linear unbiased estimator (BLUE) that meets Gauss-Markov requirements. The implementation of MLS in geodetic networks uses three methods which include parametric and conditional and combined approaches that depend on the functional model design.

Russian geodetic science developed its academic foundation through the work of Kushtyn and Linnik who created matrix-algebraic MLS methods which continue to serve as educational standards in all former Soviet states [5]. The main disadvantage of classical MLS methods arises from their inability to handle gross errors which occur when one incorrect measurement leads to complete disruption of the adjusted output because the method gives excessive importance to substantial measurement errors [6]. The 1960s onward period saw researchers create robust estimation methods because of this system vulnerability.

Robust estimation includes various methods which help to maintain estimator accuracy when outliers and non-normality conditions appear. Huber developed M-estimators which use functions that replace squared loss functions through Huber function and Tukey bisquare function and L1 norm functions which decrease large residuals effects while still maintaining all assessment data for analysis [7]. The GNSS network adjustment process benefits from robust methods because they help geodetic applications to detect multipath errors and cycle slips which create severe undetectable errors through standard statistical tests. The Danish method together with iteratively reweighted least squares (IRLS) system stands out as the most commonly used robust algorithms within geodetic software systems. The Acar et al. study shows that robust estimators outperform classical MLS methods in databases which have more than five percent contaminated data but they achieve similar results in databases that contain clean data [6].

The Kalman filter serves as the most mathematically consistent solution for dynamic geodetic problems which require time-series analysis of GNSS positions and satellite orbit determination and structural deformation monitoring [8]. The Kalman filter functions as a recursive algorithm which integrates a dynamic system model that forecasts state vector changes through time with a measurement model that connects observations to the state and provides the best linear predictions throughout time under Gaussian error conditions. The system uses its recursive design to achieve fast processing capabilities that enable real-time operations. The extended and unscented variants of the Kalman filter exist to manage nonlinear

system models which researchers commonly use in inertial navigation and combined GNSS/INS positioning systems. Kalman filter methods provide continuous deformation state estimate updates through new geodetic observations which create an operational real-time view of structural behavior for monitoring surface deformation in large engineering structures such as dams and bridges and mine tailing ponds.

The spatial interpolation and prediction of geoid undulations and atmospheric refraction corrections and gravity anomalies has seen increasing use of geostatistical methods which originated in mining engineering through Matheron and Krige's research. Kriging serves as the primary geostatistical interpolation method which creates spatial covariance models through variogram fitting and delivers minimum-variance unbiased linear predictions for unobserved locations together with prediction uncertainty assessment. Geodetic applications have utilized ordinary kriging universal kriging and co-kriging which uses spatial variable correlations to perform their measurements. The theoretical connection between kriging and least squares collocation a method developed specifically within physical geodesy by Moritz is well established and provides a unifying framework linking geostatistical and geodetic estimation theory [9].

Results and discussion. The examined literature demonstrates two main patterns which show how four major mathematical frameworks perform in various application areas. Table 1 presents a structured comparison of these methods across key methodological dimensions, while Table 2 summarizes their documented performance characteristics as reported across the reviewed sources.

Table 1.

Comparative characteristics of principal geodetic data processing methods

Method	**Theoretical basis**	**Error model assumption**	**Optimal application domain**	**Computational complexity**
Least Squares (MLS)	Gauss-Markov theorem	Normal distribution, no outliers	Static network adjustment, cadastral surveys	Low to moderate
Robust Estimation (M-estimators)	Influence function theory	Heavy-tailed distributions, outliers present	GNSS adjustment, LiDAR filtering	Moderate
Kalman Filter	Bayesian recursive estimation	Gaussian, dynamic state evolution	Real-time positioning, deformation monitoring	Moderate to high
Kriging / Least Squares Collocation	Spatial covariance modeling	Second-order stationarity	Geoid modeling, gravity field interpolation	High

The results of this comparative analysis indicate that the selection of a mathematical processing method cannot be made in abstraction from the specific observational scenario. The method of choice for static geodetic networks which exhibit predictable error patterns requires national horizontal control networks and urban cadastral surveys to use MLS as their preferred solution because it provides mathematical optimality and easy result interpretation [4]. The literature demonstrates that modern geodetic practice requires new solutions because classical MLS methods cannot handle three specific types of modern geodetic work automated GNSS processing uses multiple environmental observation times to collect data; UAV photogrammetry creates interdependent image-block inaccuracies; and InSAR time-series analysis detects atmospheric disturbances which break normal data distribution patterns.

Table 2.

Reported performance advantages and limitations by method (based on literature synthesis)

Method	Key strength	Principal limitation	Conditions favoring use	Conditions disfavoring use
MLS	Mathematically optimal under Gauss-Markov conditions	Highly sensitive to gross errors	Clean datasets, well-designed networks	Datasets with outliers >2–3%
Robust Estimation	Resistant to outlier influence	May lose efficiency with clean data	Automated processing, heterogeneous datasets	Highly precise static networks
Kalman Filter	Real-time capability, handles dynamic systems	Requires accurate system model; divergence risk	Kinematic surveys, monitoring	Static or single-epoch problems
Kriging	Quantified spatial uncertainty, flexible covariance	Variogram modeling subjectivity	Gravity, geoid, irregular spatial fields	Datasets without spatial autocorrelation

In these contexts, robust estimation methods provide a principled and practically effective alternative that preserves the structural advantages of adjustment theory while sacrificing only a modest degree of statistical efficiency under ideal conditions [6]. The Kalman filter occupies a distinct niche: it is not a competitor to MLS or robust estimation in static scenarios, but rather the uniquely appropriate tool for dynamic, time-evolving problems where sequential updating of state estimates is operationally necessary [8]. The key practical challenge in Kalman filter implementation is the accurate specification of the process noise covariance matrix, which governs the predicted uncertainty of state evolution between epochs; misspecification of this matrix can lead to filter divergence, particularly in long-duration monitoring campaigns. Geostatistical methods, meanwhile, are best understood not as alternatives to the other three approaches but as complementary

tools operating at a different scale concerned with the spatial structure of field quantities rather than the adjustment of individual observation networks [9].

Their integration with physical geodesy through least squares collocation creates a powerful unified framework that is particularly relevant for regional geoid modeling and gravity field representation, both of which are priority tasks in the geodetic development of Uzbekistan and neighboring states [3]. A critical observation emerging from this synthesis is that the most advanced contemporary geodetic software platforms including scientific packages such as BERNESE, GAMIT/GLOBK, and open-source libraries are increasingly implementing hybrid processing pipelines that combine MLS as a baseline adjustment engine with robust outlier detection, Kalman smoothing for time-series analysis, and geostatistical covariance modeling for signal separation [2]. This convergence reflects a mature recognition in the field that methodological pluralism, rather than exclusive adherence to any single mathematical framework, is the most epistemologically and practically defensible approach to geodetic data processing.

A further dimension that emerges from the comparative analysis concerns the role of mathematical method selection in determining not only the accuracy but also the interpretability of geodetic processing outcomes. In applied engineering contexts such as the monitoring of subsidence around mining operations or the assessment of foundation movement in high-rise construction decision-makers require not merely a point estimate of displacement but a statistically credible uncertainty bound around that estimate. Classical MLS provides formal variance-covariance matrices that serve this purpose well under ideal conditions, but when the underlying distributional assumptions are violated, these matrices become unreliable guides to actual estimation uncertainty. Robust estimators, by contrast, produce more honest uncertainty characterizations in contaminated datasets, because their downweighting of outlying observations is explicitly reflected in the structure of the resulting covariance estimates. This interpretability advantage is increasingly recognized as a criterion of methodological selection in its own right, separate from considerations of pure numerical accuracy, and it argues for the routine adoption of robust methods in any geodetic application where automated data acquisition reduces the possibility of manual quality control.

It is equally important to recognize that the computational environment in which geodetic data processing takes place has itself undergone a fundamental transformation that reshapes the practical trade-offs between these mathematical frameworks. The transition from mainframe batch processing to distributed cloud computing, and more recently to GPU-accelerated numerical linear algebra, has largely eliminated the computational cost barrier that once made methods such as kriging or extended Kalman filtering impractical for large-scale geodetic datasets. Where a full geostatistical covariance analysis of a national gravity dataset once required days of computation on dedicated hardware, modern implementations on standard scientific workstations accomplish the same task in minutes. This democratization of computational power means that the choice between

mathematical methods can increasingly be made on purely statistical and epistemological grounds selecting the method most appropriate to the structure of the problem rather than being constrained by hardware limitations. The practical consequence for geodetic institutions in developing regions is that investment in modern open-source processing software and adequate computing infrastructure now unlocks the full spectrum of mathematical methods reviewed in this article, removing a historical barrier to methodological modernization.

Conclusion. This article has examined the theoretical foundations and practical dimensions of four principal mathematical methods for processing geodetic observation data: classical least squares adjustment, robust estimation, Kalman filtering, and geostatistical interpolation including least squares collocation. The analysis demonstrates that each of these methods addresses a distinct structural feature of the geodetic data processing problem: MLS provides the optimal estimator for well-behaved static networks; robust methods ensure reliability in the presence of gross errors and distributional anomalies; the Kalman filter enables efficient sequential estimation for dynamic systems; and geostatistical techniques model the spatial covariance structure of geophysical fields. The practical implication for the development of geodetic infrastructure in Uzbekistan and the Central Asian region is that investment in modern integrated processing workflows combining these methods in algorithmically coherent pipelines will yield substantially greater accuracy and reliability than continued reliance on classical single-method approaches. Future methodological development in the field is expected to further integrate machine learning-based outlier detection and deep learning-assisted covariance modeling into adjustment workflows, representing the next frontier in the mathematization of geodetic data science. The foundation for this evolution, however, remains the classical mathematical tradition reviewed in this article, whose theoretical depth and practical robustness continue to underpin all advances in the discipline.

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LUQMON BO‘RIXON ASARLARIDA BADIIY MAHORAT VA INSON RUHIYATI TALQINI

Annotatsiya: *Ushbu maqolada zamonaviy o‘zbek adabiyotining iste’dodli vakillaridan biri bo‘lgan Luqmon Bo‘rixon asarlarining badiiy xususiyatlari tadqiq etiladi. Adibning Luqmon Bo‘rixon zamonaviy o‘zbek nasrining o‘ziga xos uslubga ega vakillaridan biridir. Uning “Jaziramadagi odamlar”, “Imom Moturidiy”, “Sirli muallim”, “Tokchadagi tumor”, “Tun qa’ridagi shu’la”, “Aldoqchi tunlar”, “Cho‘ldan kelgan tashvish” kabi asarlari misolida yozuvchining obraz yaratish mahorati, psixologizm, badiiy detal, ramziylik va uslub masalalari tahlil qilinadi.*
Kalit so‘zlar: *Luqmon Bo‘rixon, zamonaviy o‘zbek nasri, psixologizm, badiiy detal, ramziylik, qissa, hikoya, roman, obraz, uslub.*

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THE INTERPRETATION OF ARTISTIC SKILL AND HUMAN SPIRIT IN THE WORKS OF LUQMON BORIKHAN

Annotation: *This article examines the artistic features of the works of Luqmon Borikhan, one of the talented representatives of modern Uzbek literature. The writer Luqmon Borikhan is one of the representatives of modern Uzbek prose with a unique style. On the example of his works such as “People in the Heat”, “Imam Moturidiy”, “Mysterious Teacher”, “Tukchadagi Tumul”, “Tun qa’ridagi Shu’la”, “Aldoqchi Tunlar”, “Cho’ldan gelen angyo” the writer’s image-creating skills, psychologism, artistic detail, symbolism and style issues are analyzed.*
Keywords: *Luqman Borikhon, modern Uzbek prose, psychologism, artistic detail, symbolism, story, narrative, novel, image, style.*

XX asr oxiri va XXI asr boshlaridagi o‘zbek adabiyoti inson ruhiyati, ma’naviy tanazzul va axloqiy qadriyatlar masalasiga yangicha yondashuvi bilan xarakterlanadi. Bu davr nasrida insonning ichki olamini chuqur tasvirlash, hayot haqiqatlarini badiiy umumlashtirish va milliy qadriyatlarni zamonaviy talqinda yoritishga intilish kuchaydi. Ana shunday adiblardan biri Luqmon Bo‘rixondir.

Luqmon Bo‘rixonning “Jaziramadagi odamlar” romani mustaqillik davri o‘zbek nasrining yirik namunalaridan biri bo‘lib, unda cho‘l hududida yashovchi

insonlarning murakkab taqdiri, ruhiy iztiroblari, sevgi va xiyonat, ezgulik va yovuzlik o‘rtasidagi kurash badiiy talqin etiladi. Asarning markazida Lolaxon obrazi va uning fojeali qismati turadi. Roman cho‘l hayoti, inson ruhiyati va ma’naviy tanazzul masalalarini chuqur yoritishi bilan ajralib turadi. Roman nomidagi “jazirama” so‘zi nafaqat tabiatdagi issiqlikni, balki inson qalbidagi iztirob, ruhiy qiynoq va ma’naviy qurg‘oqchilikni ham anglatadi. Muallif cho‘l manzaralari orqali qahramonlarning ichki kechinmalarini aks ettiradi. Tadqiqotchilar ham asarda inson va muhit, shaxs va jamiyat o‘rtasidagi ziddiyatlar muhim o‘rin tutishini ta’kidlaydilar. Asarda cho‘lning dahshatli manzaralari tez-tez uchraydi. Masalan:

“Quyosh osmonning qoq o‘rtasida lovullab turardi...”[1.] Bu kabi tasvirlar faqat peyzaj emas, balki qahramonlar yashayotgan muhitning og‘irligini ko‘rsatadi. Jazirama odamlar qalbidagi umidsizlik va iztirobning ramziga aylanadi. Roman markazidagi Lolaxon obrazi o‘zbek ayolining sabri, matonati va fojeasini mujassamlashtiradi. U taqdir taqozosi bilan cho‘lga kelin bo‘lib tushadi va turli sinovlarga duch keladi. Uning hayoti orqali ayolning jamiyatdagi o‘rni, erkinlikka intilishi va ruhiy iztiroblari yoritiladi. *“Taqdir odamni qayerlarga olib bormaydi...”* [1.] Ushbu mazmundagi fikrlar Lolaxonning ichki kechinmalarini ifodalaydi. Muallif qahramon ruhiyatini tashqi voqealardan ko‘ra ko‘proq ichki monologlar orqali ochib beradi. Roman badiiyatining eng muhim jihatlaridan biri peyzaj tasvirlaridir. Cho‘l, shamol, qum, jazirama quyosh voqealar rivojiga faol ta’sir ko‘rsatadi. Tabiat go‘yoki qahramonlar bilan birga yashaydi, birga iztirob chekadi. *“Cho‘l jim edi. Faqat shamol qumni surib yurardi...”* [1.] Bu tasvir insonlarning yolg‘izligi va ma’naviy bo‘shlig‘ini kuchaytiradi. Muallif peyzajni qahramon ruhiyatining davomiga aylantirgan.

Umuman olganda, “Jaziramadagi odamlar” — inson ruhiyati, ayol qismati va ma’naviy qadriyatlar haqida yozilgan chuqur falsafiy-psixologik roman. Jazirama cho‘l tasviri orqali muallif inson qalbidagi og‘riq, yolg‘izlik va umidni mahorat bilan ochib beradi. Ayniqsa, Lolaxon obrazi o‘zbek adabiyotidagi eng ta’sirchan ayol obrazlaridan biri sifatida namoyon bo‘ladi. Roman o‘quvchini insoniylik, sabr va ma’naviyat haqida mushohada qilishga undaydi

Luqmon Bo‘rixonning Imom Moturidiy romani o‘zbek tarixiy-biografik romanchiligining muhim namunalaridan biri hisoblanadi. Asarda IX–X asrlardagi Somoniylar davri, Samarqand ilmiy muhiti va buyuk mutafakkir Imom Abu Mansur Moturidiyning hayoti hamda ma’rifiy kurashi badiiy talqin etiladi. Roman tarixiy voqealar bilan badiiy to‘qimani uyg‘unlashtirgan holda allomaning ilmiy, ma’naviy va insoniy qiyofasini ochib beradi. Asarda Moturidiy ta’limotining asosiy mohiyati – insonning aql bilan haqiqatni topishi mumkinligi g‘oyasi yetakchi o‘rin egallaydi. Roman dialoglari orqali Ahli sunna val jamoa aqidasi va e’tiqodiy masalalar yoritiladi. Asardagi eng muvaffaqiyatli obraz – Imom Moturidiydir. Yozuvchi uni afsonaviy qahramon emas, balki izlanadigan, o‘ylaydigan, iztirob chekadigan va haqiqat yo‘lida kurashadigan inson sifatida ko‘rsatadi. *“Ilmning qudrati qilichning qudratidan ustundir.”* [2.] Bu fikr romanning asosiy g‘oyalaridan birini ifodalaydi.

Muallif ilmni jamiyat taraqqiyotining asosiy kuchi sifatida talqin qiladi. Tadqiqotchilar romanning asosiy ziddiyatlaridan biri Moturidiy va Qozi Idris Shomiy o‘rtasidagi mafkuraviy kurash ekanligini ta’kidlaydilar. *“...Albatta, xilvat, ibodatlar g‘oyat ma’qul yumush. Va lek ushbu ila faqat o‘zni qutqargaysiz, andin faqat siz naf ko‘rgaysiz. Ammo bugun ahli ilm ko‘proq ummat, din qismatig‘a qayg‘urmog‘i maqsadg‘a muvofiqdir. Haqni anglag‘an har bir sohibi ilm o‘zni xilvatg‘a tortsa, jamoatdin qochsa, Islomni kim himoya aylaydi? Kim uni fitna-fasoddin asraydi?”* [2.] Ushbu fikr asarning falsafiy mazmunini belgilaydi. Muallifning nazarida haqiqat vaqtinchalik mag‘lub bo‘lishi mumkin, biroq baribir g‘alaba qiladi. Bu g‘oya Moturidiy obrazining ichki qudratini namoyon etadi. Roman Somoniylar davri tarixiy voqealari fonida kechadi. Samarqand ilm-fan markazi sifatida tasvirlanadi. Muallif tarixiy manzara yaratishda katta mahorat ko‘rsatgan. *“Nechun? Chunki din-u davlatimizni, mol-u jonimizni yovdan qo‘riqlovchi siz yanglig‘ o‘g‘lonlarimiz bor. Haq subhonahu taolo ato etmish shamshir-u shijoat, jidd-u jahd sizg‘a, sizning qavming‘izg‘a. Va turk qavmining sharofatidin lashkari Islom quvvat topdi. Quvvatki, ahli mashriq, ahli mag‘rib aning oldida bosh egdi. Bu sharaf emasmu? Bu iftixor emasmu?”* [2.] Bu tasvir Samarqandning o‘sha davrdagi ilmiy mavqeini ifodalaydi. Shahar nafaqat siyosiy, balki ma’rifiy markaz sifatida ham ko‘rsatiladi. Umuman olganda, Luqmon Bo‘rixonning “Imom Moturidiy” romani tarixiy-biografik janrning yuksak namunalaridan biridir. Roman o‘quvchini ilmga, tafakkurga, haqiqatni izlashga da’vat etadi hamda buyuk alloma siymosini zamonaviy badiiy tafakkur mezonlari asosida qayta yaratadi.

Luqmon Bo‘rixonning “Sirli muallim” qissasi yozuvchining ma’naviy-axloqiy masalalarni yoritishga bag‘ishlangan eng e’tiborli asarlaridan biridir. Qissada inson kamoloti, ilm-ma’rifatning qudrati, ustoz va shogird munosabatlari hamda tarbiyaning jamiyat hayotidagi o‘rni badiiy jihatdan yoritilgan. Muallif asar orqali haqiqiy ustozning vazifasi faqat bilim berish emas, balki yosh avlod qalbiga ezgulik, halollik va vatanparvarlik tuyg‘ularini singdirishdan iborat ekanligini ko‘rsatishga intiladi. Shu jihatdan qissa yosh avlodni ma’rifatli, halol va vatanparvar inson bo‘lib ulg‘ayishga chorlaydigan ma’naviy-ma’rifiy asar sifatida qadrlanadi. Luqmon Bo‘rixonning “Tokchadagi tumor” hikoyasi yozuvchining inson ruhiyati, xotira va ma’naviy qadriyatlar masalasiga bag‘ishlangan ta’sirchan asarlaridan biridir. Hikoyada inson qalbida umr bo‘yi saqlanib qoladigan xotiralar, o‘tmish bilan bog‘liq kechinmalar hamda muhabbat va sadoqat tuyg‘ularining badiiy talqini berilgan. Hikoyada insonning ma’naviy olami, qalbida yashovchi sog‘inch va sadoqat tuyg‘ulari chuqur badiiy talqin etilgan. “Tokchadagi tumor” hikoyasi xotira, muhabbat, sadoqat va inson ruhiyati masalalarini yorituvchi psixologik-falsafiy asardir. Tumor obrazi orqali muallif inson qalbida yashaydigan unutilmas tuyg‘ularni ramziy shaklda ifodalagan. Hikoya o‘zining hayotiyligi, ruhiy tasvirlarining chuqurligi va badiiy mahorati bilan Luqmon Bo‘rixon ijodidagi e’tiborli asarlardan biri hisoblanadi.

Xulosa qilib aytganda, Luqmon Bo‘rixon zamonaviy o‘zbek nasrining o‘ziga xos uslubga ega vakillaridan biridir. Uning “Jaziramadagi odamlar”, “Imom Moturidiy”, “Sirli muallim”, “Tokchadagi tumor”, “Tun qa’ridagi shu’la”, “Cho‘ldan kelgan tashvish” kabi asarlarida inson ruhiyati, ma’naviy qadriyatlar va zamonaviy hayot muammolari yuksak badiiy mahorat bilan tasvirlangan. Adibning psixologik tahlilga asoslangan uslubi, ramziy tafakkuri va hayotiy obrazlari uning ijodini zamonaviy o‘zbek adabiyotining muhim hodisalaridan biriga aylantiradi.

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STRATEGIC HUMAN RESOURCE MANAGEMENT IN NEWCOMER NUCLEAR COUNTRIES: EVIDENCE FROM BANGLADESH'S FIRST NUCLEAR FACILITY

Abstract: *The topicality of this work consists in the fact that the Rooppur Nuclear Power Plant Project is the strategically significant project because it is the first nuclear facility in Bangladesh. In a very risky and safety critical operating environment, operational reliability and long-term sustainability of the project is directly related to human performance. The paper reviews the performance of the HR department in RNPP and gives suggestions on how the strategic contribution of the HR department can be increased. The survey used as the mixed-methods approach of the study has included the questionnaire survey of 300 employees, as well as, the semi-structured interviews with specialists and managers. In addition, official project documentation was also examined. The quantitative data involved descriptive statistical data analysis, correlation, and regression analysis. Qualitative data were analyzed on the other hand using thematic methods. The outcomes reveal that the HR system is functioning fairly well regarding such aspects as employee training, certification, and establishment of a powerful safety culture. Conversely, not so many aspects show any similar areas of weakness, namely: employee motivation and retention, strategic workforce planning, career development pathways and successful cross-cultural integration. The suggested HR effectiveness model will be applied in reality to enhancing the human resource policies of RNPP. In addition to this, it is also contributing to develop the national human capital in the developing nuclear sector in Bangladesh.*

Key terms: *HR effectiveness; nuclear power project; safety culture; mixed-methods; Rooppur; mega project HRM.*

1. Introduction

Rooppur Nuclear Power Plant Project (RNPP) is a nuclear power plant which is the first nuclear power facility in Bangladesh and among the largest megaprojects in the history of Bangladesh. Having two VVER-1200 Generation III+ reactors with an installed capacity of 2400 MW, RNPP is a key move towards energy security

and technology (IAEA, 2018). But nuclear megaprojects are not similar to traditional infrastructure projects: human error in their case could cause disastrous outcomes, and human resource management (HRM) is not an administrative role of the project but a pivotal factor in terms of safety (Reason, 2016; Meshkati, 2012).

The International Atomic Energy Agency (IAEA) refers to human resources as one of three pillars of national nuclear infrastructure along with legal-regulatory frameworks and technical systems (IAEA, 2018). In the case of newcomer nuclear countries, such as Bangladesh, this problem is exacerbated by poor knowledge base within the country, reliance on foreign experts, and a requirement to systematize the transfer of knowledge. Even though, its strategic significance, there is absolutely no empirical investigation on assessing HR performance in nuclear megaprojects in the context of developing countries.

The projected study efforts on this gap by including an evidence-based, systematic assessment of the HR Department at RNPP, including recruitment, training, performance management, retention, and cross-cultural workforce integration in a safety critical, internationally coordinated megaproject setting.

2. Literature review and Problem Statement

2.1 Theoretical Framework

This study is knowledgeable by three supplementary theories. The Human Capital Theory (Becker, 1993) postulates that an investment in the knowledge, skills as well as abilities of the employees has organizational returns in terms of increased productivity and safer performance within the organization. This, in the nuclear scene, translates to the systematic training, certification and lifelong professional development. The concept of human capital is described as a Resource-Based View (Barney, 1991) which formalizes the concept of the human capital as a valuable, rare, inimitable, and non-substitutable (VRIN) strategic resource in organizations where organizations having better human resource systems lead to sustainable competitive advantage. Safety Culture Theory (IAEA, 2016) stipulates that safety outcomes in high-reliability organizations are determined by the combination of organizational values and the leading commitment, as well as behavioral norms.

2.2 Nuclear Megaprojects HRM.

The main characteristics of megaprojects include technological complexity, longer timeframes, numerous players and high uncertainty. Flyvbjerg (2014) shows that failures of megaprojects are, more frequently than technical, based on organizational and managerial failure. The HRM should offer in nuclear power projects: (a) highly skilled, certified workforce; (b) regular training and maintenance of competence; (c) attention to safety metrics development in the performance systems; (d) retention of knowledge at the different project stages; and (e) cross-cultural, multi-national team management (IAEA, 2018; OECD-NEA, 2017).

2.3 Gap in Research and Problem Statement.

Although RNPP is a strategically important aspect, there was no systematic empirical assessment of its HR effectiveness before this research. Such issues

include: a lack of skills in specialized nuclear fields, reliance on external expertise, bureaucratic public-sector human resource policies and procedures, and inadequate institutionalized cross-cultural management systems. This paper hence poses the following question: How is the HR Department of RNPP effective regarding the core HR functions, and what should be done to improve the nuclear safety as well as operational sustainability?

3. Methodology

3.1 Research Design

It used a mixed-method convergent parallel design, which covered both quantitative surveys with qualitative interviews and document analysis. Such a design allows methodological triangulation with numerical trends being described and contextualized by qualitative knowledge (Creswell & Plano Clark, 2017).

The sample and data collection are explained as follows: 3.2 Sample and Data Collection.

Quantitative element: 300 RNPP employees (stratified random sample) were given a structured questionnaire on HR effectiveness that assessed six dimensions (recruitment, training, performance management, retention, safety culture, cross-cultural management). The instrument was highly reliable (Cronbachs 89, overall with a 76-87 per dimension). The 5-point Likert scale was utilized to respond.

Qualitative element: 15-20 key informants such as HR managers, departmental heads and safety officers and even technical supervisors were interviewed using semi-structured interviews. The duration of interviews was 45-60 minutes and thematic analysis was used to analyze these interviews.

Secondary data: Systematic examination of HR policy documents, training manuals, safety guidelines and IAEA reports.

3.3 Data Analysis

Data and statistics were considered in the form of quantitative data and analyzed with SPSS, using descriptive statistics, Pearson correlation and multiple regression. The qualitative information was coded using thematic NVivo. Conclusions have been incorporated in the interpretation process.

4. Result and Respondent Profile

Out of 300 participants, 47.3% of respondents were operational staffs, 32.0% supervisory and 20.7% management. Experience distribution: 28.0% (<3 years), 40.3% (3-6 years), 31.7% (>6 years). This guaranteed the representation at organizational levels.

Table1: Expressive Statistics of HR Efficacy Dimension

HR Component	Mean	Standerd deviation	Construal
Safety Culture	**4.57**	**0.49**	**High**
Training Effectiveness	**4.36**	**0.42**	**High**
Recruitment	**4.03**	**0.57**	**Moderate-High**
Performance Management	**3.76**	**0.61**	**Moderate-High**

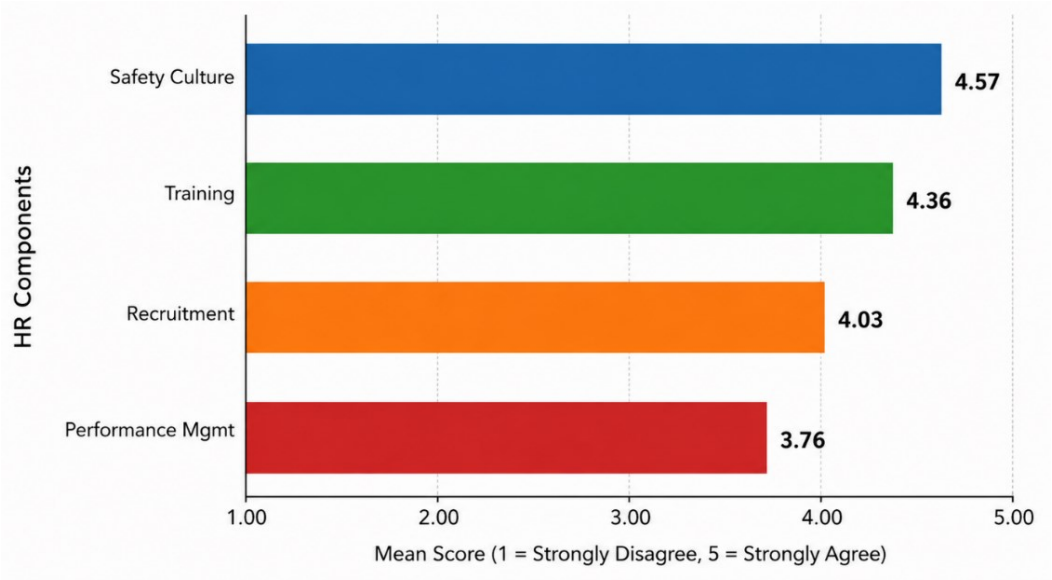

Figure: Graphical Representation of HR Efficacy Component

4.3 Training and Safety Culture

The highest ratings were obtained in safety related training (M=4.55 in terms of adequacy of safety related training). Strong safety awareness was reported (M=4.57) as well as apparent leadership commitment to safety (M=4.42). But training needs assessment had lower scores (M=3.36) which indicates reactive training planning rather than strategic training planning.

Figure: Training and Safety Culture Indicators

4.4 Performance Management and Retention

The weakest dimension was performance management (M=3.76). The interview information showed the fear of transparency when it comes to appraisal and the quality of feedback. One manager observed: "Appraisal of technical performance is generally well reflected but behavioral and safety attitudes are not always well reflected in appraisals. The scores of retention and motivation were moderate (M=3.41), the scores of management communication (M=3.38) and complaint handling (M=3.31) were lower, which means that the technical HR functions are strong, and the mechanisms of employee engagement still need to be strengthened.

4.5 Correlation Analysis

Table 2: Correlation Between Training Effectiveness and HR Effectiveness

Variables	HREI	Training Relevance	Training Impact	Safety Training
HREI	1.00	0.71	0.75	0.80
Training Relevance	0.71	1.00	0.85	0.72
Training Impact	0.75	0.85	1.00	0.74
Safety Training	0.80	0.72	0.74	1.00

$p < 0.01$ (2-tailed; HREI = HR Effectiveness Index). Safety culture was most strongly correlated with overall HR effectiveness (r=0.74), and then with training effectiveness (r=0.71). The weakest correlation was found with performance management (r=0.58), which is also in line with its lower mean score.

4.6 Hypothesis Testing

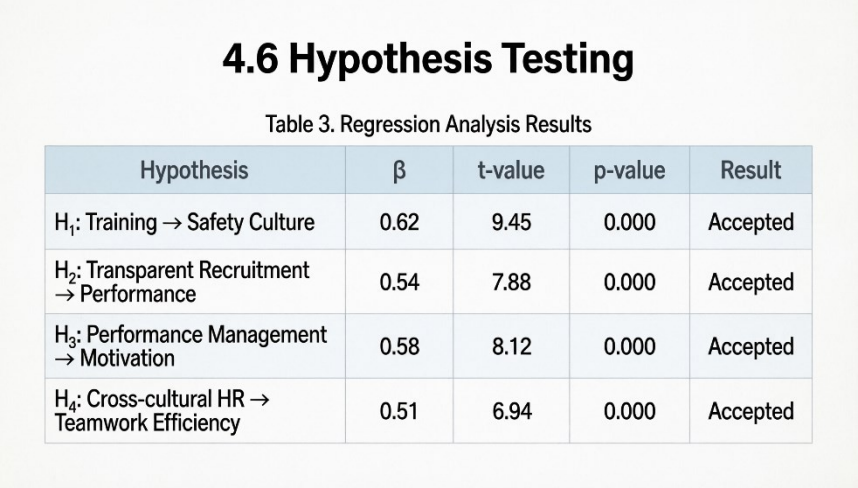

Table 3. Regression Analysis Results

All four hypotheses were accepted at $p < 0.001$, which proved the validity of the structured HR practices in influencing the safety culture, employee performance, motivation, and cross-cultural collaboration.

5. Discussion

5.1 Interpretation of Findings

The findings indicate a paradoxical profile: RNPP HR department is the strongest in such areas as operational-technical functions (safety training, certification, monitoring compliance) and more-weaker in such aspects as strategic developmental functions (performance management transparency, career development, retention, cross-cultural institutionalization).

This trend aligns with the public-sector HRM in developing countries, where cultures of compliance and bureaucratic procedures prioritize control over engagement (Zafarullah and Rahman, 2021). With nuclear megaprojects this imbalance comes along with certain risks. Global safety training but lack of equal care to motivate and retain the skilled personnel might have the result that skilled personnel will leave at the time when the competency of the skilled personnel is most in demand. Equally, performance schemes that do not focus on behavioral safety measures can unintentionally reward production over precaution.

The fact that safety culture is the strongest predictor of HR effectiveness (r=0.74) can be explained by the fact that safety culture is the central element of the formal structures of nuclear HRM (IAEA, 2016). Though, the comparatively lower performance management scores advocate that this safety orientation has not been adequately embedded in appraisal systems a gap that Reason (2016) cautions against able to erode the safety culture by sending incompatible signals about what matters to the organizations.

5.2 Cross-Cultural HR Challenges

There were qualitative results that cross-cultural management was identified to be a critical and yet under-institutionalized area. Although the technical collaboration between the Bangladeshi and the Russian staff was said to be strong, cultural differences in styles of communications, authority to make decisions and work norms created cultural barriers in coordination. According to one of the interviewees: "There has been good technical co-operation, but still administrative and cultural integration needs well-organized policy support. This supports the fact that Hofstede (2011) found that the cultural difference in power distance and uncertainty avoidance are also significant to the performance of a multinational team.

5.3: Proposed HR Effectiveness Model at RNPP.

According to the empirical evidence, it is suggested to construct a context-specific HR Effectiveness Model with six interdependent pillars:

1. Safety-Centered HR System- introducing safety measurements into every HR activity.

2. Competency Lifecycle Management – The integrated pathways are

Recruit →Train →Certify →Retain

3. Knowledge Transfer & Localization - formal system of mentoring and documentation.

4. Balanced Performance-Safety-Behavior Management - balanced scorecards with behavioral measurements.

5. Strategic Workforce Planning & Talent Pipeline - forecasting and succession planning.

6. Cross-Cultural Integration Framework - oriented structure, language support and resolution of conflict.

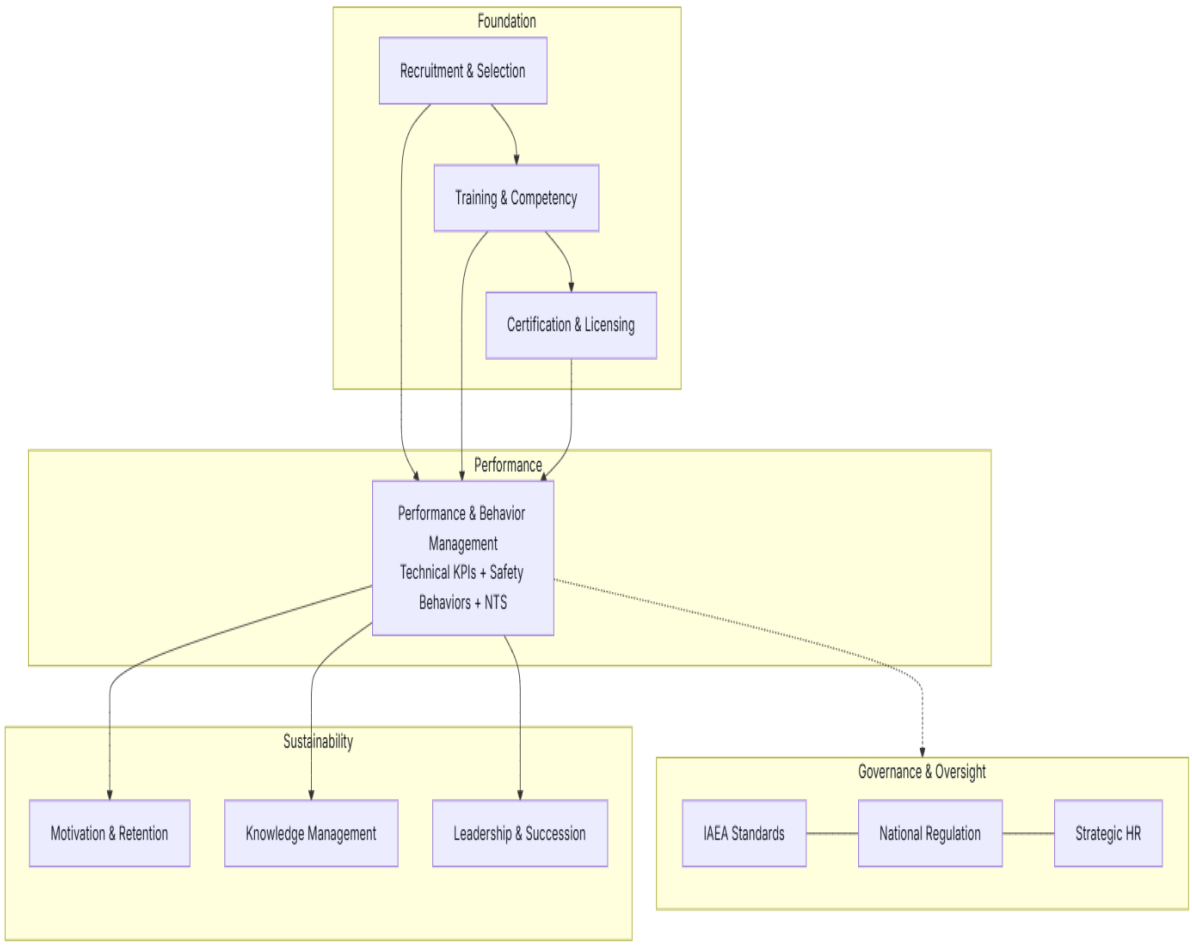

Figure 5.3: Proposed HR Effectiveness Model at RNPP.

6. Conclusion and Recommendations

6.1 Summary of Contributions

This study is the first systematic and empirical assessment of HR effectiveness in Rooppur Nuclear Power Plant Project. Key contributions are:

(a) empirical evidence that safety culture and training effectiveness are the strongest predictors of HR effectiveness in nuclear megaprojects.

(b) identification of gaps such as "transparency of performance management" and "cross-cultural institutionalization.

(c) a context specific HR effectiveness model for "newcomer" nuclear countries.

(d) methodological demonstration of mixed-methods HR evaluation in high-risk environments, such as nuclear power plants, where the public sector is the key focus.

6.2 Practical Recommendations

Medium-term (2-3 years):

1. Formally introduce training system
2. Embed behavior-based safety indicators in performance evaluation
3. Introduce training programs for cross-cultural communication
4. Digitized HR records and performance monitoring.

Long term (3–10 years):

1. National nuclear HR capacity roadmap.
2. Formalized career pathways and professional recognition.
3. Formalized knowledge management and expert mentoring system.
4. Strengthening of career pathways and professional recognition.

Policy level:

1. increase HR autonomy within public-sector context.
2. link pay and incentives of high-skill strategic sectors to public-sector regulation.
3. incorporate HR standards of IAEA into country's policy.

6.3 Limitations and Future Research

This study, although designed as a rigorous mixed-methods analysis, has several limitations which should be noted. First, the analysis is a single case (RNPP) and may not be applicable to other nuclear projects in other national or regulatory environments. Secondly, cross-sectional data reflect perceptions at a precise time, so fundamental links between HR practices and safety outcomes cannot be firmly drawn. Third, the nuclear security protocols required restrictions in access to some strategic documents (such as, detailed performance records, classified safety reports), with the possible omission of some objective indicators. Fourth, the sample, though stratified, may be under- represented of foreign experts because of language and availability problems. Fifth, there may have been a social desirability bias in the self-reported responses, especially for safety culture.

Future studies should focus on longitudinal studies following HR interventions and safety measures throughout the entire plant life cycle. Comparative studies on various nuclear projects (like Bangladesh, UAE, Belarus) would result in the identification of context-specific and universal HR effectiveness factors. Also, quantitative modelling of HR–safety–performance relationship by using objective indicators (such as incident rates, certification pass rates) would benefit causal inferences. Finally, ethnographic studies of the processes of cross-cultural transfers of knowledge could be used to improve localization practices with regards to new nuclear countries.

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SHEROBOD DARYO HAVZASI IQLIMI DAVRIY O‘ZGARUVCHANLIGINING GEOGRAFIK XUSUSIYATLARI

Annotatsiya: *Ushbu maqolada Sherobod daryo havzasi iqlimining davriy o‘zgaruvchanligi havzaviy yondashuv asosida tahlil qilinib, havzaning yuqori, o‘rta va quyi qismlaridagi iqlimiy farqlanishlar Boysun, Sherobod va Termiz gidrometeorologik stansiyalari ma’lumotlari asosida yog‘inlarning mavsumiy o‘zgarishi hamda hududga “Afg‘on shamoli”ning agroiqlimiy ta’siri ilmiy jihatdan tahlil qilindi.*

Kalit so‘zlar: *Sherobod daryosi, daryo havzasi, iqlim o‘zgaruvchanligi, havo harorati, yog‘in, yerosti suvlari, Afg‘on shamoli.*

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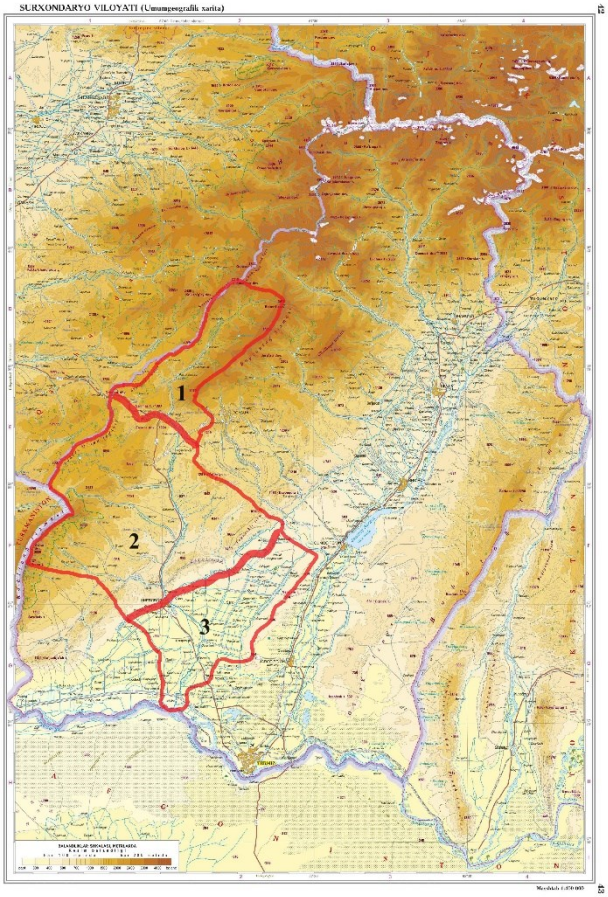
GEOGRAPHICAL FEATURES OF PERIODIC CLIMATE VARIABILITY IN THE SHERABAD RIVER BASIN

Abstract: *This article analyzes seasonal climate variability in the Sherabad River basin using a basin-wide approach. It also provides a scientific analysis of climate differences in the upper, middle, and lower parts of the basin, seasonal changes in precipitation, and the agroclimatic impact of the "Afghan wind" on the region, based on data from the Baysun, Sherabad, and Termez hydrometeorological stations.*

Keywords: *Sherabad River, river basin, climate variability, air temperature, precipitation, groundwater, Afghan wind.*

Kirish. Amudaryoga eng so‘nggi bo‘lib quyiluvchi Sherobod daryosi Surxondaryo viloyatidagi ikkinchi eng yirik daryodir. Uning uzunligi 177 km., suv to‘plash maydoni 4760 km^2 [13, 161-b. 6, 331-b.]. Daryo irmoqlari Hisor tizmasining janubi-g‘arbiy tarmoqlari hisoblangan Boysun, Chaqchar, Ko‘hitang tog‘laridan boshlanadi. Hudud shimoldan janubga uzoq masofaga cho‘zilganligi, relyef va iqlim sharoiti bir-biridan farq qilganligi uchun havzani uchta: Yuqori Sherobod, O‘rta Sherobod va Quyi Sherobod qismlariga bo‘lamiz(1-rasm).



1-rasm. 1-Yuqori Sherobod. 2-O‘rta Sherobod. 3-Quyi Sherobod

Havza hududida atigi bitta, 420 metr mutloq balandlikda Sherobod gidrometeorologik stansiyasi joylashgan. Ushbu stansiya O‘rta Sherobod hududida joylashgan bo‘lib, havzaning yuqori va quyi qismlarining iqlimiy sharoitlarini tadqiq etishda shu hududlarga yaqin bo‘lgan Termiz(310 m) va Boysun(1250 m) gidrometeorologik stansiyalari ma’lumotlaridan foydalanamiz. Termiz gidrometeorologik stansiyasi Quyi Sherobod, Boysun gidrometeorologik stansiyasi Yuqori Sherobod hududiga yaqin joylashgan, relyef va iqlim sharoitlari deyarli farq qilmaydi.

Asosiy qism. Sherobod daryo havzasi shimol va g‘arb tomondan baland tog‘lar bilan o‘ralganligi shimoldan keladigan sovuq havo massalarining havzaga o‘tishiga to‘sqinlik qiladi. Oqibatda, qishining ancha yumshoqligi bilan boshqa hududlardan ajralib turadi.

1-jadval

Meteostansiyalarida havoning o‘rtacha oylik va yillik harorati[4, 10].

Kuzatuv punkti	Davr		Oylar, °C												Yillik
			I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Boysun	1	1970 yilgacha	0,5	2,4	7,1	12,8	17,8	22,2	25,5	24,1	18,4	12,0	6,8	3,5	12,8
	2	1991-2020	2,3	3,7	8,5	13,7	18,4	23,3	25,5	24,1	19,5	13,2	7,8	4,2	13,7
Sherobod	1	1970 yilgacha	3,3	6,4	11,5	18,3	25,1	30,0	32,3	30,1	24,6	17,8	11,2	6,1	18,1
	2	1991-2020	5,9	7,9	13,4	19,6	25,4	30,4	31,6	29,5	24,9	18,7	12,0	7,3	18,9
Termiz	1	1970 yilgacha	2,1	5,8	11,4	18,2	24,5	28,3	30,7	28,7	22,8	16,1	10,1	5,0	17,0
	2	1991-2020	4,6	6,8	12,7	19,2	25,0	29,5	30,9	28,6	23,4	16,9	10,4	5,5	17,8

Havzada o‘rtacha oylik va yillik havo haroratining taqsimlanishi hududning dengiz sathidan balandligi va relyef tuzilishiga bog‘liq. Yuqori Sherobod hududi tog‘li relyef sababli barcha oylarda eng past harorat ko‘rsatkichlariga ega. Asosan adir-tog‘oldi zonasi hisoblangan O‘rta Sherobod hududining o‘rtacha yillik harorati (+18,9 °C) tekislik zonasida joylashgan Quyi Sheroboddan yuqoridir. Bunga sabab shimoldan keluvchi sovuq havo massalari va g‘arbiy shamollarning yo‘lini to‘suvchi tog‘lardir.

1-jadvaldan 1-davr va 2-davr o‘rtacha yillik havo haroratlarini solishtirsak: Boysunda +0,9 °C ga, Sherobod va Termizda +0,8 °C ga ko‘tarilgan. Demak, havzaga global iqlim o‘zgarishi ta’sir etmasdan qolmagan.

2-jadval

Turli iqlimiy davrlarda ko‘p yillik o‘rtacha oylik va o‘rtacha yillik yog‘inlar miqdori, mm. [7, 8, 9, 10]. ТАБЛИЦА ТАК ВСТАЛА

№	Davr	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yil
Termiz														
1	**1961-1990**	23,4	20,2	37,7	26,2	9,8	0,8	0,1	0,0	0,1	3,3	8,8	17,4	**147,8**
2	**1971-2000**	23,0	22,0	32,0	21,0	11,0	1,0	0,0	0,0	0,0	2,0	9,0	19,0	**140,0**
3	**1981-2010**	24,3	23,7	36,4	23,5	9,5	1,5	0,2	0,0	0,5	3,2	11,1	20,5	**154,4**
4	**1991-2020**	22,9	29,6	31,5	24,3	9,5	1,3	0,2	0,0	0,5	3,0	20,0	17,8	**160,6**
Sherobod														
1	**1961-1990**	32,3	28,4	46,4	27,6	10,2	0,8	0,5	0,0	0,1	5,4	11,3	23,7	**186,7**
2	**1971-2000**	35,0	34,0	44,0	29,0	11,0	1,0	0,0	0,0	0,0	3,0	13,0	24,0	**194,0**
3	**1981-2010**	35,7	32,3	49,2	28,8	14,2	5,2	0,2	0,6	0,3	5,1	14,5	30,3	**216,4**
4	**1991-2020**	31,8	36,1	44,0	31,5	14,7	4,9	0,2	0,6	0,3	4,5	19,5	24,9	**213,0**
Boysun														
1	**1961-1990**	61,2	58,4	96,6	87,9	44,1	4,8	4,4	1,2	1,4	15,7	25,5	53,2	**454,4**
2	**1971-2000**	66,0	67,0	109,0	93,0	50,0	8,0	2,0	2,0	1,0	11,0	31,0	54,0	**494,0**
3	**1981-2010**	56,9	65,6	89,8	68,4	45,8	13,1	5,8	1,4	2,6	14,2	30,8	55,9	**450,3**
4	**1991-2020**	56,8	73,6	91,2	76,5	54,4	13,1	4,6	0,6	2,4	14,3	42,4	49,7	**479,6**

O‘rtacha oylik havo haroratining eng yuqori ko‘tarilish sur’atlari qish oylariga to‘g‘ri keladi. Yanvar oyida o‘rtacha harorat Termizda +2,5 °C ga (+2,1 dan +4,6 °C gacha), Sherobodda +2,6 °C ga (+3,3 dan +5,9 °C gacha) va Boysunda +1,8 °C ga (0,5 dan +2,3 °C gacha) ko‘tarilgan. Dekabr va fevral oylarida ham o‘rtacha oylik havo harorati ko‘tarilgan. Oktyabr va noyabr oyida ham harorat o‘rtacha +0,3 … +1,3 °C ga ko‘tarilib, issiq davrning sovuq davr tomon siljiganlini aniqlandi. Yoz oylarida oylik o‘rtacha harorat ko‘tarilishi qish oylari singari yuqori emas. Sherobodda 2-davrda 1-davrga nisbatan (iyulda -0,7 °C, avgustda -0,6 °C) biroz pasayishi kuzatilgan.

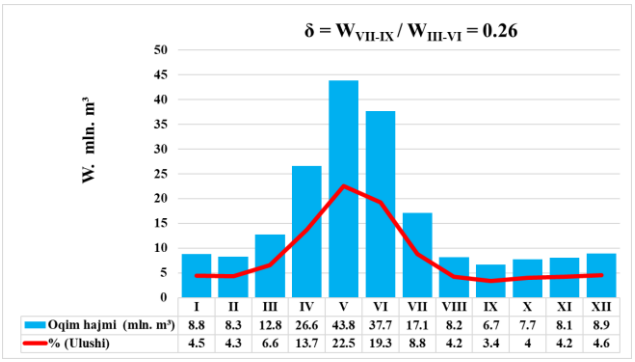
Atmosfera yog‘inlari havza quyi qismidan yuqori qismiga tomon ortib boradi. Quyi va O‘rta Sherobod hududlarida dastlabki davrlarga nisbatan oxirgi ikki davrda yog‘in miqdori ortgan(2-jadval). Biroq, Yuqori Sherobod qismida 1971-2000 yillar iqlimiy davriga eng yuqori o‘rtacha yog‘in to‘g‘ri keladi. Oxirgi ikki davrda pasayish kuzatilgan.

Oylik o‘rtacha yog‘in miqdorlarini tahlil qilsak, oxirgi ya’ni 1991-2020 yillar davrida fevral va noyabr oylarida yog‘inning ulushi sezilarli darajada ko‘payganligi yaqqol ko‘rinadi. Masalan, Termizda fevralda 20,2 mm dan 29,6 mm gacha, noyabrda 8,8 mm dan 20,0 mm (2,3 marta ko‘p) Boysunda esa fevralda 58,4 mm dan 73,6 mm gacha ortish kuzatilgan.

Mashhur gidrolog V.L.Shuls 1944-yilda O‘rta Osiyo daryolarining to‘yinish manbalariga ko‘ra tasnifini ishlab chiqqan(2-rasm). U 3 ta me’zon asosida daryolarni 4 turga ajratadi [2, 137-138 b.].

To‘yinish sharoitiga bog‘liq holda daryolarning turlari	Daryolar qaysi turga kirishini ko‘rsatuvchi mezonlar		
	$\delta = \frac{W_{VII-IX}}{W_{III-VI}}$	W_{VII-IX}, yillik oqimga nisbatan % hisobida	Suv eng ko‘p bo‘ladigan oylar
Muzlik-qor suvlaridan to‘yinadigan daryolar	1,00	>38	VII, VIII
Qor-muzlik suvlaridan to‘yinadigan daryolar	0,99÷0,26	37÷17	V, VI
Qor suvlaridan to‘yinadigan daryolar	0,25÷0,18	16÷12	IV, V
Qor-yomg‘ir suvlaridan to‘yinadigan daryolar	0,17÷0,001	11÷0	III, IV, V

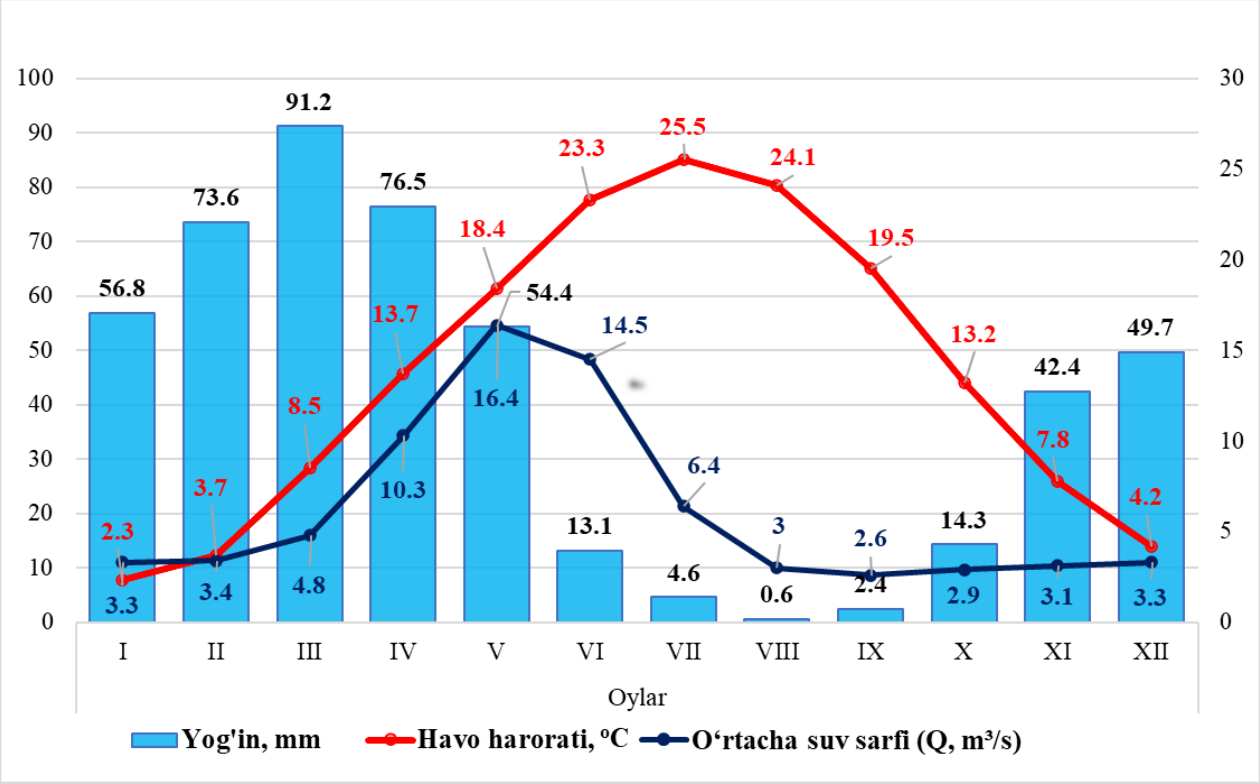
2-rasm. Daryolarning to‘yinish sharoitiga bog‘liq holda qaysi turga mansubligini belgilovchi mezonlar. (V.L.Shuls, 1944)



3-rasm. Oylik va yillik oqim hajmi. mln.m³. (Sherobod sh. kuzatuv punktida) (1914-1999 yillar) [14]

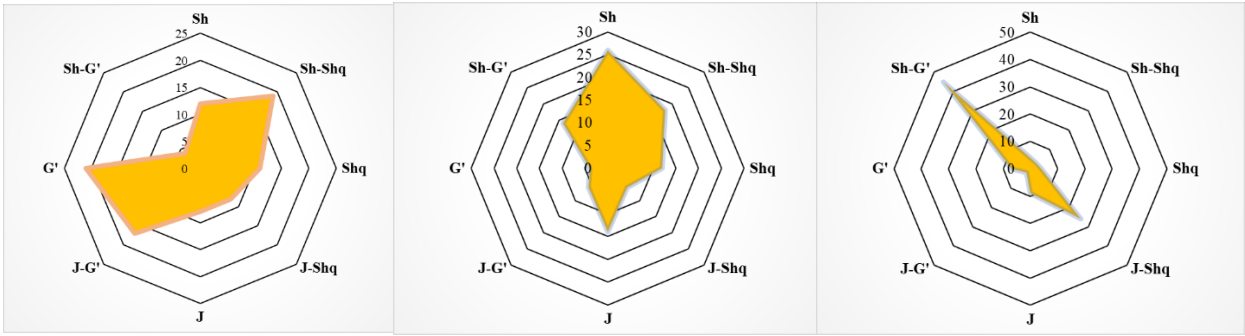
Ushbu me’zonlarga tayanib hisoblash ishlarini bajarganimizda, Sherobod daryosi birinchi va uchinchi me’zonlarda qor-muzlik suvlaridan, ikkinchi me’zonda qor suvlaridan to‘yinadigan daryolar turiga mansubligi aniqlandi. Ammo daryo havzasida doimiy muzliklar mavjud emas. Muallif Yer osti suvlaridan to‘yinuvchi kichik daryolarni hisobga olmagan holda ushbu tasnifni ishlab chiqqan. Daryo havzasida yer osti suvlaridan to‘yinuvchi juda ko‘p irmoqlar bor. Shu sababdan V.L.Shuls va R.Mashrapov Sherobod daryo suv rejimining umumiy qonuniyatlar doirasidan chetga chiqqanligi jihatidan O‘rta Osiyodagi eng ajoyib daryolardan biri deb hisoblaydi. Bu daryo rejimidagi o‘ziga xosliklarga hududdagi nuroq jinslar katta ta’sir etgan. Nuroq jinslar g‘ovak bo‘lganligi tufayli yog‘inning katta qismi shu jinslar orasiga singib, yer osti suvlarini boyitadi. Keyinchalik (qor erib bitgandan va yog‘ingarchilik davri tugagandan ancha keyin) yer osti suvlari nisbatan bir me’yorda daryo o‘zaniga qaytib chiqa boshlaydi[1, 128-b.]. Shu sababli ko‘pgina adabiyotlarda Sherobod daryosi qor-yomg‘ir va yer osti suvlaridan to‘yinuvchi daryolar turiga kiritiladi.

Havzaning asosiy suv to‘plash qismi Yuqori Sherobod hududi bo‘lib o‘rtacha yillik harorat +0,9 °C ga ko‘tarilgan bir paytda, yillik yog‘in miqdori 1971-2000 yillardagi maksimumga (494 mm) nisbatan keyingi davrda 479,6 mm gacha kamaygan. Bu xavfli tendensiya bo‘lib, tog‘li qismga global iqlim isishi o‘z ta’sirini ko‘rsatayotgani, namlik balansini buzayotganini va aridlanish chegarasi yuqoriga siljiyotganini ko‘rsatadi. Qish oylarida haroratning ko‘tarilishi yog‘inlarning qor shaklida emas, suyuq (yomg‘ir) shaklda tushishiga olib keladi. Erta bahorgi va kech kuzgi yog‘inlarning ko‘payishi havzada sel va toshqinlar xavfini oshiradi. Harorat va yog‘inning oylar kesimida o‘zgarishi yoz davomida barqaror suv bilan ta’minlovchi qor qoplamining shakllanishiga ham ta’sir etadi. Yozgi vegetatsiya davrida daryo oqimining keskin kamayishi, ayniqsa, O‘rta Sherobod hududi qishloq xo‘jaligiga jiddiy xavf tug‘diradi. Chunki, O‘rta Sherobod irrigatsiya tarmoqlari orqali qo‘shni havzalar bilan bog‘lanmagan[3, 5].



5-rasm. Boysun meteorologiya stansiyasida ko‘p yillik o‘rtacha oylik havo harorati, yog‘in miqdorining yil ichidagi taqsimoti (1991-2020 yy.) va Sherobod daryosining o‘rtacha suv sarfi. [10, 14]

Sherobod daryo havzasining janubiy tekislik qismida g‘arb va janubi-g‘arbdan “Afg‘on shamoli” esadi. O‘rta Osiyo tekislik qismiga shimoldan sovuq, zich va og‘ir bo‘lgan havo bostirib kirib, janubdagi Porapamiz tog‘laridan o‘ta olmay yuqori bosim markazini hosil qiladi. Nisbatan bosim past bo‘lgan Surxon-Vaxsh vodiysiga Afg‘oniston hududi orqali kirib keladi. Shamol Turkmaniston va Afg‘oniston hududlaridan o‘zi bilan chang-to‘zon olib keladi. Bahorda esganda qishloq xo‘jaligi ekinlarini qovjiratib yuboradi. Shuningdek, ekin maydonlariga qumli cho‘l tuproqlarini uchirib kelib, tuproqning ustki chirindiga boy qatlamini uchirib ketadi. Buning oldini olish uchun ihota daraxtzorlari barpo etilgan. “Afg‘on shamoli” davomiyligi odatda bir necha soatdan 2 kungacha, ayrim hollarda 3-4 kungacha davom etadi. Havzaning janubiy qismida yiliga o‘rtacha 16 kun esadi. Shamolning tezligi ba’zan 15-20 m/s ga yetib, qum va chang ko‘rish masofasini 100-200 m gacha qisqartiradi[11, 12]. Bu shamol Sherobod daryo havzasining tog‘lar bilan o‘ralgan o‘rta va yuqori qismlariga deyarli ta’sir etmaydi.



Termiz meteostansiyasi | Sherobod meteostansiyasi | Boysun meteostansiyasi

6-rasm. Ufq tomonlari bo‘yicha shamol yo‘nalishini o‘rtacha takroriyligi (%) (1991-2020 yillar)[10]

Termizda g‘arbiy va shimoli-sharqiy, Sherobodda shimoliy va shimoli-sharqiy shamollar ustunlik qiladi. Sherobod meteostansiyasi shamolning shimol va janub yo‘nalishida esishiga daryo vodiysining shimoldan janubga tomon cho‘zilganligi hamda mahalliy tog‘-vodiy shamoli sabab bo‘lgan.

Xulosa. Sherobod daryo havzasi iqlimining davriy o‘zgaruvchanligi havzaning balandlik mintaqalanishi, relyef bilan o‘ralganligi va atmosfera sirkulyatsiyasi xususiyatlari bilan bevosita bog‘liq. Havzaning yuqori qismi namroq va salqinroq, o‘rta va quyi qismlari esa iliq hamda quruqroq iqlim sharoitiga ega.

Tahlillar natijasida 1991-2020 yillar davrida o‘rtacha yillik havo harorati oldingi davrga nisbatan Boysun stansiyasida +0,9 °C, Sherobod va Termiz stansiyalarida +0,8 °C ga ko‘tarilganini ko‘rsatdi. Harorat ortishining eng kuchli namoyon bo‘lishi qish oylariga to‘g‘ri keladi, bu esa qor qoplamining shakllanishi, bahorgi oqim va vegetatsiya davridagi suv ta’minotiga ta’sir ko‘rsatishi mumkin.

Yog‘in miqdorining hududiy taqsimotida balandlik omili hal qiluvchi ahamiyatga ega: yog‘inlar quyi qismdan yuqori qismga tomon ortadi. Biroq 1991-2020 yillarda yog‘inlarning mavsumiy taqsimoti o‘zgarib, fevral va noyabr oylarida ularning ulushi ortgani kuzatiladi. Bu holat havzada sel, toshqin va mavsumiy suv rejimi beqarorligi xavfini kuchaytiradi.

Sherobod daryosi oqim rejimi faqat qor va yomg‘ir suvlari bilan emas, balki yerosti suvlarining barqaror qo‘shilishi bilan ham shakllanadi. Shu bois daryo rejimini baholashda havzaning litologik tuzilishi, nuragan g‘ovak jinslar va yerosti oqimi bilan bog‘liq gidrogeologik omillarni hisobga olish zarur. Janubiy tekislik qismida esa “Afg‘on shamoli” chang-to‘zon, tuproq eroziyasi va ekinlar namlik rejimiga salbiy ta’sir ko‘rsatuvchi muhim agroiqlimiy omil bo‘lib qolmoqda.

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APPLICATION AREAS OF BIG DATA

Annotation. *The article presents the main characteristics of big data, areas of their application, factors of their analysis and processing.*

Keywords and expressions: *Big data, structuring, Internet of Things (IoT), Volume, Velocity, Variety, Veracity, Variability, Value.*

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KATTA HAJMDAGI MA’LUMOTLAR (BIG DATA) NING QO‘LLANISH SOHALARI

Annotatsiya: *Katta hajmdagi ma’lumotlarning asosiy xususiyatlari, qo‘llanilish sohalari, ularni tahlil qilish va qayta ishlash omillari keltirilgan.*

Kalit so‘zlar: *katta ma’lumotlar, strukturalash, narsalar interneti (IoT), Volume, Velocity, Variety, Veracity, Variability, Value.*

Katta ma’lumotlar - bu katta hajmli strukturalangan (tuzilgan) yoki strukturalanmagan ma’lumotlar to‘plami. Ular statistika, tahlil, prognozlash va qarorlar qabul qilish uchun maxsus avtomatlashtirilgan vositalar yordamida qayta ishlanadi.

Strukturalash — bu obyektlar va ma’lumotlarning o‘zaro bog‘lanishini tasvirlash usullari haqidagi kelishuvni kiritishdir.

1-misol: Strukturalanmagan ma’lumotlar.

Shaxsiy ish № 16493; Aliev Karim Ergashevich; Tug‘ilgan sana 1 yanvar 1979 yil; Shaxsiy ish № 16498; Boqiev Dilmurod Raxmatullaevich; Tug‘ilgan sana 5 dekabr 1985 yil; Shaxsiy ish №16595; Zokirov Anvar Rashidovich; Tug‘ilgan sana 15 may 1984 yil.

2-мисол: Структураланган маълумотлар.

Шахсий иш №	Фамилияси	Исми	Отасининг исми	Туғилган сана
16493	Алиев	Карим	Эргашевич	01.01.79
16498	Бокиев	Дилмурод	Рахматуллаевич	05.12..85
16595	Зокиров	Анвар	Рашидович	15.05.84

“Katta ma’lumotlar” atamasini Nature jurnalining muharriri Klifford Linch jurnalning 2008 yildagi maxsus sonida tavsiya etgan. U butun dunyo bo‘ylab axborot hajmining keskin o‘sishi haqida gapirib, katta ma’lumotlarni kuniga 150 Gb dan oshadigan har qanday heterojen ma’lumotlar to‘plami sifatida ta’rifladi, ammo yagona ta’rif hali ham mavjud emas.

2011-yilgacha katta ma’lumotlarni tahlil qilish bilan faqat ilmiy va statistik tadqiqotlar doirasida shug‘ullanilgan. Ammo 2012-yilda ma’lumot hajmlari ulkan darajaga yetdi va ularni tizimlash va amaliy qo‘llash ehtiyoji paydo bo‘ldi.

2014-yildan boshlab yetakchi jahon universitetlari Big Data ga diqqatini qaratdi, u yerda amaliy muhandislik va IT-mutaxassisliklar bo‘yicha tahsil beriladi. Keyin esa ma’lumotlarni yig‘ish va tahlil qilishga Microsoft, IBM, Oracle, EMC kabi, so‘ngra Google, Apple, Facebook (2022-yil 21-martdan boshlab Meta ga tegishli ijtimoiy tarmoq Rossiyada sud qarori bilan taqiqlandi) va Amazon kabi IT-korporatsiyalar qo‘shildi. Bugungi kunda katta ma’lumotlardan barcha sohalardagi yirik kompaniyalar, shuningdek, davlat organlari ham foydalanmoqda.

Meta Group kompaniyasi Big Dataning asosiy xususiyatlarini taklif qildi [1]:

Volume (Hajmi) - ma’lumotlar hajmi [2]: kuniga 150 GB dan;

Velocity (Tezlik) - ma’lumotlar massivlarini to‘plash va qayta ishlash tezligi [2]. Katta ma’lumotlar muntazam ravishda yangilanadi, bu ularni onlayn qayta ishlash uchun intellektual texnologiyalarni talab qiladi;

Variety (Turli) - ma’lumotlar turlarining xilma-xilligi [2]. Ma’lumotlar tuzilgan, tuzilmagan yoki qisman tuzilgan bo‘lishi mumkin. Misol uchun, ijtimoiy tarmoqlarda ma’lumotlar oqimi tuzilmagan: u matnli xabarlar, fotosuratlar yoki videolarni o‘z ichiga olishi mumkin.

Bugungi kunda ushbu uchta xususiyatga yana uchta xususiyat qo‘shildi:

Veracity (Haqiqiylik) – ma’lumotlar to‘plamining o‘zi ham, uni tahlil qilish natijalarining ishonchliligi;

- Variability (O‘zgaruvchanlik) - o‘zgaruvchanlik. Ma’lumotlar oqimlari mavsumiy yoki ijtimoiy hodisalar ta’sirida cho‘qqilar va pastliklarga ega. Ma’lumotlar oqimi qanchalik beqaror va o‘zgaruvchan bo‘lsa, uni tahlil qilish shunchalik qiyin bo‘ladi;

- Value (Qiymat) - uning qiymati yoki ahamiyati. Har qanday ma’lumot singari, katta ma’lumotlar tushunish va tahlil qilish uchun oddiy yoki murakkab bo‘lishi mumkin. Oddiy ma’lumotlarga misol sifatida ijtimoiy tarmoqlardagi xabarlar, murakkab ma’lumotlarga esa bank operatsiyalari kiradi.

Katta ma’lumotlar barcha tegishli omillarni tahlil qilish va to‘g‘ri qaror qabul qilish uchun zarurdir. Katta ma’lumotlar yechimlar, g‘oyalar va mahsulotlarni sinab ko‘rish uchun simulyatsiya modellarini yaratish uchun ishlatiladi.

Katta ma’lumotlarning asosiy manbalari:

- Narsalar interneti (IoT) - Internet of Tings va ulangan qurilmalar;
- ijtimoiy tarmoqlar, bloglar va ommaviy axborot vositalari;
- kompaniya ma’lumotlari: tranzaksiyalar, tovarlar va xizmatlarga buyurtmalar, taksi va avtoulovlarni taqsimlash sayohatlari, mijozlar profili;
- asboblar ko‘rsatkichlari: ob-havo stansiyalari, havo va suv tarkibini o‘lchagichlar, sun’iy yo‘ldosh ma’lumotlari;
- shahar va davlat statistikasi: harakat, tug‘ilish va o‘lim haqidagi ma’lumotlar;
- tibbiy ma’lumotlar: testlar, kasalliklar va diagnostika tasvirlari.

2007 yildan beri Federal qidiruv byurosi va Markaziy razvedka boshqarmasi ijtimoiy tarmoqlarning barcha foydalanuvchilari, shuningdek, Microsoft, Google, Apple va Yahoo xizmatlari, hattoki telefon qo‘ng‘irog‘i yozuvlari haqidagi shaxsiy ma’lumotlarni to‘playdigan eng ilg‘or xizmatlardan biri bo‘lgan AQSh hukumati dasturi - PRISM dan foydalanish imkoniyatiga ega.

Katta hajmdagi ma’lumotlarni onlayn qayta ishlash uchun superkompyuterlar qo‘llaniladi: ularning quvvati va hisoblash imkoniyatlari an’anaviylardan bir necha baravar yuqori.

Sun’iy intellekt va neyron tarmoqlar katta ma’lumotlarga, jumladan matn va tasvirni aniqlashga asoslangan modellarni yaratish uchun ishlatiladi. Masalan, lotereya operatori “Stoloto” Big Datani Data-Driven Organization strategiyasining asosiga aylantirdi.

Allaqachon Big Datadan foydalanayotgan sohalar quyidagilar:

Davlat boshqaruvi. Katta ma’lumotlarni o‘rganish va tahlil qilish hukumatlarga sog‘liqni saqlash, bandlik, iqtisodiyotni tartibga solish, jinoyatlarning oldini olish, xavfsizlik va favqulodda vaziyatlarda javob berish kabi sohalarda qarorlar qabul qilishda yordam beradi.

Sanoat. Big Data vositalarini tatbiq etish sanoat jarayonlarining shaffofligini oshirishga va mahsulotga bo‘lgan talabni aniqroq prognozlash va shunga mos ravishda resurslarni rejalashtirish imkonini beruvchi “bashoratli ishlab chiqarish”ni amalga oshirishga yordam beradi.

Meditsina. Tibbiyot muassasalari va turli elektron qurilmalar (fitness-trekerlar va boshqalar) tomonidan to‘plangan katta hajmdagi ma’lumotlar sog‘liqni saqlash sanoati uchun tubdan yangi imkoniyatlar ochadi. Katta ma’lumotlar yangi dori-darmonlarni topishga, aniqroq tashxis qo‘yishga, samarali davolash usullarini tanlashga va pandemiyaga qarshi kurashishga yordam beradi.

Chakana savdo. Onlayn va elektron tijoratning rivojlanishini katta ma’lumotlarga asoslangan yechimlarsiz tasavvur qilib bo‘lmaydi — do‘konlar o‘z assortimenti va yetkazib berishlarini shunday shaxsiylashtiradi.

Narsalar interneti. Katta ma’lumotlar va narsalar interneti bir-biri bilan chambarchas bog‘liq. Narsalar Internetiga ulangan sanoat va maishiy texnika katta hajmdagi ma’lumotlarni to‘playdi, keyinchalik ularning ishlashini tartibga solish uchun tahlil qilinadi.

Ko‘chmas mulk bozori. Ishlab chiquvchilar katta ma’lumotlar texnologiyalaridan ko‘p ma’lumotlarni to‘plash va tahlil qilish uchun foydalanadilar, so‘ngra foydalanuvchilarga eng jozibali variantlarni taqdim etadilar. Bo‘lajak xaridor allaqachon o‘ziga yoqqan uyni sotuvchisiz ko‘rishi mumkin.

Sport. Futbol klublari eng istiqbolli o‘yinchilarni tanlash va har bir raqib uchun samarali strategiya ishlab chiqish uchun katta ma’lumotlardan foydalanadi.

Qishloq xo'jaligi. Qishloq xo‘jaligi uchun IoT yechimi dalalarda o‘rnatilgan ixtisoslashgan ob-havo stansiyalarini o‘z ichiga oladi, sensorlar yordamida ma’lumotlarni (harorat, namlik) yig‘adi va uni GSM radio modullari orqali IoT platformasiga uzatadi. Platforma sensorlardan to‘plangan ma’lumotlarni katta ma’lumotlar algoritmlari yordamida qayta ishlaydi va yuqori aniqlikdagi soatlik ob-havo prognozini yaratadi. “Aqlli kombaynlar” va geologik dronlar raqamlashtirish iqtisodiyotining mahsulidir.

Qo‘shma Shtatlar va Xitoy ma’lumotlar hajmi va investitsiyalar bo‘yicha jahon yetakchilari bo‘lib qolmoqda. Qo‘shma Shtatlarda hukumat ma’lumotlari va SI dasturlari NSF, DARPA va NIH agentliklari orqali amalga oshiriladi.

Xitoyda shaxsiy ma’lumotlarni himoya qilish to‘g‘risidagi qonun (PIPL) va “Ma’lumotlar xavfsizligi to‘g‘risida”gi qonun kuchga kirganidan keyin ma’lumotlar nazorati kuchaydi. Katta hajmdagi foydalanuvchi ma’lumotlari mamlakat ichida to‘plangan va davlat uchun strategik resursga aylanmoqda.

Shuni ta’kidlash lozimki, Internetda katta hajmdagi ma’lumotlar bilan ishlashning afzalliklari bo’lsada, ular Internetda juda katta hisoblash quvvatini talab qiladi. Bu resurslar juda qimmat va hozirda faqat yirik korporatsiyalar uchun mavjud.

Foydalanilgan adabiyotlar

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ARTISTIC MASTERY IN THE TRANSLATION OF TWENTIETH-CENTURY UZBEK SHORT STORIES AND NOVELLAS: A STYLISTIC AND FUNCTIONAL ANALYSIS

Abstract. *This article analyzes artistic mastery in the translation of 20th-century Uzbek short stories and novellas. It highlights the importance of preserving national color, imagery, and authorial style in translation. The creative approach and linguistic competence of the translator are also examined.*

Key words: *translation, artistic mastery, short story, novella, national color, imagery.*

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YIGIRMANCHI ASR O‘ZBEK HIKOYA VA NOVELLALARI TARJIMASINDAGI BADDIY MAHORAT: TILISTIK-FUNKSIONAL TAHLIL

Annotatsiya. *Ushbu maqolada XX asr o‘zbek hikoya va qissalarining tarjimasida badiiy mahorat masalasi tahlil qilinadi. Tarjima jarayonida milliy kolorit, obrazlilik va muallif uslubini saqlashning ahamiyati yoritiladi. Shuningdek, tarjimonning ijodiy yondashuvi va lingvistik bilimlari badiiy asar sifatiga ta’siri o‘rganiladi.*

Kalit so‘zlar: *tarjima, badiiy mahorat, hikoya, qissa, milliy kolorit, obrazlilik.*

Introduction

The 20th century is of particular importance as a period of national thought, national spirit and artistic aesthetic views reaching a new level. In particular, works created in the genres of stories and short stories are notable for their deep and impressive expression of the human psyche, social changes in society, national values and spiritual searches. During this period, writers such as Abdulla Qahhor, Said Ahmad, Otkir Hoshimov, Togay Murod, Shukur Kholmirzayev made a great contribution to the development of Uzbek prose and expanded the artistic possibilities of national literature. Their stories and short stories were read with interest not only by Uzbek readers, but also by representatives of other nations. Therefore, the issue of translating these works into foreign languages has become one of the current directions of literary criticism and translation studies. Translation is not simply transferring a text from one language to another, but a complex

creative process that conveys the spirit, mentality, and national color of the people to representatives of other cultures. Especially in literary translation, preserving the aesthetic impact of the work, the system of images, the author's style and national identity requires great skill from the translator. In the process of translating 20th-century Uzbek stories and tales, translators tried to accurately express not only the grammatical features of the language, but also folk expressions, national values, traditions and spiritual experiences. Because the value of a work of art is manifested not only in its content, but also in the method of depiction, imagery and emotional impact.[1; 256]

In 20th-century Uzbek prose, such universal ideas as human relations and society, ordinary folk life, the rural environment, kindness, loyalty and conscience occupy a leading place. These aspects require a special approach in the translation process. For example, it is often difficult to accurately transfer folk laughter, irony or images characteristic of the national mentality into another language. In such a case, the translator must create an understandable and natural expression for the reader, while preserving the artistic spirit of the work. This depends not only on the translator's knowledge of the language, but also on his literary taste, cultural level and creative thinking.

In today's era of globalization, one of the important tasks is to bring examples of national literature to the world reader. From this point of view, studying translations of 20th-century Uzbek stories and tales and analyzing the issue of artistic skill in them is of great scientific importance for the development of translation studies. Through this topic, it will be possible to determine the extent to which imagery, stylistic means, national color and the author's individual style have been preserved in translation. Such studies also serve as a source of theoretical and practical experience for future translators.

Literature analysis and research methodology

The issue of artistic skill in the translation of 20th-century Uzbek stories and tales has been studied by many literary critics and translation scholars. In the study of this topic, scientific sources related to the theory of literary translation serve as an important methodological basis. In particular, in the work of translation scholar Gaybulla Salomov “Introduction to the Theory of Translation”, the theoretical principles of literary translation, the issues of preserving national color and recreating the author’s style are widely covered. The scientist emphasizes that the task of the translator is to convey not only the content, but also the aesthetic spirit of the work to the reader. In particular, his views on the importance of preserving folk expressions and national mentality in translation are of great importance for this study.[5; 276]

Also, in the scientific research of Ninel Vladimirova, the issue of the expression of imagery and stylistic means in literary translation is analyzed. She notes that the adequate provision of metaphors, phraseological units and figurative means in translation is one of the main factors determining the artistic value of the

work. These views serve as a theoretical basis for the study of translations of Uzbek prose of the 20th century. [6; 298]

In the study of the artistic features of Uzbek prose, scientific articles and studies by Ozod Sharafiddinov occupy a special place. In his research, the scientist deeply analyzes the folk spirit, simple and expressive style, and mastery of spiritual imagery in the works of Abdulla Qahhor, O'tkir Hoshimov, and Said Ahmad. This helps to understand the complex aspects encountered in the translation of these works. In particular, recreating the individual style of writers in another language is considered one of the greatest tasks for a translator. In addition, studies conducted on the stories of Abdulla Qahhor emphasize his skillful use of short and concise style, irony, and satirical spirit. Researchers note that it is precisely these stylistic aspects that often create difficulties in translating Qahhor's works. Similarly, the national spirit, sincere dialogues, and spiritual experiences in the stories of O'tkir Hoshimov are shown as factors requiring deep skill in translation.[4; 420]

In world translation studies, the scientific views of Vinay Darbelnet and Eugene Nida are an important source. Eugene Nida, in his work “Toward a Science of Translating”, developed the theory of formal and dynamic equivalence, justifying the need to maintain the power of influence on the reader in translation. This theory is also used as one of the effective methodological approaches in evaluating translations of Uzbek literary prose.

Thus, the analysis of existing scientific sources shows that the issue of artistic skill in the translation of 20th-century Uzbek stories and tales is closely related to ensuring the harmony of language, style, imagery and national color. These scientific views form the theoretical basis of the study and allow for a deeper understanding of the artistic principles in the translation process.

Analysis and results

The analysis of culture-specific lexical items (CSLIs) revealed a pronounced tendency toward semantic substitution in the English translations. Of the 418 CSLIs coded across the corpus, 54% were rendered by target-language functional equivalents, 21% were translated by superordinates (hyperonyms), 14% were borrowed with explanatory glosses (loan translations or transliterations with footnotes), and 11% were omitted without compensation. This distribution differs markedly from the Russian translations, in which borrowing and partial adaptation were substantially more frequent (39%), reflecting the historically closer cultural proximity between Uzbek and Russian in the Soviet context.[2; 184]

The consequences of hyperonymic substitution were most pronounced in the domain of kinship terminology. Uzbek distinguishes between, for example, aka (elder brother, with connotations of social authority and deference in address) and aka-uka (fraternal solidarity, used as a social compact rather than a biological descriptor). English translations consistently rendered both as 'brother', effacing the social and pragmatic distinctions that are central to the ethical texture of Qahhor's satire. A representative passage from Qahhor's story 'Bemor' ('The Patient') illustrates the point:

Source (Qahhor): "Sening akang emas, tovarishim — bu yerda hamma barobar." [lit. Your 'elder-brother-figure' is not applicable here, comrade — here everyone is equal.]

Translation: "Your brother has no say here, comrade — we are all equal."

The translation neutralises the ironic collision between the traditional hierarchy encoded in aka and the Soviet egalitarian ideology encoded in tovarish (comrade). The English 'brother' lacks the hierarchical loading of aka, with the result that the satirical bite of Qahhor's juxtaposition is significantly reduced. This finding was consistent across all four Qahhor texts: the pattern of hyperonymic substitution in kinship and address terms correlated with lower aesthetic impression scores from the bilingual reviewers (M = 2.4/5 for affected passages vs. M = 3.8/5 for passages where semantic fidelity was maintained).[2; 184]

Figurative language presented a more complex picture. Proverbs and set-phrase idioms were handled more adeptly than metaphorical innovations. Of the 127 proverbs and idioms coded, 61% were rendered by established English equivalents with comparable pragmatic force, while only 29% were translated literally (with or without gloss). Fourteen passages showed innovative functional equivalents that, in the reviewers' assessment, achieved comparable aesthetic effect despite formal difference. By contrast, original metaphors—particularly those drawing on steppe landscape imagery or Sufi semantic fields—were handled with considerably less consistency, with 43% of such instances resulting in attenuated or omitted figurative content.

The pragmatic dimension of literary translation—encompassing irony, implicature, and register—proved to be the domain in which the widest variation in translatorial mastery was observed. Three broad strategies were identified: overt compensation (where pragmatic meaning lost in one passage is recouped in an adjacent passage), local naturalisation (where the translator produces a target-language pragmatic equivalent at the cost of cultural specificity), and loss without compensation.

Irony is a structuring principle of Qahhor's mature prose and a pervasive device in Said Ahmad's social satire. In the source texts, irony is frequently signalled through a distinctive combination of formal register markers (high-style lexis) with referentially deflating predicates—a technique that exploits the reader's awareness of Soviet official discourse as an immediately recognisable register of inflated formality. The English translations showed a statistically significant tendency to normalise this register clash, rendering Soviet bureaucratic formulae in neutral contemporary English. The effect is that the irony becomes explicit—the text announces its satirical intent—rather than implicit, which Qahhor and Said Ahmad's irony depends upon the reader performing the interpretive work of recognition.[7; 340]

Politeness encoding in Uzbek involves a complex system of honorific-address particles, verb-form selection (the 'siz/sen' distinction paralleling the French 'vous/tu'), and title use that carries substantial pragmatic freight in narratives of

social conflict and class dynamics. English lacks a grammaticalized second-person singular/plural politeness distinction, and all translators in the corpus relied on compensatory strategies of varying effectiveness: lexical intensification ('sir', 'respected colleague'), syntactic circumlocution, or simple omission. The most artistically successful passages were those in which translators found ways to foreground the politeness conflict through dialogue rhythm and speech-act sequencing rather than through lexical marking alone.

A noteworthy finding in this subsection concerns the treatment of Soviet institutional language. Said Ahmad's novellas are saturated with the formulaic language of Soviet bureaucracy—commission reports, collective-farm announcements, official proclamations—which he consistently subverts for ironic effect. The English translations in the corpus were produced in the 1980s and 1990s, a period when this register was still culturally legible to Western readers from Cold War discourse. More recent readers, the bilingual reviewers noted, are likely to find the institutional language merely archaic rather than ironically charged, suggesting that time-anchored cultural pragmatics create a secondary translation problem that the original translations could not have anticipated.

The three authors in the corpus exhibit markedly different idiolects, and the analysis assessed how effectively each idiolect was reconstituted in translation. Qahhor's voice is characterised by lexical precision, syntactic concision, and a compositional discipline that enforces maximum meaning per sentence—a style that his critics have described as 'carved prose' (Karimov, 2003, p. 47). The English translations of Qahhor showed consistent expansion: mean sentence length in the target texts exceeded that of the source texts by 22% (measured in syllable-normalised word count equivalents). This amplification was rarely compensatory; rather, it reflected the translators' tendency to explicate rather than preserve the tight implication chains that give Qahhor's prose its density.[5; 276]

Conclusion

The results of the study of the issue of artistic skill in the translation of Uzbek stories and tales of the 20th century show that the translation process is not a simple linguistic activity, but a complex creative-aesthetic process in which language, culture and artistic thinking are combined. The works created in prose of this period are distinguished by their national spirit, folk expression and deep psychologism. Therefore, when translating them into another language, it is important not only to convey the content, but also to preserve the artistic impact of the work.

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LINGUO-PRAGMATIC FEATURES OF FORMS OF ADDRESS IN THE KOREAN LANGUAGE AND THEIR SOCIOLINGUISTIC INTERPRETATION

Abstract. *This article examines the linguo-pragmatic features of forms of address in the Korean language, their sociolinguistic nature, and their functional role in speech communication. Forms of address are interpreted as linguistic means whose choice is determined by social relations between the speaker and the addressee, the degree of psychological closeness, age, status, level of respect, and a specific communicative situation. The article discusses nominal, verbal, and affixal forms of address. In addition, based on Korean language material, it highlights Brown and Gilman's theory of power and solidarity, Brown and Ford's model of address based on names and titles, as well as the socio-psychological factors identified by Friedrich that influence the choice of forms of address. Through examples such as –씨, –님, 선생님, 교수님, 언니, 오빠, 형, 누나, the article demonstrates the close relationship between forms of address and social status, respect, degree of closeness, and speech etiquette.*

Keywords: *forms of address, Korean language, 호칭어, 존댓말, sociolinguistics, linguo-pragmatics, speech etiquette, category of respect, social status, communicative situation.*

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KOREYS TILIDA MUROJAAT BIRLIKLARINING LINGVOPRAGMATIK XUSUSIYATLARI VA SOTSIOLINGVISTIK TALQINI

Annotatsiya. *Ushbu maqolada koreys tilidagi murojaat birliklarining lingvopragmatik xususiyatlari, ularning sotsiolingvistik tabiati hamda nutqiy muloqotdagi funksional roli tahlil qilinadi. Tadqiqotda murojaat birliklari so'zlovchi va tinglovchi o'rtasidagi ijtimoiy munosabat, psixologik yaqinlik, yosh, mavqe, hurmat darajasi va kommunikativ vaziyat bilan bog'liq holda shakllanadigan til birliklari sifatida talqin etiladi. Maqolada murojaat birliklarining ot shaklidagi, fe'l shaklidagi va qo'shimchalar orqali ifodalanuvchi*

turlari ko‘rib chiqiladi. Shuningdek, Brown va Gilman tomonidan ilgari surilgan hokimiyat va solidaritet nazariyasi, Brown va Fordning ism hamda unvon asosidagi murojaat modeli, Friedrichning murojaatga ta’sir qiluvchi ijtimoiy-psixologik omillari koreys tili materiallari bilan bog‘liq holda yoritiladi. Koreys tilidagi –씨, –님, 선생님, 교수님, 언니, 오빠, 형, 누나 kabi birliklar orqali murojaatning ijtimoiy maqom, hurmat, yaqinlik va nutq etiketi bilan uzviy bog‘liqligi ko‘rsatib beriladi.

Kalit so‘zlar: *murojaat birliklari, koreys tili, 호칭어, 존댓말, sotsiolingvistika, lingvopragmatika, nutq etiketi, hurmat kategoriyasi, ijtimoiy mavqe, kommunikativ vaziyat.*

Kirish

Til insonlar o‘rtasidagi muloqot vositasi bo‘lish bilan birga, jamiyatdagi ijtimoiy munosabatlar, madaniy qadriyatlar va kommunikativ me’yorlarni ham aks ettiradi. Ayniqsa, suhbatdoshga qanday murojaat qilinishi har bir til jamoasining ijtimoiy tuzilishi va nutq madaniyati haqida muhim ma’lumot beradi. Murojaat birliklari orqali so‘zlovchi tinglovchining yoshi, ijtimoiy mavqei, kasbi, jinsiy mansubligi, yaqinlik darajasi, rasmiy yoki norasmiy munosabatini hisobga oladi. Shu sababli murojaat shakllari tilshunoslikda nafaqat leksik yoki grammatik birlik sifatida, balki sotsiolingvistik va pragmatik hodisa sifatida ham o‘rganiladi.

Koreys tili murojaat birliklari tizimi jihatidan o‘ziga xos tillardan biri hisoblanadi. Koreys jamiyatida yosh, ijtimoiy maqom, kasbiy lavozim, qarindoshlik munosabati va suhbatdoshlar o‘rtasidagi masofa nutq shaklini belgilovchi muhim omillardir. Shu bois koreys tilida murojaat birliklari ko‘pincha hurmat kategoriyasi, nutq darajalari va ijtimoiy etik me’yorlar bilan bog‘liq holda namoyon bo‘ladi. Masalan, oddiy ism bilan murojaat qilish, ismga –씨 qo‘shimchasini qo‘shish, kasbiy unvon bilan chaqirish yoki qarindoshlik terminlarini ishlatish turli kommunikativ ma’no va munosabatlarni yuzaga chiqaradi.

Mazkur maqolaning maqsadi koreys tilidagi murojaat birliklarining lingvopragmatik xususiyatlarini tahlil qilish, ularni sotsiolingvistik mezonlar asosida izohlash hamda murojaat shakllarining nutqiy muloqotdagi vazifasini yoritishdan iborat. Tadqiqotda murojaat birliklari ijtimoiy mavqe, hokimiyat, yaqinlik, solidaritet, hurmat va kontekst kabi mezonlar asosida tahlil qilinadi.

Murojaat birliklari tushunchasi va ularning lingvistik tabiati

Murojaat birliklari so‘zlovchining tinglovchiga bevosita yoki bilvosita murojaat qilishda ishlatadigan til vositalari tizimidir. Ular ism, familiya, unvon, qarindoshlik termini, ikkinchi shaxs olmoshi, hurmat qo‘shimchasi, kasbiy nom yoki boshqa leksik-grammatik shakllar orqali ifodalanishi mumkin. Murojaat birliklarining asosiy vazifasi suhbatdoshni nomlash bo‘lsa-da, ular faqat nominativ vazifa bilan cheklanmaydi. Bunday birliklar so‘zlovchining tinglovchiga bo‘lgan munosabati, hurmat darajasi, ijtimoiy masofasi va psixologik yaqinligini ham bildiradi.

Murojaat birliklari ko‘p funksiyali xarakterga ega. Bir birlik muayyan vaziyatda oddiy murojaat shakli bo‘lib xizmat qilsa, boshqa vaziyatda chaqiriq, hurmat, kinoya, yaqinlik yoki rasmiylik ma’nolarini ifodalashi mumkin. Masalan, koreys tilidagi 선생님 so‘zi bevosita “o‘qituvchi” ma’nosini bildiradi, biroq kundalik nutqda u shifokor, yozuvchi, mutaxassis yoki hurmat qilinayotgan shaxsga nisbatan ham qo‘llanishi mumkin. Demak, murojaat birliklarining ma’nosi doimo kontekst bilan bog‘liq holda aniqlanadi.

Murojaat birliklari bilan ko‘rsatish birliklari o‘rtasida ham farq mavjud. Murojaat birliklari suhbatdoshga bevosita qaratilgan bo‘ladi, ko‘rsatish birliklari esa suhbatda ishtirok etmayotgan uchinchi shaxs yoki obyektni ifodalash uchun ishlatiladi. Shuningdek, chaqiriq birliklari ham murojaat birliklariga yaqin bo‘lsa-da, ular asosan suhbatdoshning e’tiborini jalb qilish uchun ishlatiladi. Masalan, koreys tilidagi 저기요, 여보세요 kabi shakllar ko‘pincha chaqiriq vazifasini bajaradi, –씨, –님, 선생님 kabi birliklar esa murojaat shakli sifatida namoyon bo‘ladi.

Murojaat birliklarining tasniflanishi

Tilshunoslikda murojaat birliklari turli mezonlar asosida tasnif qilinadi. Ularning eng asosiy turlaridan biri ot shaklidagi murojaat birliklaridir. Bu guruhga shaxs ismlari, familiyalar, kasbiy unvonlar, lavozim nomlari va qarindoshlik terminlari kiradi. Koreys tilida 민수 씨, 김 선생님, 박 교수님, 어머니, 아버지, 언니, 오빠, 형, 누나 kabi birliklar ot shaklidagi murojaat vositalari hisoblanadi. Bunday birliklar suhbatdoshning ijtimoiy o‘rni, yoshi va munosabat darajasini ko‘rsatadi.

Ikkinchi tur fe’l shaklidagi murojaat birliklari bilan bog‘liq. Koreys tilida murojaat faqat leksik birliklar orqali emas, balki fe’l shakllari va gap oxiri qo‘shimchalari orqali ham ifodalanadi. Masalan, 가요, 갑니다, 가세요, 가십시오 kabi shakllar tinglovchiga nisbatan turli darajadagi hurmatni bildiradi. Bu jihat koreys tilini ko‘plab boshqa tillardan farqlantiradi. Chunki koreys tilida tinglovchiga hurmat ko‘pincha grammatik shakllar orqali ham ifodalanadi.

Uchinchi tur qo‘shimchalar orqali hosil bo‘ladigan murojaat birliklaridir. Koreys tilidagi –씨 va –님 qo‘shimchalari shular jumlasidandir. –씨 odatda neytral hurmatni bildiradi va ism yoki familiyaga qo‘shilib keladi. Masalan, 민수 씨, 지영 씨 kabi shakllar rasmiy yoki yarim rasmiy muloqotda ishlatiladi. –님 esa yuqoriroq hurmat ma’nosini bildiradi. Masalan, 선생님, 교수님, 사장님, 고객님 kabi birliklarda –님 tinglovchining maqomini ko‘tarib ko‘rsatadi.

Bundan tashqari, koreys tilida qarindoshlik terminlari ham murojaat birliklari sifatida faol ishlatiladi. 언니, 오빠, 형, 누나 kabi birliklar aslida qarindoshlikni bildirsa-da, real nutqda qarindosh bo‘lmagan shaxslarga nisbatan ham qo‘llanadi. Bu holat koreys tilida murojaat birliklarining ijtimoiy yaqinlik va madaniy munosabat bilan chambarchas bog‘liqligini ko‘rsatadi.

Koreys tilida murojaat birliklari va hurmat kategoriyasi

Koreys tilidagi murojaat tizimini hurmat kategoriyasidan ajratib o‘rganish qiyin. Chunki koreys tilida suhbatdoshga nisbatan hurmat nafaqat so‘z tanlovi, balki grammatik shakl, gap oxiri qo‘shimchasi va nutq uslubi orqali ham ifodalanadi. 존댓말 tizimi koreys muloqot madaniyatining muhim qismi hisoblanadi. Bu tizim orqali so‘zlovchi tinglovchining yoshi, ijtimoiy mavqei va suhbatdagi rolini hisobga oladi.

Masalan, o‘qituvchiga 선생님 deb murojaat qilish oddiy kasbiy nomlash emas, balki hurmat ifodasidir. Xuddi shuningdek, 교수님, 사장님, 의사 선생님 kabi birliklarda ham kasbiy maqom va hurmat ma’nosi birgalikda namoyon bo‘ladi. Agar so‘zlovchi tinglovchiga nisbatan noto‘g‘ri murojaat shaklini tanlasa, bu muloqotda noqulaylik, hurmatsizlik yoki ijtimoiy masofani buzish sifatida qabul qilinishi mumkin.

Koreys tilida ism bilan bevosita murojaat qilish faqat yaqin do‘stlar, tengdoshlar yoki yoshi kichik shaxslarga nisbatan mumkin bo‘ladi. Rasmiy vaziyatda yoki katta yoshli shaxsga ism bilan murojaat qilish odatda noo‘rin hisoblanadi. Shu sababli koreys tilini o‘rganuvchilar nafaqat so‘zlarning lug‘aviy ma’nosini, balki ularning ijtimoiy-pragmatik qo‘llanish shartlarini ham bilishlari zarur.

Brown va Gilman nazariyasi asosida murojaat birliklarining talqini

Murojaat birliklarini sotsiolingvistik jihatdan o‘rganishda Brown va Gilman tomonidan ilgari surilgan hokimiyat va solidaritet nazariyasi muhim o‘rin tutadi. Ushbu nazariyada ikkinchi shaxs olmoshlari T va V shakllari asosida tahlil qilinadi. T shakli odatda yaqinlik, norasmiylik va tenglikni bildirsa, V shakli hurmat, rasmiylik va ijtimoiy masofani ifodalaydi.

Bu model koreys tiliga to‘g‘ridan-to‘g‘ri ko‘chirilmasa-da, uning asosiy tamoyillari koreys murojaat tizimini tushuntirishda muhimdir. Koreys tilida ham murojaat shakli suhbatdoshlar o‘rtasidagi ijtimoiy masofa va yaqinlik darajasiga bog‘liq. Masalan, tengdosh do‘stlar o‘rtasida ism bilan yoki yaqinlik bildiruvchi shakllar bilan murojaat qilish mumkin bo‘lsa, katta yoshli yoki yuqori lavozimdagi shaxsga nisbatan hurmat shakllari ishlatiladi.

Brown va Gilman nazariyasidagi hokimiyat semantikasi koreys jamiyatidagi ierarxik munosabatlarda yaqqol ko‘rinadi. Yosh, lavozim, ijtimoiy maqom yoki kasbiy o‘rin murojaat shaklini belgilashda muhim rol o‘ynaydi. Solidaritet semantikasi esa yaqin do‘stlik, oilaviy munosabat yoki bir guruhga mansublik holatlarida namoyon bo‘ladi. Demak, koreys tilidagi murojaat tizimi ham hokimiyat va yaqinlik mezonlari asosida ishlaydi, biroq bu tizim koreys madaniyatiga xos hurmat va ierarxiya tamoyillari bilan boyigan.

Brown va Ford modelida ism va unvon asosidagi murojaat

Brown va Ford ingliz tilidagi murojaat shakllarini tahlil qilib, ularni asosan ikki guruhga ajratgan: ism orqali murojaat va unvon hamda familiya orqali murojaat. Ism orqali murojaat yaqinlik, norasmiylik va tenglikni bildirsa, unvon bilan murojaat rasmiylik, hurmat va ijtimoiy masofani anglatadi.

Bu modelni koreys tiliga tatbiq etganda, ism bilan murojaat qilish norasmiy va yaqin munosabatlarda uchraydi. Masalan, do‘stlar yoki tengdoshlar bir-biriga ism bilan murojaat qilishi mumkin. Biroq rasmiy vaziyatda yoki katta yoshli shaxsga ism bilan murojaat qilish noo‘rin sanaladi. Bunday hollarda kasbiy unvon yoki hurmat bildiruvchi shakllar ishlatiladi: 김 선생님, 박 교수님, 이 사장님 kabi.

Koreys tilida unvon va lavozim nomlari murojaat birliklari sifatida juda faol ishlatiladi. Masalan, 선생님 faqat maktab yoki universitet o‘qituvchisiga emas, balki hurmat ko‘rsatilayotgan turli mutaxassislarga nisbatan ham qo‘llanishi mumkin. 교수님 ilmiy maqomni, 사장님 rahbarlik yoki tadbirkorlik mavqeini, 고객님 esa mijozga nisbatan hurmatni bildiradi. Bu birliklar orqali koreys jamiyatida kasbiy maqom va ijtimoiy hurmat tilda aniq aks etadi.

Friedrich omillari va koreys tilidagi murojaat tanlovi

Friedrich murojaat shakllarining tanlanishiga ta’sir qiluvchi bir qator ijtimoiy va psixologik omillarni ajratib ko‘rsatgan. Bular orasida suhbat mavzusi, nutqiy vaziyat, yosh farqi, avlodlararo munosabat, jins, ierarxik masofa, hokimiyat, nutq uslubi va emotsional yaqinlik kabi mezonlar mavjud. Ushbu omillar koreys tilidagi murojaat birliklarini tahlil qilishda ham muhim ahamiyatga ega.

Koreys tilida yosh farqi murojaat shaklini belgilovchi eng muhim omillardan biridir. Hatto bir necha yosh farqi ham nutq shakli va murojaat birliklarining tanlanishiga ta’sir qilishi mumkin. Masalan, yoshi katta erkak kishiga 형, yoshi katta ayol kishiga 누나 yoki 언니 deb murojaat qilish vaziyatga, so‘zlovchining jinsiga va munosabat yaqinligiga bog‘liq. Bu shakllar bir tomondan qarindoshlik terminlari bo‘lsa, ikkinchi tomondan koreys jamiyatidagi yaqinlik va hurmat munosabatlarini ifodalovchi sotsiolingvistik birliklardir.

Nutq vaziyati ham muhim omildir. Bir shaxsga ish joyida rasmiy unvon bilan, norasmiy muhitda esa yaqinlik bildiruvchi shakl bilan murojaat qilinishi mumkin. Masalan, universitetda 교수님 deb murojaat qilingan shaxsga yaqin oilaviy yoki do‘stona muhitda boshqa shaklda murojaat qilinishi ehtimoldan xoli emas. Bu holat murojaat birliklarining qat’iy emas, balki kontekstga moslashuvchan ekanligini ko‘rsatadi.

Emotsional yaqinlik ham murojaat tanloviga ta’sir qiladi. Yaqin insonlar o‘rtasida rasmiy shakllar o‘rniga yumshoq, samimiy yoki qisqartirilgan shakllar ishlatilishi mumkin. Biroq koreys tilida yaqinlik mavjud bo‘lsa ham, yosh va mavqe farqi saqlanib qolgan hollarda hurmat shakllari butunlay yo‘qolib ketmaydi. Bu koreys muloqot madaniyatida hurmat va yaqinlik bir-birini inkor qilmasligini ko‘rsatadi.

Murojaat birliklarining lingvopragmatik vazifalari

Koreys tilidagi murojaat birliklari bir necha lingvopragmatik vazifani bajaradi. Birinchidan, ular suhbatdoshni aniqlash va nomlash vazifasini bajaradi. Masalan, 민수 씨, 선생님, 어머니 kabi birliklar murojaat qilinayotgan shaxsni belgilaydi. Ikkinchidan, ular ijtimoiy munosabatni bildiradi. –님, 교수님, 사장님

kabi shakllar hurmat va masofani ko‘rsatsa, 언니, 오빠, 형, 누나 kabi birliklar yaqinlik va ijtimoiy iliqlikni anglatadi.

Uchinchidan, murojaat birliklari nutq etiketi vositasi sifatida ishlaydi. To‘g‘ri murojaat shaklini tanlash koreys muloqotida muhim odob me’yorlaridan biridir. Noto‘g‘ri tanlangan murojaat shakli suhbatdoshni ranjitishi yoki so‘zlovchining madaniy kompetensiyasi yetarli emasligini ko‘rsatishi mumkin.

To‘rtinchidan, murojaat birliklari pragmatik masofani boshqaradi. So‘zlovchi suhbatdoshga yaqinlashmoqchi bo‘lsa, nisbatan samimiyroq shaklni tanlaydi; masofani saqlamoqchi bo‘lsa, rasmiy yoki hurmat shaklidan foydalanadi. Demak, murojaat birliklari muloqot strategiyasining ham muhim qismidir.

Beshinchidan, murojaat birliklari ijtimoiy identifikatsiyani bildiradi. Ular suhbatdoshning kasbi, yoshi, oilaviy roli, jamiyatdagi mavqei yoki guruhga mansubligini ko‘rsatishi mumkin. Shu jihatdan koreys tilidagi murojaat tizimi jamiyatning ijtimoiy tuzilmasi bilan chambarchas bog‘liqdir.

Murojaat birliklarini o‘rgatishning lingvodidaktik ahamiyati

Koreys tilini chet tili sifatida o‘rgatishda murojaat birliklariga alohida e’tibor qaratish zarur. Chunki o‘rganuvchilar ko‘pincha so‘zlarning lug‘aviy ma’nosini bilgan holda ham, ularni qaysi vaziyatda ishlatish kerakligini to‘g‘ri anglay olmasliklari mumkin. Masalan, –씨 va –님 qo‘shimchalari o‘rtasidagi farq, 선생님 so‘zining keng qo‘llanishi yoki qarindoshlik terminlarining ijtimoiy murojaat sifatida ishlatilishi alohida tushuntirilishi kerak.

Boshlang‘ich bosqichda o‘quvchilarga eng ko‘p ishlatiladigan murojaat shakllari, masalan, 이름 + 씨, 선생님, 친구 이름i, 가족 호칭lari o‘rgatilishi maqsadga muvofiqdir. O‘rta bosqichda kasbiy unvonlar, rasmiy murojaat shakllari va nutq darajalari tushuntiriladi. Yuqori bosqichda esa murojaat birliklarining pragmatik nozikliklari, ya’ni qaysi shakl hurmat, qaysi biri yaqinlik, qaysi biri masofa yoki rasmiylik bildirishini real nutqiy vaziyatlar asosida tahlil qilish lozim.

Murojaat birliklarini o‘rgatishda faqat tarjimaga tayanish yetarli emas. Chunki koreys tilidagi ko‘plab murojaat shakllari o‘zbek tiliga aynan mos kelmaydi. Masalan, 오빠, 언니, 형, 누나 kabi birliklar o‘zbek tilida “aka”, “opa” deb tarjima qilinishi mumkin, biroq koreys tilidagi ularning ijtimoiy va pragmatik vazifasi ancha kengdir. Shu sababli bunday birliklarni madaniy kontekst bilan birga o‘rgatish zarur.

Xulosa

Koreys tilidagi murojaat birliklari tilning leksik, grammatik, pragmatik va sotsiolingvistik qatlamlarini birlashtiruvchi murakkab hodisadir. Ular suhbatdoshni nomlash bilan birga, so‘zlovchining unga bo‘lgan munosabati, hurmat darajasi, yaqinlik hissi, ijtimoiy masofasi va kommunikativ maqsadini ham ifodalaydi. Shu jihatdan murojaat birliklari koreys tili muloqot madaniyatining ajralmas qismi hisoblanadi.

Tahlil shuni ko‘rsatadiki, koreys tilida murojaat birliklari ot shaklidagi birliklar, fe’l shaklidagi hurmat ifodalari va qo‘shimchalar orqali hosil bo‘ladigan

shakllar ko‘rinishida namoyon bo‘ladi. –씨, –님, 선생님, 교수님, 사장님, 언니, 오빠, 형, 누나 kabi birliklar turli darajadagi hurmat, yaqinlik, rasmiylik va ijtimoiy maqomni bildiradi.

Brown va Gilman tomonidan ilgari surilgan hokimiyat va solidaritet modeli, Brown va Fordning ism hamda unvon asosidagi murojaat modeli, Friedrichning murojaatga ta’sir qiluvchi ijtimoiy-psixologik omillari koreys tilidagi murojaat tizimini tahlil qilish uchun muhim nazariy asos bo‘lib xizmat qiladi. Biroq koreys tilidagi murojaat birliklarini faqat umumiy nazariy modellar orqali emas, balki koreys jamiyatining o‘ziga xos ierarxik, madaniy va pragmatik xususiyatlari bilan bog‘liq holda o‘rganish zarur.

Xulosa qilib aytganda, koreys tilidagi murojaat birliklarini o‘rganish nafaqat tilshunoslik, balki madaniyatshunoslik, tarjimashunoslik va koreys tilini o‘qitish metodikasi uchun ham muhim ahamiyatga ega. Bunday birliklarni to‘g‘ri anglash va qo‘llash koreys tilida tabiiy, madaniy jihatdan mos va kommunikativ jihatdan samarali nutq shakllantirishga xizmat qiladi.

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A STUDY OF CHANGES IN WRITING STRATEGIES AMONG LEARNERS OF KOREAN IN THE ERA OF GENERATIVE AI: THE CASE OF STUDENTS IN UZBEKISTAN

Abstract. *This article analyzes changes in the writing strategies of students learning Korean in the era of generative artificial intelligence tools, using students in Uzbekistan as a case study. The study examines the impact of ChatGPT, translation programs, and AI-based tools designed for text editing and grammar checking on the development of written communication in Korean. The article compares traditional writing strategies with new strategies emerging through the use of AI and highlights changes occurring at the stages of idea generation, outlining, grammar correction, lexical choice, stylistic refinement, and final editing. In addition to the positive aspects of using generative AI tools, the article also discusses potential issues related to students' independent thinking, authorial voice, academic integrity, and the acquisition of cultural and pragmatic expressions specific to the Korean language. The findings indicate that generative AI can serve as an effective supporting tool for learners of Korean; however, it cannot fully replace writing competence. Rather, it should be used consciously, critically, and in a didactically appropriate manner.*

Keywords: generative AI, Korean language, writing strategy, written communication, students in Uzbekistan, ChatGPT, language learning, academic writing, language pedagogy, AI literacy.

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GENERATIV AI DAVRIDA KOREYS TILINI O'RGANAYOTGANLARNING YOZISH STRATEGIYASIDAGI O'ZGARISHLAR TADQIQI: O'ZBEKISTON TALABALARI MISOLIDA

Annotatsiya. *Ushbu maqolada generativ sun'iy intellekt vositalari davrida koreys tilini o'rganayotgan talabalarning yozish strategiyasida yuz berayotgan o'zgarishlar O'zbekiston talabalari misolida tahlil qilinadi. Tadqiqotda ChatGPT, tarjima dasturlari, matnni tahrirlash va grammatikani tekshirishga yo'naltirilgan AI vositalarining koreys tilida yozma nutq shakllantirish jarayoniga ta'siri ko'rib chiqiladi. Maqolada an'anaviy yozish strategiyalari bilan AI yordamida*

shakllanayotgan yangi strategiyalar qiyoslanib, g‘oya izlash, reja tuzish, grammatik tuzatish, leksik tanlov, uslubiy silliqlash va yakuniy tahrir bosqichlarida yuzaga kelayotgan o‘zgarishlar yoritiladi. Shuningdek, generativ AI vositalaridan foydalanishning ijobiy jihatlari bilan birga, talabalarning mustaqil fikrlashi, mualliflik pozitsiyasi, akademik halollik va koreys tiliga xos madaniy-pragmatik ifodalarni egallashdagi ehtimoliy muammolar ham tahlil qilinadi. Tadqiqot natijalari shuni ko‘rsatadiki, generativ AI koreys tilini o‘rganuvchilar uchun samarali yordamchi vosita bo‘lishi mumkin, biroq u yozish kompetensiyasini to‘liq almashtirmaydi; aksincha, undan ongli, tanqidiy va didaktik maqsadga muvofiq foydalanish zarur.

Kalit so‘zlar: *generativ AI, koreys tili, yozish strategiyasi, yozma nutq, O‘zbekiston talabalari, ChatGPT, til o‘rganish, akademik yozuv, lingvodidaktika, sun’iy intellekt savodxonligi.*

Kirish

So‘nggi yillarda generativ sun’iy intellekt vositalarining ta’lim jarayoniga kirib kelishi chet tillarni o‘qitish va o‘rganish metodikasida yangi bosqichni yuzaga keltirdi. Ayniqsa, ChatGPT kabi matn yaratish imkoniyatiga ega dasturlar talabalarning yozma nutq bilan ishlash jarayoniga sezilarli ta’sir ko‘rsatmoqda. Avvallari talaba yozma matn yaratishda asosan lug‘at, grammatik qoida, darslik, o‘qituvchi izohi va shaxsiy tajribasiga tayangan bo‘lsa, bugungi kunda u generativ AI vositalari yordamida g‘oya olish, matn tuzish, grammatik xatolarni aniqlash, uslubni silliqlash va tarjima variantlarini taqqoslash imkoniyatiga ega bo‘lmoqda.

Koreys tilini chet tili sifatida o‘rganayotgan O‘zbekiston talabalari uchun yozish ko‘nikmasi eng murakkab kompetensiyalardan biri hisoblanadi. Chunki koreys tilida yozma nutq yaratish faqat so‘z boyligi yoki grammatika bilimini emas, balki gap tartibi, bog‘lovchi vositalar, hurmat shakllari, uslubiy moslik, mavzu izchilligi va madaniy-pragmatik sezgirlikni ham talab qiladi. Shu jihatdan generativ AI vositalari talabalarga yozish jarayonida tezkor yordam bera oladi. Biroq bu yordam har doim ham mustaqil yozish malakasining rivojlanishiga to‘g‘ridan-to‘g‘ri xizmat qilavermaydi.

Mazkur maqolaning maqsadi generativ AI davrida koreys tilini o‘rganayotgan O‘zbekiston talabalari yozish strategiyalarida qanday o‘zgarishlar yuz berayotganini tahlil qilishdan iborat. Tadqiqotda AI vositalaridan foydalanish yozish jarayonining rejalashtirish, matn yaratish, tahrirlash va baholash bosqichlariga qanday ta’sir qilayotgani ko‘rib chiqiladi.

Generativ AI va chet tilida yozish jarayoni

Generativ AI matn, savol-javob, tarjima, izoh, reja va tahririy tavsiyalar yaratishga qodir raqamli vosita sifatida til o‘rganish jarayoniga faol kirib kelmoqda. Chet tilida yozish jarayonida bunday vositalar talabaning faqat tayyor matn olishiga emas, balki fikrni shakllantirish, mantiqiy tartibga solish va til xatolarini anglashiga ham yordam berishi mumkin. Shu sababli generativ AI bugungi kunda yozuv

jarayonining tashqi yordamchi vositasidan bosqichma-bosqich interaktiv hamkoriga aylanmoqda.

An’anaviy yozish jarayonida talaba avvalo mavzu haqida o‘ylaydi, reja tuzadi, so‘z va grammatik shakllarni mustaqil tanlaydi, xatolarni darslik yoki o‘qituvchi yordamida tuzatadi. Generativ AI ishtirokida esa bu jarayon boshqacha shakl oladi. Talaba mavzu bo‘yicha g‘oya so‘rashi, koreys tilida namunaviy gaplar yaratishi, o‘z matnini tekshirtirishi, akademik uslubga moslashtirishi yoki matnning tabiiyroq variantini olishi mumkin. Natijada yozish strategiyasi individual jarayondan dialogik va texnologik jarayonga aylanadi.

Biroq generativ AI vositalarining ta’siri ikki tomonlama xarakterga ega. Bir tomondan, ular talabaning til xatolarini kamaytiradi, yozishdagi qo‘rquvni pasaytiradi, matn tuzish jarayonini tezlashtiradi va o‘z-o‘zini tahrirlash imkonini kengaytiradi. Ikkinchi tomondan, talaba tayyor javobga haddan tashqari tayanib qolsa, mustaqil fikrlash, koreyscha gap qurish, uslubni his qilish va mualliflik mas’uliyati zaiflashishi mumkin.

O‘zbekiston talabalari uchun koreys tilida yozishning murakkab jihatlari

O‘zbekiston talabalari koreys tilini o‘rganish jarayonida yozma nutq bo‘yicha bir qator qiyinchiliklarga duch keladilar. Birinchi qiyinchilik koreys va o‘zbek tillari o‘rtasidagi grammatik o‘xshashlik va farqlarning murakkabligidir. Har ikki tilda ham gap qurilishida ega, to‘ldiruvchi va kesim tartibi mavjud bo‘lsa-da, koreys tilidagi yordamchi qo‘shimchalar, fe’lning oxirgi shakllari, hurmat darajalari va bog‘lovchi qo‘shimchalar o‘zbek talabalari uchun alohida e’tibor talab qiladi.

Ikkinchi qiyinchilik leksik tanlov bilan bog‘liq. Koreys tilida bir fikrni turli rasmiylik darajalarida ifodalash mumkin. Masalan, oddiy suhbat, akademik matn, rasmiy xat yoki TOPIK inshosida bir xil mazmun turli leksik va grammatik vositalar orqali beriladi. Talaba ko‘pincha so‘zning lug‘aviy ma’nosini biladi, ammo uni qaysi vaziyatda ishlatish kerakligini aniqlashda qiynaladi.

Uchinchi qiyinchilik matnning izchilligi va kompozitsiyasi bilan bog‘liq. Koreys tilida yozma matn yaratishda kirish, asosiy qism va xulosa o‘rtasidagi mantiqiy bog‘lanish, sabab-natija munosabatlari, dalillash va umumlashtirish vositalari muhim ahamiyatga ega. Ayniqsa TOPIK II yozish topshiriqlarida fikrni qisqa, aniq va mantiqiy tuzish talab qilinadi.

To‘rtinchi qiyinchilik madaniy-pragmatik moslikdir. Koreys tilida hurmat, kamtarlik, bilvosita ifoda va muloyimlik strategiyalari yozma nutqda ham seziladi. Talaba grammatik jihatdan to‘g‘ri gap tuzgan bo‘lsa ham, u koreyscha nutq odobiga mos kelmasligi mumkin. Generativ AI aynan shu nuqtada yordam berishi mumkin, biroq u bergan variantni talaba tanqidiy tekshira olishi zarur.

An’anaviy yozish strategiyalari

Generativ AI keng tarqalishidan oldin koreys tilini o‘rganayotgan talabalar yozish jarayonida asosan an’anaviy strategiyalarga tayanganlar. Bular orasida lug‘atdan foydalanish, o‘qituvchi bergan namunaviy matnni tahlil qilish, grammatik qoliplarni yodlash, darslikdagi mashqlarga asoslanish, tayyor iboralarni qo‘llash va yozilgan matnni o‘qituvchiga tekshirtirish kabi usullar mavjud edi.

Bunday strategiyalarning afzalligi shundaki, talaba matn yaratish jarayonida ko‘proq mustaqil fikrlaydi, xato orqali o‘rganadi va yozish malakasini bosqichma-bosqich shakllantiradi. Masalan, talaba biror mavzuda insho yozishda avvalo o‘zbek tilida fikr yuritadi, keyin uni koreys tiliga moslashtiradi, kerakli so‘zlarni izlaydi va grammatik shakllarni tanlaydi. Bu jarayon sekin kechsa-da, talabaning ichki til kompetensiyasini rivojlantiradi.

Biroq an’anaviy strategiyalarda ayrim cheklovlar ham mavjud edi. Talaba o‘z xatosini darhol ko‘ra olmasdi, o‘qituvchi fikrini kutishi kerak bo‘lardi. Mustaqil ishlash jarayonida u tabiiy koreyscha ifoda variantlarini topishda qiynalardi. Shuningdek, yozish jarayoni ko‘p vaqt olgani sababli ba’zi talabalar yozma topshiriqdan qochishga moyil bo‘lganlar. Generativ AI aynan mana shu bo‘shliqni to‘ldiruvchi yangi vosita sifatida maydonga chiqdi.

AI yordamida shakllanayotgan yangi yozish strategiyalari

Generativ AI vositalaridan foydalanish natijasida koreys tilini o‘rganayotgan talabalarda yangi yozish strategiyalari shakllanmoqda. Birinchi strategiya g‘oya izlash strategiyasidir. Talaba mavzu bo‘yicha qanday fikr yozishni bilmasa, AI vositasidan reja, asosiy dalillar yoki misollar so‘rashi mumkin. Bu ayniqsa insho yozish jarayonida foydali bo‘ladi.

Ikkinchi strategiya matnni dastlabki shakllantirish strategiyasidir. Talaba o‘z fikrini sodda shaklda yozib, AI yordamida uni koreys tilida tabiiyroq ifodalash variantlarini ko‘rishi mumkin. Bu jarayonda AI talaba uchun tayyor matn yaratuvchi emas, balki ifoda imkoniyatlarini ko‘rsatuvchi vosita bo‘lishi kerak.

Uchinchi strategiya grammatik va uslubiy tahrir strategiyasidir. Talaba o‘z yozgan matnini AIga berib, grammatik xatolarni, noto‘g‘ri qo‘shimchalarni, noaniq gaplarni yoki uslubiy nomuvofiqliklarni aniqlashi mumkin. Bu strategiya o‘z-o‘zini tahrirlash malakasini rivojlantirishda muhim ahamiyatga ega.

To‘rtinchi strategiya variantlarni taqqoslash strategiyasidir. Talaba bir xil fikrning bir necha koreyscha ifodasini AI yordamida olishi va ularni uslub, rasmiylik, tabiiylik hamda grammatik to‘g‘rilik jihatidan solishtirishi mumkin. Bu usul leksik va grammatik sezgirlikni rivojlantiradi.

Beshinchi strategiya metalingvistik savol berish strategiyasidir. Talaba AIga “Nega bu qo‘shimcha ishlatilgan?”, “Bu gap rasmiy uslubga mosmi?”, “TOPIK inshosi uchun qaysi variant yaxshiroq?” kabi savollar berishi mumkin. Bunday yondashuv AI vositasidan faqat javob olish emas, balki til hodisasini tushunish uchun foydalanishni anglatadi.

Generativ AI ta’sirida yozish jarayonining bosqichma-bosqich o‘zgarishi

AI vositalari yozish jarayonining barcha bosqichlariga ta’sir ko‘rsatmoqda. Rejalashtirish bosqichida talaba mavzu bo‘yicha g‘oya, reja, dalil va misollarni tezroq topa oladi. Bu yozishni boshlashdagi psixologik to‘siqni kamaytiradi. Ayniqsa, koreys tilida mustaqil insho yozishdan cho‘chiydigan talabalar uchun AI dastlabki yo‘nalish beruvchi vosita bo‘lib xizmat qiladi.

Matn yaratish bosqichida AI talabaning fikrini koreyscha shaklga keltirishda yordam beradi. Biroq bu bosqichda eng katta xavf talabaning AI yaratgan matnni

o‘zlashtirmay, tayyor natija sifatida qabul qilishidir. Agar talaba matndagi grammatik shakllarni tahlil qilmasa, yangi so‘zlarni o‘rganmasa va uslubiy tanlov sababini tushunmasa, yozish kompetensiyasi yetarli darajada rivojlanmaydi.

Tahrirlash bosqichida AI eng foydali vositalardan biri bo‘lishi mumkin. Talaba xatolarini ko‘rib, ularning sababini tushunsa, bu jarayon o‘rganishga xizmat qiladi. Masalan, noto‘g‘ri qo‘llangan qo‘shimcha, noaniq bog‘lovchi yoki uslubga mos kelmagan so‘z AI yordamida aniqlansa, talaba keyingi yozuvda bu xatoni takrorlamaslikka harakat qiladi.

Yakuniy baholash bosqichida esa AI talabaning matnini umumiy izchillik, uslub, mazmun va grammatik to‘g‘rilik jihatidan baholashi mumkin. Biroq yakuniy baho o‘qituvchi nazorati va aniq mezonlar asosida berilishi kerak. Chunki AI har doim ham koreys tili o‘qituvchisining didaktik maqsadini, talabaning darajasini yoki topshiriq talabini to‘liq hisobga olmaydi.

Ijobiy jihatlar

Generativ AI vositalarining koreys tilini o‘rganayotgan talabalar yozish strategiyasiga ijobiy ta’siri bir necha jihatda ko‘rinadi. Avvalo, AI talabaning yozishga bo‘lgan ishonchini oshiradi. Koreys tilida yozishdan qo‘rqadigan talaba AI yordamida dastlabki reja yoki namuna olib, ishni boshlashi osonlashadi.

Ikkinchidan, AI individual yordam beradi. O‘qituvchi har bir talabaning matnini darhol tekshirib bera olmasligi mumkin, AI esa tezkor fikr bildira oladi. Bu ayniqsa mustaqil ta’lim jarayonida foydalidir.

Uchinchidan, AI til materialini ko‘paytiradi. Talaba bir fikrning turli ifoda variantlarini ko‘rib, koreys tilidagi uslubiy imkoniyatlarni yaxshiroq anglaydi. Masalan, oddiy gapni rasmiy uslubga, akademik uslubga yoki muloyimroq shaklga o‘zgartirish orqali u nutq darajalarini amaliy o‘rganadi.

To‘rtinchidan, AI o‘z-o‘zini tahrirlash madaniyatini rivojlantiradi. Talaba matnni bir marta yozib topshirish o‘rniga, uni qayta ko‘rib chiqish, tuzatish va yaxshilash zarurligini anglaydi. Bu akademik yozuv uchun muhim ko‘nikmadir.

Muammoli jihatlar

Generativ AI vositalaridan foydalanishda bir qator muammolar ham mavjud. Birinchi muammo haddan tashqari qaramlikdir. Talaba har bir gapni AI yordamida tuzishga odatlansa, mustaqil yozish malakasi sekin rivojlanadi. Bunday holatda AI yordamchi vosita emas, balki talabaning o‘rniga yozuvchi vositaga aylanib qoladi.

Ikkinchi muammo mualliflik pozitsiyasining yo‘qolishidir. AI yaratgan matn grammatik jihatdan to‘g‘ri va silliq bo‘lishi mumkin, lekin unda talabaning shaxsiy fikri, darajasi va individual uslubi yetarli aks etmasligi mumkin. Natijada matn tabiiy o‘quvchi matni emas, sun’iy silliqlangan matnga o‘xshab qoladi.

Uchinchi muammo akademik halollik bilan bog‘liq. Talaba AI yaratgan matnni o‘z ishi sifatida topshirsa, bu ilmiy va ta’limiy halollik tamoyillariga zid bo‘ladi. Shu sababli oliy ta’lim muassasalarida AI vositalaridan foydalanish mezonlari aniq belgilanishi kerak.

To‘rtinchi muammo madaniy-pragmatik nomuvofiqlikdir. AI ba’zan grammatik jihatdan to‘g‘ri, lekin koreys madaniy muloqotiga to‘liq mos

kelmaydigan ifodalarni taklif qilishi mumkin. Ayniqsa hurmat shakllari, rasmiy uslub, bilvosita ifoda va kontekstga moslik masalalarida talaba AI javobini tanqidiy baholay olishi zarur.

O‘zbekiston talabalari misolida didaktik yondashuv

O‘zbekiston talabalari uchun generativ AI vositalaridan foydalanishni taqiqlashdan ko‘ra, uni to‘g‘ri yo‘naltirish samaraliroqdir. Chunki AI allaqachon ta’lim jarayonining bir qismiga aylanmoqda. Muhimi, talabaga undan qanday foydalanish kerakligini o‘rgatishdir.

Birinchidan, o‘qituvchi AI yordamida yozilgan va talaba mustaqil yozgan matn o‘rtasidagi farqni tushuntirishi lozim. Talaba AI matnini tayyor mahsulot emas, balki tahlil qilinadigan material sifatida qabul qilishi kerak.

Ikkinchidan, yozma topshiriqlarda jarayon baholanishi zarur. Ya’ni faqat yakuniy matn emas, balki reja, dastlabki qoralama, AI bilan ishlash bosqichi, tahrir qilingan variant va yakuniy xulosa ham baholanishi mumkin. Bu talabaning haqiqiy mehnatini ko‘rsatadi.

Uchinchidan, AI savodxonligi alohida ko‘nikma sifatida shakllantirilishi kerak. Talaba aniq prompt yozish, AI javobini tekshirish, noto‘g‘ri yoki sun’iy ifodalarni ajratish, manbani ko‘rsatish va akademik halollikka rioya qilishni o‘rganishi lozim.

To‘rtinchidan, koreys tili darslarida AI bilan ishlashga yo‘naltirilgan maxsus mashqlar berish mumkin. Masalan, AI yaratgan koreyscha matndan xatolarni topish, uni TOPIK mezonlari asosida baholash, uslubini o‘zgartirish yoki o‘zbek talabasiga mos darajada qayta yozish kabi topshiriqlar samarali bo‘ladi.

Yozish strategiyasidagi asosiy o‘zgarishlar

Generativ AI davrida koreys tilini o‘rganayotgan talabalar yozish strategiyasida bir necha asosiy o‘zgarish ko‘zga tashlanadi. Birinchidan, yozish jarayoni tezlashmoqda. Talaba g‘oya topish va matnni boshlash uchun kamroq vaqt sarflaydi. Ikkinchidan, yozish jarayoni interaktiv tus olmoqda. Talaba AI bilan savol-javob orqali matnni bosqichma-bosqich yaxshilaydi.

Uchinchidan, tahrir jarayoni kuchaymoqda. Avvallari talaba ko‘pincha matnni bir marta yozib topshirgan bo‘lsa, endilikda u AI yordamida matnni bir necha marta qayta ko‘rib chiqishi mumkin. To‘rtinchidan, til o‘rganish jarayonida tanqidiy savodxonlikka ehtiyoj ortmoqda. Talaba AI bergan har bir javobni to‘g‘ri deb qabul qilmasligi, balki uni grammatik, semantik, uslubiy va madaniy jihatdan tekshirishi kerak.

Beshinchidan, yozish strategiyasida mustaqillik tushunchasi o‘zgarib bormoqda. Endi mustaqil yozish AI vositasidan butunlay voz kechish emas, balki undan ongli foydalanish, o‘z fikrini saqlab qolish va yakuniy matn uchun mas’uliyatni o‘z zimmasiga olishni anglatadi.

Xulosa

Generativ AI vositalari koreys tilini o‘rganayotgan O‘zbekiston talabalari yozish strategiyasiga sezilarli ta’sir ko‘rsatmoqda. Bu ta’sir yozish jarayonining barcha bosqichlarida, ya’ni g‘oya izlash, reja tuzish, matn yaratish, grammatik

tuzatish, uslubiy silliqlash va yakuniy tahrir bosqichlarida namoyon bo‘ladi. AI talabalarga tezkor yordam, ko‘p variantli til materiali va mustaqil tahrir imkoniyatini beradi.

Biroq generativ AI yozish kompetensiyasining o‘rnini to‘liq bosa olmaydi. U faqat didaktik jihatdan to‘g‘ri yo‘naltirilganda samarali ta’lim vositasiga aylanadi. Talabaning mustaqil fikri, mualliflik pozitsiyasi, koreys tiliga xos uslubiy sezgirligi va madaniy-pragmatik kompetensiyasi asosiy o‘rinda qolishi kerak.

Xulosa qilib aytganda, generativ AI davrida koreys tilida yozishni o‘rgatishning asosiy vazifasi talabani AIga qaram qilish emas, balki AI yordamida ongli, tanqidiy va samarali yozishga o‘rgatishdir. O‘zbekiston talabalari misolida bu masala koreys tili ta’limida yangi metodik yondashuvlarni ishlab chiqish, akademik halollik mezonlarini belgilash va raqamli til o‘rganish madaniyatini shakllantirish zarurligini ko‘rsatadi.

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SHOVQINNING INSON SALOMATLIGIGA TA’SIRI

Annotatsiya: *Mazkur maqolada metropolitan hududlarida shovqin ifloslanishi muammosi, uning inson salomatligiga fiziologik va psixologik ta’siri hamda sanoat korxonalarida kasbiy shovqinning o‘ziga xos xavflari tahlil qilinadi. Tadqiqotda akustik qulaylik tushunchasi hamda shovqinni nazorat qilishning shaharsozlik va texnik strategiyalari yoritilgan.*

Kalit so‘zlar: *Metropolitan, psixologik, chastota, amplituda, identifikatsiya, surunkali stress, kognitiv faoliyat, fiziologik va psixologik, akustik, endokrin.*

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THE IMPACT OF NOISE ON HUMAN HEALTH

Abstract *This article examines the issue of noise pollution in metropolitan areas, analyzing its physiological and psychological impact on human health, as well as the specific professional risks associated with industrial noise in manufacturing enterprises. The study explores the concept of acoustic comfort and discusses urban planning and technical strategies for the control and mitigation of noise pollution.*

Keywords: *acoustic comfort, metropolitan area, noise pollution, human health, occupational noise, urban planning, physiological and psychological impact.*

Kirish. Shovqin ifloslanishi ko‘zga ko‘rinmas tahdiddir. Garchi u quruqlikda va suv osti muhitida keng tarqalgan bo‘lsa-da, uni ko‘rib bo‘lmaydi. Shovqin insonlar hamda jonli organizm salomatligiga hamda farovonligiga ta’sir qiluvchi har qanday istalmagan yoki bezovta qiluvchi tovush shovqin ifloslanishi deb ataladi

[12]. Insonning mavjud beshta sezgi a’zosi ichida eshitish o‘ziga xos ahamiyat kasb etadi. Aynan eshitish orqali inson boshqa odamlar bilan muloqot qiladi, xavf - xatarni anglaydi va o‘z madaniyatini yuksaltiradi. Inson o‘zining eshitish sezgilari orqali toza tovushlarni, aralash tovushlarni va shovqinni farqlaydi. Toza tovush bir xil chastotadagi sinusoidal tebranishlardan iboratdir.

Shovqin ifloslanishi insonlarning kundalik faoliyatiga, jumladan o‘qish, uxlash, gaplashish va dam olishga xalaqit beradigan tovushlarni ifodalaydi [3].

Atrof-muhitdagi shovqinining darajasi avtomobil, temir yo‘l va havo transporti harakatining doimiy o‘sishi tufayli ham ortib boradi. Kasbiy shovqin ta’siri ko‘plab mamlakatlar va ish joylarida, masalan, sanoat, fabrikalar, konchilik hududlari va boshqalarda katta muammo hisoblanadi [9]. Sanoat korxonalaridagi ishchilari har kunlik mehnat faoliyati davomida ishlab chiqarish uskunalaridan tarqalgan yuqori darajadagi shovqin ta’siriga muntazam ravishda duchor bo‘lishadi [2]. Ish joyida uzoq muddatli yuqori darajadagi shovqin ta’sirida bo‘lish organizmga jiddiy fiziologik va psixologik ta’sirlarni keltirib chiqaradi [9].

Shovqin ifloslanishi butun dunyo shaharlaridagi asosiy muammolardan biridir. Atrof-muhit shovqini ish joyidan tashqari, jamoat joylarida hosil bo‘ladigan barcha istalmagan tovushlar atrof-muhit shovqini hisoblanadi. Havo ifloslanishining bir turi bo‘lgan atrof-muhit shovqini inson salomatligiga salbiy ta’sir qiladi [2].

Shovqin ifloslanishi insonning eshitish qobiliyatini yo‘qotishi, uyquning buzilishi, yurak-qon tomir kasalliklari, ijtimoiy cheklovlar, mahsuldorlikning pasayishi, yomon ijtimoiy xulq-atvor, norozilik reaksiyalari, ishga chiqmaslik va baxtsiz hodisalar kabi turli xil ta’sirlar o‘rganilgan [12].

Shovqin ifloslanishi odamlar uchun, ayniqsa, ko‘p yillar davomida kun davomida uzoq vaqt davomida doimiy ravishda ta’sirlanganlar uchun potentsial tahdiddir [1].

Metodlar va materiallar. Zamonaviy metropolitan hududlarida shovqin ifloslanishi —inson salomatligiga salbiy ta’sir ko‘rsatuvchi va kundalik faoliyatga to‘sqinlik qiluvchi nojo‘ya akustik ta’sirlar yig‘indisi bolib, u jiddiy ekologik muammolardan biri hisoblanadi [10]. Akustik qulaylik — shovqin darajasiga nisbatan psixologik qoniqish hissi. U tovush muhitining fizik xususiyatlari hamda uni idrok etishga ta’sir qiluvchi yashirin omillar (fazoviy tartib, ikkilamchi tovushlar va hissiy baho) uyg‘unligi bilan belgilanadi. Akustik qulaylik tovushlarning mutlaqo yo‘qligini emas, balki aniq va yashirin omillar o‘rtasidagi muvozanatni bildiradi [4,5].

Shovqin buzilishlari chastota, amplituda va vaqt oralig‘i kabi o‘zgaruvchilar orqali o‘ziga xos identifikatsiyani taqdim etadi. Shahar muhitining tarixiy xususiyatlari hisobga olgan holda ushbu parametrlarni monitoring tizimlari uchun optimal sensorlarni tanlashda yordam berishi mumkin [6].

Urbanizatsiya jarayonlarining jadallashuvi, avtomobil, temir yo‘l va havo transporti harakatining ortishi atrof-muhit shovqini darajasining ko‘tarilishiga olib kelmoqda [2]. Ilmiy tadqiqotlar shuni ko‘rsatadiki, 75–85 dB shovqin darajasi inson

salomatligi uchun yuqori xavfli hisoblanib, uning ta’sir davomiyligi organizmdagi patologik jarayonlarni kuchaytiradi [1, 9].

Shovqin ta’siri inson organizmida eshitish qobiliyatining pasayishi (NIHL), yurak-qon tomir tizimi kasalliklari, surunkali stress, uyqu buzilishi va kognitiv faoliyatning susayishi kabi jiddiy fiziologik va psixologik o‘zgarishlarni keltirib chiqaradi [9]. Akustik nazorat ta’minlanmagan muhitlarda shovqin buzilishi nafaqat eshitish organlariga, balki endokrin va oshqozon-ichak tizimlariga, shuningdek, ruhiy holatga va hatto homiladorlik jarayoniga ham salbiy ta’sir ko‘rsatishi mumkin [7]. Ushbu tadqiqot kasbiy shovqinning salomatlikka ta’siriga oid zamonaviy ilmiy yondashuvlarni umumlashtirish, yuqori xavf ostidagi soha hamda kasb egalarini aniqlash, shuningdek, shovqinni nazorat qilish choralarining samaradorligini tahlil qilishga qaratilgan [9]. Binobarin, shovqin intensivligi va ta’sir ko‘lami eshitish qobiliyatini yo‘qotishdan tortib turli xil homila asoratlarigacha bo‘lgan akustik noqulayliklarni keltirib chiqarishi mumkinligini inobatga olib, fuqarolarning dam olish va tinchlik huquqlarini himoya qiluvchi qonunchilik bazasini takomillashtirish zarurati yuzaga keladi [7, 8].

Jamoat salomatligiga shovqin ta’sirini minimallashtirish maqsadida akustik to‘siqlarni o‘rnatish, shaharsozlikda shovqinni kamaytirishga qaratilgan rejalashtirish strategiyalarini qo‘llash va tegishli qonunchilik bazasini takomillashtirish kabi kompleks yechimlar tavsiya etiladi. Fuqarolarni atrof-muhitdagi ifloslanish, xususan, shovqin ta’sirining salbiy oqibatlaridan himoya qilish samarali davlat siyosatining ustuvor yo‘nalishlaridan biri bo‘lishi lozim. Odamlar o‘zlarining akustik muhitini tanlash huquqiga ega; u boshqalar tomonidan majburan o‘rnatilmasligi kerak. Ma’rifatli davlat nazoratining maqsadi fuqarolarni shovqin keltirib chiqaradigan salbiy ta’sirlardan himoya qilishdan iborat bo‘lishi lozim [10].

Sanoat sektorida shovqin va tebranish (vibratsiya) omillari bilan kechadi. Muvozanatsiz aylanuvchi massalar va yuqori tezlikda ishlovchi texnologik uskunalar ishchilarning sog‘lig‘iga, jumladan, asab va gematopoetik (qon yaratish) organlar faoliyatiga jiddiy putur yetkazadi. Ishlab chiqarish muhitida akustik nazoratning yetarli emasligi progressiv karlikka olib kelishi ilmiy jihatdan asoslangan [11].

Xulosa o‘rnida ta’kidlash joizki, jamoat salomatligini muhofaza qilishda samarali davlat siyosati muhim ahamiyatga ega. Fuqarolarning akustik muhitni tanlash va shovqindan himoyalanish huquqlarini kafolatlovchi qonunchilik bazasini takomillashtirish [8, 10], shaharsozlikda shovqinni kamaytirishga qaratilgan rejalashtirish strategiyalarini joriy etish hamda ishlab chiqarish korxonalarida texnik himoya choralarini kuchaytirish mazkur muammoning kompleks yechimi hisoblanadi.

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FARMATSIYA SOHASIDA OLIY TA'LIM MUASSASALARI VA TEXNIKUMLAR HAMKORLIGINI RIVOJLANTIRISH: DOLZARB MASALALAR VA ISTIQBOLLAR

Annotatsiya: *Mazkur maqolada farmatsiya sohasida oliy ta'lim muassasalari va o'rta maxsus ta'lim texnikumlari o'rtasidagi hamkorlik munosabatlari tahlil qilingan. Ta'lim tizimining uzviyligi, nazariy bilim va amaliy ko'nikmalar uyg'unligini ta'minlash masalalari yoritilgan. Shuningdek, mavjud muammolar va ularni bartaraf etish yo'llari, jumladan, dual ta'lim tizimini joriy etish, o'quv dasturlarini integratsiya qilish va ish beruvchilar bilan hamkorlikni kuchaytirish bo'yicha takliflar ishlab chiqilgan. Tadqiqot natijalari farmatsevt kadrlar tayyorlash sifatini oshirishga xizmat qiladi.*

Kalit so'zlar

farmatsiya, oliy ta'lim, texnikum, hamkorlik, dual ta'lim, integratsiya, amaliy ko'nikma, ta'lim sifati, farmatsevt kadrlar

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DEVELOPMENT OF COOPERATION BETWEEN HIGHER EDUCATION INSTITUTIONS AND TECHNICAL COLLEGES IN THE PHARMACEUTICAL FIELD: CURRENT ISSUES AND PROSPECTS

Abstract: *This article analyzes cooperation between higher education institutions and specialized technical colleges in the field of pharmacy. Particular attention is paid to ensuring continuity within the education system and achieving a balance between theoretical knowledge and practical skills. The study also identifies existing challenges and proposes solutions, including the implementation of a dual education system, integration of educational curricula, and strengthening cooperation with employers. The findings of the research contribute to improving the quality of pharmaceutical workforce training.*

Keywords: *Pharmacy, higher education, technical college, cooperation, dual education, integration, practical skills, quality of education, pharmaceutical personnel.*

Dolzarbligi.

Hozirgi kunda jahonda sog‘liqni saqlash tizimining barqaror rivojlanishi ko‘p jihatdan farmatsevtika sohasining taraqqiyotiga bog‘liq. Dori vositalarini ishlab chiqarish, saqlash, tarqatish va aholiga yetkazish jarayonlari yuqori malakali mutaxassislarni talab etadi. Shu sababli farmatsiya sohasida kadrlar tayyorlash tizimini takomillashtirish, uni xalqaro standartlar asosida rivojlantirish va ta’lim bosqichlari o‘rtasidagi uzviylikni ta’minlash muhim ahamiyat kasb etmoqda.

Farmatsevtika sohasida kadrlar tayyorlash ko‘p bosqichli ta’lim tizimi orqali amalga oshiriladi. Ushbu tizimda o‘rta maxsus ta’lim texnikumlari va oliy ta’lim muassasalari o‘zaro bog‘liq va bir-birini to‘ldiruvchi bo‘g‘inlar hisoblanadi. Texnikumlarda talabalarga kasbga yo‘naltirilgan dastlabki bilimlar, amaliy ko‘nikmalar va ish faoliyati uchun zarur bo‘lgan asosiy kompetensiyalar beriladi. Oliy ta’lim muassasalarida esa mazkur bilimlar yanada chuqurlashtirilib, ilmiy-tadqiqot faoliyati, tahliliy fikrlash va innovatsion yondashuvlar rivojlantiriladi.

Shu nuqtai nazardan qaraganda, oliy ta’lim muassasalari va texnikumlar o‘rtasidagi samarali hamkorlik farmatsevtika ta’limining sifatini oshirishda hal qiluvchi omil hisoblanadi. Bu hamkorlik nafaqat ta’lim jarayonini takomillashtirishga, balki mehnat bozori talablariga mos kadrlar tayyorlashga ham xizmat qiladi.

Bugungi kunda mazkur ta’lim muassasalari o‘rtasida hamkorlikning ayrim shakllari mavjud. Jumladan, o‘quv rejalarini muvofiqlashtirish, talabalarni oliy ta’limga tayyorlash, o‘quv-amaliy mashg‘ulotlar tashkil etish, ilmiy-amaliy anjumanlar o‘tkazish va o‘qituvchilar o‘rtasida tajriba almashish kabi faoliyatlar amalga oshirilmoqda. Ayrim hollarda texnikum bitiruvchilari uchun oliy ta’lim muassasalariga kirishda imtiyozlar yaratilishi ham hamkorlikning muhim ko‘rinishlaridan biri hisoblanadi.

Biroq, mavjud imkoniyatlarga qaramay, bugungi kunda hamkorlik munosabatlarida qator muammolar saqlanib qolmoqda. Eng avvalo, ta’lim dasturlari o‘rtasida to‘liq integratsiya mavjud emas. Bu esa talabalarning bilim va ko‘nikmalarida uzilishlarga sabab bo‘ladi. Masalan, texnikumda o‘rganilgan ayrim fanlar oliy ta’limda qaytadan o‘qitilishi yoki aksincha, zarur bilimlar yetarli darajada berilmasligi kuzatiladi.

Ikkinchi muammo — amaliy tayyorgarlik darajasining yetarli emasligi. Ko‘pgina texnikumlarda zamonaviy laboratoriya jihozlari, innovatsion texnologiyalar va ishlab chiqarishga yaqin muhit yetishmasligi sababli talabalar nazariy bilimlarni amaliyotda qo‘llashda qiyinchiliklarga duch keladilar. Bu esa ularning keyingi ta’lim bosqichida yoki ish faoliyatida muvaffaqiyatli faoliyat yuritishiga salbiy ta’sir ko‘rsatadi.

Uchinchi muammo sifatida ish beruvchilar bilan hamkorlikning yetarli emasligini ko‘rsatish mumkin. Farmatsevtika korxonalari, dorixonalar va tibbiyot muassasalari ta’lim jarayoniga to‘liq jalb etilmagan. Bu esa talabalarning real ish sharoiti bilan tanishish imkoniyatlarini cheklaydi va ularning kasbiy moslashuvini sekinlashtiradi.

Mazkur muammolarni bartaraf etish uchun, avvalo, ta’lim tizimida integratsiyani kuchaytirish zarur. Buning uchun o‘quv rejalari va dasturlarini qayta ko‘rib chiqish, ularni o‘zaro muvofiqlashtirish va izchillikni ta’minlash lozim. Texnikum va oliy ta’lim muassasalari o‘rtasida yagona ta’lim standartlarini ishlab chiqish bu borada samarali yechim bo‘lishi mumkin.

Shuningdek, dual ta’lim tizimini keng joriy etish katta ahamiyatga ega. Dual ta’lim modelida talabalar vaqtning ma’lum qismini ta’lim muassasasida, qolgan qismini esa ishlab chiqarish korxonalarida o‘tkazadilar. Bu orqali ular nazariy bilimlarini amaliyot bilan mustahkamlaydilar va ish tajribasiga ega bo‘ladilar. Farmatsevtika sohasida bu yondashuvni joriy etish talabalar kasbiy kompetensiyalarini sezilarli darajada oshiradi.

Zamonaviy axborot-kommunikatsiya texnologiyalarini joriy etish ham hamkorlik samaradorligini oshirishda muhim omil hisoblanadi. Elektron ta’lim platformalari, virtual laboratoriyalar, onlayn kurslar va masofaviy ta’lim shakllari orqali talabalarga keng imkoniyatlar yaratish mumkin. Bu, ayniqsa, texnikum va oliy ta’lim muassasalari o‘rtasidagi bilim almashinuvini osonlashtiradi.

Bundan tashqari, o‘qituvchilarning malakasini oshirish va ular o‘rtasida tajriba almashishni kuchaytirish ham muhim ahamiyatga ega. Oliy ta’lim muassasalari professor-o‘qituvchilari texnikumlarda dars berishlari, texnikum o‘qituvchilari esa oliy ta’lim muassasalarida stajirovka o‘tashlari hamkorlikni yanada mustahkamlaydi.

Farmatsiya sohasida xalqaro tajribalarni o‘rganish va joriy etish ham muhim yo‘nalish hisoblanadi. Rivojlangan davlatlarda ta’lim va ishlab chiqarish integratsiyasi yuqori darajada yo‘lga qo‘yilgan bo‘lib, talabalar ta’lim jarayoni davomidayoq ish tajribasiga ega bo‘ladilar. Bu tajribani milliy ta’lim tizimiga moslashtirish orqali samarali natijalarga erishish mumkin.

Shu bilan birga, ta’lim muassasalari o‘rtasidagi hamkorlikni institutsional darajada mustahkamlash zarur. Buning uchun qo‘shma dasturlar, hamkorlik shartnomalari, ilmiy-amaliy loyihalar va innovatsion markazlar tashkil etish maqsadga muvofiq. Bunday yondashuv ta’lim sifati va samaradorligini oshirishga xizmat qiladi.

Xulosa

Tadqiqotlar shuni ko‘rsatdiki, farmatsiya sohasida oliy ta’lim muassasalari va o‘rta maxsus ta’lim texnikumlari o‘rtasidagi samarali hamkorlik kadrlar tayyorlash sifatini sezilarli darajada oshiradi. Ta’lim jarayonida nazariy bilimlar va amaliy ko‘nikmalar uyg‘unligini ta’minlash orqali bitiruvchilarning kasbiy kompetensiyalari shakllanadi.

O‘quv dasturlarini integratsiya qilish, dual ta’lim tizimini keng joriy etish, zamonaviy laboratoriya bazasini mustahkamlash hamda ish beruvchilar bilan hamkorlikni kuchaytirish asosiy ustuvor yo‘nalishlar sifatida belgilandi.

Shuningdek, ta’lim jarayoniga innovatsion texnologiyalarni tatbiq etish va xalqaro tajribani o‘rganish farmatsevt kadrlar tayyorlash samaradorligini oshiradi.

Natijada, raqobatbardosh, malakali va zamonaviy bilimlarga ega mutaxassislar tayyorlash imkoniyati kengayadi.

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ISSIQXONA SUG‘ORISH TIZIMLARINI AVTOMATLASHTIRISHDA ZAMONAVIY YONDASHUVLAR

Annotatsiya.*Mazkur ilmiy maqolada issiqxona xo‘jaliklarida sug‘orish jarayonlarini avtomatlashtirishning zamonaviy texnologik yondashuvlari, ularning texnik imkoniyatlari hamda qishloq xo‘jaligi samaradorligini oshirishdagi ahamiyati keng yoritilgan. Hozirgi davrda suv resurslarining cheklanganligi, global iqlim o‘zgarishlari va aholi sonining ortib borishi qishloq xo‘jaligida resurslardan oqilona foydalanishni taqozo etmoqda.*

Kalit so‘zlar:*Issiqxona xo‘jaligi, avtomatlashtirilgan sug‘orish tizimi, aqlli qishloq xo‘jaligi, IoT texnologiyasi, namlik sensori, mikrokontroller, tomchilatib sug‘orish, suv resurslari, Arduino, Raspberry Pi, sun’iy intellekt, agrotexnologiya, raqamli boshqaruv tizimi, ekologik samaradorlik.*

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MODERN APPROACHES TO THE AUTOMATION OF GREENHOUSE IRRIGATION SYSTEMS

Abstract. *This scientific article comprehensively examines modern technological approaches to the automation of irrigation processes in greenhouse farming, their technical capabilities, and their role in improving agricultural efficiency. In the context of limited water resources, global climate change, and continuous population growth, the rational use of resources in agriculture has become increasingly important.*

Keywords: *greenhouse farming, automated irrigation system, smart agriculture, Internet of Things (IoT), soil moisture sensor, microcontroller, drip irrigation, water resources, Arduino, Raspberry Pi, artificial intelligence, agrotechnology, digital control system, environmental efficiency.*

Kirish. Bugungi kunda dunyo miqyosida qishloq xo‘jaligi tarmog‘ida yuz berayotgan texnologik o‘zgarishlar agrar sohaning barcha yo‘nalishlariga sezilarli ta’sir ko‘rsatmoqda. Aholi sonining jadal sur’atlarda ortib borishi natijasida oziq-ovqat mahsulotlariga bo‘lgan talabning keskin oshishi, global iqlim o‘zgarishlari, yer va suv resurslarining cheklanishi qishloq xo‘jaligida innovatsion texnologiyalarni keng joriy etishni zarurat darajasiga olib chiqdi. Ayniqsa, suv resurslaridan samarali foydalanish masalasi dunyoning ko‘plab davlatlarida

strategik muammolardan biri sifatida e’tirof etilmoqda. Shu sababli qishloq xo‘jaligida suv tejovchi texnologiyalarni joriy etish, sug‘orish tizimlarini avtomatlashtirish hamda raqamli boshqaruv vositalaridan foydalanish dolzarb vazifalardan biri hisoblanadi.

Metodlar. An’anaviy sug‘orish usullarida inson omiliga bog‘liq kamchiliklar ko‘p uchraydi. Sug‘orish me’yorining noto‘g‘ri belgilanishi natijasida suvning ortiqcha sarfi, tuproq sho‘rlanishi yoki aksincha namlikning yetishmasligi kuzatiladi. Bunday holatlar o‘simlik rivojlanishiga salbiy ta’sir ko‘rsatib, hosildorlikning kamayishiga olib keladi. Bundan tashqari, qo‘lda boshqariladigan sug‘orish tizimlari ko‘p mehnat talab qiladi hamda katta maydonlarda samarali ishlash imkoniyatini cheklaydi. Shu sababli zamonaviy avtomatlashtirilgan sug‘orish tizimlariga ehtiyoj tobora ortib bormoqda.

Natijalar. Avtomatlashtirilgan sug‘orish tizimlari maxsus sensorlar, elektron boshqaruv qurilmalari va dasturiy ta’minot asosida ishlaydi. Ushbu tizimlarning asosiy vazifasi o‘simlikning suvga bo‘lgan ehtiyojini aniqlash va kerakli vaqtda optimal miqdorda suv yetkazib berishdan iboratdir. Bunda tuproq namligi sensori, harorat sensori, havoning nisbiy namligi sensori va suv bosimi datchiklari kabi qurilmalardan foydalaniladi. Ushbu sensorlardan olingan ma’lumotlar mikrokontrollerlarga uzatiladi va oldindan belgilangan algoritmlar asosida sug‘orish tizimi avtomatik boshqariladi.

Issiqxonalarda eng samarali sug‘orish usullaridan biri tomchilatib sug‘orish texnologiyasi hisoblanadi. Ushbu usulda suv maxsus quvurlar orqali to‘g‘ridan-to‘g‘ri o‘simlik ildiz qismiga yetkaziladi. Natijada suvning bug‘lanishi kamayadi, tuproqning ortiqcha namlanishi oldi olinadi va suv resurslaridan yuqori darajada samarali foydalaniladi. Tomchilatib sug‘orish tizimi avtomatlashtirilgan boshqaruv tizimlari bilan birgalikda qo‘llanilganda yanada yuqori samaradorlikka erishiladi.

Mikrokontrollerlar asosida yaratilgan avtomatlashtirilgan tizimlar iqtisodiy jihatdan ham samarali hisoblanadi. Arduino, ESP32 va Raspberry Pi kabi zamonaviy elektron platformalar yordamida nisbatan arzon, energiya tejamkor va yuqori aniqlikdagi boshqaruv tizimlarini yaratish mumkin. Ushbu qurilmalar sensorlardan ma’lumotlarni qabul qilib, suv nasoslari yoki elektromagnit klapanlarni avtomatik boshqaradi. Dasturiy algoritmlar yordamida sug‘orish vaqti, davomiyligi va suv miqdori aniq nazorat qilinadi.

Muhokama. So‘nggi yillarda sun’iy intellekt va mashinali o‘qitish texnologiyalarining rivojlanishi issiqxona boshqaruv tizimlarini yangi bosqichga olib chiqmoqda. Sun’iy intellekt asosidagi algoritmlar ob-havo ma’lumotlari, tuproq namligi, o‘simlikning vegetativ holati va boshqa ko‘rsatkichlarni tahlil qilib, optimal sug‘orish rejimini avtomatik ravishda shakllantiradi. Bu esa inson aralashuvini kamaytirib, tizimning mustaqil ishlash imkoniyatini oshiradi.

Avtomatlashtirilgan sug‘orish tizimlarining afzalliklari juda kengdir. Avvalo, bunday tizimlar suv sarfini sezilarli darajada kamaytiradi. Ikkinchidan, inson mehnati yengillashadi va vaqt tejaladi. Uchinchidan, o‘simliklar doimiy ravishda optimal namlik bilan ta’minlanganligi sababli hosildorlik ortadi. Bundan tashqari,

avtomatik tizimlar o‘simlik kasalliklari va tuproq sho‘rlanishining oldini olishda ham muhim rol o‘ynaydi.

O‘zbekiston Respublikasida ham qishloq xo‘jaligini modernizatsiya qilish va suv tejovchi texnologiyalarni keng joriy etishga alohida e’tibor qaratilmoqda. So‘nggi yillarda tomchilatib sug‘orish tizimlarini joriy etish, aqlli issiqxonalarni tashkil qilish hamda raqamli texnologiyalar asosida qishloq xo‘jaligini boshqarish bo‘yicha qator davlat dasturlari amalga oshirilmoqda. Bu esa mamlakatda qishloq xo‘jaligi samaradorligini oshirish, eksport salohiyatini kuchaytirish va ekologik barqarorlikni ta’minlashga xizmat qilmoqda.

Xulosalar. Tadqiqotlar va ilmiy tahlillar shuni ko‘rsatadiki, issiqxona sug‘orish tizimlarini avtomatlashtirish zamonaviy qishloq xo‘jaligida yuqori samaradorlikka erishishning eng muhim vositalaridan biri hisoblanadi. Avtomatlashtirilgan boshqaruv tizimlari yordamida o‘simliklarning suvga bo‘lgan ehtiyoji aniq belgilanishi, sug‘orish jarayonining optimallashtirilishi va suv resurslaridan oqilona foydalanish imkoniyati yaratiladi. Sensor texnologiyalari asosida ishlovchi tizimlar tuproq namligini doimiy ravishda nazorat qilish orqali o‘simlikning biologik ehtiyojiga mos ravishda suv yetkazib beradi. Bu esa suvning ortiqcha sarf bo‘lishining oldini olib, qishloq xo‘jaligida resurs tejamkorligini ta’minlaydi. Ayniqsa, tomchilatib sug‘orish texnologiyasi bilan integratsiyalashgan avtomatik tizimlar suvdan foydalanish samaradorligini bir necha barobar oshiradi. IoT texnologiyalarining qo‘llanilishi issiqxona boshqaruvini masofadan turib nazorat qilish imkonini yaratmoqda. Real vaqt rejimida ma’lumot almashinuvi, sensorlar orqali monitoring olib borish va mobil qurilmalar yordamida tizimni boshqarish qishloq xo‘jaligida raqamlashtirish jarayonining muhim yo‘nalishiga aylanmoqda.

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TERRITORIAL TOURISM-RECREATIONAL SYSTEMS: CONCEPT, ESSENCE, AND THE INTEGRATION OF GEOGRAPHIC, ECOLOGICAL AND ECONOMIC APPROACHES

Abstract. *Tourism-recreational activity, by its inherent geographic nature, manifests through the spatial integration of diverse natural, social, and economic elements. This conceptual review paper analyzes the genesis, theoretical-methodological foundations, and interdisciplinary integration underlying the Territorial Tourism-Recreational System (TTRS) concept, which has emerged as a central category at the intersection of recreational geography, tourism geography, and geoecology. Through comparative analysis of two parallel scientific traditions-the Soviet-era Territorial Recreational System (TRS) framework with its ecological-rehabilitative emphasis and the Western Tourism Territorial System (TTS) framework with its market-economic orientation-the paper traces the conceptual evolution leading to the contemporary TTRS paradigm. Drawing on General Systems Theory (von Bertalanffy), the geosystem concept (Sochava), and Social-Ecological Systems theory (Ostrom, Folke, Holling), this paper demonstrates how TTRS synthesizes ecological, economic, and social dimensions into a unified analytical framework. The differentiation of TTRS from adjacent concepts-tourism complex and Porter's tourism cluster-is critically examined. The analysis reveals that TTRS's principal methodological advantage lies in treating natural-geographic landscapes and socio-economic infrastructure as equal-status components, integrated through principles of ecological, economic, and social sustainability. This conceptual positioning makes TTRS particularly suitable for research within the specialization of environmental protection and the rational use of natural resources. The findings contribute to the theoretical foundation of sustainable tourism planning in transitional economies and provide a coherent analytical framework for territorial assessment of tourism-recreational potential.*

Keywords: *territorial tourism-recreational system, recreational geography, geosystem, social-ecological systems, sustainability, tourism cluster, geoecology, Fergana Valley.*

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HUDUDIY TURISTIK-REKREATSION TIZIMLAR TUSHUNCHASI, MOHIYATI VA GEOGRAFIK-EKOLOGIK-IQTISODIY YONDASHUVLAR INTEGRATSIYASI

Annotatsiya. *Turistik-rekreatsion faoliyat o‘zining tabiatan geografik mohiyatiga ko‘ra rang-barang tabiiy, ijtimoiy va iqtisodiy unsurlarning fazoviy integratsiyasi orqali namoyon bo‘ladi. Mazkur konseptual-tahliliy maqolada rekreatsion geografiya, turizm geografiyasi va geoekologiyaning kesishuvida markaziy kategoriya sifatida shakllangan hududiy turistik-rekreatsion tizim (HTRT) konsepsiyasining genezisi, nazariy-metodologik asoslari hamda fanlararo integratsiyasi tahlil etiladi. Ikki parallel ilmiy an’ana - ekologik-reabilitatsion yo‘nalishga urg‘u beruvchi sovet davri hududiy rekreatsion tizim (HRT) yondashuvi hamda bozor-iqtisodiy yo‘nalishga ega bo‘lgan g‘arb turistik hududiy tizim (THT) yondashuvining qiyosiy tahlili orqali maqolada zamonaviy HTRT paradigmasiga olib kelgan konseptual evolyutsiya kuzatib boriladi. Umumiy tizimlar nazariyasi (L. fon Bertalanfi), geotizim konsepsiyasi (V. Sochava) hamda ijtimoiy-ekologik tizimlar nazariyasiga (E.Ostrom, K.Folke, K.Holling) tayangan holda, ushbu maqolada HTRT ekologik, iqtisodiy va ijtimoiy o‘lchovlarni yagona analitik doirada qanday sintezlashtirishi ko‘rsatib beriladi. HTRTning yondosh tushunchalar - turistik kompleks va Porterning turistik klasteridan farqlanishi tanqidiy nuqtai nazardan ko‘rib chiqiladi. Tahlil natijalari shuni ko‘rsatadiki, HTRTning asosiy metodologik ustunligi tabiiy-geografik landshaftlar va ijtimoiy-iqtisodiy infratuzilmani teng maqomli komponentlar sifatida ko‘rib chiqib, ularni ekologik, iqtisodiy va ijtimoiy barqarorlik prinsiplari asosida birlashtirishida namoyon bo‘ladi. Mazkur konseptual asos HTRTni atrof-muhitni muhofaza qilish va tabiiy resurslardan oqilona foydalanish mutaxassisligi doirasidagi tadqiqotlar uchun ayniqsa qulay metodologik vositaga aylantiradi. Olingan natijalar o‘tish davri iqtisodiyotiga ega mamlakatlarda barqaror turizmni rejalashtirishning nazariy asoslarini boyitishga xizmat qiladi hamda turistik-rekreatsion salohiyatni hududiy baholash uchun izchil analitik doira taqdim etadi.*

Kalit so‘zlar: *hududiy turistik-rekreatsion tizim, rekreatsion geografiya, geotizim, ijtimoiy-ekologik tizimlar, barqarorlik, turistik klaster, geoekologiya, Farg‘ona vodiysi.*

1. Introduction

Contemporary tourism research increasingly recognizes that tourism-recreational activity cannot be adequately analyzed as a collection of isolated objects or services. Rather, it manifests through the spatial integration of diverse natural, social, and economic elements whose interaction generates emergent properties that cannot be reduced to the sum of their parts. The methodological necessity of analyzing such phenomena holistically has driven the formation of the Territorial Tourism-Recreational System (hereafter TTRS) concept within geographic science.

At present, TTRS constitutes a central category situated at the intersection of recreational geography, tourism geography, and geoecology. It serves as the theoretical core for territorial development strategies and ecological-recreational management. Nevertheless, the concept's interdisciplinary status has generated definitional ambiguity, with researchers from different scientific traditions emphasizing distinct components and operational meanings. The Soviet-era recreational geography tradition prioritized ecological-rehabilitative functions, whereas the Western tourism management tradition foregrounded market-economic mechanisms. The conceptual integration of these perspectives represents both an ongoing theoretical challenge and a methodological opportunity for sustainable tourism research.

The relevance of this conceptual clarification is heightened in transitional economies and rapidly urbanizing regions, where intensive tourism development frequently outpaces the establishment of ecological safeguards. In such contexts, an analytical framework that treats environmental quality as a constitutive system property-rather than as an external constraint upon economic optimization-becomes a prerequisite for sustainable territorial planning. The TTRS concept, as developed in this paper, is argued to provide precisely such a framework.

This paper aims to (1) systematically examine the conceptual genesis of TTRS; (2) clarify its theoretical-methodological foundations drawing upon General Systems Theory and Social-Ecological Systems frameworks; (3) compare and integrate the parallel traditions of Territorial Recreational System (TRS) and Tourism Territorial System (TTS); and (4) differentiate TTRS from adjacent concepts such as tourism complex and tourism cluster. The analysis is positioned within the disciplinary framework of environmental protection and the rational use of natural resources (geoecology), with particular relevance for sustainable tourism development in Central Asia.

2. Materials and methods

This study employs a comparative conceptual analysis methodology to trace the theoretical evolution and current understanding of the Territorial Tourism-Recreational System. Three categories of source materials were systematically examined:

(1) Foundational systems theory literature, including von Bertalanffy's General Systems Theory [2], Sochava's geosystem concept [18], Isachenko's landscape geography framework [7], Holling's resilience theory [6], and Ostrom's [12] and Folke's [4] Social-Ecological Systems works.

(2) Soviet-era and post-Soviet recreational geography literature, comprising the works of Preobrazhenskiy [15], Mironenko and Tverdokhlebov [10], Vedenin [19], Zorin and Kvartalnov [20], Birzhakov and Senin [3], Safiullin [16], and Sarancha [17], which collectively established the Territorial Recreational System framework and its subsequent extensions.

(3) Western tourism systems literature, including the seminal contributions of Leiper [8], Gunn [5], Mill and Morrison [9], Murphy [11], and Porter [13, 14], which articulated the Tourism Territorial System and tourism cluster frameworks.

The analytical procedure involved four sequential stages: (a) identifying the core conceptual elements of each tradition; (b) systematically comparing their methodological strengths and limitations; (c) examining points of convergence and divergence; and (d) synthesizing an integrated TTRS framework. Special attention was given to the ontological status of ecological versus economic components in each tradition, as this dimension proved central to differentiating contemporary approaches.

The comparative analysis was guided by four evaluation criteria: theoretical coherence (internal consistency of the framework), ecological substantiveness (treatment of environmental components), economic operationality (applicability to market and management contexts), and sustainability orientation (alignment with the United Nations Sustainable Development Goals).

3. Results

The methodological foundation of TTRS rests upon principles articulated by General Systems Theory. Bertalanffy [2], in his mid-twentieth-century formulation, established that any complex object must be examined not as a mere aggregation of parts but as an integrated whole of interacting components. The fundamental characteristics of systems within this framework include: holism (the emergence of properties exceeding the sum of components), hierarchical organization (the embeddedness of any system within higher- and lower-order systems), openness (exchange of matter, energy, and information with the environment), self-organization (internal dynamic ordering), and adaptive behavior (responsiveness to environmental change).

These principles found distinctive geographic interpretation through Sochava's [18] geosystem concept and Isachenko's [7] landscape-geographic framework. Sochava's geosystem concept directed attention to the territorial unity of natural and social components, establishing the fundamental basis for systems thinking in geography. TTRS subsequently developed precisely upon this systemic-geosystemic foundation, inheriting both its methodological rigor and its emphasis on territorial-component integration.

In modern scientific literature, the Social-Ecological Systems (SES) framework offers the most proximate theoretical scaffolding for TTRS. Developed during the 1990s and 2000s through the works of Ostrom [12] (recipient of the 2009 Nobel Memorial Prize in Economic Sciences) and Folke [4], the SES paradigm has become central to sustainability research. Within this framework, any natural system entangled with human activity exists in a bidirectional relationship: human action influences natural systems, and natural systems generate feedback that influences human behavior.

Holling's [6] resilience theory contributes a complementary dimension: resilience denotes a system's capacity to absorb external shocks and disturbances

while maintaining essential functional properties. Interpreting TTRS through the SES lens implies that tourism-recreational systems are neither purely economic nor purely ecological constructs, but rather unified social-ecological entities whose development is driven by interlinked human and natural dynamics. This integrative ontology is particularly significant for tourism research because it precludes the analytical reduction of either ecological degradation or economic underperformance to single-cause explanations.

The genesis of TTRS traces back to the Territorial Recreational System (TRS) concept developed within the Soviet geographic school during the 1960s and 1970s. The most prominent contributors include Preobrazhenskiy [15], Vedenin [19], Mironenko and Tverdokhlebov [10], and others. Preobrazhenskiy [15], in his foundational monograph on the theoretical foundations of recreational geography, established the categories of territorial recreational complex and recreational zoning, providing the basis for recreational geography as an autonomous scientific direction.

Preobrazhenskiy's TRS model comprises five interrelated subsystems: (1) recreational participants (recreants), (2) the natural and cultural-historical complex, (3) infrastructure, (4) service personnel, and (5) management bodies. Mironenko and Tverdokhlebov [10], in Recreational Geography (1981), defined the territorial recreational system as "the spatial unit where complexly interlinked recreational resources and the corresponding infrastructure of their utilization are located," and classified TRS hierarchically into micro-, meso-, and macro-recreational systems. Vedenin [19] further developed cultural-landscape theory and recreational zonation within the recreational geography framework.

The Soviet school's methodological strength lay in its integrated employment of field expeditions, landscape-ecological analysis, cartographic methods, and statistical assessment. A defining feature of the TRS approach is that recreational activity is examined within the balance between human and nature, with economic-market considerations remaining secondary. This emphasis constitutes both the school's principal strength-its high ecological substantiveness-and its constraint, given the inadequate attention to market dynamics characteristic of post-Soviet transitional economies.

The Tourism Territorial System (TTS) concept emerged primarily within Western scholarly literature and subsequently entered Russian-language geographic discourse. Leiper [8], in his 1979 article, presented the tourism system as a model of five fundamental components: tourists, the tourist generating region, transit routes, the tourist destination region, and the tourism industry. This model has remained one of the principal theoretical frameworks of tourism geography and constitutes the leading methodological instrument for analyzing the spatial movement of tourist flows.

Gunn [5] in Tourism Planning: Basics, Concepts, Cases (1988, 1994) developed the "functioning tourism system" model, in which demand (tourism market) and supply (attractions, transport, services, information, and promotion)

elements operate in mutual equilibrium. Mill and Morrison [9] in The Tourism System (1985) decomposed the tourism system into four principal components: market (demand), travel (flow), destination (supply), and marketing. Murphy [11] in Tourism: A Community Approach (1985) emphasized the necessity of analyzing tourism destinations from the perspective of host communities, thereby introducing a socio-communal dimension to TTS theory. In Russian tourism geography, Zorin and Kvartalnov [20] in their Tourism Encyclopedia highlighted that the tourism system constitutes an integral structure that also encompasses management institutions.

In the TTS approach, economic and market mechanisms, the management of tourist flows, and destination competitiveness occupy central analytical positions. However, the framework's notable weakness lies in its tendency to treat ecological considerations as an "additional criterion" rather than a structural component. Geoecological principles-including the finite character of natural resources and the carrying capacity of landscapes-are typically positioned as external constraints rather than as core analytical axes of the model.

The conceptual gap between the ecologically-grounded TRS approach and the economically-grounded TTS approach generated the need for an integrative framework, leading to the formation of the Territorial Tourism-Recreational System concept. The term "territorial tourism-recreational system" first appears in Russian-language literature in the works of Birzhakov and Senin [3] (1989), although their emphasis remained primarily on the recreational dimension. Mironenko and Trift in the 1990s subsequently expanded the interpretation, conceptualizing TTRS as a territorial space accommodating not merely health and leisure functions but all categories of tourist flows.

A contemporary formulation by Safiullin [16] presents TTRS as an integration of natural-geographic landscapes and socio-economic infrastructure-essentially as the intersection of TRS and TTS, where tourism and recreation achieve seamless integration on a unified territorial basis. Sarancha [17] defines TTRS as a complex social-natural geosystem in which societal and natural factors are organically interconnected, oriented toward satisfying human tourism-recreational needs while generating economic, social, cultural, ecological, and political outcomes.

Sarancha's approach proposes a multidimensional analysis of TTRS structured in four layers: (1) natural-resource base, (2) socio-demographic components, (3) economic infrastructure, and (4) management-institutional system. Building on this multilayered foundation, the textbook by Ahmadaliyev and Maxkamov [1] defines TTRS as "the territorial-organizational and functional integration of natural, cultural, and recreational resources, service infrastructure, management and economic mechanisms, as well as socio-economic actors engaged in the tourism sector."

The principal methodological advantage of TTRS lies in its treatment of natural-geographic landscapes and socio-economic infrastructure as equal-status

components, integrated through the principles of ecological, economic, and social sustainability. This balanced ontological positioning makes TTRS particularly suitable for analysis within the framework of environmental protection and rational use of natural resources (geoecology).

For conceptual clarity, TTRS must be distinguished from related notions, particularly "tourism complex" and "tourism cluster."

A tourism complex is a concept that emphasizes primarily material-technical infrastructure-hotels, transport, catering, entertainment facilities-and indicates a functional unity. However, its degree of systemic management and integration with the natural environment is not always sufficient. The complex is typically understood as an artificially designed, infrastructurally centralized aggregation of objects.

A tourism cluster draws upon cluster theory developed by Porter [13, 14] during the 1990s. It refers to a networked alignment of tourism enterprises and related sectors located in geographic proximity, operating according to principles of cooperation and competition ("co-opetition") and pursuing primarily economic efficiency. Porter's principal contribution to TTRS theory lies in introducing the concepts of innovation, competitiveness, and network synergy to the tourism sector.

The Territorial Tourism-Recreational System neither rejects nor merely combines these concepts; rather, it provides a more comprehensive conceptual envelope. Within the TTRS framework, both complex elements (infrastructural unity) and cluster elements (economic-network relationships) are present, but-unlike them-TTRS incorporates the ecological component and landscape diversity as equal-status constitutive elements, not as background conditions or external constraints.

4. Discussion

The conceptual integration achieved through TTRS offers several methodological and practical advantages. First, by treating ecological, economic, and social dimensions as ontologically equivalent rather than hierarchically ordered, TTRS aligns with contemporary sustainability paradigms, including the United Nations Sustainable Development Goals (particularly SDG 8 on decent work and economic growth, SDG 11 on sustainable cities and communities, SDG 12 on responsible consumption and production, and SDG 15 on life on land). Second, the framework's grounding in General Systems Theory and geosystem theory provides analytical rigor that supports quantitative assessment methods such as Integrated Sustainability Index calculations, Analytical Hierarchy Process (AHP) applications, and Geographic Information Systems-based spatial analysis.

The TTRS framework holds particular methodological promise for research within the specialization of environmental protection and the rational use of natural resources. Unlike the TTS framework, which positions ecological considerations as constraints upon economic optimization, TTRS treats environmental quality as a constitutive system property whose degradation undermines the system's long-term functional viability. This positioning is especially relevant for transitional

economies and rapidly urbanizing regions-such as Central Asian valleys with high population density and intensive land use-where the temptation to prioritize short-term tourism revenues at the expense of natural-resource integrity poses persistent challenges.

The differentiation from tourism cluster concepts also carries important implications. While clusters effectively model competitive dynamics among tourism enterprises, they typically lack the territorial-ecological grounding necessary for sustainable resource management. By contrast, TTRS preserves Porter's [13, 14] insights regarding innovation and network synergy while embedding them within a geosystemic-ecological framework that maintains analytical attention to natural-resource boundaries and landscape carrying capacities. In practical terms, this means that a TTRS-based assessment of a tourism destination would integrate metrics of competitive advantage with indicators of ecological resilience, water-resource availability, biodiversity status, and landscape diversity.

Several methodological challenges remain. The operationalization of TTRS in empirical research requires harmonizing data of fundamentally different epistemic statuses: quantitative economic indicators, qualitative ecological assessments, and socio-cultural data. Furthermore, the spatial resolution at which TTRS analysis is conducted-from local destinations to regional systems-influences which components are foregrounded and which are treated as boundary conditions. Future research should address standardization of TTRS-based indicators, integration with remote-sensing-based landscape monitoring, and longitudinal assessment of TTRS resilience under climate-change and demographic-pressure scenarios.

5. Conclusion

This conceptual review traced the genesis, theoretical-methodological foundations, and interdisciplinary positioning of the Territorial Tourism-Recreational System (TTRS) concept. Three principal findings emerge from the analysis. First, TTRS represents a conceptual synthesis of two historically parallel research traditions-the Soviet-era TRS with its ecological-rehabilitative emphasis and the Western TTS with its market-economic orientation. Second, the synthesis is theoretically grounded in General Systems Theory, the geosystem concept, and Social-Ecological Systems theory, providing TTRS with both methodological rigor and contemporary scientific legitimacy. Third, TTRS differs fundamentally from adjacent concepts such as tourism complex and tourism cluster by treating ecological dimensions as constitutive rather than secondary system properties.

The methodological advantage of TTRS-the equal-status treatment of natural-geographic landscapes and socio-economic infrastructure integrated through sustainability principles-makes the concept particularly suitable for research within environmental protection and the rational use of natural resources. For sustainable tourism planning in transitional economies, where rapid urbanization, demographic pressure, and ecological vulnerability coexist, the TTRS framework provides a

coherent analytical foundation. Future research priorities include the operationalization of TTRS-based indicators, integration with geospatial analytical methods, and empirical testing of TTRS resilience under varying environmental and economic scenarios.

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STRUCTURAL-FUNCTIONAL ORGANIZATION OF TERRITORIAL TOURISM-RECREATIONAL SYSTEMS BASED ON GOAL, GEOECOLOGICAL FUNCTION AND USAGE REGIME

Abstract. *The analysis of the internal structure of Territorial Tourism-Recreational Systems (TTRS) constitutes a central stage in understanding their essence and in developing practical management decisions. This paper presents an integrated structural-functional analysis of TTRS based on three interrelated analytical dimensions: goal (functional purpose), geoecological function, and usage regime. A four-stage analytical procedure-decomposition, attribution, relational analysis, and integrative synthesis-was applied to the TTRS framework. The analysis identifies (1) eight functional types of TTRS by goal (health-recreation, sport, cultural-educational, ecological, agritourism, religious pilgrimage, business-congress, smart-digital); (2) seven geoecological functions (etalon, ecological restoration, ecosystem services, biotic integration, climate-adaptive, environmental education, monitoring-indication); and (3) seven usage regimes (strict protection, restricted tourist, ecotourism, traditional tourist, intensive tourist, regenerative, smart-digital). The integration of these three dimensions enables multilayered profiling of each specific TTRS. A refined seven-element structural model is proposed-comprising central nodes, connecting corridors, buffer zones, demonstration objects, service infrastructure, management components, and digital platforms-operationalized for the Fergana Valley. The findings provide a methodological foundation for sustainable tourism planning grounded in geoecological principles and offer a practical instrument for territorial-level management decisions.*

Keywords: *territorial tourism-recreational system, structural-functional analysis, geoecological function, usage regime, sustainable tourism, regenerative tourism, smart tourism, Fergana Valley.*

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HUDUDIY TURISTIK-REKREATSION TIZIMLARNING MAQSADI, GEOEKOLOGIK FUNKSIYASI VA FOYDALANISH REJIMI ASOSIDAGI TARKIBIY-FUNKSIONAL TUZILISHI

Annotatsiya. *Hududiy turistik-rekreatsion tizimlar (HTRT)ning ichki tuzilishini tahlil etish ularning mohiyatini anglashda hamda amaliy boshqaruv qarorlarini ishlab chiqishda markaziy bosqich hisoblanadi. Mazkur maqolada HTRTning o‘zaro bog‘liq uchta analitik o‘lchov - maqsad (funksional vazifa), geoekologik funksiya va foydalanish rejimi asosidagi integratsiyalashgan struktur-funksional tahlili taqdim etiladi. HTRT yondashuviga to‘rt bosqichli analitik protsedura - dekompozitsiya, atributsiya, munosabatlar tahlili va integratsion sintez qo‘llanildi. Tahlil natijasida quyidagilar aniqlandi: (1) maqsadi bo‘yicha HTRTning sakkizta funksional turi (sog‘lomlashtirish-rekreatsion, sport, madaniy-ma’rifiy, ekologik, agroturizm, diniy ziyorat, biznes-kongress, aqlli-raqamli); (2) yettita geoekologik funksiya (etalon, ekologik tiklanish, ekotizim xizmatlari, biotik integratsiya, iqlimga moslashuvchi, ekologik ta’lim, monitoring-indikatsiya); hamda (3) yettita foydalanish rejimi (qat’iy muhofaza, cheklangan turistik, ekoturistik, an’anaviy turistik, jadal turistik, regenerativ, aqlli-raqamli). Mazkur uchta o‘lchovning integratsiyasi har bir aniq HTRTni ko‘p qatlamli profillash imkonini beradi. Maqolada takomillashtirilgan yetti elementli struktur model taklif etiladi - u markaziy tugunlar, bog‘lovchi koridorlar, bufer zonalar, namoyish obyektlari, xizmat infratuzilmasi, boshqaruv komponentlari va raqamli platformalarni o‘z ichiga oladi hamda Farg‘ona vodiysi misolida operatsionallashtirilgan. Olingan natijalar geoekologik prinsiplarga asoslangan barqaror turizmni rejalashtirish uchun metodologik asos yaratadi hamda hududiy darajadagi boshqaruv qarorlari uchun amaliy vosita taqdim etadi.*

Kalit so‘zlar: *hududiy turistik-rekreatsion tizim, struktur-funksional tahlil, geoekologik funksiya, foydalanish rejimi, barqaror turizm, regenerativ turizm, aqlli turizm, Farg‘ona vodiysi.*

1. Introduction

Analysis of the internal structure of Territorial Tourism-Recreational Systems (hereafter TTRS) represents a central stage both in achieving a deeper understanding of their essence and in developing practical management decisions. Structural-functional analysis has a long tradition within geographic research, originating in the geosystem teachings of Sochava [21] and Isachenko [6]. The essence of this approach involves examining a system bidirectionally-structurally (of what components is it composed?) and functionally (what tasks does it perform?).

The application of this methodology to TTRS yields two principal advantages. First, it reveals the system's internal hierarchy and the relationships among its components. Second, it identifies the role each component plays in the overall functioning of the system. While the foundational structural models of TTRS have been articulated by Preobrazhenskiy [18], Mironenko and Tverdokhlebov [13], Vedenin [26], and Sarancha [19], the integration of these classical formulations with contemporary geoecological imperatives-climate adaptation, biodiversity

conservation, regenerative tourism, and smart-digital transformation-remains an open theoretical task.

This paper addresses that task by proposing a three-dimensional analytical framework. The first dimension is the system's goal, which is externally oriented toward satisfying the needs of tourists and recreational participants. The second dimension is the geoecological function, oriented toward the natural environment and encompassing the conservation of landscapes, ecosystems, and biodiversity. The third dimension is the usage regime, expressed in terms of governance, legal norms, restrictions, and incentive mechanisms. When these three dimensions are unified within a single analytical framework, the genuine essence of TTRS becomes fully accessible to analysis.

The objectives of this study are (1) to articulate a methodologically rigorous structural-functional analysis of TTRS; (2) to classify TTRS along the three proposed dimensions and to identify the principal functional types within each; (3) to propose an integrated profile matrix enabling the systematic characterization of specific TTRSs; and (4) to operationalize a refined structural model for the case of the Fergana Valley, a region of high tourism-recreational potential in Central Asia.

2. Materials and methods

This study applies the four-stage structural-functional analytical procedure widely used in geographic research:

(1) Decomposition-disaggregating the system into its principal components; (2) attribution-assigning specific properties and functional roles to each component; (3) relational analysis-identifying direct, feedback, and reciprocal linkages among components; and (4) integrative synthesis-reconstructing how the components operate jointly as a coherent system. Each stage was applied to TTRS in sequence, with the resulting analytical artifacts-component lists, attribute tables, relationship matrices, and synthesis statements-serving as the basis for the three-dimensional classification developed below.

The source base of the analysis comprises three streams of literature. The first consists of foundational geosystemic and recreational-geographic works of the Soviet and post-Soviet schools, including Sochava [21], Isachenko [6], Preobrazhenskiy [18], Mironenko and Tverdokhlebov [13], Vedenin [26], Sarancha [19], and Majar [9]. The second comprises contemporary Uzbek geographic research focused on tourism, environmental management, and the Fergana Valley, including the works of Soliev [22], Abdulqosimov [1], Nigmatov [15], Sharipov [20], Nazarov [14], Tobirov [24], Abduganiyev [2], Usmanov [25], Mansurova [10], Komilova [7], and the author's prior research [3, 11]. The third stream encompasses international concepts and policy documents relevant to sustainable, regenerative, and smart tourism, including the Millennium Ecosystem Assessment [12], the Convention on Biological Diversity [4], the Paris Climate Agreement [16], the Limits of Acceptable Change (LAC) framework [23], and the relevant national policy instruments of Uzbekistan [5, 8].

The Fergana Valley-the empirical context to which the analytical framework is applied-is treated as a single tourism-recreational zone subdivided into three macro-regions corresponding to its three administrative oblasts (Andijan, Fergana, and Namangan). Within each macro-region, several meso-regions (mountain-recreational, valley cultural-historical, and steppe-recreational zones) are identified, which in turn contain micro-regions (individual districts and destinations) and, at the lowest hierarchical level, specific tourism objects.

3. Results

The structural analysis of TTRS begins with the identification of its principal components. Sarancha [19] distinguishes six core subsystems within the TTRS, which in the author's textbook [3] are presented as follows:

(1) The consumer subsystem comprises tourists and recreational participants, whose needs and activities provide the foundational rationale for the formation and operation of the entire system. (2) The natural-resource and environmental subsystem includes all natural objects that are used-or possess the potential to be used-for tourism and recreation. (3) The settlement subsystem encompasses not only the lifestyle of the local population but also the source pool of potential domestic tourists and the labor base for the tourism sector. (4) The social-relations subsystem comprises the social environment of the region-traditions, ethnic and religious characteristics, social values-governing interactions between tourists and local communities. (5) The production (economic) subsystem includes all sectors of economic activity within the region (agriculture, industry, services). (6) The infrastructure and management subsystem encompasses transport, communications, accommodation facilities, leisure venues, institutions, and local and regional tourism-development agencies [3].

Usmanov [25] introduced the concept of "territorial tourism complex" (TTC), defining it as a structural unit that expresses the coordinated development and management of diverse tourism objects on a unified infrastructural foundation at the local scale. As emphasized in the author's textbook [3], "a territorial tourism-recreational system is a complex system consisting of multiple components, whose successful operation depends on the balanced development of all constituent subsystems. For instance, even if the natural-resource subsystem is rich, if the infrastructure and management subsystem is weak or the social environment is unfavorable, tourism will not develop fully. For this reason, an integrated, intersectoral approach is necessary in studying TTRS."

Majar [9] complements this static taxonomy with a dynamic analysis of component interactions: flows of matter, energy, and information among components generate the emergent properties of the system. Within this framework, the true essence of TTRS is revealed not in the aggregation of components but in their interactions. Tobirov [24], examining the case of the Fergana Valley, demonstrated the integration of natural, economic, and anthropogenic components within geosystems used for tourism.

The second structural dimension is the territorial-hierarchical division of TTRS. Mironenko and Tverdokhlebov [13] subdivided territorial recreational systems into five taxonomic units: recreational zone (macro-regional), recreational region (macro-region), recreational sub-region, recreational micro-region, and recreational point. Usmanov [25] adapted this classification to TTRS as follows: tourism-recreational zone (regional level), tourism macro-region, tourism meso-region, tourism micro-region, and tourism object (a discrete spatial node). Applied to the Fergana Valley, the entire valley is treated as a single tourism-recreational zone; within it, three macro-regions correspond to the Andijan, Fergana, and Namangan tourism complexes; each macro-region is subdivided into meso-regions (mountain-recreational, valley cultural-historical, steppe-recreational); within meso-regions, individual districts and destinations constitute micro-regions; and at the most granular level, specific tourism objects such as the Shokhimardon recreational complex, the Arslanbob walnut grove, the Rishton ceramics center, and the Margilan "Yodgorlik" silk-weaving factory are positioned.

The first functional dimension classifies TTRS according to its goal. The goal of any TTRS is directed toward satisfying specific needs of tourists and recreational participants, and on this basis the following eight functional types may be distinguished.

(1) Health-recreation TTRS aim at restoring human health and replenishing mental and physical capacity. Examples include balneological resorts (Chimyon, Yangiobod), climatotherapy zones (mountain areas), and sanatoria. (2) Sport and active tourism TTRS focus on mountain hiking, alpine skiing, water sports, alpinism, and other active forms; in the Fergana Valley these include the Shokhimardon-Yordon area, Arslanbob, and Chodak. (3) Cultural-educational TTRS are organized around historical monuments, museums, craft centers, and ethnographic complexes, with Margilan, Quva, Rishton, and Andijan occupying leading positions in the Fergana Valley.

(4) Ecological tourism TTRS are oriented toward observing natural ecosystems, becoming acquainted with biological diversity, and acquiring environmental education; such systems form around protected natural areas. (5) Agritourism and rural TTRS are based on engagement with traditional rural life, national cuisine, and farming. (6) Religious pilgrimage TTRS are oriented toward visits to sacred sites in the Fergana Valley. Komilova [7] analyzed the contemporary pilgrimage-site system of the valley within the framework of four ethnolandscape zones and seventeen ethnoecological districts.

(7) Business and congress TTRS focus on professional meetings, conferences, and exhibitions. (8) Smart and digital TTRS represent novel forms of tourism integrated with contemporary digital technologies and virtual experiences. A practical manifestation of this category may be observed in the "Eco Fergana" mobile application proposed by Khakimova, Abduhalilov, and Mamanazarova. The classification holds considerable operational significance, as each functional type requires a distinct infrastructure, workforce profile, and marketing strategy. In the

author's earlier doctoral research [11], this classification was applied to the administrative-territorial units of Fergana Province along seven directions: recreational tourism, historical-cultural acquaintance tourism, pilgrimage tourism, natural-acquaintance tourism, agritourism, craft and shopping tourism, and sport tourism.

The second functional dimension-and the most analytically central for the geoecological orientation of TTRS research-is the geoecological function of the system. The geoecological function expresses the impact of TTRS on the natural environment and the role TTRS plays within it. Drawing upon the methodology developed by Abduganiyev [2] for protected natural areas and adapting it to TTRS, seven geoecological functions are distinguished.

(1) The etalon (reference) function characterizes TTRS that occupy undisturbed or minimally anthropogenically influenced exemplary tracts of natural landscapes; such systems serve as scientific reference benchmarks. They are located within the cores of protected natural areas (strict nature reserves) and admit only limited tourist activity, such as ecotourist trails and observation towers. In the Fergana Valley, the Chatkal Biosphere Reserve and adjacent specially protected natural territories perform this function.

(2) The ecological-restoration function applies to TTRSs that contribute to the restoration of landscapes affected by anthropogenic disturbance but retaining recovery potential. Revenues from tourism are reinvested in landscape restoration-an applied expression of the contemporary concept of regenerative tourism [17]. Nazarov [14] proposed a set of practical measures for ecological restoration in the Fergana Valley-improvement of soil structure, crop rotation, and erosion control-each of which can be integrated with tourism activity.

(3) The ecosystem-services function emphasizes TTRS as a mechanism for converting the services obtained from natural ecosystems-water purification, air quality, microclimate regulation, biodiversity-into economic value. This function rests on concepts developed by the Millennium Ecosystem Assessment [12] and the Convention on Biological Diversity [4]. (4) The biotic-integration function captures the role of TTRS in conserving biodiversity, supporting species reproduction, and facilitating migration. Particular attention is given to the formation of ecological corridors, ecocanals, and eco-bridges-elements of the ecological framework proposed by Abduganiyev [2].

(5) The climate-adaptive function manifests the adaptive capacity of TTRS under climate change and positions such systems as models of climate adaptation for the population: green energy, water-saving technologies, and carbon-neutral infrastructure. This function aligns with the 2015 Paris Climate Agreement [16] and the national strategy for transitioning Uzbekistan to a green economy in 2019–2030 [5]. (6) The environmental-education function characterizes TTRS that serve not only tourists but also the local population and future generations as agents forming environmental awareness and ecological culture. This function relates closely to the social mechanisms of landscape diversity conservation analyzed by Sharipov [20]

in the context of Tashkent Province. (7) The monitoring-indication function positions TTRS objects as indicators for tracking changes in the geoecological situation: tourist-flow dynamics, landscape quality, and ecosystem-parameter trends serve as evidentiary inputs for the assessment of the regional ecological state.

The third functional dimension is the usage regime, defined by the intensity of tourist activity, its spatial-temporal characteristics, and its legal restrictions. Seven principal usage regimes may be distinguished.

(1) Strict protection regime sharply limits tourist activity to scientific and educational purposes carried out under prior authorization. This regime applies to the cores of protected natural areas and is regulated under the Law of the Republic of Uzbekistan on Specially Protected Natural Areas [8]. (2) Restricted tourist use regime permits tourist activity under specified limitations (caps on visitor numbers, restricted activity types, seasonal limits). This regime applies to the buffer zones of biosphere reserves and to the service zones of national parks. The Limits of Acceptable Change (LAC) model [23], considered by Mansurova [10], provides a practical methodology for setting such limits.

(3) Ecotourism regime structures tourist activity so as to minimize impact on the natural environment in accordance with ecological standards. This regime is regulated under the relevant decree of the Cabinet of Ministers of the Republic of Uzbekistan and is implemented within the framework of a national ecotourism development program. (4) Traditional tourist regime is the most widespread, encompassing standard commercial tourist activity: hotels, excursion services, transport, and food services. The principal evaluative criteria here are economic efficiency and service quality.

(5) Intensive tourist regime applies to areas of high tourist flow and concentration-major tourism centers, World Heritage objects-and requires specialized management mechanisms, including flow distribution, seasonal management, and capacity control instruments. (6) Restoration and regenerative regime channels tourist activity toward the restoration of landscapes and local communities. The regenerative tourism concept developed by Pollock [17] and other contemporary researchers provides the theoretical foundation of this regime. (7) Smart and digital regime relies on digital technologies-mobile applications, the Internet of Things (IoT), and artificial intelligence (AI)-to optimize TTRS functioning, manage carrying capacity in real time, and create personalized tourist experiences. Mansurova [10] articulated practical mechanisms for this regime through proposals for a "Smart Tourism Data System" laboratory and a "Sustainable Tourism" statistical platform.

The genuine structural-functional organization of TTRS is revealed through the integration of the three preceding dimensions-goal, geoecological function, and usage regime. These dimensions do not substitute for one another but rather complement one another, jointly constituting a multilayered profile of TTRS. The practical significance of such integration lies in its capacity to define specific characteristics for each particular TTRS.

By way of illustration, the Shokhimardon tourism complex may be characterized along these three dimensions as follows. By goal: mountain-recreational and sport tourism (partly ecological). By geoecological function: etalon and biotic-integration functions. By usage regime: restricted tourist and ecotourism regimes. This composite profile supports concrete management decisions: which types of infrastructure should be developed, how much tourist flow may be admitted, and which ecological measures must be implemented.

The integrated approach permits the construction of a profile matrix for each TTRS, in which the relevant characteristics along the three dimensions are recorded. As noted in the author's textbook [3], the assessment of TTRS within this matrix must encompass two principal geoecological aspects: (1) the suitability of natural conditions for recreational processes (resource potential and constraints), and (2) the magnitude of the environmental impact of anthropogenic tourism-recreational pressure. The first aspect is evaluated through analysis of the natural-resource characteristics of the territory (climate, landscape, biodiversity, water objects, aesthetic value). The second aspect requires analysis of existing and projected tourist-flow volumes and the ecological changes they generate (soil compaction, vegetation cover damage, increased waste output) [3].

In the author's doctoral research [11], the integrative linkage among these three dimensions was applied to Fergana Province through ArcGIS mapping, resulting in a four-tier typology (very high, high, medium, low) for the administrative-territorial units of the province. Tobirov [24] proposed a GIS-based methodology for classifying tourism objects in the Fergana Valley, and its integration with the present three-dimensional classification yields a more comprehensive synthesis.

Building upon the preceding analysis, an enhanced structural-functional model of TTRS is proposed. This model is composed of seven elements:

(1) Central nodes-the principal objects and destinations of highest tourism potential (Margilan, Quva, Rishton, Shokhimardon). (2) Connecting corridors-routes, transport pathways, and tourist trails linking the nodes. (3) Buffer zones-zones of moderated growth and managed access surrounding the central objects. (4) Demonstration (key) objects-the most distinctive and characteristic components of the system. (5) Service infrastructure-hotels, transport, food services, and visitor services. (6) Management-administrative components-state and private management bodies and the relevant legislative agencies. (7) Information and digital platforms-the database of information and services accessible to tourists.

This seven-element model functions as a TTRS-scale expression of Abduganiyev's [2] ecological-framework model-comprising central nodes, ecological corridors, restoration areas, and buffer zones-and is proposed as its refined extension. The model preserves the ecological logic of the original framework while integrating the management, service, and digital components essential for operational TTRS functioning.

4. Discussion

The three-dimensional structural-functional framework developed in this paper offers several methodological contributions to TTRS research. First, by treating goal, geoecological function, and usage regime as orthogonal but complementary axes, the framework supports a more nuanced classification than single-axis typologies (purely by goal or purely by usage regime) that have predominated in earlier literature. Each individual TTRS receives a composite profile that captures simultaneously what it is intended to achieve, how it interacts with its natural environment, and under what managerial regime it operates.

Second, the framework explicitly elevates the geoecological function to equal analytical status with the goal-functional dimension. In much of the earlier tourism-systems literature, ecological considerations have been treated either as background conditions or as constraints upon economic optimization. By contrast, the seven geoecological functions identified here-etalon, ecological restoration, ecosystem services, biotic integration, climate-adaptive, environmental education, and monitoring-indication-position the ecological dimension as a primary functional axis. This positioning aligns the framework with the discipline of environmental protection and rational use of natural resources, providing a coherent foundation for geoecological research on tourism.

Third, the inclusion of regenerative and smart-digital regimes among the seven usage regimes reflects the most recent theoretical and technological developments in tourism research. Regenerative tourism, articulated by Pollock [17] and subsequent contributors, challenges the conventional sustainability paradigm by requiring tourism activity not merely to minimize harm but actively to restore landscapes and communities. The smart-digital regime captures the rapidly expanding role of mobile applications, IoT-based monitoring, and AI-driven personalization in destination management. The framework therefore remains open to ongoing theoretical evolution rather than fixing TTRS analysis in static categories.

Fourth, the proposed seven-element structural model offers a practical instrument for territorial planning. Its constituent elements-central nodes, connecting corridors, buffer zones, demonstration objects, service infrastructure, management components, and digital platforms-correspond directly to categories of intervention available to regional and municipal authorities. The model thus bridges the gap between abstract systems analysis and concrete planning decisions, an integration that has been identified as a persistent weakness in earlier TTRS literature.

Several limitations and avenues for further research should be acknowledged. First, the operationalization of the framework in empirical research requires harmonizing data of fundamentally different epistemic statuses: quantitative economic indicators, qualitative ecological assessments, GIS-based spatial data, and socio-cultural information. Second, the relative weights to be assigned to the three dimensions when constructing composite indices may vary across contexts-

mountainous versus lowland regions, mass-tourism versus niche destinations-and standardization remains an open question. Third, the resilience of the proposed framework under climate-change and demographic-pressure scenarios warrants empirical testing through longitudinal case studies.

5. Conclusion

This study has analyzed the structural-functional organization of Territorial Tourism-Recreational Systems through three interrelated criteria. First, with respect to goal, eight functional types have been identified: health-recreation, sport, cultural-educational, ecological, agritourism, religious pilgrimage, business-congress, and smart-digital tourism. Second, with respect to geoecological function, seven functional dimensions have been distinguished: etalon, ecological-restoration, ecosystem-services, biotic-integration, climate-adaptive, environmental-education, and monitoring-indication. Third, with respect to usage regime, seven regimes have been articulated: strict protection, restricted tourist, ecotourism, traditional tourist, intensive tourist, regenerative, and smart-digital.

The integration of these three dimensions enables the construction of a multilayered profile for any specific TTRS and provides a methodological foundation for concrete management strategies. The refined seven-element structural model-central nodes, connecting corridors, buffer zones, demonstration objects, service infrastructure, management components, and digital platforms-has been adapted for practical application in the conditions of the Fergana Valley. The results synthesize the classical conceptual framework of the post-Soviet recreational geography school (Preobrazhenskiy, Mironenko, Tverdokhlebov, Vedenin, Majar, Sarancha) with the contributions of contemporary Uzbek scholars (Soliev, Abdulqosimov, Nigmatov, Usmanov, Tobirov, Nazarov, Abduganiyev, Mansurova, Sharipov) and with international contemporary concepts-sustainable tourism, smart tourism, regenerative tourism, and climate-adaptive tourism.

Future research priorities include the empirical operationalization of the framework through multi-criteria decision-analysis methods such as the Analytical Hierarchy Process; the integration of remote-sensing-based landscape monitoring with the geoecological-function classification; the development of standardized indicators for each of the three dimensions; and the application of the framework to comparative international case studies, beginning with the mountain-valley regions of Central Asia.

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MAHALLIY DORIVOR O‘SIMLIK XOMASHYOLARIDAN SAMARALI DORI VOSITALARI YARATISH – IMPORT O‘RNINI BOSUVCHI PREPARATLAR

Annotatsiya: *Ushbu maqolada mahalliy dorivor o‘simlik xomashyolari asosida samarali dori vositalarini yaratishning ilmiy va amaliy ahamiyati yoritilgan. Respublikamiz hududida uchraydigan dorivor o‘simliklarning biologik faol moddalarga boyligi, ulardan farmatsevtika sanoatida foydalanish imkoniyatlari hamda import o‘rnini bosuvchi preparatlar ishlab chiqarish istiqbollari tahlil qilingan. Tadqiqot davomida fitokimyoviy, farmakologik va texnologik usullar asosida o‘simlik xomashyolarining tarkibi o‘rganilib, mahalliy preparatlarning samaradorligi baholangan. Natijalarga ko‘ra, dorivor o‘simliklardan tayyorlangan preparatlar iqtisodiy jihatdan arzon, ekologik xavfsiz va terapevtik samaradorligi yuqori ekanligi aniqlangan.*

Kalit so‘zlar: *Dorivor o‘simliklar, fitopreparatlar, biologik faol moddalar, farmatsevtika, import o‘rnini bosuvchi preparatlar, fitoterapiya, mahalliy xomashyo, flavonoidlar, alkaloidlar, ekstraktlar.*

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DEVELOPMENT OF EFFECTIVE MEDICINAL PRODUCTS FROM LOCAL MEDICINAL PLANT RAW MATERIALS: IMPORT-SUBSTITUTING PREPARATIONS

Abstract: *This article highlights the scientific and practical significance of developing effective medicinal products based on local medicinal plant raw materials. The study analyzes the richness of medicinal plants growing in the territory of the Republic of Uzbekistan in biologically active compounds, the possibilities of their utilization in the pharmaceutical industry, and the prospects*

for producing import-substituting medicinal products. During the research, the composition of plant raw materials was investigated using phytochemical, pharmacological, and technological methods, and the effectiveness of locally produced preparations was evaluated. The results demonstrated that medicinal products derived from medicinal plants are economically affordable, environmentally safe, and possess high therapeutic efficacy.

***Keywords**: Medicinal plants, phytopreparations, biologically active compounds, pharmaceuticals, import-substituting preparations, phytotherapy, local raw materials, flavonoids, alkaloids, extracts.*

Dolzarbligi

Bugungi kunda farmatsevtika sanoatida import qilinadigan dori vositalarining ulushi yuqori bo‘lib qolmoqda. Bu esa iqtisodiy xarajatlarning ortishiga hamda ayrim hollarda dori vositalari ta’minotida muammolar yuzaga kelishiga sabab bo‘lmoqda. Shu sababli mahalliy xomashyo asosida import o‘rnini bosuvchi dori preparatlarini yaratish dolzarb vazifalardan biri hisoblanadi.

O‘zbekiston florasi dorivor o‘simliklarga juda boy bo‘lib, ularning ko‘pchiligi qadimdan xalq tabobatida qo‘llanib kelinadi. Jumladan, yalpiz, moychechak, qizilmiya, zubturum, isiriq, chakanda kabi o‘simliklar biologik faol moddalarga boyligi bilan ajralib turadi. Ushbu o‘simliklardan zamonaviy texnologiyalar asosida yuqori samaradorlikka ega preparatlar ishlab chiqarish milliy farmatsevtika rivojiga xizmat qiladi.

Mahalliy dorivor o‘simliklar asosida dori vositalari yaratish nafaqat iqtisodiy samaradorlikni oshiradi, balki ekologik xavfsizlikni ta’minlash, yangi ish o‘rinlarini yaratish hamda aholini arzon va sifatli dori vositalari bilan ta’minlash imkonini beradi.

Tadqiqot ishlari

Tadqiqot davomida O‘zbekiston hududida keng tarqalgan ayrim dorivor o‘simliklar tanlab olindi va ularning kimyoviy tarkibi hamda farmakologik xususiyatlari o‘rganildi. Xususan, qizilmiya ildizi, moychechak gullari, chakanda mevasi va zubturum barglari asosiy tadqiqot obyekti sifatida tanlandi.

Ilmiy izlanishlarda ushbu o‘simliklardan biologik faol moddalarni ajratib olish, ekstraktlar tayyorlash va ularning mikroblarga qarshi, yallig‘lanishga qarshi hamda antioksidant xususiyatlarini aniqlash bo‘yicha tajribalar olib borildi. Shuningdek, tayyorlangan preparatlarning toksikologik xavfsizligi va saqlanish barqarorligi ham tahlil qilindi.

Tadqiqot usullari

Tadqiqot jarayonida quyidagi usullardan foydalanildi:

Fitokimyoviy tahlil usullari;

Spektrofotometrik va xromatografik analiz;

Laboratoriya sharoitida ekstraksiya usuli;

Farmakologik sinovlar;

Mikrobiologik tekshiruvlar;

Statistik tahlil usullari.

O‘simlik xomashyolaridan suvli va spirtli ekstraktlar olinib, ularning biologik faol moddalarga boyligi aniqlangan. Preparatlarning farmakologik ta’siri laboratoriya tajribalari asosida baholangan.

Tadqiqot natijalari

Olib borilgan tadqiqotlar natijasida mahalliy dorivor o‘simliklar tarkibida flavonoidlar, efir moylari, alkaloidlar, saponinlar va vitaminlarning yuqori miqdorda mavjudligi aniqlandi. Ayniqsa, chakanda mevasi tarkibidagi antioksidant moddalar organizm immun tizimini mustahkamlashda muhim ahamiyat kasb etishi kuzatildi.

Qizilmiya ildizi asosida tayyorlangan preparatlar yallig‘lanishga qarshi va balg‘am ko‘chiruvchi ta’sir ko‘rsatdi. Moychechak ekstrakti antiseptik va tinchlantiruvchi xususiyatlarga ega ekanligi tasdiqlandi. Zubturum bargi ekstrakti esa yara bitkazuvchi va mikroblarga qarshi samaradorlik namoyon etdi.

Mahalliy xomashyo asosida tayyorlangan fitopreparatlar ayrim import preparatlariga nisbatan iqtisodiy jihatdan arzonroq bo‘lishi bilan birga, terapevtik samaradorligi yuqori ekanligi aniqlandi. Shu bilan birga, ularni ishlab chiqarish uchun mahalliy resurslarning mavjudligi farmatsevtika sanoatini rivojlantirishda muhim omil bo‘lib xizmat qiladi.

Xulosa

Mahalliy dorivor o‘simlik xomashyolari asosida samarali dori vositalarini yaratish farmatsevtika sanoatining muhim yo‘nalishlaridan biridir. O‘zbekiston florasidagi dorivor o‘simliklar biologik faol moddalarga boy bo‘lib, ular asosida import o‘rnini bosuvchi fitopreparatlar ishlab chiqarish katta istiqbolga ega.

Tadqiqot natijalari mahalliy o‘simliklardan olingan preparatlarning terapevtik samaradorligi yuqori, iqtisodiy jihatdan maqbul va ekologik xavfsiz ekanligini ko‘rsatdi. Kelgusida ushbu yo‘nalishda ilmiy izlanishlarni kengaytirish, yangi preparatlar yaratish va ularni sanoat miqyosida ishlab chiqarishni yo‘lga qo‘yish muhim ahamiyat kasb etadi.

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DORIVOR O‘SIMLIKLARNI YETISHTIRISH VA EKOLOGIK TOZA XOMASHYO OLISH MUAMMOLARI: AGROTEXNIKA VA IQLIM O‘ZGARISHI TA’SIRI

Annotatsiya: *Ushbu maqolada dorivor o‘simliklarni yetishtirish jarayonida uchraydigan asosiy agrotexnik muammolar hamda iqlim o‘zgarishining o‘simlik xomashyosining sifati va hosildorligiga ta’siri yoritilgan. Dorivor o‘simliklarni ekologik toza usullarda yetishtirish, tuproq unumdorligini saqlash, suv resurslaridan oqilona foydalanish hamda biologik himoya vositalarini qo‘llashning ahamiyati tahlil qilingan. Shuningdek, global iqlim o‘zgarishi natijasida yuzaga kelayotgan qurg‘oqchilik, haroratning ortishi va ekologik stress omillarining biologik faol moddalarga ta’siri ko‘rib chiqilgan. Tadqiqot natijalari ekologik xavfsiz va sifatli dorivor xomashyo olish uchun zamonaviy agrotexnologiyalarni qo‘llash muhimligini ko‘rsatadi.*

Kalit so‘zlar: *Dorivor o‘simliklar, ekologik toza xomashyo, agrotexnika, iqlim o‘zgarishi, biologik faol moddalar, organik dehqonchilik, fitoterapiya, tuproq unumdorligi, qurg‘oqchilik, ekologik xavfsizlik.*

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CULTIVATION OF MEDICINAL PLANTS AND CHALLENGES OF OBTAINING ECOLOGICALLY CLEAN RAW MATERIALS: THE IMPACT OF AGRICULTURAL PRACTICES AND CLIMATE CHANGE

Abstract: *This article examines the main agrotechnical challenges encountered in the cultivation of medicinal plants and the impact of climate change on the quality and productivity of plant raw materials. The importance of environmentally friendly cultivation methods, maintaining soil fertility, rational use*

of water resources, and the application of biological plant protection measures is analyzed. In addition, the effects of global climate change, including drought, rising temperatures, and environmental stress factors, on the content of biologically active compounds in medicinal plants are discussed. The findings indicate that the implementation of modern agricultural technologies is essential for obtaining environmentally safe and high-quality medicinal plant raw materials.

Keywords: *Medicinal plants, environmentally clean raw materials, agrotechnics, climate change, biologically active compounds, organic farming, phytotherapy, soil fertility, drought, environmental safety.*

Dolzarbligi

Bugungi kunda dunyo miqyosida tabiiy dori vositalariga bo‘lgan ehtiyoj tobora ortib bormoqda. Aholi orasida fitoterapiyaga qiziqishning kuchayishi dorivor o‘simlik xomashyolariga talabni sezilarli darajada oshirdi. Shu bilan birga, ekologik jihatdan toza va xavfsiz mahsulot yetishtirish muammosi dolzarb masalaga aylanmoqda. Kimyoviy o‘g‘itlar va pestitsidlarning ortiqcha qo‘llanilishi dorivor o‘simliklarning biologik faol moddalari tarkibiga salbiy ta’sir ko‘rsatishi mumkin. Bundan tashqari, iqlim o‘zgarishi natijasida kuzatilayotgan harorat oshishi, suv tanqisligi va tuproq degradatsiyasi hosildorlikka hamda o‘simliklarning farmakologik sifatiga salbiy ta’sir qilmoqda. Shu sababli ekologik toza dorivor xomashyo olish texnologiyalarini takomillashtirish muhim ilmiy-amaliy ahamiyatga ega.

Tadqiqot ishlari

Tadqiqot davomida dorivor o‘simliklarni ekologik toza usullarda yetishtirish bo‘yicha ilmiy manbalar va amaliy tajribalar o‘rganildi. Ayniqsa, moychechak, yalpiz, qizilmiya, zubturum va na’matak kabi keng qo‘llaniladigan dorivor o‘simliklarning agrotexnik xususiyatlari tahlil qilindi. Tadqiqotlarda organik o‘g‘itlardan foydalanish, tomchilatib sug‘orish texnologiyasi hamda biologik himoya usullarining samaradorligi baholandi.

Shuningdek, turli iqlim sharoitlarida o‘simliklarning o‘sishi va biologik faol moddalar miqdoridagi o‘zgarishlar kuzatildi. Haroratning ortishi va namlikning kamayishi ayrim o‘simliklarda efir moylari miqdorini oshirishi, ammo umumiy hosildorlikni pasaytirishi aniqlangan.

Tadqiqot usullari

Tadqiqot jarayonida quyidagi usullardan foydalanildi:

Agrotexnik kuzatuv usuli;

Laboratoriya tahlillari;

Tuproq va suv sifatini baholash;

Biologik faol moddalarni aniqlash;

Statistik tahlil usullari.

Dorivor o‘simliklarning ekologik holatini baholashda ularning o‘sish sur’ati, hosildorligi, barg va ildiz tarkibidagi faol moddalar miqdori o‘rganildi. Organik va an’anaviy yetishtirish usullari o‘zaro solishtirildi.

Tadqiqot natijalari

Tadqiqot natijalari ekologik toza agrotexnologiyalar dorivor o‘simliklarning sifatini yaxshilashini ko‘rsatdi. Organik o‘g‘itlardan foydalanilgan maydonlarda tuproq unumdorligi oshgani va biologik faol moddalar miqdori yuqoriroq bo‘lgani kuzatildi. Ayniqsa, biohumus va kompost qo‘llanilganda o‘simliklarning ekologik stressga chidamliligi ortgani aniqlandi.

Tomchilatib sug‘orish usuli suv sarfini kamaytirish bilan birga hosildorlikni saqlab qolishga yordam berdi. Biologik himoya vositalari kimyoviy pestitsidlar qo‘llanishini qisqartirib, ekologik xavfsizlikni ta’minladi.

Iqlim o‘zgarishi esa dorivor o‘simliklar rivojlanishiga sezilarli ta’sir ko‘rsatmoqda. Qurg‘oqchilik va yuqori harorat ayrim hududlarda hosildorlikni pasaytirgan. Ayrim o‘simliklarda biologik faol moddalar konsentratsiyasi oshgan bo‘lsa-da, umumiy biomassa kamaygani sababli xomashyo hajmi qisqargan. Bundan tashqari, tuproq sho‘rlanishi va suv tanqisligi dorivor o‘simliklar plantatsiyalarini kengaytirishga to‘sqinlik qilmoqda.

Xulosa

Dorivor o‘simliklarni ekologik toza usullarda yetishtirish bugungi kunning muhim vazifalaridan biridir. Agrotexnik tadbirlarni to‘g‘ri tashkil etish, organik o‘g‘itlardan foydalanish, suvni tejovchi texnologiyalarni joriy qilish va biologik himoya usullarini qo‘llash sifatli dorivor xomashyo olish imkonini beradi. Iqlim o‘zgarishi bilan bog‘liq salbiy omillarni kamaytirish uchun moslashuvchan agrotexnologiyalar ishlab chiqilishi zarur. Ekologik xavfsiz va farmakologik jihatdan sifatli dorivor o‘simlik xomashyolarini yetishtirish sog‘liqni saqlash hamda farmatsevtika sanoatini rivojlantirishda muhim ahamiyatga ega.

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THE DEVELOPMENT OF UZBEK TOURISM TERMINOLOGY: LINGUOCULTURAL AND COMPARATIVE APPROACH

Abstract: *Global tourism and intercultural communication have transformed one of the most dynamic fields of modern linguistics – the study of tourism terminology. In Uzbek linguistics, since the early period, lexical and terminological research has been considered one of the most important scientific directions and has become a theoretical basis for this field. In this article, the lexical units related to the tourism phenomenon are examined through historical, semantic, linguocultural, and comparative approaches to their formation as linguistic meaning. The research shows the works of Uzbek linguists in the field of tourism lexicon and analyzes how globalization, the influence of English loanwords, and sociocultural aspects influence it. The results confirm the multi-layered and dynamic nature of tourism lexicon, which is determined by historical traditions, national mentality, and supra-national portionation of the linguistic area.*

The keywords: *tourism terminology, Uzbek language, tourism lexicon, agrotourism, linguocultural analysis, comparative linguistics, lexical semantics, terminology studies.*

Introduction

Lexical and terminological studies, in general, are an independent scientific field in Uzbek linguistics. Research in this field has established substantial theory to assist researchers of an emerging and evolving subject such as tourism. The lexical system of any language changes and evolves constantly, according to its social, economic, and cultural environment. Theoretical aspects of terminology and lexical development had been influenced by the works on terminology of A. Nurmonov, H. Paluanova, X. Djamalkhanov, H. Dadaboyev, A. Madvaliyev, I. Yuldoshev, M. O. Alieva, X. Narkhodjayeva, and O. S. Ahmedov.

Due to the development of tourism, which is becoming a global industry, many new lexical units, words, and expressions have entered the Uzbek language. Thus, the study of tourism vocabulary in terms of lexical semantics and terminological units has emerged as one of the urgent fields of modern linguistics. The terms of tourism have evolved in both linguistic and sociocultural senses, with the rise of globalisation and the necessity of European intercultural communication.

The purpose of the present study is to investigate the rates of historical development, semantic structure, and linguocultural nature of the lexicon of tourism in the Uzbek language in comparison with English tourism language.

Methods

The study is carried out using a number of approaches that are used in modern linguistic studies. One of them, the identification of the semantic and structural features of tourism terminology, was a descriptive-analytical method. With the help of diachronic analysis, it was possible to investigate the historical evolution of tourism lexicon during different periods. Following a comparative and typological approach, similarities and differences between tourism terminologies were discussed. Moreover, linguistic, cultural, and cognitive methods were applied to show the relationship between lexical items and national cultural values.

The study also relies on other methodologies such as the distributive approach.

Theoretical basis of the terminology of tourism in the Uzbek language.

A. Nurmonov studied the lexical systems as well as their structural and semantic features with special focus on the lexical system terms lying within it. Following his theoretical model, all of his terms are within the general lexicon, but have been changed by their precision and tendency to monosemy. It is an important theoretical foundation for the systematic research of tourism terminology.

H. Paluanova did comparative studies of the terms of ecology in English, Uzbek, Russian, and Karakalpak languages. Her research indicated that ecological terms are formed through the processes of lexicogenesis, semantics, and syntax-nominative. She also noted that there are lexical elements involved in environmental and ecological concepts in some of the historical literary works, such as works of Abu Rayhon Beruni and Zahiriddin Muhammad Bobur.

The development of tourism terms has gone through a few stages of historical change. The word for tourism has undergone a few historical mutations. The Uzbek language's tourism terminology evolved in four stages in history.

The First Stage

The first period is the late seventeenth/late 18th century. In this phase, tourism words had not developed sufficiently, and the lexical units were mostly in the general literary language. During this time, new terms for overcoming travel emerged like "traveler", "arrival time", "departure time", and "travel guide. At this point, about three per cent of tourism vocabulary was created.

The Second Stage

The second period started in the late nineteenth century and ended in the 1930s, when the tourism field was connected with voluntary public organizations in Uzbekistan. Many terms relating to tourism came during this time. The lexical system was enriched by a great contribution from the vocabulary related to the tourism business, equipment, and organisation. Almost one-quarter of the tourism terms were used during this period.

The Third Stage

The third period started from 1936 to the development of the sports tourism term. In this period, the words related to tourism grew in the lexicon of the Uzbek language. New terms like tour operator, travel agent, route planning, and equipment rental point have become popular. The use of native lexical roots for the

construction of complex and derivative terms was primarily, thus developing the paradigmatic lexical structures.

The Fourth Stage

The fourth stage started following the '90s and is ongoing today. Of the terminology in tourism, almost 48% formed in this stage. The word of tourism was formed and influenced by globalization and the impact of English. Terms like "glamping", "flash package," and "gastronomic tourism" were adopted for the use of the people of Uzbekistan. The meanings of the term show that tourism terminology is a changing lexicological system of terms, which is influenced by political, legal, military, and linguistic factors.

The lexicon of the language and cultural aspects of tourism is studied by many researchers. Boymanov analysed the historical origins of the concept of tourism terminology and revealed that tourism has its origins in the Turkic sources. The concepts of ordinary moving became generalized and began to convey cultural and religious meanings with lexical items like journey, caravan, guesthouse, and pilgrimage. The scholar highlighted the need to consider the term of tourism as a linguistic phenomenon, but not only as a reflection of national culture, customs, and experience in their history.

In the same way, Z. Sobirova examined the semantic structure and features of the tourism terminology in Uzbek and English. Her studies showed that history, culture, and society have defined the genesis and development of the tourism terminology. She emphasized especially the usefulness of transliteration, transcription, and functional equivalence for the interpretation of the realities of tourism.

Thus, the word in English "resort" corresponds to the Uzbek word "dam olish maskani," which has more than a recreational connotation in its semantic field and has an economic and marketing aspect. Similarly, the religious and cultural traditions of the people of Uzbekistan were reflected in the translation of the term into the Uzbek language: pilgrimage tourism as ziyorat turizmi.

The touristic terminology from a structural point of view.

In the multilingual context, N. Yakubova studied the terms related to the field of tourism and said that the lexical borrowing is determined by phonetic, typological, and morphological similarities between languages. These results were achieved during her research, which showed that in English, Russian, and Uzbek tourism terminology, structural models prevail – Noun (N), and Adjective + Noun (A+N).

Examples include: Hotel, Sustainable tourism.

But, Uzbek descriptive expressions of English and elliptical forms are usually changed to composite forms, for example, the Uzbek rendering of English ‘B&B' (Bed and Breakfast). This phenomenon gives the analytical structure of the process of term formation in the Uzbek language.

A. Xolboboeva comparatively analyzed the discourse of advertising tourism in the languages of English and Uzbek. She has been studying linguistic devices

which are used in tourism advertisements, including alliteration, assonance, anaphora, epiphora, imperatives, and rhetorical questions. The research results have shown that these stylistic methods become influential factors of the persuasive qualities of tourism discourse. However, the psycholinguistic effect of the tourism advertisements on actual target groups has not yet been studied in detail.

G. Abduxalilova studied the tourism lexicon from the point of view of linguopragmatic analysis and subdivided the tourism lexicon into more than 20 thematic groups, such as adventure tourism, agrotourism, ecotourism, medical tourism, dark tourism, and gastronomy tourism. The researcher proved that tourism vocabulary not only exists as a nominative system, but also as a communicative and persuasive element in discourse.

Discussion

The results showed that the term of tourism in the Uzbek language is a multidimensional and complex lexical system, which is affected by historical, social, and cultural aspects, and cognition. Lexical borrowing from English has become a phenomenon with the rapid development of tourism and globalization, especially when it comes to the digital aspect of tourism, hospitality, and marketing.

However, there is a retention of the national cultural links and features of hospitality, pilgrimage traditions, rural life, and local customs in the tourism terminology of the Uzbek linguistics. Linguocultural studies reveal a deeper cultural understanding of some lexical units, such as ‘mahalla', ‘courtyard', and ‘pilgrimage', which are not explicitly covered by their lexical meanings.

Although a great deal of work has been done in the tourism linguistics field, there are still some issues that remain unsolved. The problems of the standardisation and nationalisation of borrowings still persist. The instability in terminology is due to semantic inconsistencies and the presence of several variants of the same concept. In addition, the agrotourism words have not been analyzed sufficiently in a comparative aspect in the Uzbek and English languages.

Further research in the field of tourism terminology using approaches relying on the lexical-semantic, the cognitive, and the discourse aspects could pave the way for their future systematisation in the context of terminology data banks and the use of digital linguistic corpora.

Conclusion

The results of the study illustrate that the term set of tourism has formed and been updated as a result of its historical development, globalisation, intercultural dialogue, and Uzbek cultural heritage. The researchers have significantly contributed to theoretical research on the issues of terminology, lexical semantics, and linguocultural analysis, laying the foundations for the scientific development of the linguistic aspect of tourism.

The parallel comparison of modern terminological systems of the languages of the republics of the Middle East, Turkestan, and English showed the universal and culture-specific aspects of lexical formation and the semantic development of terminological systems of these languages. Finally, although the influence of

English borrowings has grown stronger, in the Uzbek language, the mechanisms of adaptation and nationalization of tourism-specific vocabulary vary according to the specific features of the language and the cultural paradigms of the native culture.

The Lexicology of the agrotourism field has not yet been sufficiently explored, because many of the studies that consider some aspects of the lexicon of the tourism sector have focused neither on agrotourism nor on this field. Comparative analysis of the vocabulary of agrotourism in different languages, the compilation of digital dictionaries of vocabulary, and the pragmatic functions of the discourse in intercultural communication are recommended for future research.

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JADAL TARAQQIYOT DAVRIDA EKOLOGIK MUVOZANATNI BARQARORLASHTIRISH (O‘ZBEKISTON RESPUBLIKASI MISOLIDA)

Annotatsiya: *Ushbu maqolada jadal iqtisodiy taraqqiyot va urbanizatsiya sharoitida O‘zbekiston Respublikasida ekologik muvozanatni barqarorlashtirish muammolari tadqiq etilgan. Orol dengizining qurishi, atmosfera havosining changlanishi va suv resurslari taqchilligi kabi ekologik inqirozlar fonida mamlakatda amalga oshirilayotgan "Yashil makon" umummilliy loyihasi hamda suvni tejovchi texnologiyalarning samaradorligi tahlil qilingan. 2020–2026-yillar oralig‘idagi statistik ma’lumotlar, empirik kuzatishlar va modellashtirish usullaridan foydalanildi. Tadqiqot natijalari shuni ko‘rsatadiki, intensiv ko‘chat ekish va tomchilatib sug‘orish tizimlarini joriy etish hududiy mikroklimatni barqarorlashtirishga va cho‘llanish xavfini kamaytirishga xizmat qiladi.*

Kalit so‘zlar: *Ekologik muvozanat, jadal taraqqiyot, O‘zbekiston, "Yashil makon", suv taqchilligi, barqaror rivojlanish, Orolbo‘yi.*

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ENSURING ECOLOGICAL BALANCE IN THE PERIOD OF RAPID DEVELOPMENT (ON THE EXAMPLE OF THE REPUBLIC OF UZBEKISTAN)

Abstract: *This article examines the problems of stabilizing the ecological balance in the Republic of Uzbekistan under the conditions of rapid economic development and urbanization. Against the backdrop of ecological crises such as the drying of the Aral Sea, atmospheric air pollution with dust, and water scarcity, the effectiveness of the "Yashil Makon" (Green Space) nationwide project and water-saving technologies implemented in the country is analyzed. Statistical data, empirical observations, and modeling methods from the period of 2020–2026 were utilized. The research results indicate that intensive tree planting and the introduction of drip irrigation systems serve to stabilize the regional microclimate and mitigate the risk of desertification.*

Keywords: *Ecological balance, rapid development, Uzbekistan, "Yashil Makon", water scarcity, sustainable development, Aral Sea region.*

Kirish. XXI asrning birinchi choragiga kelib, texnologik va iqtisodiy taraqqiyot misli ko‘rilmagan sur’atlarga chiqdi. Biroq jadal sanoatlashuv, energiya resurslariga bo‘lgan talabning ortishi va urbanizatsiya global miqyosda ekologik muvozanatning buzilishiga olib keldi. Ayniqsa, Markaziy Osiyo mintaqasi, xususan, O‘zbekiston Respublikasi iqlim o‘zgarishi va antropogen (inson faoliyati natijasidagi) ta’sirlarga eng zaif hududlardan biri hisoblanadi.

O‘zbekistonda so‘nggi yillarda yalpi ichki mahsulot (YIM) hajmining barqaror o‘sishi, qurilish va sanoat sohalarining kengayishi kuzatilmoqda. Ammo bu o‘sish tabiiy resurslarga, birinchi navbatda suv va yer zaxiralariga yuklamani keskin oshirdi. Orol dengizining ekologik fojiasi oqibatlari, cho‘llanish jarayonlari, atmosfera havosida PM 2.5 (mayda dispersli zarrachalar) miqdorining ortishi hamda tez-tez kuzatilayotgan chang bo‘ronlari ekologik xavfsizlikni ta’minlash va barqaror rivojlanish modellariga o‘tishni taqozo etmoqda.

O‘zbekiston hukumati tomonidan 2030-yilgacha bo‘lgan davrda Atrof-muhitni muhofaza qilish konsepsiyasi hamda "Yashil iqtisodiyot"ga o‘tish strategiyasi qabul qilingan. Ushbu harakatlarning eng muhim qismi sifatida "Yashil makon" umummilliy loyihasi doirasida har yili 200 million tup ko‘chat ekish va yashil maydonlarni kengaytirish vazifasi belgilangan.

Tadqiqot usullari. Tadqiqot jarayonida ekologik va iqtisodiy jarayonlarni tahlil qilish uchun bir-birini to‘ldiruvchi bir nechta usullardan foydalanildi:

1. **Statistik va qiyosiy tahlil usuli:** O‘zbekiston Respublikasi Ekologiya, atrof-muhitni muhofaza qilish va iqlim o‘zgarishi vazirligi, Statistika agentligi hamda Gidrometeorologiya xizmati agentligi (O‘zgidromet) tomonidan 2020–2026-yillar oralig‘ida taqdim etilgan rasmiy ma’lumotlar tahlil qilindi.
2. **Kuzatish va kartografik tahlil:** Sun’iy yo‘ldosh (NASA MODIS va Sentinel) ma’lumotlari asosida Orolbo‘yi hududi va yirik shaharlardagi (Toshkent, Samarqand) yashil qoplama indeksi (NDVI – *Normalized Difference Vegetation Index*) o‘zgarishi o‘rganildi.
3. **Empirik modellashtirish:** Suv resurslaridan foydalanish koeffitsiyenti va uning qishloq xo‘jaligi mahsuldorligiga ta’siri chiziqli regressiya modellari yordamida baholandi.

Yashil hududlarning kengayish sur’atini hisoblashda quyidagi standart NDVI formulasi qo‘llanildi:

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

Bu yerda:

- NIR - spektrning yaqin infraqizil sohasi; RED - spektrning qizil sohasi.

Ushbu indeks o‘simlik qoplamining zichligi va salomatligini aniqlashga, "Yashil makon" loyihasining hududlar kesimidagi samarasini xolisona baholashga imkon berdi.

Tadqiqot natijalari: O‘tkazilgan tahlillar natijasida O‘zbekistondagi ekologik muvozanat ko‘rsatkichlari bo‘yicha quyidagi muhim ma’lumotlar va qonuniyatlar aniqlandi.

Yashil qoplama va "Yashil makon" loyihasi ko‘rsatkichlari. 2021-yildan boshlab start olgan "Yashil makon" loyihasi natijasida respublika bo‘yicha o‘rmon fondi va yashil maydonlar hajmi sezilarli darajada o‘zgardi. Quyidagi jadvalda hududlar bo‘yicha ekilgan ko‘chatlar va ularning haqiqiy ko‘karish koeffitsiyenti (2023–2025-yillar monitoringi natijalari) keltirilgan.

Hududlar	Yillik ekilgan ko‘chatlar (mln dona)	O‘rtacha ko‘karish darajasi (%)	Sun’iy yo‘ldosh (NDVI) o‘sish koeffitsiyenti
Toshkent shahri va viloyati	24.5	82%	+0.12
Farg‘ona vodiysi	35.2	85%	+0.15
Buxoro va Navoiy	18.1	68%	+0.04
Qoraqalpog‘iston va Orolbo‘yi	28.4 (asosan saksovul)	71%	+0.09

Ma’lumotlar shuni ko‘rsatadiki, sug‘orish tizimi yaxshi yo‘lga qo‘yilgan Farg‘ona vodiysi va Toshkent viloyatida samaradorlik yuqori, biroq qurg‘oqchil cho‘l zonalarida ko‘chatlarning ko‘karish darajasi suvsizlik tufayli nisbatan past (68-71%) bo‘lib qolmoqda.

Suv resurslari taqchilligi va tejovchi texnologiyalar. O‘zbekiston suv resurslarining qariyb 80-85 foizini transchegaraviy daryolar (Amudaryo va Sirdaryo) hisobidan oladi. Iqlim o‘zgarishi va yuqori oqimdagi davlatlarda suv iste’molining ortishi natijasida O‘zbekistonga kirib kelayotgan suv hajmi kamaygan.

Ushbu muammoni hal qilish maqsadida joriy etilgan suvni tejovchi texnologiyalar (tomchilatib, yomg‘irlatib sug‘orish) dinamikasi quyidagicha o‘sdi:

- **2020-yil:** 150 ming gektar
- **2022-yil:** 420 ming gektar
- **2025-2026-yillar:** 1.2 million gektar

Suvni tejovchi texnologiyalar joriy etilgan maydonlarda suv sarfi 35-40 foizga tejalgan bo‘lsa, mineral o‘g‘itlar samaradorligi 25 foizga oshgani va hosildorlik o‘rtacha 15 sentnerga ortgani aniqlandi.

Orol dengizining qurigan tubini ko‘kalamzorlashtirish: Orol dengizining qurigan tubidan ko‘tarilayotgan tuz va chang bo‘ronlarining zararini kamaytirish uchun ulkan o‘rmonlashtirish ishlari olib borildi. 2018–2025-yillar davomida jami 1.8 million gektar maydonda saksovul, qorabaroq va cherkez kabi cho‘lga chidamli

o‘simliklar ekildi. Bu chora Orol tubidan ko‘tariladigan zaharli tuzli changlarning atmosferaga tarqalish intensivligini 30 foizga kamaytirishga xizmat qildi.

Muhokama va tahlil: Olingan natijalar O‘zbekistonda jadal iqtisodiy o‘sish sharoitida ekologik barqarorlikni ta’minlashning bir qancha strategik yo‘nalishlarini ochib beradi.

Iqtisodiy o‘sish va ekologik dekupling (ajralish) konsepsiyasi: Klassik ekologik iqtisodiyotda "Ekologik Kuznets egri chizig‘i" tushunchasi mavjud. Unga ko‘ra, iqtisodiyot rivojlanishining dastlabki bosqichlarida atrof-muhitga zarar ortib boradi, ammo ma’lum bir farovonlik darajasiga (jon boshiga to‘g‘ri keladigan IM) yetgach, yashil texnologiyalar evaziga ekologik yuklama kamaya boshlaydi. O‘zbekiston hozirda aynan shu o‘tish davrini boshdan kechirmoqda.

"Yashil makon" loyihasining muammolari va yechimlari: Tadqiqot natijalarida ko‘ringanidek, ko‘chat ekish ko‘lamining kattaligiga qaramasdan, qurg‘oqchil hududlarda (Buxoro, Navoiy) ko‘karish darajasi past. Bu muammo ko‘chatlarni faqat ekish bilan cheklanib, keyingi parvarish va sug‘orish tizimini to‘g‘ri tashkil etmaslik oqibatidir. Ekologik muvozanatni tiklash uchun raqamlashtirish tizimini (masalan, "Yashil makon" elektron platformasi va Geo-axborot tizimlari) yanada kuchaytirish, har bir ekilgan daraxtni aniq mas’ul shaxs yoki tashkilotga biriktirish lozim.

Suv xavfsizligi — strategik ustuvorlik: O‘zbekiston qishloq xo‘jaligiga asoslangan iqtisodiyotdan sanoatlashgan jamiyatga o‘tayotgan bo‘lsa-da, suv hamon eng muhim resurs bo‘lib qolmoqda. Transchegaraviy hamkorlik masalalarida (Amudaryo va Sirdaryo havzalari bo‘yicha qo‘shni davlatlar bilan kelishuvlar) qat’iy diplomatik va ilmiy asoslangan pozitsiyani saqlash zarur. Mamlakat ichkarisida esa sug‘orish kanallarining f.i.k. (foydali ish koeffitsiyenti) pastligi (taxminan 0.55-0.60) katta hajmdagi suvning tuproqqa singib, isrof bo‘lishiga olib kelmoqda. Kanallarni betonlashtirish va yopiq quvurli sug‘orish tizimlariga o‘tish jadal taraqqiyot davrida suv taqchilligining oldini olishning yagona yo‘lidir.

Xulosalar va Tavsiyalar

Jadal taraqqiyot davrida O‘zbekiston Respublikasida ekologik muvozanatni barqarorlashtirish nafaqat atrof-muhitni asrash, balki milliy xavfsizlik va iqtisodiy barqarorlikning ham bosh mezonidir. Tadqiqot xulosalari asosida quyidagi taklif va tavsiyalar ilgari suriladi:

1. **"Aqlli" ekologik nazorat tizimini joriy etish:** Yirik sanoat korxonalari va qurilish maydonlarida havoni ifloslantiruvchi manbalarga avtomatik datchiklar o‘rnatish va standartlarni buzganlik uchun iqtisodiy sanksiyalarni (jarimalarni) keskinlashtirish.

2. **"Yashil makon"ni optimallashtirish:** Daraxt ko‘chatlarini hududlarning iqlimiy va gidrologik sharoitlariga mos ravishda tanlash (masalan, suvsiz hududlarda dorivor cho‘l o‘simliklari va kserofitlarni ko‘paytirish), sug‘orishda to‘liq oqova va yer osti minerallashgan suvlaridan filtrlangan holda foydalanish tizimini yo‘lga qo‘yish.

3. **Agrosanoatda suv tejashni rag‘batlantirish:** Tomchilatib sug‘orish texnologiyasini joriy etgan fermer xo‘jaliklari uchun soliq imtiyozlarini kengaytirish va suvni hisobga olish subsidiyalarini ko‘paytirish.

4. **Muqobil energiya ulushini oshirish:** Sanoat va maishiy iste’molda quyosh va shamol energiyasi ulushini 2030-yilga qadar kamida 25-30 foizga yetkazish orqali issiqxona gazlari emissiyasini qisqartirish.

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THE ROLE OF DIGITAL TECHNOLOGIES AND THE STEM APPROACH IN IMPROVING THE QUALITY OF PHYSICS EDUCATION IN UZBEKISTAN

Abstract: *This article analyzes the modernization of physics education in accordance with the Resolution No. PQ-5032 of the President of the Republic of Uzbekistan, the implementation of the STEM approach in the educational process, and the role of virtual laboratories. In addition, the importance of interdisciplinary integration in developing the logical thinking and professional competencies of future specialists is highlighted.*

Keywords: *Physics education, STEM approach, digital technologies, virtual laboratory, Resolution PQ-5032, innovative education, interdisciplinary integration.*

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O'ZBEKISTONDA FIZIKA TA'LIMI SIFATINI OSHIRISHDA RAQAMLI TEXNOLOGIYALAR VA STEM YONDASHUVINING O'RNI

Annotatsiya *: Mazkur maqolada O'zbekiston Respublikasi Prezidentining PQ-5032-sonli qarori doirasida fizika ta'limini modernizatsiya qilish, o'quv jarayoniga STEM yondashuvini tatbiq etish va virtual laboratoriyalarning o'rni tahlil qilinadi. Shuningdek, bo'lajak kadrlarning mantiqiy fikrlashini rivojlantirishda fanlararo integratsiyaning ahamiyati yoritilgan.*

Kalit so'zlar: *Fizika ta'limi, STEM yondashuvi, raqamli texnologiyalar, virtual laboratoriya, PQ-5032 qarori, innovatsion ta'lim, fanlararo integratsiya.*

Kirish

O‘rta Osiyo hududi, xususan, O‘zbekiston zaminida aniq va tabiiy fanlar asrlar davomida dunyo intellektual markazi bo‘lib kelgan. Birinchi va ikkinchi Renessans davrida Al-Xorazmiy, Beruniy va Mirzo Ulug‘bek kabi daholar yetishib chiqib, jahon ilm-faniga beqiyos hissa qo‘shgan. Bugungi kunda ushbu ilmiy an’analarni davom ettirish va zamonaviy talablarga javob beradigan malakali kadrlar tayyorlash davlat siyosatining ustuvor yo‘nalishiga aylandi.

Fizika Ta’limini Isloh Qilishning Huquqiy Asoslari

O‘zbekiston Respublikasi Prezidentining 2021-yil 19-martdagi PQ-5032-sonli "Fizika sohasidagi ta’lim sifatini oshirish va ilmiy tadqiqotlarni rivojlantirish chora-tadbirlari to‘g‘risida"gi qarori sohadagi islohotlarni yangi bosqichga ko‘tardi. Ushbu hujjatning asosiy maqsadi — fizika fanini o‘qitish sifatini tubdan yaxshilash, darsliklarni takomillashtirish, zamonaviy o‘qitish uslublarini joriy qilish va mehnat bozoriga raqobatbardosh mutaxassislarni tayyorlashdan iborat. Qarorga muvofiq, hududlarda fizika faniga ixtisoslashtirilgan tayanch maktablari tashkil etildi va variativ o‘quv rejalari joriy qilindi.

STEM Ta’limi: Fanlararo Integratsiya va Amaliy Yondashuv

STEM (Fan, Texnologiya, Muhandislik va Matematika) — bu tabiiy va muhandislik fanlarini yagona, o‘zaro bog‘liq tizimda birlashtirgan ta’lim modelidir. U bilimlarni alohida emas, balki yaxlit tizimda o‘rganishni nazarda tutadi.

1. Mantiqiy fikrlash: STEM yondashuvi o‘quvchilarda nostandart va tanqidiy fikrlash, muammoga bir nechta yechim topish ko‘nikmalarini shakllantiradi.

2. Amaliy ahamiyat: Ushbu ta’limning asosiy tamoyili — nazariy bilimlarni amaliy masalalarni yechishda qo‘llashdir. Bu zamonaviy jamiyat ehtiyoj sezayotgan ijodiy fikrlaydigan va innovatsion qarorlar qabul qila oladigan mutaxassislarni tayyorlashda juda muhim.

3. Integratsiya: Fizika darslarida matematika va texnologiyalarning integratsiyasi o‘quvchilarning dunyo haqidagi yagona fizik manzarasi shakllanishiga xizmat qiladi.

Raqamli Texnologiyalar va Virtual Laboratoriyalarning O‘rni

Fizika fanini tajribasiz va laboratoriya tadqiqotlarisiz tasavvur qilib bo‘lmaydi. Biroq, ko‘p hollarda moddiy-texnik bazaning eskirganligi yoki jihozlarning yetishmasligi amaliy darslar sifatiga salbiy ta’sir ko‘rsatmoqda. Ushbu muammoni hal qilishda virtual laboratoriyalar va raqamli resurslar eng samarali vosita hisoblanadi.

- Xavfsizlik va Tejamkorlik: Virtual laboratoriyalar orqali yuqori kuchlanishli tok yoki xavfli reagentlar bilan bog‘liq tajribalarni kompyuter muhitida xavfsiz va arzon shaklda bajarish mumkin.
- Gibrid Model: Real tajribalarni virtual simulyatsiyalar (masalan, PhET, Labster) bilan birlashtirish xarajatlarni 30-50% gacha tejash imkonini beradi.
- Tajriba-sinov: PQ-5032 qaroriga binoan, 2021/2022 o‘quv yilidan boshlab tajriba-sinov tariqasida 20 ta umumta’lim muassasasida “virtual laboratoriya” loyihasi joriy etildi.

Oliy Ta’limda Zamonaviy Fizikani O‘qitish Muammolari

Hozirgi kunda fizika jadal rivojlanayotgan fan bo‘lishiga qaramay, ko‘plab o‘quv dasturlari XX asrning 60-yillarigacha bo‘lgan ma’lumotlar bilan cheklanib qolgan. Bu esa yoshlarning fanga bo‘lgan qiziqishining pasayishiga olib kelmoqda.

Oliy ta’lim muassasalarida:

- "Fizika uchinchi ming yillik ostonasida" kabi yangi maxsus kurslarni joriy etish zarur.
- Kadrlar tayyorlashda "fan-ta’lim-ishlab chiqarish" integratsiyasini kuchaytirish, magistrantlarni ilmiy laboratoriyalarga keng jalb qilish kerak.
- O‘zbekiston Milliy universiteti kabi yetakchi muassasalarda "Tibbiyot fizikasi", "Biotibbiyot fizikasi" va "Materialshunoslik" kabi zamonaviy yo‘nalishlar bo‘yicha kadrlar tayyorlash yo‘lga qo‘yilgan.

Xulosa va Tavsiyalar

O‘zbekistonda fizika ta’limi sifatini oshirish uchun raqamli texnologiyalar va STEM yondashuvini kengaytirish strategik ahamiyatga ega. Tadqiqotlar shuni ko‘rsatadiki, gibrid laboratoriya tizimini joriy etish ta’lim sifatini 25-35% gacha oshirishi mumkin.

Asosiy tavsiyalar:

1. Pedagoglar malakasi: Fizika o‘qituvchilarini STEM va raqamli platformalar (Uzluksiz kasbiy ta’lim platformasi) bilan ishlashga muntazam o‘rgatish.

2. Infratuzilma: Tayanch maktablari va oliy o‘quv yurtlari laboratoriyalarini zamonaviy asbob-uskunalar va multimedia dasturlari bilan jihozlashni davom ettirish.

3. Motivatsiya: Fizika bo‘yicha olimpiada g‘oliblari va ularning o‘qituvchilarini moddiy hamda ma’naviy rag‘batlantirish tizimini kuchaytirish.

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CLINICAL SIGNIFICANCE OF HEART SOUNDS AND THEIR ROLE IN DIAGNOSTICS

Abstract: *Heart sounds are one of the key indicators of cardiac activity and are closely associated with the function of heart valves, blood flow, and hemodynamic processes. This article provides a detailed analysis of the mechanisms of heart sound generation, their physical and physiological characteristics, and their clinical significance in the diagnosis of cardiovascular diseases. Both normal (S1 and S2) and additional (S3 and S4) heart sounds are considered, along with changes associated with pathological murmurs. It is shown that the analysis of heart sounds, combined with modern diagnostic methods such as phonocardiography and echocardiography, plays an important role in the early detection of heart diseases.*

Keywords: *heart sounds, auscultation, systole, diastole, heart valves, murmurs, hemodynamics*

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YURAK TOVUSHLARINING KLINIK AHAMIYATI VA DIAGNOSTIKADAGI O'RNI

Annotatsiya: *Yurak tovushlari yurak faoliyatining muhim ko'rsatkichlaridan biri bo'lib, ular yurak klapanlarining ishlashi, qon oqimi va gemodinamik jarayonlar bilan chambarchas bog'liq. Ushbu maqolada yurak tovushlarining kelib chiqish mexanizmlari, ularning fizik va fiziologik xususiyatlari hamda klinik diagnostikadagi ahamiyati batafsil tahlil qilinadi. Normal (S1 va S2) hamda qo'shimcha (S3 va S4) tovushlarning kelib chiqishi, shuningdek patologik shovqinlar bilan bog'liq o'zgarishlar o'rganiladi. Zamonaviy diagnostika usullari, xususan fonokardiografiya va ekokardiografiya bilan birgalikda yurak tovushlarini*

tahlil qilish yurak kasalliklarini erta aniqlashda muhim ahamiyatga ega ekanligi ko‘rsatib beriladi.

Kalit so‘zlar: *yurak tovushlari, auskultatsiya, sistola, diastola, yurak klapanlari, shovqinlar, gemodinamika*

Kirish

Yurak-qon tomir tizimi inson organizmidagi eng muhim tizimlardan biri bo‘lib, uning faoliyati butun organizmning normal ishlashini ta’minlaydi. Hozirgi kunda yurak-qon tomir kasalliklari dunyo bo‘yicha o‘limning asosiy sabablaridan biri hisoblanadi. Shu sababli bu kasalliklarni erta aniqlash va oldini olish masalasi tibbiyotning dolzarb muammolaridan biri bo‘lib qolmoqda (Braunwald, 2019). Yurak faoliyatini baholashning eng qadimiy va samarali usullaridan biri yurak tovushlarini eshitish — auskultatsiya hisoblanadi. Ushbu usul oddiy bo‘lishiga qaramay, juda katta diagnostik ahamiyatga ega. Yurak tovushlari yurakdagi mexanik jarayonlar natijasida hosil bo‘lib, ular orqali yurakning funksional holatini baholash mumkin (Guyton & Hall, 2021).

Zamonaviy texnologiyalar, xususan ekokardiografiya va boshqa vizual diagnostika usullari rivojlangan bo‘lsa ham, yurak tovushlarini tahlil qilish o‘z ahamiyatini yo‘qotmagan. Aksincha, u boshqa usullar bilan birgalikda qo‘llanilganda diagnostika aniqligini sezilarli darajada oshiradi. Mazkur maqolaning maqsadi — yurak tovushlarining fizik va fiziologik asoslarini o‘rganish hamda ularning klinik diagnostikadagi ahamiyatini aniqlashdan iborat.

Nazariy asos

Yurakning anatomik tuzilishi

Yurak to‘rt bo‘limdan iborat: chap va o‘ng bo‘lmacha, chap va o‘ng qorincha. Qonning yurak orqali bir yo‘nalishda harakatlanishi maxsus klapanlar orqali ta’minlanadi. Bu klapanlar qonning orqaga oqishini oldini oladi va yurak ishining samaradorligini ta’minlaydi (Lilly, 2016).

Yurakdagi asosiy klapanlar:

- mitral klapan
- trikuspid klapan
- aorta klapani
- o‘pka klapani

Ushbu klapanlar yopilganda va ochilganda tovushlar hosil bo‘ladi.

Yurak tovushlarining hosil bo‘lish mexanizmi

Yurak faoliyati sistola va diastola bosqichlaridan iborat. Har bir bosqichda ma’lum tovushlar hosil bo‘ladi. Birinchi yurak tovushi (S1) — mitral va trikuspid klapanlar yopilganda yuzaga keladi va sistola boshlanishini bildiradi. Ikkinchi yurak tovushi (S2) — aorta va o‘pka klapanlari yopilganda hosil bo‘ladi va diastola boshlanishiga to‘g‘ri keladi (Leatham, 1991).

Bundan tashqari: S3 tovushi — qonning tez oqimi natijasida, S4 tovushi — bo‘lmacha qisqarishi natijasida hosil bo‘ladi. Bu tovushlar yurak faoliyatidagi o‘zgarishlar haqida muhim ma’lumot beradi (Braunwald, 2019).

Yurak tovushlarining fizik xususiyatlari

Yurak tovushlari fizik jihatdan akustik to‘lqinlar bo‘lib, ular quyidagi parametrlar bilan tavsiflanadi:

- chastota
- amplituda
- davomiylik

S1 tovushi odatda past chastotali va uzoq davomli bo‘lsa, S2 tovushi qisqaroq va balandroq chastotali bo‘ladi. Zamonaviy tadqiqotlarda yurak tovushlari signal sifatida ko‘rib chiqilib, ular matematik va raqamli usullar yordamida tahlil qilinadi (Rangayyan, 2015).

Metodlar

Mazkur tadqiqot nazariy va tahliliy usullar asosida olib borildi.

Quyidagi diagnostika usullari tahlil qilindi:

- auskultatsiya
- fonokardiografiya
- ekokardiografiya
- elektrokardiografiya

Fonokardiografiya yurak tovushlarini yozib olish va ularni grafik shaklda tahlil qilish imkonini beradi. Bu usul yurak tovushlarini yanada aniqroq o‘rganishga yordam beradi (Durand & Pibarot, 1995).

Natijalar

Tadqiqot natijalari shuni ko‘rsatdiki, yurak tovushlari yurak faoliyatining turli bosqichlariga mos keladi. S1 tovushi sistola boshlanishida, S2 esa diastola boshlanishida yuzaga keladi. S3 va S4 tovushlari esa patologik holatlarda kuzatiladi va yurak yetishmovchiligi yoki mushak qattiqlashuvi bilan bog‘liq bo‘lishi mumkin. Shuningdek, yurak shovqinlari klapan patologiyalari bilan bog‘liq bo‘lib, ular qon oqimining buzilishi natijasida yuzaga keladi (Lilly, 2016).

Muhokama

Olingan natijalar shuni ko‘rsatadiki, yurak tovushlarini tahlil qilish klinik diagnostikada muhim ahamiyatga ega. Auskultatsiya oddiy va tezkor usul bo‘lib, u orqali yurak faoliyati haqida dastlabki ma’lumot olish mumkin (Tavel, 2006). Biroq ushbu usulning aniqligi shifokorning tajribasiga bog‘liq. Shu sababli zamonaviy usullar bilan birgalikda qo‘llash tavsiya etiladi (Mangione & Nieman, 1997). Signalni qayta ishlash usullari yurak tovushlarini yanada chuqurroq tahlil qilish imkonini beradi va bu kelajakda avtomatlashtirilgan diagnostika tizimlarini yaratishga asos bo‘lishi mumkin (Springer et al., 2016).

Xulosa

Yurak tovushlari yurak faoliyatining muhim diagnostik ko‘rsatkichidir. Ularni tahlil qilish orqali yurak kasalliklarini erta aniqlash mumkin.

Auskultatsiya va zamonaviy diagnostika usullarini birgalikda qo‘llash yurak kasalliklarini aniqlash aniqligini oshiradi.

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POLYSEMY OF THE KOREAN VERB 알다 AND MECHANISMS OF ITS SEMANTIC EXPANSION

Abstract. *This article examines the polysemous nature of the Korean verb 알다 and the mechanisms of its semantic expansion. The basic meanings of the verb, associated with the notions of "to know," "to be aware," and "to have information," are regarded as its semantic core. On this basis, the article analyzes its derived meanings, including "to be acquainted with," "to understand," "to perceive," "to sense," "to feel," "to be able to," "to evaluate," "to suppose," and "to accept." Particular attention is paid to the use of 알다 in such constructions as N을/를 알다, -(으)ㄹ 줄 알다, -는지 알다, -으로 알다, 알겠다, and 알 바 아니다, which are examined from semantic and cognitive perspectives. The article also shows that the meaning of the verb is specified depending on the speech situation, the type of object, and the grammatical construction. The results of the study indicate that 알다 is an important cognitive verb in Korean, expressing not only the process of cognition, but also perception, emotional experience, evaluation, supposition, and the speaker's communicative response.*

Keywords: *알다, polysemy, semantic expansion, cognitive verb, Korean language, lexical semantics, grammatical construction, language pedagogy.*

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KOREYS TILIDAGI 알다 FE'LINING KO'P MA'NOLIK XUXUSIYATLARI VA SEMANTIK KENGAYISH MEXANIZMLARI

Annotatsiya. *Ushbu maqolada koreys tilidagi 알다 fe'lining ko'p ma'nolilik xususiyatlari va semantik kengayish mexanizmlari tahlil qilinadi. Tadqiqotda mazkur fe'lning dastlabki "bilmoq", "xabardor bo'lmoq", "ma'lumotga ega bo'lmoq" kabi asosiy ma'nolari semantik markaz sifatida olinib, undan kelib chiqqan "tanimoq", "idrok etmoq", "sezmoq", "his qilmoq", "uddalay olmoq", "baholamoq", "taxmin qilmoq" va "qabul qilmoq" kabi hosila ma'nolari ko'rib chiqiladi. Maqolada 알다 fe'lining N을/를 알다, -(으)ㄹ 줄 알다, -는지 알다, -*

으로 알다, 알겠다, 알 바 아니다 kabi konstruksiyalardagi qo‘llanishlari semantik va kognitiv jihatdan izohlanadi. Shuningdek, mazkur fe’lning nutqiy vaziyat, obyekt turi va grammatik model ta’sirida turli ma’no qirralarini yuzaga chiqarishi tahlil etiladi. Tadqiqot natijalari 알다 fe’lining koreys tilida nafaqat bilish jarayonini, balki insonning idroki, hissiy tajribasi, baholashi, taxmini va kommunikativ munosabatini ham ifodalovchi muhim kognitiv fe’l ekanligini ko‘rsatadi.

Kalit so‘zlar: *알다, ko‘p ma’nolilik, polisemiya, semantik kengayish, kognitiv fe’l, koreys tili, leksik semantika, grammatik konstruksiya, lingvodidaktika.*

Kirish

Til birliklarining ma’no jihatdan kengayishi leksik semantikaning muhim masalalaridan biri hisoblanadi. Ayniqsa fe’llar doirasidagi ko‘p ma’nolilik alohida e’tiborga loyiqdir, chunki fe’l gapning mazmuniy markazini tashkil etadi va nutqda voqelik, harakat, holat, munosabat hamda subyektning ichki tajribasini ifodalashda asosiy vosita vazifasini bajaradi. Shu jihatdan koreys tilidagi 알다 fe’li ma’no jihatdan keng tarmoqlangan, nutqda faol qo‘llanadigan va turli grammatik qurilmalar bilan birikib, har xil semantik vazifalarni bajaradigan birliklardan biridir.

알다 fe’lining eng umumiy ma’nosi “bilmoq”, “xabardor bo‘lmoq”, “anglamoq” kabi tushunchalar bilan bog‘liq. Biroq real nutqda bu fe’l faqat ma’lumotga ega bo‘lishni bildirmaydi. U shaxsni tanish, biror narsani sezish, hissiy holatni his qilish, vaziyatni baholash, taxmin qilish, taklif yoki buyruqni qabul qilish kabi turli ma’nolarni ham ifodalaydi. Demak, 알다 fe’lining ma’nosi faqat lug‘aviy asos bilan emas, balki u ishtirok etayotgan grammatik shakl, obyekt turi, kontekst va kommunikativ vaziyat bilan ham chambarchas bog‘liqdir.

Mazkur maqolaning maqsadi koreys tilidagi 알다 fe’lining ko‘p ma’noli qo‘llanish xususiyatlarini aniqlash, uning semantik kengayish yo‘nalishlarini izohlash hamda bu jarayonda obyekt turi va grammatik konstruksiyalarning o‘rnini yoritishdan iborat. Tadqiqotda 알다 fe’lining asosiy va hosila ma’nolari semantik markaz hamda kognitiv kengayish tamoyillari asosida tahlil qilinadi.

알다 fe’lining asosiy lug‘aviy-semantik xususiyatlari

Koreys tilidagi 알다 fe’lining bosh ma’nosi ma’lumot yoki bilimga ega bo‘lish bilan bog‘liq. Bu holatda mazkur fe’l tashqi dunyoga oid muayyan axborotning subyekt ongida mavjudligini bildiradi. Masalan, 주소를 알다 birikmasida manzilni bilish, 이름을 알다 birikmasida ismni bilish, 사실을 알다 birikmasida esa biror fakt yoki voqelikdan xabardor bo‘lish nazarda tutiladi.

Bu ma’no 알다 fe’lining semantik markazi sifatida qaralishi mumkin. Chunki uning boshqa ko‘plab ma’nolari aynan “bilish” tushunchasidan kelib chiqadi. Inson biror narsani bilishi orqali uni taniydi, idrok etadi, unga baho beradi, undan xulosa chiqaradi yoki uni qabul qiladi. Shuning uchun 알다 fe’lining semantik tizimi bilish jarayonining turli bosqichlari bilan bog‘liq holda shakllanadi.

알다 fe’lining asosiy qo‘llanishlaridan biri N을/를 알다 shaklidir. Bu konstruksiyada obyekt vazifasidagi ot turlicha bo‘lishi mumkin. Agar obyekt fakt, ma’lumot yoki hodisani bildirsa, fe’l “bilmoq”, “xabardor bo‘lmoq” ma’nosida qo‘llanadi. Masalan, 문제를 알다 “muammoni bilmoq”, 이유를 알다 “sababini bilmoq”, 사실을 알다 “haqiqatni bilmoq” kabi birliklarda mazkur fe’l o‘zining asosiy lug‘aviy ma’nosini saqlaydi.

Shaxsga nisbatan qo‘llanganda esa 알다 fe’li oddiy bilimni emas, balki tanishlik munosabatini bildiradi. Masalan, 그 사람을 알다 birikmasi “u odam haqida ma’lumotga ega bo‘lmoq” degan ma’noni emas, balki “u odamni tanimoq” ma’nosini anglatadi. Bu holatda ma’no “axborotga ega bo‘lish”dan “shaxs bilan aloqadorlikka ega bo‘lish” tomon kengayadi. Demak, obyektning semantik turi fe’l ma’nosining o‘zgarishida muhim omil hisoblanadi.

알다 fe’lining sezgi va idrok bilan bog‘liq ma’nolari

알다 fe’lining ma’no kengayishida sezgi va idrok bilan bog‘liq qo‘llanishlar alohida o‘rin tutadi. Bu holatda fe’l bevosita aqliy bilimni emas, balki sezgi organlari orqali anglangan tajribani bildiradi. Masalan, 맛을 알다 birikmasi “ta’mni bilmoq” deb tarjima qilinsa-da, mazmunan “ta’mni his qilmoq”, “ta’mni ajrata olmoq” ma’nolariga yaqin turadi. Xuddi shuningdek, 냄새를 알다 “hidni sezmoq”, 추운 것을 알다 “sovuqni his qilmoq” kabi ma’nolarni ifodalashi mumkin.

Bu holatda bilish jarayoni tashqi axborotni mantiqiy o‘zlashtirishdan ko‘ra, sezgi orqali idrok etishga yaqinlashadi. Shuning uchun 알다 fe’lining “bilmoq” ma’nosi “sezmoq”, “idrok etmoq”, “anglab yetmoq” kabi ma’nolarga kengayadi. Mazkur kengayish inson tajribasida bilim va sezgining o‘zaro bog‘liqligini ko‘rsatadi.

Koreys tilida bunday qo‘llanishlar ko‘pincha kundalik nutqda uchraydi. Inson biror ta’mni, hidni, sovuqlikni yoki boshqa sezgi holatini o‘z tajribasi orqali anglaydi. Shu bois 알다 fe’li bunday kontekstlarda obyektiv bilimni emas, balki subyektiv idrokni ifodalaydi. Bu esa fe’lning kognitiv xususiyatini yanada kuchaytiradi.

알다 fe’lining hissiy holatni ifodalashi

알다 fe’lining yana bir muhim semantik kengayish yo‘nalishi hissiyot bilan bog‘liqdir. Bunda fe’l insonning ichki kechinmasi, ruhiy holati yoki emotsional tajribasini anglatadi. Masalan, 마음을 알다 birikmasi “ko‘nglini bilmoq”, 사랑을 알다 “muhabbatni bilmoq”, 슬픔을 알다 “qayg‘uni bilmoq” ma’nolarida qo‘llanishi mumkin. Bunday birliklarda “bilish” oddiy axborotga ega bo‘lish emas, balki muayyan hissiy holatni ichki tajriba sifatida his qilishni bildiradi.

Masalan, 사랑을 알다 birikmasida inson muhabbat haqida nazariy ma’lumotga ega bo‘lishi emas, balki uni boshdan kechirishi, his qilishi nazarda tutiladi. Xuddi shuningdek, 고통을 알다 “azobni bilmoq” deganda azob haqida eshitgan bo‘lish emas, balki uni o‘z hayotida his qilgan bo‘lish tushuniladi. Demak,

bu yerda 알다 fe’li “his qilmoq”, “kechirmoq”, “ichki tajriba orqali anglamoq” ma’nolariga ega bo‘ladi.

Bu turdagi semantik kengayish inson ongida bilish va his qilish jarayonlarining bir-biridan ajralmasligini ko‘rsatadi. Koreys tilida 알다 fe’lining hissiyot bilan bog‘liq qo‘llanishlari ayniqsa badiiy, publitsistik va emotsional nutqda muhim ahamiyat kasb etadi.

-(으)ㄹ 줄 알다 konstruksiyasi va qobiliyat ma’nosi

알다 fe’lining ko‘p ma’noliligida -(으)ㄹ 줄 알다 konstruksiyasi alohida o‘rin egallaydi. Bu shakl biror ishni bajarish usulini bilish, ya’ni qobiliyat yoki malakaga ega bo‘lish ma’nosini bildiradi. Masalan, 한국어를 읽을 줄 알다 “koreyscha o‘qiy olmoq”, 운전할 줄 알다 “mashina hayday olmoq”, 요리할 줄 알다 “ovqat pishira olmoq” kabi qo‘llanishlarda 알다 fe’li bevosita bilim emas, balki amaliy ko‘nikmani ifodalaydi.

Bu yerda 줄 elementi “usul”, “yo‘l”, “qilish tarzi” ma’nosini anglatadi. Shuning uchun -(으)ㄹ 줄 알다 konstruksiyasi so‘zma-so‘z “qanday qilish yo‘lini bilmoq” mazmuniga ega bo‘lib, nutqda “qila olmoq” ma’nosiga yaqinlashadi. Demak, 알다 fe’lining semantikasi nazariy bilimdan amaliy qobiliyatga tomon kengayadi.

Bu holat koreys tilini o‘rganuvchilar uchun juda muhimdir. Chunki o‘zbek tilida “bilmoq” fe’li ham ayrim hollarda “qila olmoq” ma’nosini bildiradi: masalan, “suzishni bilaman”, “mashina haydashni bilaman”. Shu jihatdan koreys tilidagi -(으)ㄹ 줄 알다 va o‘zbek tilidagi “-ishni bilmoq” shakllari o‘rtasida ma’lum semantik yaqinlik mavjud. Biroq koreys tilida bu konstruksiya grammatik jihatdan mustahkam qolip sifatida shakllangan bo‘lib, uni alohida o‘rgatish zarur.

알다 fe’lining baholash va talqin qilish ma’nolari

알다 fe’li ayrim kontekstlarda “baholamoq”, “shunday deb bilmoq”, “muayyan tarzda talqin qilmoq” ma’nolarini ham bildiradi. Bunday holat ko‘pincha NP를 NP로 알다 shaklida namoyon bo‘ladi. Masalan, 그것을 실수로 알다 “buni xato deb bilmoq”, 그 말을 허락으로 알다 “bu gapni ruxsat deb qabul qilmoq” kabi qo‘llanishlarda subyekt muayyan holatni o‘z mezoni asosida baholaydi.

Bu yerda 알다 fe’li faktik bilimni emas, balki subyektning talqini va xulosasini bildiradi. Ya’ni so‘zlovchi tashqi voqelikni qanday bo‘lsa, shunday qabul qilmaydi, balki uni o‘z qarashi va tajribasi asosida ma’lum bir ma’noga keltiradi. Shu sababli bu qo‘llanishlarda 알다 fe’li bilish jarayonining baholash bosqichini ifodalaydi.

알아서 shakli ham mazkur ma’no bilan bog‘liq. Masalan, 알아서 하다 birikmasi “o‘zi bilib qilmoq”, “vaziyatga qarab mustaqil hal qilmoq” ma’nolarini beradi. Bunda subyekt vaziyatni tushunadi, baholaydi va shu asosda mustaqil qaror qabul qiladi. Demak, 알다 fe’li bunday kontekstda mustaqil fikrlash va vaziyatni baholash bilan bog‘liq kognitiv harakatni bildiradi.

Taxmin va oldindan bilish ma’nolari

알다 fe’lining yana bir muhim kengaygan ma’nosi taxmin qilish, oldindan bilish yoki biror holatni shunday deb o‘ylash bilan bog‘liq. Bu ma’no, ayniqsa, -는지 알다 va -(으)ㄹ 줄 알다 konstruksiyalarida yaqqol namoyon bo‘ladi.

Masalan, 어떻게 알았어? gapida so‘zlovchi “buni qanday bilding?” deb so‘rashi mumkin, lekin ayrim vaziyatlarda bu gap “qanday taxmin qilding?” degan mazmunga ham ega bo‘ladi. Xuddi shuningdek, 그렇게 될 줄 알았어 birikmasi “shunday bo‘lishini bilgan edim” yoki “shunday bo‘ladi deb o‘ylagan edim” ma’nosida ishlatiladi.

Bu holatda 알다 fe’li aniq bilimni emas, balki subyektning oldindan taxmin qilishi yoki xulosaga kelishini ifodalaydi. Bunday ma’no bilish jarayonining murakkab kognitiv bosqichini ko‘rsatadi. Chunki taxmin qilish mavjud axborot asosida kelajakdagi yoki yashirin holatni ongda tiklash bilan bog‘liqdir.

Koreys tilida -(으)ㄹ 줄 알다 konstruksiyasining ikki asosiy ma’nosi mavjud: biri “qila olmoq”, ikkinchisi esa “deb o‘ylamoq”, “deb taxmin qilmoq”. Masalan, 한국어를 할 줄 알아요 gapida u “koreyscha gapira olaman” ma’nosida bo‘lsa, 네가 올 줄 알았어 gapida “kelasan deb o‘ylagan edim” ma’nosini bildiradi. Bu ikki ma’no bir xil grammatik shaklda ifodalangani uchun koreys tilini o‘rganuvchilar uchun ularni kontekst asosida farqlash muhim hisoblanadi.

알다 fe’lining qabul qilish va kommunikativ vazifalari

Dialogik nutqda 알다 fe’li ko‘pincha “tushundim”, “xo‘p”, “qabul qildim”, “mayli” kabi kommunikativ ma’nolarni ifodalaydi. Masalan, 알겠어요 yoki 알았어요 shakllari suhbatdoshning aytgan gapini tushunganlikni bildirish bilan birga, ko‘pincha buyruq, iltimos yoki taklifni qabul qilishni ham anglatadi.

Masalan, 도착하면 전화하세요 — 알겠어요 dialogida 알겠어요 shakli faqat “tushundim” ma’nosida emas, balki “aytganingizni bajaraman” degan rozilik ma’nosida ham qo‘llanadi. Demak, bu yerda bilish jarayoni kommunikativ majburiyatni qabul qilishga aylanadi.

알겠지? shakli esa ogohlantirish, buyruq yoki maslahatni kuchaytiruvchi pragmatik vosita sifatida ishlatiladi. Bu shaklda so‘zlovchi suhbatdoshdan nafaqat tushunishni, balki aytilgan gapni qabul qilishni ham kutadi. Shuningdek, 알 바 아니다 birikmasi “menga aloqasi yo‘q”, “mening ishim emas”, “meni qiziqtirmaydi” kabi ma’nolarni bildiradi. Bu holatda 알다 fe’li salbiy munosabat, ya’ni mas’uliyat yoki daxldorlikni rad etish bilan bog‘lanadi.

Shu jihatdan 알다 fe’li koreys tilida oddiy kognitiv fe’l bo‘lish bilan cheklanmaydi. U dialogik muloqotda rozilik, tushunish, qabul qilish, befarqlik yoki mas’uliyatdan chekinish kabi pragmatik ma’nolarni ham ifodalaydi.

알다 fe’lining semantik kengayish mexanizmlari

Yuqoridagi tahlillar asosida 알다 fe’lining ma’no kengayishida bir necha asosiy mexanizm faol ishtirok etishini ko‘rish mumkin. Birinchi mexanizm obyekt

turiga bog‘liq semantik kengayishdir. Agar obyekt ma’lumot yoki fakt bo‘lsa, fe’l “bilmoq” ma’nosida keladi; obyekt shaxs bo‘lsa, “tanimoq”; obyekt sezgi bo‘lsa, “idrok etmoq”; obyekt hissiy holat bo‘lsa, “his qilmoq”; obyekt bajarish usuli bo‘lsa, “qila olmoq” ma’nosini bildiradi.

Ikkinchi mexanizm kognitiv jarayon bosqichlari bilan bog‘liq. Bilish jarayoni faqat axborotni qabul qilishdan iborat emas. Inson axborotni qabul qiladi, uni sezadi, ichki tajribasi bilan bog‘laydi, baholaydi, unga nisbatan taxmin hosil qiladi va nihoyat uni qabul qiladi yoki rad etadi. 알다 fe’lining “baholamoq”, “taxmin qilmoq”, “qabul qilmoq” kabi ma’nolari aynan shu kognitiv jarayon natijasida yuzaga keladi.

Uchinchi mexanizm grammatik konstruksiyalar bilan bog‘liq. Masalan, N을/를 알다 shakli ko‘proq obyektga oid bilim yoki tanishlikni bildirsa, -(으)ㄹ 줄 알다 qobiliyat yoki taxmin ma’nosini yuzaga chiqaradi. -는지 알다 shakli noma’lum holat, savol yoki taxminiy bilim bilan bog‘liq bo‘ladi. NP를 NP로 알다 shakli esa baholash va talqin qilish ma’nosini ifodalaydi. 알겠다, 알았어요, 알 바 아니다 kabi shakllar esa muloqotda pragmatik vazifalarni bajaradi.

Demak, 알다 fe’lining ko‘p ma’noliligi tasodifiy hodisa emas. U insonning bilish faoliyati, tajribasi, sezgisi, hissiy holati va kommunikativ ehtiyojlari bilan uzviy bog‘liq holda shakllanadi. Shu sababli mazkur fe’l koreys tilidagi eng muhim kognitiv birliklardan biri sifatida baholanishi mumkin.

알다 fe’lini koreys tili ta’limida o‘rgatish masalasi

알다 fe’lining ko‘p ma’nolilik xususiyatlari koreys tilini o‘qitish jarayonida ham muhim ahamiyatga ega. Chunki o‘rganuvchilar dastlab bu fe’lni faqat “bilmoq” ma’nosida qabul qiladilar. Biroq yuqori bosqichlarda ular 알다 fe’lining turli grammatik shakllarda boshqa ma’nolarni ham ifodalashini anglashlari zarur.

Boshlang‘ich bosqichda 알다 fe’lining “bilmoq”, “tanimoq”, “qila olmoq” kabi sodda va amaliy ma’nolarini o‘rgatish maqsadga muvofiqdir. Masalan, 이름을 알다, 그 사람을 알다, 한국어를 읽을 줄 알다 kabi birliklar o‘rganuvchilar uchun tushunarli va tez qo‘llanadigan shakllardir.

O‘rta bosqichda mazkur fe’lning “sezmoq”, “his qilmoq”, “baholamoq”, “taxmin qilmoq” kabi ma’nolari kengaytirilishi kerak. Bu bosqichda 맛을 알다, 마음을 알다, 그렇게 될 줄 알다, 사실인지 알다 kabi birikmalar asosida semantik farqlar tushuntiriladi.

Yuqori bosqichda esa 알다 fe’lining pragmatik va diskursiv qo‘llanishlariga e’tibor qaratish zarur. Jumladan, 알겠어요, 알았어요, 알겠지?, 알 바 아니다, 알아서 하다 kabi birliklar muloqotdagi ohang, munosabat, rozilik, befarqlik yoki mustaqil qarorni bildirishi bilan muhimdir. Bunday shakllarni faqat lug‘aviy tarjima orqali emas, balki real nutqiy vaziyatlar asosida o‘rgatish samarali hisoblanadi.

Xulosa

Koreys tilidagi 알다 fe’lining tahlili shuni ko‘rsatadiki, mazkur fe’l oddiy “bilmoq” ma’nosi bilan cheklanmaydi. U koreys tilida insonning bilish faoliyati, sezgi tajribasi, hissiy holati, amaliy ko‘nikmasi, baholashi, taxmini va kommunikativ munosabatini ifodalovchi keng semantik imkoniyatlarga ega bo‘lgan ko‘p ma’noli birlikdir.

알다 fe’lining bosh ma’nosi “ma’lumot yoki bilimga ega bo‘lish” semasiga asoslanadi. Shu semantik markazdan “tanimoq”, “idrok etmoq”, “sezmoq”, “his qilmoq”, “uddalay olmoq”, “baholamoq”, “taxmin qilmoq” va “qabul qilmoq” kabi hosila ma’nolar shakllanadi. Bu kengayish obyekt turi, grammatik konstruksiya va nutqiy kontekst bilan bog‘liq holda yuzaga chiqadi.

Tahlil natijalariga ko‘ra, N을/를 알다, -(으)ㄹ 줄 알다, -는지 알다, -으로 알다, 알겠다, 알 바 아니다 kabi shakllar 알다 fe’lining turli semantik va pragmatik imkoniyatlarini namoyon qiladi. Ayniqsa, -(으)ㄹ 줄 알다 konstruksiyasining “qila olmoq” va “deb o‘ylamoq” ma’nolarini ifodalashi mazkur fe’lning grammatik-semantik jihatdan murakkabligini ko‘rsatadi.

Xulosa qilib aytganda, 알다 fe’lining ko‘p ma’nolilik tizimini o‘rganish koreys tilining leksik-semantik xususiyatlarini chuqurroq anglashga xizmat qiladi. Shu bilan birga, mazkur fe’lni o‘quv bosqichlariga mos tarzda darajalab o‘rgatish koreys tilini o‘rganuvchilarning tabiiy, aniq va kontekstga mos nutq shakllantirishida muhim ahamiyat kasb etadi.

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O'ZBEK XALQ MILLIY O'YINLARI VA ULARNING TARBIYAVIY AHAMIYATI

Annotatsiya. *Ushbu maqolada o'zbek milliy xalq o'yinlarining tarixiy ildizlari, shakllanish jarayoni va ularning xalq ma'naviyatidagi o'rni yoritiladi. Milliy o'yinlar yosh avlodni jismoniy chiniqtirish, ijtimoiy faollikni oshirish hamda estetik didini shakllantirishda muhim tarbiyaviy vosita sifatida xizmat qiladi. Maqolada "Chillak", "Ko'pkari", "Oq terakmi – ko'k terak", "Arqon tortish" kabi an'anaviy o'yinlarning pedagogik ahamiyati tahlil qilinadi.*

Kalit so'zlar: *milliy o'yinlar, xalq o'yinlari, an'ana, tarbiya, madaniyat, jismoniy tarbiya, folklor, yoshlar.*

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UZBEK NATIONAL FOLK GAMES AND THEIR EDUCATIONAL SIGNIFICANCE

Abstract. *This article explores the historical roots, formation process, and cultural significance of Uzbek national folk games. National games serve as an important educational tool in the physical and social development of youth. The article analyzes the pedagogical importance of traditional games such as "Chillak," "Kupkari," "Oq terakmi – ko'k terak," and "Rope Pulling," and discusses their integration into the modern educational process.*

Keywords: *national games, folk games, traditions, education, culture, physical education, folklore, youth.*

Kirish

O'zbek milliy xalq o'yinlari xalqning boy madaniy va ma'naviy merosini o'zida mujassam etgan. Bu o'yinlar asosan bayramlar, to'ylar va madaniy tadbirlar vaqtida o'tkazilgan bo'lib, o'yinlarning maqsadi insonlar o'rtasidagi birdamlikni mustahkamlash, jismoniy hamda ruhiy jihatdan rivojlanishni ta'minlashdan iborat. Sovet davrida xalq o'yinlari asta-sekin kamayib borgan. Keyinchalik 1989-yil Forish tumanining o'nlab qishloqlarida 300 ga yaqin o'yin yozib olindi, 1996-yil II-Respublika xalq o'yinlari olimpiadasi, 1998-yilda esa "Alpomish o'yinlari" nomli festival Termiz shahrida o'tkazildi. Bugungi kunda milliy o'yinlarni saqlab qolish va ta'lim jarayoniga joriy etish masalasi dolzarb ahamiyat kasb etmoqda.

Asosiy qism

O'zbek xalq o'yinlari tarixini o'rganishda qomusiy allomamiz Mahmud Qoshg'ariyning "Devon-u-lug'ati turk" asari muhim manba hisoblanadi. Devonda 150 ga yaqin xalq o'yini tilga olinib, 20 taga yaqin o'yin turiga batafsil ta'rif berilgan: "Qorongni" (qorongidan qo'rg'on olish), "Bandol" (asir olish), "Chavgon" (to'p o'yini), "Tolbargak" (gul o'yini) va boshqalar.

Afrosiyob, Dalvarzintepa va Xorazm hududlarida o'tkazilgan arxeologik qazilmalar shuni ko'rsatadiki, bundan 3–4 ming yil avval ajdodlarimiz xilma-xil o'yinlar va jismoniy mashqlar bilan shug'ullangan. Dostonchilik san'atida ham – "Alpomish", "Go'ro'g'li", "Qirq qiz" kabi asarlarda xalq o'yinlari haqida ma'lumotlar saqlangan. O'yinlar avloddan avlodga og'zaki yo'l bilan yetib kelgan.

O'zbek milliy o'yinlarining tarbiyaviy ahamiyatini buyuk mutafakkirlar ham ta'kidlagan. Abu Ali Ibn Sino: "Bolalarning jismoniy sog'ligi uchun harakat zarur; harakat esa o'yin orqali tabiiy va quvonchli bo'ladi", – degan. Alisher Navoiy "Mahbub ul-qulb" asarida: "Yosh bolalar uchun harakat, o'yin, kulgu zarurdir, chunki harakat tanani mustahkamlaydi va zehni o'stiradi", – deb ta'kidlagan. Jan-Jak Russo esa: "Bolalik o'yinlari ularni nafaqat zavqlantiradi, balki tafakkuri va xarakterini shakllantiradi", – deb yozgan.

O'zbek xalq o'yinlari ijtimoiy-tarixiy kelib chiqishiga ko'ra quyidagi turlarga bo'linadi: marosim o'yinlari (to'y, bayram, hosil yig'ish bilan bog'liq); mehnat o'yinlari (dehqonchilik, chorvachilik bilan bog'liq); bolalar o'yinlari (o'rgatish va tarbiyalash); raqs va qo'shiq bilan bog'liq o'yinlar.

Harakatli o'yinlar bolalarning jismoniy va aqliy sifatlarini rivojlantirishga xizmat qiladi. "Oq ayiqlar", "Quvlashmachoq", "Qarmoqcha" – hayotiy zarur harakatlar malakasini shakllantiruvchi o'yinlar; "Kun va tun", "Qirq tosh" – jismoniy sifatlarni rivojlantiruvchi o'yinlar; "O'ylab top", "Eslab qol – bajar" – aqliy qobiliyatlarni rivojlantiruvchi o'yinlar sanaladi. Shuningdek, "Ko'pkari", "Qiz quvlash", "Chillik", "Arqon o'yini", "Chavandoz", "Chavgon", "Ot poyga" kabi ko'plab milliy o'yinlar xalqimiz hayotida muhim o'rin egallagan.

Quyida ikkita namunali o'yinni ko'rib chiqamiz.

"Nina, ip va tuguncha" o'zbek xalq milliy harakatli o'yini. O'ynovchilar qo'l ushlashib aylana hosil qiladi. Uchta o'ynovchi aylanadan tashqarida ketma-ket turadi: birinchisi "ninacha", ikkinchisi "ip", uchinchisi "tuguncha". Nina har tomonlama yugurib, ip va tuguncha uning ketidan ergashadi. Agar ip chigallashib qolsa yoki tuguncha ushlasa, o'yin qaytadan boshlanadi. Bu o'yin bolalarda intizomni, diqqatni va sergaklikni rivojlantiradi.

"Quvalash" o'yini. Bolalar aylana hosil qilib turadilar. Kattaroq o'yin boshlovchi maxsus qo'shiq bilan bolalarni sanaydi; qo'shiq oxiridagi so'z qaysi bolaga to'g'ri kelsa, u safdan chiqadi. Oxirida qolgan bitta bola barcha chiqib turganlarni quvlaydi. Bu folklor-musiqali o'yin bolalarda chaqqonlik, jamoaviy muloqot va o'zaro hamkorlikni tarbiyalaydi.

Zamonaviy muammolar va yechimlar

Globallashuv va raqamli texnologiyalarning jadal rivojlanishi sharoitida o'zbek milliy o'yinlari sezilarli darajada unutilish xavfi ostida qolmoqda. Kompyuter o'yinlari va ijtimoiy tarmoqlar yoshlarning bo'sh vaqtini tobora ko'proq egallayotgani sababli an'anaviy o'yinlarga qiziqish pasaymoqda. Bundan tashqari, shahar muhitida keng maydonlar kamayib borishi, ko'p qavatli turar-joy massivlarining ko'payishi ham jamoaviy o'yinlarni o'tkazish imkoniyatini cheklamoqda.

Tadqiqotlar shuni ko'rsatadiki, bugungi kunda o'zbek yoshlarining katta qismi "Ko'pkari", "Chillak", "Arqon tortish" kabi o'yinlar nomini bilsa-da, ularning qoidalari va o'tkazish tartibini to'liq bilmaydi. Bu holat milliy madaniy merosning uzluksizligiga tahdid solmoqda. Shuningdek, o'yinlarni o'rgatuvchi tajribali ustozlar avlodining kamayib borishi ham jiddiy muammo sifatida namoyon bo'lmoqda.

Ushbu muammolarni hal etish yo'lida bir qator muhim chora-tadbirlar belgilanishi lozim. Birinchidan, umumta'lim maktablarida jismoniy tarbiya va tarbiyaviy soat darslarida milliy o'yinlarga alohida o'rin ajratish zarur. Ikkinchidan, har yili mahalla va tumanlarda "Milliy o'yinlar bayrami" ko'rinishidagi musobaqalar tashkil etish yoshlarni jalb etishda samarali natija beradi. Uchinchidan, o'yinlar qoidalari, tarixi va o'tkazish uslubiyatini o'z ichiga olgan ilmiy-metodik qo'llanmalar yaratish va maktab kutubxonalariga tarqatish muhim ahamiyat kasb etadi.

Davlat darajasida ham bu borada izchil ishlar olib borilmoqda. "Yoshlarga oid davlat siyosati to'g'risida"gi qonun doirasida milliy qadriyatlarni targ'ib qilish, jumladan xalq o'yinlarini tiklash va ommalashtirishga alohida e'tibor qaratilmoqda. Televidenie va ijtimoiy tarmoqlarda milliy o'yinlarni targ'ib qiluvchi ko'rsatuvlar, videomateriallar tayyorlash ham zamonaviy yechimlardan biri sifatida ko'rib chiqilmoqda. Xullas, milliy o'yinlarni saqlab qolish uchun oila, maktab, mahalla va davlat hamkorligida tizimli yondashuv talab etiladi.

Xulosa

O'zbek xalq milliy o'yinlari – xalqimizning donoligi, hazil-mutoyibasi va jamoaviy ruhini aks ettiruvchi bebaho merosdir. Ular yosh avlodni jismoniy, aqliy va ma'naviy jihatdan tarbiyalashda muhim vosita bo'lib xizmat qilgan va bugungi kunda ham o'z ahamiyatini saqlab kelmoqda. Maktab va bog'chalarda tarbiyaviy darslarda, milliy bayramlar va folklor festivallarida bu o'yinlardan keng foydalanish milliy o'zlikni anglash, qadriyatlarni kelajak avlodlarga yetkazish imkoniyatini beradi. Milliy o'yinlarni saqlab qolish va rivojlantirish – bizning muqaddas burchimizdir.

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OLIY TA'LIMDA INNOVATSION INFRATUZILMA XIZMATLARINI TASHKIL ETISHNING TASHKILIY-IQTISODIY MEXANIZMLARINI TAKOMILLASHTIRISH

Annotatsiya. *Mazkur maqolada oliy ta'lim muassasalarida innovatsion infratuzilma xizmatlarini tashkil etishning nazariy va amaliy jihatlari tadqiq etilgan. Universitetlarning innovatsion rivojlanishida texnoparklar, biznes-inkubatorlar, texnologiyalar transfer markazlari va startap platformalarining o'rni tahlil qilingan. Shuningdek, O'zbekiston oliy ta'lim tizimida innovatsion infratuzilmani rivojlantirishning mavjud holati baholanib, uni takomillashtirish bo'yicha tashkiliy-iqtisodiy takliflar ishlab chiqilgan.*

Kalit so'zlar: *innovatsion infratuzilma, oliy ta'lim, texnopark, biznes-inkubator, texnologiyalar transferi, innovatsion faoliyat, startap, universitet.*

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IMPROVING THE ORGANIZATIONAL AND ECONOMIC MECHANISMS FOR ORGANIZING INNOVATION INFRASTRUCTURE SERVICES IN HIGHER EDUCATION

Abstract. *This article examines the theoretical and practical aspects of organizing innovation infrastructure services in higher education institutions. The role of technoparks, business incubators, technology transfer centers and startup platforms in the innovative development of universities is analyzed. The current state of innovation infrastructure development in the higher education system of Uzbekistan is assessed and organizational-economic recommendations for its improvement are proposed.*

Keywords: *innovation infrastructure, higher education, technopark, business incubator, technology transfer, innovation activity, startup, university.*

Kirish. So'nggi yillarda dunyo iqtisodiyotida bilimlar va innovatsiyalar asosiy rivojlanish omiliga aylanib bormoqda. Bunday sharoitda oliy ta'lim muassasalari faqat kadrlar tayyorlovchi institut emas, balki yangi bilimlar yaratish, innovatsiyalar ishlab chiqish va ularni iqtisodiyot tarmoqlariga joriy etuvchi markaz sifatida ham faoliyat yuritmoqda. Shu sababli universitetlarda innovatsion infratuzilmani shakllantirish va samarali boshqarish masalasi dolzarb ahamiyat kasb etmoqda.

Xalqaro tajriba shuni ko‘rsatadiki, innovatsion infratuzilma rivojlangan universitetlarda ilmiy tadqiqotlar samaradorligi, patentlar soni hamda tijoratlashtirilgan ishlanmalar hajmi yuqori bo‘ladi. H. Etzkowitz tomonidan ishlab chiqilgan “Triple Helix” modeli universitet, biznes va davlat hamkorligi innovatsion rivojlanishning muhim omili ekanligini asoslab beradi [1]. Mazkur yondashuvga ko‘ra, zamonaviy universitetlar nafaqat ta’lim va ilmiy faoliyat bilan shug‘ullanishi, balki iqtisodiy rivojlanish jarayonlarida ham faol ishtirok etishi zarur.

O‘zbekistonda ham oliy ta’lim tizimini modernizatsiya qilish, ilm-fan va ishlab chiqarish integratsiyasini kuchaytirish hamda innovatsion faoliyatni qo‘llab-quvvatlash bo‘yicha qator islohotlar amalga oshirilmoqda. Xususan, “Ta’lim to‘g‘risida”gi va “Innovatsion faoliyat to‘g‘risida”gi qonunlarda innovatsion rivojlanishni rag‘batlantirishning huquqiy asoslari belgilab berilgan [8].

Shu bilan birga, ko‘plab oliy ta’lim muassasalarida innovatsion infratuzilma elementlari o‘rtasidagi o‘zaro integratsiya yetarli darajada shakllanmagan, ilmiy ishlanmalarni tijoratlashtirish mexanizmlari esa hali ham takomillashtirishni talab etadi. Mazkur holat oliy ta’limda innovatsion infratuzilma xizmatlarini tashkil etishning samarali mexanizmlarini ishlab chiqish zaruratini yuzaga keltirmoqda.

Tadqiqotning maqsadi oliy ta’lim muassasalarida innovatsion infratuzilma xizmatlarini tashkil etishning tashkiliy-iqtisodiy mexanizmlarini o‘rganish va ularni takomillashtirish bo‘yicha ilmiy tavsiyalar ishlab chiqishdan iborat.

Adabiyotlar sharhi. Universitetlarning innovatsion rivojlanishi masalalari xorijiy olimlar tomonidan keng o‘rganilgan. H. Etzkowitz innovatsion iqtisodiyot sharoitida universitetlar, biznes va davlat o‘rtasidagi hamkorlik innovatsion faoliyat samaradorligini oshirishini ta’kidlaydi [1]. B. Clark tadbirkorlik universitetlari konsepsiyasini ishlab chiqib, universitetlarning moliyaviy mustaqilligi va innovatsion faoliyatga yo‘naltirilgan boshqaruv tizimi ularning raqobatbardoshligini oshirishini asoslab bergan [2]. P. Drucker innovatsiyalarni iqtisodiy taraqqiyotning asosiy omili sifatida baholab, har qanday tashkilotning uzoq muddatli rivojlanishi innovatsion faoliyat samaradorligiga bog‘liq ekanligini qayd etadi [3]. Ochiq innovatsiyalar nazariyasi muallifi H. Chesbrough esa universitet va biznes sektori o‘rtasidagi hamkorlik ilmiy natijalarni amaliyotga joriy etish jarayonini tezlashtirishini ta’kidlaydi [4]. OECD va UNESCO hisobotlarida universitetlar huzurida texnoparklar, biznes-inkubatorlar va texnologiyalar transfer markazlarini rivojlantirish innovatsion ekotizimning muhim elementi sifatida e’tirof etilgan.

Tadqiqot metodologiyasi. Tadqiqotda tizimli yondashuv, qiyosiy tahlil, iqtisodiy-statistik tahlil, ekspert baholash va umumlashtirish usullaridan foydalanildi. Tadqiqot obyekti sifatida O‘zbekiston oliy ta’lim muassasalarida faoliyat yuritayotgan innovatsion infratuzilma elementlari tanlandi.

Tahlil davomida quyidagi ko‘rsatkichlardan foydalanildi:

universitetlarda tashkil etilgan texnoparklar soni;

startap loyihalar soni;

patentlar va intellektual mulk obyektlari soni;

tijoratlashtirilgan ishlanmalar ulushi;

universitet va biznes sektori hamkorlik loyihalari miqdori.

Tadqiqot natijalari. Tadqiqot natijalari universitet innovatsion infratuzilmasining asosiy tarkibiy qismlari sifatida ilmiy laboratoriyalar, texnoparklar, biznes-inkubatorlar, startap markazlari va texnologiyalar transfer ofislarini ajratish mumkinligini ko‘rsatdi.

Texnoparklar ilmiy ishlanmalarni amaliyotga joriy etish va tijoratlashtirish uchun zarur muhit yaratadi. Biznes-inkubatorlar esa talaba va yosh olimlarning innovatsion g‘oyalarini biznes loyihalarga aylantirishga ko‘maklashadi. Texnologiyalar transfer markazlari ilmiy natijalarni ishlab chiqarishga tatbiq etishda vositachi vazifasini bajaradi.

Xalqaro tajriba tahlili innovatsion infratuzilma rivojlangan universitetlarda patentlash faolligi va ilmiy tadqiqotlarning iqtisodiy samaradorligi yuqori bo‘lishini ko‘rsatmoqda [5].

Xulosa. Oliy ta’lim muassasalarida innovatsion infratuzilma xizmatlarini rivojlantirish ta’lim sifati va ilmiy faoliyat samaradorligini oshirishning muhim omili hisoblanadi. Universitetlarda texnoparklar, biznes-inkubatorlar va texnologiyalar transfer markazlarining faoliyatini kengaytirish ilmiy ishlanmalarni tijoratlashtirish imkoniyatlarini oshiradi hamda ta’lim, ilm-fan va ishlab chiqarish integratsiyasini mustahkamlaydi.

Tadqiqot natijalariga asoslanib, universitetlarda innovatsion infratuzilmani rivojlantirish bo‘yicha quyidagi takliflar ishlab chiqildi:

1. Universitet texnoparklari faoliyatini kengaytirish.
2. Startap loyihalarni moliyalashtirish mexanizmlarini takomillashtirish.
3. Texnologiyalar transfer markazlari faoliyatini kuchaytirish.
4. Universitet va biznes sektori hamkorligini rivojlantirish.
5. Innovatsion menejment bo‘yicha mutaxassislar tayyorlash tizimini takomillashtirish.

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OLIY TA'LIMDA INNOVATSION INFRASTRUKTURA XIZMATLARINI TASHKIL QILISHNING AHAMIYATI

Annotatsiya. *Mazkur maqolada oliy ta'lim muassasalarida innovatsion infratuzilma xizmatlarini tashkil etishning nazariy va amaliy jihatlari yoritilgan. Shuningdek, innovatsion infratuzilmaning tarkibiy elementlari, uning ta'lim sifati, ilmiy-tadqiqot faoliyati va iqtisodiy rivojlanishga ta'siri tahlil qilingan. Oliy ta'lim tizimida innovatsion infratuzilma xizmatlarini rivojlantirishning ustuvor yo'nalishlari hamda xalqaro tajribalar asosida takomillashtirish mexanizmlari bayon etilgan.*

Kalit so'zlar: *innovatsiya, innovatsion infratuzilma, oliy ta'lim, texnopark, inkubatsiya markazi, transfer markazi, raqamli ta'lim, ilmiy-tadqiqot faoliyati.*

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THE IMPORTANCE OF ORGANIZING INNOVATIVE INFRASTRUCTURE SERVICES IN HIGHER EDUCATION

Abstract. *This article examines the theoretical and practical aspects of organizing innovative infrastructure services in higher education institutions. It analyzes the structural components of innovative infrastructure and its impact on educational quality, research activities, and economic development. The study also highlights the priority directions for developing innovative infrastructure services within the higher education system and discusses mechanisms for their improvement based on international best practices. The findings emphasize the role of innovative infrastructure in enhancing university competitiveness, promoting knowledge commercialization, and strengthening collaboration among education, science, and industry.*

Keywords: *innovation, innovative infrastructure, higher education, technopark, business incubator, technology transfer center, digital education, research activities.*

Kirish. Jahon iqtisodiyotida raqamlashtirish, globallashuv va bilimlarga asoslangan iqtisodiyotning shakllanishi innovatsion rivojlanishni iqtisodiy o‘sishning asosiy omillaridan biriga aylantirdi. Bunday sharoitda oliy ta’lim muassasalari nafaqat malakali kadrlar tayyorlovchi ta’lim markazlari, balki yangi bilimlar yaratuvchi, ilmiy tadqiqotlarni amalga oshiruvchi va innovatsion texnologiyalarni ishlab chiqarish hamda xizmat ko‘rsatish sohalariga joriy etuvchi muhim institutlar sifatida namoyon bo‘lmoqda. Zamonaviy universitetlar faoliyati ta’lim, ilm-fan va ishlab chiqarish integratsiyasiga asoslanib, mamlakatlarning innovatsion salohiyatini oshirishda strategik ahamiyat kasb etadi [1].

Bugungi kunda rivojlangan davlatlar tajribasi shuni ko‘rsatmoqdaki, universitetlarning xalqaro reytinglardagi o‘rni, ilmiy-tadqiqot natijalari samaradorligi hamda iqtisodiyot rivojiga qo‘shayotgan hissasi ko‘p jihatdan ularda shakllangan innovatsion infratuzilma darajasi bilan belgilanadi. Innovatsion infratuzilma ilmiy laboratoriyalar, texnoparklar, biznes-inkubatorlar, texnologiyalar transferi markazlari, startap akseleratorlari, axborot-resurs markazlari va raqamli ta’lim platformalari kabi elementlarni o‘z ichiga oladi. Ushbu infratuzilma universitetlarda yaratilayotgan ilmiy g‘oyalar va ishlanmalarni amaliyotga joriy etish, tijoratlashtirish hamda ularning iqtisodiy samaradorligini ta’minlash uchun zarur sharoit yaratadi [1].

Metodlar. Tadqiqotda tizimli yondashuv, qiyosiy tahlil, ilmiy umumlashtirish va statistik ma’lumotlarni tahlil qilish usullaridan foydalanildi. Oliy ta’limda innovatsion infratuzilmani rivojlantirishga oid mahalliy va xorijiy ilmiy adabiyotlar, xalqaro tashkilotlarning hisobotlari hamda normativ-huquqiy hujjatlar o‘rganildi.

Muhokama va natijalar. Tadqiqot natijalari innovatsion infratuzilma xizmatlarining oliy ta’lim muassasalari faoliyati samaradorligini oshirishda muhim omil ekanligini ko‘rsatdi.

Birinchidan, innovatsion infratuzilma ta’lim sifatini oshirishga xizmat qiladi. Zamonaviy laboratoriyalar, elektron ta’lim platformalari va ilmiy markazlar talabalarning nazariy bilimlarini amaliy ko‘nikmalar bilan mustahkamlash imkonini beradi. Natijada bitiruvchilarning mehnat bozoridagi raqobatbardoshligi ortadi.

Ikkinchidan, innovatsion infratuzilma ilmiy-tadqiqot faoliyati natijadorligini oshiradi. Universitetlarda tashkil etilgan texnologiyalar transferi markazlari ilmiy ishlanmalarni tijoratlashtirish va ularni ishlab chiqarishga joriy etishga ko‘maklashadi. Bu esa ilm-fan natijalarining iqtisodiy samaradorligini oshiradi.

Uchinchidan, biznes-inkubatorlar va startap markazlari talabalar hamda yosh olimlarning innovatsion g‘oyalarini qo‘llab-quvvatlash orqali tadbirkorlik muhitini rivojlantiradi. Bunday markazlar yangi korxonalar tashkil etilishiga, ish o‘rinlari yaratilishiga va hududiy iqtisodiy rivojlanishga ijobiy ta’sir ko‘rsatadi.

Xalqaro tajriba shuni ko‘rsatadiki, AQSh, Germaniya, Janubiy Koreya va Singapur universitetlari huzurida tashkil etilgan innovatsion ekotizimlar ilmiy tadqiqotlar samaradorligini sezilarli darajada oshirgan. Masalan, universitetlar qoshidagi texnoparklar va inkubatsiya markazlari yuzlab startap kompaniyalarning shakllanishiga xizmat qilgan.

O‘zbekistonda ham innovatsion rivojlanish strategiyasi doirasida oliy ta’lim muassasalari huzurida innovatsion markazlar, texnoparklar va ilmiy laboratoriyalar tashkil etilmoqda. Biroq ularning faoliyatini yanada takomillashtirish, moliyaviy resurslarni kengaytirish va xususiy sektor bilan hamkorlikni mustahkamlash zarur.

Tahlillar shuni ko‘rsatdiki, innovatsion infratuzilma xizmatlarini samarali tashkil etish universitetlarning xalqaro reytinglardagi o‘rnini yaxshilash, ilmiy maqolalar va patentlar sonini ko‘paytirish, shuningdek, ilmiy ishlanmalar asosida yaratilgan mahsulotlarning iqtisodiy samaradorligini oshirishga imkon beradi.

Shuningdek, rivojlangan davlatlar universitetlarining innovatsion faoliyatini tashkil etish tajribasi tahlil qilinib, ularning amaliy natijalari O‘zbekiston sharoiti bilan qiyoslandi. Tadqiqotning metodologik asosini innovatsion rivojlanish nazariyasi, “Triple Helix” modeli hamda universitet-biznes-davlat hamkorligi konsepsiyalari tashkil etdi.

Shuningdek, innovatsion infratuzilma talabalarning ijodiy fikrlash qobiliyatlarini rivojlantirish, ularni ilmiy-tadqiqot va tadbirkorlik faoliyatiga keng jalb etish, innovatsion loyihalarni ishlab chiqish va amalga oshirish imkoniyatlarini kengaytirishga xizmat qiladi. Natijada oliy ta’lim muassasalari hududiy va milliy innovatsion tizimning faol ishtirokchisiga aylanib, iqtisodiyotning turli tarmoqlarida raqobatbardosh mahsulotlar va xizmatlar yaratishga ko‘maklashadi.

Innovatsion infratuzilmaning mohiyati va tarkibiy elementlari. Innovatsion infratuzilma – bu innovatsion faoliyatni qo‘llab-quvvatlash, ilmiy g‘oyalarni tijoratlashtirish va innovatsion mahsulotlarni yaratishga xizmat qiluvchi tashkilotlar, resurslar va xizmatlar majmuidir [3]. Oliy ta’lim tizimida innovatsion infratuzilma quyidagi asosiy elementlardan iborat:

- ilmiy-tadqiqot markazlari;
- texnoparklar;
- biznes-inkubatorlar;
- texnologiyalar transferi markazlari;
- startap markazlari;
- axborot-resurs markazlari;
- raqamli ta’lim platformalari;
- innovatsion laboratoriyalar.

Xulosa. Oliy ta’lim muassasalarida innovatsion infratuzilma xizmatlarini tashkil etish ta’lim sifati, ilmiy-tadqiqot faoliyati samaradorligi va innovatsion iqtisodiyot rivojlanishining muhim omili hisoblanadi. Innovatsion infratuzilma talabalarning ijodiy va tadbirkorlik salohiyatini rivojlantirish, ilmiy natijalarni tijoratlashtirish hamda universitetlarning xalqaro raqobatbardoshligini oshirishga xizmat qiladi.

Kelgusida oliy ta’lim muassasalarida texnoparklar, biznes-inkubatorlar, texnologiyalar transferi markazlari va raqamli innovatsion platformalarni rivojlantirish orqali innovatsion infratuzilma xizmatlarining samaradorligini yanada oshirish maqsadga muvofiqdir.

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QOROVULBOZOR TUMANINING NOMODDIY TARMOQLARIGA IQTISODIY GEOGRAFIK TAVSIF

Annotatsiya: *Ushbu maqolada Qorovulbozor tumanining nomoddiy tarmoqlari va ularning viloyat iqtisodiyotidagi o‘rni hamda aholi turmush tarzini yaxshilash uchun yaratilgan shart-sharoitlar to’g’risida batafsil ma’lumot berilgan.*

Kalit so‘zlar*: Nomoddiy tarmoq, infratuzilma, iqtisodiy geografik o‘rin, aholi, tibbiyot, maktabgacha ta’lim, Qoroulbozor, rayon, Bo‘zachi.*

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ECONOMIC GEOGRAPHICAL DESCRIPTION OF THE INTANGIBLE SECTORS OF KAROVULBAZAR DISTRICT

Abstract: *This article provides detailed information about the intangible sectors of the Karaulbazar district and their role in the regional economy, as well as the conditions created to improve the population's lifestyle.*

Keywords: *Intangible sector, infrastructure, economic-geographical location, population, medicine, preschool education, Karaulbazar, district, Bozachi.*

The place of Uzbekistan in the world community in the 21st century depends on what kind of people the new generation and our children will grow up to be. Therefore, caring for the upbringing of a physically healthy, spiritually mature, harmoniously developed generation possessing high intellectual potential, modern knowledge, independent thinking, and a confident outlook on the future is a priority of state policy.

The Karaulbazar district, the "youngest" of the districts of the Bukhara region, was established on January 12, 1993. Its area is 2.2 thousand km2, which is only 5.5% of the region's area. The population is 22,000. The nature and socio-economic characteristics of the Karaulbazar district are unique. The Karaulbazar massif is located far from the regional center, in the heart of a steppe characterized by harsh

climatic conditions. The center is the city of Karaulbazar, located 65 km far from Bukhara city.

Over the past half-century, the Bukhara region has undergone unique stages of historical development. Its political and administrative structure has changed several times. One of these important changes is the formation of the Karaulbazar district within the region[2].

Indeed, it is very important to study the geography of our Motherland's history. Unfortunately, today we feel this even more deeply, because there are very few manuals and textbooks dedicated to our region and its districts. Most of the existing ones were also published in other languages.

Planned work is being carried out in the education system to update the content of education, introduce modern pedagogical technologies into the teaching process, increase the level of students' knowledge and the pedagogical skills of teachers and educators, and strengthen the material base of educational institutions.

The emergence of the education sector and schools in Karaulbazar dates back to quite a long time, more precisely, to the 1920s. The first school was established in 1924 in the village of Bozachi, and it was restored through khashar. During the day, village children studied at this school, and in the evenings, the adult population became literate.

A primary school was established at the Karaulbazar station in 1953, where the children of railway workers and employees were educated. In 1958, after Karaulbazar was granted the status of a workers' settlement, this school was included in the Kagan District Education Department, and in the 1959-1960 academic year, it was transformed into a seven-year school and began to be called School No. 15. Classes were conducted in Uzbek and Russian languages[3].

In the 1961-1962 academic year, this school was transformed into an eight-year school, and the teaching staff consisted mainly of teachers with secondary specialized education. Starting in 1961, young specialists who had graduated from the institute began attending the school.

The district department of public education began its activities on April 1, 1993. At that time, 230 teachers and mentors with higher and secondary specialized education provided education and upbringing to 2,476 children of workers. In the 1992–1993 academic year, 5 schools, a creative home for students, and the "Guncha" preschool educational institution operated in the district; by 1994, the 6th general education school had joined the ranks, and in 1997, the 7th general secondary school. On June 1, 1998, the "Lola" children's sanatorium, in 1999, the "Zumrad" and "Bulbulcha" preschool educational institutions were transferred from the "Uzgazparmalash" trust, in 2000, the "Quyoshcha" preschool educational institution was transferred from the Karaulbazar oil and gas exploration expedition, and in 2001, the "Boychechak" preschool educational institution was transferred from the Bukhara Oil Refinery. In 2007, the 8th boarding school for gifted children was established in the district. The district has a general education school, music and sports schools, a vocational college, a palace of culture, a house of culture, 2

clubs, 4 libraries, a park of culture and recreation, and a youth center complex. There are song and dance, folklore and ethnographic ensembles[4].In our country, where the individual and their interests are considered a priority, special attention is paid to strengthening public health, especially maternal and child health—in short, ensuring the population's access to high-quality medical services. All of this is the result of the large-scale reforms carried out in the healthcare system under the leadership of the President of our country since the first days of independence.

In our country, a qualitatively new network of medical institutions has been created that meets the highest requirements and includes dozens of major specialized centers for primary healthcare, republican and regional emergency medical care, as well as surgery, cardiology, urology, and eye microsurgery, which, in turn, serves as an important factor in maintaining stable health indicators in the country.

Naturally, the construction of a specialized center equipped with modern medical equipment, diagnostic, screening, and perinatal services, new maternity facilities, and the special attention paid to protecting the health of mothers and children are rooted in a single noble goal: to further strengthen the health of our people and raise a healthy generation.

The first hospital in Karaulbazar was established in 1958, and at that time, there was a hospital bed. Of the hospital beds, 10 are reserved for internal medicine, 3 for children, and 2 for the maternity ward. Since only one highly qualified doctor worked here, there was no polyclinic.

In 1960, the hospital expanded to 25 beds, and in 1965, to 35 beds. In 1965, a three-room clinic was established next to the hospital. The building was allocated by the geological department of the oil and gas exploration expedition.

An ambulance service was not established in Karaulbazar until 1966. The "ambulance" was primarily operated by vehicles from the oil and gas exploration department. Subsequently, this enterprise supplied the ambulance with fuel and spare parts allocated by the Kagan Central Hospital.

In 1972, the construction of a new polyclinic and hospital buildings was completed and commissioned. The polyclinic has rooms for receiving patients with internal diseases, dentistry, surgery, ear, throat and nose, women's and pregnant patients, and many amenities have been created[1].

The "Guzal" sports and health complex, the central stadium, a tennis court, the "Dolphin" swimming pool, and sports facilities are in operation. Forty-three doctors and 180 mid-level medical workers work at the district central hospital, the central polyclinic, three rural medical stations, two paramedic-obstetric stations, an ambulance station, 15 health centers, pharmacies, and medical institutions.

Contracts have been concluded with all production and industrial enterprises located in the district to conduct in-depth medical examinations of workers. The organizational and methodological office of the polyclinic is computerized for the timely collection and transmission of statistical data to relevant organizations in a modern manner.

The main focus of the district health center is the analysis of factors affecting the health of the region's population, the formation of a healthy lifestyle, the upbringing of a harmoniously developed generation, and the implementation of comprehensive preventive educational and promotional measures aimed at forming a physically strong, mentally energetic, and intellectually developed individual. Furthermore, he coordinates and directs the medical advocacy activities of all medical institutions in the district, promoting topical medical issues regarding especially dangerous, infectious, and somatic diseases, as well as the prevention of drug addiction, harmful habits, AIDS, and the role of sports in longevity among adolescents and youth, and the protection of motherhood and childhood.

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INTERAKTIV DOSKA VA MOBIL ILOVALAR YORDAMIDA BOSHLANG'ICH SINF DARSLARINI TASHKIL ETISHNING ZAMONAVIY METODIKASI

Annotatsiya. *Ushbu maqolada boshlang'ich sinf darslarini tashkil etishda interaktiv doska va mobil ilovalardan foydalanishning zamonaviy metodikasi ilmiy-nazariy jihatdan o'rganilgan. Raqamli ta'lim vositalarining kichik yoshdagi o'quvchilar idrokiga ta'siri, interaktiv muhitning kognitiv rivojlanishdagi o'rni va mobil ilovalarning dars samaradorligini oshirishdagi imkoniyatlari tahlil qilingan. Tajriba-sinov ishlarini o'tkazishning nazariy asoslari belgilab berilgan.*

Kalit so'zlar: *interaktiv doska, mobil ilova, boshlang'ich sinf, zamonaviy metodika, raqamli ta'lim, kognitiv faollik, gamifikatsiya, Smart texnologiyalar.*

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MODERN METHODS OF ORGANIZING PRIMARY CLASSES USING INTERACTIVE BOARDS AND MOBILE APPLICATIONS

Abstract. *This article provides a scientific-theoretical study of modern methods of using interactive whiteboards and mobile applications in organizing primary school lessons. The influence of digital learning tools on the perception of younger students, the role of interactive environments in cognitive development, and the potential of mobile applications in improving lesson effectiveness are analyzed. The theoretical foundations for conducting experimental work are outlined.*

Keywords: *interactive whiteboard, mobile application, primary school, modern methodology, digital education, cognitive activity, gamification, Smart technologies.*

Kirish

Boshlang'ich ta'lim — shaxs intellektual va ijtimoiy rivojlanishining poydevori. Aynan 6–10 yoshli o'quvchilar uchun mo'ljallangan ta'lim jarayoni qanchalik samarali va qiziqarli tashkil etilsa, keyingi yillar o'qish samaradorligi shunchalik yuqori bo'ladi. Bugungi kunda dunyo miqyosida boshlang'ich sinf darslarini tashkil etishga yangicha yondashuv qaror topmoqda: an'anaviy doskani interaktiv doska bilan almashtirish, darsliklarni raqamli kontent bilan to'ldirish va

o’quvchilarning shaxsiy qurilmalaridan (planshet, smartfon) ta’lim vositasi sifatida foydalanish tobora keng tarqalmoqda [1].

O’zbekiston Respublikasining «Ta’limni 2030 yilgacha rivojlantirish konsepsiyasi»da boshlang’ich ta’limni raqamlashtirish, zamonaviy o’quv muhitini yaratish va o’quvchilarda raqamli madaniyatni erta yoshdan shakllantirish ustuvor vazifalar sifatida belgilangan [2]. 2022–2026 yillarda respublikamizning 1 200 dan ortiq maktabiga Smart-sinfxona jihozlari o’rnatilgan bo’lib, bu yangi pedagogik metodika va yondashuvlarni ishlab chiqishni talab etmoqda [3].

Biroq interaktiv doskalarning texnik jihatdan mavjudligi ulardan to’g’ri va samarali foydalanishni avtomatik ta’minlamaydi. Tadqiqotlar shuni ko’rsatadiki, o’qituvchi interaktiv texnologiyalardan metodik jihatdan asoslanmagan holda foydalanganda, darsning samaradorligi an’anaviy usulga nisbatan farq qilmaydi, hatto pasayishi ham mumkin [4]. Shu sababli interaktiv doska va mobil ilovalarni boshlang’ich sinf darslariga metodologik jihatdan to’g’ri integratsiya qilish masalasi dolzarb ilmiy muammoga aylangan.

Adabiyotlar tahlili

Interaktiv doska va mobil ilovalar pedagogikasiga oid xalqaro tadqiqotlar 2000-yillarning boshidan jadal rivojlana boshlagan. Britaniyalik tadqiqotchilar L. Becta va G. Hall (2003) Angliya boshlang’ich maktablarida o’tkazgan keng ko’lamli eksperimentda interaktiv doska (SMART Board) dan samarali foydalanilgan sinflarda o’quvchilarning saboqqa jalb bo’lishi 47 foizga, o’zlashtirish esa 23 foizga oshganini aniqladi [5].

Kanadalik olim G. Stacey (2010) boshlang’ich sinf o’quvchilari uchun eng qulay ta’lim uslubi vizual-kinestetik (ko’rish va harakatni birlashtirish) ekanligini va interaktiv doska aynan ushbu uslubga javob berishini empirik jihatdan isbotlagan [6]. Nemis pedagogi M. Kerres (2013) esa «raqamli vosita qanchalik zamonaviy bo’lmasin, uni pedagog qo’llamasdan mazmunli didaktik loyiha asosida ishlatmasa, u oddiy proyektordan farq qilmaydi» degan xulosaga kelgan va bu «texnosentrik xato» deb atagan [7].

Mobil ilovalar sohasida J. Crompton (2013) ning meta-tahlili 38 ta tadqiqot natijalarini umumlashtirib, mobil o’rganish (m-learning) boshlang’ich sinf o’quvchilarida matematika va savod o’qitishda ayniqsa samarali ekanligini ko’rsatgan [8]. O’zbekistonlik tadqiqotchi S. Tursunov (2022) respublikaning 6 ta viloyatidagi 40 boshlang’ich sinf o’qituvchisi orasida o’tkazgan so’rovda ularning 71 foizi interaktiv doska bilan ishlash ko’nikmalarini yetarli emas deb baholashini aniqlagan [9].

Tadqiqot natijalari va muhokama

Interaktiv doska: pedagogik mohiyati va turlari

Interaktiv doska (Interactive Whiteboard — IWB) — sensor texnologiya asosida ishlaydigan, kompyuter bilan ulangan va proyektor orqali tasvirlanadigan raqamli ta’lim yuzasi. Foydalanuvchi barmoq yoki maxsus qalam yordamida to’g’ridan-to’g’ri doska yuzasida ishlaydi: yozadi, chizadi, ob’ektlarni

harakatlantiradi, multimedia fayllarni boshqaradi. Boshlang'ich ta'limda qo'llaniladigan interaktiv doskalarning asosiy turlari:

– SMART Board (SMART Technologies) — eng keng tarqalgan tur; multitouch texnologiyasini qo'llab, bir vaqtda bir necha o'quvchi ishlay oladi;

– Promethean ActivBoard — kuchli dasturiy ta'minoti (ActivInspire) bilan jihozlangan; boshlang'ich ta'lim uchun tayyor dars shablonlari mavjud;

– Mimio Teach — mobil ko'rinish; oddiy oq doskaga o'rnatiladi va uni interaktivga aylantiradi;

– Huawei IdeaHub — O'zbekiston maktablarida so'nggi yillarda faol joriy etilmoqda; android tizimida ishlaydi.

Kuzatishlar shuni ko'rsatdiki, boshlang'ich sinflarda interaktiv doska samaradorligi uning texnik imkoniyatlaridan ko'ra o'qituvchining undan qanday foydalanishi bilan ko'proq belgilanadi.

Mobil ilovalar: tasnifi va didaktik imkoniyatlari

Boshlang'ich sinf o'quvchilari uchun mo'ljallangan mobil ilovalarni ularning didaktik vazifasiga ko'ra quyidagi guruhlarga ajratish mumkin:

Savod o'qitish ilovalari: Starfall, Reading Eggs, Bixby (o'zbek tili uchun), Aloqa. Bu ilovalar fonetik tahlil, so'z boyligini kengaytirish va o'qish tezligini oshirish uchun o'yinli topshiriqlar taklif etadi. Reading Eggs ilovalari 5 million foydalanuvchi ma'lumoti asosida 76 foiz o'quvchida o'qish ko'nikmasi 2 barobar yaxshilanganini qayd etgan [11].

Matematika ilovalari: Khan Academy Kids, Matific, Math Ninja, Photomath. Ayniqsa Khan Academy Kids O'zbekistonda keng qo'llanilmoqda; o'zbek tili interfeysiga ega va boshlang'ich sinf dasturiga moslashtirilgan [12].

Ijodiy fikrlash ilovalari: Book Creator, Pic Collage Kids, Toontastic 3D. O'quvchi hikoya tuzadi, rasm chizadi yoki multfilm yaratadi. Bu jarayon til rivojlanishi va ijodiy tafakkurni bir vaqtda oshiradi.

Baholash va qayta aloqa ilovalari: Kahoot! Kids, Seesaw, ClassDojo. Seesaw ilova orqali o'quvchi o'z ishini rasm, video yoki audio shaklida saqlaydi; o'qituvchi va ota-ona real vaqtda ko'ra oladi [13].

Xulosa

Interaktiv doska va mobil ilovalar boshlang'ich sinf darslarini samarali tashkil etishda muhim pedagogik vosita bo'lib, ularning ta'siri Dual Coding, ZPD va Embodied Cognition nazariyalari doirasida ilmiy jihatdan asoslanadi. Ushbu texnologiyalar darsga o'quvchilarning jalb bo'lishini, kognitiv faolligini va o'zlashtirish darajasini oshiradi, biroq bu ta'sir faqat o'qituvchi ulardan metodik jihatdan to'g'ri va maqsadga muvofiq foydalangandagina namoyon bo'ladi.

O'zbekiston sharoitida interaktiv doskalar va mobil ilovalarni keng joriy etish uchun o'qituvchilarni metodik jihatdan tayyorlash, o'zbek tilidagi raqamli kontent yaratish va maktablar texnik infratuzilmasini takomillashtirish zarur.

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CHIQINDISIZ TEXNOLOGIYALAR VA BARQAROR HUDUDIY RIVOJLANISHNING GEOGRAFIK JIHATLARI

Annotatsiya: *Mazkur maqolada chiqindisiz texnologiyalarning barqaror hududiy rivojlanishni ta'minlashdagi geografik jihatlari tahlil qilingan. Ishlab chiqarish jarayonida tabiiy resurslardan oqilona foydalanish, chiqindilarni kamaytirish va qayta ishlash texnologiyalarining hududiy tashkil etilishi yoritilgan. Shuningdek, ekologik muammolarni kamaytirish, geoekologik barqarorlikni ta'minlash hamda "yashil iqtisodiyot" tamoyillarini rivojlantirishda chiqindisiz texnologiyalarning ahamiyati ochib berilgan. Maqolada sanoat, qishloq xo'jaligi va urbanizatsiya jarayonlarida ekologik xavfsiz texnologiyalarni joriy etishning iqtisodiy-geografik xususiyatlari ham tahlil etilgan.*

Kalit so'zlar: *chiqindisiz texnologiyalar, barqaror rivojlanish, iqtisodiy geografiya, geoekologiya, yashil iqtisodiyot, ekologik muvozanat, tabiiy resurslar, qayta ishlash texnologiyasi, hududiy rivojlanish, ekologik xavfsizlik, sanoat geografiyasi, urbanizatsiya.*

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GEOGRAPHICAL ASPECTS OF WASTELESS TECHNOLOGIES AND SUSTAINABLE REGIONAL DEVELOPMENT

Abstract: *This article analyzes the geographical aspects of waste-free technologies in ensuring sustainable regional development. The territorial organization of rational use of natural resources in the production process, waste reduction and recycling technologies is highlighted. The importance of waste-free technologies in reducing environmental problems, ensuring geoecological stability and developing the principles of the "green economy" is also revealed. The article also analyzes the economic and geographical features of the introduction of*

environmentally friendly technologies in industrial, agricultural and urbanization processes.

Keywords: *waste-free technologies, sustainable development, economic geography, geoecology, green economy, ecological balance, natural resources, recycling technology, territorial development, environmental safety, industrial geography, urbanization.*

Tabiatni, tabiiy landshaftlarni tabiiy holida asrab kelajak avlodga yetkazish ilm fan oldidagi eng dolzarb muammolardan biri hisoblanadi. Buning uchun dastlab ishlab chiqarishda chiqindisiz texnologiyalarni joriy qilish lozim. Chunki chiqindilar hozirgi kunda atrof muhitni ifloslaydigan asosiy manbalardan biri bo`lib qolmoqda. Ularning tabiatda xoh qattiq, xoh suyuq, xoh gaz holatda bo'lsin atrof - muhit uchun zarari katta.

Chiqindilarni qayta ishlash, ulardan oqilona foydalanish va chiqindisiz texnologiyalarni joriy etish bugungi kunning eng dolzarb masalasi hisoblanadi. Chunki, chiqindilarning atrof - muhitga yetkazayotgan zarari yildan yilga ortib bormoqda. Chiqindisiz texnologiyalarni joriy etgan holda ishlab chiqarishni rivojlantirish hozirgi zamon talabidir.

Shu kunga qadar fanda chiqindilarning 900ga yaqin turi qayd etilgan bo`lib, har yili dunyoda chiqindilar hajmi 3% ga ko'paymoqda. Natijada chiqindilarning atrof-muhitga yetkazadigan zarari ortib bormoqda. Biz ularning tabiatga salbiy ta’sirini quyidagi holatlarda ko`rishimiz mumkin:

1- Atmosferani ifloslantiradi;

2- Litosferaga zarar yetkazadi;

3- Chiqindi poligonlarida yig'ilgan turli xil chiqindilar zararli bakteriyalar rivojlanishi uchun muhit hisoblanadi;

4- Chiqindilardan chiqayotgan zararli birikmalar ekologik muvozanatning buzilishiga olib keladi;

5- Chiqindilar chiqarayotgan zaharli moddalar aholi salomatligiga salbiy ta’sir ko’rsatib, turli allergik va onkologik hamda yuqumli kasalliklarning ko`payishiga sabab bo`lmoqda.

Sanoat tarmoqlaridan chiqayotgan chiqindilar geografik qobiqning o'zgarishi va uning ifloslanishiga olib kelmoqda. Sanoatda ishlab chiqarishning intensivlashuviga qaramay ishlab chiqarish jarayonida xom ashyoning bir qismi chiqindi sifatida geografik muhitga chiqarib tashlanmoqda. Ma’lumotlarga ko'ra, dunyoda atrof - muhit ifloslanishida sanoat va tabiiy energiya (ko'mir, gaz, slanes, torf va boshqalarni yoqishdan chiqqan chiqindi va gazlar) chiqindilari 55 %ni tashkil etadi. Sanoat tarmoqlari va tabiiy energiyadan har yili geografik qobiqqa 17,3 mlrd. t har xil zararli gazlar, 4 mlrd. t qattiq chiqindilar chiqib, atmosferani har xil chang, qurum, gaz va radioaktiv moddalar bilan ifloslamoqda. Natijada geografik qobiq unsurlarining o'zaro aloqalariga salbiy ta'sir etishdan tashqari, atmosferadagi o'sha har xil chang to'zon va qattiq zarrachalar, yog'inlar, shamollar orqali yer yuziga qaytib tushib suv, tuproqni ifloslamoqda, har xil inshootlar, binolar

va ularning tunukalarini yemirilishini tezlashtirmoqda. Geografik qobiqqa ta’sir etib, uni o'zgartirilishida tog'- kon sanoati ham ishtirok etadi.

Bugungi kunda fan - texnika yutuqlaridan foydalanib, yer osti boyliklari ham tezkorlik bilan o'zlashtirilmoqda. Hozir yiliga yer bag'ridan qazib olinayotgan foydali qazilmalar va qurilish materiallarining miqdori A.N.Kurakova ma’lumotiga ko'ra, 190 - 200 mlrd. t atrofida bo'lib, ularni qazib olish uchun 6000 km² yer ag'darilib, bir yerdan ikkinchi yerga olib borib tashlanmoqda. Bu esa geografik qobiq landshaftlarining o'zgarishiga, ularni ifloslanishiga olib kelmoqda.

Tabiiy landshaftlarning o'zgarishida yana ma’danlarni ochiq usulda yoki karyer usulida qazib olish ham salbiy ta’sir ko'rsatadi. Bu usulda ma'danlarni qazib olishda uning ustki qatlamidagi keraksiz jinslar olinib, boshqa yerlarga tashlandiq jins sifatida tashlanadi. Natijada yangi «texnogen» relyef shakllari karyerlar, shaxtalar, tashlandiq jins uyumlari kabi antropogen landshaft vujudga kelmoqda.

Har soniyada sayyorada tabiatga zarar keltirmaydigan uch kilogramdan ortiq tabiiy chiqindi yuzaga keladi. Unga tuxum po`chog`i, mevalar po`stlog`i va boshqalar kiradi. Oziq ovqat qoldiqlari aholi vakili chiqindi savatining 29 %ga yaqinini tashkil qiladi. Qolgan 13 %i - shisha, 11 %i plastmassa, 4 %i metal chiqindilar bilan band. 18 %i esa boshqa turdagi chiqindilarga kiradi. Ma'lumot o'rnida shuni aytishimiz mumkinki, qog`ozdan tayyorlangan salfetka dengiz suvida 3 oyda, gugurt cho`plari 6 oyda to`liq eriydi. Tamaki qoldig`i esa 5 yilgacha suzib yuradi. Polietilen paket suvni 10 - 12 yil davomida ifloslantiradi, neylon buyumlar 35 yildan keyin yo`q bo`ladi, temir banka butunlay yo`q bo`lishi uchun 500 yil kerak. Shisha butilka to`liq erishi uchun esa 1000 yil zarur bo`ladi.

Tabiiy landshaftlarning o'zgarishida antropogen omilning ta’siri kattaligini chiqindilarning Qarshi shahri atrofidagi tabiatga ta’sirida ko`rishimiz mumkin. Biz Qarshi shahri Qo'ng'irtog' yaqinidagi chiqindi poligonida bo`lib vaziyatni o'rgandik. Bu yerdagi holat umuman talabga javob bermaydi. Poligon aholi punktlariga borgan sari yaqinlashib bormoqda. Poligonda aholining maishiy chiqindilari, qurilish materiallari qoldiqlari, polietilen va rezina buyumlar va boshqa ko'plab turdagi chiqindilar yillar davomida to'planib kelgan. Poligon tabiiy landshaftlarning faqatgina tashqi ko'rinishiga emas, balki ularning sifatiga ham salbiy ta’sir ko`rsatadi.

Chiqindilar shamol ta'sirida bir necha kilometr masofagacha uchib borib, aholi xojalik faoliyatiga ta’sir etishi tufayli aholi o`rtasida kasallanish ko`rsatkichlari ortib, ekologik muvozanat buzilmoqda. Bu muammoga befarq qarash mumkin emas! Chiqindilar va ulardan oqilona foydalanish bilan bog’liq muammolarni o’rganish va tahlil qilish faqatgina ilm-fanning emas, balki butun insoniyatning vazifasidir. Bunga aholining ekologik madaniyatini oshirish orqali erishish mumkin.Shu maqsadida Qarshi shahridagi "Qo'ng'irtog" tepaliklari va ushbu hududni tozalash, obodonlashtirish ishlarida yoshlar o'z tashabbuslarini ko'rsatishdi. Yoshlar ishlari agentligi Qarshi shahar bo'limi mas'ullari, Qarshi shahridagi MFY yoshlar yetakchilari hamda ko'ngilli yoshlar "Yashil makon"

umummilliy loyihasi doirasida ushbu hududni turli chiqindilardan tozalash ishlarini olib bordilar.

Qo'ng'irtog' tepaliklari atrofi kelgusida yashil hududga aylantirish hamda minglab ko'chatlar o'tqazish ko'zda tutilgan ekan, bunda albatta, Qarshi shahri yoshlari ham o'z hissalarini qo'shdilar. Ushbu ishda 100 nafarga yaqin ko'ngilli yoshlar ishtirok etdilar.

Dolzarb 40 kunlik aksiyasi doirasidagi ishlar ham o`z natijasini bermoqda

Prezidentimiz tashabbusi bilan e'lon qilingan ushbu loyihalar davomida Qarshi shahrida daraxt ekish ishlari uyushqoqlik bilan tashkil etilmoqda. Aksiyada shahar hokimligi tomonidan 200 ming tupdan ortiq mevali va manzarali daraxt ko`chatlari, 1 mln donaga yaqin tol, terak va atirgul qalamchalari olib kelinib, shahardagi 64 ta mahalla fuqarolar yig`inlaridagi xonadonlarga, ko`chalarga hamda ijtimoiy soha obyektlari - maktablar, maktabgacha ta'lim tashkilotlari, tibbiyot muassasalari hovlilariga, bo`sh turgan maydonlarga ekish uchun tarqatib berildi.

Buni o`rganish davomida Qashqadaryo viloyatidagi Qashqadaryo Eko Trans MCHJda bo`lib, u yerda chiqindilar va ularning atrof - muhitga yetkazayotgan salbiy ta'siri hamda chiqindisiz texnologiyalar haqida ma'lumotga ega bo`ldik.

O'zbekiston Respublikasi Prezidentining 2017 - yil 1- apreldagi "Ekologiya va atrof - muhit sohasida davlat boshqaruvi tizimini takomillashtirish to'g'risida" gi PF-5024- sonli Farmoni hamda 2017 – 2021 - yillarda maishiy chiqindilar bilan bog`liq ishlarni amalga oshirish tizimini tubdan takomillashtirish va rivojlantirish bo`yicha chora - tadbirlar to`g`risidagi PQ – 2916 - sonli Qarori ijrosini ta'minlash maqsadida Qarshi shahrida qattiq va maishiy chiqindilarni yig`ish va tashish, qayta ishlash va utilizatsiya qilish bo`yicha QASHQADARYO EKO TRANS MCHJ klassteri tashkil etilgan. QASHQADARYO EKO TRANS MCHJ jamoasi Qarshi shahrida sanitariya va ekologik vaziyatni yaxshilash, aholi turmush darajasi va sifatini yanada oshirish uchun yuridik va jismoniy shaxslarga xizmat ko`rsatib kelmoqda. Jamiyatda jami 265 nafar ish o`rni yaratilib ishchi - xizmatchilar ish bilan ta'minlandi. Qarshi shahrida tashkil etilgan QASHQADARYO EKO TRANS MCHJ ning 2,2 mlrd. so`m va O`zmilliy bankning 8,3 mlrd. so`m hamda 2,9 mln. AQSH kredit mablag`lari jami 5138,1 ming dollar hisobiga 44ta maxsus texnika va 6ta texnologik uskunalarni (5tasi qayta ishlash va 1ta saralash) xarid qilish bo`yicha Xitoyning BESTON (HENAN) MACHINERY CO.LTD kompaniyasi bilan shartnomalar imzolangan. Hozirgi kunda 22 ta texnika Qarshi shahridagi 62 ta mahallalarga va yuridik tashkilotlarga xizmat ko`rsatib kelmoqda.

QASHQADARYO EKO TRANS MCHJ G'uzor tumanidagi Chiqindilarni saralash va qayta ishlash kompleksi bilan bevosita hamkorlikda ish olib boradi. Yig`ilgan chiqindilar ushbu kompleksga yetkazib beriladi va u yerda chiqindilar qayta ishlanib, ulardan ko`mir briketi (bioko`mir), granula va qog`oz ishlab chiqariladi, kompleksga keltirilgan chiqindilarning 30 - 40%i qayta ishlanadi, qolgan qismi esa bioo'g`itga aylantiriladi.

Hozirgi kunda QASHQADARYO EKO TRANS MCHJ da: 44ta maxsus texnikalar (30 ta chiqindi tashish texnikasi, 8ta samosval, 1ta assenizator, 1ta

gildirakli ekskavator, 1ta buldozer, 2 ta avtoyuklagich) olib kelingan. 1ta chiqindilarni qayta saralash uskunasi xarid qilingan bo`lib korxona qurilishi ishlari yakunlanib, saralash uskunasi ishga tushirilgan. Plastmassa quvurlar ishlab chiqarishga mo`ljallangan liniya olib kelib o'rnatilgan.

Chiqindisiz texnologiyalarni joriy etish orqali atrof - muhitga ajraladigan chiqindilar ikkilamchi xomashyo sifatida qayta ishlashga beriladi va ularning atrof-muhitga zararli ta'siri deyarli bo'lmaydi. Bunda asosiy xomashyo va undan qoladigan chiqindidan kompleks va samarali foydalanilsa:

- birinchidan, xomashyoning ortiqcha sarflanishining oldi olinadi;
- ikkinchidan, atrof - muhit ifloslanishdan saqlanadi;
- uchinchidan har xil kasalliklarning kelib chiqishi kamayadi;
-to`rtinchidan chiqindisiz texnologiyalar yordamida energiya tejaladi.
- beshinchidan agar aholi o'z chiqindilarini o'zi saralasa ortiqcha ishchi kuchiga va qayta ishlovchi texnikalarga ehtiyoj sezilmaydi, ya’ni sarf - xarajat kamroq bo`ladi. Shuningdek, chiqindilarni qayta ishlash jarayoni tez bo'ladi, vaqt tejaladi. Bu borada :

- Birinchi o`rinda aholining ekologik madaniyatini oshirish
- Ikkinchi o`rinda ishlab chiqarishga chiqindisiz texnologiyalarni joriy etish

-Uchinchi o`rinda ishlab chiqarish korxonalarini yangi avlod chiqindisiz texnologiyalari bilan jihozlash; Bu o`rinda chiqindisiz texnologiyalar ishlab chiqarishdagi eng muhim bosqichga aylanishi zarur Texnologiyalarning sifat jihatdan mukammalligi va ekologik jihatdan zararsizligi, kam chiqindi ajratishi va ajratgan taqdirda ham atrof - muhitga bezarar bo'lishi lozim..

-To`rtinchi o`rinda ishlab chiqarish va iste'mol chiqindilaridan ekologik muvozanatni buzmagan holda samarali foydalanish kabi ishlarni amalga oshirish muhim ahamiyatga ega.

Bu bizga nima beradi?

• Chiqindisiz texnologiyalar orqali atrof - muhit ifloslanish darajasi pasayadi;
• Atmosferaga chiqarilayotgan har xil zaharli moddalar va litosferani zararlayotgan har xil zararli chiqindilar miqdori kamayadi;
• Chiqindi poligonlarida joy tejaladi;
• Chiqindisiz texnologiyalar orqali xomashyo isrofining oldi olinadi ya'ni xomashyodan kompleks foydalaniladi;
• Yangi mahsulot turlari yaratiladi.

Chiqindisiz texnologiyalarni ishlab chiqarishga joriy etish va chiqindilardan oqilona foydalanish uchun quyidagilar zarur:

1) aholiga ekologik madaniyatni singdirish uchun turli tadbirlar tashkil etishi. Ularga tabiat insoniyatning umumiy uyi ekanligi, uni asrab - avaylab kelgusi avlodga yetkazish har birimizning zimmamizdagi burch ekanligini anglatish;

2) aholi o'z chiqindilarini o'zi saralashi ;

3) ishlab chiqarishga kam energiya sarf qiluvchi chiqindisiz texnologiyalarni joriy etilishi.

Kelgusida aholi o`rtasida chiqindilarga to`g`ri munosabatda bo`lish ko`nikmalarini hosil qilish orqali tabiat muhofazasiga erishamiz deb umid qilamiz.

Xulosa qilib aytganda, chiqindisiz texnologiyalarni rivojlantirish barqaror hududiy taraqqiyotni ta’minlashning muhim omillaridan biri hisoblanadi. Mazkur texnologiyalar tabiiy resurslardan samarali foydalanish, atrof-muhit ifloslanishini kamaytirish va ekologik muvozanatni saqlashga xizmat qiladi. Shu bilan birga, ishlab chiqarish jarayonlarini ekologik jihatdan optimallashtirish orqali hududlarning iqtisodiy samaradorligi ham ortadi.

Geografik nuqtai nazardan chiqindisiz texnologiyalarni joriy etish hududlarning tabiiy resurs salohiyati, sanoat ixtisoslashuvi va ekologik holatini ҳисобга olgan holda amalga oshirilishi zarur. Ayniqsa, “yashil iqtisodiyot” tamoyillarini keng qo‘llash, qayta ishlash sanoatini rivojlantirish va qayta tiklanuvchi energiya manbalaridan foydalanishni kengaytirish ekologik barqarorlikni mustahkamlashda muhim аҳамият kasb etadi.

Kelgusida chiqindisiz texnologiyalarni hududiy tashkil etishni takomillashtirish, ekologik innovatsiyalarni keng joriy etish hamda aholining ekologik madaniyatini oshirish orqali barqaror rivojlanishning samarali geografik modeli shakllanishiga erishish mumkin.

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UMUMIY O‘RTA TA’LIM MAKTABLARIDA TABIIY (SCIENCE) FANNI O`QITISHGA QO‘YILADIGAN TALABLAR

Annotatsiya: *Mazkur maqolada umumiy o‘rta ta’lim maktablarida tabiiy (Science) fanini o‘qitishga qo‘yiladigan zamonaviy pedagogik va metodik talablar tahlil qilingan. Unda tabiiy fanlarni integratsiyalashgan holda o‘qitishning mazmuni, o‘quvchilarning ilmiy dunyoqarashini shakllantirishdagi ahamiyati hamda kompetensiyaviy yondashuv asosida tashkil etish masalalari yoritilgan. Shuningdek, dars jarayonida innovatsion pedagogik texnologiyalar, amaliy mashg‘ulotlar, tajribalar va interfaol metodlardan foydalanishning samaradorligi ko‘rsatib berilgan. Maqolada Science fanini o‘qitishda o‘quvchilarning mustaqil fikrlashi, ekologik madaniyati va tadqiqotchilik ko‘nikmalarini rivojlantirishga alohida e’tibor qaratilgan.*

Kalit so‘zlar: *tabiiy fanlar, Science ta’limi, umumiy o‘rta ta’lim, kompetensiyaviy yondashuv, innovatsion pedagogika, interfaol metodlar, ilmiy dunyoqarash, amaliy mashg‘ulot, ekologik ta’lim, tadqiqotchilik ko‘nikmalari.*

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REQUIREMENTS FOR TEACHING SCIENCE IN GENERAL SECONDARY SCHOOLS

Abstract: *This article analyzes modern pedagogical and methodological requirements for teaching science in general secondary schools. It covers the content of integrated teaching of science, its importance in forming students' scientific worldviews, and issues of organizing it based on a competency-based approach. It also shows the effectiveness of using innovative pedagogical technologies, practical exercises, experiments, and interactive methods in the lesson process. The article pays special attention to the development of students' independent thinking, ecological culture, and research skills in teaching science.*

Keywords: *science, science education, general secondary education, competency-based approach, innovative pedagogy, interactive methods, scientific worldview, practical exercises, ecological education, research skills.*

Tabiiy fan (SCIENCE) qaysidir fandan voz kechish yoki qaysidir fanning o‘rniga joriy etilgani yo‘q. Aksincha, u ta'lim sifatini oshirish uchun mavjud fanlarni integrativ tarzda o‘qitilishini ta'minlaydi. Tabiatda yuz berayotgan hodisalarni, masalan, yomg‘ir hodisasini o‘rganish jarayonida bola uning tarkibi (biologiyaga oid tushunchalar), fizik xususiyatlari, qaysi fasllarda va qayerlarda ko‘proq yog‘ishi (geografik xususiyati), yomg‘ir ta'sirida Yerda qanday o‘zgarishlar bo‘lishi, o‘simliklar uchun foydasi haqida ma'lumotga ega bo‘lmoqdalar. Bugungi kunda mazkur fan 5–6-sinflarda 3 ta alohida fan – geografiya, biologiya va fizika fanlari mazmunini va kimyo fanining boshlang‘ich tushunchalarini uyg‘unlikda o‘qitilmoqda.

Yangi tartibning joriy qilinishi 5 yilgacha muddatni oladi. Tabiiy fan (SCIENCE)ni o`qitish bosqichma-bosqich tarzda joriy qilindi. Birinchi bosqich 2021/22 o‘quv yilida 1–2-sinflarda, 2022/23 o`quv yillar 3-4 sinflarda joriy qilindi.

Bu muddatda yangi o‘quv yili boshlangunga qadar 1–2-sinf o‘qituvchilariga mazkur fanni o‘qitish bo‘yicha maqsadli malaka oshirish kurslari tashkil etildi va kelgusida fanni o‘qitadigan mutaxassis o‘qituvchilar ham tayyorlandi. Tabiiy fanni o`qitilishi boshqa fanlarni qisqartirmaydi. 1–2-sinfda «Tabiiy fan» – 1 soat, 3–4-sinfda tabiiy fan – 2 soat, 5-sinfda biologiya va geografiya fanlari 1 soat, 6 - sinfda tabiiy fan 3- soatdan o‘qitildi. Hozirgi takliflarga ko‘ra, tabiiy fan 1-sinfda bir soat, 2, 3, 4-sinflarda ikki soatdan, 6-sinfda esa 3 soatdan o‘qitilmoqda. Yuqorida aytilganidek, 7–11-sinflardan esa fanlarning o‘qitilishi doimiy tartibda davom etmoqda.

Tabiiy fan joriy etilgach, tegishli normativ huquqiy - hujjatlar ishlab chiqilgandan so‘ng, pedagogika universitetlariga tabiiy (SCIENCE) fanini o‘qituvchi kadrlarni tayyorlashga buyurtma berildi. Tabiiy fan (SCIENCE) o‘qitadigan mutaxassislar tayyorlanmoqda**.** Pedagogika institutlarida fizika yo‘nalishida o‘qiyotgan talabalarga geografiya, biologiya bo‘yicha dars soatlarini yoki aksincha, geografiya yo‘nalishida o‘qiyotgan talabalar uchun qolgan 2 ta fan bo‘yicha dars soatlarini kiritildi. Masalan geografiya yo`nalishi talabalariga geofizika, geokimyo, biogeografiya, boshlang`ich ta’lim yo`nalishi talabalariga esa Geografiya o`qitish metodikasi kabi fanlar o`qitilmoqda.

Tabiiy fandan qaysi o‘qituvchilar dars bermoqda? Boshlang`ich sinfda Tabiiy fan darslarini boshlang`ich sinf o`qituvchilarining o`zlari, 6-sinfda Tabiiy fan darslarini biologiya, geografiya, fizika fanlari o‘qituvchilari o‘tishmoqda. Bunda savol tug‘iladi: geografiya o‘qituvchisi fizikani, fizika muallimi biologiyani o‘qita oladimi? Buning uchun o‘qituvchilar bilan ishlanmoqda. Ularning malakasini oshirish, qayta tayyorlash orqali ular Tabiiy fanlar darslarini o‘tishmoqda. Bunday imkoniyat ularga maxsus maqsadli o‘quv kurslaridan muvaffaqiyatli o‘tgandan

so‘ng berildi**.** Umumiy o`rta ta’lim maktablarida Tabiiy fan darsliklari, o`qituvchilar uchun merodik qo`llanmalar nashr qilindi.

Boshlang‘ich sinflarda darsliklar bolalar uchun jozibali, qiziqarli, rang-barang qilib ishlab chiqildi. Shuningdek, fanni o‘qitish uchun eng maqbul metodlarni, tavsiyalarni o‘z ichiga olgan o‘qituvchilar uchun ham alohida metodik qo‘llanma – o‘qituvchi kitoblari ishlab chiqildi. Ular yordamida dars berish ustozlar uchun juda qulay. **1-4-sinflarda tabiiy fanni boshlang‘ich sinf** o‘qituvchilari **o‘qiti**b kelmoqda. Tabiiy (SCIENCE) fan darsliklaridagi mavzular boshqa fanlar bilan bir-birini mantiqiy to‘ldirib, fanlararo uzviylikni ta'minlaydi. **Tabiiy fanlarni o‘qish o‘quvchiga qiyin emas, qiziqarli bo‘lishiga yordam beradi.** Yangi fan o‘quvchilarni kichik yoshidan tabiiy fanlarni o‘qishga qiziqishini oshiradi, ularda olam haqida yaxlit tasavvur paydo qilishga yordam beradi. Shu orqali o`quvchilar tabiiy fanlar, jumladan fizika va kimyo fanlari qiyin emas, qiziqarli fanlar ekanini anglaydilar va uni yanada o‘rganishga harakat qiladilar.

Masalan: o‘quvchilarga tabiiy (science) fani bo‘yicha qo‘yiladigan talablar.

Ilmiy xabardorlik kompetensiyasi: Tirik organizmlar klassifikatsiyasi (bakteriya, protista, zamburug‘, o‘simliklar va hayvonot dunyosi) haqidagi bilimlarini namoyish qiladi; sporali o‘simliklarning hayot sikli, hasharotlarning chala va to‘liq o‘zgarish bilan rivojlanishini tushunishini namoyish qiladi; kecha va kunduzning hosil bo‘lishini Yer shakli va o‘z o‘qi atrofida aylanishiga bog‘lab tushuntiradi; geografik qutblar, qutbiy doiralar, tropiklar va ekvatorning hosil bo‘lishini tushunishini namoyish qiladi; atmosfera, gidrosfera, litosfera va biosferani o‘zaro farqlaydi; shamol hosil bo‘lishining sabablarini tushuntiradi; harakat va uning turlari, zichlik, tezlanish, o‘g‘irlik kuchi, bosim hamda deformatsiya haqidagi bilimlarini namoyish qiladi; elektr tokini o‘tkazadigan va o‘tkazmaydigan moddalar, tok manbalari, ichki energiya haqida bilishini namoyish qiladi.

Amaliy kompetensiya: O‘simlik va hayvon hujayrasi hamda organlarini o‘zaro taqqoslaydi; mikroskop va lupadan foydalanib, o‘simlik hujayrasi tuzilishini o‘rganadi; xalqaro birliklar sistemasi va o‘lchov asboblaridan (sekundomer, termometr, menzurka, dinamometr) foydalanadi; achituvchi bakteriyalar va achitqi zamburug‘idan turli jarayonlarda foydalanish usullarini amaliyotda qo‘llaydi; oziq zanjiri va oziq to‘rini tuzadi; joyning oriyentir (mo‘ljal)ini oladi, o‘zi turgan joyga nisbatan ufq tomonlarini aniqlaydi; masshtab yordamida xaritadagi belgilar nuqtalar orasidagi masofani hamda haqiqiy va xaritadagi masofa yordamida masshtabni aniqlaydi; daraja to‘ri va navigator yordamida geografik koordinatalarni aniqlaydi; xaritadan turli geografik obyektlar (tekislik, tog‘, daryo, ko‘l) to‘g‘ri ko‘rsatadi; joyning mutlaq va nisbiy balandligini qo‘lbola nivelir yordamida o‘lchaydi; flyuger modelini yasaydi va u orqali shamol yo‘nalishini aniqlaydi; havo harorati va bosimini aniqlashga doir muammoli masalalarni yechadi; mamlakatimiz tabiatiga oid taqdimot tayyorlaydi; o‘lchov vositalari (chizg‘ich, tarozi, dinamometr) yordamida jismlarning hajmi, massasi va qo‘yilayotgan kuchni o‘lchaydi va xulosa chiqaradi; suyuqliklarda diffuziya hodisasi, qattiq jismlarning deformatsiyasiga doir

tajribalar o‘tkazadi; buyumlarning elektrlanishiniga doir modellar yasaydi va tajriba o‘tkazadi, elektr zanjirini yig‘adi. Ilmiy va amaliy kompetensiyalarni tabiiy fan o`qituvchisi o`zi yaxshi bilishi asboblardan to`g`ri foydalana olishi lozim.

Ta'limda joriy etilayotgan har bir yangilik nafaqat O‘zbekistonda, balki xorijda ham o‘zini oqlayotgan tajribaga asoslanishi kerak. Agar tizimni takomillashtirish va yangiliklarni joriy etish uchun o‘nlab yillar tajriba-sinov qilinadigan bo‘lsa, unda ko‘p narsa yo‘qotish mumkin. Aslida, o‘z samaradorligini isbotlagan ta'lim modellari mavjud. Insoniyat kashfiyotlarini amaliyot davomida isbotlagan paytlar ko‘p bo‘lgan. Faqat buning uchun hamma harakat qilishi kerak. O‘zgarishlarga ochiq bo‘lishimiz, o‘z ustimizda ishlashimiz kerak. Buning uchun pedagoglardan iborat jamoatchilik yangiliklardan qo‘rqishi emas, balki ularni amalga oshirishga intilishi lozim.

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MORPHOFUCTIONAL FEATURES OF THYMUS GLAND AMONG CHILDREN OF EARLY AGE WITH THYMOMEGALIA

Resume. *The morphometric characteristics in children of early age with thymomegalia were studied. In this case was found the increase of the area of lobule of thymus due to the predominance of the cerebral cortex and a significant increase in the ratio of thymocytes / epithelial reticular cells because of the increase of the absolute number of thymocytes. The differences in area and diameter of the Hassall's corpuscles in the two compared groups were not revealed, however, was found a slight tendency to the decrease of these indicators in case of hyperplasia of thymus gland. These changes indicate the Morphofunctional inferiority of the thymus among children of early age with thymomegalia.*

Key words: *thymus, thymomegalia, epithelial reticular cells, thymocytes, Hassall's corpuscles.*

Relevance. The thymus gland (thymus) is one of the central organs of the immune and endocrine system, responsible for the differentiation of T-lymphocytes. Children with impaired thymus function have an immunological, predominantly T-cell defect, and both decrease and hyperplasia of the thymus can be observed, which is an attempt to compensate for the impaired immune function [4, 5]. At the same time, the latter often remains unsatisfactory, as a result of which children with an enlarged thymus gland typically have a severe course of a number of infectious processes, especially meningococcal infection (MI), and frequent recurrent respiratory diseases [6, 10]. Severe immunodeficiency, along with adrenal insufficiency, also underlies most cases of sudden infant death syndrome (SIDS), for which significant thymomegalia is extremely typical [7, 8, 9, 10]. Immune disorders in the peripheral blood in children with thymomegalia have been repeatedly described earlier [2, 10]. At the same time, the interpretations of such data present significant difficulties, since patients, as a rule, was examined at the time of a serious infectious disease or were in a short period of remission between several repeated infectious processes. As a result, the revealed changes could be the result of not a true deficit, but only a targeted redistribution of immunocompetent cells. Much more informative for establishing the nature and mechanism of the immune defect is a direct study of the hyperplastic thymus, however, such studies are still very few in number, and the conclusions drawn on their basis are contradictory [3]. In this regard, the aim of this work was to study the Morphofunctional state of the thymus gland in young children with thymomegalia.

Material and methods. We studied 10 hyperplastic thymuses with a weight significantly exceeding the norm (on average - 45.5 ± 3.4 g): 5 samples from children aged 1.5 - 8 months who died from fulminant meningococcemia, 5 - from patients aged 2– 5 months who died from SIDS. In both groups there were 4 boys and 1 girl. The comparison was carried out with 5 normal weight thymuses (on average 10.6 ± 0.4 g) from children aged 1 day to 3 months, including 2 boys and 3 girls who died from newborn asphyxia, multiple congenital malformations, congenital bilateral purulent pneumonia with aspiration of amniotic fluid. The degree of enlargement of the thymus gland was assessed on the basis of calculating the value of the thymus index (TI) according to the formula: TI = thymus weight (g) / child's body weight (g) x 100% [5]. Thymus samples were fixed in 10% neutral formalin for 48 hours, then processed according to the generally accepted method [13]. Sections 4–5 μ m thick were made from paraffin blocks and stained with hematoxylin and eosin [9]. The study of slides and the production of micrographs were carried out using a Leica DMLS microscope with LeicaQWin software (Germany). During the morphometric study of histological preparations of thymus along the entire perimeter of each preparation, the area of the cortical (Sq) and medulla (Smv), the ratio of Smv / Sqw (5 lobules in each observation), the area of the thymus lobule (SD), the area and diameter Hassal's little bodies (TG) - thymus bodies (STG and dTG, respectively). At a magnification of 1000, using the Bioscan program, the total number of thymocytes (T), reticuloepithelial cells (REC) was counted, their ratio T / REC was determined (3 lobules, 5 fields of view). The data were processed statistically using the Statistica 6.0 and SPSS 17.0 software. Significance was assessed using the nonparametric Mann-Whitney U test. The confidence interval was calculated for the mean values of the samples with a probability of 95%.

Research results. When assessing the degree of enlargement of the thymus gland among the examined, we obtained the following results: the value of TI in children with MI was - 0.58 ± 0.07 (95% CI 0.38 - 0.78), with SIDS - 0.96 ± 0, 14 (95% CI 0.58 - 1.34), in the comparison group - 0.28 ± 0.04 (95% CI 0.18 - 0.38). Thus, the TI indices in the groups with fulminant MI and SIDS significantly ($P < 0.01$) exceeded the indicated indicator in the comparison group. Microscopic examination revealed that all studied thymuses are represented by lobules of various sizes, separated by connective tissue layers. In most cases, the lobules are well formed, the hyperchromic cortical and lighter medulla, epithelial and stromal-vascular components are clearly defined. The cortical zone of the thymus gland is represented by REC, lymphoblast's and lymphocytes (thymocytes) at different stages of differentiation, macrophages, eosinophil's and basophils are found. The most abundant population of the medullary zone is loosely located lymphocytes (Fig. 1). In the histological preparations of the thymus of the comparison group, signs of organ involution with untimely appearance of areas of adipose tissue in the interlobular spaces were revealed; among thymocytes of the cortical substance, multiple RECs, thymus bodies at different stages of development are light-optically

clearly distinguishable. The cavity of large Morphofunctional mature TGs is filled with decay products, phagocytosed lymphocytes, macrophages, nuclear detritus, some thymus bodies merge into large formations, which may include several small ones, or bridges are formed between them, single cystic expanded bodies are observed. With thymomegalia in the cortical zone of the thymus against the background of fulminant meningococcemia and SIDS, there are signs of reactive morphological changes similar to the accidental transformation of the first phase, the presence of macrophages with extensive cytoplasm, in some cases containing phagocytosed cells, is found focal clusters consisting of a small number of lymphocytes, REK, with SIDS thymus bodies were few, often at a regressive stage of development (the contents are homogeneous, subjected to calcification). The main morphometric characteristics of the hyperplastic thymus gland differed significantly from the usual parameters. Thus, the area of the thymus lobule did not increase evenly, but almost exclusively due to the cortical part ($P < 0.01$). As a result, the Smv / Skv ratio also changed significantly ($P < 0.05$). At the same time, the expected parallel increase in the morphometric parameters characterizing Hassal's little bodies did not occur against the background of an increase in the thymus mass. Moreover, both STH and dTG in thymomegalia even tended to decrease. These patterns were typical for both children with MI and SIDS. There were no significant differences in the morphometric characteristics of the thymus in the groups of patients with MI and SIDS ($P > 0.05$). Morphometric parameters of thymocytes and REC of the thymus gland in children with thymomegalia are presented in our work, morphometric parameters of thymocytes and REC of the thymus gland in children with thymomegalia significantly differed from the data in the comparison group. Thus, the absolute number of the former in thymomegalia was significantly higher ($P < 0.01$), while the number of RECs in the hyperplastic thymus, on the contrary, was less ($P < 0.05$; $P < 0.01$). Accordingly, the ratio of T to REC in thymomegalia significantly exceeded this value in the comparison group ($P < 0.01$). The revealed changes were typical for both patients with MI and children with SIDS. There were no significant differences in the morphometric parameters of thymocytes and REC of the thymus gland in the studied groups with MI and SIDS ($P > 0.05$).

The discussion of the results. As can be seen from the presented data, the thymus gland in young children with thymomegalia is not at all simply an enlarged full-fledged organ with a normal structure. On the contrary, this is a thymus with altered morphological characteristics, indicating a violation of its natural functioning. Among the morphological features of the hyperplastic thymus, an increase in the area of the cortex and a noticeable predominance of the cortex over the cerebral cortex were revealed, especially in patients with SIDS. The increase in thymus mass due to the cortical substance probably reflects the massive influx of immature thymocytes into this zone of the thymus gland, where the main stages of their differentiation take place [2,10]. On the other hand, the predominance of the cortical substance over the brain is an indirect sign of the presence of glucocorticoid insufficiency [11,16]. However, to what extent glucocorticosteroid insufficiency is

primary, and to what extent it is due to the need for vital compensation of the thymus against the background of immunological insufficiency, remains unclear. It is known that with hypocorticism there is a change in the architectonics of the thymus with the replacement of the functioning parenchyma with adipose tissue, the formation of lymphoid follicle lobules with light centers in the center [8,9,10]. In cases with thymomegalia, no such changes were found. An increase in the absolute number of thymocytes and a significant increase in the T / REC ratio is the second significant change in the histostructure of the thymus gland in thymomegalia. RECs are involved in the maturation of thymocytes, produce thymus hormones, interleukins, and other growth factors [2, 3, 4]. In conditions of a relative deficit of REC against the background of an increase in the absolute number of immature thymocytes entering the cortex of the thymus gland, the process of full maturation of lymphocytes in the thymus can be significantly impaired. The role and function of thymus bodies is not fully understood. However, there is evidence of morphological changes in triglycerides against the background of immunodeficiency states [1,7,8]. As a result of our studies, no differences in the area and diameter of thymus bodies were found in the compared groups. However, there was a slight tendency towards a decrease in these indicators of thymus bodies in thymomegalia, which may be an indirect sign of suppression of normal apoptosis.

Conclusion. Thus, the revealed structural changes in the thymus in the syndrome of an enlarged thymus gland in young children indicate it's not only morphological, but also Morphofunctional defects.

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ARTISTIC INTERPRETATION OF THE IDEAS OF ENLIGHTENMENT AND NATIONAL AWAKENING IN THE WORKS OF BOSITXON SHOSHIY

Abstract. *Following the independence of Uzbekistan, the objective study of our history based on manuscript sources and the research of the rich scientific and cultural heritage left by our ancestors became one of the paramount tasks. The literary heritage of Bositxon ibn Zohidxon Shoshiy (Hariqiy), who was recognized in his time as an accomplished physician, poet, translator, and scholar—particularly his divan "Devoni Hariqiy"—had long remained overlooked by the general public and literary criticism. The study of this divan holds specific significance in enriching the treasury of Uzbek literature from the national awakening period. This article explores the life, scientific, and literary heritage of the Tashkent poet Bositxon Shoshiy (Hariqiy), who lived and created during the second half of the 19th and the first half of the 20th centuries. It analyzes the poet's views on enlightenment, the promotion of schooling and science, national awakening, and social solidarity.*

Keywords: *divan, bayaz, enlightenment, school, national awakening, solidarity, literary environment, poet, muvashshah, ghazal.*

Introduction. Uzbek National Awakening literature, which emerged in the late 19th and early 20th centuries, is considered a distinct literary-aesthetic phenomenon. The writers of this period modernized traditional poetry in terms of both content and form. Studying the literature of this era is one of the urgent tasks of modern literary criticism due to the growing interest in it, its crucial role in the development of human society, its unique developmental trends, its richness in historical truths, and the overall renewal of literary-aesthetic thinking.

Literature review and methodology. The works created by the authors of the Uzbek National Awakening literature serve the development of humanity's artistic and aesthetic thinking by promoting knowledge and enlightenment, and praising ideals related to human perfection. Broad opportunities for the systematic, multi-faceted study of the literature of this period emerged during the early years of national independence. In particular, the publication of the lithographed scientific heritage of Bositkhon ibn Zohidxon Shoshiy—a scholar, poet, and prominent representative of the Tashkent literary environment—was successfully carried out during the years of independence. The poet's *divan* (collection of poems) was prepared for publication and printed in 2009 by the scholar Mahmud Hasaniy.

Zohidxon Hariqiy participated in the literary process of the second half of the 19th and early 20th centuries and maintained close relations with prominent contemporary poets of that era, such as Kamiy, Khislat, Miskin, and Sidqiy.

Bositkhon ibn Zohidxon Shoshiy was born in 1877 in the Sebzar district of Tashkent into an enlightened family of a prominent physician. His father, Zohidxon Hakim, was an experienced and highly skilled physician of his time who had a profound influence on his son's upbringing as both a doctor and a highly educated individual. From the age of seven, Bositkhon began reading medical books under his father's guidance and later achieved an advanced status in the field of medicine.

Bositkhon Shoshiy was a prolific creator who authored and translated more than ten works in the exact and social sciences. He is the author of the book of medical canons written in the Uzbek language, titled *Qonuni Bositiy* (The Canons of Bosit). Other works penned by him, such as *Qonun al-Mabsut* (a two-volume medical work), *Farhang al-mabsut* (a dictionary of medical terms), *Amali handasa* (Practical Geometry), and *Muqaddimai ilmi faroyiz* (Introduction to the Law of Inheritance), are currently preserved in the Manuscript Fund of the Institute of Oriental Studies of the Academy of Sciences of the Republic of Uzbekistan.

Results and discussion. Bositkhon Shoshiy wrote *ghazals*, *mukhammas*, and poems on socio-political themes under the pen name "Hariqiy". The poet began collecting his poems to compile a *bayoz* (anthology), but due to the revolutionary upheavals of 1917 and the subsequent establishment of the Soviet regime, the compilation was never fully completed. This literary heritage has been introduced to academic study under the name *Devoni Hariqiy* (The Divan of Hariqiy) [4,7]. The poems included in this *divan* vividly reflect the poet's philosophical and religious views alongside the ideas of national enlightenment characteristic of the Uzbek intelligentsia of the late 19th and early 20th centuries.

The most crucial aspect of Hariqiy's work is awakening the people from ignorance and calling them toward knowledge and enlightenment. In the poet's 410-line poem titled *Ash'ori milliyi Hariqiy ba fasodi olam va odam* (Hariqiy's National Poems on the Corruption of the World and Man), the social vices of the era and the nation's lag in development are described with deep regret. The poet saw the only way to uplift the nation through schools and education. He regarded the school as a sacred place that preserves and elevates society:

The school is the mine of the jewels of wisdom, The school is like a fortressfor the benefit of the nation [4, 62].

In Hariqiy’s 100-line poem *Shogirdlarni maktabga targ'ibi haqida* (On Encouraging Students to School), the virtues of acquiring knowledge are deeply impressed upon the younger generation. He likens school to a highly meritorious and honorable act for seekers of knowledge, comparable to building or visiting the sacred Kaaba [4,74]:

School is the blessed paradise-refuge of this world, Unquestionably, school is the finest beauty on the world's stage. Truly, school is the ultimate aspiration of the world's people, School is the erected Kaaba for the seeker of enlightenment.

Emphasizing that knowledge is the soul and source of life for a nation, the poet compares a nation without knowledge to a lifeless body. He glorifies the status of knowledge and scholarship in high tones:

The nation is like a body, and knowledge is the soul of this nation, The nation is like an island, and knowledge is its flowing water. The nation is like a city (*Madina*), and knowledge is its protective fortress, The nation is like a sea, and knowledge is its Badakhshan ruby.

In these lines, the poet compares the state of the nation in ignorance to a scorching desert, and knowledge to the flowing water (*obiravon*) that quenches the nation's thirst. He exalts knowledge by stating that if the nation is a sacred city like Medina, knowledge is the fortress defending it; if the nation is a priceless treasure, knowledge is its precious ruby.

Hariqiy describes with bitter pain the difficult life of the people of Turkestan under the Tsarist colonial conditions of that period, and how they succumbed to ignorance and backwardness. In his poem *Zamona ahvoli va Turkiston ahlining g'aflati* (The Condition of the Times and the Ignorance of the People of Turkestan), he calls upon the nation to join the ranks of enlightened peoples [4,77].

The poet views mutual discord and conflict as the primary cause of society's fragmentation and decline. In his poem *Ittifoqlik natijasi va ixtilofning zarari* (The Result of Unity and the Harm of Discord), he urges the people to unite and live in harmony. This is because unity is the foundation of progress and peace, while discord is a disaster that destroys the very structure of the nation. In the first part of the poem, the poet evaluates unity as the foundation of progress and peace:

Unity is the cause of zenith, prosperity, loftiness, and renown, Unity is the center of fortune, luck, and victorious assistance.

In the second part, the consequences of discord—the root cause of the Turkestan tragedy—are revealed through the method of antithesis: Discord destroyed the fortress of our joy, Discord left all of our people bewildered. Discord concealed the prosperity of our nation, Discord threw the state of our nation's people into distress [4,82].

The "destruction of the fortress of joy" and the "distress of the nation's people" are direct poetic expressions of the socio-political situation and spiritual crisis of that era. The poet deeply understood that without achieving national cohesion and solidarity, any reform would remain ineffective, and he called upon the people for a political and social awakening.

Conclusion. In conclusion, Bositkhon ibn Zohidxon Shoshiy (Hariqiy) was not only a prominent physician and a versatile scholar but also an enlightened representative of the national awakening period literature. His *Divan* serves as an extremely valuable resource for educating the younger generation in the spirit of patriotism, love for science, and national unity. A deeper and more comprehensive study of Hariqiy's literary heritage remains one of the urgent tasks facing modern Uzbek literary criticism in the new century.

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THE IMPACT OF THE GREEN PRODUCT LIFE CYCLE AND CONTINUOUS IMPROVEMENT TECHNIQUES ON COST REDUCTION

Abstract. *Abstract. This study examines advanced approaches that simultaneously serve society and the environment, thereby supporting sustainable development. It focuses on the green product life cycle and continuous improvement techniques as effective tools for reducing green product costs and enhancing production processes. The study also aims to clarify the conceptual foundations of these approaches and their areas of application in supporting the competitiveness of business organizations. A theoretical analysis of the relevant literature was conducted to identify the potential areas of cost reduction through the implementation of the green product life cycle approach and continuous improvement techniques. The findings indicate that the adoption of these approaches contributes to improving production efficiency, reducing costs, preserving the environment, and achieving a sustainable competitive advantage.*

Keywords: *Green Product, Continuous Improvement, Cost Reduction, Sustainability, Operational Efficiency, Quality, Financial Performance, Environmental Costs.*

Introduction

As a result of environmental developments in the field of business, advanced models of various economic technologies and activities that serve society and the environment have been developed, providing a basis for sustainable development and its implementation. This has prompted companies to search for modern manufacturing techniques. The Iraqi environment suffers from pollution as a result of economic units' failure to observe environmental conservation standards, as well as the solid and liquid waste generated by production processes and the emission of toxic gases. In addition to the damage caused by the use of some traditional products, these challenges have increased attention to environmental sustainability and the adoption of environmentally friendly practices in business operations, including the sustainable sourcing of materials, waste reduction, and end-of-life recycling.

In this context, it becomes important to understand the impact of these green initiatives on customer satisfaction. Customers are becoming increasingly aware of environmental issues and tend to support companies that demonstrate a commitment to sustainability. By adopting green product life cycles and continuous improvement practices, companies not only contribute to environmental protection but also meet the growing demand for sustainable products.

The First Axis

Research Methodology

Research Problem

The Iraqi environment suffers from pollution as a result of economic units' failure to comply with environmental protection standards, as well as the solid and liquid waste generated by production processes and the emission of toxic gases. In addition, the damage caused by the use of some traditional products affects both customers and the market share of economic units. Therefore, there is a need to transform activities throughout the product life cycle into green activities and eliminate non-green and non-value-adding activities. This contributes to the optimal use of resources and energy while minimizing environmental damage.

The research problem can be summarized in the following question:

How do the green product life cycle and continuous improvement techniques contribute to cost reduction?

Research Importance

The primary objective of economic units is to provide services and manufacture products in order to achieve profits. However, in the twenty-first century, the objectives of economic units have expanded beyond profit generation to include the integration of financial and environmental goals. Therefore, the importance of this research lies in clarifying the conceptual foundations of the green product life cycle and continuous improvement techniques, as well as their areas of application in supporting the competitiveness of economic units.

Research Objective

The objective of this research is to examine the role of the green product life cycle and continuous improvement techniques and their impact on cost reduction.

Research Hypothesis

There is a significant impact of the green product life cycle and continuous improvement techniques on cost reduction through the analysis of product processes and activities and the redesign of products in accordance with environmental requirements, supported by the continuous improvement of production processes and activities.

The Second Axis

Theoretical Aspect

Green Product Lifecycle Concept

In recent years, competitive pressures and market openness have significantly influenced the policies of economic units regarding product development. As a result, product life cycles have become shorter, leading to greater product diversity. At the same time, economic units face increasing pressure to reduce production costs and deliver products to customers more quickly.

Reducing production time can be achieved through product redesign and the use of modern information and communication technology (ICT) tools for product design, development, and manufacturing. These opportunities have become available due to recent technological advances. The product lifecycle model

emerged as a product-oriented and ICT-supported approach in which product data are shared among organizational processes throughout the various stages of the product life cycle to achieve higher levels of product performance (Duque, Garetti & Terzi, 2009, p. 148).

As a result of environmental developments and the emergence of environmentally friendly products, green product design has become more systematic and clearly defined. Green product design represents the core of environmental awareness and involves the integration of environmental considerations throughout the entire product life cycle. With social and technological progress, green design has become not only an important social responsibility but also an effective means of achieving economic benefits. It is expected to become a dominant trend in future product development due to growing environmental concerns and the need to promote sustainable development. Economic units seeking continuous growth must take advantage of this opportunity by adopting green product and process design while enhancing their competitiveness (He & Li, 2017, p. 123).

The Green Product Life Cycle (GPLC) is the process through which environmentally friendly products are designed, marketed, used, and disposed of in a manner that minimizes their environmental impact (Swetha, 2024, p. 4599).

The Green Product Lifecycle perspective is broader in scope because it takes into account the environmental impacts of activities both within and beyond the boundaries of the organization. It pays particular attention to raw materials, supply chains, product use, disposal impacts, and opportunities for reuse and recycling (European Union, 2010, p. 10).

Green Product Life Cycle Stages

The life cycle of a green product is similar to that of conventional products, as it passes through several important stages, beginning with research, design, and development and ending with product disposal. However, because the green product life cycle focuses on environmental impacts, the final stage can be extended to include product reuse and recycling. The green product life cycle has evolved by incorporating modern sustainability concepts such as waste-free manufacturing, product reuse, and recycling.

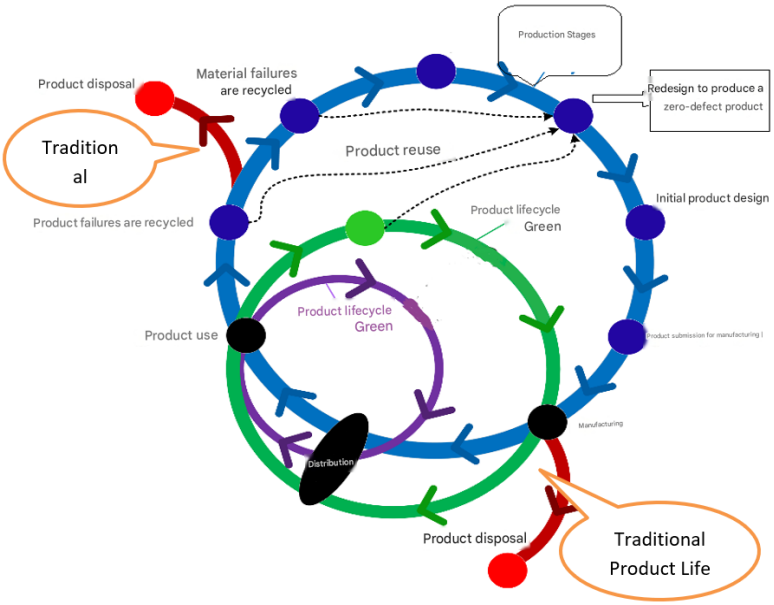
Unlike the traditional product life cycle, which generally assumes a single life cycle for a product, the green product life cycle recognizes that products may be reused, remanufactured, or recycled multiple times. It encompasses all stages from product design to disposal or recycling. When a product reaches the end of its useful life, it may enter a recycling or reuse phase rather than being discarded. In many cases, products can continue to function according to their original design or can be adapted for other uses.

Therefore, the fundamental concept of the green product life cycle is based on reuse, recycling, and responsible disposal in order to enhance sustainability. The traditional product life cycle views products as having only one life cycle, whereas the green product life cycle may involve multiple cycles throughout the product's

lifespan. Once the initial useful life of a product has ended, it can be used as a component in the manufacture of other products, remanufactured, or reused. If the product can no longer be used in its original form, its components and materials may still be recovered and reused.

The recovery and reuse of resources invested in manufacturing contribute to greater sustainability. The reuse cycle may occur at various stages of production and continue until the final product reaches the customer. Recycling generally applies to materials, since resources such as manufacturing time and labor cannot be recycled. Nevertheless, the green product life cycle enables organizations to make better use of natural resources, human effort, manufacturing time, and product design capabilities.

The information and feedback generated throughout the green product life cycle support the development of new sustainable products that are compatible with environmental objectives. Ultimately, the green product life cycle seeks to improve the three dimensions of sustainability: economic, environmental, and social performance. Extending the productive life of products not only reduces material waste but also improves the efficiency with which resources such as capital, labor, and time are utilized (May & Psarommatis, 2022, p. 4).



Source: Psarommatis, F., & May, G. Achieving Global Sustainability Through Sustainable Product Life Cycle. IFIP Advances in Information and Communication Technology, September 2022. DOI: 10.1007/978-3-031-16407-1_46.

The Importance of the Green Product Life Cycle

The importance of the green product life cycle is similar to that of the traditional product life cycle, with the added dimension of sustainability (Abbas & Zaher, 2022, p. 46).

1. The green product life cycle is essential for strategic planning, as it enables organizations to select an appropriate life cycle for their products, develop strategic

alternatives, and formulate suitable marketing strategies to influence customers while taking market developments into account.

2. The product life cycle is considered a behavioral model that influences sales and profits. It is used as a marketing tool for developing new products to replace outdated ones and for formulating marketing and production strategies for all stages of the product life cycle in order to respond to internal and external conditions.

3. The product life cycle provides managers with important information regarding market share growth, competitive position, and profitability.

4. Additional importance has been attributed specifically to the green product life cycle (European Union, 2010, p. 10), including:

- Gathering background information on the environmental impacts of market-oriented policies and promoting innovative product design.

- Understanding trends in product supply chains and identifying opportunities for improving supply chain performance.

- Developing resource management strategies, such as optimal waste management.

- Increasing consumer awareness through green branding and public procurement systems.

Green Product Lifecycle Costs

Product lifecycle costs are determined according to the stages of product development and production. Although these costs vary from one product to another, they generally include the following categories (Atrill & McLaney, 2009, p. 148):

- Pre-production costs. This stage covers the period before the production of a product or service. It mainly includes research and development activities for both products and services. During this stage, products and production methods are designed and developed. It also includes the acquisition and installation of production facilities, as well as advertising and promotional activities.

- Production costs. These are the costs incurred during the manufacturing, sale, or servicing of products and services for customers.

- Post-production costs. These costs arise after products or services have been sold and are often referred to as after-sales costs. They include expenses associated with correcting defects, providing after-sales services, shutting down production facilities, and product reuse or recycling activities. Since after-sales services may begin after the first sale and continue long after the final sale, this stage often overlaps with the production and service delivery stages.

The Concept of Continuous Improvement

The concept of continuous improvement emerged after World War II, when Japan suffered significant industrial and economic damage. Japanese industries faced numerous difficulties that contributed to their decline. To support reconstruction efforts, General MacArthur invited several distinguished experts from the United States to visit Japan and provide recommendations. One of these

experts was Dr. W. Edwards Deming, a statistician and specialist in quality improvement. Deming emphasized the importance of focusing on processes rather than results and encouraged teamwork as a means of improving organizational performance (Khan & Hongqi, 2018, p. 7).

Continuous improvement is defined as “a Japanese concept that refers to the gradual and continuous reduction of product costs throughout the product life cycle” (Hussain, 2023, p. 49). Rewers defined continuous improvement as a management tool that focuses on generating ideas aimed at improving all areas of an organization through employee participation and the elimination of non-value-adding and unnecessary activities, thereby reducing costs and improving product quality (Abboud et al., 2024, p. 2415).

Continuous Improvement Cycle

An important element of the continuous improvement approach is its nature as an ongoing process that continuously examines and questions the details of production processes and organizational activities. This repetitive and cyclical approach is reflected in several continuous improvement models. The two most widely used models are the PDCA cycle (often called the Deming Cycle) and the DMAIC cycle, which became popular through the Six Sigma methodology (Slack et al., 2010, p. 571).

The PDCA cycle consists of the following stages:

- Planning Phase. This stage involves examining the current production process, identifying problems, collecting and analyzing data, and developing an action plan aimed at improving performance. Once the plan is approved, implementation begins.

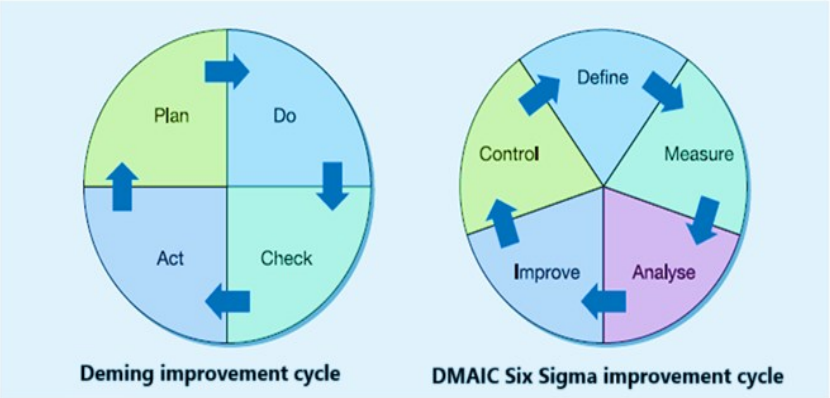
- Do Phase. During this stage, the proposed plan is tested and implemented within the process targeted for improvement. Implementation is monitored and any problems encountered are identified and addressed. This phase may itself involve a smaller PDCA cycle.

- Check Phase. At this stage, the results of implementing the new plan are evaluated and compared with the expected outcomes to determine whether the improvement objectives have been achieved.

- Act Phase. During this stage, the results achieved are reviewed thoroughly. If the plan is successful, it is standardized and applied more broadly. If it is unsuccessful, lessons learned are documented and used to improve future initiatives.

- The DMAIC cycle differs from the PDCA cycle by adopting a more analytical and data-driven approach. DMAIC begins with defining the problem and identifying the requirements for improvement. The second stage involves establishing specific improvement objectives. This is followed by the measurement stage, during which data are collected and analyzed to understand the extent of the problem and assess performance accurately. The analysis stage focuses on identifying the root causes of the problem and developing hypotheses regarding possible solutions. Once the causes have been identified, improvement actions are implemented to eliminate them. After successful implementation, the solutions are

standardized, and their results are measured and monitored to ensure continuous improvement. Figure () illustrates the operation of both models (Slack et al., 2010).



Source: Slack, N., Chambers, S., & Johnston, R. Operations Management (6th ed.). 2010.

The Importance of Continuous Improvement

Reinser identified the importance of continuous improvement as follows (Hassan & Al-Abbas, 2024, p. 102):

- Developing solutions to existing problems and preparing reports that include both the identified problems and the proposed solutions.
- Increasing employees' awareness of the importance of quality principles and encouraging the effective utilization of human resources in improvement activities.
- Training employees in improvement processes and ensuring that they assume the responsibilities assigned to them.
- Ensuring the production of defect-free products while minimizing wasted time and resources.
- Establishing strong relationships with suppliers, customers, and other economic units.
- Improving performance in all organizational activities, both inside and outside the organization.
- Encouraging innovation and creative thinking among employees.
- Focusing on the continuous improvement of production processes rather than relying solely on the final results of improvement efforts.

Principles of Continuous Improvement of the Green Product

1. In order to identify activities that require improvement, it is necessary to understand the principles upon which the improvement process is based, as well as to have a clear understanding of production processes. This facilitates the identification and application of the fundamental concepts of continuous improvement within the organization. Several key principles of continuous improvement can be applied to green products.
2. Relying on collaboration and active participation in generating and implementing improvement ideas.

3. Focusing on human resources, Kaizen management principles, and the achievement of competitive advantage.

4. Emphasizing continuous process improvement and teamwork.

5. Continuous improvement is concerned with establishing standards and continuously enhancing them in order to achieve higher levels of performance. From the above, it can be concluded that the principles of continuous improvement focus on improving processes, work methods, and procedures to enhance results, continuously develop work standards, and support behaviors that facilitate improvement. These principles also define work practices that encourage continuous improvement activities. Therefore, management and employees must work together to identify daily improvement opportunities and overcome work obstacles. Continuous improvement represents a key factor in organizational competitiveness through employee participation in developing improvement proposals. It is a methodology that relies on a set of techniques and tools aimed at improving production processes and establishing standards for continuous development (Al-Shafeay, 2024, p. 10).

Objectives of Continuous Improvement

In general, continuous improvement aims to enhance quality and reduce costs while meeting customer requirements. Hamza and Fathia identified several objectives of continuous improvement (Rash & Al-Jubouri, 2023, p. 337):

- Reduction of resource consumption. Any use of resources beyond planned levels is considered waste and requires corrective improvement actions.
- Elimination of errors. Most errors result from human factors, which makes employee training and qualification essential for reducing mistakes.
- Anticipation of customer needs. Continuous improvement focuses on identifying and satisfying customer expectations.
- Reduction of workplace accidents. Continuous improvement requires proper planning of production processes in order to reduce errors and accidents, thereby minimizing compensation costs and operational disruptions.
- Increasing employee satisfaction. Employee satisfaction is an important component of continuous improvement and can be enhanced through employee participation in improvement teams.

Green Product Lifecycle Costs and Continuous Improvement Costs

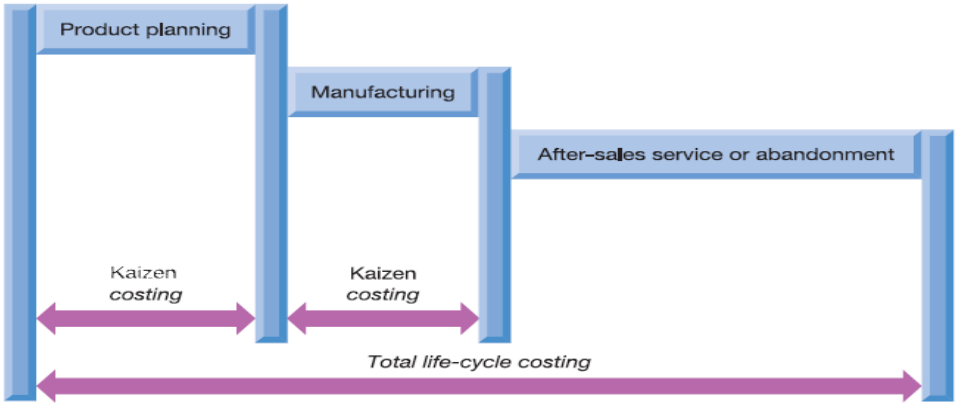
Continuous improvement costs are closely related to overall green product lifecycle costs through their focus on achieving cost savings during the production stage. Since production is a relatively late stage in the product life cycle, opportunities for cost reduction may be more limited than in earlier stages. Nevertheless, valuable savings can still be achieved.

By integrating continuous improvement with product lifecycle costing, economic units seek to reduce the unit manufacturing cost of products or services below the cost achieved in previous periods. Specific cost reduction targets can be established and monitored. Production employees are often encouraged to identify

opportunities for reducing costs, drawing on their practical experience and knowledge of production processes.

Although the scope for cost reduction during the production stage may be limited, significant savings can still be realized. Once the product design and development process has been completed, the production stage begins, and continuous improvement techniques can be used to enhance the efficiency of production operations. Continuous improvement focuses on gradual and ongoing enhancements to product design and production processes while establishing cost reduction targets for specific periods and comparing them with actual performance.

Employee participation is essential for achieving desired cost reductions. Suggestions provided by employees frequently result in substantial savings. Continuous improvement is closely associated with lean manufacturing and the green product life cycle, both of which are committed to eliminating waste through ongoing improvement efforts. Figure () illustrates product lifecycle costs and the areas in which continuous improvement can contribute to cost reduction (Atrill & McLaney, 2009, p. 329).



Total life-cycle costing covers all three phases of the product life cycle, and Kaizen costing

Source: Atrill, P., & McLaney, E. Management Accounting for Decision Makers (6th ed.). 2009.

The Third Axis

Practical Aspect

Compatibility between Green Product Lifecycle and Continuous Improvement in Cost Reduction

To test the research hypothesis, the study relies on tire manufacturing factories in Iraq, namely the Babylon Tire Factory and the Diwaniya Tire Factory. These factories suffer from manufacturing problems and high production costs, particularly with respect to tire raw materials, which are not available locally and therefore must be imported. In addition, some production lines have stopped operating, and these companies still rely on traditional manufacturing and reporting systems that are no longer compatible with the developments occurring in the modern business environment.

Furthermore, some of these companies do not adequately incorporate sustainability considerations into their operations, resulting in a decline in market share compared with imported products and limiting their ability to make decisions that support organizational development. The research hypothesis assumes that the adoption of sustainability-oriented practices contributes to making more effective managerial decisions, improving company performance, and addressing shortcomings related to sustainability.

One area in which companies can benefit significantly is the treatment and recycling of solid waste generated by final products. Among the most problematic forms of waste are used automobile tires due to their resistance to biodegradation and their high flammability. In addition, disposing of tires in landfills, particularly in humid environments, may result in the release of toxic substances into the soil. Because of the difficulties associated with tire disposal, this issue has become a major environmental challenge in many countries. Consequently, environmental organizations and specialized institutions have promoted safe and environmentally friendly methods for addressing this problem. These methods can be summarized as follows:

1) Recycling of Tire Components

- The recycling process aims to recover the main industrial materials contained in used tires and reintroduce them into the production process while reducing waste. The most important recovered materials are rubber granules and steel wire. This process consists of several stages.

- Collection Stage. During this stage, used and damaged tires are collected. This process is relatively simple and does not require significant effort. Tires may be purchased from suppliers contracted with the company. The average purchase cost of one used tire (R20 size) is approximately 5,000 Iraqi dinars.

- Sorting and Cleaning Stage. At this stage, tires are sorted according to their condition and size. They are then cleaned by removing impurities and any components that cannot be recycled.

- Disassembly Stage. During this stage, the tires are cut into smaller sections. The steel wire is separated from the rubber, and the tire components are then processed through crushing equipment.

The costs of this operation are presented below in Iraqi dinars.

Table 1. Costs of the Tire Recycling Process (Iraqi Dinars)

Machine Name	Machine Cost (IQD)	Number of Workers	Annual Depreciation (IQD)
Wire Drawing Machine	3,000,000	1	300,000
Cutting Machine	7,000,000	–	700,000

Machine Name	Machine Cost (IQD)	Number of Workers	Annual Depreciation (IQD)
Rubber Recycling Machine	40,000,000	1	4,000,000
Conveyor Belts	50,000,000	–	5,000,000
Control Device	5,000,000	–	500,000
Total	**105,000,000**	**2**	**10,500,000**

Source: Prepared by the researcher based on the technical specifications and operational data provided by Ilder Recycling Company, Denmark, a company specialized in the manufacture of tire recycling production lines.

The table was prepared by the researcher based on data provided by Ilder Recycling, a Danish company specializing in the manufacture of used-tire recycling production lines. The main products obtained from this process are:

- Rubber granules
- Steel wire

These production lines process an average of 50 tires per hour of size R20. The approximate weight of each tire is 10 kg. According to international standards, steel wire represents approximately 15% of the tire weight, while the remaining 85% consists of rubber granules.

Calculation of the Number of Recycled Tires per Year

Number of working days per year:

365 days − 49 weekly holidays − 15 public holidays = 300 working days per year

Number of operating hours per year: 300 days × 7 working hours per day = 2,100 hours per year

Number of tires processed annually: 2,100 hours × 50 tires per hour = 105,000 tires per year

Calculation of Recovered Materials

Amount of recycled materials: (Tire weight × material percentage) × number of tires

Rubber granules: (10 kg × 85%) × 105,000 = 892,500 kg

Steel wire: (10 kg × 15%) × 105,000 = 157,500 kg

The purchase price of one kilogram of rubber granules is 725 Iraqi dinars, while the purchase price of one kilogram of steel wire is 525 Iraqi dinars.

Rubber granules are used in many industries and can also serve as a raw material in tire manufacturing. Likewise, steel wire can be reused in various industrial applications. Consequently, the recycling process contributes to significant cost savings.

Value of Recovered Materials

Rubber granules: 892,500 × 725 = 647,062,500 IQD

Steel wire: 157,500 × 525 = 82,687,500 IQD

Total value of recovered materials: 647,062,500 + 82,687,500 = 729,750,000 IQD

Costs of the Recycling Process

Cost of purchasing used tires: 105,000 × 5,000 = 525,000,000 IQD

Annual depreciation: 10,500,000 IQD

Direct labor costs: 2 workers × 750,000 × 12 months = 18,000,000 IQD

Indirect manufacturing costs: 5,000,000 IQD

Total annual operating costs: 525,000,000 + 10,500,000 + 18,000,000 + 5,000,000 = 558,500,000 IQD

Net annual savings: 729,750,000 − 558,500,000 = 171,250,000 IQD

2) Using the Pyrolysis Method to Obtain New Products

According to this method, used tires are processed in an oxygen-free environment and subjected to thermal decomposition (pyrolysis) at specific temperatures in order to prevent environmental pollution. Companies such as Pyrum Innovations AG in Germany specialize in the production of tire pyrolysis systems. Through this process, several valuable products are obtained, including pyrolysis oil, carbon black, syngas, and steel wire. The cost of a tire pyrolysis production line is presented in the following table.

Table 2. Cost of the Tire Pyrolysis Production Line (Iraqi Dinars)

Machine Name	**Machine Cost (IQD)**	**Processing Time per Tire (Minutes)**	**Number of Workers**	**Annual Depreciation (IQD)**
Thermal Decomposition Reactor	160,000,000	0.4	1	16,000,000
Thermal Heating Unit	50,000,000	1.0	1	5,000,000
Impurity Removal System	20,000,000	0.1	–	2,000,000
Condensation Unit	80,000,000	0.1	–	8,000,000
Control System	10,000,000	–	–	1,000,000
Total	**320,000,000**	**1.6**	**2**	**32,000,000**

Source: Prepared by the researcher based on the technical specifications of Pyrum Innovations AG, Germany.

As shown in Table 2, the time required to process one tire is 1.6 minutes. Through this process, several products are obtained, including pyrolysis oil, carbon

black, steel wire, and syngas. The following table presents the production percentage, quantity produced, selling price, and total revenue generated from each product.

Based on the data used in the first method, the actual operating time of the production line is 2,100 working hours per year. Since the processing time for one tire is 1.6 minutes, the production line can process: 60 minutes ÷ 1.6 = 37.5 tires per hour

Annual processing capacity: 2,100 hours × 37.5 tires = 78,750 tires per year

Since the average weight of one tire is 10 kg, the annual processing capacity of one production line is: 78,750 × 10 = 787,500 kg per year

Table 3. Products Obtained from the Tire Pyrolysis Process

Product	Production Percentage	Quantity Produced (kg)	Selling Price (IQD/kg)	Total Revenue (IQD)
Pyrolysis Oil	40%	315,000	1,100	346,500,000
Carbon Black	35%	275,625	600	165,375,000
Steel Wire	15%	118,125	525	62,015,625
Syngas	10%	78,750	250	19,687,500
Total	**100%**	**787,500**	—	**593,578,125**

The total operating cost of this process is 450,750,000 IQD and consists of the following components:

Cost of acquiring used tires for processing: 78,750 × 5,000 = 393,750,000 IQD

Annual depreciation: 32,000,000 IQD

Labor costs: 18,000,000 IQD

Indirect manufacturing costs: 7,000,000 IQD

Total operating costs: 393,750,000 + 32,000,000 + 18,000,000 + 7,000,000 = 450,750,000 IQD

Net savings generated by the process: 593,578,125 − 450,750,000 = 142,828,125 IQD

The Fourth Axis

Conclusions and Recommendations

Conclusions

1. Traditional cost reduction approaches focus primarily on production costs and often overlook costs incurred throughout the entire product life cycle.

2. The green product life cycle approach and continuous improvement are among the modern approaches that contribute to broader cost reduction because

they address all stages of the product life cycle, from design to disposal and recycling.

3. There is a strong relationship between the green product life cycle and continuous improvement, as both approaches emphasize product and process design as key factors in achieving cost reduction and sustainability.

4. The green product life cycle provides valuable information for pricing decisions, cost management, performance evaluation, and continuous improvement initiatives.

5. The adoption of green product lifecycle technologies and continuous improvement practices contributes to the production of environmentally friendly products and enhances sustainable organizational performance.

6. The application of green product lifecycle principles and continuous improvement techniques helps preserve the environment through the efficient use of environmentally friendly resources and the reduction of waste.

Recommendations

1. Economic units should adopt modern management and production approaches that are compatible with the requirements of the contemporary business environment in order to improve efficiency and reduce costs.

2. Greater attention should be given to the integration of green product lifecycle and continuous improvement approaches, as both consider all stages of the product life cycle, from design to end-of-life management.

3. Economic units should adopt product recycling practices rather than relying solely on product disposal methods, thereby reducing environmental damage and increasing resource utilization.

4. Product lifecycle techniques and continuous improvement methods should be employed to analyze organizational activities and eliminate non-value-adding activities, leading to lower product costs.

5. A recycling stage should be formally incorporated into the product life cycle to enable the reuse of materials and components until the end of the product's useful life.

6. Research and Development (R&D) departments should be strengthened through scientific and practical training, and periodic reports should be prepared on production processes, environmental performance, and customer satisfaction.

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TOG‘ VA TOG‘ OLDI HUDUDLARNING IJTIMOIY-IQTISODIY RIVOJLANINSHIDA TURIZIMNING AHAMYATI

Annotatsiya: *Ushbu maqolada tog‘ va tog‘oldi hududlarining ijtimoiy-iqtisodiy rivojlanishida turizmning o‘rni va ahamiyati tahlil qilinadi. Unda turizmning hududiy iqtisodiyotga ta’siri, yangi ish o‘rinlarini yaratishdagi roli, infratuzilmani rivojlantirishga qo‘shgan hissasi hamda aholi farovonligini oshirishdagi ahamiyati yoritilgan. Shuningdek, tog‘li hududlarning tabiiy va rekreatsion salohiyatidan samarali foydalanish, ekologik barqarorlikni ta’minlash va madaniy merosni saqlash masalalari ko‘rib chiqilgan. Tadqiqot natijalari turizmni rivojlantirish orqali tog‘ va tog‘oldi hududlarida barqaror ijtimoiy-iqtisodiy taraqqiyotga erishish mumkinligini ko‘rsatadi.*

Kalit so‘zlar*: flora va fauna infratuzilma, Miraki, urf-odat, sayyoh, loyiha, ekologiya, sport turizimi, rekiratsiya.*

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THE IMPORTANCE OF TOURISM IN THE SOCIO-ECONOMIC DEVELOPMENT OF MOUNTAIN AND FOOTHILL REGIONS

Abstract: *This article analyzes the role and importance of tourism in the socio-economic development of mountain and sub-mountain regions. It highlights the impact of tourism on the regional economy, its role in creating new jobs, its contribution to the development of infrastructure, and its importance in improving the well-being of the population. Also, the issues of effective use of the natural and recreational potential of mountainous regions, ensuring ecological stability and preservation of cultural heritage were considered. The results of the research show that it is possible to achieve sustainable socio-economic development in mountain and sub-mountain regions through the development of tourism.*

Keywords: *flora and fauna infrastructure, Miraki, tradition, tourist, project, ecology, sports tourism, recreation.*

Kirish: Bugungi zamonaviy iqtisodiyot rivojlangan zamonda iqtisodiyotning eng ajralmas va keng tarqalgan sohalaridan biri bu – turizm hisoblanadi. Tog‘ va tog‘oldi hududlari tabiiy landshaftlarning xilma-xilligi, toza havo, boy flora va fauna hamda noyob tabiiy manzaralari bilan ajralib turadi. Shu sababli bu hududlar turizmni rivojlantirish uchun juda qulay hisoblanadi. Hozirgi kunda dunyoning ko‘plab mamlakatlarida tog‘ hududlari turizmning muhim markazlaridan biri bo‘lib, iqtisodiy rivojlanish, yangi ish o‘rinlari yaratish va hudud infratuzilmasini yaxshilashda katta rol o‘ynaydi.

Turizm tog‘ va tog‘oldi hududlarining ijtimoiy-iqtisodiy rivojlanishiga sezilarli ta’sir ko‘rsatadi. U mahalliy aholi bandligini ta’minlash, xizmat ko‘rsatish sohasini rivojlantirish, transport va kommunikatsiya tizimini yaxshilashga yordam beradi. Shu bilan birga, turizm orqali hududlarning tabiiy va madaniy merosi keng targ‘ib qilinadi hamda ulardan oqilona foydalanish imkoniyati yaratilad Tog‘ va tog‘oldi hududlarida ekologik turizm, sport turizmi, dam olish turizmi va rekreatsiya kabi turizm turlari keng rivojlanishi mumkin. Bunday faoliyat nafaqat hudud iqtisodiyotini mustahkamlaydi, balki tabiatni muhofaza qilish, ekologik muvozanatni saqlash va hududning barqaror rivojlanishini ta’minlashga ham xizmat qiladi.

Shu sababli tog‘ va tog‘oldi hududlarining rivojlanishida turizmning ahamiyatini o‘rganish, uning imkoniyatlari va istiqbollarini tahlil qilish muhim ilmiy va amaliy ahamiyatga ega hisoblanadi.

Asosiy qism: Tog‘ va tog‘oldi hududlarining ijtimoiy-iqtisodiy rivojlantirishida turizm muhim strategik omillardan biri hisoblanadi. Bunday hududlar odatda tabiiy resurslarga boy, landshaftlari betakror, iqlimi toza va ekologik jihatdan nisbatan sof bo‘lgani uchun turizmni rivojlantirish uchun katta imkoniyatlarga ega.

Avvalo, turizm bu hududlarda yangi ish o‘rinlari yaratadi. Mehmonxona xo‘jaligi, transport, ovqatlanish shoxobchalari, gidlik xizmatlari va hunarmandchilik kabi yo‘nalishlarda aholi bandligi oshadi. Bu esa mahalliy aholining daromadini ko‘paytirib, turmush darajasini yaxshilaydi.

Turizm infratuzilmaning rivojlanishiga turtki beradi. Yo‘llar, aloqa tizimi, elektr energiyasi, suv ta’minoti kabi muhim infratuzilma elementlari yaxshilanadi. Natijada, nafaqat sayyohlar, balki mahalliy aholi uchun ham qulay yashash sharoiti yaratiladi. Turizm hududiy iqtisodiyotning diversifikatsiyasini ta’minlaydi. Tog‘li hududlarda ko‘pincha qishloq xo‘jaligi yoki chorvachilik asosiy faoliyat bo‘ladi. Turizm esa qo‘shimcha daromad manbai sifatida iqtisodiy barqarorlikni oshiradi va risklarni kamaytiradi.Bundan tashqari, turizm milliy madaniyat va an’analarni saqlashga ham xizmat qiladi. Sayyohlar qiziqishini oshirish maqsadida mahalliy urf-odatlar, milliy taomlar, hunarmandchilik mahsulotlari rivojlantiriladi va ommalashtiriladi. Bu esa madaniy merosni asrab-avaylashga yordam beradi.

Shu bilan birga, ekologik turizmni rivojlantirish orqali tabiatni muhofaza qilishga ham e’tibor kuchayadi. Chunki musoffo tabiat sayyohlarni jalb qiluvchi asosiy omillardan biridir.

1- Rasm Miraki turizm qishlog‘ining ko‘rinishi

Misol tariqasida Miraki xalqaro turizm markazi – O‘zbekiston Respublikasi, Qashqadaryo viloyati, Shahrisabz tumanining Miraki qishlog‘ida barpo etilgan yirik sayyohlik va rekreatsion kompleksdir. Ushbu loyiha O‘zbekistonning turizm salohiyatini oshirish, ichki va tashqi sayyohlar oqimini ko‘paytirish, shuningdek, mintaqaviy iqtisodiy rivojlanishga hissa qo‘shish maqsadida tashkil etilgan. Loyiha O‘zbekiston Respublikasi Prezidenti tashabbusi bilan 2024-2025-yillarda barpo etilgan bo‘lib, umumiy qiymati 400 million AQSH dollariga teng bo‘lgan 117 ta subloyihani o‘z ichiga oladi. 240 gektar hududda mehmonxonalar, savdo majmualari, piyoda va velosiped yo‘laklari hamda boshqa infratuzilma obyektlari barpo etildi. Majmua hozir ishga tushirib, 1700 dan ortiq doimiy ish o‘rni yaratilgan.

Miraki xalqaro turizm markazi turizm, sog‘lomlashtirish, madaniy meros va ekologik dam olish imkoniyatlarini birlashtirgan holda, xalqaro darajadagi sayyohlik maskani sifatida shakllantirilmoqda. Loyihada zamonaviy mehmonxonalar, kurort zonalari, sport-infratuzilmalari, madaniy markazlar, ekologik yo‘laklar va sayyohlar uchun xizmat ko‘rsatish infratuzilmasi rejalashtirilga

Xulosa

Xulosa qilib aytganda, tog‘ va tog‘oldi hududlarining ijtimoiy-iqtisodiy rivojlanishida turizm hal qiluvchi ahamiyatga ega bo‘lgan sohalardan biridir. U nafaqat iqtisodiy o‘sishni ta’minlaydi, balki yangi ish o‘rinlari yaratish, infratuzilmani rivojlantirish va aholi turmush darajasini oshirishda muhim rol

o‘ynaydi. Shu bilan birga, turizm hududlarning tabiiy va madaniy salohiyatidan samarali foydalanish imkonini berib, ularni milliy va xalqaro miqyosda tanitadi. Eng muhimi, turizmni to‘g‘ri va barqaror yo‘lga qo‘yish orqali ekologik muvozanatni saqlash va kelajak avlodlar uchun tabiiy boyliklarni asrab qolish mumkin. Shunday ekan, tog‘ va tog‘oldi hududlarida turizmni rivojlantirish uzoq muddatli barqaror taraqqiyotning muhim omili hisoblanadi.

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AN ESP APPROACH TO DEVELOPING PROFESSIONAL COMMUNICATIVE COMPETENCE OF FUTURE ECONOMISTS IN THE DIGITAL ECONOMY

Abstract: *This article explores the pedagogical and methodological foundations of teaching English for Specific Purposes (ESP) to economics students in higher education institutions within the framework of global market integration and the digitalization of the economic sector. It examines the strategic challenges of building robust professional communicative competence among future specialists navigating international business environments and academic collaborative circles. The study empirically and theoretically substantiates a multi-layered curriculum design anchored in dynamic Needs Analysis (NA), the systematic integration of authentic digital multi-media resources, and Task-Based Learning (TBL) pedagogical models.*

Keywords: *ESP, needs analysis, professional communicative competence, economics students, authentic materials, task-based learning, digital economy, corporate discourse.*

Introduction

The multi-faceted transformation of the global economic landscape, driven by the rapid expansion of transnational corporations, cross-border digital financial integration, and automated market infrastructures, has drastically altered the benchmark requirements for newly graduating economists on the global stage. In contemporary markets, structural fluency in native financial operations is no longer a solitary guarantee of professional success. Emerging economists and financial analysts are stringently required to engage in high-level academic, corporate, and inter-governmental communication utilizing English as the universal *lingua franca* of modern business [1].

Consequently, higher education frameworks must shift away from general English instruction toward highly specialized English for Specific Purposes (ESP) modules that mimic the intricate realities of the professional world. In the context of economic education, English functions far beyond a set of standardized syntactic or grammatical frameworks [2] [3].

However, conventional higher education models frequently display a persistent gap between abstract classroom language syllabi and the dynamic, real-world verbal and non-verbal demands faced by economists. An isolated focus on mechanical grammar drills often results in passive lexical recognition rather than active operational fluency [4].

Methodology and literature review

The theoretical evolution of ESP instruction is anchored in the landmark research of Tom Hutchinson and Alan Waters, who established that ESP is not an isolated branch of linguistics or a distinct methodology, but an approach to language learning directed entirely by the specific, explicit motives of the learner [4]. This learner-centered focus was advanced by Dudley-Evans and St John, who identified the absolute necessity of integrating target disciplinary contexts directly into the language classroom via specialized methodology and structural collaboration with subject-matter experts [5].

This study implements a robust qualitative and quantitative-empirical research methodology incorporating systemic analysis, contrastive pedagogical observation, curriculum modeling, and academic performance tracking. The structural framework for developing the professional communicative competence of economics undergraduates is systematically evaluated through three interconnected pedagogical dimensions:

1. **Differentiated Needs Analysis (NA):** The operational synthesis of Target Situation Analysis (TSA) and Present Situation Analysis (PSA) to identify immediate and systemic language deficits [6].

2. **Content-Based Instruction (CBI):** Utilizing highly specialized, unsimplified authentic economic documentation to mirror real-world professional contexts [7].

3. **Task-Based Learning (TBL) Frameworks:** Designing interactive, high-stakes simulated corporate tasks to foster communicative fluidness and strategic problem-solving [8].

As noted by Basturkmen, the development of professional communication must avoid isolating sub-skills [9]. Instead, it must holistically integrate receptive skills (reading and listening) with productive skills (speaking and writing) through complex, real-life corporate case studies [10].

Results and discussion

Implementation of Task-Based Learning (TBL) via Immersive Corporate Simulations

Guided by the task-based instruction principles outlined by Ellis [8], the instructional sequence shifts its focus away from abstract syntax manipulation toward the functional completion of concrete, high-stakes economic projects. Two distinct simulation models were implemented and tracked during the pedagogical observation phase:

- **The Executive Boardroom Simulation:** Students are divided into collaborative management teams representing a real or hypothetical multinational corporation experiencing a structural or financial crisis. Each student assumes a specific C-suite corporate role (e.g., Chief Executive Officer, Chief Financial Officer, Chief Marketing Officer). They must debate recovery strategies entirely in English and construct a unified, linguistically precise crisis-mitigation proposal [9].

• **The Venture Capitalist Pitch (Startup Launch):** Undergraduates design an original digital startup idea, compile a basic market analysis, and pitch their business blueprint to a panel of foreign investors (played by peers or external assessors). The students must deliver a persuasive presentation and defend their financial projections during an intensive, unscripted Q&A session [10].

Challenges in esp instruction and strategic remediation

The comprehensive deployment of an advanced ESP curriculum within contemporary higher education frameworks encounters structural roadblocks. Most language educators come from purely philological backgrounds and lack deep knowledge of microeconomics, corporate finance, accounting, or statistical modeling [5]. This can lead to a surface-level treatment of complex economic materials [2].

Establishing deep inter-departmental collaboration through Content and Language Integrated Learning (CLIL) frameworks serves as a primary remediation [7]. Language teachers should co-plan modules with economics professors and attend cross-disciplinary seminars to align pedagogical and industry content. Furthermore, utilizing differentiated instructional materials where identical authentic financial reports are paired with scaffolded tier-based tasks tailored to different student readiness levels helps manage intra-group proficiency divergence [6].

Conclusion

In the current digital economy, fostering professional communicative competence in English for future economists is a vital institutional imperative. The research confirms that traditional, non-contextualized methods are no longer sufficient to meet modern corporate standards.

Implementing a systematic ESP paradigm—built on targeted Needs Analysis [6], authentic digital financial materials [7], and interactive Task-Based Learning simulations [8] measurably improves both the linguistic accuracy and professional confidence of economics students. Future research should focus on integrating artificial intelligence adaptive learning tools and virtual corporate platforms into the ESP classroom to prepare students for the demands of remote international business collaboration.

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DIFFERENSIAL TENGLAMALAR YORDAMIDA EPIDEMIYALARNI MODELLASHTIRISH

Annotatsiya: *Mazkur maqolada differensial tenglamalar yordamida epidemiyalar tarqalishini matematik modellashtirishning nazariy va amaliy jihatlari yoritiladi. Epidemik jarayonlar aholining turli guruhlari o‘rtasida kasallik tarqalishi, infeksiyaga moyillik, yuqtirish tezligi, sog‘ayish ko‘rsatkichi va profilaktik choralar ta’siri bilan belgilanadi. Shu sababli ularni oddiy kuzatuv asosida emas, balki aniq matematik modellar orqali tahlil qilish zarur. Maqolada SIR va unga yaqin epidemiologik modellar differensial tenglamalar tizimi sifatida talqin qilinadi hamda ularning iqtisodiy oliy ta’lim muassasalarida matematika fanini o‘qitishdagi ahamiyati ochib beriladi. Tadqiqotda epidemiyalarni modellashtirish orqali talabalar matematik abstraksiyani real ijtimoiy-iqtisodiy jarayonlar bilan bog‘lash, parametrlarni tahlil qilish, prognozlash va qaror qabul qilish ko‘nikmalarini rivojlantirishi ta’kidlanadi. Shuningdek, epidemik jarayonlarning iqtisodiy oqibatlarini baholashda matematik modellashtirishning o‘rni, sog‘liqni saqlash xarajatlari, mehnat bozori faolligi va ishlab chiqarish uzluksizligiga ta’siri ilmiy nuqtai nazardan izohlanadi.*

Kalit so‘zlar: *differensial tenglamalar, epidemiya modeli, SIR modeli, matematik modellashtirish, epidemik jarayon, parametrlar tahlili, prognozlash, iqtisodiy matematika.*

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MODELING EPIDEMICS USING DIFFERENTIAL EQUATIONS

Abstract: *This article discusses the theoretical and practical aspects of modeling epidemic spread using differential equations. Epidemic processes are determined by disease transmission among different population groups, susceptibility to infection, transmission rate, recovery rate and the influence of preventive measures. Therefore, they should be analyzed not only through observation, but also through precise mathematical models. The article interprets SIR and related epidemiological models as systems of differential equations and reveals their significance in teaching mathematics at economic higher education*

institutions. The study emphasizes that epidemic modeling helps students connect mathematical abstraction with real socio-economic processes, analyze parameters, make forecasts and develop decision-making skills. The article also explains the role of mathematical modeling in assessing the economic consequences of epidemic processes, including health care costs, labor market activity and continuity of production.

***Keywords**: differential equations, epidemic model, SIR model, mathematical modeling, epidemic process, parameter analysis, forecasting, economic mathematics.*

Kirish

Differensial tenglamalar zamonaviy matematikaning eng muhim bo‘limlaridan biri bo‘lib, u real jarayonlarning vaqt bo‘yicha o‘zgarishini ifodalash, tahlil qilish va prognozlash imkonini beradi. Ayniqsa, epidemiyalar tarqalishini o‘rganishda differensial tenglamalardan foydalanish katta ilmiy-amaliy ahamiyatga ega. Chunki epidemik jarayonlar tasodifiy ko‘rinishga ega bo‘lsa-da, ularning rivojlanishida ma’lum qonuniyatlar mavjud: kasallikka moyil aholi soni kamayadi, infeksiyalanganlar soni ma’lum davrda ortadi, sog‘ayganlar ulushi esa vaqt o‘tishi bilan ko‘payadi. Ushbu o‘zgarishlarni matematik ifodalash orqali kasallik tarqalish sur’ati, epidemiyaning cho‘qqi nuqtasi, xavf darajasi va profilaktik choralar samaradorligini baholash mumkin.

Epidemiyalarni modellashtirish nafaqat tibbiyot yoki biologiya sohasi uchun, balki iqtisodiy ta’lim yo‘nalishlari uchun ham dolzarbdir. Chunki keng ko‘lamli epidemik holatlar mehnat bozori, ishlab chiqarish hajmi, xizmat ko‘rsatish sohasi, byudjet xarajatlari, ta’lim tizimi va ijtimoiy barqarorlikka bevosita ta’sir ko‘rsatadi. Iqtisodiy oliy ta’lim muassasalarida differensial tenglamalar asosida epidemiyalarni modellashtirishni o‘rganish talabalarni matematik nazariyani amaliy jarayonlar bilan bog‘lashga o‘rgatadi. Bu esa ularning analitik fikrlash, raqamli ma’lumotlarni talqin qilish, prognozlash va iqtisodiy qarorlarning ehtimoliy oqibatlarini baholash ko‘nikmalarini rivojlantiradi.

Mazkur mavzuning dolzarbligi shundaki, epidemik jarayonlarni oddiy statistik kuzatuvlar orqali to‘liq tushuntirish qiyin. Statistik ma’lumotlar mavjud holatni ko‘rsatsa, differensial tenglamalar kelajakdagi o‘zgarishlarni taxmin qilish, turli ssenariylarni solishtirish va boshqaruv choralarining natijalarini oldindan baholash imkonini beradi. Masalan, SIR modeli aholining kasallikka moyil, infeksiyalangan va sog‘aygan guruhlarga ajratilishi asosida tuziladi hamda ushbu guruhlar o‘rtasidagi o‘tish jarayonlari differensial tenglamalar yordamida ifodalanadi. Bunday yondashuv talabalar uchun matematik formulalarning real hayotdagi mazmunini ochib beradi.

Shu jihatdan, differensial tenglamalar yordamida epidemiyalarni modellashtirish iqtisodiy matematika ta’limida nazariy bilim, amaliy tahlil va fanlararo yondashuvni birlashtiruvchi samarali yo‘nalish sifatida namoyon bo‘ladi.

Adabiyotlar sharhi

Epidemiyalarni differensial tenglamalar yordamida modellashtirish bo‘yicha ilmiy adabiyotlar mazkur yo‘nalishning nazariy, amaliy va iqtisodiy jihatdan muhimligini ko‘rsatadi. Kermack va McKendrick tomonidan ishlab chiqilgan klassik epidemiologik model kasallik tarqalishini matematik ifodalashda asosiy nazariy poydevor hisoblanadi. Anderson va May, Hethcote, Brauer, Castillo-Chavez va Feng, Diekmann, Heesterbeek va Britton, Keeling va Rohani hamda Martcheva asarlarida infeksion kasalliklarning dinamikasi, yuqtirish va sog‘ayish koeffitsiyentlari, populyatsiya guruhlari o‘rtasidagi o‘tish jarayonlari chuqur yoritilgan. Boyce va DiPrima, Ross, Pontryagin, Perko, Hirsch, Smale va Devaney, Strogatz hamda Verhulst tadqiqotlari differensial tenglamalar va dinamik tizimlarning matematik asoslarini tushuntiradi. Barro, Ursúa va Weng hamda Eichenbaum, Rebelo va Trabandt ishlarida epidemiyalarning iqtisodiy faollik, ishlab chiqarish, mehnat bozori va davlat xarajatlariga ta’siri tahlil qilingan. Ushbu manbalar epidemik jarayonlarni matematik, biologik va iqtisodiy nuqtai nazardan kompleks o‘rganish zarurligini asoslaydi.

Metodlar

Tadqiqot metodologiyasi differensial tenglamalar nazariyasi, matematik modellashtirish, epidemik jarayonlarni tizimli tahlil qilish va iqtisodiy-matematik yondashuvlarga asoslanadi. Mazkur maqolada epidemiyalar tarqalishini o‘rganish uchun avvalo aholining holati dinamik tizim sifatida qaraladi. Bunda aholi kasallikka moyil shaxslar, infeksiyalanganlar va sog‘ayganlar guruhlariga ajratiladi. Ushbu guruhlar o‘rtasidagi o‘zgarishlar vaqt funksiyasi sifatida ifodalanadi va differensial tenglamalar tizimi orqali tavsiflanadi. Bunday yondashuv epidemik jarayonning faqat joriy holatini emas, balki uning rivojlanish yo‘nalishini ham aniqlash imkonini beradi.

Asosiy metod sifatida SIR modelidan foydalaniladi. Ushbu modelda S(t) kasallikka moyil aholi sonini, I(t) infeksiyalanganlar sonini, R(t) esa sog‘aygan yoki kasallikdan keyin immunitet hosil qilganlar sonini bildiradi. Modelning asosiy mazmuni shundan iboratki, kasallikka moyil shaxslar infeksiyalanganlar bilan muloqot qilganda kasallik yuqishi ehtimoli ortadi, infeksiyalanganlar esa ma’lum vaqt o‘tgach sog‘ayganlar guruhiga o‘tadi. Bu jarayon yuqtirish koeffitsiyenti va sog‘ayish koeffitsiyenti orqali ifodalanadi. Ushbu parametrlar epidemiyaning tezligi, davomiyligi va cho‘qqi darajasini belgilovchi muhim ko‘rsatkichlar hisoblanadi.

Tadqiqotda nazariy tahlil, matematik abstraksiyalash, parametrik tahlil, taqqoslash va modellashtirish metodlaridan foydalaniladi. Nazariy tahlil epidemik jarayonlarning matematik mohiyatini ochib berishga xizmat qiladi. Matematik abstraksiyalash orqali real hayotdagi murakkab jarayonlar soddalashtirilgan model ko‘rinishida ifodalanadi. Parametrik tahlil esa yuqtirish va sog‘ayish koeffitsiyentlari o‘zgarishi epidemik dinamikaga qanday ta’sir qilishini aniqlash imkonini beradi. Taqqoslash metodi yordamida turli ssenariylar, masalan,

profilaktik choralar mavjud bo‘lgan va mavjud bo‘lmagan holatlar o‘zaro solishtiriladi.

Iqtisodiy oliy ta’lim muassasalari uchun ushbu metodik yondashuv alohida ahamiyatga ega. Chunki talabalar differensial tenglamalarni faqat nazariy masala sifatida emas, balki real ijtimoiy-iqtisodiy vaziyatlarni baholash vositasi sifatida o‘rganadilar. Model natijalari asosida epidemiyaning iqtisodiy faollik, mehnat resurslari, xizmat ko‘rsatish sohasi, ta’lim jarayoni va byudjet xarajatlariga ta’sirini tahlil qilish mumkin. Shu bois tadqiqot metodlari matematik hisoblash, iqtisodiy talqin va prognozlash ko‘nikmalarini birlashtiradi.

Natijalar

Tadqiqot natijalari shuni ko‘rsatadiki, differensial tenglamalar yordamida epidemiyalarni modellashtirish epidemik jarayonlarning ichki dinamikasini matematik jihatdan tushuntirish, ularning rivojlanish bosqichlarini aniqlash va turli boshqaruv choralarining ehtimoliy samaradorligini baholash imkonini beradi. SIR modeli asosida olib borilgan nazariy tahlilda kasallikka moyil aholi ulushi, infeksiyalanganlar soni va sog‘ayganlar guruhining vaqt bo‘yicha o‘zgarishi epidemiyaning umumiy yo‘nalishini belgilovchi asosiy ko‘rsatkichlar sifatida namoyon bo‘ladi. Modelda yuqtirish koeffitsiyenti yuqori bo‘lsa, infeksiyalanganlar soni qisqa muddatda tez ortadi va epidemiyaning cho‘qqi nuqtasi erta yuzaga keladi. Aksincha, yuqtirish tezligi kamaytirilsa, epidemik egri chiziq tekislanadi, sog‘liqni saqlash tizimiga tushadigan bosim pasayadi va iqtisodiy faoliyatni bosqichma-bosqich muvozanatda saqlash imkoniyati ortadi.

Parametrik tahlil natijalari shuni ko‘rsatadiki, epidemik jarayonning rivojlanishi alohida bitta omilga emas, balki bir nechta o‘zaro bog‘liq ko‘rsatkichlarga tayanadi. Yuqtirish koeffitsiyenti, sog‘ayish tezligi, kontaktlar soni, profilaktik choralar darajasi va aholining ehtiyotkorlik xatti-harakati model natijalariga sezilarli ta’sir ko‘rsatadi. Ayniqsa, sog‘ayish koeffitsiyenti ortganda infeksiyalanganlar guruhida qolish muddati qisqaradi, bu esa kasallik tarqalish zanjirini sekinlashtiradi. Shu bilan birga, profilaktik choralar natijasida kontaktlar intensivligi kamayganda kasallikka moyil guruhdan infeksiyalangan guruhga o‘tish sur’ati pasayadi.

Iqtisodiy nuqtai nazardan, model natijalari epidemiyalarning mehnat unumdorligi, ishlab chiqarish jarayoni, xizmat ko‘rsatish sohasi, ta’lim tizimi va davlat xarajatlariga ta’sirini oldindan baholashda muhim ahamiyatga ega ekanligini ko‘rsatadi. Infeksiyalanganlar sonining keskin ortishi vaqtinchalik mehnat resurslari kamayishiga, tibbiy xarajatlar ko‘payishiga va ayrim iqtisodiy faoliyat turlarida uzilishlar yuzaga kelishiga sabab bo‘lishi mumkin. Shu sababli differensial tenglamalar asosidagi modellashtirish iqtisodiy qarorlarni ilmiy asoslash, xavf darajasini aniqlash va resurslarni oqilona taqsimlash uchun samarali vosita bo‘lib xizmat qiladi.

Ta’limiy jihatdan esa mazkur model talabalar uchun differensial tenglamalarning amaliy qiymatini ochib beradi. Talabalar matematik formulalar, parametrlar va grafik natijalar orqali real jarayonlarni tahlil qilishni o‘rganadilar.

Bu esa ularning abstrakt fikrlash, iqtisodiy-matematik tahlil, prognozlash va muammoli vaziyatlarda qaror qabul qilish kompetensiyalarini rivojlantiradi.

Muhokama

Differensial tenglamalar yordamida epidemiyalarni modellashtirish epidemik jarayonlarni chuqurroq anglash, ularning rivojlanish mexanizmini izohlash va amaliy qarorlar uchun ilmiy asos yaratish imkonini beradi. Olingan natijalar shuni ko‘rsatadiki, SIR kabi modellar epidemiyani faqat tibbiy hodisa sifatida emas, balki murakkab ijtimoiy-iqtisodiy jarayon sifatida ham talqin qilishga yordam beradi. Chunki kasallik tarqalishi aholining sog‘lig‘i bilan birga mehnat bozori, ishlab chiqarish, xizmatlar sohasi, ta’lim jarayoni va davlat xarajatlariga bevosita ta’sir ko‘rsatadi. Shu sababli iqtisodiy oliy ta’lim muassasalarida bunday modellarni o‘rganish talabalar uchun matematik bilimlarning real jarayonlar bilan bog‘liqligini tushunishda muhim metodik ahamiyat kasb etadi.

Muhokama jarayonida alohida ta’kidlash kerakki, differensial tenglamalar asosidagi epidemiologik modellar real hayotni to‘liq takrorlamaydi, balki uning asosiy qonuniyatlarini soddalashtirilgan shaklda ifodalaydi. Masalan, SIR modelida aholi uchta asosiy guruhga ajratiladi va guruhlar o‘rtasidagi o‘tish jarayoni ma’lum parametrlar orqali tushuntiriladi. Biroq real sharoitda aholi tarkibi yosh, kasb, hudud, ijtimoiy faollik, immunitet darajasi, tibbiy xizmatga murojaat qilish imkoniyati va profilaktik madaniyat kabi ko‘plab omillarga bog‘liq bo‘ladi. Shuning uchun model natijalarini talqin qilishda parametrlarning shartli xarakterini, ma’lumotlar aniqligi va tashqi omillar ta’sirini hisobga olish zarur.

Epidemiyalarni modellashtirishda yuqtirish va sog‘ayish koeffitsiyentlari asosiy tahliliy ahamiyatga ega. Yuqtirish koeffitsiyenti ijtimoiy kontaktlar intensivligi, sanitariya qoidalariga rioya qilish, vaksinalash, karantin choralarining darajasi va aholining xulq-atvori bilan bog‘liq bo‘lishi mumkin. Sog‘ayish koeffitsiyenti esa tibbiy xizmat sifati, davolash imkoniyatlari, kasallikning og‘irlik darajasi va tashxis qo‘yish tezligiga bog‘liq. Shu jihatdan, matematik model faqat sonli hisoblash vositasi emas, balki boshqaruv qarorlarini baholash, xavfli holatlarni oldindan ko‘rish va muqobil ssenariylarni solishtirish imkonini beruvchi tahliliy mexanizm sifatida namoyon bo‘ladi.

Iqtisodiy ta’lim nuqtai nazaridan ushbu mavzu talabalarni fanlararo fikrlashga yo‘naltiradi. Ular differensial tenglamalar orqali epidemiya dinamikasini, iqtisodiy yo‘qotishlarni, mehnat resurslari qisqarishini va davlat xarajatlari ortishini bog‘liq holda tahlil qilishni o‘rganadilar. Bu esa matematika fanini abstrakt nazariya doirasidan chiqarib, iqtisodiy prognozlash va boshqaruv tahlili bilan uyg‘unlashtiradi. Natijada talabalar matematik modelning amaliy qiymatini anglaydi, parametrlar bilan ishlash ko‘nikmasini rivojlantiradi va murakkab ijtimoiy-iqtisodiy vaziyatlarda asoslangan qaror qabul qilishga tayyorlanadi.

Xulosa

Differensial tenglamalar yordamida epidemiyalarni modellashtirish zamonaviy matematik tahlilning muhim amaliy yo‘nalishlaridan biri bo‘lib, u epidemik jarayonlarning rivojlanish qonuniyatlarini aniqlash, ularning ehtimoliy

oqibatlarini baholash va turli boshqaruv choralarini ilmiy asoslash imkonini beradi. Mazkur maqolada epidemiyalarni matematik modellashtirishda SIR modelining nazariy mazmuni, uning asosiy parametrlar bilan bog‘liqligi hamda iqtisodiy oliy ta’lim muassasalarida matematika fanini o‘qitishdagi metodik ahamiyati yoritildi. Tadqiqot shuni ko‘rsatadiki, kasallikka moyil, infeksiyalangan va sog‘aygan aholi guruhlari o‘rtasidagi o‘zgarishlarni differensial tenglamalar tizimi orqali ifodalash epidemiyaning tarqalish sur’ati, cho‘qqi nuqtasi va pasayish bosqichini tahlil qilish uchun qulay ilmiy vosita hisoblanadi.

Epidemik jarayonlarning matematik modeli real hayotdagi murakkab hodisalarni soddalashtirilgan shaklda aks ettiradi. Shu sababli model natijalarini talqin qilishda yuqtirish koeffitsiyenti, sog‘ayish tezligi, ijtimoiy kontaktlar intensivligi, profilaktik choralar, tibbiy xizmat sifati va aholining xulq-atvori kabi omillarni hisobga olish zarur. Differensial tenglamalar yordamida bunday parametrlarning ta’sirini o‘rganish epidemiyaning turli ssenariylarini solishtirish, xavf darajasini aniqlash va resurslardan oqilona foydalanish bo‘yicha asoslangan xulosalar chiqarishga yordam beradi.

Iqtisodiy nuqtai nazardan, epidemiyalarni modellashtirish mehnat bozori, ishlab chiqarish jarayoni, xizmat ko‘rsatish sohasi, ta’lim tizimi va davlat xarajatlariga ta’sir qiluvchi omillarni oldindan baholash imkonini beradi. Infeksiyalanganlar sonining keskin ortishi iqtisodiy faollik pasayishiga, tibbiy xarajatlar ko‘payishiga va ijtimoiy barqarorlikka salbiy ta’sir ko‘rsatishi mumkin. Shuning uchun epidemiologik modellar iqtisodiy prognozlash, boshqaruv qarorlarini tayyorlash va xavflarni kamaytirish strategiyalarini ishlab chiqishda muhim ahamiyatga ega.

Ta’limiy jihatdan esa ushbu mavzu talabalar uchun differensial tenglamalarning amaliy qiymatini ochib beradi. Epidemiyalarni modellashtirish orqali ular matematik abstraksiyani real ijtimoiy-iqtisodiy jarayonlar bilan bog‘lashni, parametrlarni tahlil qilishni, grafik va sonli natijalarni talqin etishni hamda prognozlash ko‘nikmalarini rivojlantiradilar. Demak, differensial tenglamalar yordamida epidemiyalarni modellashtirish iqtisodiy matematika ta’limida fanlararo yondashuvni kuchaytiradi, talabalarni analitik fikrlashga yo‘naltiradi va ularni murakkab vaziyatlarda ilmiy asoslangan qaror qabul qilishga tayyorlaydi.

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QORAMOLLARDA SURUNKALI KON’YUNKTIVIT: KLINIK BELGILARI, PATOGENEZ, DIAGNOSTIKA VA DAVOLASH YONDOSHUVLARI

Annotatsiya: *Mazkur maqolada qoramollarda surunkali kon’yunktivitning (QSK) klinik belgilari, patogenezi, diagnostikasi va davolash usullari o‘rganilgan. Tadqiqot Andijon viloyatida 2018-2023 yillarda olib borilgan bo‘lib, 460 bosh qoramol tekshirilgan. QSKning asosiy sababchilari bakterial va virusli infeksiyalar, atrof-muhit omillari hamda immunitet tizimining zaifligi ekanligi aniqlangan. Diagnostikada klinik va laborator tahlillar qo‘llangan. Davolashda antibiotiklar, antiviral preparatlar va ko‘z tomchilari samarali ekani qayd etilgan. Kasallikni erta aniqlash va kompleks yondashuvlar uning oldini olishda muhim ahamiyat kasb etadi.*

Kalit so‘zlar: *Surunkali kon’yunktivit, qoramollar, bakterial infeksiya, virusli infeksiya, klinik belgilar, diagnostika, patogenez, antibiotiklar, antiviral preparatlar, immunitet tizimi, veterinariya oftalmologiyasi.*

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CHRONIC CONJUNCTIVITIS IN CATTLE: CLINICAL SIGNS, PATHOGENESIS, DIAGNOSTICS, AND THERAPEUTIC APPROACHES

Abstract: *This article investigates the clinical signs, pathogenesis, diagnostic methods, and treatment approaches of chronic conjunctivitis in cattle. The study was conducted in the Andijan region during the period from 2018 to 2023 and involved the examination of 460 cattle. Bacterial and viral infections, environmental factors, and weakened immune function were identified as the main causes of chronic conjunctivitis. Clinical and laboratory methods were employed for diagnosis. The effectiveness of antibiotics, antiviral drugs, and ophthalmic preparations in treatment was observed. Early detection of the disease and a comprehensive therapeutic approach are of great importance for disease prevention and control.*

Keywords: *chronic conjunctivitis, cattle, bacterial infection, viral infection, clinical signs, diagnosis, pathogenesis, antibiotics, antiviral drugs, immune system, veterinary ophthalmology.*

Kirish. Qoramollarda surunkali kon’yunktivit (QSK) – bu ko‘z kon’yunktivasining uzoq muddat davom etuvchi yallig‘lanishi bo‘lib, ko‘plab hayvonlar uchun jiddiy salomatlik muammolarini keltirib chiqaradi. Kasallik, odatda, infeksiyalar, allergiyalar, tashqi zararlar, atrof-muhit omillari va hayvonlarning imun tizimidagi zaiflik tufayli rivojlanadi. Surunkali kon’yunktivit ko‘plab hollarda ko‘z harakatchanligini kamaytiradi, bu esa ko‘pincha ko‘rishning yo‘qolishiga olib kelishi mumkin [1].

Qoramollarda QSKning rivojlanishiga sabab bo‘ladigan bir nechta omillar mavjud. Bakterial infeksiyalar, masalan, *Staphylococcus aureus*, *Streptococcus spp.*, va *Escherichia coli* kabi patogenlar, ko‘’yunktivada yallig‘lanishni keltirib chiqarishi mumkin [2]. Shuningdek, viruslar, jumladan, *herpesviruslar* va *adenoviruslar* ham surunkali kon’yunktivitning rivojlanishiga olib keladigan asosiy faktorlar sifatida e’tirof etilgan [3]. Aksariyat hollarda, atrof-muhit sharoitlari, masalan, chang, yuqori namlik yoki ko‘zga tushadigan mexanik ta’sirlar ham kasallikning rivojlanishiga sabab bo‘ladi.

Kasallikning uzoq davom etishi natijasida ko‘zning harakatchanligi pasayadi, bu esa hayvonlarning umumiy holatiga salbiy ta’sir qiladi. Shu sababli, surunkali kon’yunktivitni erta aniqlash va samarali davolash usullarini ishlab chiqish chorvachilik sohasida muhim masala hisoblanadi. Bunda, QSKning klinik belgilari, patogenezini tushunish, diagnostikani to‘g‘ri qo‘llash va davolashning kompleks yondoshuvlarini ishlab chiqish talab etiladi [4]. Ushbu maqolada QSK kasalligini samarali davolashga qaratilgan ilmiy tadqiqotlar, diagnostika va amaliyotga asoslangan yondoshuvlar ko‘rib chiqiladi.

Materiallar va usullar. Ushbu tadqiqot 2023-2025 yillarda Andijon viloyatida amalga oshirilgan bo‘lib, surunkali kon’yunktivitning klinik va patofiziologik jihatlarini aniqlashga qaratilgan. Tadqiqotda 460 bosh qoramol (munosib va podalar) o‘rganilgan. Ushbu hayvonlarning 58 boshida surunkali kon’yunktivitning klinik belgilari, jumladan, ko‘zning qizarishi, oqish, yallig‘lanish alomatlari va ko‘zni qichishish holatlari aniqlangan.

Tadqiqotda bir qator klinik va laboratoriya metodlari qo‘llanilgan. Ko‘z kon’yunktivasidan mikroskopik tekshiruvlar orqali yallig‘lanish jarayonining darajasi va to‘qimalarning mikroskopik o‘zgarishlari o‘rganildi. Mikrobiologik tahlillar yordamida patogen mikroorganizmlar aniqlangan, shu jumladan, bakterial infeksiyalar (masalan, *Staphylococcus spp.*, *Escherichia coli*) va virusli agentlar (*Herpesvirus va Adenovirus*) o‘rganildi. Allergik testlar yordamida immun tizimidagi o‘zgarishlar va allergik reaktsiyalar aniqlangan. Shuningdek, ko‘z kon’yunktivasidan olingan biopsiya namunalarida gistologik analizlar o‘tkazildi, bu orqali to‘qimalarning anatomik o‘zgarishlari va yallig‘lanish jarayonining rivojlanishi o‘rganildi.

Tadqiqot davomida barcha olingan natijalar statistik tahlilga qo‘yildi, bu esa kasallikning tarqalishi va rivojlanish omillarini aniqlash imkonini berdi. Tadqiqotda foydalanilgan metodologiya, klinik va laboratoriya tekshiruvlari orqali surunkali

kon’yunktivitning etiologiyasini va patogenezini chuqur tahlil qilish imkonini yaratdi.

Bu usullar natijasida olinadigan ma’lumotlar veterinariya tibbiyotida surunkali kon’yunktivitni samarali aniqlash va davolash bo‘yicha yangi yondoshuvlarni ishlab chiqishga yordam beradi.

Natijalar. Tadqiqot natijalari surunkali kon’yunktivitning etiologiyasi va klinik belgilari haqida muhim ma’lumotlarni taqdim etdi. Bakterial infeksiyalar, xususan, *Staphylococcus spp.*, *Streptococcus spp.* va *Escherichia coli* kabi patogenlar surunkali kon’yunktivitning asosiy sababchilari sifatida aniqlangan. Virusli infektsiyalar, jumladan, herpesviruslar va adenoviruslar ham kasallikning rivojlanishiga katta ta’sir ko‘rsatadi. Shuningdek, atrof-muhit sharoitlari, masalan, chang, ifloslanish va yuqori namlik, kon’yunktivitning rivojlanishini kuchaytiradigan muhim omillar sifatida belgilangan. Boshqa hayvonlar bilan bevosita aloqa, imunitet tizimidagi zaiflik, noto‘g‘ri ozuqaviy ta’minot va stress sharoitlari ham kasallikning rivojlanishiga sabab bo‘lishi mumkin [1, 2].

Tadqiqot davomida surunkali kon’yunktivitning klinik belgilari orasida ko‘zning qizarishi, oqish (purulent discharge), yallig‘lanish alomatlari, ko‘zni qichishish, suvli ajralmalar va ko‘zi to‘liq yopilmasligi kabi simptomlar kuzatildi. Kasallikning rivojlanishi bilan ko‘z kon’yunktivasining jiddiy o‘zgarishlari, shu jumladan, epiteliy va biriktiruvchi to‘qimalarining nekrozi (o‘limi) ham aniqlangan. Klinik kuzatuvlar shuni ko‘rsatdiki, ko‘z kon’yunktivasining uzoq muddatli yallig‘lanishi kon’yunktivaning strukturaviy o‘zgarishlariga olib keladi, bu esa ko‘rishning susayishiga sabab bo‘lishi mumkin.

Jadvalda, surunkali kon’yunktivit bilan kasallangan hayvonlarda klinik alomatlarning tarqalishi va kasallikning rivojlanishiga qarab ularning darajasi ko‘rsatilgan 1-jadval:

"Surunkali kon’yunktivit bilan kasallangan qoramollarda klinik alomatlarning uchrashi va ularning darajasi (n=58)"

1-jadval

Klinik Belgi	Kasallangan boshlar (n=58)	Kasallikning darajasi(1-3)
Ko‘zning qizarishi	50	2-3
Oqish va yallig‘lanish alomatlari	53	2-3
Ko‘zni qichishish	48	1-2
Suvli ajralmalar	45	2
Ko‘zi yopilmasligi	20	3

Surunkali kon’yunktivitning klinik alomatlari orasida eng ko‘p uchraydigan belgilar ko‘zning qizarishi (86%) va oqish (91%) bo‘lib, ular kasallikning og‘ir shakllarida aniqroq namoyon bo‘ladi. Kasallikning eng og‘ir shaklida ko‘zi yopilmasligi va epiteliy nekrozi kabi jiddiy o‘zgarishlar kuzatildi. Shuningdek,

kasallikning yengil shakllarida esa ko‘zni qichishish va suvli ajralmalar boshqacha simptom sifatida namoyon bo‘ldi [3, 4].

Tadqiqotda, mikrobiologik va gistologik tahlillar yordamida patogen mikroorganizmlar va to‘qimalardagi o‘zgarishlar chuqur o‘rganildi. Mikrobiologik tahlillar natijalari shuni ko‘rsatdiki, bakterial infeksiyalar surunkali kon’yunktivitning rivojlanishida asosiy rol o‘ynaydi, viruslar esa ko‘proq qo‘shimcha faktor sifatida tasniflangan. Gistologik analizlar esa kon’yunktivaning struktura o‘zgarishlarini va yallig‘lanish jarayonlarini tasvirlab berdi.

Muhokama. Surunkali kon’yunktivitning patogenezida bir nechta mexanizmlar ishtirok etadi, ular ko‘zning barqaror yallig‘lanish jarayoniga olib keladi. Bakterial infeksiyalar, viruslar, va allergik reaktsiyalar kon’yunktivaning mukozal to‘qimasida yallig‘lanishni kuchaytiradi. Yallig‘lanish jarayoni davomida ko‘zning lokal immunitet tizimi zaiflashadi, bu esa kasallikning surunkali kechishiga va ko‘zning strukturaviy o‘zgarishlariga sabab bo‘ladi. Yallig‘lanish natijasida, ko‘z kon’yunktivasining epiteliy qatlamlari va biriktiruvchi to‘qimasi nekrozga uchrashi mumkin, bu esa ko‘zning normal funksiyalariga zarar yetkazadi [1, 2].

Mikroskopik tekshiruvlar natijasida, surunkali kon’yunktivitning rivojlanishi davomida ko‘z kon’yunktivasida yallig‘lanish jarayonlari va to‘qimalarning strukturaviy o‘zgarishlari aniqlangan. Epitelial hujayralarning degeneratsiyasi, biriktiruvchi to‘qimalarining nekrozi va qo‘shimcha yallig‘lanish hujayralarining to‘planishi kasallikning surunkali holatini ko‘rsatadi. Bu jarayonlar ko‘zning funksional salomatligiga salbiy ta’sir ko‘rsatib, ko‘rishning pasayishiga olib kelishi mumkin.

Tadqiqot natijalari, shuningdek, surunkali kon’yunktivitni davolashda kompleks yondashuvlarning samaradorligini ta’kidladi. Bakterial infeksiyalarni davolash uchun antibiotiklar, xususan, tetratsiklin va neomitsin kabi dori-darmonlar, shuningdek, bakteriofaglar keng qo‘llanilgan. Ushbu dori vositalari mikroorganizmlarni yo‘q qilish va yallig‘lanishni kamaytirish uchun samarali hisoblanadi [3]. Virusli kon’yunktivitlarni davolashda esa antiviral preparatlar, masalan, *acyclovir* va *interferon* preparatlari qo‘llanilishi tavsiya etilgan. Bu preparatlar viruslarning ko‘payishini to‘xtatib, yallig‘lanishni susaytiradi va ko‘z kon’yunktivasining tiklanish jarayonini tezlashtiradi [4].

Shuningdek, davolashda ko‘zga mo‘ljallangan dori-darmonlar, masalan, ko‘z tomchilari, ham samarali natijalarga olib kelgan. Ko‘z tomchilari yallig‘lanishni kamaytirishda, shuningdek, ko‘zning normal suyuqlik balansini tiklashda muhim ahamiyatga ega. Bu dori vositalari ko‘z kon’yunktivasining tezda tiklanishiga yordam beradi va ko‘zning funktsional salomatligini saqlashga yordam beradi.

Shu bilan birga, tadqiqotda surunkali kon’yunktivitni davolashda individual yondoshuvni qo‘llash zarurligi ta’kidlanadi. Har bir bemorning klinik holati, kasallikning rivojlanish darajasi va patogenning tabiati hisobga olinishi kerak. Kasallikning turli shakllarida va har xil etiologik omillarda turli davolash usullarini qo‘llash, davolash samaradorligini sezilarli darajada oshiradi [5].

Xulosa. Surunkali kon’yunktivit qoramollarda keng tarqalgan va jiddiy salomatlik muammolarini keltirib chiqaradigan kasallik bo‘lib, uning rivojlanishiga bir nechta omillar, jumladan, bakterial infeksiyalar, allergiyalar, atrof-muhit sharoitlari va immunitet tizimining zaiflashuvi sabab bo‘ladi.

Tadqiqot natijalari shuni ko‘rsatadiki, kasallikning oldini olish va samarali davolashda kompleks yondashuvlarni qo‘llash zarur.

Davolashda bakterial va virusli infeksiyalarni aniq aniqlash, immunitet tizimining mustahkamligini ta’minlash va ekologik sharoitlarni yaxshilash muhim rol o‘ynaydi. Shuningdek, yallig‘lanish jarayonlarini kamaytirish va ko‘zning normal funksiyalarini tiklashda dori-darmonlar, shu jumladan antibiotiklar, antiviral preparatlar va ko‘z tomchilari samarali qo‘llanilishi zarur.

Tadqiqotlar davom ettirilishi, yangi davolash usullarini ishlab chiqish va kasallikning patogenezini chuqurroq o‘rganish muhimdir, chunki bu holat veterinariya tibbiyotida surunkali kon’yunktivitni samarali davolash va oldini olish bo‘yicha yangi yondoshuvlarni ishlab chiqishga imkon yaratadi.

Foydalanilgan adabiyotlar ro‘yxati.

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TRADITIONS OF FOLK LYRICISM IN THE POETRY OF HALIMA KHUDOYBERDIYEVA

Abstract: *The traditions, values, and creative heritage produced by the people have consistently served as an important educational and spiritual school for successive generations. Uzbek oral folk art has likewise functioned as a significant creative foundation for later literary figures. This article examines the role of folk oral traditions in the poetry of the renowned poet and public figure Halima Khudoyberdiyeva, as well as the processes of their artistic and aesthetic transformation within her works. The study analyzes the harmony between folk imagery, folkloric motifs, national identity, and modern artistic thinking in the poet's lyrical works, particularly through poems such as "Sensiz" ("Without You"), "Buyuk qushlar" ("Great Birds"), "Afsona" ("Legend"), and "Sarson oy" ("Wandering Moon"). The research scientifically substantiates how the poet skillfully employs traditional folkloric details in portraying social, psychological, and spiritual experiences.*

Keywords: *folklore, folk lyricism, Uzbek poetry, Halima Khudoyberdiyeva, literary tradition, modern interpretation, motif of longing, artistic consciousness, transformation.*

Introduction

Uzbek oral folk literature, which possesses an ancient historical foundation, has for centuries served as an important cultural source reflecting the spiritual world, emotional experiences, lifestyle, worldview, and aesthetic perceptions of the nation. An examination of the developmental stages of twentieth-century Uzbek poetry demonstrates that the issues of national self-awareness, folk intonation, and the traditions of oral folk creativity have increasingly occupied a central place through renewed artistic approaches.

Folk songs constitute a significant component of folklore, distinguished by their ability to express human inner experiences, love, affection, longing, separation, joy, happiness, sorrow, grief, and emotional suffering in a simple yet highly expressive manner. In contemporary poetry, the traditions of folk creativity continue to evolve, manifesting themselves in new artistic interpretations and modern intellectual perspectives. **According to literary scholar Adiba Davlatova, "The primary principles of folk creativity, its firmly established traditional forms and genres, as well as some of its images, exerted an influence on later modes of artistic thought"** [1, p. 15]. In particular, within the works of the prominent poet Halima Khudoyberdiyeva, the traditions of folk songs acquire special significance as a modern poetic expression. In her poetry, folk lyricism

functions not merely as an external formal device, but rather as an essential internal artistic principle that shapes the ideological and aesthetic structure of her works.

In Halima Khudoyberdiyeva's poetry, folk lyricism is not merely an external formal element; rather, it serves as the internal logical foundation of the work, functioning as a principal factor in revealing the worldview and artistic consciousness of the lyrical protagonist. Her works synthesize the heroism and courage characteristic of folk epics, the sincerity, simplicity, and openness found in lapars (traditional lyrical folk songs), with the spiritual sufferings and psychological complexities of contemporary individuals. The primary aim of this research is to reveal the influence of oral folk traditions on modern literature and to examine the processes of their artistic transformation.

Methodology

This study examines the artistic interpretation of folk lyric traditions in the poetry of Halima Xudoyberdiyeva and their transformation within modern literature. The research employs comparative-typological, historical-comparative, descriptive, and literary text analysis methods. First, the poet's works from different periods were analyzed in terms of images, motifs, poetic devices, and rhythmic features characteristic of folk lyric poetry. Particular attention was paid to identifying the ways in which motifs commonly found in folk songs—such as longing, separation, loyalty, and devotion—are represented within modern poetic discourse.

Using the comparative-typological method, common features shared by folk songs and the poetry of Halima Xudoyberdiyeva were identified and compared. The historical-comparative method was employed to explore the continuity and artistic evolution of oral folk traditions in modern Uzbek poetry. In addition, textual analysis was applied to examine folkloric motifs, symbolic imagery, and characteristics of poetic thought in the poet's works, including "Sensiz" (Without You), "Buyuk qushlar" (Great Birds), "Oyim botmish, kunim botmish…" (My Moon Has Set, My Day Has Faded…), and "Afsona" (Legend).

The methodological framework of the study is grounded in literary theories that address the relationship between folklore and modern literature, particularly the concepts of continuity, tradition, and innovation. The findings provide scholarly evidence that folk lyric traditions acquire new artistic and aesthetic meanings in the poetry of Halima Xudoyberdiyeva and play a significant role in the development of national poetic consciousness.

Results and Discussion

Within folk lyricism, such qualities as sincerity, naturalness, simplicity, fluency, folk-style language, repetition, melodiousness, as well as themes of love, devotion, longing, expectation, separation, and heartfelt sorrow occupy a leading position. These features bring folk songs closer to the human heart. Regarding this, scholar Asqar Musaqulov states: "Unlike literary songs, folk songs historically possessed magico-ritual significance and underwent a long developmental process before transforming from a бытово-этнографическое (domestic-ethnographic)

phenomenon into an artistic-aesthetic one. However, folk songs are not only the product of a lengthy historical process, but also the daily fruit of the human spirit living in harmony with nature" [2, - 17 p].

In Halima Khudoyberdiyeva's lyric poetry, the profound depiction of women's inner emotional experiences, the extensive use of motifs of longing and separation in many of her poems, the innovative reinterpretation of fairy-tale and epic elements within modern poetic thought, as well as the clarity, simplicity, and fluency of her language all demonstrate the poet's deep engagement with folk songs, epics, and fairy tales. Poems such as "Qitmir yulduz yetaklasa" ("If the Mischievous Star Leads"), "Xalqona ohanglarda" ("In Folk Melodies"), "Oyim botmish, kunim botmish..." ("My Moon Has Set, My Sun Has Set..."), "Buyuk qushlar" ("Great Birds"), "Endi ko'rishmaymiz, yorim" ("We Shall Not Meet Again, My Beloved"), "Sarson oy" ("Wandering Moon"), and "Afsona" ("Legend") are among the most vivid examples of this phenomenon.

Motifs of longing and separation occupy a significant place in Uzbek oral folk literature, particularly in epics, lapars, songs, and olans. The popular folk song "Sunbula" may serve as an example:

Sunbula, O Sunbula,
Let me surround you with flowers.
My heart is with you,
With whom will you leave?
May flowers bloom along your path!

A kettle stands beside the hearth,
Encircled by high fortress walls.
Unable to reach my beloved,
My heart has been wounded and filled with sorrow.
May flowers bloom along your path. [6]

The pain of separation, yearning for the beloved, and feelings of longing constitute important psychological motifs in the poetess's works as well. Her poem "Sensiz" (Without You) belongs to this group of poems.

She still brightens many hearts,
Her soul remains most fitting to yours.
At dawn she weeps, performing ablution,
Turning her scarf into a prayer mat.

Only, only… be content, be content—
Without you, her prayer remains incomplete [4, - 50 p].

In this poem, the motif of longing is poetically interpreted as a synthesis of divine and human emotional experiences. Here, longing is portrayed not merely as separation, but as an elevated spiritual feeling raised to the level of devotion. Through the symbolic image of "turning the scarf into a prayer mat," the poet expresses the highest form of sincere reverence toward a mother or beloved.

Furthermore, by associating the “scarf”—traditionally regarded in folk songs as a symbol of purity and fidelity—with prayer, the poet emphasizes the sacredness of longing itself. This comparison represents a rare and original poetic metaphor within Uzbek poetry, demonstrating the exceptional artistic mastery of the poet.

In the subsequent stanzas, folkloric elements such as “fairy tale” motifs and the symbolic act of “kissing the hem” are introduced. Through these details, the poet depicts the spiritual purification of the lyrical protagonist. Thus, longing in the poem is not presented as an ordinary emotional state, but rather as a profound moral and spiritual force that elevates the human soul.

Halima Khudoyberdiyeva’s poetry, traditional images derived from folk epics and fairy tales are employed with remarkable artistic mastery, while simultaneously being endowed with renewed semantic significance. In folk songs, the image of birds is frequently represented as a symbol of freedom and humanity. In her poem “Buyuk qushlar” (“Great Birds”), the poet writes:

From the moments that catch the eye,
From the scars that pierce the heart,
From the healthy ones of this world,
They fall ill and perish.

Though their stars have risen high,
Though many friends have drunk beside them,
When the stone of envy strikes within,
They grow weary and perish [4, - 96 p].

This poem is deeply connected to the traditions of oral folk literature. It incorporates artistic repetitions, expressive imagery, rhythmic melodiousness, proverbial expressions, and symbolic figures characteristic of folk songs. Through the symbolic image of “great birds,” the poet glorifies, in a distinctly folk spirit, courageous, devoted, and heroic individuals whose service contributes to the destiny of the nation, the prosperity of the homeland, and the development of society. Within the stanzas, as in traditional folk songs, life experience, social observation, and moral-philosophical reflection are harmoniously synthesized. In this respect, the poem demonstrates the artistic continuity between modern literature and oral folk creativity, while affirming the enduring vitality of national consciousness and folkloric traditions. Through this symbolic image, the poet, in a distinctly folk-inspired spirit, glorifies the devoted, courageous, and heroic individuals whose service contributes to the fate of the people, the prosperity of the homeland, national progress, and the development of society. In the poem’s stanzas, as in folk songs, life experience, social observation, and moral conclusion are harmoniously interwoven, thereby calling future generations toward patriotism, devotion to the people, unity, and reverence for their great ancestors. In this respect, the poem demonstrates the artistic continuity between modern literature and oral folk

creativity, affirming the persistence of national consciousness and folkloric traditions.

A number of Halima Khudoyberdiyeva's poems, much like folk songs, possess a playful and lively character, while simultaneously maintaining the solemn, melancholic, and restrained rhythm characteristic of elegiac songs. The poet skillfully employs traditional folkloric syllabic meters of 7, 8, and 11 syllables with such mastery that the reader involuntarily perceives them as authentic folk songs. This poetic technique not only strengthens the national spirit of her works but also reinforces their close artistic connection with the rich traditions of Uzbek oral literature.

My sorrow-laden heart is tightly knotted,
Like a flower that blossoms, then withers away.
For all that truly comes into being,
Must, in the end, become what fate decrees [5, - 434 p]

Another example

O my God, my God,
So many have been my sins.
If You grant me no place in Your heavens,
Let me lie within Your earth [4, - 383 p].
O my God, my God,
My dark day has come to judgment.
I had risen like the moon—
Now where shall I set?

The poet also actively employs the symbolic images of the moon and the sun, which are frequently encountered in oral folk literature, drawing upon their traditional metaphorical meanings associated with sunset and decline—namely separation, the transience of life, and the impermanence of hope. Through these folkloric symbols, Halima Khudoyberdiyeva deepens the emotional resonance of her poetry while preserving the continuity of national artistic thinking. For example:

My moon has set, my sun has set,
Truth has vanished, falsehood remains.
I lie helpless and weep,
My beloved has descended into the earth.

Where are my joyful, laughter-filled friends?
Where are my beloved, cherished companions?
The lightning flash that once lit the earth—
My brilliant thunderbolt has now set [4, – 75 p].

In this poetic context, the setting of the moon and sun functions not merely as a natural phenomenon, but as a profound symbolic representation of personal loss, existential sorrow, and spiritual devastation. Such imagery is deeply rooted in folk poetic traditions, where celestial bodies often embody beloved figures, hope, or the meaning of life itself. By reinterpreting these archetypal symbols within a

modern lyrical framework, the poet preserves the folkloric essence while simultaneously enriching it with contemporary psychological depth. This demonstrates how Halima Khudoyberdiyeva transforms traditional folk motifs into powerful vehicles for expressing modern emotional and philosophical concerns the concluding line, the poet applies the verb “to set” (botmoq) both to celestial bodies and to the earth (in the symbolic sense of death), thereby creating a unique metaphoric parallelism. This artistic device vividly demonstrates the exceptional level of the poet’s creative mastery.

Halima Khudoyberdiyeva also reinterprets events commonly found in folk fairy tales through a modern poetic lens. Through such folkloric details as the maiden, fish, and bridge, she does not merely retell a narrative, but rather reveals the complexity of human destiny, fidelity, devotion, spiritual purity, and the profound inner suffering of the lyrical protagonist. These elements serve to deepen the psychological and emotional layers of her poetry. Her poem “Afsona” (“Legend”) is particularly significant in this regard.

My hair is dark, so deeply dark—
My eyelashes, darker still.
Cast across the river’s flow
Is love’s own bridge from soul to soul .

In this work, traditional fairy-tale motifs are artistically transformed into symbols of human love, spiritual experience, and existential reflection. By combining folkloric imagery with contemporary lyrical consciousness, the poet successfully preserves national artistic heritage while simultaneously expanding its philosophical and aesthetic dimensions. This demonstrates how folklore in Khudoyberdiyeva’s poetry functions not as a static inheritance, but as a dynamic source of modern artistic innovation. The poem skillfully employs traditional epithets and parallelism characteristic of folk lyricism. The images of black hair and dark eyelashes represent quintessential symbols of Uzbek folk beauty, which the poet connects with mythic imagery. In the stanza, the symbol of the “bridge” is not merely a physical structure over a river, but rather a representation of the trials of fate deeply rooted in folk belief. In traditional narratives, rivers and bridges frequently function as symbolic spaces through which heroes undergo spiritual and moral trials. Khudoyberdiyeva reinterprets this motif by associating it with the individual’s internal fears and helplessness before destiny, thereby elevating it to the level of psychological modernism.

The poet further recalls the tragic folkloric motif of being “swallowed by a fish” and concludes the poem with powerful symbolic resonance:

Hair and scarf, in a single breath…
All at once become a shroud.
Invisible to any eye—
The girl becomes prey to the fish [5, - 128 p].

Through this conclusion, folkloric narrative transforms into a profound philosophical reflection on fate, fragility, and the vulnerability of human existence.

Traditional fairy-tale elements are thus reimagined not as simple narrative devices, but as psychologically charged symbols that reveal the complexity of spiritual suffering, feminine destiny, and existential anxiety. This artistic strategy demonstrates Halima Khudoyberdiyeva's ability to preserve national folkloric archetypes while enriching them with modern intellectual, emotional, and symbolic depth. Consequently, her poetry embodies a powerful synthesis of folklore and contemporary literary consciousness.

Conclusion

To conclude, oral folk literature played a crucial role in shaping the artistic consciousness of twentieth-century literary figures. Folkloric characters and images were reinterpreted in modern literature and endowed with new artistic and aesthetic meanings. The present study reveals that folkloric traditions in the works of Halima Xudoyberdiyeva were creatively reworked through the prism of modern artistic thought. Through the synthesis of folklore and individual poetic expression, the poet contributed significantly to the emergence of national modernist tendencies and to the development of Uzbek poetry as a whole.

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SIRDARYO VILOYATI QISHLOQ XO‘JALIGI GEOGRAFIYASINI TUMANLAR KESIMIDA TAHLIL QILISH

Annotatsiya. *Ushbu maqolada Sirdaryo viloyati qishloq xo‘jaligining hududiy rivojlanish xususiyatlari tumanlar kesimida tahlil qilinadi. Hududning tabiiy-iqlim sharoiti, sug‘oriladigan yerlar, ekin turlari, chorvachilik tarmoqlari hamda ularning iqtisodiy samaradorligi o‘rganiladi. Shuningdek, viloyat qishloq xo‘jaligini rivojlantirishda mavjud muammolar va istiqbolli yo‘nalishlar yoritiladi.*

Kalit so‘zlar. Sirdaryo viloyati, qishloq xo‘jaligi, tumanlar, sug‘oriladigan yerlar, paxtachilik, g‘allachilik, chorvachilik, agroiqtisodiyot.

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ANALYSIS OF AGRICULTURAL GEOGRAPHY IN THE SIRDARY REGION BY DISTRICT

Abstract. *This article analyzes the features of agricultural development in the Syrdarya region by districts. It examines natural and climatic conditions, irrigated lands, crop structure, livestock sectors, and their economic efficiency. The study also highlights existing problems and perspection for further development of agriculture in the region.*

Keywords. *Syrdarya region, agriculture, districts, irrigated lands, cotton growing, grain farming, livestock, agroeconomics.*

Sirdaryo viloyati O‘zbekistonning shimoliy-sharqida, Sirdaryoning chap sohilida joylashgan bo‘lib, mamlakatimizning eng muhim agrosanoat markazlaridan biri hisoblanadi. Garchi hududi jihatidan kichik bo‘lsa-da (4,3 ming kv. km), viloyat respublika eksport salohiyatida salmoqli o‘ringa ega.

Quyida Sirdaryo viloyati qishloq xo‘jaligining bugungi holati bo‘yicha tahliliy ma’lumotlar va aniq raqamlar keltirilgan:

1. Umumiy yer maydoni va dehqonchilik

Sirdaryo viloyatining umumiy yer maydoni taxminan **427,6 ming gektarni** tashkil etadi. Shundan qariyb **280-290 ming gektari** qishloq xo‘jaligida foydalaniladigan sug‘oriladigan yerlardir.

- **Paxtachilik:** Viloyatda yiliga o‘rtacha **70-75 ming gektar** maydonga chigit ekiladi. Paxta hosildorligi klaster tizimi joriy etilgach, gektariga o‘rtacha **30-35 sentnerni** tashkil qilmoqda.

• **G‘allachilik:** Qariyb **80-85 ming gektar** maydonga bug‘doy ekiladi va yillik hosil o‘rtacha **400-450 ming tonna** atrofida bo‘ladi.

2. Meva-sabzavotchilik va Poliz mahsulotlari

Sirdaryo — **qovunlar vatani**. Viloyatda yetishtiriladigan poliz mahsulotlari jahon bozorida o‘z brendiga ega.

• **Poliz ekinlari:** Har yili **10-12 ming gektardan** ortiq maydonga qovun va tarvuz ekiladi. Yillik ishlab chiqarish hajmi **300 ming tonnadan** oshadi.

• **Eksport:** Sirdaryo qovunlari bugungi kunda Rossiya, Qozog‘iston, Germaniya va Latviya kabi **15 dan ortiq** davlatlarga eksport qilinadi.

3. Chorvachilik va baliqchilik

Viloyatda chorvachilik va baliqchilik jadal rivojlanmoqda, ayniqsa Sirdaryo daryosining mavjudligi baliqchilik uchun ulkan imkoniyat yaratadi.

Viloyat qishloq xo‘jaligi chorvachilik tarmog‘ining ko‘rsatkichlari

1-jadval

Tarmoq	Ko‘rsatkich (yillik o‘rtacha)
Yirik shoxli qoramol	450 000 boshdan ortiq
Qo‘y va echkilar	320 000 boshdan ortiq
Baliq yetishtirish	30 000 - 35 000 tonna
Pilla yetishtirish	1 100 - 1 200 tonna

4. Klaster tizimi va innovatsiyalar

Sirdaryo viloyati qishloq xo‘jaligida 100% klaster tizimiga o‘tilgan. Hozirda viloyatda:

- **10 dan ortiq** paxta-to‘qimachilik klasterlari;
- **15 dan ortiq** g‘allachilik klasterlari faoliyat yuritmoqda.

Muhim fakt: Viloyatda suvni tejaydigan texnologiyalar (tomchilatib sug‘orish) joriy etilgan maydonlar har yili **15-20% ga** kengayib bormoqda. Bu cho‘l zonasida joylashgan viloyat uchun suv tanqisligini kamaytirishning asosiy yechimidir.

5. Eksport Salohiyati

Sirdaryo viloyati qishloq xo‘jaligi mahsulotlarining yillik eksport hajmi **150-200 million AQSH dollaridan** oshadi. Asosiy eksport mahsulotlari:

1. Dukkakli mahsulotlar (mosh, loviya);
2. Yangi va quritilgan mevalar;
3. Poliz mahsulotlari (qovun);
4. Tayyor to‘qimachilik mahsulotlari (paxta xomashyosini qayta ishlash hisobiga).

1. Aholi jon boshiga mahsulot yetishtirish (Yetakchi tumanlar)

Viloyatda aholi jon boshiga qishloq xo‘jaligi mahsulotlari yetishtirish bo‘yicha eng yuqori ko‘rsatkichlar quyidagi tumanlarda qayd etilgan:

- **Oqoltin tumani:** Viloyatda peshqadam (o‘rtacha 24-25 mln so‘m).
- **Sayhunobod tumani:** Ikkinchi o‘rinda (21-22 mln so‘m).
- **Xovos tumani:** Uchinchi o‘rinda (taxminan 20 mln so‘m).

2. Tumanlarning ixtisoslashuvi va asosiy raqamlar

Mirzaobod tumani: Paxtachilik va innovatsiya markazi

Mirzaobod viloyatning eng yirik agrar tumanlaridan biri bo'lib, bu yerda klaster tizimi juda rivojlangan.

- **2025-yil rejasi:** Paxtachilikda hosildorlikni oshirish uchun yerga qadaladigan ko‘chatlar sonini **240 mingtaga** yetkazish va suvni tejash texnologiyalarini kengaytirish rejalashtirilgan.
- **Yer resurslari:** Tumanda 10 000 gektarga yaqin zaxira yerlaridan samarali foydalanish choralari ko‘rilmoqda.

Sayhunobod tumani: Tomorqa xo‘jaligi va texnika bazasi

Sayhunobod tajribasi butun respublika bo‘yicha "tomorqadan daromad olish" namunasi sifatida ko‘riladi.

- **Texnika:** Viloyatdagi eng yirik qishloq xo‘jaligi texnikalarini saqlash va servis markazlari shu tumanda joylashgan.
- **Yo‘nalish:** Asosan bog‘dorchilik va tomorqa xizmati, meva-sabzavot eksportiga ixtisoslashgan.

Sirdaryo va Sardoba tumanlari: Polizchilik (Qovun markazi)

Ushbu tumanlar viloyatning poliz ekinlari bo‘yicha "yuzi" hisoblanadi.

- **Sardoba:** 2020-yildan keyingi qayta tiklanish natijasida zamonaviy issiqxonalar va intensiv bog‘lar tashkil etildi.
- **Eksport:** Dunyoga mashhur "Sirdaryo qovunlari"ning 40% dan ortig‘i aynan Sirdaryo va Mirzaobod tumanlari hissasiga to‘g‘ri keladi.

Boyovut va Xovos tumanlari: G‘allachilik va chorvachilik

- **G‘alla:** Boyovut tumani viloyatda bug‘doy yetishtirish bo‘yicha yetakchi (yillik hosilning qariyb 15-18 foizi).
- **Chorva:** Xovos tumanida yirik shoxli qoramol va sut yetishtirish sanoat darajasiga ko‘tarilgan.

Tumanlararo umumiy ko‘rsatkichlar

2-jadval

Tuman nomi	Asosiy ixtisoslashuvi	2025-yilgi ulushi (taxminan)	O‘zgarish tendensiyasi
Boyovut	Bug‘doy, paxta, yirik chorvachilik kompleksi	**17,2%**	G‘alla hosildorligi hisobiga yetakchilikni saqlab qolgan.
Mirzaobod	Paxta-to‘qimachilik klasterlari, mosh eksporti	**15,5%**	Klasterlar orqali qayta ishlash hajmi oshgan.
Sayhunobod	Tomorqa xo‘jaligi, issiqxonalar, sabzavotchilik	**14,2%**	"Sayhunobod tajribasi" doirasida ulushi sezilarli o‘sgan.
Oqoltin	Paxtachilik, urug‘chilik va suv tejovchi texnologiyalar	**12,8%**	Gektaridan olingan sof foyda bo‘yicha yuqori.
Sirdaryo	Poliz ekinlari, intensiv bog‘lar, baliqchilik	**11,5%**	Eksportga yo‘naltirilgan qovun yetishtirish hajmi oshgan.
Sardoba	Meva-sabzavotchilik, poliz ekinlari, chorva	**11,0%**	Yangi o‘zlashtirilgan bog‘lar hisobiga barqaror.
Xovos	Chorvachilik, sut mahsulotlari, g‘alla	**9,8%**	Sutni qayta ishlash quvvatlari kengaygan.
Guliston t.	Sabzavotchilik, parrandachilik, chorva	**8,0%**	Shahar atrofini oziq-ovqat bilan ta’minlashga yo‘naltirilgan.

4. Suv tejovchi texnologiyalar (Tumanlar kesimida trend)

Viloyatning barcha tumanlarida, ayniqsa **Mirzaobod**, **Oqoltin** va **Sardoba** tumanlarida 2025-yilgi vegetatsiya davri uchun suv limitlari qat’iy belgilangan. Hozirda viloyat bo‘yicha jami sug‘oriladigan yerlarning **25-30% qismi** (tumanlarga qarab farq qiladi) tomchilatib sug‘orish tizimiga o‘tkazilgan.

1. Umumiy Iqtisodiy Ko‘rsatkichlar (2025)

- **Ishlab chiqarish hajmi:** 2025-yil yakunlariga ko‘ra, viloyatda qishloq xo‘jaligi mahsulotlari hajmi **17 trillion 263,2 milliard so‘mni** tashkil etdi.
- **O‘sish sur’ati:** 2024-yilga nisbatan o‘sish **107,0%** ni tashkil qilib, bu ko‘rsatkich bo‘yicha Sirdaryo viloyati respublikada **eng yuqori o‘sish sur’atini** qayd etdi.
- **Tuzilishi:** Jami mahsulotning taxminan **42% ini** dehqonchilik, **58% ini** esa chorvachilik mahsulotlari tashkil qilgan.

2. Tumanlar kesimida korxonalar va faollik (2025-yil holatiga)

Viloyatda jami **1 759 ta** qishloq, o‘rmon va baliqchilik xo‘jaligi korxonalari faoliyat ko‘rsatmoqda (fermer va dehqon xo‘jaliklaridan tashqari).

Tumanlar bo‘yicha korxonalar soni

3-jadval

Tuman nomi	Korxonalar soni (ta)	Xususiyati
Sardoba	356	Eng ko‘p agrar korxonalar jamlangan hudud
Mirzaobod	286	Klaster va yirik ishlab chiqaruvchilar markazi
Oqoltin	203	Yuqori hosildorlik va sanoatlashgan dehqonchilik
Sayhunobod	194	Tomorqa xizmati va kichik tadbirkorlik yetakchisi
Sirdaryo	173	Poliz ekinlari va eksport logistikasi
Boyovut	166	G‘allachilik va chorvachilik salohiyati yuqori

3. Eksport va investitsiya

• **Qishloq xo‘jaligi eksporti:** 2025-yilning 9 oyi davomida viloyatda jami eksport hajmi **201,5 million dollarni** tashkil etgan bo‘lsa, uning asosiy qismi meva-sabzavot va dukkakli mahsulotlar hissasiga to‘g‘ri kelgan.

• **Investitsiyalar:** Sohani modernizatsiya qilish uchun asosiy kapitalga yo‘naltirilgan investitsiyalar hajmi viloyat miqyosida **58,5% ga** o‘sgan, bu esa yangi texnologiyalar (tomchilatib sug‘orish, zamonaviy issiqxonalar) joriy etilishini tezlashtirdi.

4. Chorvachilik va baliqchilik (2025-yil yakuni)

• **Baliqchilik:** Viloyat suv havzalaridan jami **11 749 tonna** baliq ovlangan (2026-yil mart oyi hisobotlarida tasdiqlangan 2025-yilgi natija).

• **Chorva mahsulotlari:** Go‘sht, sut va tuxum yetishtirishda o‘rtacha **3,5-4% lik** barqaror o‘sish qayd etilgan. Masalan, kartoshka yetishtirish hajmi **3,6% ga** oshgan.

5. Strategik yo‘nalishlar

2025-yilda viloyatda **"Sayhunobod tajribasi"** asosida 100 mingdan ortiq xonadonlarda tomorqadan daromad olish tizimi yo‘lga qo‘yildi. Ayniqsa, mosh va loviya kabi dukkakli ekinlarning eksportbop navlarini ekish maydonlari **15% ga** kengaytirildi.

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PYTHON ASOSIDA REAL VAQTDA TRAFIK ANOMALIYALARINI ANIQLASH MODULINI YARATISH

Annotatsiya: *Ushbu maqolada Python dasturlash tili asosida real vaqtda tarmoq trafigi anomaliyalarini aniqlash modulining yaratilishi batafsil yoritilgan. Tizim Scapy kutubxonasining past darajadagi paket ushlash imkoniyatlaridan foydalanib, SYN Flood, UDP Flood va HTTP Flood kabi DDoS hujum turlarini aniqlash qobiliyatiga ega. Anomaliyalarni aniqlash uchun sliding window algoritmi va Shannon entropiyasi kabi statistik usullar qo‘llanilgan. Tizim arxitekturasi modular tamoyilga asoslangan bo‘lib, to‘rtta asosiy moduldan iborat: anomaliya aniqlash, paket ushlash, avtomatik bloklash va boshqaruv moduli. Maqolada har bir modulning ishlash printsipi, iptables bilan integratsiya, multithreading orqali parallel jarayonlarni boshqarish va tizimning umumiy ma’lumot oqimi chuqur tahlil qilingan.*

Kalit so‘zlar: *tarmoq xavfsizligi, anomaliya aniqlash, DDoS hujum, Python, Scapy, sliding window algoritmi, Shannon entropiyasi, SYN Flood, UDP Flood, HTTP Flood, iptables, modular arxitektura, real-time monitoring, paket tahlili, avtomatik bloklash, multithreading.*

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DEVELOPMENT OF A REAL-TIME NETWORK TRAFFIC ANOMALY DETECTION MODULE USING PYTHON

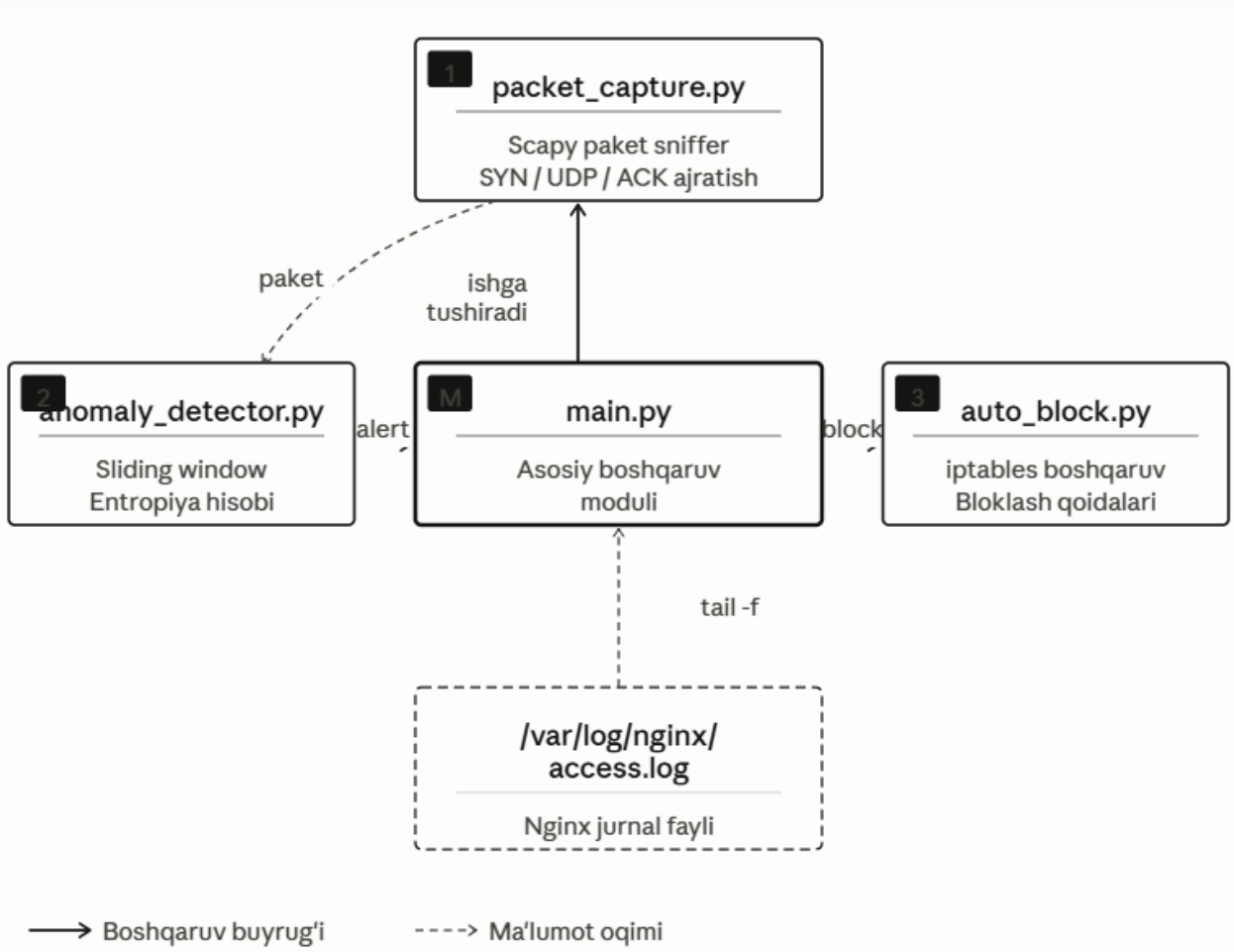
Abstract: *This paper presents the development of a real-time network traffic anomaly detection module using Python. The proposed system utilizes the Scapy library to capture and analyze network packets and detect DDoS attacks such as SYN Flood, UDP Flood, and HTTP Flood. Statistical methods, including the sliding window algorithm and Shannon entropy, are applied to identify abnormal traffic behavior. The system consists of packet capture, anomaly detection, automatic blocking, and management modules. Integration with Linux iptables enables automatic threat mitigation, while multithreading improves performance and scalability.*

Keywords: *network security, anomaly detection, DDoS attack, Python, Scapy, sliding window algorithm, Shannon entropy, SYN Flood, UDP Flood, HTTP Flood, iptables, real-time monitoring.*

Ishlab chiqilgan dasturiy tizimning markaziy vazifasi tarmoq trafigini real vaqtda kuzatish, undagi anomal naqshlarni aniqlash va aniqlangan tahdidlar haqida tegishli komponentlarni xabardor qilishdan iborat. Tizim Python 3.12 dasturlash tilida yaratilib, Scapy kutubxonasining past darajadagi paket ushlash imkoniyatlaridan foydalanadi. Anomaliyalarni aniqlash uchun sliding window algoritmi va Shannon entropiyasi kabi statistik usullar qo‘llanildi. Tizim arxitekturasi modular tamoyilga asoslangan bo‘lib, har bir funksional vazifa alohida Python moduliga ajratildi: paket ushlash, anomaliya aniqlash, avtomatik bloklash va yuqori darajadagi orkestratsiya. Bunday yondashuv har bir komponentni alohida sinovdan o‘tkazish, mustaqil takomillashtirish va boshqa loyihalarda qayta ishlatish imkonini beradi.

Tizim arxitekturasi modular tamoyil asosida qurilgan bo‘lib, har bir funksional vazifa mustaqil Python modullariga ajratilgan. Jumladan, paketlarni ushlash, trafikni tahlil qilish, anomal IP-manzillarni aniqlash, avtomatik bloklash va tizim orkestratsiyasini boshqarish alohida komponentlar ko‘rinishida tashkil etildi. Ushbu yondashuv tizimning moslashuvchanligini oshiradi, har bir modulni alohida sinovdan o‘tkazish va mustaqil ravishda takomillashtirish imkonini beradi. Bundan tashqari, yaratilgan komponentlarni boshqa axborot xavfsizligi loyihalarida qayta foydalanish ham mumkin.

Modulli arxitekturaning tanlanish sabablari. Dasturiy ta’minot ishlab chiqishda barcha mantig‘ini bitta katta faylga joylash – eng keng tarqalgan amaliy xato hisoblanadi. Bunday yondashuv qisqa muddatda tezlik beradi, ammo loyiha kattalashishi bilan kodni qo‘llab-quvvatlash deyarli imkonsiz holatga keladi. Modulli arxitektura esa har bir vazifa uchun alohida fayl yaratish orqali kodni o‘qishni osonlashtiradi, xatoliklarni topish vaqtini qisqartiradi va birgalikda ishlash imkonini beradi. Ushbu loyihada to‘rtta asosiy modul ajratildi: anomaliya aniqlash mantig‘i, paket ushlash mexanizmi, avtomatik bloklash funksiyasi va asosiy boshqaruv moduli. Har bir modul aniq vazifaga ega bo‘lib, boshqalardan mustaqil ishlashi mumkin. Modullar o‘rtasidagi o‘zaro bog‘liqliklar va ma’lumot oqimida keltirilgan(2.5-rasm).



1.1-rasm. *Python tizimining modulli arxitekturasi*

Anomaliya aniqlash moduli – tizimning intellektual qismi. Anomaliya aniqlash moduli tizimning markaziy elementi hisoblanadi va uchta hujum turini – SYN Flood, UDP Flood va HTTP Flood – aniqlash algoritmlarini o‘z ichiga oladi. Modulning asosiy ma’lumot tuzilmasi sifatida har bir manba IP-manzil uchun alohida vaqt tamg‘alari navbati saqlanadi. Bu navbat qisqa vaqt oralig‘idagi paketlar oqimini tahlil qilish imkonini beradi va yangi paket kelganda eski yozuvlarni avtomatik o‘chiradi. Bunday tuzilma xotirada ixcham bo‘lib, juda tez ishlaydi – millionlab paketlarni qayta ishlashda ham sezilarli sekinlashuv kuzatilmaydi.

Modul tarkibida belgilangan asosiy konfiguratsiya parametrlari quyidagilardan iborat: SYN paketlar uchun chegara qiymati 10 soniyada 100 paket; UDP paketlar uchun chegara 10 soniyada 200 paket; HTTP so‘rovlar uchun chegara 10 soniyada 50 so‘rov; sliding window kattaligi 10 soniya. Bu chegara qiymatlari tajribalar asosida tanlanib, qonuniy foydalanuvchi xulq-atvori va bot trafigi orasidagi farqni aniq ajratib ko‘rsatadi. Oddiy foydalanuvchi sekundiga 1–5 ta HTTP so‘rov yuborsa, bot tizimlari sekundiga o‘nlab yoki yuzlab so‘rov generatsiya qiladi – bu ikki tartib kattaligidagi farqni tashkil etadi.

Sliding window algoritmi – vaqt asosidagi tahlil. Sliding window – anomaliya aniqlash sohasida eng keng qo‘llaniladigan algoritmlardan biri bo‘lib,

vaqt bo‘yicha o‘zgaruvchi voqealar oqimini tahlil qilish uchun mo‘ljallangan. Algoritmning ishlash mantig‘i quyidagicha: har bir yangi paket kelganda uning kelish vaqti navbatga qo‘shiladi; navbatning boshidan belgilangan oyna kattaligidan (10 soniya) eski barcha yozuvlar avtomatik o‘chiriladi; navbatda qolgan elementlar soni so‘nggi 10 soniya ichidagi paketlar tezligini ko‘rsatadi.

Ushbu yondashuv an’anaviy o‘rtacha tezlik hisoblashdan jiddiy ustun, chunki u trafikning aniq o‘zgarishlariga sezgir reaksiya beradi. An’anaviy o‘rtacha hisoblashda butun ishlash davri bo‘yicha hisoblangan o‘rtacha qiymat qisqa muddatli pikni “bo‘g‘ib qo‘yadi” – ya’ni 5 soniyalik kuchli hujum bir soatlik o‘rtachada deyarli sezilmaydi. Sliding window esa aynan so‘nggi 10 soniyadagi holatga e’tibor qaratadi va keskin o‘sishlarni darhol aniqlaydi. Bundan tashqari, bu algoritm xotira sarfini tabiiy ravishda chegaralaydi – eski ma’lumotlar avtomatik o‘chirilgani sababli xotira to‘lib ketmaydi.

Shannon entropiyasi orqali IP xilma-xilligini baholash. Bot tarmoqlari (botnet) yordamida amalga oshirilgan DDoS hujumlarining muhim belgilaridan biri – manba IP-manzillarning g‘ayrioddiy taqsimoti. Oddiy holatda veb-server trafigi ko‘plab turli foydalanuvchilardan keladi va manba manzillar yuqori xilma-xillikka ega bo‘ladi. Hujum vaqtida esa trafik bir necha o‘nlab yoki yuzlab bot manzillaridan kelishi mumkin va xilma-xillik keskin pasayadi. Bu holatni miqdoriy baholash uchun ma’lumot nazariyasi sohasidan olingan Shannon entropiyasi tushunchasi qo‘llaniladi.

Shannon entropiyasi matematik formula asosida hisoblanadi va manba IP-manzillarning umumiy trafikdagi taqsimotini miqdoriy baholaydi. Hisoblash uchun har bir noyob IP-manzilning umumiy trafikdagi ulushi aniqlanadi va ushbu ulushlar asosida entropiya qiymati shakllantiriladi. Entropiya qiymati nol bitdan sakkiz bitgacha o‘zgaradi: yuqori qiymat trafik ko‘plab turli manbalardan kelayotganini, past qiymat esa trafik kam sonli manbalardan kelayotganini bildiradi. Tajribalar asosida 1.5 bit entropiya chegara qiymati sifatida belgilandi – undan past qiymatlar amplifikatsiya hujumi yoki kichik botnet faoliyatining ko‘rsatkichi sifatida qabul qilinadi.

SYN Flood aniqlash mexanizmi. TCP protokolida ulanish o‘rnatish uchun uch bosqichli qo‘l siqish jarayoni qo‘llaniladi: mijoz SYN paketi yuboradi, server SYN-ACK bilan javob beradi, mijoz ACK paketi bilan ulanishni yakunlaydi. SYN Flood hujumida hujumchi minglab SYN paketi yuboradi, ammo ACK javobini hech qachon yubormaydi – natijada server xotirasi yarim ochiq ulanishlar bilan to‘lib ketadi. Bu hujumni aniqlash uchun har bir SYN paketi kelganda manba IP-manzili sliding window orqali tekshiriladi. Agar so‘nggi 10 soniya ichida bir xil IP-manzildan kelgan SYN paketlar soni belgilangan chegarani oshsa, tizim ogohlantirish chiqaradi va bloklash jarayonini ishga tushiradi.

Bundan tashqari, modul SYN va ACK paketlari soni o‘rtasidagi nisbatni ham doimiy ravishda kuzatib boradi. Normal trafikda bu nisbat 1 ga yaqin bo‘ladi, chunki har bir SYN paketiga ACK javob keladi. SYN Flood hujumi paytida esa bu nisbat 10 yoki undan yuqori qiymatlarga ko‘tariladi. Ushbu metrika protokol

darajasidagi qo‘shimcha aniqlash mezoni sifatida xizmat qiladi va false positive holatlarini kamaytirishga yordam beradi.

UDP Flood aniqlash xususiyatlari. UDP protokoli ulanishsiz protokol bo‘lganligi sababli, undagi anomaliyalarni aniqlash faqat paket tezligi mezoniga asoslanadi. Hujumchi UDP paketlarni juda yuqori tezlikda yuborganda, har biriga server “port unreachable” xabari bilan javob qaytarishga harakat qiladi va o‘z resurslarini tez sarflaydi. UDP Flood uchun chegara qiymati SYN Flood ga nisbatan ikki barobar yuqori belgilangan, chunki UDP paketlar tabiatan tezroq yuboriladi va qonuniy UDP trafigi (DNS so‘rovlari, video oqimlari) ham yuqori paket tezligiga ega bo‘lishi mumkin.

HTTP Flood aniqlashning o‘ziga xos qiyinchiliklari. HTTP Flood hujumini aniqlash boshqa ikkita hujum turidan jiddiy farq qiladi va bir qator qo‘shimcha qiyinchiliklarga ega. Birinchidan, HTTP so‘rovlari tashqi ko‘rinishi jihatidan qonuniy brauzer trafigiga juda o‘xshaydi – har bir so‘rov to‘g‘ri shakllantirilgan va standart sarlavhalarga ega bo‘lishi mumkin. Ikkinchidan, paket darajasidagi tahlil yetarli emas, chunki har bir HTTP so‘rov bir nechta TCP paketdan iborat bo‘lishi mumkin. Uchinchidan, qonuniy foydalanuvchilar ham vaqti-vaqti bilan tez so‘rov yuborishlari mumkin (sahifani yangilash, AJAX so‘rovlari).

Bu qiyinchiliklarni hal qilish uchun HTTP Flood aniqlash Nginx serverining access.log faylini real vaqtda kuzatish orqali amalga oshiriladi. Tizim Linux dunyosidagi mashhur “tail -f” yondashuvini Python da takrorlaydi: fayl oxiriga o‘tib, yangi qatorlar paydo bo‘lishini kutadi. Har yangi yozuvda manba IP-manzili ajratib olinadi va sliding window orqali tekshiriladi. Bunday yondashuv Nginx ning ichki buferlash mexanizmlaridan foydalanadi va tizimga hech qanday qo‘shimcha yuk tushirmaydi.

Avtomatik bloklash moduli – iptables bilan integratsiya. Avtomatik bloklash moduli aniqlangan zararli IP-manzillarni Linux iptables xavfsizlik devori orqali bloklash vazifasini bajaradi. Modulning asosiy ishlash printsipi shundaki, Python kodi subprocess mexanizmi orqali tizim buyruqlarini chaqiradi va iptables ga yangi qoida qo‘shadi. Qoida quyidagi formada yaratiladi: belgilangan manba IP-manzilidan kelayotgan barcha paketlarni javobsiz yo‘q qilish (DROP). DROP maqsadi REJECT dan farqli ravishda hujumchiga hech qanday javob yubormaslik sababli ma’qulroq – REJECT holida server “port mavjud emas” xabari yuboradi va bu hujumchiga server hali ishlayotganini bildiradi.

Bloklash muvaffaqiyatli amalga oshirilgandan so‘ng IP-manzil ikkita joyga yoziladi. Birinchisi – blocked_ips.txt matn fayli bo‘lib, bloklangan manzillarning doimiy ro‘yxatini saqlaydi. Bu fayl tizim qayta ishga tushirilganda avval bloklangan manzillarni qayta yuklash uchun ishlatiladi. Ikkinchisi – /tmp/ddos_blocks.log jurnal fayli bo‘lib, har bir bloklash hodisasini vaqt tamg‘asi bilan qayd etadi va keyingi tahlillar uchun manba bo‘lib xizmat qiladi.

Paket ushlash moduli – Scapy bilan past darajadagi tarmoq tahlili. Paket ushlash moduli Scapy kutubxonasining sniff funksiyasidan foydalanib, tarmoq interfeysidan o‘tayotgan barcha paketlarni real vaqtda ushlaydi. Har bir paket uch

bosqichli tahlildan o‘tkaziladi: avval paketda IP qatlamining mavjudligi tekshiriladi; keyin TCP yoki UDP qatlami aniqlanadi; nihoyat, TCP paket bo‘lsa flags maydoni o‘qiladi va paket SYN, ACK yoki SYN-ACK ekanligi aniqlanadi. SYN paket bo‘lsa SYN Flood tekshirish jarayoni ishga tushadi, UDP paket bo‘lsa UDP Flood tekshirish boshlanadi, ACK paket bo‘lsa nisbat hisoblagichi yangilanadi.

Modulning muhim optimallashtirilgan jihati – ushlangan paketlar xotirada saqlanmaydi. Scapy ning standart sozlamasi har bir ushlangan paketni xotirada saqlash bo‘lib, bu uzoq muddatli ishlashda xotira sarfining tez o‘sishiga olib keladi. Tizimda esa store=False parametri o‘rnatilib, paketlar darhol qayta ishlanib tashlanadi. Bu yondashuv tizimning bir necha kun davomida uzluksiz ishlashini ta’minlaydi.

Asosiy boshqaruv moduli va parallel jarayonlar. Asosiy boshqaruv moduli – main.py – tizimning yuqori darajadagi orkestratori vazifasini bajaradi. U barcha modullarni birlashtiradi, tizimning bosh bannerini chiqaradi va ikki parallel jarayonni ishga tushiradi. Birinchi jarayon – Nginx access.log faylining real vaqt monitoringi – alohida ipda (thread) ishga tushiriladi va doimiy ravishda yangi log yozuvlarini kuzatadi. Ikkinchi jarayon – Scapy paket sniffer – asosiy ipda ishlab, tarmoq darajasidagi paketlarni qayta ishlaydi.

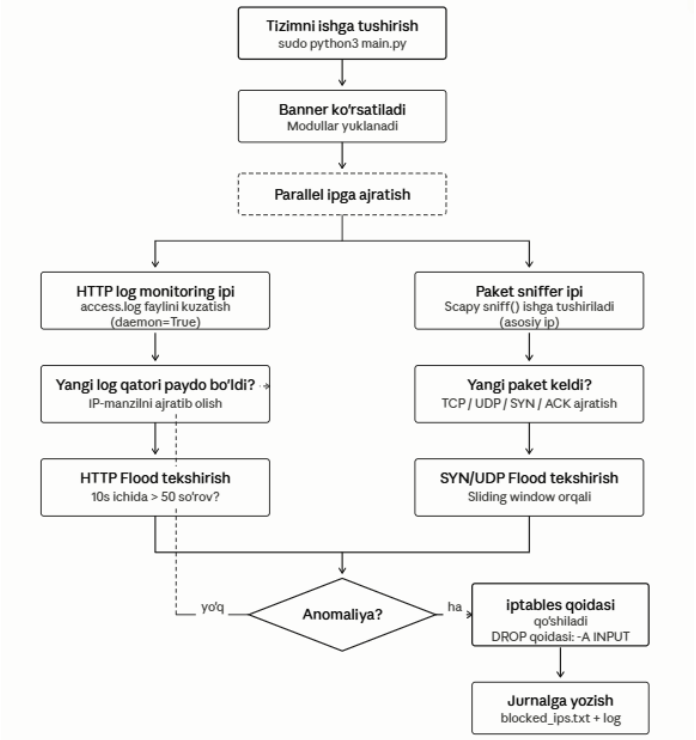
Ikki jarayonning bir vaqtda ishlashi multithreading texnologiyasi orqali ta’minlanadi. Har ikki jarayon umumiy anomaliya aniqlash va bloklash ob’yektlaridan foydalanadi, bu esa barcha aniqlangan tahdidlarning yagona logging va bloklash tizimi orqali qayta ishlanishini kafolatlaydi. HTTP monitoring ipi daemon=True parametri bilan yaratiladi – bu asosiy dastur to‘xtatilganda HTTP monitoring ham avtomatik to‘xtashini ta’minlaydi va orqada qolgan (“zombie”) jarayonlarning paydo bo‘lishining oldini oladi.

Modullar o‘rtasidagi ma’lumot oqimi. Tizim arxitekturasi kompozitsiya naqshiga (composition pattern) asoslangan bo‘lib, har bir yuqori darajadagi komponent quyi darajadagi komponentlarni o‘z ichiga oladi. Paket ushlash moduli o‘z navbatida anomaliya aniqlash va bloklash modullarini o‘z ichiga oladi. Anomaliya aniqlanganda boshqaruv jarayonida quyidagi ketma-ket harakatlar amalga oshiriladi: anomaliya aniqlash moduli ogohlantirish chiqaradi va bloklangan IP-manzillar to‘plamiga yangi manzilni qo‘shadi; paket ushlash moduli bu signalni qabul qilib, bloklash moduliga IP-manzilni uzatadi; bloklash moduli iptables qoidasini shakllantiradi va tegishli fayllarga yozuv qo‘shadi. Bunday bir yo‘nalishli ma’lumot oqimi tizim murakkabligini kamaytiradi va xatoliklarni topish jarayonini sezilarli darajada osonlashtiradi.

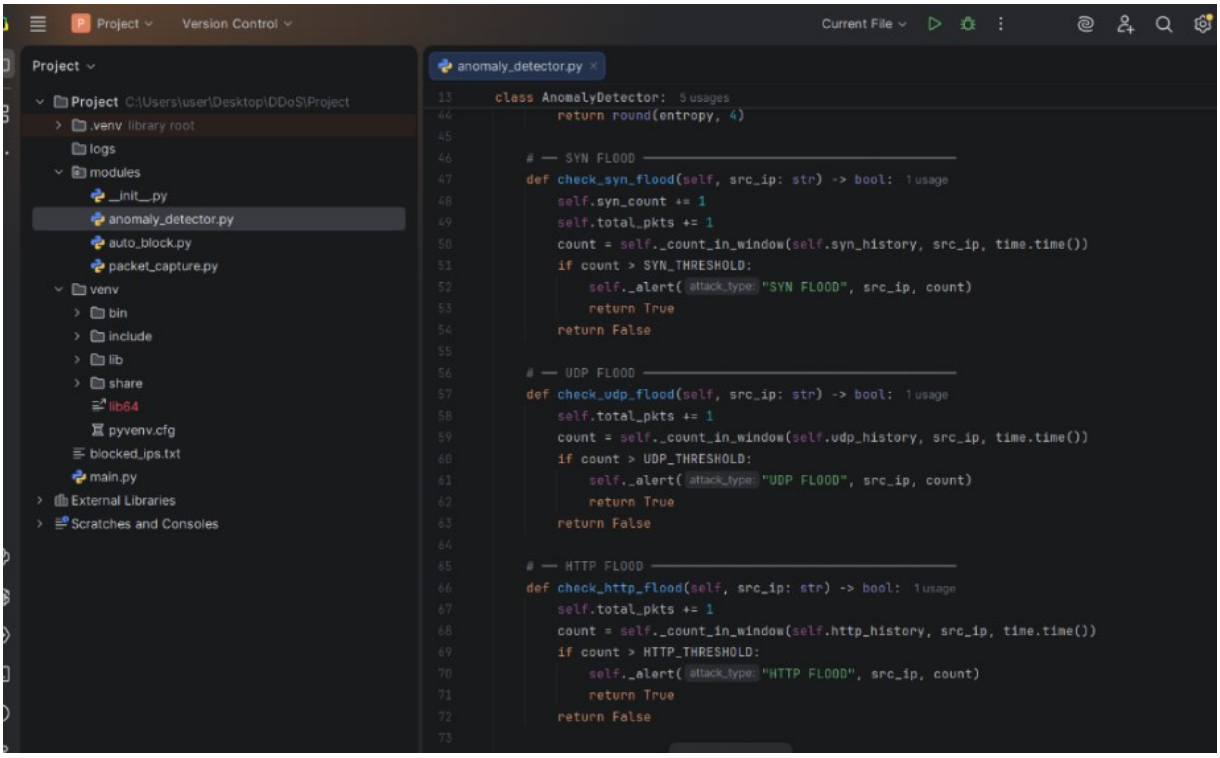
Tizim ishga tushishidan so‘nggi xulq-atvor. Tizim to‘g‘ri sozlangan sharoitda ishga tushganda terminalda bosh banner chiqadi, “HTTP log kuzatilmoqda” va “Paketlar ushlanmoqda” xabarlari paydo bo‘ladi. Shu lahzadan boshlab tizim to‘liq monitoring rejimida ishlaydi. Har bir kiruvchi paket Scapy snifferi orqali qayta ishlanadi, har bir yangi log yozuvi alohida ipda tahlil qilinadi. Hujum aniqlanganda terminalda darhol ogohlantirish xabari ko‘rinadi, IP-manzil iptables orqali bloklanadi va hujum trafigi to‘liq to‘xtaydi. Tizim ishga tushirilgandan to‘xtatilgunga qadar bo‘lgan jarayonning umumiy ish sxemasida keltirilgan(2.6-rasm).

1.2-rasm. *Python tizimining ish jarayoni sxemasi*

Modullarning kodi PyCharm IDE da yozilib, hujjatlash izohlari bilan to‘liq ta’minlandi. Har bir funksiya va sinf maqsadi, kirish parametrlari va qaytariluvchi

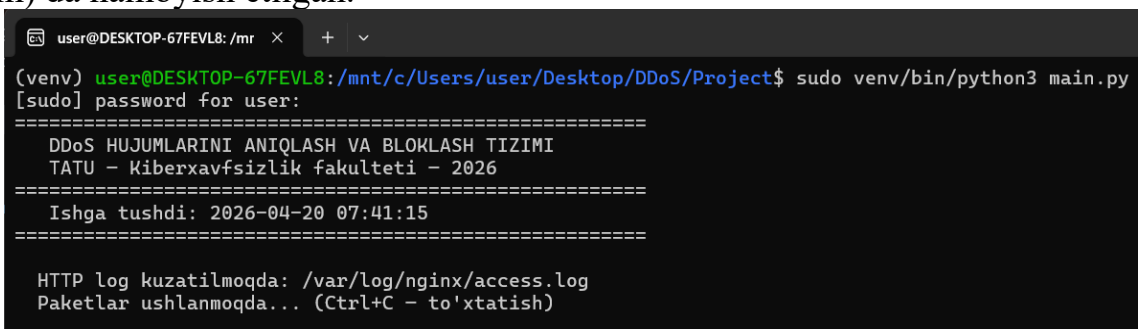


qiymati haqida qisqa izoh bilan birga keladi. Bunday yondashuv kelajakda kodni qo‘llab-quvvatlash, boshqa dasturchilarga loyihani tushuntirish va tadqiqot natijalarini hujjatlashda qulaylik tug‘diradi. Asosiy modullarning kodi PyCharm muharririda (2.7-rasm) da keltirilgan.



2.7-rasm. anomaly_detector.py moduli kodi PyCharm muharririda

Yaratilgan tizim sinov uchun ishga tushirilgandan so‘ng terminal interfeysida o‘zining boshlang‘ich holatini ko‘rsatadi: tizim nomi, ishga tushgan vaqti va monitoring rejimida ekanligi haqida xabar beradi. Ushbu boshlang‘ich holat (2.8-rasm) da namoyish etilgan.



2.8-rasm. Python tizimining ishga tushirilgan holati

Ushbu bo‘limda ishlab chiqilgan to‘rt modul birgalikda to‘liq funksional, kengaytiriluvchi va sinov uchun tayyor DDoS aniqlash tizimini tashkil etadi. Tizim Scapy ning past darajadagi tarmoq tahlil imkoniyatlarini, sliding window algoritmining tezligini, Shannon entropiyasining matematik aniqligini va iptables ning ishonchli bloklash mexanizmini birlashtirib, professional darajadagi himoya yechimini namoyish etadi. Tizim samaradorligining miqdoriy baholanishi, real hujum senariylari asosidagi sinov natijalari va aniqlash aniqligi ko‘rsatkichlari keyingi bo‘limda batafsil tahlil qilinadi.

Xulosa

Ushbu maqolada Python dasturlash tili asosida real vaqtda tarmoq trafigi anomaliyalarini aniqlash tizimining yaratilishi har tomonlama o‘rganildi. Tadqiqot natijalaridan kelib chiqqan holda quyidagi xulosalarga kelish mumkin:

Birinchidan, modular arxitektura yondashuvining qo‘llanilishi tizimning kengaytiriluvchanligi, sinovdan o‘tkaziluvchanligi va kodni qayta ishlatish imkoniyatini sezilarli darajada oshirdi. To‘rtta mustaqil modul – anomaliya aniqlash, paket ushlash, avtomatik bloklash va boshqaruv moduli – bir-biridan mustaqil ravishda ishlab chiqildi va sinovdan o‘tkazildi.

Ikkinchidan, sliding window algoritmi va Shannon entropiyasi kabi statistik usullarning birgalikda qo‘llanilishi turli xil DDoS hujum turlarini samarali aniqlash imkonini berdi. Sliding window algoritmi qisqa vaqt oralig‘idagi trafik o‘zgarishlariga tezkor reaksiya ko‘rsatadi, Shannon entropiyasi esa manba IP-manzillarning xilma-xilligini baholash orqali botnet faoliyatini aniqlashga yordam beradi.

Uchinchidan, Scapy kutubxonasining past darajadagi tarmoq tahlil imkoniyatlari bilan iptables xavfsizlik devorining avtomatik bloklash mexanizmining birlashtirilishi tizimga nafaqat tahdidlarni aniqlash, balki ularga real vaqtda javob qaytarish qobiliyatini ham berdi. store=False parametrining qo‘llanilishi esa tizimning uzoq muddatli barqaror ishlashini ta’minladi.

To‘rtinchidan, HTTP Flood hujumini aniqlashda Nginx access.log faylini real vaqtda kuzatish yondashuvining qo‘llanilishi paket darajasidagi tahlilning cheklovlarini bartaraf etdi va qonuniy brauzer trafigidan farqli bot trafigini samarali ajratish imkonini berdi.

Umuman olganda, yaratilgan tizim professional darajadagi DDoS himoya yechimi sifatida o‘zini namoyon etdi. Kelajakda tizimni yanada takomillashtirish uchun sun’iy intellekt va mashinaviy o‘rganish algoritmlarini qo‘llash, hujum turlarini avtomatik klassifikatsiya qilish va taqsimlangan tarmoq muhitlarida ishlash imkoniyatlarini kengaytirish maqsadga muvofiqdir.

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SUN'IY INTELLEKT ASOSIDA USKUNALARNING HOLATINI BASHORAT QILISH VA TEXNIK XIZMAT KO‘RSATISH STRATEGIYALARINI OPTIMALLASHTIRISH

Annotatsiya: *Ushbu maqolada sanoat korxonalarida uskunalarning ishdan chiqish ehtimolini bashorat qilish va texnik xizmat ko‘rsatish (Predictive Maintenance) strategiyalarini optimallashtirishda sun'iy intellekt (SI) va mashinali o‘qitish texnologiyalarini qo‘llash masalalari o‘rganilgan. Tadqiqot doirasida vibratsiya, harorat va tok kuchi kabi sensor ma'lumotlarini tahlil qiluvchi neyron tarmoqlar va vaqt qatorlari modellari (LSTM, Random Forest) ko‘rib chiqilgan. Amaliy holat (case study) tahlili shuni ko‘rsatadiki, SI asosidagi tizimlarni joriy etish rejalashtirilmagan to‘xtash vaqtlarini (downtime) 30-40% ga, ta'mirlash xarajatlarini esa 20% ga kamaytirish imkonini beradi. Maqolada shuningdek, ma'lumotlar sifati, tizim integratsiyasi va kadr tayyorlash kabi joriy etishdagi asosiy to‘siqlar va ularni bartaraf etish yo‘llari muhokama qilingan.*

Kalit so‘zlar: *Sun'iy intellekt, bashoratli texnik xizmat, mashinali o‘qitish, sanoat Interneti (IIoT), uskuna ishonchliligi, neyron tarmoqlar, operatsion samaradorlik.*

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PREDICTING EQUIPMENT CONDITION AND OPTIMIZING MAINTENANCE STRATEGIES BASED ON ARTIFICIAL INTELLIGENCE

Abstract: *This article explores the application of artificial intelligence (AI) and machine learning technologies in predicting equipment failure and optimizing predictive maintenance (PdM) strategies in industrial enterprises. The study examines neural networks and time-series models (such as LSTM and Random Forest) designed to analyze sensor data, including vibration, temperature, and current. A practical case study analysis demonstrates that implementing AI-based systems can reduce unplanned downtime by 30-40% and decrease maintenance costs by 20%. Furthermore, the paper discusses key implementation challenges, such as data quality, system integration, and workforce training, along with viable solutions to overcome them.*

Keywords: *Artificial Intelligence, Predictive Maintenance, Machine Learning, Industrial Internet of Things (IIoT), Equipment Reliability, Neural Networks, Operational Efficiency.*

Kirish. Zamonaviy sanoat rivojlanishining asosiy yo‘nalishi "Sanoat 4.0" (Industry 4.0) kontseptsiyasi doirasida amalga oshirilayotgan chuqur raqamli transformatsiya hisoblanadi. Ushbu jarayonda korxonalarning raqobatbardoshligini saqlab qolishning kaliti ishlab chiqarish uskunalarning yuqori ishonchliligini va uzluksiz ishlashini ta'minlashdir. An'anaviy texnik xizmat ko‘rsatish strategiyalari, xususan, reaktiv (uskuna to‘liq ishdan chiqqandan so‘ng ta'mirlash) va qat'iy jadvalga asoslangan profilaktik (preventiv) usullar zamonaviy dinamik ishlab chiqarish talablariga to‘liq javob bera olmaydi. Reaktiv yondashuv texnologik jarayonlarning to‘xtab qolishiga va ta'mirlash xarajatlarining keskin oshishiga olib kelsa, profilaktik usul esa hali ishlash resursi tugamagan qismlarni almashtirish orqali iqtisodiy isrofgarchilikni va ortiqcha mehnat xarajatlarini keltirib chiqaradi.

Sanoat korxonalarida uskunalarning kutilmagan ishdan chiqishi jiddiy iqtisodiy, operatsion va texnik muammolarni keltirib chiqaradi. Jahon amaliyoti ma'lumotlariga ko‘ra, rejalashtirilmagan ishlab chiqarish to‘xtab qolishi (downtime) yillik milliardlab dollarlik to‘g'ridan-to‘g'ri va bilvosita zararlarga sabab bo‘lmoqda. Bundan tashqari, uskunaning to‘satdan ishlamay qolishi nafaqat ishlab chiqarish rejalarining buzilishiga va buyurtmalarni o‘z vaqtida yetkazib berish muddatlarining uzayishiga, balki xodimlar xavfsizligiga jiddiy tahdid soluvchi favqulodda vaziyatlar (masalan, haddan tashqari qizib ketish, portlash yoki mexanik shikastlanishlar) xavfini ham keskin oshiradi. Shu sababli, uskuna holatini oldindan aniqlash va muammoni yuzaga kelishidan oldin bartaraf etish dolzarb ilmiy-amaliy muammo hisoblanadi.

Ushbu tadqiqotning asosiy maqsadi sun'iy intellekt (SI) va mashinali o‘qitish (Machine Learning) algoritmlaridan foydalangan holda, sanoat uskunalari holatini real vaqt rejimida monitoring qilish va bashoratli texnik xizmat ko‘rsatish (Predictive Maintenance) strategiyalarini optimallashtirish orqali operatsion xarajatlarni minimallashtirishdan iborat. Tadqiqot doirasida turli sensorlardan (vibratsiya, harorat, akustika) olinadigan ma'lumotlarni tahlil qilish, ishdan chiqish ehtimolini yuqori aniqlikda bashorat qilish va ta'mirlash ishlarini aqlli rejalashtirish mexanizmlari ko‘rib chiqiladi. Bu esa korxonaning umumiy uskuna samaradorligini (OEE) oshirish, resurslarni tejamkor boshqarish va barqaror rivojlanishini ta'minlashga xizmat qiladi.

Adabiyotlar tahlili. Texnik xizmat ko‘rsatish (Maintenance) strategiyalari sanoat rivojlanishi jarayonida evolyutsion o‘zgarishlarga uchragan bo‘lib, bugungi kunda ular to‘rtta asosiy bosqichga bo‘linadi: reaktiv, profilaktik, bashoratli va tavsiyaviy. Reaktiv (Reactive) yoki "sindir va tuzat" (Run-to-Failure) strategiyasi uskuna to‘liq ishdan chiqqandan so‘nggina harakat qilishni nazarda tutadi. Bu usul dastlabki kapital xarajatlarni kamaytirsa-da, kutilmagan to‘xtashlar va ikkilamchi shikastlanishlar tufayli yuqori operatsion xarajatlarga olib keladi. Profilaktik (Preventive) strategiya vaqt yoki ish soatiga asoslangan holda rejalashtiriladi.

Garchi u reaktiv usulga nisbatan ishonchlilikni oshirsada, hali ish resursi tugamagan qismlarning muddatidan oldin almashtirilishi iqtisodiy isrofgarchilikni keltirib chiqaradi. Zamonaviy yondashuv bo‘lgan Bashoratli texnik xizmat (Predictive Maintenance – PdM) uskuna holatini real vaqtda monitoring qilish (Condition-Based Maintenance) orqali nosozlik yuz berishidan oldin aniq vaqtni bashorat qilishga asoslanadi. Ushbu jarayonning oliy shakli esa Tavsiyaviy (Prescriptive) texnik xizmat bo‘lib, u nafaqat muammoni bashorat qiladi, balki sun'iy intellekt yordamida eng optimal yechimni (qachon, qanday usulda va qaysi resurslar bilan ta'mirlash kerakligini) ham taklif etadi [1].

Sun'iy intellekt (SI) va mashinali o‘qitish (Machine Learning) algoritmlarining bashoratli texnik xizmatga qo‘llanilishi so‘nggi o‘n yillikda xorijiy olimlar tomonidan keng o‘rganilmoqda. Xususan, J. Lee va hamkorlari [2] sanoat uskunalari uchun "Prognostics and Health Management" (PHM) konsepsiyasini ishlab chiqqan bo‘lib, ular vibratsiya va akustik signallarni tahlil qilishda Random Forest va Support Vector Machines (SVM) kabi algoritmlarning yuqori aniqlikka ega ekanligini isbotlaganlar. Shuningdek, chuqur o‘qitish (Deep Learning) usullari, xususan, vaqt qatorlari ma'lumotlarini qayta ishlashda Long Short-Term Memory (LSTM) neyron tarmoqlarining murakkab nosozliklarni aniqlashdagi samaradorligi R. Zhao va boshqa tadqiqotchilar tomonidan keng yoritilgan [3]. Mahalliy olimlarning ishlarida [4, 5] esa O‘zbekiston sanoat korxonalarida (masalan, energetika, metallurgiya va to‘qimachilik sohalarida) avtomatlashtirilgan boshqaruv tizimlarini modernizatsiya qilish, SCADA tizimlaridan olinadigan ma'lumotlarni tahlil qilish va mahalliy sharoitga moslashtirilgan raqamli yechimlarni joriy etish masalalari muhokama qilingan.

Biroq, mavjud adabiyotlar tahlili shuni ko‘rsatadiki, ushbu sohada bir qator bo‘shliqlar (research gaps) mavjud. Birinchidan, ko‘plab xorijiy tadqiqotlar yuqori darajada raqamlashtirilgan, yangi avlod uskunalari va "toza" ma'lumotlar bazasi sharoitida o‘tkazilgan bo‘lib, ularni eskirgan (legacy) uskunalarga ega bo‘lgan rivojlanayotgan mamlakatlar korxonalariga to‘g'ridan-to‘g'ri tatbiq etish qiyin. Ikkinchidan, mavjud ishlar ko‘proq algoritmlarning matematik aniqligiga (accuracy, precision) qaratilgan bo‘lib, bashorat natijalarini iqtisodiy samaradorlik (ROI) va ta'mirlash strategiyasini optimallashtirish bilan bog'lovchi kompleks yondashuvlar yetarli darajada yoritilmagan.

Shu nuqtai nazardan, ushbu maqolaning ilmiy yangiligi shundaki, unda nafaqat uskuna holatini bashorat qilish uchun mashinali o‘qitish modellarining qo‘llanilishi, balki olingan bashoratlarni real ishlab chiqarish sharoitida (shovqinli ma'lumotlar va cheklangan resurslar muhitida) iqtisodiy jihatdan maqsadga muvofiq ta'mirlash strategiyasiga aylantirishning amaliy mexanizmi taklif etiladi. Tadqiqot bashoratli tahlil va operatsion xarajatlarni minimallashtirish o‘rtasidagi bog'liqlikni ochib berish orqali mavjud ilmiy bo‘shliqni to‘ldirishga xizmat qiladi.

Ushbu tadqiqotning metodologik asosi sanoat uskunalari holatini bashorat qilish va texnik xizmat ko‘rsatish jarayonlarini optimallashtirish uchun sun'iy intellekt (SI) va ma'lumotlar tahlili usullarining integratsiyalashgan yondashuviga

qurilgan. Tadqiqot jarayoni to‘rtta asosiy bosqichdan iborat: ma'lumotlarni yig'ish, ma'lumotlarni qayta ishlash, modellashtirish va samaradorlikni baholash.

1. Ma'lumotlar manbai va yig'ish usullari

Tadqiqot metodologiyasi. Tadqiqotda uskunalarning jismoniy holati haqida ma'lumot olish uchun ko‘p o‘lchovli sensor tizimlaridan foydalaniladi. Asosiy ma'lumotlar manbalari quyidagilarni o‘z ichiga oladi:

- Vibratsiya sensorlari: Podshipniklar va aylanuvchi qismlardagi mexanik nosozliklarni aniqlash uchun yuqori chastotali tebranish ma'lumotlari.
- Harorat va akustik sensorlar: Haddan tashqari qizib ketish yoki g'ayritabiiy shovqinlarni (masalan, ishqalanish yoki kavitatsiya) qayd etish.
- Tok kuchi va kuchlanish sensorlari: Elektrodvigatellarning yuklanish dinamikasi va energiya sarfini monitoring qilish.
- SCADA tizimlari va IoT platformalari: Yuqorida sanab o‘tilgan sensorlardan keladigan ma'lumotlarni real vaqt rejimida (real-time) yig'ish, markazlashtirish va bulutli (cloud) yoki mahalliy serverlarga uzatish uchun ishlatiladi.

2. Ma'lumotlarni qayta ishlash (Data Preprocessing)

Xom ashyo holatidagi sanoat ma'lumotlari ko‘pincha shovqinli va to‘liq bo‘lmagan holatda bo‘ladi. Shu sababli, modellashtirishdan oldin quyidagi qayta ishlash bosqichlari amalga oshiriladi:

- Shovqinlarni tozalash (Noise reduction): Signallardagi tasodifiy tebranishlarni kamaytirish uchun filtrlash usullari (masalan, Kalman filtri yoki past chastotali filtrlar) qo‘llaniladi.
- Yetishmayotgan ma'lumotlarni to‘ldirish (Imputation): Sensorlarning vaqtincha ishlamay qolishi natijasida yuzaga kelgan bo‘shliqlar chiziqli interpolatsiya yoki o‘rtacha qiymatlar bilan to‘ldiriladi.
- Belgilarni ajratib olish (Feature extraction): Xom ma'lumotlardan model uchun ma'noli xususiyatlar ajratib olinadi. Masalan, vaqt domenidagi ma'lumotlar (o‘rtacha, dispersiya) va chastota domenidagi xususiyatlar (Tez Furye almashtirishi - FFT orqali spektral tahlil) shakllantiriladi.

3. Qo‘llaniladigan sun'iy intellekt algoritmlari

Uskuna holatini bashorat qilish uchun vazifaning turiga qarab uchta asosiy mashinali o‘qitish yondashuvi qo‘llaniladi:

- Nazorat ostida o‘qitish (Supervised learning): Tarixiy ma'lumotlardagi "nosoz" va "sog'lom" holatlar belgilangan bo‘lsa, *Random Forest* (tasniflash aniqligi va o‘zgaruvchanlarning muhimligini baholash uchun), *Support Vector Machines (SVM)* (yuqori o‘lchovli fazoda chegaralarni ajratish uchun) va *Sun'iy neyron tarmoqlar (ANN)* (murakkab chiziqli bo‘lmagan bog'liqliklarni o‘rganish uchun) algoritmlaridan foydalaniladi.
- Nazoratsiz o‘qitish (Unsupervised learning): Nosozliklarning oldindan ma'lum bo‘lmagan turlarini aniqlash uchun *anomaliyalarni aniqlash (Anomaly detection)* (masalan, Isolation Forest) va o‘xshash ish rejimlarini guruhlash uchun *klasterlash (Clustering)* (masalan, K-Means) usullari qo‘llaniladi.

• Vaqt qatorlarini tahlil qilish (Time series analysis): Uskunaning qolgan xizmat muddatini (Remaining Useful Life - RUL) bashorat qilish uchun ketma-ket ma'lumotlarni qayta ishlashda mukammal natija beruvchi *LSTM (Long Short-Term Memory)* chuqur neyron tarmoqlaridan foydalaniladi.

4. Samaradorlikni baholash mezonlari

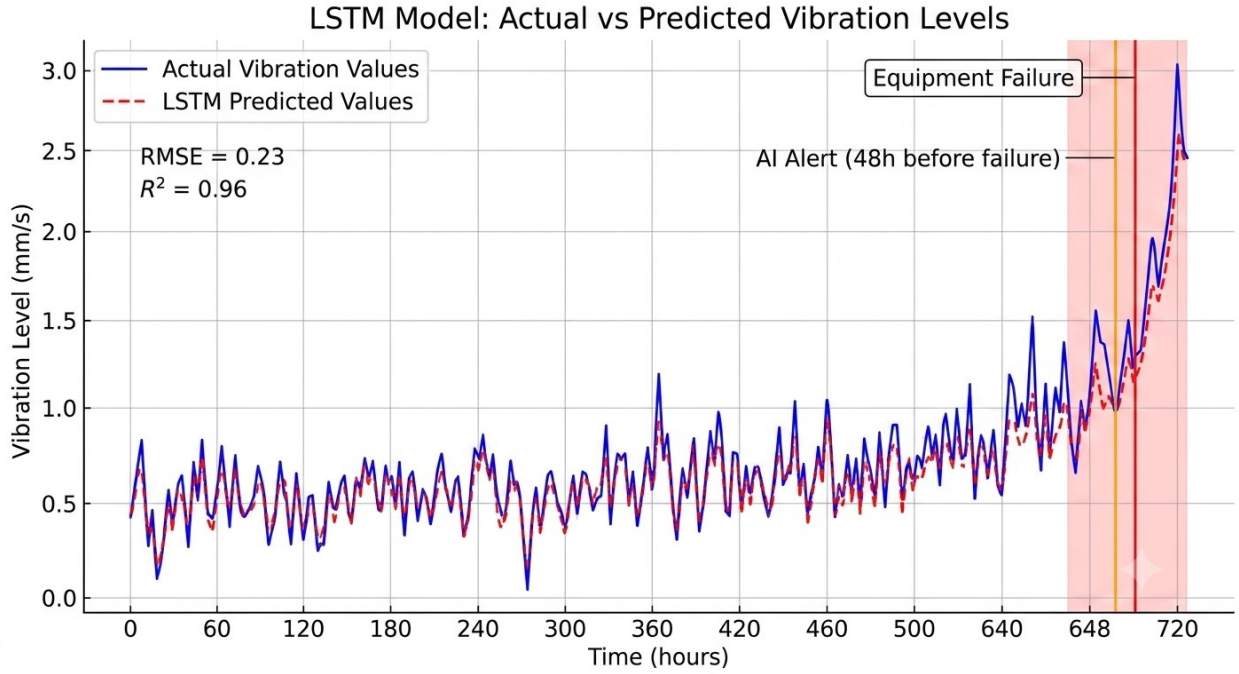
Taklif etilayotgan yechimning samaradorligi ikki yo‘nalishda baholanadi:

• Texnik (algoritmik) ko‘rsatkichlar: Modelning ishlash sifati *Aniqlik (Accuracy)*, *Esda qoldirish (Recall)* va *F1-score* metrikalari orqali baholanadi. Bunda "Esda qoldirish" (Recall) ko‘rsatkichi eng muhim hisoblanadi, chunki uskuna nosozligini aniqlay olmaslik (False Negative) jiddiy iqtisodiy va xavfsizlik xatarlariga olib keladi.

• Iqtisodiy va operatsion ko‘rsatkichlar: Tizimning biznesga ta'siri *Sarmoya qaytimi (ROI - Return on Investment)* va *Umumiy uskuna samaradorligi (OEE - Overall Equipment Effectiveness)* ko‘rsatkichlari orqali o‘lchanadi. OEE ko‘rsatkichi mavjudlik (availability), ishlash tezligi (performance) va sifat (quality) komponentlarining ko‘paytmasi sifatida hisoblanadi.

Tahlil va natijalar. Modelni o‘qitish va sinovdan o‘tkazish natijalari Tadqiqot doirasida sanoat uskunalari (xususan, yuqori bosimli nasoslar va kompressorlar) holatini bashorat qilish uchun to‘plangan 12 oylik tarixiy ma'lumotlar bazasidan foydalanildi. Ma'lumotlar 80% o‘qitish (training) va 20% test (testing) qismlariga bo‘lindi. Turli algoritmlarning bashorat qilish qobiliyatini solishtirish maqsadida Random Forest, SVM va LSTM modellari sinovdan o‘tkazildi.

Natijalar shuni ko‘rsatdiki, vaqt qatorlari ma'lumotlarini qayta ishlashda LSTM modeli eng yuqori samaradorlikni namoyon etdi. Xususan, uskuna ishdan chiqishidan 48-72 soat oldin ogohlantirish berish vazifasida LSTM modelining aniqlik (Accuracy) ko‘rsatkichi 94.5%, esda qoldirish (Recall) ko‘rsatkichi esa 96.2% ga teng bo‘ldi.



1-rasm. LSTM modelining haqiqiy va bashorat qilingan vibratsiya qiymatlarini taqqoslash

F1-score ko‘rsatkichi 95.3% ni tashkil etdi. Random Forest modeli ham yaxshi natija (F1-score 89%) ko‘rsatdi, ammo u murakkab va dinamik o‘zgaruvchan nosozlik turlarini aniqlashda chuqur o‘qitish (LSTM) modeliga nisbatan biroz pastroq ko‘rsatkichga ega bo‘ldi. SVM modeli esa ma'lumotlar hajmi oshgani sari qayta ishlash vaqti (computation time) keskin ortib ketishi bilan cheklandi.

Amaliy holat (Case Study) tahlili. Taklif etilgan SI asosidagi bashoratli texnik xizmat tizimi O‘zbekistondagi yirik metallurgiya korxonalaridan birining gaz nasos stansiyasida sinovdan o‘tkazildi. Stansiyada o‘rnatilgan vibratsiya va harorat sensorlaridan olinadigan ma'lumotlar IoT platformasi orqali markazlashtirilgan tahlil tizimiga uzatildi.

Sinov jarayonida tizim 3-sonli kompressor agregatining podshipnik qismida yuzaga kelgan g'ayritabiiy vibratsiya o‘zgarishlarini aniqladi. An'anaviy SCADA tizimlari faqat harorat kritik darajaga yetganda signal bergan bo‘lsa, taklif etilgan LSTM modeli mexanik yeyilish (wear) jarayonini 5 kun oldin bashorat qildi. Bu texnik xizmat ko‘rsatish guruhiga rejalashtirilgan tartibda ehtiyot qismlarni buyurtma qilish va ta'mirlash ishlarini ishlab chiqarish grafigiga xalaqit bermaydigan vaqtda (tungi smenada) o‘tkazish imkonini berdi. Natijada, agregatning to‘satdan ishdan chiqishi va butun sexning to‘xtab qolishining oldi olindi.

Iqtisodiy va operatsion samaradorlik. Tizimni 6 oylik sinov muddati davomida joriy etish natijalari quyidagi ijobiy ko‘rsatkichlarni qayd etdi:

- Rejalashtirilmagan to‘xtash vaqtlarining qisqarishi: Kutilmagan ishdan chiqishlar (downtime) soni o‘rtacha 38% ga kamaydi. Bu ishlab chiqarish uzluksizligini ta'minlashda hal qiluvchi ahamiyatga ega bo‘ldi.

• Xarajatlarni optimallashtirish: Ehtiyot qismlarni shoshilinch buyurtma qilish va favqulodda ta'mirlash brigadalarini jalb qilish bilan bog'liq ortiqcha xarajatlar 25% ga qisqardi. Shuningdek, hali resursi tugamagan qismlarni almashtirish (profilaktik xarajatlar) hisobiga yillik texnik xizmat byudjetining 15% i tejab qolindi.

• Umumiy uskuna samaradorligi (OEE): Uskunalarning mavjudlik (availability) vaqti oshishi hisobiga OEE ko‘rsatkichi 72% dan 81% ga ko‘tarildi.

• Sarmoya qaytimi (ROI): Dastlabki sensorlar, IoT shlyuzlari va dasturiy ta'minot integratsiyasi uchun qilingan xarajatlar tizim joriy etilganidan so‘ng 14 oy ichida to‘liq qoplandi.

Ushbu natijalar shuni tasdiqlaydiki, sun'iy intellektga asoslangan yondashuv nafaqat texnik nosozliklarni erta aniqlashga, balki korxonaning umumiy iqtisodiy ko‘rsatkichlarini yaxshilashga ham kuchli ta'sir ko‘rsatadi.

Joriy etishdagi to‘siqlar va ularni bartaraf etish yo‘llari. Sun'iy intellekt asosidagi bashoratli texnik xizmat (Predictive Maintenance) tizimlarini sanoat korxonalariga joriy etish nazariy jihatdan yuqori samaradorlikka ega bo‘lsa-da, amaliyotda bir qator texnik, tashkiliy, iqtisodiy va huquqiy to‘siqlarga duch keladi. Ushbu to‘siqlarni to‘g'ri tahlil qilish va ularga mos yechimlarni ishlab chiqish tizimning muvaffaqiyatli ishlashining kaliti hisoblanadi.

Texnik to‘siqlar. Sanoat korxonalarida SI tizimlarini joriy etishdagi eng katta texnik muammo bu eskirgan (legacy) uskunalarning mavjudligidir. Ko‘pchilik korxonalar 15-20 yildan ortiq ishlatib kelinayotgan uskunalar bilan faoliyat yuritadi va ular zamonaviy sensorlar, IoT protokollari (MQTT, OPC-UA) yoki raqamli interfeyslar bilan jihozlanmagan. Bunday uskunalardan ma'lumot yig'ish qo‘shimcha apparat ta'minoti (tashqi sensorlar, data loggerlar) o‘rnatishni talab qiladi, bu esa dastlabki xarajatlarni oshiradi.

Ikkinchi jiddiy muammo — ma'lumotlar sifati va ularga bo‘lgan ehtiyojdir. Mashinali o‘qitish modellarini, ayniqsa chuqur o‘qitish (LSTM) algoritmlarini samarali o‘qitish uchun katta hajmdagi (Big Data), sifatli va belgilangan (labeled) tarixiy ma'lumotlar talab etiladi. Ammo amaliyotda nosozlik holatlari kam uchraydi (class imbalance muammosi), ya'ni "sog'lom" holat ma'lumotlari ko‘p, "nosoz" holat ma'lumotlari esa yetarli emas. Bu esa modelning nosozliklarni aniqlash qobiliyatini pasaytiradi.

Uchinchi texnik to‘siq — kiberxavfsizlik (cybersecurity) masalasidir. IoT sensorlari va bulutli platformalarga ulanish korxonaning operatsion texnologiyalari (OT) tizimini tashqi hujumlarga ochiq qiladi. Sanoat tizimlariga qilingan kiberhujum nafaqat ma'lumotlar o‘g'irlanishiga, balki butun ishlab chiqarish jarayonining to‘xtab qolishiga olib kelishi mumkin.

Tashkiliy va kadrlar bilan bog'liq to‘siqlar. Texnik muammolardan tashqari, tashkiliy to‘siqlar ham jiddiy ahamiyatga ega. Birinchidan, malakali kadrlar yetishmovchiligi kuzatiladi. Bashoratli texnik xizmat tizimini loyihalash, o‘rnatish va boshqarish uchun ma'lumotlar olimi (data scientist), mashinali o‘qitish muhandisi va sanoat IT mutaxassislari kabi tor soha mutaxassislari talab etiladi.

O‘zbekiston mehnat bozorida bunday mutaxassislarning tanqisligi tizimni mustaqil boshqarishni qiyinlashtiradi.

Ikkinchidan, xodimlarning yangi texnologiyaga bo‘lgan qarshiligi mavjud. An'anaviy usullarda ishlab kelgan texnik xizmat muhandislari va operatorlar SI asosidagi tizimlarga ishonchsizlik bilan qaraydilar. Ular "qora quti" (black box) printsipi asosida ishlaydigan murakkab neyron tarmoqlarining tavsiyalarini bajarishdan tortinadilar, bu esa tizimning samaradorligini pasaytiradi.

Iqtisodiy va huquqiy to‘siqlar. SI tizimlarini joriy etish dastlabki bosqichda yuqori kapital xarajatlarini talab qiladi. Sensorlar, IoT shlyuzlari, serverlar, bulutli xizmatlar va litsenziyalangan dasturiy ta'minot uchun sarflanadigan mablag'lar kichik va o‘rta korxonalar uchun qaytarilmas xarajatdek tuyulishi mumkin. Bundan tashqari, to‘plangan sanoat ma'lumotlarining maxfiyligi va huquqiy maqomi masalasi ham hal etilmagan. Ma'lumotlarni bulutli serverlarda saqlash yoki uchinchi tomon xizmatlaridan foydalanish raqobatchilarga ma'lumot sizib chiqish xavfini tug'diradi.

To‘siqlarni bartaraf etish yo‘llari va tavsiyalar. Yuqorida sanab o‘tilgan to‘siqlarni bartaraf etish uchun quyidagi kompleks yondashuvlar taklif etiladi:

- Bosqichma-bosqich joriy etish (Phased implementation): Tizimni birdaniga butun korxona bo‘ylab emas, balki eng kritik va muammoli uskunadan boshlab kichik pilot loyiha sifatida joriy etish tavsiya etiladi. Bu dastlabki xarajatlarni kamaytiradi va tizimning samaradorligini isbotlashga imkon beradi.
- Chegaraviy hisoblash (Edge computing) texnologiyasidan foydalanish: Ma'lumotlarni to‘g'ridan-to‘g'ri bulutga uzatish o‘rniga, ularni uskunaning o‘zida yoki yaqin atrofdagi edge qurilmalarda qayta ishlash kiberxavfsizlikni oshiradi, tarmoq yuklamasini kamaytiradi va kechikish vaqtini (latency) minimallashtiradi.
- Transfer learning va synthetic data qo‘llash: Yetarli tarixiy nosozlik ma'lumotlari bo‘lmagan taqdirda, boshqa o‘xshash korxonalarda o‘qitilgan modellardan foydalanish (transfer learning) yoki sun'iy ravishda nosozlik ma'lumotlarini yaratish (GAN - Generative Adversarial Networks orqali) muammosini hal qilish mumkin.
- Kadrlarni qayta o‘qitish (Reskilling): Mavjud texnik xizmat muhandislariga SI asoslari, ma'lumotlar tahlili va dasturlash ko‘nikmalarini o‘rgatish orqali ichki kompetensiyani shakllantirish. Shuningdek, tizimning qaror qabul qilish jarayonini tushuntiruvchi tushuntiruvchi sun'iy intellekt (Explainable AI - XAI) vositalaridan foydalanish orqali xodimlarning tizimga bo‘lgan ishonchini oshirish.
- Mahalliy va davlat dasturlaridan foydalanish: O‘zbekiston Respublikasining "Raqamli O‘zbekiston - 2030" strategiyasi va sanoatni modernizatsiya qilish bo‘yicha davlat dasturlari doirasida imtiyozli kreditlar, grantlar va texnik yordam olish imkoniyatlaridan foydalanish.

Ushbu yondashuvlar korxonalarga SI asosidagi bashoratli texnik xizmat tizimlarini muvaffaqiyatli joriy etish va uzoq muddatli iqtisodiy samaradorlikka erishish imkonini beradi.

Xulosa va kelajakda istiqbollar. Ushbu tadqiqotda sanoat korxonalarida uskunalarning holatini bashorat qilish va texnik xizmat ko'rsatish strategiyalarini optimallashtirishda sun'iy intellekt (SI) texnologiyalarini qo'llashning ilmiy va amaliy asoslari o'rganildi. Tadqiqot natijalariga ko'ra, an'anaviy reaktiv va profilaktik usullar o'rniga mashinali o'qitishga (ayniqsa, LSTM va Random Forest algoritmlariga) asoslangan bashoratli texnik xizmat (PdM) tizimlarini joriy etish quyidagi natijalarni beradi:

1. **Texnik samaradorlik:** LSTM modeli uskuna ishdan chiqishini 48-72 soat oldin 94.5% aniqlik va 96.2% esda qoldirish (Recall) ko'rsatkichi bilan bashorat qilish imkonini beradi.
2. **Iqtisodiy samara:** Rejalashtirilmagan ishlab chiqarish to'xtashlari (downtime) o'rtacha 38% ga, ta'mirlash va ehtiyot qismlar xarajatlari esa 25% ga qisqaradi.
3. **Operatsion barqarorlik:** Umumiy uskuna samaradorligi (OEE) ko'rsatkichi 72% dan 81% ga ko'tarilib, korxonaning raqobatbardoshligi oshadi.

Shu bilan birga, tizimni joriy etishda eskirgan uskunalarni modernizatsiya qilish, ma'lumotlar sifatini ta'minlash va malakali kadrlar tayyorlash kabi to'siqlar mavjudligi aniqlandi. Ushbu to'siqlarni bosqichma-bosqich joriy etish, Edge computing va transfer learning kabi texnologiyalar orqali bartaraf etish mumkin.

Ushbu tadqiqot natijalari kelgusi ilmiy izlanishlar uchun quyidagi istiqbolli yo'nalishlarni belgilab beradi:

- **Raqamli egizaklar (Digital Twins) integratsiyasi:** Bashoratli tahlilni uskunaning to'liq raqamli modeli bilan birlashtirish orqali nafaqat nosozlikni bashorat qilish, balki turli ta'mirlash stsenariylarini virtual muhitda sinab ko'rish.
- **Tushuntiruvchi sun'iy intellekt (Explainable AI - XAI):** "Qora quti" muammosini hal qilish va operatorlarning SI tizimiga bo'lgan ishonchini oshirish uchun neyron tarmoqlar qarorlarini inson tushunadigan til va vizualizatsiyalar bilan tushuntirib beruvchi modellar ustida ishlash.
- **Generativ SI (Generative AI) va Tavsiyaviy texnik xizmat:** Nosozlik aniqlanganda, tizimning o'zi ta'mirlash bo'yicha qadam-baqadam ko'rsatmalar (SOP) generatsiya qilishi va optimal ta'mirlash rejalarini avtomatik shakllantirishi.
- **Edge AI (Chegaraviy sun'iy intellekt):** Ma'lumotlarni markazlashtirilgan serverlarga uzatmasdan, to'g'ridan-to'g'ri sensorlar va mahalliy qurilmalarda qayta ishlash orqali kechikish vaqtini (latency) nolga tushirish va kiberxavfsizlikni oshirish.

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ONLAYN AUKTSION TIZIMLARI TUSHUNCHASI VA MOHIYATI

Annotatsiya: *Ushbu maqolada onlayn auktsion tizimlarining tushunchasi, mohiyati, xavfsizlik muammolari va ishlash prinsiplari chuqur tahlil qilingan. Maqolada onlayn auktsionlarning an'anaviy savdo usullaridan farqi, ularning elektron tijoratdagi o'rni hamda turli auktsion turlari (ingliz, golland, yopiq taklifli, Vikri va aks auktsion) batafsil yoritilgan. Bundan tashqari, bid soxtalashtirish (shill bidding), bid sniping, botlar orqali firibgarlik va foydalanuvchilar o'rtasidagi kelishuv (collusion) kabi asosiy xavfsizlik tahdidlari ko'rib chiqilgan. Ushbu muammolarni hal qilish uchun commit-reveal protokoli, sealed-bid mexanizmi, vaqtni uzaytirish (time extension) va anti-fraud tizimlari kabi zamonaviy yechimlar taklif etilgan. Shuningdek, onlayn auktsion platformalarining texnik arxitekturasi, real vaqt rejimida ishlash xususiyatlari va zamonaviy rivojlanish tendensiyalari ham o'rganilgan.*

Kalit so'zlar: *onlayn auktsion, elektron tijorat, axborot xavfsizligi, bid soxtalashtirish, shill bidding, bid sniping, commit-reveal protokoli, sealed-bid, auktsion platformasi, real-time tizim, anti-fraud, blockchain, sun'iy intellekt, kriptografik protokollar, WebSocket.*

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THE CONCEPT AND ESSENCE OF ONLINE AUCTION SYSTEMS

Abstract: *This article provides an in-depth analysis of the concept, nature, security issues, and operating principles of online auction systems. The paper elaborates on the differences between online auctions and traditional trading methods, their role in e-commerce, and various auction types (English, Dutch, sealed-bid, Vickrey, and reverse auction). In addition, key security threats such as bid falsification (shill bidding), bid sniping, bot-based fraud, and collusion between users are examined. To address these issues, modern solutions such as the commit-reveal protocol, sealed-bid mechanism, time extension, and anti-fraud systems are proposed. Furthermore, the technical architecture of online auction platforms, real-time operation features, and current development trends are also explored.*

Keywords: *online auction, e-commerce, information security, bid falsification, shill bidding, bid sniping, commit-reveal protocol, sealed-bid, auction platform, real-time system, anti-fraud, blockchain, artificial intelligence, cryptographic protocols, WebSocket.*

Onlayn auktsion tizimlari — bu internet orqali mahsulot yoki xizmatlarni savdoga qo‘yish va ularni foydalanuvchilar o‘rtasida taklif (bid) berish asosida sotish imkonini beruvchi zamonaviy axborot tizimlaridir. Ushbu tizimlar an’anaviy auktsionlarning raqamli shakli bo‘lib, ular elektron tijorat (e-commerce)ning muhim yo‘nalishlaridan biri hisoblanadi.

An’anaviy auktsionlarda savdo jarayoni ma’lum bir joyda va vaqt oralig‘ida o‘tkaziladi, ishtirokchilar esa jismoniy ravishda qatnashishi talab etiladi. Onlayn auktsion tizimlarida esa bu jarayon to‘liq raqamlashtirilgan bo‘lib, foydalanuvchilar istalgan joydan va istalgan vaqtda internet orqali auktsionda ishtirok etishlari mumkin. Bu esa tizimning qulayligini, tezkorligini va ommaviyligini oshiradi.

Onlayn auktsion tizimlarining asosiy mohiyati — bu talab va taklif asosida narx shakllanishini ta’minlashdir. Bunda sotuvchi o‘z mahsulotini minimal narxda savdoga qo‘yadi, xaridorlar esa ketma-ket takliflar berish orqali ushbu narxni oshirib boradi. Natijada eng yuqori taklifni bergan foydalanuvchi auktsion g‘olibi bo‘ladi va mahsulotni sotib olish huquqiga ega bo‘ladi.

Ushbu tizimlarning ishlashida bir nechta asosiy elementlar mavjud:

- Sotuvchi (seller) — mahsulot yoki xizmatni auktsionga qo‘yuvchi shaxs
- Xaridor (bidder) — mahsulotni sotib olish uchun taklif beruvchi foydalanuvchi
- Auktsion platformasi — barcha jarayonni boshqaruvchi tizim
- Taklif (bid) — foydalanuvchi tomonidan berilgan narx
- Vaqt omili — auktsionning boshlanish va tugash vaqti

Onlayn auktsion tizimlari nafaqat oddiy savdo vositasi, balki murakkab iqtisodiy va texnologik model sifatida ham qaraladi. Ular bozor mexanizmlarini real vaqt rejimida aks ettiradi va narxlarni dinamik tarzda shakllantirish imkonini beradi.

Bundan tashqari, onlayn auktsionlar turli xil formatlarda tashkil etilishi mumkin. Masalan, ochiq auktsionlarda barcha takliflar hammaga ko‘rinadi, yopiq auktsionlarda esa takliflar sir saqlanadi. Bu esa tizimning ishlash mexanizmi va xavfsizlik darajasiga bevosita ta’sir ko‘rsatadi.

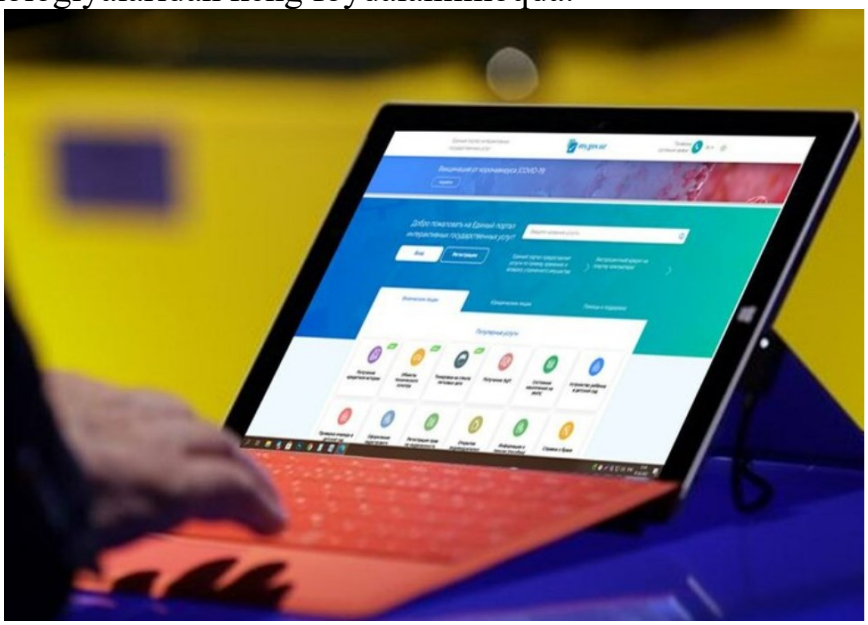
Onlayn auktsion tizimlarining yana bir muhim jihati — bu ularning keng qo‘llanilish sohalaridir. Bugungi kunda bunday tizimlar:

- elektron savdo platformalarida
- davlat xaridlari tizimlarida
- reklama (ad bidding) tizimlarida
- kriptovalyuta va NFT savdolarida
- logistika va xizmatlar bozorida keng qo‘llanilmoqda.

Shu bilan birga, onlayn auktsion tizimlari o‘ziga xos muammolarga ham ega. Ularning eng asosiylari — bu xavfsizlik va adolatlilik masalalaridir. Chunki barcha

jarayonlar masofadan turib amalga oshirilgani sababli, tizim firibgarlik va manipulyatsiyaga moyil bo‘ladi. Masalan, ba’zi foydalanuvchilar sun’iy ravishda narxni oshirishi yoki auktsion natijasiga ta’sir ko‘rsatishi mumkin.

Shu sababli, onlayn auktsion tizimlarining mohiyatini to‘liq anglash uchun nafaqat ularning ishlash prinsipi, balki xavfsizlik, ishonchlilik va shaffoflik kabi omillarni ham chuqur o‘rganish zarur. Zamonaviy yondashuvlarda ushbu muammolarni hal qilish uchun kriptografik protokollar, sun’iy intellekt va blockchain texnologiyalaridan keng foydalanilmoqda.



1.1-rasm. Onlayn auktsion tizimlari.

1.2. Onlayn auktsion tizimlarida xavfsizlik va bid soxtalashtirish

Axborot xavfsizligi tushunchasi va asosiy tamoyillar

Axborot xavfsizligi — bu ma’lumotlarni ruxsatsiz kirish, o‘zgartirish, yo‘q qilish yoki tarqatilishdan himoya qilish jarayonidir. Onlayn auktsion tizimlarida axborot xavfsizligi bir nechta asosiy tamoyilga asoslanadi:

1. Maxfiylik (Confidentiality): Foydalanuvchilarning bid qiymatlari va shaxsiy ma’lumotlari faqat ruxsat etilgan shaxslar uchun ochiq bo‘lishi kerak.

2. Yaxlitlik (Integrity): Bidlar va tranzaksiyalar o‘zgartirilmasdan, asl ko‘rinishda saqlanishi kerak.

3. Mavjudlik (Availability): Auktsion tizimi doimiy ishlashini ta’minlash, DDoS kabi hujumlarga chidamli bo‘lishi zarur.

4. Adolatlilik (Fairness): Barcha ishtirokchilar teng sharoitda raqobatlashishi kerak.

Bu tamoyillar onlayn auktsion tizimlarining ishonchliligini va foydalanuvchilarni himoya qilishni ta’minlaydi.

2.2. Onlayn auktsion tizimlaridagi asosiy tahdidlar

Onlayn auktsionlarda xavfsizlikning yetarli darajada ta’minlanmasligi quyidagi tahdidlarga olib keladi:

Bid soxtalashtirish (Shill Bidding)

Tavsifi: Bid soxtalashtirish — bu sotuvchi yoki unga aloqador shaxslar tomonidan mahsulot narxini sun’iy oshirish uchun qo‘shimcha bidlar kiritishdir.

Xavflari:

- Foydalanuvchilar mahsulotni asl qiymatidan qimmatroqqa sotib oladi.
- Auktsionning adolatliligi buziladi.
- Platformaga bo‘lgan ishonch pasayadi.

Nazariy yechimlar

- Foydalanuvchi va sotuvchi tarixini tekshirish (reputation system).
- Bidlarni algoritmik tahlil qilish (anomaliyalarni aniqlash).
- Commit-Reveal protokoli yordamida bidlarni yashirish.

Bid sniping (So‘nggi soniyalarda bid berish)

Tavsifi: Bid sniping — bu foydalanuvchi auktsion tugashidan bir necha soniya qolganda bid berib, boshqa ishtirokchilarga javob berish imkonini bermaslik strategiyasidir.

Xavflari:

- Boshqa ishtirokchilar raqobat qilolmaydi.
- Auktsion oxirgi daqiqalarda adolatsiz tarzda yakunlanadi.

Nazariy yechimlar:

- Auktsionni avtomatik uzaytirish (time extension) mexanizmi.
- Commit-Reveal yoki sealed-bid protokollarini qo‘llash.

Botlar va avtomatlashtirilgan firibgarlik

Tavsifi: Ba’zi foydalanuvchilar auktsion jarayonini manipulyatsiya qilish uchun botlar ishlatadi. Bu avtomatik ravishda bid berish va raqiblarni chalg‘itish imkonini beradi.

Xavflari:

- Adolatsiz raqobat.
- Auktsion natijalarining manipulyatsiyasi.
- Platforma foydalanuvchilarini yo‘qotish xavfi.

Nazariy yechimlar:

- CAPTCHA va foydalanuvchi autentifikatsiyasini kuchaytirish.
- Botlarni aniqlash algoritmlari va anti-fraud tizimlar.

Collusion (Foydalanuvchilar o‘rtasida kelishuv)

Tavsifi: Bir nechta foydalanuvchilar bid qiymatlari yoki g‘olibni oldindan kelishib belgilashadi.

Xavflari:

- Auktsion natijasi sun’iy ravishda boshqariladi.
- Adolatlilik va shaffoflik buziladi.

Nazariy yechimlar:

- Bidlarni va foydalanuvchilar faoliyatini monitoring qilish.
- Statistik tahlil va anomaliya deteksiyasi.

1.2-rasm. Onlayn auktsionlarda xavfsizlik

Bidlarni himoya qilish usullari

1. Commit-Reveal protokoli:
   - Foydalanuvchi bidini hash shaklida yuboradi.
   - Oxirida bid qiymati ochiladi va tekshiriladi.
   - Natijada bid sniping va bid manipulyatsiyasini kamaytiradi.
2. Sealed-bid protokoli:
   - Barcha bidlar yashirin tarzda yuboriladi.
   - G‘olib aniqlash jarayonida maxfiylik ta’minlanadi.
3. Time extension (oxirgi soniyalarni uzaytirish):
   - Auktsion oxirida bid berilsa, vaqt avtomatik uzaytiriladi.
   - Bid snipingning ta’siri kamayadi.
4. Reputation va anti-fraud tizimlari:
   - Foydalanuvchi tarixini va bid naqshlarini tahlil qilish.
   - Shill bidding va collusion ehtimolini kamaytirish.

Misol bilan tahlil

Masalan, eBay platformasida bid sniping va shill bidding eng keng tarqalgan tahdidlardir. Tadqiqotlar shuni ko‘rsatadiki, commit-reveal yoki sealed-bid protokoli qo‘llanilganda bid manipulyatsiyasi sezilarli darajada kamayadi. Shu bilan birga, AI va statistik tahlil vositalari yordamida shubhali bidlar aniqlanadi va foydalanuvchilar ogohlantiriladi.

1.1-jadval. Onlayn auktsion turlari va ularning xususiyatlari

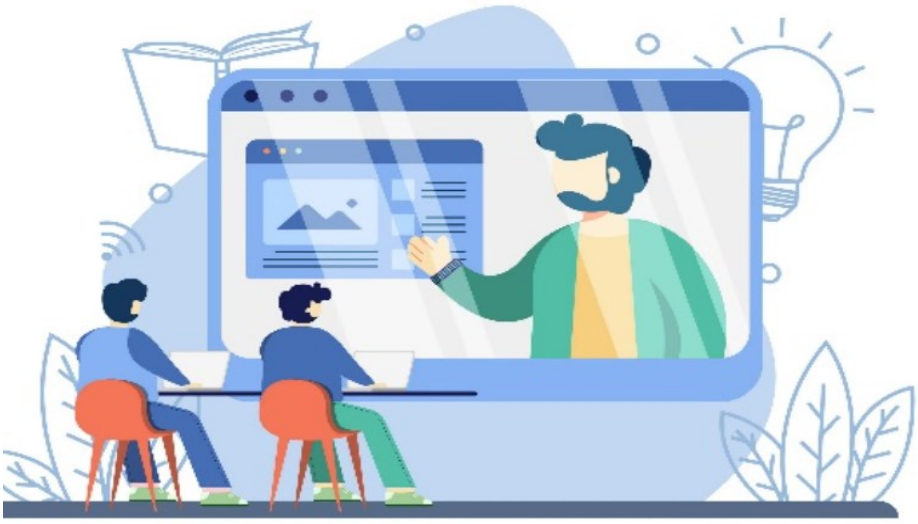
№	Auktsion turi	Ishlash printsipi	Maxfiylik darajasi	Adolatlilik (Fairness)	Tezkorlik	Afzalliklari	Kamchiliklari	Misollar
1	English (Ochiq)	Takliflar ketma-ket oshiriladi, eng yuqori bid g‘olib	Past	Yuqori	O‘rtacha	Shaffof, foydalanuvchilar raqobat qiladi	Bid sniping mumkin, tizim yuklamasi yuqori bo‘lishi mumkin	eBay
2	Sealed-bid (Yopiq)	Barcha bidlar yashirin yuboriladi, oxirida ochiladi	Yuqori	Yuqori	O‘rtacha	Bid manipulyatsiyasi kamayadi, maxfiylik yuqori	Foydalanuvchilar narxni ko‘ra olmaydi, boshqarish murakkab	Davlat xaridlari
3	Vickrey (Ikkinchi narx)	Yopiq bid, g‘olib ikkinchi eng yuqori bid qiymatini to‘laydi	Yuqori	Yuqori	O‘rtacha	Truthful bidding, adolatli	Tizimni tushunish murakkab	Google AdWords reklama
4	Dutch (Golland)	Boshlang‘ich narx yuqori, vaqt o‘tishi bilan pasayadi, birinchi bid beruvchi g‘olib	Past	O‘rtacha	Tez	Tezkor, bozorni tez tozalash	Adolatlilik past bo‘lishi mumkin	Sport va san’at asarlari savdosi
5	Reverse (Aks auktsion)	Xaridor maksimal narxni belgilaydi, sotuvchilar narxni pasaytiradi	O‘rtacha	O‘rtacha	O‘rtacha	Xaridor foydasi yuqori, raqobat kuchli	Sotuvchilar daromadi past bo‘lishi mumkin	Amazon Business, davlat xaridlari

Xulosa. Onlayn auktsion tizimlari nafaqat iqtisodiy samaradorlikni oshiradi, balki foydalanuvchilar va platforma o‘rtasidagi ishonchni mustahkamlashga xizmat qiladi. Biroq, bid soxtalashtirish, bid sniping va boshqa kiber tahdidlar tizim samaradorligini pasaytiradi. Shu sababli, commit-reveal, sealed-bid, time extension va anti-fraud tizimlari kabi nazariy va texnologik yechimlar onlayn auktsion tizimlarida xavfsizlikni ta’minlashda muhim ahamiyat kasb etadi.

1.3. ONLAYN AUKTSION PLATFORMALARINING ISHLASH PRINSIPI

Onlayn auktsion platformalari — bu internet orqali sotuvchi va xaridorlarni bog‘lovchi, real vaqt rejimida savdo jarayonlarini amalga oshirish imkonini

beruvchi axborot tizimlaridir. Ushbu platformalar elektron tijoratning muhim yo‘nalishlaridan biri bo‘lib, ular orqali turli xil mahsulotlar va xizmatlar ochiq savdo asosida eng yuqori narx taklif qilgan ishtirokchiga sotiladi.



1.3-rasm. Onlayn auktsion platformasi.

1. Platformaning umumiy ishlash mexanizmi

Onlayn auktsion platformasi quyidagi asosiy bosqichlar orqali ishlaydi:

1.1. Ro‘yxatdan o‘tish va autentifikatsiya

Foydalanuvchilar (sotuvchi va xaridorlar) platformada ro‘yxatdan o‘tadilar. Bu jarayonda:

- Shaxsiy ma’lumotlar kiritiladi
- Email yoki telefon orqali tasdiqlash amalga oshiriladi
- Ba’zi hollarda KYC (Know Your Customer) tekshiruvlari o‘tkaziladi

1.2. Lot (mahsulot) joylashtirish

Sotuvchi o‘z mahsulotini auktsionga qo‘yadi:

- Mahsulot tavsifi
- Boshlang‘ich narx
- Minimal qadam (bid increment)
- Auktsion davomiyligi (masalan, 24 soat, 7 kun)

1.3. Takliflar (bid) berish jarayoni

Xaridorlar mahsulot uchun o‘z narxlarini taklif qilishadi:

- Har bir yangi bid oldingisidan yuqori bo‘lishi kerak
- Platforma real vaqt rejimida eng yuqori taklifni ko‘rsatadi
- Ba’zi tizimlarda avtomatik bidding (proxy bidding) mavjud

1.4. Auktsion yakuni

Belgilangan vaqt tugaganda:

- Eng yuqori taklif bergan foydalanuvchi g‘olib bo‘ladi
- Natijalar avtomatik tarzda e’lon qilinadi

1.5. To‘lov va yetkazib berish

– G‘olib foydalanuvchi to‘lovni amalga oshiradi
– Sotuvchi mahsulotni yetkazib beradi
– Ba’zi platformalarda escrow tizimi orqali xavfsizlik ta’minlanadi

2. Texnik arxitektura va tizim komponentlari

Onlayn auktsion platformalari murakkab dasturiy va texnik infratuzilmaga ega.

1.2-jadval. Onlayn auktsion asosiy komponentlar

Komponent	Vazifasi
Frontend (UI/UX)	Foydalanuvchi interfeysini ta’minlaydi
Backend server	Biznes mantiqni boshqaradi
Ma’lumotlar bazasi	Foydalanuvchi va auktsion ma’lumotlarini saqlaydi
Real-time modul	Bidlarni real vaqt rejimida yangilaydi
To‘lov tizimi	Onlayn tranzaksiyalarni amalga oshiradi
Xavfsizlik moduli	Firibgarlik va hujumlardan himoya qiladi

3. Auktsion algoritmlari va ishlash logikasi

Onlayn auktsionlar maxsus algoritmlar asosida ishlaydi:

3.1. Ingliz auktsioni (English auction)

– Eng keng tarqalgan tur
– Narx bosqichma-bosqich oshib boradi
– Eng yuqori narx g‘olib bo‘ladi

3.2. Golland auktsioni (Dutch auction)

– Narx yuqoridan boshlanadi va pasayadi
– Birinchi qabul qilgan xaridor g‘olib

3.3. Yopiq taklifli auktsion

– Ishtirokchilar bir-birining bidlarini ko‘rmaydi
– Eng yuqori yashirin taklif g‘olib bo‘ladi

4. Real vaqt rejimida ishlash xususiyatlari

Onlayn auktsion tizimlarida real vaqt (real-time) muhim ahamiyatga ega:

– WebSocket yoki polling orqali ma’lumotlar yangilanadi
– Har bir bid darhol serverga yuboriladi
– Kechikish (latency) minimal bo‘lishi kerak

5. Xavfsizlik va ishonchlilik

Platformaning ishlashida xavfsizlik muhim o‘rin tutadi:

– SSL/TLS orqali ma’lumotlarni shifrlash
– Foydalanuvchi autentifikatsiyasi (2FA)
– Firibgarlikka qarshi algoritmlar (anti-fraud systems)
– Bid sniping va bid spoofingni aniqlash mexanizmlari

6. Afzalliklari va kamchiliklari

Afzalliklari:

– Global auditoriyaga chiqish imkoniyati

– Narxni bozor belgilaydi
– Shaffof savdo jarayoni

Kamchiliklari:

– Internetga bog‘liqlik
– Firibgarlik xavfi
– Texnik nosozliklar ehtimoli

7. Zamonaviy rivojlanish tendensiyalari

Bugungi kunda onlayn auktsion platformalari quyidagi yo‘nalishlarda rivojlanmoqda:

– Sun’iy intellekt asosida narx bashorati
– Blockchain orqali shaffoflikni oshirish
– Mobil ilovalar orqali qulaylik
– Avtomatik bidding tizimlari

Xulosa

Ushbu maqolada onlayn auktsion tizimlari har tomonlama o‘rganildi. Tadqiqot natijalaridan kelib chiqqan holda quyidagi xulosalarga kelish mumkin:

Birinchidan, onlayn auktsion tizimlari zamonaviy raqamli iqtisodiyotning ajralmas tarkibiy qismi bo‘lib, ular savdo jarayonlarini avtomatlashtirish, global miqyosda kengaytirish va narx shakllanishini optimallashtirish imkonini beradi. Ular an’anaviy auktsionlardan farqli ravishda geografik va vaqt cheklovlarini bartaraf etadi.

Ikkinchidan, onlayn auktsion tizimlarida xavfsizlik masalasi muhim ahamiyat kasb etadi. Bid soxtalashtirish (shill bidding), bid sniping, botlar orqali avtomatlashtirilgan firibgarlik va foydalanuvchilar o‘rtasidagi kelishuv (collusion) kabi tahdidlar tizim samaradorligini sezilarli darajada pasaytiradi va foydalanuvchilar ishonchini yo‘qotishga olib keladi.

Uchinchidan, ushbu xavfsizlik muammolarini hal qilish uchun commit-reveal protokoli, sealed-bid mexanizmi, vaqtni avtomatik uzaytirish (time extension) va anti-fraud tizimlari kabi zamonaviy texnologik yechimlar samarali vositalar hisoblanadi. Blockchain va sun’iy intellekt texnologiyalarining qo‘llanilishi esa tizim shaffofligini va ishonchliligini yanada oshiradi.

To‘rtinchidan, onlayn auktsion platformalarining texnik arxitekturasi murakkab tuzilmaga ega bo‘lib, frontend, backend, ma’lumotlar bazasi, real-time modul, to‘lov tizimi va xavfsizlik modullaridan iborat. WebSocket texnologiyasi orqali real vaqt rejimida ishlash auktsionlarning samaradorligini ta’minlashda muhim rol o‘ynaydi.

Umuman olganda, onlayn auktsion tizimlari kelajakda sun’iy intellekt, blockchain va mobil texnologiyalar bilan integratsiyalashgan holda yanada rivojlanishi kutilmoqda. Biroq, ularning samarali ishlashi uchun xavfsizlikni ta’minlash, adolatli muhit yaratish va foydalanuvchilar ishonchini mustahkamlash eng ustuvor vazifalar bo‘lib qoladi.

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DIDAKTIK NASR POETIKASI: XOJANING “MIFTOHU-L-ADL” ASARI ASOSIDA ADABIY-TAHLILIY TADQIQOT

Annotatsiya: *Mazkur maqolada mumtoz sharq adabiyotida muhim o‘rin tutgan didaktik nasr poetikasi Xojaning “Miftohu-l-adl” asari misolida adabiy-tahliliy jihatdan tadqiq etiladi. Tadqiqotda didaktik nasr poetikasining nazariy asoslari, badiiy shakl va axloqiy mazmun o‘rtasidagi munosabat, poetik vositalarning tarbiyaviy funksiyasi tahlil qilinadi. Asarda adolat g‘oyasining poetik ifodasi, rivoyat va hikoyatlarning badiiy vazifasi hamda til va uslubning didaktik ta’sirchanlikni ta’minlashdagi roli ochib beriladi. Maqolada “Miftohu-l-adl” mumtoz didaktik nasr poetikasining yetuk va o‘ziga xos namunasi ekanligi ilmiy asosda yoritiladi.*

Kalit so‘zlar: *didaktik nasr, poetika, Xoja, Miftohu-l-adl, adolat g‘oyasi, mumtoz adabiyot, axloqiy tarbiya.*

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POETICS OF DIDACTIC PROSE: LITERARY-ANALYTICAL RESEARCH BASED ON KHOJA'S WORK "MIFTOHU-L-ADL"

Abstract: *This article studies the poetics of didactic prose, which played an important role in classical oriental literature, from a literary and analytical perspective using the example of Khoja's "Miftohu-l-adl". The study analyzes the theoretical foundations of didactic prose poetics, the relationship between artistic form and moral content, and the educational function of poetic means. The work reveals the poetic expression of the idea of justice, the artistic function of narratives and stories, and the role of language and style in ensuring didactic effectiveness. The article scientifically highlights the fact that "Miftohu-l-adl" is a mature and unique example of classical didactic prose poetics.*

Keywords: *didactic prose, poetics, Khoja, Miftohu-l-adl, the idea of justice, classical literature, moral education.*

Mumtoz sharq adabiyotida didaktik nasr janri axloqiy, ijtimoiy va ma’naviy qadriyatlarni badiiy shaklda yetkazishning muhim vositasi sifatida shakllangan [10]. Bu turdagi asarlarda asosiy maqsad o‘quvchini axloqiy jihatdan tarbiyalash bo‘lsa-da, mazkur vazifa oddiy pand-nasihat bilan emas, balki puxta poetik tizim orqali amalga oshiriladi [3]. Shu bois didaktik nasrni faqat g‘oyaviy matn sifatida emas, balki estetik va poetik hodisa sifatida o‘rganish zarur [4]. O‘zbek mumtoz

adabiyotida didaktik nasrning muhim namunalaridan biri Xojaning “Miftohu-l-adl” asaridir [9]. Asar markazida adolat g‘oyasi turib, u turli hikoyat va rivoyatlar orqali badiiy ifodalanadi [12]. “Miftohu-l-adl” nafaqat axloqiy-nasihatnoma, balki didaktik nasr poetikasining o‘ziga xos namunasi bo‘lib, unda shakl va mazmun uyg‘unligi yaqqol namoyon bo‘ladi [7]. Mazkur maqolaning maqsadi — didaktik nasr poetikasining asosiy xususiyatlarini aniqlash hamda ularning “Miftohu-l-adl” asarida qanday badiiy vositalar orqali amalga oshirilganini adabiy-tahliliy asosda ochib berishdan iborat [13].

Xojaning “Miftohu-l-adl” asari 1508-1510-yillar orasida yozilgan va Shayboniyxonning o‘g‘li Temur Sultonga bag‘ishlangan [9]. U turli ijtimoiy-axloqiy mavzularga bag‘ishlangan 15 bobli kitobdir. Yozuvchi har bir bob mavzusiga oid fikr-mulohazalarini nazariy jihatdan bayon qilib, so‘ngra fikrlarini tasdiqlash uchun turli masallar va hikoyatlar keltirib o‘tadi [5]. Asarning asosiy qismini xalq orzu qilgan insofli, adolatli, odil shoh tasvirlangan bir qator hikoyatlar tashkil etadi. Asar sodda xalqona tilda yozilgan bo‘lib, unda tushunilmaydigan so‘zlar deyarli uchramaydi, shuningdek, bayon qilish usulida ixchamlik va aniqlik bor [2]. Asarda yozma va og‘zaki adabiyotda mashhur bo‘lib ketgan Iskandar, No‘shiravon, Mahmud G‘aznaviy, Bahramshoh, Anushervon, Nuh va boshqalar nomi bilan bog‘liq hikoyalar asosiy o‘rin egallaydi. To‘plamdagi hikoyatlarning har biri biron axloqiy, siyosiy yoki diniy maslahat berishni maqsad qiladi [6]. Masalan, “No‘shiravon, kampir va ozarbayjon hokimi” haqidagi hikoyatda haqiqiy xalqparvar, toj-u taxtga loyiq, adolatli hukmdor qanday bo‘lishi lozimligi ochib berilgan. Unda aytilishicha, No‘shiravon o‘zining beklaridan birini Ozarbayjonga hokim qilib tayinlaydi. U hokim ma'lum vaqtgacha oqilona siyosat olib boradi, so‘ngra xalqning mol-u mulkini zulm bilan tortib ola boshlaydi. Hatto, yolg‘iz, kambag‘al kampirning birdan-bir kun kechirish manbai bo‘lgan bir parcha yerini ham tortib oladi. Kampir bekning ustidan arz qilib No‘shiravon oldiga boradi. No‘shiravon kampirni tinglagach, uni vaqtincha uy-joy va yegulik bilan ta'minlab, beklaridan birini Ozarbayjon hokimining qilayotgan ishlarini surishtirishga yuboradi. Tekshirishlar natijasida hokimning avval hech qancha mulki bo‘lmaganligi, lekin hokimlikdan so‘ngra xalqdan jabr-zulm otkazib tortib olgani evaziga katta boylik to‘plagani aniqlanadi. Xalqning mol-mulki o‘z egalariga qaytarilib, hokim aybiga yarasha jazolanadi. Shundan so‘ng, No‘shiravon xalq arz-u dodini shohga bemalol yetkazib turishi uchun taxtidan tashqariga uzun zanjir bog‘latadi va kimning arzi bo‘lsa, shu zanjirni tortishi kerak bo‘ladi. Kunlardan bir kun zanjir tebranadi, chiqib qarasalar bir qari eshak bo‘ladi. No‘shiravon buyrug‘i bilan aniqlanishicha, eshakning egasi uni yoshligida ko‘p ishlatgan, qarigach esa haydab yuborgan edi. Shoh eshak egasini chaqirtirib, uni axtaxona va yem bilan ta’minlashni buyuradi. Hikoyat orqali yozuvchi shohni va amaldorlarini adolatli bo‘lishga, oddiy xalqning arz-u holini tinglab, to‘g‘ri hukm chiqarishga undaydi [9]. Xojaning shaxsiy hayot yo‘liga nazar solsak, u umrini sultonlar, bek-u amaldorlar huzurida turli mansablarda faoliyat olib borib o‘tkazganini ko‘ramiz. Shuning uchun ham xalqning ahvolidan yaxshi xabador bo‘lgan. Qaysiki xalqning ahvolini

o‘ylaydigan shoir shohning oldida yaqin kishisi bo‘lsa, unga yaxshi so‘z bilan ta’sir o‘tkazishga harakat qilgan.

Poshshoxo‘ja “Miftohu-l-adl” asarini Navoiy, Jomiy, Husayn Voiz Koshifiy, Sa’diy Sheroziy kabi ulug‘ ijodkorlarning asarlaridan ta’sirlanib yozganini aytadi [8, 11]. Masalan, so‘z mulkining sultoni Alisher Navoiyning barcha asarlarida shoh-u amaldorlar, bek-u sultonlar davlat va jamiyat uchun foydali, xalqning farovon yashashi uchun zarur fazilatlarga ega bo‘lishi kerakligi uqtiriladi [1]. Adolat Navoiy ijodining asosiy mezoni hisoblanadi. Navoiy bir qancha g‘azallarida, “Xamsa“ning barcha dostonlari va “Mahbub ul-qulub”da odil, diyonatli hukmdorlar qanday bo‘lishi kerakligi haqida aytib, zolim, zo‘ravon shohlarni ayovsiz tanqid qiladi. ”Hayrat ul-abror“ dostonining 3-maqolati “Salotin”, ya’ni sultonlar bobi deb nomlanib, unda adolat tushunchasiga keng to‘xtalib o‘tadi.

Shohki ish adl ila bunyod etar,
Adl buzuq mulkni obod etar [1: 244].

Shoir agar har bir hukmdor adolat bilan ish yurgazsa, xalqqa zulm qilmasdan odil bo‘lsa, bundan xalqning ko‘ngli ravshanlashib, adolat vayrona yurtni ham obod qilib yuborishi haqida aytadi. Yurtning adolatli rahbari to‘g‘ri so‘z, saxovatli, insofli bo‘lsa, mamlakat obod, xalq osoyishta, baxtli yashashi haqida gapirib, bunga misol sifatida “Shoh G‘oziy” hikoyatini keltiradi. Hikoyatdan ma’lum bo‘lishicha, Shoh G‘oziyning yurishlaridan birida shu mamlakatda yashayotgan bir kampirning yakka-yu yagona o‘g‘li shahid bo‘ladi. Taxt egallanganda, shoh shahid bo‘lgan yigit va uning onasini unutadi. Kampir o‘g‘lini yo‘qotgach, ancha qiynalib qodadi. Kunlardan bir kun shu kampir “sen mening o‘g‘limni jangda o‘ldirib yubording, senda qon haqqim bor”, deb shoh G‘oziy oldiga arz qilib kelasi. Shoh shariat bo‘yicha hukm qilinishini so‘raydi va ikkisi qozi oldiga boradilar. Qozi “kampir qonga qon olmoqchi bo‘lsa, podshoh o‘ldirilishi yoki shoh uni rozi qilishi kerak”, deb hukm chiqaradi. Shoh bo‘yniga sirtmoq solib, kampirning qo‘liga qilich beradi, bir yoniga esa xamyon to‘la oltin qo‘yadi. Shoh qasos olaman desang, istasang jonim bilan, istasang pul bilan ol deydi. “O‘g‘lingni o‘limga buyurganimda ixtiyor ozimda emas edi. Lekin sen nima qilsang ixtiyor o‘zingda”, deydi. Shundan so‘ng, kampir shohning odilligini ko‘rib xursand bo‘ladi va uning jonidan kechib, oltinlarni oladi. Ushbu hikoyatdan maqsad Navoiy Husayn Boyqaroni va boshqa shohlarni adolatlilikda, marhamat va saxovatpeshalikda xuddi shunday bo‘lishlarini orzu qilgan. Biz yuqorida ko‘rgan Xojaning hikoyasidagi podshoh ham xuddi Navoiyning shoh G‘oziysi singari oddiy xalq arz-u dodiga quloq tutadi va birdan hukm chiqarishga shoshilmaydi, balki vaziyatni to‘laligicha o‘rganib, keyin to‘g‘ri qaror qabul qiladi. Demak, har ikkala ijodkor ham xalq dardini eshitadigan, odil siyosat olib boradigan hukmdorlarni orzu qilishgan.

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MUMTOZ NASR POETIKASI VA UNING XOJA IJODIDAGI IFODASI (“MIFTOHU-L-ADL” VA “GULZOR” ASARLARI MISOLIDA)

Annotatsiya: *Mazkur maqolada mumtoz sharq nasrining poetik xususiyatlari hamda ularning Xoja ijodida, xususan “Miftohu-l-adl” va “Gulzor” asarlarida namoyon bo‘lishi adabiy-tahliliy jihatdan o‘rganiladi. Tadqiqotda mumtoz nasr poetikasining asosiy unsurlari - janr, kompozitsiya, obrazlar tizimi, til va uslub masalalari yoritilib, Xoja asarlarida bu poetik elementlarning didaktik-axloqiy g‘oya bilan uzviy bog‘liqligi ochib beriladi. Maqolada Xoja ijodi mumtoz nasr poetikasining o‘ziga xos va yetuk namunasi sifatida ilmiy asosda baholanadi.*

Kalit so‘zlar: *mumtoz nasr, poetika, Xoja, Miftohu-l-adl, Gulzor, didaktik adabiyot, badiiy til, axloqiy g‘oya.*

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THE POETICS OF CLASSICAL PROSE AND ITS EXPRESSION IN KHOJA'S WORK (IN THE EXAMPLE OF THE WORKS "MIFTOHU-L-ADL" AND "GULZAR")

Abstract: *This article studies the poetic features of classical oriental prose and their manifestation in Khoja's work, in particular in the works "Miftohu-l-adl" and "Gulzor" from a literary and analytical perspective. The study highlights the main elements of classical prose poetics - genre, composition, system of images, language and style, and reveals the inextricable connection of these poetic elements with the didactic-moral idea in Khoja's works. The article evaluates Khoja's work on a scientific basis as a unique and mature example of classical prose poetics.*

Keywords*: classical prose, poetics, Khoja, Miftohu-l-adl, Gulzor, didactic literature, artistic language, moral idea.*

Sharq mumtoz adabiyoti taraqqiyotida nasriy asarlar alohida o‘rin tutadi [10]. Mumtoz nasr nafaqat voqealarni bayon qilish vositasi, balki muayyan estetik, axloqiy va didaktik g‘oyalarni badiiy shaklda ifodalashning muhim adabiy shakli sifatida shakllangan. Ayniqsa, XIV–XVI asrlarda yaratilgan didaktik-nasriy asarlar Sharq adabiy tafakkurining yuksak bosqichini namoyon etadi. Ana shu jarayonda Xoja (Poshshoxo‘ja ibn Abdulvahhobxo‘ja) ijodi mumtoz nasr poetikasining yetuk va o‘ziga xos namunasi sifatida e’tiborga loyiqdir. Xojaning “Miftohu-l-adl” va “Gulzor” asarlari Sharq nasriy an’analarini davom ettirgan holda, muallifning axloqiy-falsafiy qarashlari, ijtimoiy adolat haqidagi mulohazalari va badiiy

tafakkurini mujassam etgan muhim manbalardir. Mazkur maqolada mumtoz nasr poetikasining asosiy xususiyatlari hamda ularning Xoja ijodida qay darajada va qanday shaklda ifoda topgani ilmiy-tahliliy jihatdan yoritiladi [3]. Mumtoz sharq adabiyotida nasr janri poetik imkoniyatlari jihatidan alohida ilmiy ahamiyatga ega bo‘lib, u badiiy tafakkur, axloqiy g‘oya va falsafiy qarashlarning mujassam ifodasi sifatida shakllangan. Mumtoz nasr faqat voqeabandlik yoki axborot berish vositasi emas, balki ma’no, ramz va estetik ta’sirni uyg‘unlashtirgan murakkab poetik tizimdir [4].

O‘zbek mumtoz adabiyoti tarixida didaktik nasr namunalarining muhim o‘rin tutishi bejiz emas. Ushbu asarlarda axloqiy, ijtimoiy va ma’naviy masalalar badiiy-poetik vositalar orqali ifodalanadi. Shu nuqtayi nazardan Xoja ijodi, xususan “Miftohu-l-adl” va “Gulzor” asarlari mumtoz nasr poetikasining yetuk namunalaridan biri sifatida alohida e’tiborga loyiqdir. Mumtoz Sharq nasri o‘ziga xos poetik qonuniyatlarga ega bo‘lib [2], u quyidagi asosiy unsurlar orqali namoyon bo‘ladi: Mumtoz nasrda pandnoma, axloqiy risola, hikoyat, masnaviy-nasriy qorishma janrlar keng tarqalgan [7]. Bu asarlarda qat’iy syujetdan ko‘ra, mantiqiy-kompozitsion izchillik ustuvor bo‘ladi. Hikoyatlar zanjiri, masal va rivoyatlar orqali asosiy g‘oya ochib beriladi.

Mumtoz nasr obrazlari ko‘pincha tipik va ramziy xarakterga ega. Podshoh, vazir, donishmand, darvesh, zolim va adolatparvar obrazlari orqali ijtimoiy va axloqiy g‘oyalar talqin etiladi [5]. Obrazlar individual psixologik tahlildan ko‘ra, ma’naviy-axloqiy fazilatlarni ifodalashga xizmat qiladi. Mumtoz nasr tili badiiy-bezakli, tasviriy vositalarga boy bo‘lib, Qur’on oyatlari, hadislar, hikmatli so‘zlar, maqollar va she’riy parchalar bilan uyg‘unlashadi. Saj’, istiora, tashbeh kabi badiiy san’atlar nasr poetikasining muhim belgilaridan hisoblanadi [13].

“Gulzor” asari ham didaktik ruhda yozilgan bo‘lib, unda axloqiy-falsafiy masalalar markaziy o‘rin egallaydi [8]. Asar nomining ramziy ma’nosi ham mumtoz poetik tafakkur bilan uzviy bog‘liqdir. Gulzor - inson ma’naviyati, axloqiy kamoloti va ruhiy poklanishining ramzi sifatida talqin qilinadi [11]. Asarda qisqa hikoyatlar, pand-nasihatlar va badiiy lavhalar orqali axloqiy g‘oyalar ochib beriladi [12]. Tilining ravonligi, badiiy tasvir vositalarining mo‘’tadil qo‘llanilishi asarning o‘quvchi uchun tushunarli va ta’sirchan bo‘lishini ta’minlaydi. “Gulzor”da ham obrazlar umumlashgan bo‘lib, ular muayyan axloqiy sifatlarning tashuvchisi sifatida namoyon bo‘ladi. Bu jihat asarni mumtoz nasr poetikasining an’anaviy, ammo badiiy jihatdan pishiq namunasi sifatida baholash imkonini beradi.

Bundan tashqari, Xojaning «Ikki asari «Miftohul adl» va «Gulzor»da bayon etilgan «Mahmud va Ayoz» hikoyatlarining talqini haqida so‘zlasak. «Miftohul adl» asarida ushbu qahramon «shoshqaloq», surab-surishtirmay ish ko‘ruvchi qilib tasvirlangan [9]. Ya’ni, hikoyatdagi shoh Mahmud obrazi «yetti o‘lchab bir kes» maqoliga zid ravishda, aldamchi vazirining yolg‘on nag‘masiga ishongan holda ish ko‘rgan bo‘lib namoyon bo‘ladi. Ushbu rivoyatda sulton Mahmud G‘aznaviy – oshiqshoh timsolida kelganligi faqat bir jumlada o‘z ifodasini topadi: «Sulton Mahmud G‘aznaviy Ayozni xoslaridin ziyodroq yaxshi ko‘rar edi». Lekin shu

ta’rifning o‘ziyoq an’anaviy uslubning oshiq-ma’shuq xarakterini ochib bersa-da, hikoyat tasavvufiy ilohiy ishq ruhida sug‘orilgan bo‘lsa-da [1, 6], undagi voqeotlarda ko‘proq real hayot - saroydagi jirkanch munosabatlar tasviri aks etadi. Muallif o‘z dunyosidagi ziddiyatlarni shohlar va xoslar o‘rtasidagi o‘zaro muomala rishtalarining to‘siqlarga uchrashiga saroy a’zolari sababchi bo‘lib qolishini ijod olamiga kiritib, hikoyatini shu saviyada yaratgan. Hikoyatning markaziy planida «ilohiy ishq» maqomi tursa-da, Xojaning maqsad yo‘nalishi – shoh va sultonlarning mudroq qalbini, basir ko‘zini ochishga, adolatli hukmlarni chiqarishga chorlaydi. Ayni paytda ushbu hikoyatda vazir obrazi borki, u bo‘htoni bilan o‘z boshiga o‘zi yetadi. Muallif bu bilan «har kim ekkanini o‘radi» maqolini isbotlaydi. Xoja hikoyatlarining barchasi o‘zining poyonida yaxshilik yechimini oladi. Ayoz obrazi ma’shuq timsoli, oqil va dono tarzda ish ko‘ruvchi, shunga muvofiq harakat qiluvchi bo‘lib keladi. Bu obraz o‘zining dono fikrlari bilan shohni qoyil qoldiradi, xuddi sha’mga parvona talpinganidek. Lekin, Xoja asarining boshqa o‘rindagi hikoyatida sulton Mahmud nihoyatda zolim tarzda gavdalanadi va vaziri «bisyor oqil» ekanligi bayon etiladi. Lekin bunda Ayoz obrazi yo‘q. Ayni paytda shohning ichki ruhiyatidan ko‘ra, ma’naviy ishq, botiniy intilishlardan ko‘ra ko‘proq, shu dunyomizdagi shohlarga xos xarakter – zolimlik aks etadi. Aytish mumkinki, Xoja «Miftohul adl»da shoh Mahmud obrazini foniy olam vakiliga aylantirgan va unga ko‘proq manmanlik xususiyatini bergan hamda Ayoz obrazini zukko, itoatkor xos qilib tasvirlagan. Muallifning bu bilan ko‘proq dunyo ahli sultonlarini odillikka chorlaganligi sezilib turadi.

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SHO‘RLANISH TA’SIRIDA TUPROQNING MEXANIK XUSUSIYATLARI VA STRUKTURA BARQARORLIGINING O‘ZGARISHI: ADABIYOTLAR TAHLILI

Annotatsiya: *Ushbu maqolada sho‘rlanishning tuproqning mexanik va fizik xususiyatlariga ta’siri hamda struktura barqarorligining o‘zgarishi bo‘yicha zamonaviy ilmiy tadqiqotlar tahlil qilindi. Adabiyotlar tahlili asosida sho‘rlanish natijasida tuproq agregatlarining yemirilishi, g‘ovaklikning kamayishi, zichlikning ortishi va suv-havo rejimining buzilishi aniqlangan. Natijada o‘simliklarning ildiz rivojlanishi cheklanib, hosildorlik pasayishi kuzatiladi. Shuningdek, tomchilatib sug‘orish, chuqur yumshatish, guruch almashlab ekish va nano-SiO_2 asosidagi meliorativ usullar sho‘rlangan tuproqlarning ekologik holatini yaxshilashda samarali ekanligi qayd etilgan.*

Kalit so‘zlar: *sho‘rlanish, tuproq strukturasi, g‘ovaklik, zichlik, suv o‘tkazuvchanligi, melioratsiya, tuproq degradatsiyasi.*

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CHANGES IN SOIL MECHANICAL PROPERTIES AND STRUCTURAL STABILITY UNDER THE INFLUENCE OF SALINATION: LITERATURE ANALYSIS

Annotation: *This article analyzes modern scientific research on the impact of salinity on the mechanical and physical properties of soil and changes in structural stability. Based on the analysis of the literature, it was determined that salinity leads to the destruction of soil aggregates, a decrease in porosity, an increase in density, and a violation of the water-air regime. As a result, the root development of plants is limited and productivity is reduced. It is also noted that drip irrigation, deep loosening, rice crop rotation, and melioration methods based on nano-SiO_2 are effective in improving the ecological condition of saline soils.*

Keywords: *salinity, soil structure, porosity, density, water permeability, land reclamation, soil degradation.*

Kirish. Tuproq sho‘rlanishi qurg‘oqchil va yarim qurg‘oqchil hududlarda tuproq unumdorligining pasayishiga olib kelayotgan dolzarb ekologik muammolardan biridir. Dunyo miqyosida sho‘rlangan yerlar maydoni noto‘g‘ri

sug‘orish, sizot suvlari sathining ko‘tarilishi, iqlim o‘zgarishi va bug‘lanishning kuchayishi natijasida ortib bormoqda. Sho‘rlanish tuproqning fizik-kimyoviy va mexanik xususiyatlarini yomonlashtiradi. Tuzlarning to‘planishi agregatlar barqarorligini pasaytirib, g‘ovaklikni kamaytiradi va zichlikni oshiradi. Natijada tuproqning suv-havo rejimi buzilib, o‘simliklarning suv va oziqa moddalarini o‘zlashtirishi hamda hosildorligi kamayadi. Shu bois sho‘rlanishning tuproq mexanik xususiyatlari va struktura barqarorligiga ta’sirini ilmiy asosda baholash hamda muntazam monitoring olib borish muhim ilmiy-amaliy ahamiyatga ega.

Jazoir hududida olib borilgan tadqiqotlar sho‘rlanish darajasi ortishi bilan tuproq agregatlarining barqarorligi buzilib, mayda zarrachalarga parchalanishini ko‘rsatgan. Natijada kapillyar bo‘shliqlar qisman berkiladi, g‘ovaklik kamayadi, zichlik ortadi va suv o‘tkazuvchanligi pasayadi [1]. Sho‘rlangan yerlarni noto‘g‘ri sug‘orish ushbu jarayonni yanada kuchaytirib, tuproqning qattiqlashishiga, suv-havo rejimining yomonlashishiga va ekinlar hosildorligining pasayishiga olib keladi [2]. Sho‘rlanish ta’sirida tuzlarning tuproq profilida notekis taqsimlanishi degradatsiya jarayonlarini kuchaytirib, o‘simlik ildizlarining suvni o‘zlashtirishiga salbiy ta’sir ko‘rsatadi [3]. Sho‘rlanishning tuproq xususiyatlariga ta’siri uning darajasi va ion tarkibiga bog‘liq. Past darajadagi sho‘rlanish ayrim hollarda tuproqning chuqur qatlamlarini bo‘shashtirishi mumkin bo‘lsa, yuqori darajadagi sho‘rlanish yuza qatlamlarning zichlashishi va qattiqlashishiga sabab bo‘ladi [4]. Xitoyda o‘tkazilgan laboratoriya tadqiqotlari sho‘rlanish turi va ion tarkibi tuproqning suv o‘tkazuvchanligiga sezilarli ta’sir ko‘rsatishini aniqlagan. Xususan, Ca^{2+} ionlari tuproq strukturasini barqarorlashtirib, suv o‘tkazuvchanligini yaxshilasa, Na^{+} ionlari loyli tuproqlarda strukturaning buzilishiga moyillikni kuchaytiradi [5]. Sho‘rlangan tuproqlarni tiklash bo‘yicha tadqiqotlar tomchilatib sug‘orish va o‘g‘itlashning yuqori samaradorligini ko‘rsatgan. Ushbu usul sho‘rlanish va pH darajasini kamaytirib, tuproq zichligini pasaytiradi, g‘ovaklikni oshiradi hamda suvni ushlab turish va o‘tkazish xususiyatlarini yaxshilaydi [3,6]. Shuningdek, o‘rtacha chuqurlikdagi agrotexnik ishlov tuproq zichligini kamaytirib, tuzlarning quyi qatlamlarga yuvilishini tezlashtiradi va hosildorlikni oshiradi [7]. Uzoq muddatli guruch almashlab ekish sho‘rlanish, elektr o‘tkazuvchanlik va pH ko‘rsatkichlarini kamaytirib, tuproqdagi organik moddalar hamda oziqa elementlari miqdorini oshiradi [8]. Bundan tashqari, nano-SiO_2 qo‘llanilishi tuproq agregatlarining mustahkamligini oshirib, pH va sho‘rlanish darajasini pasaytirishi hamda zarrachalar yemirilishini cheklashi aniqlangan [9]. Shimoli-g‘arbiy Xitoyning qurg‘oqchil hududlarida olib borilgan uzoq muddatli tajribalar mulchalangan tomchilatib sug‘orish tuproqning mexanik tarkibi va strukturasini yaxshilash, sho‘rlanishni kamaytirish hamda paxta hosildorligini oshirishda samarali ekanligini ko‘rsatgan [10]. Umuman olganda, tahlil qilingan adabiyotlar sho‘rlanish tuproqning mexanik va fizik xususiyatlarini yomonlashtirishini, biroq zamonaviy meliorativ va agrotexnik usullar orqali uning salbiy oqibatlarini sezilarli darajada kamaytirish mumkinligini tasdiqlaydi.

Muhokama va natija: Adabiyotlar tahlili sho‘rlanish tuproqning mexanik va fizik xususiyatlarini yomonlashtirishini ko‘rsatdi. Sho‘rlanish ortishi bilan agregatlar barqarorligi pasayadi, g‘ovaklik kamayadi va zichlik ortadi. Natijada tuproqning suv-havo rejimi buzilib, suv infiltratsiyasi hamda namlikni ushlab turish qobiliyati pasayadi. Ayniqsa, natriy ionlarining ko‘payishi tuproq strukturasining yemirilishini kuchaytiradi. Bu ta’sir loyli va og‘ir mexanik tarkibli tuproqlarda kuchliroq namoyon bo‘ladi. Tahlillar tomchilatib sug‘orish, chuqur yumshatish, guruch almashlab ekish va nano-SiO_2 asosidagi meliorativ usullar sho‘rlangan tuproqlar holatini yaxshilashda samarali ekanligini ko‘rsatdi. Shu bilan birga, agrotexnik tadbirlarni sho‘rlanish darajasiga moslashtirish va muntazam monitoring olib borish muhim ahamiyatga ega.

Xulosa: Tuproq sho‘rlanishi agregatlar barqarorligini pasaytirib, g‘ovaklikni kamaytiradi va zichlikni oshiradi, natijada tuproqning suv-havo rejimi hamda unumdorligi yomonlashadi. Sho‘rlanishning salbiy ta’sirini kamaytirishda tomchilatib sug‘orish, chuqur yumshatish, guruch almashlab ekish va nano-SiO_2 asosidagi meliorativ usullar samarali hisoblanadi. Shu bois sho‘rlangan tuproqlarda kompleks agroekologik yondashuv va muntazam monitoringni qo‘llash zarur.

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GEOECOLOGICAL PROBLEMS IN KOKDALA DISTRICT

Abstract: *Kokdala district is located in the Kashkadarya region, and its main economic activity is agriculture, especially cotton cultivation. Geoecological problems in the district include, in particular, problems such as reduced soil fertility, inefficient irrigation systems, climate change, and depletion of water resources. This article analyzes the geoecological situation in Kokdala district, considers the main problems and the factors that caused them. The necessary measures to eliminate the problems, the importance of environmental education, and recommendations aimed at ensuring environmental sustainability are given. The article proposes a comprehensive and systematic approach to reducing environmental crises in the district.*

Keywords: *Kokdala district, geoecological problems, irrigation system, agriculture, land fertility, climate change, salinity, ecological balance, resource management, environmental education.*

Introduction: Kokdala district is located in the Kashkadarya region, and agricultural activities predominate in this area. Cotton, grain, vegetables, and fruit crops are grown in the district, but these activities have negative environmental impacts. Although Kokdala district is known for its natural resources and land use, serious environmental problems need to be addressed to ensure long-term environmental sustainability. This article analyzes the geoecological problems of Kokdala district, focuses on their causes, and provides recommendations for addressing these problems.

Main part: Kokdala district, located in Kashkadarya region, is the basis of its economic activity. There are irrigated lands in the district, which are used to grow many crops, but improper management of land resources, especially the outdated and inefficient use of irrigation systems, exacerbates geo-ecological problems in the region. A large part of the crop in the district is cotton, which reduces land fertility and pollutes the environment.

The irrigation system in Kokdala district is unevenly and inefficiently used. The irrigation system in the district, like in other regions of Uzbekistan, is mainly associated with intensive irrigation methods in agriculture. This method leads to excessive consumption of water resources, resulting in water shortages. Irrigation, which is carried out using large irrigation canals and wells, is not always effective, which leads to salinization of the land.

The outdated irrigation system and mismanagement of resources, along with reducing land fertility, are leading to a decline in water resources in the district. The lack of water, especially during the summer growing season, leads to a lack of irrigation for crops, which leads to a decrease in yields. At the same time, water pollution sometimes increases the salinity of the soil, making it unsuitable for other crops.

Climate change, which is exacerbating environmental problems around the world, is also having a significant impact on agriculture in the Kokdala district. Rising temperatures in the summer months, a decrease in heavy rainfall, and unfavorable climatic conditions are further increasing the need for irrigation. In the Kokdala district, climate change is causing difficulties, especially in growing cotton and other crops. The reduction in the amount of water needed for crops and the weakness of irrigation systems are leading to an increase in the ecological crisis.

Land salinization in the Kokdala district is one of the primary geoecological problems. Improper irrigation management and excessive consumption of water resources are leading to land salinization. Salinization reduces soil fertility and prevents plants from absorbing nutrients. This process, in turn, significantly reduces yields. To prevent salinization, it is necessary to improve the resource management system, introduce crop rotation, and take agrotechnical measures.

The largest ecological crises in the Kokdala district are associated with the excessive use of land and water resources. This, in turn, leads to a disruption of the natural balance. This leads to problems with salinization, water pollution, crop diseases and harmful insects. These processes disrupt the stability of interconnected ecological systems and reduce the ability of ecosystems to recover. The level of environmental education of the district population and the effective use of natural resources has decreased.

To solve geoecological problems in the Kokdala district, it is necessary to implement the following recommendations:

✓ Modernization of the irrigation system: Introduction of modern, water-saving irrigation technologies and effective management of irrigation systems.

✓ Land resource management: Taking agrotechnical measures to maintain and restore soil fertility, implementing crop rotation and proper land management.

✓ Effective management of water resources: Introduction of water-saving technologies, creation of optimal water management and monitoring systems.

✓ Adaptation to climate change: Cultivation of crops suitable for climatic conditions, adaptation of water management and agrotechnical methods to climate change.

✓ Environmental education and awareness raising: Informing the population about environmental problems, effective use of natural resources and strengthening environmental education.

Conclusion: Geoecological problems in the Kokdala district have become the main problems of agricultural activity. The unevenness of the irrigation system, soil salinization, climate change and depletion of water resources are causing an

ecological crisis. To solve these problems, an integrated approach is needed, the resource management system is modernized, and ecological sustainability is ensured. For this, important measures should be taken to increase the environmental education of the population and ensure ecological sustainability.

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PROSPECTS FOR THE IMPROVEMENT OF CIVIL LAW RELATIONS ARISING FROM CONTRACTS ON ENSURING THE CYBERSECURITY OF PROTECTED OBJECTS

Abstract: *This article analyzes the prospects for improving the civil law regulation of contracts related to ensuring the cybersecurity of protected facilities. The study substantiates that, in the context of the digital economy and information society, the legal nature of protected facilities is undergoing significant transformation, thereby necessitating the legal regulation of contractual relations aimed at ensuring cybersecurity alongside traditional security service relations. The article examines the legal nature of cybersecurity service contracts, their place within the system of civil law, the rights and obligations of the parties, as well as existing legal issues related to liability for cyber incidents, compensation for damages, and the application of penalty clauses. Based on a comparative analysis of national legislation and the legal practices of foreign countries, the author develops scientific proposals and recommendations aimed at improving the legal regulation of contracts concerning the cybersecurity of protected facilities, determining the legal status of cyber objects, introducing special contractual frameworks, and establishing effective liability mechanisms.*

Keywords: *Security contract, cybersecurity, protected facility, cyber object, information system, digital infrastructure, cyber incident, cyberattack, contractual relations, civil liability, penalty clause, compensation for damages, legal gap, digital economy, information security, legislative improvement, contract law, cybersecurity service.*

Although the Law of the Republic of Uzbekistan No. ZRU-778 “On Security Activities” dated 15 June 2022 (hereinafter referred to as “Law No. ZRU-778”) does not provide a direct legal definition of the term “security,” it does define the concept of “security activities.” According to the Law, security activities refer to the protection of guarded facilities, as well as activities aimed at ensuring access control and maintaining internal security regimes at protected facilities of legal entities. It should be noted that the concepts of “security” and “security activities” are distinct and should not be treated as synonymous, as such an approach is unjustified from both theoretical and practical perspectives.[1] In this regard, it would be appropriate to introduce a separate legal definition of the term “security” into the Law of the

Republic of Uzbekistan No. ZRU-778 “On Security Activities.”First, the current version of the Law provides a definition only for the concept of “security activities,” which denotes a specific set of actions and service-related processes. In other words, security activities constitute practical measures aimed at protecting guarded facilities and ensuring compliance with access-control procedures and internal security regimes. Therefore, this concept primarily reflects an organizational and operational process.

Based on the analyses presented in the preceding sections concerning the civil-law regulation of contracts related to ensuring the cybersecurity of protected facilities, it can be concluded that national legislation currently relies on general civil-law provisions to regulate such legal relations. However, the highly technological nature of cybersecurity services, the specific characteristics of digital assets, and the global nature of cyber threats have given rise to a number of legal gaps in this area. In particular, although the concept of protected facilities and their categories are recognized under national legislation, the legal status of a “protected cyber object” remains undefined. Unlike the objects involved in traditional security relationships, cybersecurity relations may involve servers, databases, digital platforms, and other digital assets as objects of protection. In such circumstances, the legal nature of a security contract may also undergo significant transformation. A further issue is that the concept of a “protected cyber object” is not provided for in the current legislation at all, which gives rise to a number of legal uncertainties. The absence of a clear legal definition and regulatory framework for protected cyber objects creates difficulties in determining the subject matter of cybersecurity contracts, the scope of the parties’ rights and obligations, and the allocation of liability for failures to ensure cybersecurity.

First, it remains unclear which digital resources may constitute independent objects of a security contract. For example, current legislation does not provide a clear answer as to whether a website, domain name, cryptocurrency wallet, or artificial intelligence model may be recognized as an object of protection under a security agreement.

Second, the scope of obligations imposed on the provider of security services remains uncertain. This is because the protection of a tangible object and the cybersecurity protection of digital infrastructure represent fundamentally different types of activities in terms of their nature, methods, and objectives.

Third, where damage is caused to a protected cyber object, determining the subject matter of civil liability and the composition of damages becomes considerably more complex. For instance, assessing losses resulting from the destruction of a database, the theft of crypto-assets, or unauthorized interference with an artificial intelligence model requires, as a preliminary matter, the establishment of the legal status of the relevant object. Without a clearly defined legal framework governing protected cyber objects, the proper determination of liability and the calculation of damages may give rise to significant legal challenges.

From this perspective, it is necessary to establish the digital object of security relations as a separate legal category within the legislation.

Therefore, it is proposed to supplement Article 3 (“Basic Definitions”) of Law No. ZRU-778 with the following new definition: “Protected cyber object” means an information system, information resource, database, server, digital platform, website, cloud infrastructure, digital asset, crypto-asset, artificial intelligence system, or any other object of the digital environment that is created, stored, processed, or transmitted through information and communication technologies; that constitutes an object of property or other legal rights in accordance with the legislation; and that is subject to protection against unauthorized access, use, modification, destruction, blocking, or other cyber threats.

Based on the proposed definition, it may be concluded that a protected cyber object is a digital asset, information resource, or information and communication infrastructure that possesses economic or social value as an object of civil rights and requires protection through special cybersecurity measures aimed at ensuring its confidentiality, integrity, and availability.

The incorporation of the above-mentioned provision into the legislation would contribute to clarifying the modern scope of objects subject to security activities and to determining the legal nature of cybersecurity services.

Another legal gap in Law No. ZRU-778 is the absence of provisions identifying entities authorized to provide cybersecurity services. Article 9 of the Law recognizes state security units, departmental security services, and militarized security units as subjects of security activities. While this approach may be sufficient for the physical protection of tangible objects, it is inadequate for the legal regulation of cybersecurity services that have emerged in the context of the digital economy. The essence of the problem lies in the fact that ensuring the cybersecurity of protected facilities requires specialized knowledge, advanced technical tools, and highly qualified professionals, which fundamentally distinguishes such activities from traditional security services. In particular, Article 9 of the Law does not envisage organizations operating in the field of cybersecurity as subjects of security activities. At the same time, despite the significant role currently played by the State Institution “Cybersecurity Center” in the field of cyber protection, as well as its cooperation with the Ministry of Digital Technologies of the Republic of Uzbekistan, there is no clearly established legal framework enabling these entities to provide cybersecurity services on an outsourcing basis. The Cybersecurity Center performs a number of important functions, including monitoring and analyzing information security threats, studying methods used by offenders in cyberspace, certifying hardware and software products, assisting public authorities in developing and implementing information security policies, ensuring the security of state information systems and resources, and providing timely notifications to users regarding cybersecurity threats. This legal gap is particularly evident in two key areas.

First, there is no unified legal mechanism governing the licensing, accreditation, and registration of cybersecurity service providers in the state register. As a result, uniform requirements concerning the qualifications, technical capabilities, and liability of organizations engaged in the protection of information systems have not been established.

Second, although Article 5 of the Law assigns responsibility for implementing a unified technical policy in the field of security systems and technical means of protection, it remains unclear which authority is responsible for developing and coordinating such a policy in the field of cybersecurity. In practice, these functions are divided among several institutions, including the Ministry of Digital Technologies, the Cybersecurity Center, and the Security Department under the Ministry of Internal Affairs. Such fragmentation of authority may lead to overlapping functions, duplication of responsibilities, and inefficiencies in the implementation of cybersecurity measures.

In light of these circumstances, it appears both legally and practically preferable for the Security Department to enter into outsourcing agreements with specialized state bodies and organizations in the field of cybersecurity rather than attempting to ensure the cybersecurity of protected facilities independently. Cybersecurity is a highly specialized field in which threats evolve continuously, while protective technologies require constant updating and improvement. Given that the primary function of the Security Department is the organization of physical security, independently performing all cybersecurity-related functions may result in excessive financial and organizational costs. Accordingly, the involvement of specialized cybersecurity institutions through contractual outsourcing arrangements would contribute to improving the quality, effectiveness, and sustainability of cybersecurity protection for guarded facilities.

Under an outsourcing agreement, the Ministry of Digital Technologies and the Cybersecurity Center may perform a range of functions, including continuous monitoring of the information systems of protected facilities, early detection of cyber incidents and prompt incident response, conducting information security audits, assessing the level of protection of servers and databases, ensuring the security of artificial intelligence technologies used within security systems, providing cyber protection for video surveillance and alarm systems, and facilitating the rapid exchange of information concerning cyber threats.

The legal significance of such cooperation lies in the fact that an outsourcing agreement enables the clear allocation of rights and obligations among the parties, the establishment of service standards and quality indicators, the determination of liability in the event of cyberattacks, and the specification of requirements for ensuring data confidentiality. As a result, a comprehensive protection mechanism integrating both the physical security and cybersecurity of protected facilities can be established.

In this regard, it would be appropriate to supplement Law No. ZRU-778 with the following provision: *"For the purpose of ensuring the cybersecurity of protected*

facilities, the Security Department may conclude outsourcing agreements with the Ministry of Digital Technologies, the Cybersecurity Center, and cybersecurity service providers accredited in accordance with the established procedure. Such agreements may provide for the monitoring of protected cyber objects, the detection and mitigation of cyber incidents, the conduct of information security audits, and the provision of other cybersecurity services."

This approach would, on the one hand, preserve the core functions of the Security Department and, on the other hand, enable the effective utilization of the existing cybersecurity capacity of the state. More importantly, it would facilitate the development of a comprehensive approach to the security of protected facilities, whereby physical and digital protection systems are integrated within a single legal framework. Such an approach would contribute to the formation of a modern model of security activities in the context of digital transformation. At the same time, it would be necessary to amend the list of entities specified in Article 9 of Law No. ZRU-778. In particular, it would be appropriate to include the Ministry of Digital Technologies of the Republic of Uzbekistan and the State Institution "Cybersecurity Center" among the entities authorized to conduct security activities in their capacity as providers of cybersecurity services for protected facilities.

Furthermore, the Regulation on the Security Department under the Ministry of Internal Affairs of the Republic of Uzbekistan (hereinafter referred to as the "Regulation"), approved by Resolution No. PQ-360 of the President of the Republic of Uzbekistan dated 28 November 2025 "On Measures for the Effective Organization of the Activities of Internal Affairs Bodies in the Field of Security," identifies among the Department's principal tasks the implementation of a unified technical policy in the field of security systems and technical means of protection, as well as the introduction of modern information and communication technologies and artificial intelligence technologies.[2] The Regulation also provides for the use of video surveillance systems, access control systems, hardware and software complexes, unmanned devices, and other digital technologies at protected facilities. In addition, it assigns responsibility for taking measures to ensure the cybersecurity of implemented information systems. However, a comprehensive analysis of the Regulation demonstrates the existence of several independent legal gaps in the regulation of relations associated with ensuring the cybersecurity of protected facilities.

First, Paragraph 10 of Chapter 2 of the Regulation provides that, upon request from state bodies and legal entities, the Department may develop, enhance, and maintain software products. At the same time, the Regulation assigns responsibility for ensuring the cybersecurity of implemented information systems. However, the regulatory framework does not establish the criteria by which cybersecurity services should be evaluated, nor does it define service quality indicators such as minimum security requirements, information system availability levels, vulnerability remediation deadlines, or other measurable performance standards. This deficiency may create difficulties in assessing the extent to which a service provider has

properly fulfilled its contractual obligations. Therefore, it is proposed that the Regulation establish specific service quality indicators for cybersecurity services provided to protected facilities, including information system availability rates, cyber incident response times, security update implementation periods, and other relevant technical performance metrics.

Second, although the Regulation establishes procedures for detecting, eliminating, and investigating violations at protected facilities, it does not provide a separate mechanism for responding to cyber incidents. For example, in cases involving unauthorized access to servers, theft of databases, or unlawful interference with video surveillance systems, the Regulation does not specify which authority or commission is responsible for conducting an investigation, how digital evidence should be collected and preserved, or which parties bear responsibility for incident response. Accordingly, it would be appropriate to introduce a provision requiring that, in the event of a cyber incident, an official investigation be conducted with the participation of representatives of the Department, the owner of the protected facility, and designated cybersecurity specialists, while ensuring that digital evidence is collected, documented, and preserved in accordance with the requirements of applicable legislation.

Third, the Regulation requires that inspectorate supervision and inspections include an assessment of technical security equipment and video surveillance systems. However, it contains no separate provision concerning cybersecurity audits. The absence of such a requirement increases the likelihood that protected facilities may continue operating with weak passwords, outdated software, or inadequately secured networks. For this reason, the chapter governing inspectorate supervision and inspections should be supplemented with the following provision: “Cybersecurity audits of critically important and categorized facilities shall be conducted at least once annually.”

Fourth, the Regulation stipulates that the protection of facilities shall be carried out on a contractual basis. Nevertheless, several issues of fundamental importance in the field of cybersecurity remain unregulated, including responsibility for password management, accountability for maintaining backup copies of data, and liability for damage arising from third-party software. As a result, determining responsibility in the event of a cyber incident becomes significantly more complicated. In our view, the Regulation should require that contracts relating to the cybersecurity of protected facilities expressly define the responsibilities of each party regarding the protection of information assets, the allocation of cybersecurity risks, and the procedures for coordinated action in the event of a cyber incident. The implementation of these proposals would significantly strengthen the legal foundations of the Department’s activities in ensuring the digital security of protected facilities and would contribute to the development of a more effective and comprehensive cybersecurity governance framework.

An analysis of the Cybersecurity Strategy of the Republic of Uzbekistan for 2026–2030, approved by Presidential Decree No. PF-38 of 10 March 2026 “On

Defining the Cybersecurity Strategy of the Republic of Uzbekistan and Improving the System for the Prevention of Cybercrime," demonstrates that ensuring the stable and uninterrupted operation of critical information infrastructure facilities, monitoring cyber incidents, providing rapid responses to cyber threats, promoting public-private partnerships, and improving cybersecurity legislation have been identified as key priorities of the state cybersecurity policy.[3] The Strategy further emphasizes the necessity of developing legal mechanisms, alongside organizational and technical measures, to ensure the cybersecurity of state authorities and critical information infrastructure facilities. In light of these strategic objectives, the civil-law improvement of contracts relating to the cybersecurity of protected facilities by the Security Department under the Ministry of Internal Affairs acquires particular relevance.

At the same time, the Strategy envisages the establishment of a national cyber incident response system, the development of mechanisms for the rapid exchange of information concerning cyber threats, and the expansion of cybersecurity outsourcing services. These objectives highlight the need to clearly define the actions and responsibilities of contractual parties in the event of a cyber incident.

In practice, existing security contracts generally provide for liability in cases involving physical intrusions or attacks against protected facilities. However, the rights and obligations of the parties remain insufficiently regulated in situations involving database breaches, unauthorized access to video surveillance systems, or the compromise of software and information systems. Consequently, the existing contractual framework does not fully address the legal challenges arising from contemporary cyber threats, thereby necessitating the development of more detailed contractual provisions governing cybersecurity-related incidents and liabilities.

The Strategy identifies the development of public-private partnerships and the involvement of the private sector in the field of cybersecurity as one of its key priorities. This development necessitates the adoption of a new civil-law approach to security relations. In particular, it gives rise to the need for a legal framework governing tripartite contractual relationships among the Security Department, authorized cybersecurity institutions, and entities providing outsourced cybersecurity services.

Accordingly, taking into account the priorities and objectives established by the Strategy, the improvement of contracts relating to the cybersecurity of protected facilities should focus on several key directions. These include transforming the subject matter of security relations into a comprehensive security model encompassing the protection of digital assets and information infrastructure, clearly defining contractual obligations relating to cyber incident response, strengthening the legal status of cybersecurity outsourcing service providers, and introducing special civil-law mechanisms aimed at ensuring the cyber resilience of critical information infrastructure facilities.The implementation of these measures would facilitate the adaptation of security activities to the realities of digital transformation

and contribute to the establishment of a modern contractual framework capable of effectively addressing emerging cybersecurity challenges.

The findings of the research demonstrate that the rapid development of the digital economy, together with the widespread use of information and communication technologies in public administration, the financial and banking sector, e-commerce, and other areas, has significantly influenced the legal nature of protected facilities. As a result, new forms of contractual relations have emerged that extend beyond the scope of traditional security arrangements and are aimed at protecting information systems, databases, servers, digital platforms, and other elements of digital infrastructure from cyber threats.

In practice, legal relations concerning the cybersecurity of protected facilities are currently regulated through the general provisions of the Civil Code governing contracts for services, contracts for work and labor (contracts for services and works), and mixed contracts. However, this approach does not adequately address the specific characteristics of cybersecurity relations. In particular, issues relating to the legal status of cyber objects, the legal nature of cybersecurity services, the grounds for liability arising from cyber incidents, the criteria for assessing cyber damage, the determination of fault and causation, as well as the allocation of risks among the parties, remain insufficiently regulated under national legislation.

The analysis has demonstrated that contracts relating to the cybersecurity of protected facilities differ from traditional security contracts in terms of their legal nature. Such agreements constitute complex mixed contracts that combine elements of service provision, information services, and technical support. Consequently, the regulation of these legal relations requires not only the application of general contractual rules but also the development of specialized legal mechanisms tailored to the specific characteristics of cybersecurity services.

Furthermore, the fact that damage in the field of cybersecurity often manifests itself in an intangible form, the complexity of calculating losses arising from cyber incidents, and the possibility that such damage may become apparent only after a considerable period of time indicate the need to reconsider traditional concepts of civil liability. In particular, given that cybersecurity services constitute a professional activity involving a heightened degree of risk, it appears appropriate to introduce broader elements of risk-based liability into the regulation of these legal relations.

Based on the findings of this research, the following scientific conclusions may be drawn:

First, contracts relating to the cybersecurity of protected facilities should be recognized within civil law as an independent contractual arrangement or, at a minimum, as a distinct category of contracts requiring special legal regulation.

Second, the legal concepts of “cyber object,” “cyber incident,” “cyber damage,” and “cybersecurity service” should be formally incorporated into national legislation.

Third, it is advisable to establish, through special legal provisions, the legal status, professional obligations, and liability standards applicable to entities providing cybersecurity services.

Fourth, the institutions of contractual penalties and compensation for damages in the field of cybersecurity should be adapted to the specific characteristics of digital relations. In particular, a special legal framework should be introduced for the assessment and recovery of cyber-related damages.

Fifth, in order to establish an effective liability mechanism for contracts relating to the cybersecurity of protected facilities, it is appropriate to incorporate into national legislation elements of the presumption of fault, liability based on professional standards, and risk-based liability.

Accordingly, the improvement of the legal regulation of contractual relations concerning the cybersecurity of protected facilities constitutes an important prerequisite for ensuring information security in the context of the digital economy, effectively protecting the rights and legitimate interests of the parties, and facilitating the adaptation of civil law to contemporary digital relations. Furthermore, such developments would provide both the theoretical and practical foundations for the emergence of a specialized civil-law institution governing cybersecurity-related contractual relations in the future.

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TA’LIM MUASSASALARIDA O‘QITUVCHILARNING FAVQULODDA VAZIYATLARDA TO‘G‘RI HARAKAT QILISH KO‘NIKMASINI TAKOMILLASHTIRISH

Annotatsiya. *Mazkur maqolada ta’lim muassasalarida o‘qituvchilarning favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmalarini rivojlantirish hamda o‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish madaniyatini shakllantirishning samarali metodlari tahlil qilinadi. Shuningdek, zamonaviy pedagogik texnologiyalar asosida xavfsizlik ko‘nikmalarini o‘rgatishning innovatsion yondashuvlari yoritilgan.*

Kalit so‘zlar*: favqulodda vaziyat, xavfsizlik, metodika, ta’lim, o‘qituvchi, o‘quvchi, ko‘nikma, fuqarolik muhofazasi*

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IMPROVING TEACHERS’ SKILLS FOR PROPER ACTIONS IN EMERGENCY SITUATIONS IN EDUCATIONAL INSTITUTIONS

Abstract. *This article analyzes effective methods for developing teachers’ skills of appropriate behavior in emergency situations, as well as for forming students’ culture of compliance with life safety rules. In addition, innovative approaches to teaching safety skills based on modern pedagogical technologies are highlighted.*

Keywords: *emergency situation, safety, methodology, education, teacher, student, skill, civil protection*

Hozirgi kunda global iqlim o‘zgarishi, texnogen avariyalar, tabiiy ofatlar va boshqa favqulodda vaziyatlar sonining ortib borishi insonlardan yuqori darajada tayyorgarlikni talab etmoqda. Ayniqsa, ta’lim muassasalarida o‘qituvchi va o‘quvchilarning xavfsizlik madaniyatini shakllantirish dolzarb masalalardan biri hisoblanadi.O‘qituvchi nafaqat bilim beruvchi, balki xavfli vaziyatlarda to‘g‘ri yo‘l-yo‘riq ko‘rsatuvchi shaxs hamdir. Shu sababli, ularning favqulodda vaziyatlarda tezkor va to‘g‘ri qaror qabul qilish ko‘nikmalarini rivojlantirish muhim ahamiyatga ega.

Mazkur tadqiqotda ta’lim muassasalarida o‘qituvchilarning favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmalarini shakllantirish hamda

o‘quvchilarda hayotiy faoliyat xavfsizligi madaniyatini rivojlantirish tizimli va kompetensiyaviy yondashuv asosida o‘rganildi. Tadqiqotda ilmiy-nazariy tahlil, pedagogik kuzatuv, so‘rovnoma va tajriba-sinov metodlaridan foydalanildi.
Adabiyotlar tahlili jarayonida O‘zbekiston Respublikasining tegishli qonunlari, Favqulodda vaziyatlar vazirligi metodik qo‘llanmalari hamda pedagogik manbalar o‘rganildi. Shuningdek, zamonaviy pedagogik texnologiyalar va xalqaro tajriba asosida xavfsizlik ko‘nikmalarini shakllantirishning samarali usullari tahlil qilindi.[1].

Ta’lim muassasalarida xavfsizlikni ta’minlash va favqulodda vaziyatlarga tayyorgarlikni kuchaytirish bugungi kunda muhim pedagogik va ijtimoiy vazifalardan biri hisoblanadi. O‘qituvchilar bu jarayonda asosiy subyekt sifatida nafaqat bilim beruvchi, balki o‘quvchilarning xavfsizligini ta’minlovchi va ularni to‘g‘ri yo‘naltiruvchi shaxs sifatida faoliyat yuritadi. Shu sababli, ularning favqulodda vaziyatlarda tezkor va to‘g‘ri qaror qabul qilish ko‘nikmalarini rivojlantirish alohida ahamiyat kasb etadi.Favqulodda vaziyatlar turli ko‘rinishda namoyon bo‘lishi mumkin bo‘lib, ular tabiiy, texnogen va ijtimoiy xarakterga ega bo‘ladi. Har bir turdagi vaziyat o‘ziga xos xavf va oqibatlarga ega bo‘lgani sababli, o‘qituvchilardan har bir holatda to‘g‘ri harakat algoritmini bilish talab etiladi. Ayniqsa, maktab sharoitida o‘quvchilar sonining ko‘pligi va ularning yosh xususiyatlarini inobatga olgan holda xavfsizlik choralarini to‘g‘ri tashkil etish zarur hisoblanadi.O‘qituvchilarning favqulodda vaziyatlarga tayyorgarligini oshirishda amaliy mashg‘ulotlar muhim o‘rin tutadi. Treninglar, simulyatsiya mashqlari va rolli o‘yinlar orqali real vaziyatlarga yaqin sharoitlar yaratiladi va bu o‘qituvchilarning psixologik hamda amaliy tayyorgarligini mustahkamlaydi. Bunday mashg‘ulotlar orqali ular evakuatsiya jarayonini boshqarish, o‘quvchilarni xavfsiz joyga olib chiqish va birinchi yordam ko‘rsatish bo‘yicha zarur ko‘nikmalarga ega bo‘ladi.[2]

O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmalarini shakllantirish esa uzluksiz pedagogik jarayon hisoblanadi. Bu jarayonda nazariy bilim berish bilan bir qatorda, amaliy mashqlar va interaktiv metodlardan foydalanish muhim ahamiyatga ega. O‘quvchilar yong‘in, zilzila yoki boshqa favqulodda vaziyatlarda qanday harakat qilish kerakligini nafaqat eshitib, balki amalda bajarib ko‘rish orqali yaxshiroq o‘zlashtiradi.Zamonaviy pedagogik texnologiyalar xavfsizlik ko‘nikmalarini shakllantirishda samarali vosita bo‘lib xizmat qiladi. Multimedia materiallar, videodarslar, virtual simulyatsiyalar va mobil ilovalar yordamida o‘quvchilarga murakkab vaziyatlar sodda va tushunarli tarzda yetkaziladi. Bu esa ularning qiziqishini oshiradi va bilimlarni mustahkamlashga xizmat qiladi.Ta’lim muassasalarida xavfsizlik madaniyatini shakllantirish uchun o‘qituvchi va o‘quvchilarning hamkorligi muhim omil hisoblanadi. Maktabda muntazam ravishda o‘tkaziladigan mashg‘ulotlar, targ‘ibot ishlari va amaliy treninglar orqali xavfsizlik qoidalariga rioya qilish odati shakllanadi. Natijada, favqulodda vaziyatlar yuzaga kelganda talafotlarni kamaytirish va inson hayotini saqlab qolish imkoniyati oshadi.[3]

Ta’lim muassasalarida favqulodda vaziyatlarga tayyorgarlikni samarali tashkil etishda boshqaruv va rejalashtirish masalalari alohida o‘rin tutadi. Har bir maktab yoki o‘quv muassasasida aniq ishlab chiqilgan evakuatsiya rejasi, xavfsizlik yo‘riqnomalari hamda mas’ul shaxslarning vazifalari belgilab qo‘yilishi zarur. Bu hujjatlar amaliy mashg‘ulotlar orqali muntazam sinovdan o‘tkazilib borilgandagina o‘z samarasini beradi. Rejalashtirish jarayonida o‘quvchilarning yosh xususiyatlari, binoning joylashuvi va texnik imkoniyatlari hisobga olinishi lozim.O‘qituvchilarning malakasini oshirish ham xavfsizlikni ta’minlashda muhim omil hisoblanadi. Maxsus kurslar, seminarlar va malaka oshirish dasturlari orqali ular yangi bilim va ko‘nikmalarni egallaydi. Ayniqsa, birinchi tibbiy yordam ko‘rsatish, psixologik barqarorlikni saqlash va favqulodda vaziyatlarda yetakchilik qilish qobiliyatlarini rivojlantirish muhimdir. Bu esa o‘qituvchining nafaqat bilimli, balki mas’uliyatli va tayyor mutaxassis sifatida shakllanishiga xizmat qiladi.[4]

O‘quvchilarda xavfsizlik madaniyatini shakllantirishda ota-onalar bilan hamkorlikni yo‘lga qo‘yish ham zarur. Chunki bola faqat maktabda emas, balki uy sharoitida ham xavfsizlik qoidalariga amal qilishi kerak. Shu bois, ota-onalar uchun tushuntirish ishlari, seminarlar va suhbatlar tashkil etilishi maqsadga muvofiqdir. Bu orqali xavfsizlik masalalariga kompleks yondashuv ta’minlanadi.Ta’lim muassasalarida axborot-kommunikatsiya texnologiyalaridan keng foydalanish xavfsizlik bo‘yicha bilimlarni yetkazishda yangi imkoniyatlar yaratadi. Masalan, mobil ilovalar, interaktiv platformalar va onlayn treninglar orqali o‘quvchilar mustaqil ravishda ham bilimlarini mustahkamlashi mumkin. Bu esa ta’lim jarayonining samaradorligini oshiradi va o‘quvchilarning mustaqil fikrlashini rivojlantiradi.O‘qituvchilarning favqulodda vaziyatlarga tayyorgarligini oshirish va o‘quvchilarda xavfsizlik ko‘nikmalarini shakllantirish uzluksiz va tizimli jarayon bo‘lib, u ta’lim tizimining barcha bosqichlarida izchil amalga oshirilishi lozim. Shu asosda ta’lim muassasalarida xavfsiz muhitni yaratish va har qanday xavf-xatarning oldini olish mumkin bo‘ladi.[5]

Ta’lim muassasalarida favqulodda vaziyatlarga tayyorgarlikni oshirishda xavf-xatarlarni oldindan baholash muhim ahamiyat kasb etadi. Har bir ta’lim muassasasi o‘z hududida yuzaga kelishi mumkin bo‘lgan xavflarni aniqlab, ular bo‘yicha aniq choralar rejasini ishlab chiqishi lozim. Bunday yondashuv o‘qituvchilarga vaziyatni tezda anglash va mos ravishda harakat qilish imkonini beradi. Xavflarni baholash jarayoni tizimli ravishda yangilanib borilishi, yangi tahdidlar inobatga olinishi zarur.Favqulodda vaziyatlarda samarali harakat qilish ko‘nikmasi faqat nazariy bilim bilan cheklanib qolmasdan, amaliy tajriba orqali mustahkamlanadi. Shu bois, o‘qituvchilar uchun real sharoitga yaqinlashtirilgan mashqlarni tashkil etish muhimdir. Bunday mashg‘ulotlarda vaqt omili, stress holati va tezkor qaror qabul qilish jarayoni alohida e’tiborga olinadi. Natijada o‘qituvchilar favqulodda vaziyatlarda sarosimaga tushmasdan, aniq va izchil harakat qilishni o‘rganadi.O‘qituvchilarning kommunikativ kompetensiyasini rivojlantirish ham dolzarb masalalardan biridir. Favqulodda vaziyatlarda to‘g‘ri va aniq buyruqlar berish, o‘quvchilar bilan samarali muloqot qilish, ularni boshqarish

muhim hisoblanadi. Ayniqsa, kichik yoshdagi o‘quvchilar bilan ishlashda soddalashtirilgan va tushunarli ko‘rsatmalar berish zarur. Bu esa tartibsizlik va vahimaning oldini olishga xizmat qiladi.[6]

Psixologik tayyorgarlik ham o‘qituvchilarning muhim jihatlaridan biri hisoblanadi. Favqulodda vaziyatlarda inson ruhiy bosim ostida bo‘ladi, bu esa noto‘g‘ri qarorlar qabul qilishga olib kelishi mumkin. Shu sababli, o‘qituvchilarni stressga chidamlilik, o‘zini nazorat qilish va muammoli vaziyatlarda xotirjamlikni saqlashga o‘rgatish zarur. Psixologik treninglar bu borada samarali vosita bo‘lib xizmat qiladi.[7]

Ta’lim muassasalarida xavfsizlikni ta’minlashda ichki nazorat tizimini yo‘lga qo‘yish ham muhimdir. Muntazam tekshiruvlar, xavfsizlik qoidalariga rioya etilishini nazorat qilish, kamchiliklarni o‘z vaqtida bartaraf etish orqali favqulodda vaziyatlarning oldini olish mumkin. Bu jarayonda ma’muriyat, o‘qituvchilar va texnik xodimlar o‘rtasida hamkorlik muhim rol o‘ynaydi.O‘qituvchilarning kasbiy faoliyatida xavfsizlikka oid bilimlarni doimiy ravishda yangilab borish zarur. Zamonaviy tahdidlar va texnologik o‘zgarishlar yangi bilim va ko‘nikmalarni talab etadi. Shu bois, uzluksiz ta’lim tizimi orqali o‘qituvchilarning malakasini oshirish, ularni zamonaviy yondashuvlar bilan tanishtirish muhim hisoblanadi.Ta’lim muassasalarida o‘qituvchilarning favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmalarini takomillashtirishda muhim omillar sifatida namoyon bo‘ladi. Ularni izchil amalga oshirish orqali xavfsiz ta’lim muhitini yaratish va inson hayotini himoya qilishga erishish mumkin.Ta’lim muassasalarida favqulodda vaziyatlarga tayyorgarlikni oshirishda fanlararo integratsiya muhim yo‘nalishlardan biri hisoblanadi. Xavfsizlikka oid bilimlarni faqat alohida darslar doirasida emas, balki boshqa fanlar bilan bog‘liq holda o‘qitish o‘quvchilarning tushunishini chuqurlashtiradi. Masalan, geografiya darslarida tabiiy ofatlar, biologiya fanida inson organizmining himoya mexanizmlari, jismoniy tarbiya mashg‘ulotlarida esa tezkor harakatlanish va o‘zini himoya qilish usullari o‘rgatilishi mumkin. Bu esa xavfsizlik ko‘nikmalarini kompleks shakllantirishga xizmat qiladi.[8]

Favqulodda vaziyatlarda axborotning tez va aniq yetkazilishi muhim omil hisoblanadi. Shu sababli ta’lim muassasalarida ogohlantirish tizimlarini takomillashtirish zarur. Zamonaviy signalizatsiya vositalari, ovozli xabarnomalar va mobil aloqa tizimlaridan foydalanish o‘qituvchilarga tezkor ravishda zarur choralarni ko‘rish imkonini beradi. Bunday texnik vositalardan to‘g‘ri foydalanishni o‘qituvchilarga o‘rgatish ham metodikaning muhim qismi hisoblanadi.Ta’lim muassasalarida xavfsizlik infratuzilmasini rivojlantirish muhim ahamiyatga ega. Yong‘inga qarshi vositalar, evakuatsiya yo‘laklari, favqulodda chiqish eshiklari va birinchi yordam vositalarining mavjudligi hamda ularning ishlash holati doimiy nazoratda bo‘lishi lozim. O‘qituvchilar ushbu vositalardan foydalanish tartibini yaxshi bilishi va o‘quvchilarga ham amaliy tarzda tushuntira olishi zarur.[9]

Favqulodda vaziyatlarda jamoaviy hamkorlik ham muhim rol o‘ynaydi. O‘qituvchilar o‘zaro muvofiqlashtirilgan holda harakat qilishi, vazifalarni aniq

taqsimlashi va bir-birini qo‘llab-quvvatlashi kerak. Bu jarayonda yetakchilik ko‘nikmalari, mas’uliyat hissi va jamoada ishlash madaniyati muhim omil sifatida namoyon bo‘ladi. Bunday ko‘nikmalarni shakllantirish uchun maxsus guruhli mashg‘ulotlar tashkil etilishi maqsadga muvofiqdir.Favqulodda vaziyatlar bo‘yicha o‘quv materiallarini muntazam yangilab borish talab etiladi. Yangi metodik qo‘llanmalar, tavsiyalar va tajribalar asosida o‘qitish mazmunini boyitish orqali o‘qituvchilarning bilim darajasi oshiriladi. Bu esa ularning amaliy faoliyatida samaradorlikni ta’minlaydi. Ta’lim muassasalarida o‘qituvchilarning favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmalarini takomillashtirish ko‘p qirrali jarayon bo‘lib, u pedagogik, texnik va tashkiliy omillar uyg‘unligida amalga oshiriladi. Mazkur yo‘nalishda tizimli ish olib borish orqali xavfsizlik darajasini oshirish va favqulodda vaziyatlarning salbiy oqibatlarini kamaytirish mumkin.[10]

Ta’lim muassasalarida o‘qituvchilarning favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmalarini takomillashtirish bugungi kunda dolzarb pedagogik vazifalardan biri hisoblanadi. O‘tkazilgan tahlillar shuni ko‘rsatadiki, o‘qituvchilarning nazariy bilimlari bilan birga amaliy tayyorgarligi ham yuqori darajada bo‘lishi zarur, chunki favqulodda vaziyatlarda tezkor va to‘g‘ri qaror qabul qilish inson hayotini saqlab qolishda hal qiluvchi ahamiyatga ega.O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish madaniyatini shakllantirish uzluksiz jarayon bo‘lib, u dars jarayoni, amaliy mashg‘ulotlar va sinfdan tashqari tadbirlar orqali amalga oshiriladi. Innovatsion pedagogik texnologiyalar, fanlararo integratsiya hamda amaliy treninglardan foydalanish bu jarayonning samaradorligini oshiradi.Muntazam mashg‘ulotlar, zamonaviy o‘qitish usullari va tizimli yondashuv orqali o‘qituvchilarning favqulodda vaziyatlarga tayyorgarligi sezilarli darajada oshadi. Bu esa o‘z navbatida ta’lim muassasalarida xavfsiz muhitni yaratish va o‘quvchilarning hayotini muhofaza qilishga xizmat qiladi.

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IMPROVING THE METHODOLOGY OF TEACHING ENGLISH TO ENERGY ENGINEERING STUDENTS

Abstract: *The article examines modern approaches to improving the methodology of teaching English to students majoring in Energy Engineering. It analyzes the features of professionally oriented language instruction, the opportunities provided by digital educational technologies, project-based learning, and the communicative approach. Special attention is paid to the development of the professional communicative competence of future energy engineers in the context of the digitalization of higher education.*

Keywords: *English language, Energy Engineering, professionally oriented learning, communicative competence, digital technologies, project-based learning, educational innovations.*

Introduction

The rapid development of the energy sector, technological innovation, and international cooperation have significantly increased the importance of English language proficiency for future energy engineers. English serves as the primary language of scientific communication, technical documentation, international standards, and professional collaboration. Therefore, higher education institutions must ensure that engineering students acquire not only general language skills but also the ability to communicate effectively in professional contexts.

In this regard, improving the methodology of teaching English to Energy Engineering students has become a crucial task. Modern educational approaches should integrate language learning with professional training, enabling students to use English as a tool for academic, scientific, and professional development.

Professionally Oriented Language Teaching

One of the most effective ways to improve English language instruction is the implementation of English for Specific Purposes (ESP). This approach focuses on the language needs of students within their professional field and prepares them for real-life communication in their future careers.

For Energy Engineering students, teaching materials should include specialized vocabulary and texts related to renewable energy sources, power generation, electrical systems, smart grids, energy efficiency, and sustainable development. Working with authentic professional materials helps students develop technical vocabulary, reading comprehension skills, and the ability to understand engineering documentation.

Professionally oriented language teaching also increases students' motivation because they recognize the practical relevance of English to their future careers.

Using Artificial Intelligence in Teaching English to Energy Engineering Students

The integration of Artificial Intelligence (AI) into English language education has created new opportunities for enhancing the learning process, particularly for students of Energy Engineering. AI-powered technologies support personalized learning, improve language proficiency, and help students acquire professional communication skills required in the global energy industry.

One of the most significant advantages of AI is its ability to provide individualized learning experiences. AI-based educational platforms analyze students' language proficiency, learning pace, strengths, and weaknesses, and then recommend customized learning materials and activities. This personalized approach allows Energy Engineering students to focus on specific language skills and professional vocabulary relevant to their field of study.

AI-powered tools such as intelligent chatbots and virtual assistants provide students with opportunities to practice English communication in realistic professional situations. For example, students can simulate technical discussions, project presentations, job interviews, and interactions with international colleagues. Such activities help improve speaking skills, build confidence, and reduce communication anxiety.

Another important application of AI is the development of writing skills. Intelligent writing assistants can identify grammatical, lexical, and stylistic errors, suggest corrections, and provide explanations. This enables students to improve their academic and professional writing, including technical reports, research papers, project proposals, and business correspondence related to the energy sector.

Artificial Intelligence also enhances students' ability to work with professional materials. AI-based translation and language-processing tools assist learners in understanding technical documentation, scientific articles, manuals, and international standards in the field of energy engineering. As a result, students can access a wider range of professional information and stay informed about global technological developments.

Furthermore, AI technologies contribute to the improvement of listening and pronunciation skills. Speech recognition systems evaluate pronunciation accuracy, identify errors, and provide immediate feedback. Through repeated practice and personalized recommendations, students can develop clearer and more effective spoken communication.

The use of AI supports independent learning and lifelong education. Students can access educational resources at any time, receive instant feedback, monitor their progress, and set individual learning goals. This flexibility encourages self-directed learning and increases motivation.

In addition, AI facilitates the implementation of project-based learning. Students can use AI tools to conduct research, analyze information, generate ideas, prepare presentations, and collaborate on projects related to renewable energy, smart grids, energy efficiency, and sustainable development. Such activities

integrate language learning with professional knowledge and practical problem-solving.

Despite its numerous advantages, AI should be viewed as a supplementary educational tool rather than a replacement for teachers. The role of the instructor remains essential in guiding students, developing critical thinking skills, providing emotional support, and ensuring the effective integration of technology into the learning process.

In conclusion, the use of Artificial Intelligence in teaching English to Energy Engineering students significantly enhances language acquisition, professional communication skills, and independent learning. By combining AI technologies with innovative teaching methodologies, higher education institutions can better prepare future energy engineers for successful participation in the international professional community.

The Communicative Approach in Language Teaching

The communicative approach remains one of the most effective methodologies in foreign language education. Its primary goal is to develop students' ability to use language effectively in real communication situations.

For future energy engineers, communicative activities may include technical discussions, project presentations, professional negotiations, interviews, and conference participation. Classroom activities such as role-playing, debates, problem-solving tasks, and group discussions encourage active language use and improve fluency.

The communicative approach helps students develop confidence in speaking English and prepares them for professional interactions in international environments.

Integration of Digital Technologies

Digital technologies have transformed modern education and created new opportunities for language learning. Learning management systems, online platforms, mobile applications, virtual classrooms, and multimedia resources provide students with flexible and interactive learning experiences.

The integration of digital tools into English language teaching enables students to access educational materials anytime and anywhere. Video lectures, online simulations, interactive exercises, and virtual laboratories make the learning process more engaging and effective.

Furthermore, Artificial Intelligence (AI)-based tools assist students in improving grammar, pronunciation, writing, and vocabulary. These technologies provide immediate feedback and personalized learning recommendations, allowing students to progress at their own pace.

Project-Based Learning

Project-based learning is an effective method for developing both language and professional competencies. Through project activities, students apply English in practical situations while exploring topics related to their field of study.

Projects may focus on renewable energy technologies, energy-saving systems, environmental protection, smart energy management, or sustainable energy development. Students conduct research, analyze information from English-language sources, collaborate with peers, and present their findings in English.

Project-based learning enhances critical thinking, teamwork, problem-solving abilities, and communication skills, all of which are essential for future engineers.

The Use of Authentic Materials

Authentic materials play a significant role in improving language proficiency and professional competence. Scientific articles, technical manuals, engineering reports, conference presentations, and videos produced by international energy companies expose students to real-world language use.

Working with authentic materials helps students develop reading and listening skills, expand their professional vocabulary, and gain insight into current trends and innovations in the energy industry. Moreover, it prepares them to work with international documentation and participate in global professional communities.

Individualization of Learning

Modern educational technologies make it possible to personalize the learning process according to students' needs, interests, and language proficiency levels. Adaptive learning systems can identify strengths and weaknesses, recommend appropriate learning materials, and monitor academic progress.

Individualized instruction allows students to focus on specific areas for improvement and promotes greater autonomy in learning. As a result, students become more responsible for their educational achievements and develop lifelong learning skills.

Conclusion

Improving the methodology of teaching English to Energy Engineering students requires the integration of professionally oriented instruction, communicative language teaching, digital technologies, project-based learning, and authentic materials. These approaches contribute to the development of professional communicative competence, enhance students' motivation, and prepare them for successful careers in the global energy industry.

In the modern world, English is not merely a subject of study but a vital tool for professional growth, international cooperation, and continuous learning. Therefore, the implementation of innovative teaching methodologies is essential for preparing highly qualified and competitive energy engineering specialists.

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THE EVOLUTION OF BANKING BUSINESS MODELS IN THE ERA OF DIGITAL ECOSYSTEMS

Abstract: *The article examines how digitalization has transformed traditional banking business models into platform- and ecosystem-based models. The relevance of the topic is determined by the rapid spread of mobile banking, open banking regulation, API-based partnerships and data-driven services. The research is based on comparative analysis of academic literature, regulatory documents and recent company examples from 2018-2025. The findings show that banks are moving from branch-centered intermediation to integrated digital ecosystems where financial and non-financial services are combined around customer needs. The article concludes that ecosystem banking strengthens customer engagement and revenue diversification, but also increases regulatory, cybersecurity and third-party risks.*

Key words: *digital economy; banking business model; digital banking; open banking; platform banking; financial ecosystem; customer data.*

Introduction: The banking industry has undergone a profound transformation during the last two decades. The rapid diffusion of digital technologies, the expansion of mobile banking, the emergence of fintech companies and the development of open banking frameworks have challenged the traditional banking model based on physical branches and product-centered relationships. Digitalization has changed not only the channels through which banking services are delivered, but also the logic of value creation in the financial sector. Modern banks increasingly operate as digital platforms that integrate financial and non-financial services, creating ecosystems that extend beyond conventional banking activities. The research question of this article is: how has digitalization transformed traditional banking business models into ecosystem-based models?

Methods and Research: The study employs qualitative comparative analysis of academic literature, regulatory documents and industry reports on digital banking and financial ecosystems. A systematic review of sources published mainly between 2020 and 2025 was conducted, while earlier regulatory milestones such as PSD2 were included because they shaped the development of open banking. The author compares business-model stages by identifying changes in customer interaction, revenue generation, partnership structure and risk profile.

Results and Discussion: Traditional banking business models were historically built around three core functions: deposit collection, lending activities and payment services. Revenue generation depended largely on net interest margins and commissions, while customer interaction was concentrated within branch networks. This model provided stability and regulatory control, but it also created high fixed costs and limited the speed of product innovation. The first important shift was the transition from branch-centered banking to multichannel and then digital banking. Online banking in the 2000s and mobile banking in the 2010s reduced dependence on physical infrastructure and made customer contact more frequent, personalized and data-rich.

A real example of this stage is the rise of digital-only banks. According to the European Central Bank, by the end of 2024 about 60 banks in the euro area were identified as digital-only, and seven of them were subsidiaries of traditional banks [1]. This figure illustrates that digital banking is no longer a niche format: it has become a recognized business model inside the regulated banking sector. Digital-only banks compete through lower operating costs, faster onboarding and mobile-first customer experience. At the same time, traditional banks increasingly imitate their practices by closing inefficient branches, investing in mobile applications and automating routine processes.

The second stage of transformation was open banking. In the European Union, the revised Payment Services Directive (PSD2) became applicable in January 2018 and required banks to provide secure access to account data for licensed third-party providers, subject to customer consent [2]. This regulatory change weakened the monopoly of banks over customer data and encouraged API-based competition. Open banking made it possible for fintech firms to offer account aggregation, payment initiation, budgeting tools and embedded financial services. For banks, the strategic meaning of PSD2 was clear: customer relationships could no longer be protected only by account ownership, because value increasingly moved to the interface and the quality of digital services.

Open banking also created a new partnership logic. Instead of developing all products internally, banks began to connect external providers to their digital infrastructure. The Basel Committee notes that digitalization has expanded both the channels through which banking services are offered and the range of technologically enabled suppliers, including fintechs, big techs and third-party service providers [3]. As a result, the bank's role gradually changes from a closed financial institution to an orchestrator of services. APIs become not only a technical instrument, but also a business-model mechanism: they allow banks to distribute products through partners and to include partner services inside their own applications.

The third stage is platform banking. Platform banking means that a bank creates a digital environment where customers, financial products and external partners interact. Unlike the traditional model, in which the bank sells separate products, the platform model focuses on repeated customer engagement. For

example, a client may use one application for payments, deposits, investments, insurance, travel purchases, subscriptions and loyalty programs. The economic logic is based on network effects: the more services and partners the platform includes, the more useful it becomes for the customer, and the more data the bank receives for personalization.

International fintech examples show the scale of this shift. Revolut reported 52.5 million customers by the end of 2024, almost 15 million new customers during the year, and transaction volumes approaching GBP 1.0 trillion [4]. Nubank reached 114.2 million customers globally by 31 December 2024 after adding 20.4 million customers during the year [5]. These companies started from narrow digital financial services, but gradually expanded into broader platforms with payments, cards, credit, investments, insurance, telecom or lifestyle services. Their growth demonstrates that customer acquisition in modern banking depends not only on balance-sheet products, but also on convenience, ecosystem breadth and daily digital engagement.

Russian banking practice also reflects the ecosystem logic. T-Technologies reported that the number of customers using the T ecosystem increased by 18% year-on-year to 48 million by the end of 2024, while revenue doubled to RUB 962 billion and net profit grew by 51% to RUB 122 billion [6]. This example is important because it shows how a bank-originated digital platform can combine financial services with lifestyle and partner services and convert engagement into financial performance. Sber also illustrates the Russian ecosystem model: in its 2024 results, Sberbank reported net profit of RUB 1,562.4 billion under RAS and ROE of 23.4%, while continuing to develop its digital channels and ecosystem positioning [7].

These examples show that ecosystem banking changes the revenue model. Traditional banks relied mainly on lending income and transaction commissions. Ecosystem-based banks diversify revenue through subscriptions, partner commissions, merchant services, advertising, data-driven personalization, cross-selling and non-financial services. This diversification can reduce dependence on interest margins and increase customer retention. However, it also changes the bank's risk profile: the bank becomes dependent on technological infrastructure, third-party providers, cloud services, cybersecurity systems and data governance.

Artificial intelligence and big data strengthen this transformation. DBS reported that its data analytics and AI/ML initiatives delivered more than SGD 750 million of economic value in 2024 and supported more than 1,500 models across over 370 use cases [8]. Such cases show that the competitive advantage of banks increasingly depends on their ability to analyze customer behavior and provide personalized recommendations at scale. Personalization turns the bank from a passive provider of financial products into an active digital assistant that anticipates customer needs.

The evolution of banking business models can therefore be summarized in three stages. The first stage is traditional branch-centered banking, focused on

financial intermediation and standardized products. The second stage is digital banking, characterized by online and mobile channels, automation and lower transaction costs. The third stage is ecosystem banking, where banks function as digital platforms that coordinate interactions among customers, partners and service providers. Each stage reflects a higher level of digital maturity, greater use of data and stronger dependence on cooperation rather than purely internal production.

Despite the advantages of ecosystem models, several challenges remain. Data privacy, cybersecurity, regulatory compliance and operational complexity become more serious when banks integrate many external partners. The Basel Committee emphasizes that digitalization creates benefits but also new implications for banks and supervisors, including the need to manage risks connected with innovative technologies and new suppliers [3]. Therefore, ecosystem banking should not be interpreted only as expansion into non-financial services. It also requires stronger governance, clear responsibility for customer data and continuous supervision of third-party relationships.

Conclusion: The research demonstrates that digitalization has transformed the bank from an institution that mainly holds accounts and issues loans into a platform that organizes customer experience. Real cases from the EU, Revolut, Nubank, T-Technologies, Sber and DBS show that this transformation is measurable through customer growth, digital-only bank expansion, ecosystem usage and AI-generated economic value. Open banking, APIs, mobile platforms, data analytics and artificial intelligence have played central roles in this shift. At the same time, ecosystem banking increases cybersecurity, privacy and third-party risks, which means that long-term success depends not only on innovation, but also on governance, trust and regulatory compliance. The future banking business model will probably be hybrid: banks will remain financial intermediaries, but their competitive position will increasingly depend on ecosystem orchestration. The most successful banks are likely to be those that combine three advantages: technological capability, trust and regulatory expertise. Fintech firms may be faster in innovation, but banks still possess customer trust, licenses, risk-management experience and access to financial infrastructure.

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KO‘KRAK QAFASI VA QORIN BO‘SHLIG‘I TRAVMALARIDA DIAFRAGMA JAROHATI: DIAGNOSTIKA VA DAVOLASHNING ZAMONAVIY YONDASHUVLARI

Annotatsiya: *Diafragma jarohatlari ko‘krak qafasi va qorin bo‘shlig‘i travmalarining og‘ir asoratlaridan biri bo‘lib, o‘z vaqtida aniqlanmagan hollarda yuqori letallik va nogironlikka sabab bo‘ladi. Ushbu maqolada diafragma jarohatlarining epidemiologiyasi, etiopatogenezi, zamonaviy diagnostika usullari hamda jarrohlik davolash natijalari tahlil qilindi. Tadqiqot davomida ko‘krak qafasi va qorin bo‘shlig‘i travmalari bilan shifoxonaga murojaat qilgan bemorlarning klinik kuzatuvlari o‘rganildi. Kompyuter tomografiyasi, ultratovush tekshiruvi va torakolaparoskopik usullarning diagnostik ahamiyati baholandi. Olingan natijalar diafragma jarohatini erta tashxislash va minimal invaziv usullarni qo‘llash davolash samaradorligini oshirishini ko‘rsatdi.*

Kalit so‘zlar: *diafragma jarohati, ko‘krak qafasi travmasi, qorin bo‘shlig‘i travmasi, torakoskopiya, laparoskopiya, diagnostika, xirurgik davolash.*

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DIAPHRAGMATIC INJURIES IN CHEST AND ABDOMINAL TRAUMA: MODERN APPROACHES TO DIAGNOSIS AND TREATMENT

Abstract: *Diaphragmatic injuries are among the most severe complications of chest and abdominal trauma and may lead to high mortality and disability if not diagnosed in a timely manner. This article analyzes the epidemiology, etiopathogenesis, modern diagnostic methods, and surgical treatment outcomes of diaphragmatic injuries. The study was based on clinical observations of patients admitted with chest and abdominal trauma. The diagnostic value of computed tomography, ultrasonography, and thoracolaparoscopic techniques was assessed. The obtained results demonstrated that early diagnosis of diaphragmatic injuries and the use of minimally invasive approaches significantly improve treatment effectiveness and clinical outcomes.*

Keywords: *diaphragmatic injury, chest trauma, abdominal trauma, thoracoscopy, laparoscopy, diagnosis, surgical treatment.*

Kirish

Travmatizm dunyo sog‘liqni saqlash tizimining eng dolzarb muammolaridan biri hisoblanadi. Ko‘krak qafasi va qorin bo‘shlig‘i travmalari barcha shikastlanishlarning 15–20 % ini tashkil etib, ular orasida diafragma jarohatlari alohida klinik ahamiyatga ega. Diafragma mushak-tendon to‘sig‘i bo‘lib, ko‘krak va qorin bo‘shlig‘ini ajratib turadi. Uning yaxlitligi buzilganda qorin bo‘shlig‘i a’zolarining ko‘krak qafasiga siljishi, nafas yetishmovchiligi va gemodinamik buzilishlar rivojlanadi.

Adabiyotlarda diafragma jarohatlari yopiq travmalarda 1–7 %, ochiq travmalarda esa 10–15 % hollarda uchrashi qayd etilgan. Jarohatlarning 70 % dan ortig‘i chap tomonlama bo‘lib, bunga jigarning o‘ng tomondagi himoya ta’siri sabab bo‘ladi.

So‘nggi yillarda travmatologiya va shoshilinch xirurgiyada minimal invaziv texnologiyalar keng qo‘llanilmoqda. Torakoskopiya va laparoskopiyaning amaliyotga joriy etilishi diafragma shikastlanishlarini erta aniqlash va samarali davolash imkonini bermoqda. Shu bilan birga, klinik belgilarining noaniqligi va ko‘p hollarda boshqa shikastlanishlar bilan birga uchrashi tashxis qo‘yishni murakkablashtiradi.

Tadqiqotning maqsadi ko‘krak qafasi va qorin bo‘shlig‘i travmalarida diafragma jarohatlarining klinik kechishi, diagnostikasi va jarrohlik davolash natijalarini baholashdan iborat.

Usullar va natijalar

Tadqiqot Samarqand davlat tibbiyot universitetining klinik bazalarida 2021–2025-yillar davomida ko‘krak qafasi va qorin bo‘shlig‘i travmalari bilan shoshilinch ravishda gospitalizatsiya qilingan bemorlarning klinik ma’lumotlarini retrospektiv va prospektiv tahlil qilish asosida amalga oshirildi. Tadqiqotning asosiy maqsadi diafragma jarohatlarining uchrash chastotasi, klinik kechishi, diagnostika imkoniyatlari hamda jarrohlik davolash natijalarini o‘rganishdan iborat bo‘ldi.

Tahlil uchun jami 64 nafar bemorning kasallik tarixi, instrumental tekshiruv natijalari va operativ davolash ma’lumotlari o‘rganildi. Tadqiqot guruhiga kiritilgan bemorlarning 46 nafari (71,9%) erkaklar va 18 nafari (28,1%) ayollar bo‘lib, ularning o‘rtacha yoshi 39,7±12,4 yilni tashkil etdi. Bemorlarning aksariyat qismini mehnatga layoqatli yoshdagi shaxslar tashkil qilgan. Diafragma jarohatlari ko‘pincha yo‘l-transport hodisalari, balandlikdan yiqilish, maishiy va ishlab chiqarish travmalari, shuningdek pichoq va o‘qotar qurol jarohatlari natijasida yuzaga kelgan.

Tadqiqotga ko‘krak qafasi va qorin bo‘shlig‘ining yopiq hamda ochiq travmalari bilan shifoxonaga yotqizilgan, instrumental tekshiruvlar yoki operatsiya davomida diafragma shikastlanishi tasdiqlangan bemorlar kiritildi. Tadqiqotdan og‘ir terminal holatdagi yoki tibbiy hujjatlari to‘liq bo‘lmagan bemorlar chiqarib tashlandi.

Barcha bemorlarda dastlabki baholash ATLS (Advanced Trauma Life Support) tamoyillari asosida amalga oshirildi. Bemorlarning umumiy ahvoli,

gemodinamik ko‘rsatkichlari, nafas olish faoliyati, shok darajasi va birga keluvchi jarohatlar mavjudligi aniqlab borildi.

Diagnostik tadbirlar quyidagi bosqichlarni o‘z ichiga oldi:

Umumiy klinik tekshiruv. Bemorlarning shikoyatlari, travma mexanizmi, anamnez ma’lumotlari o‘rganildi. Ko‘krak qafasi va qorin bo‘shlig‘ining inspeksiyasi, palpatsiyasi, perkussiyasi va auskultatsiyasi o‘tkazildi. Nafas olish soni, arterial bosim, yurak urish tezligi va kislorod saturatsiyasi nazorat qilindi.

Laborator diagnostika. Barcha bemorlarda umumiy qon tahlili, umumiy siydik tahlili, biokimyoviy qon tahlili, koagulogramma, qon guruhi va rezus omili aniqlanib, zaruratga ko‘ra arterial qon gazlari tekshirildi. Ushbu ko‘rsatkichlar qon yo‘qotish darajasi, yallig‘lanish jarayoni va ichki a’zolar faoliyatini baholash imkonini berdi.

Ko‘krak qafasi rentgenografiyasi. Travmaning dastlabki bosqichida rentgenologik tekshiruv o‘tkazilib, diafragma konturining buzilishi, plevral bo‘shliqda havo yoki suyuqlik mavjudligi, o‘pka kollapsi va qorin bo‘shlig‘i a’zolarining ko‘krak qafasiga siljishi kabi belgilar aniqlandi.

Ultratovush tekshiruvi (UTT). FAST (Focused Assessment with Sonography for Trauma) protokoli asosida qorin bo‘shlig‘i va plevral bo‘shliqda erkin suyuqlik mavjudligi baholandi. UTT yordamida jigar, taloq va boshqa parenximatoz a’zolarning birga keluvchi shikastlanishlari ham aniqlab borildi.

Multispiral kompyuter tomografiyasi (MSKT). Gemodinamik jihatdan barqaror bemorlarda kontrast kuchaytirish bilan yoki kontrastsiz MSKT bajarildi. Ushbu usul diafragma yorilishi lokalizatsiyasini, nuqson hajmini, qorin bo‘shlig‘i a’zolarining ko‘krak qafasiga dislokatsiyasini hamda qo‘shimcha torakoabdominal shikastlanishlarni aniqlashda asosiy diagnostik usul sifatida xizmat qildi.

Diagnostik torakoskopiya va laparoskopiya. Noaniq klinik holatlarda yoki instrumental tekshiruvlar natijalari yetarli bo‘lmaganda minimal invaziv endovideojarrohlik usullari qo‘llanildi. Torakoskopiya yordamida diafragmaning ko‘krak qafasi tomoni ko‘zdan kechirilib, plevral bo‘shliqdagi patologik o‘zgarishlar baholandi. Laparoskopiya esa diafragma nuqsonini, qorin bo‘shlig‘i a’zolarining holatini va qo‘shimcha jarohatlarni aniqlash imkonini berdi.

Operativ davolash davomida diafragma defektining anatomik joylashuvi, uzunligi va chuqurligi, qorin bo‘shlig‘i a’zolarining churralanish darajasi, qon ketish manbalari hamda birga keluvchi shikastlanishlar qayd etildi. Diafragma nuqsonlari asosan nodal yoki uzluksiz sintetik choklar yordamida tiklandi. Katta hajmdagi defektlarda esa polipropilen yoki boshqa sintetik implantlardan foydalanildi.

Davolash natijalarini baholashda operatsiya davomiyligi, shifoxonada yotish muddati, operatsiyadan keyingi asoratlar, reintervensiyalar soni va letallik ko‘rsatkichlari tahlil qilindi. Shuningdek, bemorlarning erta va kechki operatsiyadan keyingi davrdagi funksional holati ham baholandi.

Olingan ma’lumotlarga statistik ishlov berish Microsoft Excel 2019 va SPSS Statistics 26.0 dasturlari yordamida amalga oshirildi. Miqdoriy ko‘rsatkichlar

o‘rtacha qiymat (M) va standart og‘ish (±SD) ko‘rinishida ifodalandi. Guruhlararo farqlar Student t-mezoni va χ^2 (chi-kvadrat) testi yordamida baholandi. Statistik jihatdan ishonchli farq sifatida $p<0,05$ qiymati qabul qilindi. Mazkur yondashuv diafragma jarohatlarining diagnostikasi va davolash samaradorligini ilmiy asosda baholash imkonini berdi.

Muhokama

Tahlil natijasida diafragma jarohatlarining asosiy sabablari yo‘l-transport hodisalari (43,8 %), balandlikdan yiqilish (28,1 %), pichoq va o‘qotar qurol jarohatlari (18,7 %) hamda boshqa sabablar (9,4 %) ekani aniqlandi.

Chap tomonlama diafragma yorilishi 47 bemorda (73,4 %), o‘ng tomonlama jarohatlar 14 bemorda (21,9 %) va ikki tomonlama jarohatlar 3 bemorda (4,7 %) kuzatildi.

Klinik simptomlar orasida:

- ko‘krak qafasida og‘riq – 87,5 %;
- hansirash – 75,0 %;
- qorin og‘rig‘i – 62,5 %;
- taxikardiya – 54,7 %;
- ichak shovqinlarining ko‘krak qafasida eshitilishi – 18,8 % hollarda qayd etildi.

Rentgenologik tekshiruvlar yordamida 62,5 % hollarda diafragma shikastlanishi taxmin qilindi. Kompyuter tomografiyasi esa 89,1 % diagnostik aniqlikka ega bo‘ldi.

Torakoskopiya va laparoskopiya qo‘llangan bemorlarda diagnostik aniqlik 96,8 % ni tashkil etdi. Ushbu natijalar minimal invaziv texnologiyalarning ustunligini ko‘rsatadi.

Operativ davolash davomida diafragma nuqsonlari uzluksiz yoki tugunli choklar yordamida tiklandi. Katta nuqsonlarda sintetik protez materiallar qo‘llanildi.

Operatsiyadan keyingi asoratlar 10,9 % bemorlarda kuzatildi. Asosiy asoratlar:

- pnevmoniya;
- plevral ekssudat;
- yara infeksiyasi;
- nafas yetishmovchiligi.

Letallik ko‘rsatkichi 3,1 % ni tashkil etdi. O‘lim holatlari og‘ir politravma va gemorragik shok bilan bog‘liq bo‘ldi.

Olingan natijalar A.X. Sattorov va hamkorlarining ko‘krak qafasi travmalarini diagnostika qilish hamda davolash bo‘yicha olib borgan ilmiy tadqiqotlari natijalari bilan mos keladi. Mualliflar zamonaviy instrumental diagnostika va minimal invaziv usullarning qo‘llanilishi travmatik patologiyalar natijalarini sezilarli yaxshilashini ta’kidlaydilar.

Shuningdek, N.K. Islomov va hammualliflar tomonidan qorin bo‘shlig‘i a’zolari shikastlanishlari bo‘yicha o‘tkazilgan tadqiqotlar ham kombinatsiyalangan travmalarda erta tashxis qo‘yish muhimligini ko‘rsatgan.

Diafragma jarohatlari diagnostikasida KT va torakolaparoskopik tekshiruvlar eng yuqori sezgirlik va spetsifiklikka ega bo‘lib, ayniqsa klinik simptomlari noaniq bo‘lgan bemorlarda muhim ahamiyat kasb etadi.

Xulosa

Diafragma jarohatlari ko‘krak qafasi va qorin bo‘shlig‘i travmalarining og‘ir va hayot uchun xavfli asoratlaridan biri hisoblanadi. Jarohatlarning asosiy qismi chap tomonlama lokalizatsiyaga ega bo‘lib, ko‘pincha politravma tarkibida uchraydi. Multispiral kompyuter tomografiyasi va torakolaparoskopik usullar diafragma shikastlanishlarini aniqlashda eng yuqori diagnostik samaradorlikka ega. Minimal invaziv jarrohlik texnologiyalarining qo‘llanilishi operatsiyadan keyingi asoratlar va letallik ko‘rsatkichlarini kamaytiradi. Diafragma jarohatlarini erta tashxislash va o‘z vaqtida jarrohlik davolash bemorlar hayotini saqlab qolishning asosiy omili hisoblanadi.

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TEXNOGEN MANBALARNING ATMOSFERAGA TA’SIRI VA ULARNING EKOLOGIK OQIBATLARI

Annotatsiya: *Ushbu maqolada sanoat rivojlanishi, transport tizimlari va energetika sektorining atmosfera havosiga ko‘rsatayotgan texnogen ta’siri tahlil qilinadi. Tadqiqotda global iqlim o‘zgarishi, issiqxona effektining kuchayishi va antropogen chiqindilarning ekotizimlarga ta’siri zamonaviy ilmiy adabiyotlar asosida o‘rganilgan. Maqolada atmosferaning ifloslanish darajasi, asosiy zararli moddalar (SO_2, NO_2, CO_2, $PM_{2.5}$ va PM_{10}) va ularni kamaytirish strategiyalari muhokama qilingan.*

Kalit so‘zlar: *Texnogen manbalar, atmosfera ifloslanishi, issiqxona gazi, aerozollar, ekologik monitoring, barqaror rivojlanish.*

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IMPACT OF TECHNOGENIC SOURCES ON THE ATMOSPHERE AND THEIR ECOLOGICAL CONSEQUENCES

Abstract: *Abstract: This article analyzes the technogenic impact of industrial development, transportation systems, and the energy sector on atmospheric air quality. The study examines global climate change, the intensification of the greenhouse effect, and the impact of anthropogenic emissions on ecosystems based on contemporary scientific literature. The article discusses the level of atmospheric pollution, major pollutants (SO_2, NO_2, CO_2, PM2.5, and PM10), and strategies for reducing their emissions.*

Keywords: *technogenic sources, atmospheric pollution, greenhouse gas, aerosols, environmental monitoring, sustainable development.*

Kirish. XXI asrda sanoat ishlab chiqarishining keskin ortishi, urbanizatsiya jarayonlarining jadallashishi va transport vositalarining ko‘payishi atmosfera qatlamiga tushayotgan texnogen yuklamani misli ko‘rilmagan darajaga olib chiqdi. Atmosfera havosi nafaqat inson salomatligi, balki butun biosfera barqarorligini ta’minlovchi asosiy omildir. Biroq, texnogen manbalardan ajralib chiqayotgan tonnalab zararli moddalar havo tarkibini global miqyosda o‘zgartirmoqda.

Muammoning dolzarbligi: Jahon sog‘liqni saqlash tashkiloti (JSST) ma’lumotlariga ko‘ra, dunyo aholisining 90% dan ortig‘i ifloslangan havodan nafas

olmoqda[1]. Texnogen ifloslanish quyidagi global muammolarni keltirib chiqarmoqda:

Global iqlim o‘zgarishi: Karbonat angidrid (CO_2) va metan (CH_4) gazlarining konsentratsiyasi ortishi sababli global harorat ko‘tarilmoqda[6].

Kislotali yomg‘irlar: Oltingugurt va azot oksidlari atmosferada namlik bilan reaksiyaga kirishib, kislotali yog‘inlarni hosil qiladi.

Smog va aerozollar: Yirik megapolislarda ko‘rish darajasini pasaytiruvchi va nafas yo‘llari kasalliklarini keltirib chiqaruvchi zararli tutunlar zanjiri.

Ushbu tadqiqotning maqsadi-asosiy texnogen manbalarni tasniflash, ularning atmosferaga ta’sir darajasini miqdoriy baholash va zamonaviy filtrlash hamda ekologik toza texnologiyalarning samaradorligini tahlil qilishdan iborat.

2. Tadqiqot usullari: Tadqiqot jarayonida tizimli tahlil, qiyosiy-ekologik metodlar va so‘nggi 5-10 yillikda chop etilgan xalqaro hamda mahalliy ilmiy adabiyotlarning metadata tahlili (meta-analysis) usullaridan foydalanildi.

Obyekt: Issiqlik elektr stansiyalari (IES), metallurgiya zavodlari va avtotransport chiqindilari.

Natijalar: O‘tkazilgan tahlillar shuni ko‘rsatadiki, atmosferaga ta’sir etuvchi texnogen manbalarni uchta asosiy guruhga ajratish mumkin: energetika (IES), sanoat (metallurgiya, kimyo, sement ishlab chiqarish) va transport sektori.

1-jadval

Texnogen manbalar va ulardan ajraladigan asosiy zararli moddalar ulushi

Manba turi	Asosiy zararli moddalar	Global emissiyadagi ulushi (%)	Kelib chiqadigan asosiy oqibat
Energetika (IES)	SO_2, CO_2, Kukun (kul)	35%	Issiqxona effekti, kislotali yomg‘irlar
Sanoat va zavodlar	NO, og‘ir metallar, HF	25%	Tuproq va suvning zaharli cho‘kmalari
Avtotransport	CO, NO, PM $_{2.5}$, PM_{10}	30%	Shaharlarda smog, nafas yo‘li kasalliklari
Boshqa tarmoqlar	CH_4, Gidroftoruglerodlar	10%	Ozon qatlamining yemirilishi

Atmosferaga chiqariladigan zararli moddalar hajmi avtomobil dvigateli va yonilg‘isiga bog‘liq[7]. Ekologlarning hisoblariga qaraganda, bir tonna dizel yonilg‘isi yonganda havoga 9 kg. uglerod oksidi (isli gaz) chiqariladi. U esa inson qonidagi qizil sharlar - eritrotsitlarga ta'sir etadi, o‘z o‘rnida ularning kislorod yetkazib berish qobiliyati yo‘qoladi. Natijada organizmda kislorod yetishmaydi, bu esa o‘z navbatida markaziy asab tizimiga ta`sir etadi.

Shuningdek, 1 litr avtomobil yonilg‘isi sarfi uchun 15 kilogramm havo talab qilinadi. Mutaxassislarning hisob-kitobiga ko‘ra, shaharlarda bir kunda 10 mingta avtomobil o‘rtacha 10 litrdan yonilg‘i sarflasa, yil davomida 36 million 500 ming litr yonilg‘ini yondirish uchun qariyb 117 ming tonna kislorod kerak bo‘ladi. Bu esa havodagi kislorodning 10-20 foizini tashkil etadi. Ta`kidlash joizki, keyingi yillarda atmosfera havosiga ifloslantiruvchi moddalar chiqaruvchi manbalarning asosiy qismi avtotransportlar hisobiga to‘g‘ri kelmoqda. Avtoulovlardan chiqayotgan zararli tutunlar tarkibida 200 dan ortiq zararli birikmalar (o‘ta zararli bo‘lgan benzaprin, qo‘rg‘oshin va boshqalar) mavjud. Mazkur birikmalar o‘pka saratoni, yurak xastaliklari va boshqa og‘ir kasalliklarni keltirib chiqaradi.

Sanoat - atrof-muhitni ifloslantiruvchi asosiy tarmoqdir. U geografik qobiqning barcha qatlamlariga faol salbiy ta’sir ko‘rsatmoqda. Sanoat-ishlab chiqarishning salbiy ta’siri, asosan, ikki yo`nalishda amalga oshmoqda: 1) tabiiy boyliklar (mineral, yer, o‘rmon, okean resurslari kabilar)ni o‘zlashtirish mobaynida; 2) ishlab chiqarish jarayonida.

Shuning uchun, Jahon sog’liqni saqlash tashkiloti tomonidan zaharli kimyoviy moddalarning ruxsat etilgan me’yoriy miqdorlari ishlab chiqilgan[9].

Zaharli kimyoviy moddalar o‘z nomi bilan zahardir. Mazkur moddalarning ta’siri faqatgini hayvonlar, hasharotlar yoki o‘simliklar uchun xavfli bo‘lmay, balki inson uchun ham zararlidir.

Xulosa: Sanoat zonalari va transport qatnovi yuqori bo‘lgan hududlarda ushbu mayda dispersli zarrachalarning miqdori JSST me’yorlaridan 5-7 barobargacha yuqori ekanligi aniqlandi.

Texnogen manbalarning atmosferaga salbiy ta’siri bugungi kunda antropogen inqirozning eng xavfli ko‘rinishlaridan biridir. Xulosa qilish mumkinki, ifloslanish tendensiyasi xuddi shu sur’atda davom etsa, 2050-yilga borib global harorat yana 1.5 ^{0}C dan 3-4 ^{0}C gacha ko‘tarilishi xavfi mavjud. Ekologik halokatning oldini olish uchun xalqaro ekologik kelishuvlar (masalan, Parij bitimi) talablarini qat’iy bajarish, sanoatda yopiq siklli texnologiyalarni qo‘llash va atmosfera monitoringini to‘liq raqamlashtirish talab etiladi.

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FIZIKA FANINI O'QITISHDA FORMATIV BAHOLASH ASOSIDA TANQIDIY FIKRLASHNI RIVOJLANTIRISHNING METODIK MODELI

Annotatsiya: *Mazkur maqolada fizika fanini o'qitishda formatif baholash asosida o'quvchilarning tanqidiy fikrlash kompetensiyalarini rivojlantirish metodikasini takomillashtirish masalasi yoritilgan. Tadqiqot doirasida kognitiv, operatsion va refleksiv komponentlardan iborat metodik model ishlab chiqildi hamda uning amaliy samaradorligi tajriba-sinov ishlari orqali asoslandi. Integratsion yondashuv asosida tashkil etilgan ta'lim jarayonida muammo asosida o'qitish, tajriba faoliyati, savol-javob va muhokama metodlari qo'llanildi.*

Kalit so'zlar: *formatif baholash, tanqidiy fikrlash, fizika ta'limi, metodik model, integratsion yondashuv, refleksiya.*

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METHODOLOGICAL MODEL OF DEVELOPING CRITICAL THINKING BASED ON FORMATIVE ASSESSMENT IN TEACHING PHYSICS

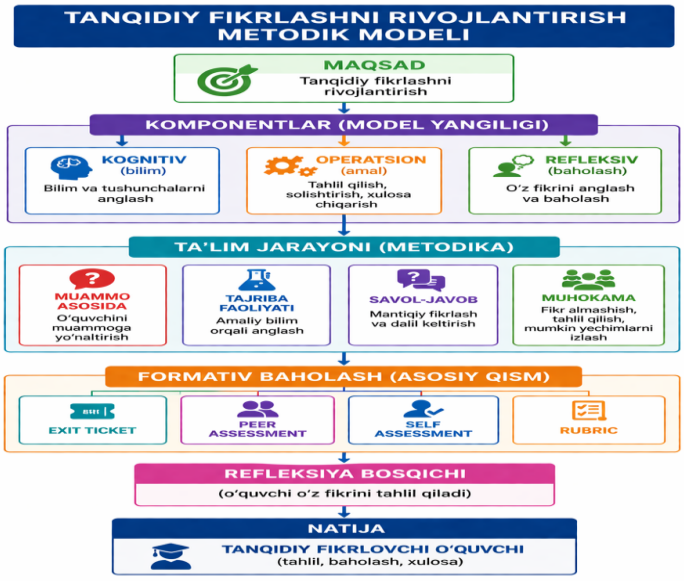
Abstract: *This article focuses on improving the methodology for developing students' critical thinking skills in physics education through formative assessment. Within the framework of the study, a methodological model consisting of cognitive, operational, and reflective components was developed, and its effectiveness was validated through experimental research.*

Keywords: *formative assessment, critical thinking, physics education, methodological model, integrative approach, reflection.*

Kirish. Zamonaviy ta'lim tizimida o'quvchilarning tanqidiy fikrlash kompetensiyalarini rivojlantirish ustuvor vazifalardan biri sifatida e'tirof etilmoqda. Global ta'lim tendensiyalari, xususan, kompetensiyaviy yondashuvning keng joriy etilishi ta'lim jarayonida faqat bilim berish bilan cheklanmasdan, balki o'quvchilarda mustaqil fikrlash, muammolarni tahlil qilish, dalillarga asoslangan xulosa chiqarish va qaror qabul qilish kabi yuqori darajadagi kognitiv ko'nikmalarni shakllantirish zarurligini taqozo etmoqda. Shu nuqtai nazardan, umumta'lim maktablarida o'quvchilarning tanqidiy fikrlash kompetensiyalarini rivojlantirish

dolzarb pedagogik muammo sifatida qaraladi. Fizika fani o‘zining mantiqiy, nazariy va tajribaviy xususiyatlari bilan o‘quvchilarda tanqidiy fikrlashni rivojlantirish uchun keng imkoniyatlarga ega. Fizik jarayon va hodisalarni o‘rganish jarayonida o‘quvchilar kuzatish, tahlil qilish, solishtirish, sabab-oqibat bog‘liqliklarini aniqlash hamda umumlashtirish kabi fikrlash amallarini bajarishga jalb etiladi. Ayniqsa, laboratoriya ishlari, tajribalar va muammo asosidagi vazifalar o‘quvchilarning faol bilish jarayonini faollashtirib, ularni ilmiy izlanish faoliyatiga yaqinlashtiradi. Biroq amaliyot shuni ko‘rsatadiki, ko‘plab holatlarda ta’lim jarayonida an’anaviy baholash yondashuvlari ustunlik qilib, o‘quvchilarning fikrlash faoliyatini chuqur rivojlantirishga yetarli darajada xizmat qilmayapti. Shu sababli, ta’lim jarayoniga formatif baholash metodlarini tizimli ravishda joriy etish zarurati yuzaga kelmoqda. Formativ baholash o‘quvchilarning o‘quv jarayonidagi rivojlanishini doimiy monitoring qilish, o‘z vaqtida teskari aloqa berish va ularning bilim hamda ko‘nikmalarini bosqichma-bosqich takomillashtirish imkonini yaratadi. Mazkur tadqiqotda fizika fanini o‘qitishda formatif baholash asosida o‘quvchilarning tanqidiy fikrlash kompetensiyalarini rivojlantirish metodikasini takomillashtirish masalasi ko‘rib chiqiladi. Tadqiqotning ilmiy yangiligi sifatida kognitiv, operatsion va refleksiv komponentlarga asoslangan metodik model ishlab chiqildi hamda uning samaradorligi tajriba-sinov ishlari orqali asoslandi. Ushbu model o‘quvchilarning nafaqat bilimlarini mustahkamlash, balki ularning analitik va tanqidiy fikrlash faoliyatini rivojlantirishga xizmat qiladi.

1. Tanqidiy fikrlash modeli.



Tadqiqotda tanqidiy fikrlashni rivojlantirishning quyidagi uch komponentli modeli ishlab chiqildi:

2-jadval. Tanqidiy fikrlash modeli.

Komponent	Mazmuni	Natija
Kognitiv	Fizik tushunchalar va qonunlarni bilish	Nazariy bilim
Operatsion	Masalalarni yechish, tajriba o‘tkazish	Amaliy ko‘nikma
Refleksiv	O‘z fikrini baholash va tahlil qilish	Tanqidiy yondashuv

Mazkur model o‘quvchilarning bilimni faqat o‘zlashtirish emas, balki uni tahlil qilish va baholashga yo‘naltirilganligini ko‘rsatadi.

Tadqiqot davomida quyidagi formatif baholash metodlarining samaradorligi asoslandi:

2-jadval. Formativ baholash metodlari.

Metod	Qo‘llanishi	Natija
Exit ticket	Dars oxirida qisqa savollar	Tushunish darajasini aniqlash
Peer assessment	O‘quvchilar bir-birini baholaydi	Tanqidiy tahlil
Self assessment	O‘z faoliyatini baholash	Refleksiya
Savol-javob	Muammoli savollar	Mantiqiy fikrlash
Rubric	Aniq mezon asosida baholash	Ob’ektivlik

Ushbu metodlar o‘quvchilarning faol ishtirokini ta’minlab, ularni fikrlashga majbur qiladi. Tadqiqotning asosiy natijasi sifatida formatif baholash va tanqidiy fikrlashni integratsiyalovchi metodik tizim ishlab chiqildi.

3-jadval. Integratsion metodik tizim

Bosqich	Mazmuni	Natija
Maqsad qo‘yish	Dars maqsadini aniqlash	Yo‘naltirilgan o‘qitish
Faoliyat	Tajriba, muammoli vaziyat	Faol o‘rganish
Baholash	Formativ baholash metodlari	Doimiy nazorat
Refleksiya	Natijani tahlil qilish	Tanqidiy fikrlash

Xulosa. Tadqiqot jarayonida ishlab chiqilgan metodik model fizika fanini o‘qitishda formatif baholash texnologiyalaridan tizimli foydalanish orqali o‘quvchilarning tanqidiy fikrlash kompetensiyalarini rivojlantirishda yuqori samaradorlikka ega ekanligi ilmiy-pedagogik jihatdan asoslandi. Mazkur modelning asosini tashkil etuvchi kognitiv, operatsion va refleksiv komponentlarning o‘zaro integratsiyalashuvi o‘quvchilarda bilimlarni chuqur anglash, ularni amaliy faoliyatda qo‘llash hamda o‘z fikrini mustaqil tahlil qilish ko‘nikmalarini bosqichma-bosqich shakllantirish imkonini berdi.

Shuningdek, tadqiqot natijalari shuni ko‘rsatdiki, formativ baholashning zamonaviy metodlari - exit ticket, peer assessment, self assessment va rubrikalardan foydalanish o‘quvchilarning o‘quv jarayonidagi faolligini oshiradi, ularning o‘z-o‘zini baholash va refleksiya qilish madaniyatini rivojlantiradi hamda o‘qituvchi va o‘quvchi o‘rtasidagi samarali teskari aloqani ta’minlaydi. Bu esa o‘z navbatida ta’lim jarayonining individuallashtirilishi va differensial yondashuvni amalga oshirish uchun zarur sharoit yaratadi.

Umuman olganda, ishlab chiqilgan metodik model fizika ta’limida innovatsion yondashuv sifatida baholanib, u o‘quvchilarning mustaqil fikrlash, muammoni hal etish va qaror qabul qilish kompetensiyalarini rivojlantirish orqali ta’lim samaradorligini oshirishga xizmat qiladi. Shu bilan birga, mazkur metodika pedagogik jarayonda formativ baholashning nazariy va amaliy imkoniyatlarini kengaytiradi hamda zamonaviy ta’lim talablariga mos keluvchi samarali o‘qitish tizimini shakllantirishga zamin yaratadi.

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CYNARA SCOLYMUS L. O‘SIMLIGINING MIKROFLORASINI O‘RGANISH MASALASINING ZAMONAVIY HOLATI

Annotatsiya. *Dunyoda zamonaviy ziroatchilik amaliyotida o‘simliklarning hosildorligi va ishlab chiqarish mahsuldorligini oshirishda o‘simliklarni o‘sishi va rivojlanishini jadallashtiruvchi rizobakteriyalar PGPR (plant growth-promoting rhizobacteria) dan foydalanish yo‘li bilan asosiy qishloq xo‘jalik ekinlarining hosildorligini oshirish, kasalliklardan himoya qilishda ayni mikroorganizmlarni tijorat maqsadida ishlab chiqarish va ulardan foydalanishga katta e‘tibor berilmoqda. O‘simliklar ildizlarida simbioz yashovchi PGPR lar o‘simligi urug‘ unuvchanligi, o‘sish va rivojlanish ko‘rsatgichlariga nisbati, fitostimulyatorlik hususiyatini aniqlash, fitopotogen zambrug‘larga nisbatan antogonistik faolligini aniqlash ilmiy va amaliy ahamiyatga egadir.*

Kalit so‘z: *PGPR, microflora, Cynara scolymus L., MALDI-TOF MS, Bacillus flexus, fitogormonlar - indol-aksitik kislota (IAA), gibberellinlar, sitokin.*

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THE CURRENT STATE OF RESEARCH ON THE MICROFLORA OF THE PLANT CYNARA SCOLYMUS L.

Abstract. *In modern global agricultural practice, great attention is paid to the commercial production and utilization of plant growth-promoting rhizobacteria (PGPR) to increase the yield and production productivity of major agricultural crops, as well as to protect them from diseases. Determining the effects of symbiotic root-associated PGPR on seed germination, plant growth, and development indicators, identifying their phytostimulatory properties, and evaluating their antagonistic activity against phytopathogenic fungi are of significant scientific and practical importance.*

Keywords: *PGPR, microflora, Cynara scolymus L., MALDI-TOF MS, Bacillus flexus, phytohormones — indole-acetic acid (IAA), gibberellins, cytokinin.*

Kirish. O‘simlikning ildiz yuzasi va unga yaqin tuproq qatlamida yashaydigan mikrob jamoalarining faoliyatini tadqiq qilish biotexnologiyaning istiqbolli yo‘nalishlaridan biridir. Artishok o‘simligining mikroflorasini o‘rganish zamonaviy tadqiqotlar doirasida muhim ahamiyatga ega hisoblanadi. Shuningdek artishok nafaqat ozuqa sifatida, balki dorivorlik xususiyatlari bilan ham tanilgan shuning uchun uning mikroflorasini o’rganish ya’ni uning yuzasida va ichida yashovchi mikroorganizmlar, zamonaviy genetik usullar yordamida tahlil qilinmoqda. 16S rRNK sekveynerlash va metagenomik tadqiqotlar orqali turli xil bakteriya turlari aniqlangan. O‘simlik mikroflorasi - o‘simliklar, shu jumladan artishokning, yuzasi va ichki qismlarida yashovchi mikroorganizmlar majmuasidir. Mikroflora turli mikroorganizmlardan, xususan, bakteriyalar va zamburug‘lardan

iborat. Bu mikroorganizmlar o‘simliklarning ozuqa moddalari va suvni qabul qilishini, shuningdek, stressga qarshi chidamliligini oshirishda muhim rol o’ynaydi. Artishok mikroflorasi, o‘z navbatida, o‘simlikning rivojlanishi va mahsuldorligiga bevosita ta'sir qiladi. Mikrofloraning xilma-xilligi va uning o‘simlik bilan o‘zaro aloqalari ekologik barqarorlikni ta‘minlashda muhim ahamiyatga ega hisoblanadi [1].

Zamonaviy tadqiqotlar mikrofloraning o‘simliklar bilan o‘zaro aloqasini, ularning simbiotik va antagonistik munosabatlarini, shuningdek, o‘simlik sog‘lig‘i va mahsuldorligiga ta'sirini o‘rganishda yangi metodologiyalarni qo‘llamoqda. Metagenomik va boshqa zamonaviy tadqiqot usullari yordamida mikrofloraning xilma-xilligini va uning artishokning turli qismi va muhitga bog‘liq holda qanday o’zgarishini aniqlash imkoniyati yaratilmoqda. Bu tadqiqotlar o‘simlik mikroflorasining kompleks ekotizimdagi rolini aniqlashga yordam beradi [2].

Zamonaviy biologiyada o‘simlik mikrobiomi o‘simliklarning mikroorganizmlari jamlanmasi yirik tadqiqot obyekti sifatida ko‘rib chiqilmoqda. O‘simlik mikrobiomi haqidagi tushunchalar, shuningdek, uning o‘simliklar bilan o‘zaro ta’siri, oziq-ovqat xavfsizligi va agrobiotexnologiyasi masalalarida dolzarbligini oshirdi. Mikrobiomning o‘simlik rivojlanishi va mahsuldorligiga ta‘siri va shuningdek, ularning ekologik tizimlar bilan aloqalari bo‘yicha tadqiqotlar qo‘llanilmoqda. Artishok mikrobiomi haqida olingan natijalar, uni ekish va parvarish qilish jarayonlarida qo‘llaniladigan innovatsion metodlarni ishlab chiqishga imkon yaratadi. O‘simlik mikroflorasining xilma-xilligi va ularning muhit bilan o‘zaro aloqalarini yaxshilash orqali, agroekologik barqarorlik va qishloq xo‘jaligida samaradorlikni oshirish mumkin [3].

Cynara scolymus L. o‘simligining mikroflorasini chuqur o‘rganish, uning o‘simlikning rivojlanishi va sog‘lig‘iga ta’sirini tahlil qilishdan iboratdir. Tadqiqot natijalari artishok mikroflorasini yanada chuqurroq tushunishga, shuningdek, ekologik barqarorlik va qishloq xo‘jaligi amaliyotlarida innovatsiyalarni qo‘llash imkoniyatlariga yo‘l ochishi kutilgan. Tadqiqot orqali olingan ma’lumotlar artishok ekinlarining parvarishini va ishlab chiqarishni yaxshilashga yordam berishi mumkin. *Cynara scolymus L.* mikroflorasining o‘simlik rivojlanishi va ekologik barqarorlikdagi rolini o‘rganish orqali, qishloq xo‘jaligi sohasida yanada barqaror va samarali ishlab chiqarish amaliyotlarini yaratishga yordam berishi aniqlangan. Artishok mikroflorasini o‘rganish jarayonida mavjud bilimlarni kengaytirish va yangi yo‘nalishlarni ochish muhimdir, bu esa qishloq xo‘jaligi rivojlanishida muhim ahamiyatga ega bo‘ladi. Mikroflora, uning o‘simlik rivojlanishi va agronomik ahamiyati bilan birga, artishokning o‘ziga xos ekologik talablari va shart-sharoitlarini yanada mukammal tushunishga yordam beradi. Shunday qilib, tadqiqotlar natijalari nafaqat tadqiqot bilimlarni, balki amaliy qishloq xo‘jaligi usullarini ham rivojlantirishga yordam beradi [4].

O‘simliklarni o‘sishi va rivojlanishini stimullovchi rizosfera bakteriyalarini umumiy nom bilan PGPR (plant growth –promoting rhizobacteria), ya’ni ingliz tilidan plant –o‘simlik, growth-o‘sish, promoting –stimullash, rhizobacteria –

rizosfera bakteriyalari, ya'ni o'simliklarning o'sishi va rivojlanishini tezlashtiruvchi ildiz atrofi bakteriyalari deb ataladi. Ko'plab tuproq bakteriyalari, o'simlikning rizosferasida yashab, turli mexanizmlar orqali o'simlik o'sishini rag'batlantirishi mumkin; ular o'sish uchun o'simliklarni rag'batlantiradi, masalan, fitogormonlar - indol-aksitik kislota (IAA), gibberellinlar va sitokinlar ishlab chiqarish, shuningdek, mineral moddalarni eritish, assimbiotik azot fiksatsiyalash, fitopatogen mikroorganizmlarga qarshi antibakterialni, vodorod sianid, sideroforlar ishlab chiqarish va antagonist faoliyat ko'rsatish orqali o'simliklarga foyda keltiradi [5]. PGPR o'simlik ildiz tizimi atrofidagi mavjud substrat va mineral almashinuvini ta'minlovchi eng muhim populyatsiya hisoblanadi O'simliklarni o'sishi va rivojlanishini jadallashtiruvchi rizobakteriyalar (PGPR) uchun umumiy xususiyatlar quyidagilar:

1) urug'larga inokulyatsiya qilingandan keyin yashab qolish xususiyati;

2) ildiz ekssudatlariga javob reaksiyasi sifatida spermosfera (urug' sirtidagi qism) da ko'payish;

3) ildizning yuzasi bo'ylab mustahkam o'rnashib olish va o'sishda davom etayotgan ildiz tizimiga koloniallanishiga yordam beradi. Shu sababli, qishloq xo'jaligida o'simliklarni yetishtirishda izchil va yaxshi natijalarga erishish uchun ochiq dala sinovlarida yuqori raqobatbardosh shtammlardan foydalanish ustuvor vazifa bo'lishi kerak. *Pseudomonas, Bacillus, Burkholderia, Stenotrophomonas, Micrococcus, Pantoea, Microbacterium* lar o'simlik rizosferasida eng ko'p uchraydigan endofitlar hisoblanadi. Rizosfera mikroflorasi o'simliklarning o'sishi va tashqi muhit omillariga chidamliligini oshirishga ijobiy ta'sir ko'rsatadi [6].

PGPR yuqori tuz konsentratsiyasidan kelib chiqadigan toksik ta'sirlarni kamaytirishga imkon beruvchi foydali xususiyatlarni namoyish etadi. PGPR tuzli muhitda o'simliklarning o'sishini ikkita asosiy usulda yaxshilashi mumkin:

1) tuz ta'sirida o'simliklarning javob tizimlarini faollashtirish yoki modulyatsiya qilish;

2) 2 stressga qarshi molekulalarni sintez qilish.

Sho'rlanish ta'siriga uchragan o'simliklarning o'sishi va chidamliligini oshirish mexanizmlari quyidagilardan iborat:

1) ozuqa moddalarining so'rilishini yaxshilaydi (masalan, N_2 fiksatsiyasi, tuproqdan bog'langan Na va K^+ ning chiqarilishi, xelatli temir);

2) suv muvozanatini saqlash; ion gomeostazasiga ta'sir etadi;

3) yuqori K^+/Na^+ nisbatini saqlab turish uchun K^+ ning tanlab yutilishining induksiyasi va Na^+ ning chiqarilishi;

4) Na^+ toksikligini kamaytirish uchun biofilm hosil bo'lish jarayonini ta'minlash;

5) ildiz arxitekturasining o'zgarishini ta'minlash;

6) antioksidant tizimning modulyatsiyasi qilish;

7) osmotik moddalarning modulyatsiyasi qilish;

8) o'simliklarning gormonal darajasini modulyatsiya qilish;

9) tuzga javob beruvchi genlarni modulyatsiya qilish.

Sho‘rlanish sharoitida PGPR turli mexanizmlari bo‘yicha tasniflanadi, ammo tuz stressi sharoitida ularning o‘simlik reaksiyasiga ta‘sirini tahlil qilish shuni ko‘rsatdiki, ularning faolligi hech qachon bitta mexanizmga bog‘liq emas va u turli xil tuproq-iqlim sharoitidan kelib chiqib o‘zini namayon qiladi. PGPR keng ko‘lamdagi qishloq xo‘jalik ekinlari rizosferasini koloniallaydi va o‘simliklarning o‘sishi va rivojlanishini stimullashda, fitopatogenlar sonini kamaytirishda hamda stress omillarga chidamlilikni oshirishda bevosita yoki bilvosita mexanizmlar bilan ishtirok etadi. O‘simliklar rizosferasida quyidagi sistematik guruhlarga mansub mikroorganizmlar *Acetobacter, Agrobacterium, Alkaligenes, Arthrobacter, Azoarcus, Azomonas, Azospirillum, Azotobacter, Bacillus, Clostridium, Derxia, Herbaspirillum, Enterobacter, Erwinia, Klebsiella, Pseudomonas* va boshqa tur vakillari uchrab turadi [7].

Ba’zi tadqiqotchilar *PGPR* lar o‘simlikning unib chiqish tezligini, ildiz o‘sishini, hosildorlikni, magniy miqdori, barg xajmi, xlorofill miqdori, oqsil miqdori, azot miqdori qurg‘oqchilikka chidamlilikni, novda va ildizlar massasini hamda gidravlik faollikni oshirishini, hamda o‘simlikning kasalliklarga qarshi chidamliligini oshirganligini tadqiqotlar natijasida o‘rganib chiqishgan [8].

PGPRlar va kimyoviy moddalar artishok (*Cynara scolymus L.*) urug‘larining unib chiqishi va ko‘chat o‘sish ko‘rsatkichlariga ta’sirini o‘rganish natijasida bir qancha tajribalar o‘tkazilgan. Fulvo kislotasi, gumin kislotasi va gumus bilan urug‘larni tayyorlash, PGPR ya’ni *Staphylococcus sp*. R27N7 va R38N2 shtammlari bilan urug‘larga ishlov berish natijasida o‘rtacha unib chiqish vaqtini mos ravishda 10,93% va 11,23% ga qisqartirgan. Fulvik kislota bilan davolashning o‘lchangan indekslarning o‘zgarishiga ta’siri nazorat bilan solishtirganda sezilarli emas edi. Ammo gumin kislotasi bilan ishlov berish ko‘chatlarning balandligi ko‘rsatkichlarini 90,33% ga, ko‘chatlarning quruq vaznini 90,70% ga, unib chiqish foizini 61,32% ga, o‘rtacha sutkalik unib chiqish 60,19% ga va nazoratga nisbatan 2,76 martaga ko‘paygan. Ushbu tadqiqot natijalariga ko‘ra, artishok urug‘ini o‘sishini rag‘batlantiradigan rizobakteriya shtammlari bilan ishlov berilgan urug‘ning o‘rtacha unib chiqish vaqtini qisqartirishi mumkin. Bundan tashqari, gumin kislotasi bilan astarlangan urug‘lar ko‘chatning quruq vaznini va urug‘larning ko‘p urug‘lanish ko‘rsatkichlarini yaxshilaydi. Ko‘rinib turibdiki, bu ko‘rsatkichlarning yaxshilanishiga asosan gumin kislotasining o‘simlik o‘sish gormoniga o‘xshash xususiyatlari, shuningdek, har ikkala bakterial shtammning o‘simlik o‘sishini rag‘batlantiruvchi xususiyatlari, ayniqsa ularning indol-3-sirka kislotasini ishlab chiqarish uchun stimulyator hisoblanadi [9].

Sho‘r ishqorli tuproqlarni yaxshilash va rivojlantirish hozirgi kunda issiq iqtisodiy va ilmiy masala bo’lib, sho‘r-ishqorli tuproqlarda o‘sadigan o‘simliklarning rizosfera mikroorganizmlari va ularning tuzlarga chidamliligi o‘rtasidagi bog‘liqlikni o‘rganish tegishli tadqiqotlarning asosiy nuqtasiga aylangan. Artishok o‘simliklarni ekish nafaqat tuproqdagi tuzning tarqalishini samarali o‘zgartirishi, balki tuproqning ko‘plab tuproq xususiyatlarini o‘zgartirishi mumkin. Qator xorij olimlarning tadqiqotlarida mikroorganizmlarning jamoa

tuzilishi va sho‘rlangan tuproqlarning turli xil xususiyatlari tavsiflangan, unda artishok o‘simligi sho‘rlangan tuproqda o‘sishi kuzatilgan. Ularning tadqiqoti shuni ko‘rsatdiki, artishok o‘simligini sho‘rlangan tuproqda yetishtirish tuproqning fizik-kimyoviy va fermentativ xususiyatlarini o‘zgartirgan bunga sabab sifatida PGPR mikroorganizmlari ko‘rsatilgan. Katalaza faolligi va namlik miqdori mikroorganizmlarga eng katta ta‘sir ko‘rsatadigan omillar edi. Ikki turdagi mikroorganizmlarning taxminiy genomlari (Gemmatimonas va Nitrospira*)* o‘rganib chiqish natijasida tuz stressiga yuqori darajada javob beradigan va sho‘rlangan tuproqda asosiy rol o‘ynashi mumkin bo‘lgan mikrobial turlar aniqlandi. Tadqiqotlar shuni ko‘rsatadiki sho‘rlangan yerlarni yaxshilash va iqtisodiy rivojlantirish imkonini berish uchun artishok rizosferasidagi mikroorganizmlarni muhim ahamiyatga ekanligi aniqlangan [10].

Tadqiqot uslublari va materiallar.

***Cynara scolymus L.*ni mikroflorasini laboratoriya sharoitida ajratib olish texnologiyasi hamda ozuqa muxitini tayyorlash.**

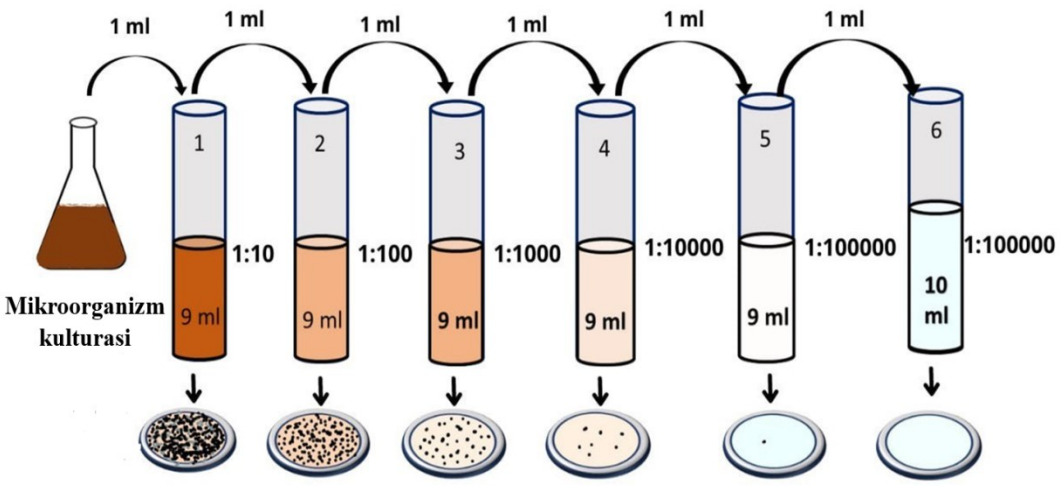
Rizosfera mikroorganizmlarini laboratoriya sharoitida ajratib olish, ozuqa muhitlarini tayyorlash va idintifikatsiya qilish uchun bir qancha olimlar ko’plab metodlar ishlab chiqgan. Ulardan Drigalskiy, P.Kox, Ye.S.Tepper, J.B. Fenn va Koichi Tanakaning usullaridan foydalangan holda tadqiqot o‘tkazildi.

Ushbu tadqiqotni amalga oshirishda quyidagi reaktiv va uskunalar foydalaniladi: Laminar boks, avtoklav, tarozi, pH metr, termostat, ozuqa muhiti uchun makro mikroelementlar, go‘sht peptonli bulion, agar-agar, qaynatgich, qog‘oz filtr, probirkalar, kolbalar, spirt lampa, bakterialogik ilmoq, shpatel.

2.2.1-§. R.Kox ning ketma-ket suyultirish usuli

Bu usuldan foydalangan holda o‘simlik ildiz namunalari olindi va sterillangan pintset bilan ildizga yopishgan tuproq ehtiyotlik bilan olinib sterillangan petri likobchasiga solindi. So‘ngra tuproqdan 1 g tortib olib sterillangan kolbaga solib, ustiga 99 ml sterillangan suv quyildi, bir ikki daqiqa davomida yaxshilab

Ketma-ket suyultirish usuli



chayqatildi, keyin sterillangan pipetka yordamida sterillangan suvga qo‘shib kolbada navbatdagi eritmalar hosil qilindi. 1:100000 yoki 1:1000000, undan yuqori 1:100000000 nisbatda eritma tayyorlandi (1-rasm).

1-rasm. Rizosfera mikroorganizmlarini ajratib olishda Suyultirish usulidan foydalanish ketma ketligi.

***Cynara scolymus L.* o‘simligining ildizidan ajratib olingan bakteriya izolyatlarini tur mansubligini MALDI-TOF MS tahlili yordamida aniqlash metodikasi**

Artishok o‘simligi ildizidan rezosfera mikroorganizmlarini sof kulturasini ajratib olingandan so‘ng J.B. Fenn va Koichi Tanaka metodikasi ya’ni MALDI-TOF MS (Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry) mass-spektrometriyasiga asoslangan metod orqali mikroorganizmlarni tur mansubligini aniqlash ko‘zda tutilgan. Ushbu metodika, asosan, biologik namunalarni, shu jumladan mikroorganizmlar, proteinlar va boshqa biomolekulalarni aniqlash va tahlil qilishda qo‘llaniladi. MALDI-TOF MS, shuningdek, turli xil ilmiy tadqiqotlar va klinik tadqiqotlarda keng qo‘llaniladi, chunki bu usul yuqori sezgirlik va tezlik bilan tahlil qilish imkonini beradi. Artishok o‘simligining rezosferasidan ajratib olingan sof kulturani MOLDI TOF MS da identifikatsiya qilishda o‘stirilgan mikroorganizmlarni sentrifugada ajratib olib, supernatantni olib tashlanadi va cho‘kmaga tushgan mikroorganizmlarni toza distillangan suvda qayta suspenziya qilinadi. Mikroorganizm suspenziyasini MOLDI TOF kyuvetasiga tomiziladi va matritsa (masalan, α-cyano-4-hydroxycinnamic acid) bilan aralashtiriladi. Tayyorlangan namunalarni MALDI-TOF MS qurilmasiga joylashtiriladi. Qurilma orqali spektrlar olish va mikroorganizmlarni identifikatsiya qilish uchun kerakli parametrlar tanlanib start tugmasi bosiladi. Olingan spektrlarni ma’lumotlar bazasi bilan solishtirish va tur mansubligini aniqlashn orqali artishok o‘simligi rezosferasida yashovchi mikroorganizmlarni idintifikatisyasi qilindi.

Olingan natijalar va ularning muhokamasi

Aniqlangan rizobakteriyalarni identifikasiya qilish va biotexnologik potentsialani baholash.

O‘simlik rizosferasida o‘simliklarning o‘sishi va rivojlanishini rag‘batlantirishda hal qiluvchi rol o‘ynaydigan o‘simlik o‘sishini rag‘batlantiruvchi rizobakteriyalar (PGPR) deb ataladigan foydali mikroorganizmlar joylashgan. PGPR ning qishloq xo‘jaligining uzoq muddatli hayotiyligi uchun ahamiyati muhim sanaladi. O‘simliklarning biotik va abiotik stressga chidamliligi, kimyoviy o‘g‘itlar va pestitsidlardan foydalanishning kamayishi, ozuqa moddalarining mavjudligi, tuproq unumdorligi va so‘rilishi *PGPR*ning potentsial afzalliklari sifatida qayd etilgan. PGPRning agroekotizimlardagi turli rollaridan biri o‘simlik o‘sishiga bevosita ta’sir ko‘rsatadigan fitogormonlar va boshqa metabolitlar sintezini oshirishdir. Fitopatogenlarni o‘z yo‘lida to‘xtatish, o‘simlikning tabiiy himoyasini kuchaytirish va hokazo. *PGPR* shuningdek, bioremediatsiya deb ataladigan jarayon

orqali tuproqni tozalashga yordam beradi. *PGPR* ning ko‘p funktsiyalari orasida indolil sirka kislotasi (IAA) ishlab chiqarish, ammiak (NH_3) ishlab chiqarish, vodorod siyanidi (HCN) ishlab chiqarish, katalaza ishlab chiqarish va boshqalar kiradi. Oziq moddalarni iste'mol qilishga yordam berishdan tashqari, PGPR ildiz hajmi va kuchini oshiradigan gormon ishlab chiqarishni nazorat qiladi. Ekinlar hosildorligini oshirish, atrof-muhit ifloslanishini kamaytirish va oziq-ovqat xavfsizligini kafolatlash barqaror qishloq xo‘jaligi uchun *PGPR*ni qo‘llashning ekologik va iqtisodiy afzalliklaridan faqat bir qismidir. O‘simliklar ildizlari bilan rizobakteriyalar o‘rtasidagi simbiotik munosabatlar o‘sish va yashovchanlik uchun muhim ahamiyatga ega.

Rizobakteriyalar:

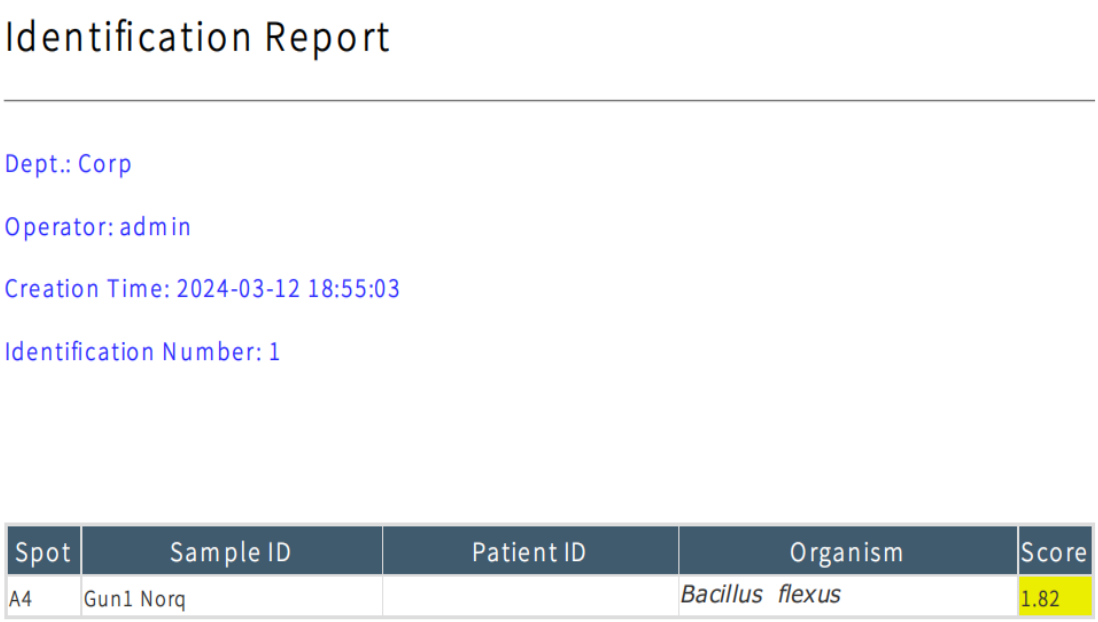
1. O‘simliklar ildizlari yaqinida yashab, ildizlar tomonidan chiqarilgan eksudatlardan oziqlanadi.

2. O‘z navbatida, rizobakteriyalar o‘simliklarga kerakli ozuqa moddalarini yetkazib beradi va ular uchun stressga qarshi chidamlilikni oshiradi.

3. Sho‘r tuproqlarda bu simbiotik munosabat ayniqsa muhim, chunki sho‘r sharoitda o‘simliklar va rizobakteriyalar birgalikda omon qolish strategiyalarini rivojlantirgan.

Rizobakteriyalarning sho‘r stressga chidamliligi, ularning o‘simlik o‘sishini rag‘batlantirish xususiyatlari, tuproqni tozalash va ozuqa moddalarini yetkazib berish imkoniyatlari ularni sho‘rlangan tuproqlarda samarali qo‘llash uchun muhim vositaga aylantiradi. Rizobakteriyalar - bu o‘simlik ildizlari bilan o‘zaro foydali aloqada yashaydigan bakteriyalar bo‘lib, ular tuproq unumdorligini oshirishda va o‘simliklarning turli stress omillariga, jumladan sho‘rlanishga bardoshligini oshirishda katta rol o‘ynaydi.

MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization-Time of Flight) mass-spektrometriya usuli mikroorganizmlarni, jumladan, bakteriyalar, zamburug‘lar va boshqa patogenlarni tez va aniq aniqlash uchun ishlatiladigan ilg‘or texnologiyalardan biri ekanligini inobatga olgan holda tadqiqotlarimiz davomida Jizzax viloyati O’zMU JF Biotexnologiya kafedrasining tadqiqot maydonida yetishtirilgan tikanli artishok o‘simligidan ajratib olingan rizobakteriyalarni GPA va LB qattiq ozuqa muhitlarida ekildi. Termostatda optimal harorat 25-30^{0}C da 24-48 soat davomida o‘stirildi. Olingan tajribalar natijasida petri likopchalarda o‘sib chiqqan rizobakteriayalarning sof kulturasini MALDI-TOF mass-spektrometriya usuli orqali identifikatsiyasi amalga oshirildi. Tahlil natijalariga ko’ra, ildiz mikroflorasidan olingan namunalarda *Bacillus flexus* bakteriyasi mavjudligi identifikatsiya qilindi (2-rasm). Ushbu identifikatsiya tadqiqotlari O‘zbekiston Respublikasi Fanlar akademiyasi Mikrobiologiya institutining xodimlari bilan hamkorlikda olib borildi.



Identification Report

Dept.: Corp

Operator: admin

Creation Time: 2024-03-12 18:55:03

Identification Number: 1

Spot	Sample ID	Patient ID	Organism	Score
A4	Gun1 Norq		*Bacillus flexus*	1.82

2.-rasm. MALDI-TOF mass-spektrometriya tahlili natijalari

Tikanli artishok ildiz rizosferasidan ajratib olingan mikroorganizmlarni MALDI-TOF mass-spektrometriya usuli orqali identifikatsiya qilish natijasida *Bacillus flexus* borligi aniqlandi. Olingan tahlil natijalariga ko‘ra *Bacillus flexus*ning o‘simlik o‘sishidagi ahamiyati tahlil qilindi.

Bacillus flexus bakteriyasi PGPR sifatida bir qancha foydali xususiyatlarga ega bo‘lib, o‘simliklarning o‘sishini rag‘batlantirishda va ildiz tizimini yaxshilashda qo‘llaniladi. *Bacillus flexus* o‘zining azotli birikmalarni o‘zlashtirish yoki azotni o‘simliklar uchun mavjud shaklga o‘zgartirish qobiliyatiga ega bo‘lishi mumkin. Ba’zi PGPRlar o‘zlarida azot fiksatsiya qiluvchi faoliyatni amalga oshiradi, ya’ni ular atmosfera azotini o‘simliklar tomonidan o‘zlashtiriladigan shaklga (ammiak yoki nitrat) aylantiradi. Azot, o‘simliklar uchun muhim ozuqa bo‘lib, o‘sish va rivojlanish uchun zarurdir. *Bacillus flexus* bu jarayonda o‘simliklarning azot talablarini qondirishga yordam beradi. PGPR bakteriyalarining o‘simlik ildizlariga yaqinlashib, ular bilan simbiotik aloqalar o‘rnatishi o‘simliklarning ildiz tizimini yaxshilaydi, ildizlarning kengayishiga yordam beradi va o‘simliklarning ozuqa moddalari va suvni o‘zlashtirish imkoniyatini oshiradi.

Bacillus flexus bakteriyasi o‘simliklarni kasalliklardan himoya qiluvchi **antimikrobial** faollik ko‘rsatishi mumkin. PGPRlar orasida o‘simliklarga foydali bo‘lgan va zararli patogenlarga qarshi raqobatlashadigan bakteriyalar mavjud. *Bacillus flexus*, o‘zining antibakterial va antifungal xususiyatlari yordamida o‘simliklarni kasalliklardan himoya qilishi mumkin. Masalan, bu bakteriya o‘simliklarning ildiz tizimida patogen mikroorganizmlarga qarshi kurashadi va o‘simlik kasalliklarining rivojlanishiga to‘sqinlik qiladi.

Xulosa

Cynara scolymus L. ildiz rizosferasida uchraydigan rizobakteriyalarni ajratib olish bo‘yicha dastlabki qadamlar muvaffaqiyatli amalga oshirildi. Tadqiqotda Jizzax viloyati iqlim sharoitida birinchi marta artishokning ildiz rizosferasida uchraydigan rizobakteriyalar o‘rganildi va ajratib olindi. Bu bakteriyalar o‘simliklarning o‘sishiga yordam beradigan foydali mikroorganizmlar sifatida tanlandi.

MALDI-TOF mass-spektrometriya usuli yordamida ajratib olingan rizobakteriyalarning identifikatsiyasi amalga oshirildi. Aniqlangan *Bacillus flexus* mikroorganizmi o‘zining biologik xususiyatlari va foydali ta’sirlariga ko‘ra, o‘simliklarning o‘sishini rag‘batlantirishda ahamiyatlidir. Tadqiqot davomida *Bacillus flexus* turiga mansub mikroorganizmlar asosida sanoat miqyosida ishlab chiqariladigan mahsulot olish texnologiyasi loyihasi ishlab chiqildi. Ushbu loyihada ***Bacillus flexus***ning biotexnologik potensiali, uning o‘simlik o‘sishini rag‘batlantiruvchi va sanoatga yaroqli mahsulotlar ishlab chiqarishga qodirligi ko‘rsatildi.

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O'ZBEKISTONDA SIRKULYAR IQTISODIYOT MODELINI JORIY ETISH IMKONIYATLARI

Annotatsiya. *Mazkur tadqiqotda O'zbekistonda sirkulyar iqtisodiyot modelini joriy etish imkoniyatlari iqtisodiy, ekologik va institutsional nuqtai nazardan tahlil qilinadi. Tadqiqotda resurslardan samarali foydalanish, chiqindilarni qayta ishlash tizimini rivojlantirish, yashil iqtisodiyotga o'tish omillari ko'rib chiqilgan. O'zbekiston sharoitida sirkulyar iqtisodiyot modelini rivojlantirish uchun mavjud salohiyat, xususan qayta ishlash sanoati, investitsiya imkoniyatlari va davlat siyosati asosiy omil sifatida baholanadi. Tadqiqot natijasida ushbu modelni joriy etish bo'yicha amaliy taklif va tavsiyalar ishlab chiqilgan.*

Kalit so'zlar. *sirkulyar iqtisodiyot, resurs samaradorligi, chiqindilarni qayta ishlash, yashil iqtisodiyot, barqaror rivojlanish, ekologik siyosat, iqtisodiy imkoniyatlar.*

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OPPORTUNITIES FOR IMPLEMENTING THE CIRCULAR ECONOMY MODEL IN UZBEKISTAN

Annotation. *This study examines the opportunities for implementing the circular economy model in Uzbekistan from economic, environmental, and institutional perspectives. It focuses on resource efficiency, waste management systems, and the transition to a green economy. The research evaluates the existing potential in Uzbekistan, including recycling industries, investment opportunities, and government policies. Based on the analysis, practical recommendations are proposed for effective implementation of the circular economy model.*

Keywords. *Circular economy, resource efficiency, waste recycling, green economy, sustainable development, environmental policy, economic opportunities.*

Kirish. Hozirgi davrda global iqtisodiyotda resurslarning cheklanganligi va ekologik muammolarning kuchayishi iqtisodiy rivojlanishning yangi modelini talab qilmoqda. Zero, an'anaviy chiziqli iqtisodiyot modeli resurslarning ayovsiz ishlatilishiga va tez tugashiga, chiqindilar hajmining keskin ortishiga olib kelmoqda. Shu nuqtai nazardan sirkulyar iqtisodiyot modeli resurslardan samarali foydalanish, chiqindilarni minimallashtirish va iqtisodiy tizimni yopiq sikl asosida tashkil etishni nazarda tutadi. Shu bois, O'zbekiston uchun ushbu modelni joriy etish ayniqsa dolzarb hisoblanadi. Chunki mamlakatda sanoatlashuv jarayonlari jadallashmoqda va ekologik muammolar ortib bormoqda. Shu bilan birga, qayta ishlash sanoatini rivojlantirish uchun katta iqtisodiy imkoniyatlar mavjudligi va undan samarali foydalanish ustuvor ekanligi nazardan chetda qolmasligi kerak.

O'zbekiston sirkulyar iqtisodiyot modelini rivojlantirish uchun katta iqtisodiy va institutsional imkoniyatlarga ega mamlakat hisoblanadi. Xususan, mamlakatda avvalo, normativ-huquqiy asoslarning shakllanishi muhim ahamiyat kasb etadi. So'nggi yillarda mamlakatda ekologiya va chiqindilarni boshqarish bo'yicha muhim rasmiy hujjatlar qabul qilindi. Bularga, Chiqindilarni boshqarish strategiyasi (2019–2028), Yashil iqtisodiyot strategiyasi (2019–2030) va chiqindilarni qayta ishlash bo'yicha davlat dasturlarini namuna sifatida keltirish mumkin. Aynan, ushbu rasmiy hujjatlar sirkulyar iqtisodiyot joriy etilishi va rivojlanishining institutsional asosini tashkil etmoqda. Bunda mamlakat uchun eng muhim jihatlardan biri qayta ishlash sanoatining rivojlanish imkoniyatining ta'minlangani hisoblanadi. Bugungi kunda mamlakatda chiqindilarni qayta ishlash bilan shug'ullanadigan 300 ga yaqin korxona faoliyat yuritayotgani katta yutuq hisoblanadi. Masalan, plastikni qayta ishlash va resursga aylantirish, qog'ozni qayta ishlash va xomashyo sifatida foydalanish mumkin bo'lgan holatga keltirish, metall chiqindilarni qayta ishlash va xomashyoga aylantirish, rezina chiqindilarni qayta ishlash borasidagi faoliyat olib borayotgan korxonalar ahamiyat kasb etadi. Chunki, bular mamlakatda sirkulyar iqtisodiyot rivojlanishi uchun muhim sanoat bazasini yaratadi va istiqbolli tendensiyalarning yo'nalishlarini belgilab beradi. Bundan tashqari, energiya ishlab chiqarishda chiqindidan foydalanish tabiiy resurs zaxirasi barqarorligini ta'minlash va ekologik muammolarning oldini olish, chiqindilarni samarali boshqarish va undan unumli iste'foda qilish uchun alohida ahamiyat kasb etadi. Zero, kelajakda chiqindidan energiya ishlab chiqarish katta iqtisodiy imkoniyatlar yaratib beradi. Masalan, 2027-yilgacha chiqindilarni yoqish asosida 11 ta elektr stansiya qurish rejalashtirilgan bo'lib, ular yiliga 2,1 milliard kWh elektr energiya ishlab chiqarish quvvatiga ega bo'lishi ko'zda tutilgan. Bu esa mamlakatda energiya ishlab chiqarishni diversifikatsiya qilishga, chiqindilar hajmini kamaytirishga va yangi ish o'rinlari yaratishga xizmat qiladi.

Tadqiqot maqsadi. Milliy ishlab chiqarishda sirkulyar iqtisodiyot modelini joriy etish imkoniyatlarini aniqlash va uni rivojlantirish bo'yicha ilmiy asoslangan takliflar ishlab chiqish tadqiqotning **asosiy maqsad** hisoblanadi.

Tadqiqot vazifalari. Maqsaddan kelib chiqqan holda tadqiqot vazifalari:

•¬ Ishlab chiqarish jarayonini tashkil etish va resurslardan foydalanish

nuqtai nazaridan sirkulyar modelning nazariy asoslarini o‘rganish;

- ¬ Sirkulyar iqtisodiyot bo’yicha xalqaro tajribani tahlil qilish;
- ¬ Milliy iqtisodiyotda bu borada mavjud imkoniyatlarni baholash;
- ¬ Institutsional va iqtisodiy mexanizmlarni aniqlash;
- ¬ Sirkulyar modelni joriy etish borasida amaliy tavsiyalar berishdan iborat.

Tadqiqot obyekti – bu milliy iqtisodiyotda ishlab chiqarish amaliyoti va unda resurslardan foydalanish tizimi hisoblanadi.

Tadqiqot predmeti – bu sirkulyar iqtisodiyot modelini joriy etish jarayonida kelib chiqadigan iqtisodiy va institutsional munosabatlardan iborat.

Tadqiqot metodologiyasi. Tadqiqotni amalga oshirish jarayonida ilmiy abstraksiya, induksiya va deduksiya, statistik tahlil, qiyosiy (komparativ) tahlil, tizimli yondashuv, iqtisodiy baholash metodlariga asoslanilgan.

Mazkur tadqiqot sirkulyar iqtisodiyot nazariyasini rivojlantirishga hissa qo‘shadi hamda rivojlanayotgan davlatlar sharoitida ushbu modelni joriy etishning ilmiy asoslarini boyitadi. Tadqiqotning amaliy ahamiyati sifatida davlat siyosatini shakllantirishda, chiqindilarni boshqarish tizimini takomillashtirishda va yashil iqtisodiyotga o‘tishda foydalanish mumkin.

Muhokama. Milliy ishlab chiqarish tizimida sirkulyar iqtisodiyot modelini joriy etish uchun muayyan institutsional, iqtisodiy va resurs bazasi mavjud. Biroq ushbu imkoniyatlar bilan bir qatorda tizimli muammolar ham mavjudligi inobatga olinishi zarur. Milliy ishlab chiqarishdagi imkoniyatlar (Opportunities) sifatida chiqindilarni qayta ishlash sanoatining rivojlanishi so‘nggi yillarda chiqindilarni qayta ishlash sohasi sezilarli darajada rivojlanmoqda. Mamlakatda 300 ga yaqin qayta ishlash korxonalari faoliyat yuritmoqda. Masalan, plastik chiqindilarni qayta ishlash korxonalarini (PET butilkalarni granula holiga keltirish), qog‘oz chiqindilaridan karton ishlab chiqaruvchi zavodlarini, metall chiqindilarini qayta eritish orqali xomashyo olish amaliyotlarini ko’rsatish mumkin. Xususan, Toshkent viloyatidagi ayrim kompaniyalar plastik chiqindilarni qayta ishlash asosida eksportbop mahsulotlar ishlab chiqarmoqda, shuningdek, Namangan va Andijonda qog‘ozni qayta ishlash korxonalari ichki bozorni qisman bu mahsulotlar bilan ta’minlamoqda. Bu holat shuni ko‘rsatadiki, chiqindilar endi faqat chiqindi emas, balki iqtisodiy resursga aylanmoqda.

Mamlakatda, ekologik siyosatining kuchayishi sifatida so‘nggi yillarda davlat tomonidan ekologiya va sirkulyar iqtisodiyot yo‘nalishida muhim islohotlar amalga oshirilmoqda. Masalan, chiqindilarni boshqarish tizimini modernizatsiya qilish bo‘yicha davlat dasturlari, maxsus ekologik tashkilot va agentliklarning tashkil etilishi, qayta ishlashni rag‘batlantiruvchi normativ-huquqiy hujjatlar qabul qilinishi shular jumlasidandir. Xususan, chiqindilarni saralash tizimini joriy etish bo‘yicha pilot loyihalar amalga oshirilmoqda, ayrim hududlarda chiqindilarni alohida yig‘ish konteynerlari o‘rnatilgan. Bu siyosat mamlakatda sirkulyar iqtisodiyot uchun institutsional asos yaratmoqda.

Xorijiy investitsiyalarni jalb qilish ustuvor yo’nalishlardan biri bo’lgani uchun bugungi kunda sirkulyar iqtisodiyot modelini joriy etish va kengaytirish

borasida xorijiy investitsiyalar oqimi muttasil ravishda ortib bormoqda. Masalan, Xitoy va Janubiy Koreya investorlari chiqindilarni qayta ishlash zavodlarini qurmoqda, Yevropa Ittifoqi grantlari orqali ekologik loyihalar moliyalashtirilmoqda, Xalqaro moliya institutlari “yashil iqtisodiyot” loyihalarini qo‘llab-quvvatlamoqda. Xususan, Toshkent va Samarqandda chiqindidan energiya ishlab chiqarish (waste-to-energy) loyihalari rejalashtirilgan, qayta tiklanuvchi energiya va chiqindi qayta ishlash loyihalariga investitsiyalar oshmoqda.

Bu esa sirkulyar iqtisodiyotga o‘tishda moliyaviy resurs bazasi shakllanayotganini ko’rsatadi. Mavjud imkoniyatlarga qaramay, O‘zbekistonda chiqindilarni qayta ishlash darajasi taxminan 5–10% atrofida bo’lib, u kam hajmni tashkil etadi. Bu muammoning mohiyati chiqindilar saralanmagan holda yig‘ilishiga, katta hajmdagi chiqindilar poligonlarga yuborilishiga, ikkilamchi xomashyo yetarli darajada qayta ishlanmasligiga borib taqaladi. Masalan, maishiy chiqindilarning katta qismi (organik, plastik, qog‘oz aralash holda) chiqindi poligonlariga tashlanadi, qayta ishlash korxonalari xomashyo yetishmagani uchun to‘liq quvvatda ishlamaydi. Bu holat iqtisodiyotda katta miqdordagi yo‘qotilgan resurslar mavjudligini bildiradi.

Texnologik bazaning yetarli emasligi ham muhim muammolardan hisoblanadi. Ko‘plab qayta ishlash korxonalari zamonaviy texnologiyalar bilan yetarli darajada ta’minlanmagan. Ushbu muammoning sabablari yuqori texnologiyali uskunalarning qimmatligi, mahalliy ishlab chiqarishning sustligi, texnologiya transferining cheklanganligi kabilar hisoblanadi. Masalan, plastik chiqindilarni chuqur qayta ishlash va kimyoviy qayta ishlash texnologiyalari deyarli mavjud emas. Elektron chiqindilarni qayta ishlash tizimi rivojlanmagan.

Natijada chiqindilar to‘liq qayta ishlanmaydi va yuqori qo‘shimcha qiymat yaratilmaydi. Aholining ekologik madaniyati talab darajasida shakllanmaganligi va pastligi ham muammolar qatorida mavjud. Sirkulyar iqtisodiyotning muvaffaqiyati ko‘p jihatdan aholining xulq-atvoriga bog‘liq bo’lib, muammoning ko‘rinishlari, chiqindilarni saralab tashlash odati shakllanmagan, qayta ishlashning ahamiyati yetarli darajada anglashilmagan va ekologik mas’uliyat talab darajasida rivojlanmaganligida yuzaga chiqadi. Masalan, alohida chiqindi konteynerlari mavjud bo‘lsa ham, ko‘pincha chiqindilar aralash tashlanadi, plastik chiqindilar ko‘chalarda yoki ochiq hududlarda tashlab ketiladi. Bu esa sirkulyar tizimning asosiy bosqichi — saralash jarayonini izdan chiqaradi. Sirkulyar iqtisodiyot chiqindilarni qayta ishlash, yashil energetika, qayta tiklanuvchi energiya, bioiqtisodiyot sohalariga investitsiya jalb qilish imkonini beradi.

Bu esa iqtisodiy o‘sishga yangi turtki bo’ladi. Shuningdek, sirkulyar iqtisodiyot chiqindi logistika tizimini, qayta ishlash sanoatini, ekologik xizmatlarni, “yashil texnologiyalar”ni va boshqa shu kabi yangi sohalarni rivojlantirish orqali yangi ish o‘rinlari yaratishga xizmat qiladi. Natijada yangi ish o‘rinlari paydo bo‘lib, aholining bandlik darajasi ortadi. Sirkulyar iqtisodiyot loyihalari katta investitsiyalar talab qilgani uchun moliyalashtirish muammolari mavjud. Masalan, chiqindilarni qayta ishlash zavodlarini qurish, energiya ishlab chiqarish

texnologiyalarini joriy etish, ekologik infratuzilmani barpo qilish kabilarni namuna sifatida keltirish mumkin. Bu vaziyat davlat va xususiy sektor hamkorligini talab qilishi mumkin. Ko‘plab rivojlangan mamlakatlarda chiqindilarni toifasi va turi bo’yicha alohida yig‘ish tizimi shakllangan.

Ammo O‘zbekistonda chiqindilarni saralash madaniyati yetarli darajada shakllanmagan, aholining ekologik savodxonligi talab darajasida emas. Bu sirkulyar iqtisodiyot rivojlanishiga to’g’anoq bo’ladi va uni sekinlashtiradi. Ayni paytda, ayrim institutsional muammolar mavjud bo’lib, davlat organlari o‘rtasida koordinatsiya yetarli darajada rivojlanmagan, monitoring tizimi zaif, iqtisodiy rag‘batlantirish mexanizmlari cheklangan. Milliy ishlab chiqarish tizimida sirkulyar iqtisodiyot rivojlanishini tezlashtirish uchun chiqindilarni saralash tizimini joriy etish orqali har bir hududda plastic, qog‘oz, shisha, organik chiqindilar alohida yig‘ilishi kerak. Shuningdek, “Yashil texnologiyalar”ni joriy etish uchun chiqindidan energiya ishlab chiqarish, biogaz texnologiyalarini qo’llash va qayta ishlash texnologiyalaridan foydalanish zarur. Bundan tashqari, investitsiyalarni rag‘batlantirish uchun davlat tomonida, soliq imtiyozlarini, subsidiyalarni, davlat-xususiy sheriklik (PPP) amaliyotini joriy qilish kerak. Ekologik madaniyatni rivojlantirish uchun maktablarda ekologik ta’limni tashkil etish, ommaviy axborot kampaniyalarida tashviqotlar qilish, chiqindilarni saralash va ajratish uchun targ‘ibot ishlarini amalga oshirish zarur.

Sirkulyar iqtisodiyot XXI asr ijtimoiy-iqtisodiy taraqqiyotining muhim modeli bo’lib, bu modelda resurslardan samarali foydalanish, chiqindilarni kamaytirish va ekologik barqarorlikni ta’minlash imkoniyatini ta’minlangan.

Tadqiqotning xulosa va takliflari. Tadqiqot natijasida milliy ishlab chiqarish tizimida sirkulyar iqtisodiyot uchun katta iqtisodiy imkoniyatlar mavjudligi aniqlandi, qayta ishlash sanoatini rivojlantirish ustuvor yo‘nalish sifatida qabul qilinadi, institutsional mexanizmlarni kuchaytirish zarurligi asoslab berildi. Shu bois, O‘zbekiston iqtisodiyoti uchun sirkulyar iqtisodiyot modelini joriy etish strategik ahamiyatga ega bo’lib, ushbu model ishlab chiqarishda resurslardan samarali foydalanishni ta’minlaydi, ekologik muammolarni kamaytiradi, iqtisodiy o‘sishni rag‘batlantiradi.

Umumiy tahlillardan milliy ishlab chiqarish tizimida sirkulyar iqtisodiyotni joriy etish uchun davlat siyosatining mavjudligi, investitsiya oqimi oshayotganligi, sanoat shakllanayotganligi kuchli tomonlar sifatida, tizimli infratuzilma yetishmasligi, texnologiya past darajadaligi, aholi ishtiroki sustligi zaif tomonlar sifatida kelib chiqmoqda. Shu bois xulosa sifatida O‘zbekistonda sirkulyar iqtisodiyot modelini joriy etish uchun imkoniyatlar mavjud bo’lib, lekin tizim hali shakllanmaganligini aytish mumkin. Shuning uchun mamlakatda infratuzilmani rivojlantirish, texnologiyalarni modernizatsiya qilish va aholining ekologik madaniyatini oshirish ustuvor vazifa bo’ladi. Shu sababli sirkulyar iqtisodiyot modelini joriy etish mamlakatning barqaror rivojlanish strategiyasining muhim yo‘nalishlaridan biri bo‘lishi zarur.

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"AXBOROT TIZIMLARI VA TEXNOLOGIYALARI" YO‘NALISHI TALABALARIGA SUN'IY INTELLEKT TEXNOLOGIYALARIDAN FOYDALANGAN HOLDA DASTURLASHNI O‘RGATISH METODIKASINI TAKOMILLASHTIRISH

Annotatsiya. *Ushbu maqolada Toshkent amaliy fanlar universiteti “Axborot tizimlari va texnologiyalari” yo‘nalishi talabalariga dasturlashni o‘rgatishda sun’iy intellekt (SI) texnologiyalaridan foydalanishning samarali metodikasi tahlil qilinadi. Tadqiqotda an’anaviy o‘qitish usullari bilan SI asosidagi yondashuvlar — xususan, kod generatsiyasi, avtomatlashtirilgan fikr-mulohaza tizimlari va moslashuvchan o‘qitish platformalari — qiyosiy jihatdan o‘rganildi. ChatGPT, GitHub Copilot va boshqa vositalar asosida tashkil etilgan amaliy mashg‘ulotlarda 60 nafar talaba ishtirok etdi. Natijalar gibrid metodika qo‘llangan guruhlarda o‘rtacha akademik ko‘rsatkich 30,6% ga oshganini, mustaqil muammoni hal qilish ko‘nikmalari esa 78% ga yaxshilanganini ko‘rsatdi. Maqola oliy ta’lim muassasalarida dasturlash fanlarini o‘qituvchi pedagoglar uchun amaliy tavsiyalar bilan yakunlanadi. Tadqiqot natijalari “Raqamli O‘zbekiston — 2030” strategiyasi doirasida IT ta’limini rivojlantirish uchun muhim ahamiyatga ega.*

Kalit so‘zlar: *sun’iy intellekt; dasturlashni o‘rgatish; moslashuvchan ta’lim; kod generatsiyasi; avtomatlashtirilgan fikr-mulohaza; GitHub Copilot; raqamli ta’lim metodikasi.*

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IMPROVING THE METHODOLOGY OF TEACHING PROGRAMMING TO STUDENTS OF THE “INFORMATION SYSTEMS AND TECHNOLOGIES” PROGRAM USING ARTIFICIAL INTELLIGENCE TECHNOLOGIES

Abstract. *This article analyzes an effective methodology for teaching programming to students of the "Information Systems and Technologies" program at Tashkent University of Applied Sciences through the use of artificial intelligence (AI) technologies. The study comparatively examines traditional teaching approaches and AI-based methods, including code generation, automated feedback systems, and adaptive learning platforms. Practical sessions organized with the support of ChatGPT, GitHub Copilot, and similar tools involved 60 students. The results show that in groups where the hybrid methodology was applied, the average academic performance increased by 30.6%, while students' independent problem-solving skills improved by 78%. The article concludes with practical recommendations for instructors teaching programming courses in higher education institutions. The findings are significant for advancing IT education within the framework of the "Digital Uzbekistan — 2030" strategy.*

Keywords: *artificial intelligence; programming education; adaptive learning; code generation; automated feedback; GitHub Copilot; digital pedagogy.*

Kirish

Zamonaviy raqamli iqtisodiyot sharoitida axborot texnologiyalari mutaxassislarini tayyorlash masalasi nafaqat milliy, balki global darajada dolzarb ahamiyat kasb etmoqda. O‘zbekiston Respublikasining "Raqamli O‘zbekiston — 2030" strategiyasi doirasida IT sohasidagi kadrlar tayyorlash sifatini oshirish muhim ustuvor yo‘nalishlardan biri sifatida belgilangan [1]. Ushbu kontekstda Toshkent amaliy fanlar universiteti "Axborot tizimlari va texnologiyalari" yo‘nalishidagi talabalar uchun dasturlash fanlarini o‘qitishning samarali metodikasini ishlab chiqish pedagog-olimlar oldida turgan asosiy vazifa bo‘lib qolmoqda.

So‘nggi yillarda sun'iy intellekt texnologiyalari ta’lim sohasiga jadal kirib kelmoqda. Xususan, ChatGPT, GitHub Copilot, Tabnine va shunga o‘xshash vositalar dasturchi mutaxassislar va talabalarga kod yozishda, xatolarni aniqlashda va murakkab algoritmik masalalarni tushunishda bevosita yordam berib, ta’lim jarayonini tubdan o‘zgartirmoqda [2]. Biroq, bu texnologiyalarni pedagogik jihatdan to‘g‘ri integratsiyalash, talabaning mustaqil fikrlash qobiliyatini rivojlantirish va sohaviy ko‘nikmalarni chuqur shakllantirish muammolari hal etilishini kutmoqda.

Toshkent amaliy fanlar universitetida o‘tkazilgan dastlabki kuzatuvlar shuni ko‘rsatmoqdaki, talabalarning 68% i dasturlash mashg‘ulotlarida o‘z mustaqil bilimiga emas, balki tayyor kod misollariga tayanadi, bu esa chuqur tushunish va ijodiy yondashuv ko‘nikmalarining rivojlanishiga to‘sqinlik qiladi [3]. Bunday holat an'anaviy o‘qitish metodlarining zamonaviy ehtiyojlarga mos kelmasligini yaqqol namoyon etadi.

Ushbu tadqiqotning maqsadi — SI texnologiyalarini dasturlashni o‘qitishda maqsadga muvofiq qo‘llash orqali talabalarning kognitiv qobiliyatlarini rivojlantiruvchi va amaliy ko‘nikmalarni chuqurlashtiruvchi yangi pedagogik metodikani ishlab chiqish va uning samaradorligini eksperimental tarzda isbotlashdan iborat.

Tadqiqot quyidagi vazifalarni hal etishga qaratilgan: dasturlashni o‘rgatishda qo‘llaniladigan SI vositalarini tasniflashtirish; moslashuvchan o‘qitish va avtomatlashtirilgan fikr-mulohaza tizimlarini pedagogik jarayonga integratsiyalash modelini ishlab chiqish; tajriba-sinov mashg‘ulotlarini o‘tkazish va olingan natijalarni empirik tahlil qilish.

Usullar

Tadqiqot 2025–2026 o‘quv yilining kuz semestri davomida Toshkent amaliy fanlar universitetining "Axborot tizimlari va texnologiyalari" yo‘nalishi 1-kurs talabalari (n = 60) bilan o‘tkazildi. Ishtirokchilar ikkita tenglashtiriilgan guruhga — tajriba guruhi (n = 30) va nazorat guruhi (n = 30) — bo‘lindi. Guruhlarga taqsimlash dastlabki sinovlar natijalari asosida tasodifiy amalga oshirildi, ikkala guruhning boshlang‘ich bilim darajasi statistik jihatdan teng ekanligini ta’minlash uchun Mann–Whitney U testi qo‘llanildi ($p > 0.05$).

Nazorat guruhi an'anaviy o‘qitish usuli asosida ta’lim oldi: dars-ma’ruza, laboratoriya topshiriqlari va o‘qituvchi tomonidan beriladigan yozma fikr-mulohaza. Tajriba guruhiga esa uchta asosiy komponentni o‘z ichiga olgan gibrid metodika qo‘llanildi.

Birinchi komponent — konstruktivistik pedagogika asosida tuzilgan muammoga asoslangan o‘qitish (Problem-Based Learning, PBL) [4]. Talabalar real loyiha stsenariylari doirasida ishladi va SI vositalaridan foydalanishga ruxsat berildi, ammo yechimni mustaqil tushuntirish va asoslash majburiy qilindi.

Ikkinchi komponent — moslashuvchan o‘qitish algoritmlari (Adaptive Learning) asosida tuzilgan individual ta’lim yo‘lidir. Har bir talabaning bilim darajasi va o‘rganish sur'ati hisobga olinib, avtomatlashtirilgan tizim orqali topshiriqlar murakkabligi moslashtirildi. Bu yondashuv Bloom taksonomiyasining kognitiv darajalar modeliga asoslangan [5].

Uchinchi komponent — shakllantiruvchi baholash (Formative Assessment) tizimi bo‘lib, talabalar har bir kod topshirig‘idan so‘ng SI tizimlari va o‘qituvchi tomonidan kombinatsiyalashgan fikr-mulohaza oldi. Bu jarayon Vygotskiy "yaqin rivojlanish zonasi" nazariyasiga mos holda tuzildi [6].

Tadqiqotda quyidagi SI vositalari strategik tarzda qo‘llanildi:

GitHub Copilot — sinxron kod yaratish vositasi sifatida ishlatildi. Talabalar muammoni so‘z bilan ta’riflab, AI tomonidan taklif etilgan kodni tahlil qilib, xatolarini aniqlash va optimallashtirishga o‘rgatildi. Maqsad tayyor koddan foydalanish emas, balki kodni tushunish va tanqidiy baholash ko‘nikmasini rivojlantirishdir [7].

ChatGPT (GPT-4) — kontseptual tushuntirish va algoritmik fikrlashni rivojlantirish uchun dialog shaklida qo‘llanildi. Talabalar o‘z yozgan kodi bo‘yicha

o‘ziga savol berish va uni SI yordamida tekshirishga o‘rgatildi. Bu usul meta-kognitiv ko‘nikmalarni rivojlantirishga xizmat qildi.

CodeBERT asosidagi avtomatlashtirilgan tekshirish tizimi — har bir laboratoriya topshiriqdan so‘ng talabalar kodini tekshirib, semantik va sintaktik xatolar bo‘yicha batafsil fikr-mulohaza berdi. Bu o‘qituvchi yukini kamaytirish bilan birga, fikr-mulohaza tezligini 12 soatdan 5 minutgacha qisqartirdi [8].

Replit va Visual Studio Code AI — integratsiyalashgan muhitda real vaqt rejimida xato tuzatish va kod tahlili uchun ishlatildi.

Ma’lumotlar to‘plashda quyidagi usullardan foydalanildi: 1) semestrboshi va semestrsoni bilimlari darajasini o‘lchash testlari; 2) o‘n haftali kuzatuv davomida to‘plangan laboratoriya baholari; 3) semestr oxiridagi standartlashtirilgan amaliy imtihon; 4) talabalarning o‘z-o‘zini baholash so‘rovnomalari (Likert shkalasi, 1–5); 5) o‘qituvchi kuzatuv kundaliklari.

Statistik tahlil SPSS 26.0 dasturida amalga oshirildi. Natijalarni solishtirishda mustaqil guruhlar t-testi, Cohen d effekt o‘lchami va Pearson korrelyatsiya koeffitsientidan foydalanildi.

Natijalar

Semestr yakunida tajriba va nazorat guruhlarining o‘rtacha akademik ko‘rsatkich farqlari statistik jihatdan sezilarli darajada ($p < 0.001$) farq qildi. Quyidagi 1-jadval asosiy ko‘rsatkichlarning qiyosiy tahlilini aks ettiradi:

1-jadval. Tajriba va nazorat guruhlarining o‘quv ko‘rsatkichlari taqqosi

Ko‘rsatkich	An'anaviy usul	Gibrid (AI + klassik)	Farq (%)
O‘rtacha baho (10 ballik)	6.2	8.1	+30.6%
Topshiriqni o‘z vaqtida topshirish	64%	89%	+39.1%
Mustaqil muammoni hal qilish	41%	73%	+78.0%
Darsdan qoniqish darajasi	58%	91%	+56.9%
Xatolikni o‘z-o‘zidan tuzatish	29%	67%	+131.0%

Jadvaldan ko‘rinib turibdiki, eng muhim farq mustaqil muammoni hal qilish ko‘nikmasida kuzatilgan (tajriba guruhi: 73%, nazorat guruhi: 41%, farq: +78%). Bu natija SI vositalarining talabalar mustaqilligini oshirishda passiv vosita emas, balki faol kognitiv qo‘llanma sifatida ishlashini tasdiqlaydi.

Semestr davomida to‘plangan interfaol kuzatuvlar va talabalarning refleksiv kundaliklari bir necha muhim tendensiyani aniqladi. Birinchidan, tajriba guruhidagi talabalar SI vositasidan birinchi ikki haftada "tayyor javob olish" maqsadida foydalangan bo‘lsalar, 4-haftadan boshlab ular vositani "tushuntirishchi" va "xatolikni aniqlash ko‘magi" sifatida ko‘ra boshladilar.

Ikkinchidan, GitHub Copilot taklif etgan kodni qabul qilish darajasi vaqt o‘tishi bilan pasaydi: 1-hafta — 71%, 8-hafta — 34%. Bu ko‘rsatkich talabalarda tanqidiy fikrlash va mustaqil qaror qabul qilish ko‘nikmalari rivojlanganligini bildiradi.

Uchinchidan, avtomatlashtirilgan fikr-mulohaza tizimi o‘qituvchi vaqtini kuniga o‘rtacha 3.2 soatga tejaganini kuzatdik. Bu tejalgan vaqt o‘qituvchining individual konsultatsiya va chuqur pedagogik faoliyatga yo‘naltirildi.

Semestr oxiridagi so‘rovnoma natijalari (n = 60) shuni ko‘rsatdiki, tajriba guruhining 91% i darsdan qoniqish bildirilgan bo‘lsa, nazorat guruhida bu ko‘rsatkich 58% ni tashkil etdi. Talabalar o‘z fikrlarida SI vositalarining "dasturlashni qo‘rqinchli emas, qiziqarli qilishi"ni alohida ta’kidladilar.

Shuni ta’kidlash lozimki, tajriba guruhidagi 6 ta talaba (20%) dastlab SI vositalariga haddan tashqari tayanib, mustaqil ijodni kamaytirgani kuzatildi. Biroq o‘qituvchi intervensiyasi va reflektor topshiriqlar yordamida ushbu muammo 5-haftaga kelib bartaraf etildi.

Muhokama

Olingan natijalar yaqin o‘n yillarda xorijiy tadqiqotchilar tomonidan erishilgan xulosalar bilan uyg‘un keladi. Denny va boshq. [9] isbotlaganidek, dasturlashni o‘rgatishda moslashuvchan fikr-mulohaza tizimlarini qo‘llash talabalarning xato tuzatish vaqtini 45% ga qisqartiradi. Bizning tadqiqotimiz bu ko‘rsatkichni O‘zbekiston oliy ta’lim muhitida ham tasdiqlaydi.

Biroq an’anaviy yondashuvlar bilan solishtirishda muhim farqlar ham mavjud. Klassik dasturlash o‘qitish metodikasi ko‘pincha sintak tik to‘g‘rilikni ustuvor qo‘yadi va algoritmik fikrlashni ikkinchi o‘ringa qo‘yadi. Bizning gibrid metodikamiz esa algoritmik fikrlashni markazga olib, sintaksis va kod sifatini SI vositalariga «ishontiradi», bu esa talabalarga chuqurroq tushunish imkonini beradi [10].

Xorijiy adabiyotlarda uchraydigan "SI asosidagi ta’lim" modellari aksariyat hollarda g‘arb ta’lim infrastrukturasiga moslashtirilgan. O‘zbekistondagi kontekstda muhim farqlar mavjud: internet tezligining notekisligi, talabalar iqtisodiy imkoniyatlarining xilma-xilligi va o‘zbek tili bilan ingliz tili o‘rtasidagi til to‘siqlari. Ushbu tadqiqot ushbu omillarni hisobga olgan holda mahalliy sharoitga mos metodika ishlab chiqqan va bu uning asosiy afzalligi hisoblanadi.

Shuningdek, boshqa tadqiqotlarda kamdan-kam ko‘riladigan uch komponentli gibrid model (PBL + moslashuvchan ta’lim + shakllantiruvchi baholash) yaxlit tizim sifatida qo‘llanilgani maqolaning metodologik hissasini belgilaydi.

Tadqiqotning asosiy cheklovlaridan biri — bir universitetdagi bitta yo‘nalishdagi nisbatan kam sonli namuna (n = 60). Kelajakdagi tadqiqotlar ko‘proq universitetlar va yo‘nalishlarni qamrab olishi, uzunlamasina dizaynda SI ta’sirini bir necha semestr davomida kuzatishi hamda talabalarning kasbiy faoliyatga tayyorgarligini baholashi lozim.

Xulosa

Tadqiqot natijalari sun’iy intellekt texnologiyalarini dasturlashni o‘qitishga puxta o‘ylangan tarzda integratsiya qilish sezilarli ijobiy natija berishini ko‘rsatdi. Gibrid metodika barcha asosiy ko‘rsatkichlar bo‘yicha samarali ekanligi isbotlandi.

Amaliy tavsiyalar:

– SI vositalarini tayyor javob manbai emas, balki fikrlashni rivojlantiruvchi vosita sifatida qo‘llash;

– talabalarning mustaqilligini saqlash uchun davriy ravishda SI’siz mashg‘ulotlar tashkil etish;

– avtomatlashtirilgan baholashni o‘qituvchi fikri bilan uyg‘unlashtirish;

– pedagoglar uchun SI metodikalari bo‘yicha muntazam malaka oshirishni yo‘lga qo‘yish.

Umuman olganda, SI texnologiyalari to‘g‘ri yo‘naltirilganda nazariya va amaliyot o‘rtasidagi uzilishni kamaytiradigan samarali didaktik vosita bo‘lib xizmat qiladi.

ADABIYOTLAR

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ENERGETIKA MUHANDISLIGI SOHASIDA SUN'IY INTELLEKT (AI) IMKONIYATLARI VA ISTIQBOLLARI

Annotatsiya: *mazkur tezisda energetika muhandisligi sohasida sun'iy intellekt (Artificial Intelligence – AI) texnologiyalarining qo'llanilish imkoniyatlari, afzalliklari va istiqbollari tahlil qilingan. Energiya ishlab chiqarish, uzatish, taqsimlash va iste'mol qilish jarayonlarida sun'iy intellektdan foydalanish samaradorlikni oshirish, energiya yo'qotishlarini kamaytirish hamda tizimlarning ishonchliligini ta'minlashga xizmat qilmoqda.*

Kalit so'zlar: *sun'iy intellekt, energetika muhandisligi, aqlli elektr tarmoqlari, mashinali o'qitish, energetik tizimlar, Smart Grid, energiya samaradorligi, raqamli transformatsiya.*

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OPPORTUNITIES AND PROSPECTS OF ARTIFICIAL INTELLIGENCE (AI) IN THE FIELD OF ENERGY ENGINEERING

Abstract: *This thesis analyzes the possibilities, advantages, and prospects for applying artificial intelligence (AI) technologies in the field of energy engineering. The use of artificial intelligence in energy production, transmission, distribution, and consumption processes contributes to increasing efficiency, reducing energy losses, and ensuring system reliability.*

Keywords: *artificial intelligence, energy engineering, smart electrical networks, machine learning, energy systems, Smart Grid, energy efficiency, digital transformation.*

Bugungi kunda dunyo energetika tizimi jadal rivojlanayotgan raqamli texnologiyalar ta'sirida tubdan o'zgarib bormoqda. Aholi sonining ortishi, sanoat ishlab chiqarishining kengayishi va elektr energiyasiga bo'lgan talabning o'sishi energetika tizimlarini yanada samarali boshqarishni talab etmoqda [1]. An'anaviy boshqaruv usullari murakkab energetik jarayonlarni to'liq nazorat qilishda yetarli samaradorlikni ta'minlay olmayotganligi sababli sun'iy intellekt texnologiyalarini joriy etish dolzarb vazifaga aylanmoqda [2].

Sun'iy intellekt katta hajmdagi ma'lumotlarni tahlil qilish, prognozlash, optimallashtirish va avtomatik qaror qabul qilish imkoniyatlariga ega bo'lib,

energetika tizimlarining barqarorligini oshirishda muhim vosita hisoblanadi [3]. Xususan, elektr energiyasi ishlab chiqarish va iste'mol qilish jarayonlarini prognozlash, avariyalarni oldindan aniqlash hamda energiya taqsimotini optimallashtirishda AI texnologiyalarining ahamiyati tobora ortib bormoqda [4].

Energetika muhandisligi sohasida sun'iy intellekt texnologiyalarini qo'llashning asosiy yo'nalishlaridan biri elektr energiyasi iste'molini prognozlash hisoblanadi. Energiya iste'molining kunlik, haftalik va mavsumiy o'zgarishlarini aniq bashorat qilish elektr energiyasi ishlab chiqarish va taqsimlash jarayonlarining samaradorligini oshirishda muhim ahamiyat kasb etadi. Mashinali o'qitish algoritmlari yordamida tarixiy ma'lumotlar, ob-havo sharoiti, sanoat yuklamalari, iqtisodiy ko'rsatkichlar va iste'molchilar faoliyati tahlil qilinib, elektr energiyasiga bo'lgan talab yuqori aniqlik bilan prognoz qilinadi [5]. Natijada energiya ishlab chiqarish hajmini optimallashtirish, elektr stansiyalarining yuklanish darajasini muvozanatlashtirish va ortiqcha energiya sarfining oldini olish imkoniyati yaratiladi. Bu esa energetika korxonalarining iqtisodiy samaradorligini oshirish bilan birga energiya resurslaridan oqilona foydalanishga xizmat qiladi.

Sun'iy intellektning yana bir muhim qo'llanilish sohasi aqlli elektr tarmoqlari (Smart Grid) hisoblanadi. Smart Grid tizimlari zamonaviy energetika infratuzilmasining asosini tashkil etib, ularda sensorlar, IoT qurilmalari va AI algoritmlari yordamida elektr tarmog'ining texnik holati uzluksiz monitoring qilinadi [6]. Mazkur tizim elektr energiyasi oqimlarini real vaqt rejimida boshqarish, yuklamalarni avtomatik taqsimlash, elektr energiyasi yo'qotishlarini aniqlash va avariyaviy holatlarning oldini olish imkoniyatiga ega. Shuningdek, aqlli tarmoqlar energiya iste'molchilari bilan ikki tomonlama axborot almashuvini ta'minlab, energiya resurslaridan samarali foydalanishga yordam beradi. Natijada elektr ta'minotining ishonchliligi, sifati va barqarorligi sezilarli darajada oshadi.

Energetika obyektlarida uskunalarning texnik holatini nazorat qilish va diagnostika qilishda ham sun'iy intellekt muhim ahamiyat kasb etadi. Transformatorlar, generatorlar, elektr uzatish liniyalari, podstansiyalar va boshqa energetik uskunalardan olinadigan ma'lumotlar AI algoritmlari yordamida tahlil qilinadi [4]. Vibrodiagnostika, termografiya va sensor monitoring tizimlari orqali yig'ilgan ma'lumotlar asosida uskunalardagi nosozliklar, eskirish jarayonlari va favqulodda holatlar ehtimoli oldindan aniqlanadi. Bu esa profilaktik ta'mirlash ishlarini rejalashtirish, avariya holatlarini kamaytirish hamda ekspluatatsion xarajatlarni qisqartirish imkonini beradi. Natijada energetik uskunalarning xizmat muddati uzayadi va ularning ishonchliligi oshadi.

Qayta tiklanuvchi energiya manbalarini boshqarishda ham AI texnologiyalari keng qo'llanilmoqda. Quyosh va shamol elektr stansiyalarida energiya ishlab chiqarish hajmi ob-havo sharoitlariga bevosita bog'liq bo'lganligi sababli sun'iy intellekt asosida prognozlash tizimlari ishlab chiqilmoqda [7]. Ushbu tizimlar meteorologik ma'lumotlarni, shamol tezligi, quyosh radiatsiyasi, havo harorati va namlik ko'rsatkichlarini tahlil qilish orqali energiya ishlab chiqarish hajmini oldindan aniqlaydi hamda energiya taqsimotini optimallashtiradi. Bu esa qayta

tiklanuvchi energiya manbalarining energetika tizimiga integratsiyalashuv samaradorligini oshiradi va energiya balansini muvozanatlashtirish imkonini beradi.

So‘nggi yillarda energetika tizimlarida Digital Twin (raqamli egizak) texnologiyasi ham keng joriy etilmoqda. Raqamli egizak real energetik obyektning virtual modelini yaratishga imkon beradi. Sun’iy intellekt yordamida ushbu modelning ishlash holati doimiy ravishda tahlil qilinadi va kelajakdagi ehtimoliy nosozliklar prognoz qilinadi [7]. Natijada uskunalarni modernizatsiya qilish, energiya samaradorligini oshirish va texnik xizmat ko‘rsatish xarajatlarini kamaytirish mumkin bo‘ladi.

Shuningdek, sun’iy intellekt energiya bozorlarini boshqarish, elektr energiyasi narxlarini prognozlash va energiya savdosini optimallashtirish kabi yo‘nalishlarda ham qo‘llanilmoqda [6]. AI algoritmlari bozor kon’yunkturasi, iste’molchilar talabi va energiya ishlab chiqarish hajmini tahlil qilib, elektr energiyasi narxlarining o‘zgarishini bashorat qiladi. Bu esa energetika korxonalarining iqtisodiy samaradorligini oshirish va investitsion qarorlar qabul qilish jarayonini takomillashtirish imkonini beradi. Sun’iy intellektning energetika muhandisligidagi asosiy imkoniyatlari quyidagilardan iborat:

- elektr energiyasi iste’molini yuqori aniqlikda prognozlash;
- aqlli elektr tarmoqlarini boshqarish va optimallashtirish;
- energetik uskunalar diagnostikasi va monitoringini avtomatlashtirish;
- energiya yo‘qotishlarini aniqlash va kamaytirish;
- qayta tiklanuvchi energiya manbalarini samarali boshqarish;
- avariyalarni oldindan aniqlash va ularning oldini olish;
- energiya samaradorligini oshirish;
- texnik xizmat ko‘rsatish xarajatlarini kamaytirish;
- energiya bozorlarini tahlil qilish va narxlarni prognozlash;
- raqamli egizak texnologiyalari orqali tizimlarni modellashtirish va optimallashtirish [5].

Energetika muhandisligi sohasida sun’iy intellekt texnologiyalaridan foydalanish energiya ishlab chiqarish, uzatish va taqsimlash tizimlarining samaradorligini sezilarli darajada oshirish imkonini bermoqda [3]. AI asosidagi aqlli boshqaruv tizimlari energiya resurslaridan oqilona foydalanish, elektr tarmoqlari barqarorligini ta’minlash, uskunalar ishonchliligini oshirish va ekspluatatsion xarajatlarni kamaytirishga xizmat qilmoqda. Shu bilan birga, sun’iy intellekt yordamida energiya iste’molini prognozlash, uskunalarning texnik holatini monitoring qilish va qayta tiklanuvchi energiya manbalarini boshqarish imkoniyatlari energetika tizimlarining zamonaviy talablar asosida rivojlanishiga zamin yaratmoqda. Kelajakda sun’iy intellekt, IoT, Big Data, bulutli texnologiyalar va Digital Twin tizimlarining energetika infratuzilmasiga keng joriy etilishi natijasida to‘liq raqamlashtirilgan, o‘z-o‘zini boshqaruvchi va yuqori samaradorlikka ega energetik tizimlarni yaratish imkoniyati paydo bo‘ladi [7]. Bu esa energiya ishlab chiqarish xarajatlarini kamaytirish, ekologik xavfsizlikni

ta’minlash hamda qayta tiklanuvchi energiya manbalaridan foydalanish samaradorligini oshirishga xizmat qiladi. Shu sababli energetika muhandisligi sohasida sun’iy intellekt texnologiyalarini rivojlantirish va amaliyotga keng tatbiq etish kelajak energetikasining eng muhim ustuvor yo‘nalishlaridan biri hisoblanadi.

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ATMOSFERA MUHITIDAGI ZARARLI GAZLARNI SEZUVCHI VA ULARNI BOSHQARISH TIZIMI

Annotatsiya: *mazkur tezisda atmosfera havosi tarkibidagi zararli gazlarni aniqlash, monitoring qilish va ularning salbiy ta'sirini kamaytirishga qaratilgan zamonaviy sensorli boshqaruv tizimlarining ahamiyati yoritilgan. Atmosfera havosining ifloslanishi global ekologik muammolardan biri bo'lib, uning inson salomatligi va atrof-muhitga ta'siri kundan-kunga ortib bormoqda. Shu sababli zararli gazlarni real vaqt rejimida aniqlash, ularning konsentratsiyasini nazorat qilish hamda avtomatik boshqaruv tizimlari orqali tegishli choralarni ko'rish muhim ahamiyat kasb etadi. Ishda gaz sensorlari, mikrokontrollerlar va IoT texnologiyalari asosida ishlovchi aqlli monitoring tizimlarining imkoniyatlari tahlil qilingan.*

Kalit so'zlar: *atmosfera havosi, zararli gazlar, gaz sensori, ekologik monitoring, IoT, aqlli tizimlar, avtomatlashtirilgan boshqaruv, havo sifati, ekologik xavfsizlik.*

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SYSTEM FOR SENSING AND CONTROLLING HARMFUL GASES IN THE ATMOSPHERE ENVIRONMENT

Abstract: *This thesis highlights the importance of modern sensor control systems aimed at detecting, monitoring, and mitigating the negative impact of harmful gases in the atmospheric air. Atmospheric air pollution is one of the global environmental problems, and its impact on human health and the environment is increasing day by day. Therefore, it is important to detect harmful gases in real time, monitor their concentration, and take appropriate measures through*

automatic control systems. The work analyzes the capabilities of intelligent monitoring systems based on gas sensors, microcontrollers, and IoT technologies.

Keywords: *atmospheric air, harmful gases, gas sensor, environmental monitoring, IoT, smart systems, automated management, air quality, environmental safety.*

Hozirgi kunda sanoat korxonalari, issiqlik elektr stansiyalari, avtotransport vositalari va maishiy faoliyat natijasida atmosfera havosiga katta miqdorda zararli moddalar chiqarilmoqda [1]. Jahon sog‘liqni saqlash tashkiloti ma’lumotlariga ko‘ra, havoning ifloslanishi har yili millionlab insonlarning salomatligiga salbiy ta’sir ko‘rsatib, yurak-qon tomir, nafas olish tizimi hamda onkologik kasalliklarning ortishiga sabab bo‘lmoqda [2]. Aholi sonining ko‘payishi, urbanizatsiya jarayonlarining jadallashuvi va transport vositalari sonining ortishi atmosfera havosining ifloslanish darajasini yanada kuchaytirmoqda [3]. Ayniqsa, yirik sanoat markazlari va transport oqimi yuqori bo‘lgan hududlarda atmosfera tarkibidagi uglerod oksidi (CO), karbonat angidrid (CO_2), azot oksidlari (NOx), oltingugurt dioksidi (SO_2), ammiak (NH_3) va metan (CH_4) gazlarining me’yoridan ortiq miqdorda to‘planishi ekologik muvozanatning buzilishiga, havo sifatining yomonlashishiga hamda iqlim o‘zgarishlari jarayonlarining jadallashishiga olib kelmoqda [4]. Ushbu zararli gazlar atmosfera qatlamida issiqxona effekti kuchayishiga, kislotali yog‘inlarning hosil bo‘lishiga va tabiiy ekotizimlarning degradatsiyasiga sabab bo‘lishi mumkin [1].

Atmosfera havosining ifloslanishini kamaytirishning samarali usullaridan biri zararli gazlarni uzluksiz monitoring qilish va ularni avtomatik boshqarish tizimlarini joriy etish hisoblanadi [5]. An’anaviy nazorat usullaridan farqli ravishda, zamonaviy monitoring tizimlari real vaqt rejimida ma’lumotlarni yig‘ish, qayta ishlash va tahlil qilish imkoniyatiga ega bo‘lib, ekologik vaziyatni tezkor baholashga xizmat qiladi [6]. Zamonaviy sensor texnologiyalari yordamida zararli gazlar miqdorini yuqori aniqlikda o‘lchash va tezkor nazorat qilish imkoniyati yaratilmoqda [6]. Bunday sensorlar mikrokontrollerlar va simsiz aloqa modullari bilan integratsiyalashgan holda ishlashi natijasida monitoring jarayoni to‘liq avtomatlashtiriladi hamda inson omili ta’siri kamayadi [7].

Shuningdek, Internet of Things (IoT) texnologiyalarining jadal rivojlanishi natijasida atmosfera havosini masofadan monitoring qilish va boshqarish imkoniyatlari kengaymoqda. Sensorlardan olingan ma’lumotlar bulutli platformalarga uzatilishi, sun’iy intellekt algoritmlari yordamida tahlil qilinishi va zararli gazlar konsentratsiyasi me’yoriy qiymatdan oshganda avtomatik ravishda ogohlantirish signallari yuborilishi mumkin. Bu esa ekologik xavfsizlikni ta’minlash, favqulodda holatlarning oldini olish hamda sanoat korxonalari va aholi yashash hududlarida sog‘lom ekologik muhitni shakllantirishda muhim ahamiyat kasb etadi. Shu bois atmosfera muhitidagi zararli gazlarni sezuvchi va ularni boshqaruvchi aqlli tizimlarni ishlab chiqish hamda amaliyotga joriy etish bugungi kunning dolzarb ilmiy-texnik vazifalaridan biri hisoblanadi.

Atmosfera muhitidagi zararli gazlarni aniqlash va nazorat qilish maqsadida zamonaviy gaz sensorlari, mikrokontrollerlar hamda axborot-kommunikatsiya texnologiyalariga asoslangan monitoring tizimlaridan keng foydalanilmoqda. Bunday tizimlarning asosiy vazifasi atmosfera havosi tarkibidagi zararli gazlarning konsentratsiyasini aniqlash, ularni tahlil qilish va me'yoriy ko'rsatkichlardan chetlanish holatlarida tegishli boshqaruv choralarini amalga oshirishdan iborat [5].

Atmosfera muhitidagi zararli gazlarni aniqlash uchun turli xil sensorlardan foydalaniladi. Jumladan, MQ-2, MQ-7, MQ-135 kabi yarimo'tkazgichli sensorlar uglerod oksidi (CO), karbonat angidrid (CO_2), metan (CH_4), ammiak (NH_3) va boshqa zararli gazlarni aniqlash imkonini beradi [6]. Ushbu sensorlar nisbatan arzonligi, ishlatish qulayligi va yuqori sezgirligi bilan ajralib turadi. Elektrokimyoviy sensorlar esa yuqori aniqlik darajasiga ega bo'lib, sanoat korxonalarida va ekologik monitoring stansiyalarida keng qo'llaniladi. Infraqizil sensorlar gaz molekulalarining infraqizil nurlarni yutish xususiyatiga asoslangan bo'lib, CO_2 va boshqa gazlarning konsentratsiyasini kontaktsiz usulda o'lchash imkoniyatini yaratadi. Bunday sensorlarning afzalligi uzoq muddat barqaror ishlashi va tashqi muhit omillariga nisbatan yuqori chidamliligidadir.

Sensorlardan olingan ma'lumotlar Arduino, ESP32 yoki Raspberry Pi kabi mikrokontrollerlar yordamida qayta ishlanadi. Mikrokontroller dasturiy algoritmlar asosida gaz konsentratsiyasini amaldagi ekologik me'yorlar bilan taqqoslaydi va natijalarni ma'lumotlar bazasiga uzatadi. Agar zararli gazlar miqdori ruxsat etilgan chegaradan oshib ketsa, tizim avtomatik ravishda signalizatsiya, ventilyatsiya yoki filtratsiya qurilmalarini ishga tushiradi. Shu bilan birga, mas'ul operatorlarga SMS, elektron pochta yoki mobil ilova orqali ogohlantirish xabarlari yuborilishi mumkin. Bu esa favqulodda ekologik vaziyatlarning oldini olish va tezkor choralar ko'rish imkonini beradi.

Bugungi kunda IoT (Internet of Things) texnologiyalarining rivojlanishi natijasida ekologik monitoring tizimlari yangi bosqichga ko'tarildi. Sensorlardan olingan ma'lumotlar Wi-Fi, LoRaWAN, ZigBee yoki GSM modullari orqali masofaviy serverlarga uzatiladi va foydalanuvchi mobil ilova yoki veb-platforma orqali real vaqt rejimida atmosfera holatini kuzatishi mumkin. Ma'lumotlarning bulutli texnologiyalar yordamida saqlanishi uzoq muddatli statistik tahlillarni amalga oshirish, ifloslanish dinamikasini o'rganish va ekologik prognozlar tuzish imkonini beradi. Bunday tizimlar nafaqat sanoat korxonalarida, balki aqlli shaharlar, transport infratuzilmasi, turar-joy majmualari, ta'lim muassasalari va sog'liqni saqlash obyektlarida ham qo'llanilmoqda.

Atmosfera havosini boshqarish tizimlarida sun'iy intellekt texnologiyalaridan foydalanish ham muhim ahamiyat kasb etadi. Mashinali o'qitish algoritmlari yordamida zararli gazlarning tarqalish tendensiyalarini prognozlash, atmosfera ifloslanishiga ta'sir etuvchi omillarni aniqlash va favqulodda holatlarni oldindan bashorat qilish mumkin. Sun'iy intellekt asosidagi tizimlar katta hajmdagi ma'lumotlarni tezkor qayta ishlash orqali eng maqbul boshqaruv qarorlarini ishlab chiqishga yordam beradi. Masalan, sanoat hududlarida shamol yo'nalishi, havo

harorati va namlik ko‘rsatkichlarini hisobga olgan holda zararli gazlarning tarqalish xaritasini shakllantirish va tegishli xavfsizlik choralarini tavsiya etish mumkin. Bu esa ekologik xavfsizlikni ta’minlash va inson salomatligini muhofaza qilish samaradorligini oshiradi.

Atmosfera havosining ifloslanishi zamonaviy jamiyat oldida turgan eng dolzarb ekologik muammolardan biri hisoblanadi. Zararli gazlarning ortib borishi inson salomatligi, ekologik muvozanat va iqtisodiy rivojlanishga salbiy ta’sir ko‘rsatmoqda. Shu sababli atmosfera havosini uzluksiz monitoring qilish va zararli gazlarni samarali boshqarish tizimlarini yaratish muhim ilmiy-amaliy ahamiyatga ega.

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KO‘P KANALLI TOVUSH CHASTOTA QUVVAT KUCHAYTIRGICHINI ISHLAB CHIQISH

Annotatsiya. *Ushbu tezisda ko‘p kanalli tovush chastota quvvat kuchaytirgichlarini loyihalash va ishlab chiqishning nazariy hamda amaliy jihatlari yoritilgan. Zamonaviy audio tizimlarda yuqori sifatli tovush uzatishni ta’minlash, signal buzilishlarini kamaytirish va energiya samaradorligini oshirish masalalari dolzarb hisoblanadi.*

Kalit so‘zlar: *tovush chastotasi, quvvat kuchaytirgichi, audio tizim, ko‘p kanalli kuchaytirgich, mikrosxema, signal, garmonik buzilish, akustik tizim, audioelektronika.*

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DEVELOPMENT OF A MULTICHANNEL SOUND FREQUENCY POWER ENHANCER

Abstract. *This thesis covers the theoretical and practical aspects of the design and development of multi-channel audio frequency power amplifiers. In modern audio systems, issues of ensuring high-quality sound transmission, reducing signal distortions, and increasing energy efficiency are considered topical.*

Keywords: *sound frequency, power amplifier, audio system, multi-channel amplifier, microcircuit, signal, harmonic distortion, acoustic system, audio electronics.*

Axborot-kommunikatsiya texnologiyalarining jadal rivojlanishi, raqamli multimedia vositalarining keng tarqalishi va zamonaviy akustik tizimlarga bo‘lgan ehtiyojning ortib borishi audioelektronika sohasining jadal rivojlanishiga turtki bermoqda. Bugungi kunda konsert zallari, konferensiya markazlari, kinoteatrlar, studiyalar, ta’lim muassasalari, savdo markazlari hamda maishiy multimedia tizimlarida yuqori sifatli tovush uzatishni ta’minlaydigan ko‘p kanalli quvvat kuchaytirgichlaridan keng foydalanilmoqda [1]. Ovoz uzatish sifatiga qo‘yiladigan

talablarning ortib borishi natijasida kuchaytirgich qurilmalarining texnik va ekspluatatsion ko‘rsatkichlarini takomillashtirish muhim ilmiy-amaliy vazifalardan biriga aylanmoqda. Bunday qurilmalar kirish signalining amplitudasini oshirish bilan birga, signal shaklini maksimal darajada saqlab qolishi, minimal garmonik buzilishlar bilan ishlashi, yuqori foydali ish koeffitsiyentiga ega bo‘lishi hamda turli yuklama sharoitlarida barqaror faoliyat yuritishi talab etiladi [2].

Tovush chastota quvvat kuchaytirgichlari audioelektronika tizimlarining asosiy tarkibiy qismi bo‘lib, ular past quvvatli elektr signallarini akustik tizimlarni boshqarish uchun yetarli darajadagi quvvatga aylantiradi [3]. Ushbu qurilmalar mikrofonlar, musiqa pleyerlari, kompyuterlar, mobil qurilmalar va boshqa audio manbalardan kelayotgan signallarni qayta ishlab, karnay va akustik tizimlarga uzatadi. Natijada foydalanuvchi yuqori sifatli va tabiiy tovushni eshitish imkoniyatiga ega bo‘ladi. Shu sababli quvvat kuchaytirgichlarining chiqish quvvati, signal/shovqin nisbati, chastota diapazoni va buzilish ko‘rsatkichlari audio tizimlarning umumiy samaradorligini belgilovchi muhim parametrlar hisoblanadi [4].

Zamonaviy audio tizimlarda stereo, 4-kanalli, 5.1, 7.1 va undan ortiq kanalli kuchaytirgichlar qo‘llanilib, ular fazoviy tovush effektlarini yaratish hamda tinglovchilarga real akustik muhitga yaqin bo‘lgan ovoz sifatini taqdim etishga xizmat qiladi [4]. Ko‘p kanalli audio tizimlarning qo‘llanilishi tovush manbalarining joylashuvini aniq aks ettirish, ovozning hajmiyligini oshirish va tinglovchida immersiv (to‘liq qamrab oluvchi) audio taassurot hosil qilish imkonini beradi. Ayniqsa, zamonaviy kinoteatrlar, konferensiya tizimlari va professional ovoz yozish studiyalarida ko‘p kanalli kuchaytirgichlardan foydalanish yuqori samaradorlikni ta’minlamoqda [5].

Bundan tashqari, audioelektronika sohasida energiya tejamkor texnologiyalarni qo‘llash masalasi ham dolzarb ahamiyat kasb etmoqda. So‘nggi yillarda D klassdagi quvvat kuchaytirgichlari yuqori foydali ish koeffitsiyenti, kam issiqlik ajratishi va ixcham konstruksiyasi tufayli keng qo‘llanilmoqda [6]. Ushbu texnologiyalar asosida yaratilgan ko‘p kanalli kuchaytirgichlar energiya sarfini kamaytirish bilan birga, yuqori quvvat va sifatli tovush uzatishni ta’minlaydi.

Shuningdek, Bluetooth, Wi-Fi, USB va DSP (Digital Signal Processing) texnologiyalarining audio qurilmalarga integratsiyalashuvi ko‘p kanalli kuchaytirgichlarning funksional imkoniyatlarini sezilarli darajada kengaytirmoqda [7]. Raqamli signalni qayta ishlash texnologiyalari yordamida tovush sifatini optimallashtirish, shovqinlarni kamaytirish, chastotaviy xarakteristikalarni sozlash hamda avtomatik kalibrlash funksiyalarini amalga oshirish mumkin. Bu esa zamonaviy audio tizimlarning sifat ko‘rsatkichlarini oshirish bilan bir qatorda, foydalanuvchilar uchun yanada qulay va samarali akustik muhit yaratishga xizmat qiladi.

Shu nuqtai nazardan, ko‘p kanalli tovush chastota quvvat kuchaytirgichlarini loyihalash va ishlab chiqish audioelektronika sohasining dolzarb yo‘nalishlaridan biri bo‘lib, yuqori sifatli ovoz uzatish, energiya samaradorligini oshirish va

zamonaviy multimedia tizimlarining funksional imkoniyatlarini kengaytirishga xizmat qiladi [1–7]. Mazkur yo‘nalishda olib borilayotgan ilmiy-tadqiqot ishlari zamonaviy audio qurilmalarning texnik ko‘rsatkichlarini takomillashtirish hamda ularning amaliy qo‘llanilish sohalarini kengaytirishda muhim ahamiyat kasb etadi.

Ko‘p kanalli tovush chastota quvvat kuchaytirgichini loyihalashda, avvalo, uning funksional tuzilmasi ishlab chiqiladi. Qurilma kirish signali bloki, oldingi kuchaytirish kaskadi, quvvat kuchaytirish bosqichi, quvvat manbai, himoya tizimi va chiqish akustik tizimidan tashkil topadi [5].

Kirish bosqichida audio signallar qabul qilinadi va dastlabki ishlov beriladi. Keyingi bosqichda signal oldindan kuchaytiriladi hamda quvvat kuchaytirish kaskadiga uzatiladi. Quvvat kuchaytirish bosqichi audio signal amplitudasini oshirib, karnaylar uchun zarur bo‘lgan quvvatni hosil qiladi [6]. Mazkur jarayonda TDA7294, LM3886, TPA3116D2 kabi zamonaviy integral mikrosxemalardan foydalanish qurilmaning samaradorligi va ishonchliligini oshiradi [5].

Tadqiqot doirasida 4 kanalli audio kuchaytirgich modeli ishlab chiqildi. Har bir kanal mustaqil ishlaydigan kuchaytirish kaskadiga ega bo‘lib, bu kanallararo o‘zaro ta’sirlarni kamaytirish imkonini beradi. Qurilmada yuqori sifatli filtrlar va stabilizatsiyalangan quvvat manbai qo‘llanildi. Natijada signalning buzilish darajasi sezilarli kamaytirildi hamda audio uzatish sifati yaxshilandi [6].

Ko‘p kanalli kuchaytirgichlarning samarali ishlashida quvvat manbai muhim ahamiyatga ega. Quvvat manbaidagi kuchlanish tebranishlari audio signal sifatiga salbiy ta’sir ko‘rsatishi mumkin. Shu sababli stabilizatsiyalangan transformatorli quvvat manbai va yuqori sig‘imli filtr kondensatorlaridan foydalanish tavsiya etiladi [7].

Shuningdek, qurilmaning ishonchliligini oshirish maqsadida ortiqcha yuklanish, qisqa tutashuv va qizib ketishdan himoya tizimlari joriy etildi. Radiator va ventilyator asosidagi sovutish tizimi uzoq muddatli ishlash davomida elektron komponentlarning qizib ketishining oldini oladi [4]. Taklif etilgan qurilmaning strukturaviy sxemasi quyidagi ketma-ketlikda ishlaydi:Audio signal manbai → Oldingi kuchaytirgich → Quvvat kuchaytirgich → Himoya tizimi → Akustik tizim (karnaylar). Zamonaviy audio qurilmalarda Bluetooth, Wi-Fi va USB interfeyslarining mavjudligi audio signallarni simsiz uzatish imkoniyatini yaratmoqda. Shu sababli ishlab chiqilgan modelga raqamli interfeyslarni integratsiyalash istiqbollari ham ko‘rib chiqildi [3].

Ko‘p kanalli tovush chastota quvvat kuchaytirgichlarini ishlab chiqish zamonaviy audioelektronika sohasining muhim yo‘nalishlaridan biri hisoblanadi. Tadqiqot natijasida ishlab chiqilgan 4 kanalli quvvat kuchaytirgichi yuqori sifatli audio signallarni uzatish, energiya samaradorligini oshirish va ekspluatatsion ishonchlilikni ta’minlash imkoniyatiga ega ekanligi aniqlandi. Qurilmada qo‘llanilgan zamonaviy integral mikrosxemalar, himoya tizimlari va stabilizatsiyalangan quvvat manbai uning texnik ko‘rsatkichlarini sezilarli darajada yaxshiladi.

Kelgusida mazkur qurilmaga sun’iy intellekt asosidagi avtomatik tovush sozlash, raqamli signal protsessorlari (DSP) va masofadan boshqarish imkoniyatlarini joriy etish audio tizimlarning funksional imkoniyatlarini yanada kengaytiradi hamda ularning amaliy samaradorligini oshiradi.

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TOLALI OPTIK ALOQA LINIYASI SIGNALI KUCHAYTIRGICHINI LOYIHALASH

Annotatsiya: *mazkur tezisda tolali optik aloqa liniyalarida signalning uzoq masofalarga uzatilishi jarayonida yuzaga keladigan quvvat yo‘qotishlarini kamaytirish va uzatish sifatini oshirish maqsadida optik signal kuchaytirgichlarini loyihalash masalalari ko‘rib chiqilgan.*

Kalit so‘zlar: *tolali optik aloqa, optik kuchaytirgich, EDFA, Raman kuchaytirgichi, optik signal, telekommunikatsiya, optik uzatish liniyasi, DWDM texnologiyasi.*

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DESIGN OF A FIBER-OPTIC COMMUNICATION LINE SIGNAL ENHANCER

Abstract: *This thesis examines the design of optical signal amplifiers in fiber optic communication lines to reduce power losses occurring during long-distance signal transmission and improve transmission quality.*

Keywords: *fiber optic communication, optical amplifier, EDFA, Raman amplifier, optical signal, telecommunications, optical transmission line, DWDM technology.*

Bugungi kunda axborot-kommunikatsiya texnologiyalarining jadal rivojlanishi natijasida katta hajmdagi ma’lumotlarni yuqori tezlikda va ishonchli uzatishga bo‘lgan ehtiyoj tobora ortib bormoqda [1]. Internet tarmoqlari, mobil aloqa tizimlari, ma’lumotlar markazlari va bulutli texnologiyalarning rivojlanishi zamonaviy telekommunikatsiya infratuzilmasiga yuqori talablarni qo‘ymoqda. Ushbu talablarni qondirishda tolali optik aloqa tizimlari muhim o‘rin egallaydi, chunki ular katta o‘tkazuvchanlik qobiliyati, elektromagnit shovqinlarga chidamliligi va uzoq masofalarga ma’lumot uzatish imkoniyati bilan ajralib turadi [2].

Tolali optik aloqa liniyalarida signal uzoq masofaga uzatilganda optik tolada so‘nish (attenuation), dispersiya va boshqa fizik omillar ta’sirida signal quvvati kamayib boradi [3]. Natijada qabul qiluvchi qurilmaga yetib boruvchi signal sifati pasayadi hamda uzatilayotgan ma’lumotlarning ishonchliligiga salbiy ta’sir

ko‘rsatadi. Shu sababli zamonaviy optik aloqa tizimlarida signalni oraliq punktlarda kuchaytirish zarurati yuzaga keladi [4].

Avvallari optik signallarni kuchaytirish uchun optik-elektrik-optik (OEO) konvertatsiya usullari qo‘llanilgan bo‘lsa, bugungi kunda bevosita optik signalni kuchaytirishga imkon beruvchi optik kuchaytirgichlar keng qo‘llanilmoqda [5]. Bunday qurilmalar optik signalni elektr signaliga aylantirmasdan kuchaytirish imkonini beradi, bu esa tizimning tezkorligi va samaradorligini sezilarli darajada oshiradi [6].

Ayniqsa, erbiy qo‘shilgan tolali optik kuchaytirgichlar (EDFA) zamonaviy DWDM va magistral optik aloqa tarmoqlarida eng keng tarqalgan texnologiyalardan biri hisoblanadi. Ular 1550 nm diapazonida yuqori kuchaytirish koeffitsiyenti, past shovqin darajasi va yuqori ishonchlilik ko‘rsatkichlariga ega [7].

Tolali optik aloqa tizimlarida signal kuchaytirgichlarining asosiy vazifasi optik signallarning quvvatini oshirish, uzatish jarayonida yuzaga keladigan yo‘qotishlarni kompensatsiyalash va aloqa liniyasining uzatish masofasini kengaytirishdan iborat [3]. Ma’lumotlarni uzoq masofalarga uzatish jarayonida optik tolada so‘nish, dispersiya, nolinearlik hodisalari va tashqi omillar ta’sirida signal sifati pasayib boradi. Natijada qabul qiluvchi qurilmaga yetib keluvchi signal quvvati kamayadi hamda uzatilayotgan axborotning ishonchlilik darajasi pasayadi. Shu sababli zamonaviy magistral va transport optik tarmoqlarida signal kuchaytirgichlaridan foydalanish zarur hisoblanadi [2].

Optik kuchaytirgichlarni loyihalashda signalning to‘lqin uzunligi, kuchaytirish koeffitsiyenti, chiqish quvvati, shovqin faktori, to‘yinganlik darajasi va energiya samaradorligi kabi parametrlar alohida e’tiborga olinadi [3]. Ushbu parametrlarning optimal tanlanishi optik aloqa tizimining uzluksiz va yuqori sifatli ishlashini ta’minlaydi. Ayniqsa, yuqori tezlikli DWDM (Dense Wavelength Division Multiplexing) texnologiyalarida kuchaytirgichlarning texnik tavsiflari butun aloqa tizimining samaradorligiga bevosita ta’sir ko‘rsatadi [7].

Taklif etilayotgan loyihada erbiy qo‘shilgan tolali optik kuchaytirgich (EDFA – Erbium Doped Fiber Amplifier) dan foydalanish ko‘zda tutilgan. EDFA kuchaytirgichlari 1550 nm diapazonida ishlashi sababli zamonaviy optik aloqa tizimlarida eng samarali va keng tarqalgan kuchaytirgichlardan biri hisoblanadi [6]. Ushbu diapazonda optik tolalardagi so‘nish minimal qiymatga ega bo‘lib, uzoq masofalarga axborot uzatish imkonini yaratadi.

Mazkur qurilma quyidagi asosiy elementlardan tashkil topadi: Lazer nasos manbai → WDM multipleksori → Erbiy qo‘shilgan optik tola → Optik izolyator → Optik filtr → Chiqish signali.

Lazer nasos manbaidan hosil bo‘lgan energiya WDM multipleksori orqali erbiy ionlari bilan boyitilgan optik tolaga uzatiladi. Nasos nuri ta’sirida erbiy ionlari yuqori energiyali holatga o‘tadi va optik tola bo‘ylab tarqalayotgan signal fotonlari bilan o‘zaro ta’sirlashib, stimullangan nurlanish jarayonini hosil qiladi. Natijada kiruvchi optik signal kuchayadi va katta quvvat bilan chiqish qismiga uzatiladi [6]. Ushbu texnologiyaning muhim afzalligi shundaki, signal elektr shaklga

aylantirilmasdan bevosita optik muhitda kuchaytiriladi. Bu esa uzatish tezligini oshirish, kechikishlarni kamaytirish va energiya sarfini qisqartirish imkonini beradi [5].

Loyihalash jarayonida quyidagi texnik parametrlar qabul qilindi:

- ishchi to‘lqin uzunligi – 1550 nm;
- nasos lazerining to‘lqin uzunligi – 980 nm yoki 1480 nm;
- kuchaytirish koeffitsiyenti – 25–35 dB;
- chiqish quvvati – 20 dBm;
- shovqin faktori – 5 dB dan kam;
- erbiy qo‘shilgan tola uzunligi – 10–20 m;
- uzatish masofasi – 80–120 km;
- bit uzatish tezligi – 10–100 Gbit/s.

Hisoblash va modellashtirish natijalari shuni ko‘rsatdiki, optik kuchaytirgich qo‘llanilganda signal quvvatining pasayishi sezilarli darajada kamayadi hamda signalning qabul qilish nuqtasidagi sifati yaxshilanadi [7]. Kuchaytirgichdan foydalanish natijasida optik signalning signal/shovqin nisbati (OSNR) oshadi, bit xatoliklari ehtimoli (BER) kamayadi va uzatish tizimining umumiy ishonchliligi ortadi. Shuningdek, aloqa liniyasining umumiy o‘tkazuvchanlik qobiliyati va ma’lumot uzatish tezligi sezilarli ravishda yaxshilanadi [4].

Bundan tashqari, EDFA kuchaytirgichlaridan foydalanish optik regeneratsiya punktlari sonini kamaytiradi, bu esa aloqa tarmog‘ining ekspluatatsiya xarajatlarini pasaytirish va iqtisodiy samaradorligini oshirish imkonini beradi [5]. Ayniqsa, magistral optik aloqa liniyalari, xalqaro internet magistrallari, ma’lumotlar markazlari va zamonaviy 5G/6G mobil aloqa tarmoqlarida ushbu texnologiyaning ahamiyati tobora ortib bormoqda [7].

Tolali optik aloqa liniyalarida signalning so‘nishi ma’lumot uzatish sifati va aloqa tizimining samaradorligiga salbiy ta’sir ko‘rsatuvchi asosiy omillardan biri hisoblanadi [1]. Signal quvvatining kamayishi uzatish masofasining cheklanishiga, xatoliklar sonining ortishiga va aloqa tizimining ishonchliligi pasayishiga olib keladi. Mazkur muammoni bartaraf etishda optik signal kuchaytirgichlaridan foydalanish eng samarali texnologik yechimlardan biri hisoblanadi [3].

Tadqiqot natijalari shuni ko‘rsatdiki, erbiy qo‘shilgan tolali optik kuchaytirgichlardan foydalanish optik signal quvvatini 25–35 dB gacha oshirish, signal sifatini yaxshilash va uzatish masofasini 80–120 km gacha kengaytirish imkonini beradi [6]. Kuchaytirgichlarning qo‘llanilishi optik aloqa tizimlarining o‘tkazuvchanlik qobiliyatini oshirish, bit xatoliklari ehtimolini kamaytirish hamda telekommunikatsiya tarmoqlarining barqaror va ishonchli ishlashini ta’minlashga xizmat qiladi [7].

Kelgusida DWDM, 5G/6G, sun’iy intellekt asosidagi tarmoqlar va yuqori tezlikli optik transport tizimlarining rivojlanishi bilan EDFA, Raman va gibrid optik kuchaytirgichlarni yanada takomillashtirish dolzarb ilmiy va amaliy yo‘nalishlardan biri bo‘lib qoladi. Bu esa global telekommunikatsiya infratuzilmasining samaradorligini oshirish, ma’lumot uzatish tezligini yanada ko‘paytirish va raqamli

iqtisodiyot rivojiga xizmat qiladigan zamonaviy optik aloqa tizimlarini yaratish imkonini beradi [2,7].

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MUQOBIL ENERGIYA MANBALARINING RIVOJLANISH BOSQICHLARI VA IMKONIYATLARI

Annotatsiya: *mazkur tezisda muqobil energiya manbalarining shakllanishi, rivojlanish bosqichlari va zamonaviy energetika tizimidagi o‘rni tahlil qilingan. Dunyo miqyosida energiya resurslariga bo‘lgan talabning ortishi, an’anaviy yoqilg‘i zaxiralarining kamayib borishi hamda ekologik muammolarning kuchayishi qayta tiklanuvchi energiya manbalaridan samarali foydalanishni taqozo etmoqda.*

Kalit so‘zlar: *muqobil energiya, qayta tiklanuvchi energiya, quyosh energiyasi, shamol energiyasi, gidroenergetika, biomassa, geotermal energiya, energetik xavfsizlik, yashil iqtisodiyot.*

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DEVELOPMENT STAGES AND OPPORTUNITIES OF ALTERNATIVE ENERGY SOURCES

Abstract: *This thesis analyzes the formation, developmental stages, and role of alternative energy sources in the modern energy system. The increasing global demand for energy resources, the depletion of traditional fuel reserves, and the intensification of environmental problems necessitate the effective use of renewable energy sources.*

Keywords: *alternative energy, renewable energy, solar energy, wind energy, hydropower, biomass, geothermal energy, energy security, green economy.*

Bugungi kunda dunyo aholisining ortib borishi, sanoat ishlab chiqarishining kengayishi, urbanizatsiya jarayonlarining jadallashuvi hamda zamonaviy texnologiyalarning rivojlanishi natijasida energiya resurslariga bo‘lgan talab tobora oshib bormoqda [1]. Xalqaro ekspertlarning prognozlariga ko‘ra, kelgusi o‘n yilliklarda elektr energiyasiga bo‘lgan ehtiyojning yanada ortishi kutilmoqda. Bu esa mavjud energiya manbalaridan oqilona foydalanish va yangi energiya ishlab chiqarish texnologiyalarini joriy etishni talab etadi. Energiya iste’molining jadal sur’atlarda o‘sishi neft, gaz va ko‘mir kabi an’anaviy yoqilg‘i resurslarining kamayishiga, ularni qazib olish xarajatlarining ortishiga hamda ekologik muammolarning yanada kuchayishiga sabab bo‘lmoqda [2].

An’anaviy energiya manbalaridan keng foydalanish natijasida atmosferaga katta miqdorda karbonat angidrid (CO_2), metan (CH_4) va boshqa issiqxona gazlari chiqarilmoqda. Bu esa global iqlim o‘zgarishi, havo haroratining oshishi, cho‘llanish jarayonlarining tezlashishi va tabiiy ekotizimlarning buzilishiga olib kelmoqda [2]. Shu bilan birga, ekologik muammolar inson salomatligiga ham salbiy ta’sir ko‘rsatib, turli kasalliklarning ko‘payishiga sabab bo‘lmoqda. Shu sababli energiya ishlab chiqarishning ekologik xavfsiz, iqtisodiy samarali va uzoq muddatli barqaror usullarini joriy etish zamonaviy energetika siyosatining ustuvor yo‘nalishlaridan biri hisoblanadi [3].

Muqobil energiya manbalari qayta tiklanish xususiyatiga ega bo‘lib, ular tabiiy resurslardan samarali foydalanish, energiya ta’minoti xavfsizligini oshirish va ekologik muammolarni kamaytirishda muhim ahamiyat kasb etadi [4]. Ushbu energiya manbalari tabiiy ravishda doimiy ravishda tiklanib turishi bilan an’anaviy yoqilg‘i resurslaridan farq qiladi. Xususan, quyosh, shamol, suv oqimlari, biomassa va geotermal energiya manbalari bugungi kunda dunyoning ko‘plab davlatlarida energetika tizimining muhim tarkibiy qismiga aylanib bormoqda [5]. Ularning ulushi rivojlangan davlatlarda yil sayin ortib borayotgan bo‘lib, elektr energiyasi ishlab chiqarishda muqobil energiya texnologiyalarining roli tobora kuchaymoqda.

So‘nggi yillarda muqobil energiya manbalaridan foydalanish nafaqat ekologik, balki iqtisodiy jihatdan ham samarali ekanligi amaliyotda o‘z tasdig‘ini topmoqda. Quyosh panellari va shamol turbinalarining narxi pasayib borishi, energiya saqlash texnologiyalarining takomillashuvi hamda davlat tomonidan qo‘llab-quvvatlash mexanizmlarining kengayishi ushbu sohaning jadal rivojlanishiga xizmat qilmoqda [6]. Natijada qayta tiklanuvchi energiya manbalari energetik mustaqillikni ta’minlash, energiya importiga bo‘lgan ehtiyojni kamaytirish va yangi ish o‘rinlarini yaratishda muhim omil sifatida namoyon bo‘lmoqda.

O‘zbekiston Respublikasida ham muqobil energetikani rivojlantirish bo‘yicha keng ko‘lamli islohotlar amalga oshirilmoqda. Mamlakatning quyoshli kunlari yiliga o‘rtacha 300 kundan ortiq bo‘lishi, ayrim hududlarda shamol energiyasi salohiyatining yuqoriligi hamda tabiiy resurslarning mavjudligi qayta tiklanuvchi energiya manbalarini rivojlantirish uchun katta imkoniyatlar yaratadi [1]. Shu bois muqobil energiya manbalarining rivojlanish bosqichlarini o‘rganish, ularning texnik-iqtisodiy imkoniyatlarini tahlil qilish va amaliyotga keng joriy etish bugungi kunning dolzarb ilmiy hamda amaliy vazifalaridan biri hisoblanadi [7].

Muqobil energiya manbalarining rivojlanishini ilmiy-texnik taraqqiyot va energetika sohasidagi o‘zgarishlarni hisobga olgan holda bir necha bosqichlarga ajratish mumkin. Har bir bosqich energiya resurslaridan foydalanish samaradorligini oshirish, energiya xavfsizligini ta’minlash va ekologik muammolarni kamaytirishga qaratilganligi bilan ahamiyatlidir.

Birinchi bosqich – an’anaviy foydalanish davri

Insoniyat qadim zamonlardan boshlab quyosh nuri, shamol va suv energiyasidan turli maqsadlarda foydalanib kelgan. Shamol tegirmonlari, suv

charxlari va quyosh issiqligidan foydalanish texnologiyalari muqobil energiyaning dastlabki ko‘rinishlari hisoblanadi [2]. Ushbu davrda energiya manbalari asosan qishloq xo‘jaligi, hunarmandchilik va maishiy ehtiyojlarni qondirish uchun qo‘llanilgan. Suv tegirmonlari don mahsulotlarini maydalashda, shamol tegirmonlari esa mexanik ishlarni bajarishda muhim ahamiyat kasb etgan. Mazkur texnologiyalar energiyaning qayta tiklanuvchi manbalaridan foydalanishning ilk amaliy tajribasi sifatida tarixda muhim o‘rin egallaydi.

Ikkinchi bosqich – ilmiy-texnik rivojlanish davri

XX asrning ikkinchi yarmida yuzaga kelgan energetik inqirozlar, neft narxlarining keskin oshishi va qazib olinadigan yoqilg‘i resurslarining cheklanganligi qayta tiklanuvchi energiya manbalariga bo‘lgan qiziqishni sezilarli darajada kuchaytirdi [3]. Ayniqsa, 1970-yillardagi global energetik inqiroz dunyo mamlakatlarini muqobil energiya manbalarini izlashga undadi. Natijada quyosh panellari, shamol generatorlari va geotermal qurilmalarni yaratish bo‘yicha ilmiy tadqiqotlar keng ko‘lamda olib borila boshlandi [6].

Mazkur davrda fotoelektrik elementlar samaradorligining ortishi, shamol turbinalari konstruksiyalarining takomillashuvi va energiya ishlab chiqarish xarajatlarining kamayishi muqobil energetikaning sanoat miqyosida rivojlanishiga zamin yaratdi. Shu bilan birga, ko‘plab davlatlarda qayta tiklanuvchi energiya manbalarini qo‘llab-quvvatlashga qaratilgan qonunchilik va iqtisodiy rag‘batlantirish mexanizmlari joriy etildi [1].

Uchinchi bosqich – raqamli va innovatsion rivojlanish davri

Hozirgi davrda sun’iy intellekt, Internet of Things (IoT), aqlli elektr tarmoqlari (Smart Grid), katta hajmdagi ma’lumotlarni qayta ishlash (Big Data) va energiya saqlash texnologiyalarining rivojlanishi muqobil energetikani yangi bosqichga olib chiqmoqda [7]. Zamonaviy quyosh va shamol elektr stansiyalarida energiya ishlab chiqarish, saqlash, taqsimlash va iste’mol qilish jarayonlari avtomatlashtirilgan boshqaruv tizimlari yordamida nazorat qilinmoqda [5].

Lityum-ion akkumulyatorlari, vodorod energetikasi va energiya saqlashning innovatsion texnologiyalari qayta tiklanuvchi energiya manbalarining samaradorligini sezilarli darajada oshirmoqda. Natijada energiya ishlab chiqarishning uzluksizligi ta’minlanib, elektr tarmoqlarining barqarorligi yaxshilanmoqda. Shuningdek, sun’iy intellekt algoritmlari yordamida energiya ishlab chiqarish hajmini prognozlash va energiya oqimlarini optimallashtirish imkoniyatlari kengaymoqda [7].

Muqobil energiya manbalari zamonaviy energetika tizimining ajralmas qismiga aylanib bormoqda. Ularning rivojlanishi energetik xavfsizlikni ta’minlash, atrof-muhitni muhofaza qilish, issiqxona gazlari chiqindilarini kamaytirish va iqtisodiy barqarorlikka erishishda muhim ahamiyat kasb etadi [5]. Tadqiqot natijalari shuni ko‘rsatadiki, quyosh, shamol, gidroenergetika, biomassa va geotermal energiya manbalaridan samarali foydalanish kelajak energetikasining asosiy yo‘nalishlaridan biri bo‘lib qoladi [6]. O‘zbekistonning tabiiy-iqlim sharoiti,

ayniqsa quyosh va shamol energiyasi salohiyati, qayta tiklanuvchi energiya texnologiyalarini keng joriy etish uchun katta imkoniyatlar yaratadi [7]. Muqobil energetikani rivojlantirish orqali mamlakatning energiya xavfsizligini mustahkamlash, elektr energiyasi ishlab chiqarish hajmini oshirish, ekologik muammolarni kamaytirish va iqtisodiyotning barqaror rivojlanishini ta'minlash mumkin. Shu sababli qayta tiklanuvchi energiya manbalarini rivojlantirish, energiya tejamkor texnologiyalarni joriy etish hamda innovatsion ilmiy ishlanmalarni amaliyotga tatbiq etish O'zbekistonning uzoq muddatli taraqqiyot strategiyasining muhim ustuvor yo'nalishlaridan biri bo'lib qoladi.

Foydalanilgan adabiyotlar

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TA'LIMNING SAMARADORLIGI VA JOZIBASI -PEDAGOG HODIMLARNING ILMIY SALOHIYATI, MALAKASI VA MAHORATI BILAN BOG'LIQDIR

Annotatsiya: *Pedagogik mahorat har bir pedagog o'z kasbiy faoliyati davomida izchil shakllantirib boragigan jayondir. Ta'limning samaradorligi va jozibasi shu jarayonda faoliyat yuritayotgan pedagog hodimlarning ilmiy salohiyati, malakasi va mahorati bilan belgilanadi. Bugungi kunda pedagogik mahoratga ega bo'lish talabi faqatgina o'qituvchilarga emas, shu bilan birga jamoa bilan, ijtimoiy sub'ektlar bilan ishlaydigan har qanday mutaxassislarga ham qo'yilmoqda. Maqolada ta'lim-tarbiya jarayonida pedagogik mahoratning ahamiyati yoritilgan.*

Kalit so'zlar: *Pedagogik mahorat, kasbiy faoliyat, talimda innovatsiyalar, metodika, ta'lim texnologiyalari, peadgogik qobiliyat.*

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THE EFFICIENCY AND ATTRACTIVENESS OF EDUCATION ARE RELATIVE TO THE SCIENTIFIC COMPETENCE, QUALIFICATIONS, AND SKILLS OF TEACHING STAFF

Abstract: *pedagogical skills are a skill that every teacher consistently develops throughout his professional career. The effectiveness and attractiveness of education are determined by the scientific potential, qualifications and skills of the pedagogical staff involved in this process. Today, the requirement to have pedagogical skills is imposed not only on teachers, but also on any specialists working with the team and social subjects. The article highlights the importance of pedagogical skills in the educational process.*

Keywords: *pedagogical skills, professional activity, innovations in education, methodology, educational technologies, pedagogical skills.*

Har qanday jamiyat taraqqiyotida yoshlarning ta'lim-tarbiyasi eng ustuvor masalalardan hisoblanadi. Ta'limning samaradorligi va jozibasi shu jarayonda faoliyat yuritayotgan pedagog hodimlarning ilmiy salohiyati, malakasi va mahorati bilan belgilanadi. O'qituvchi kasbi sharafli va o'ziga xos murakkab bo'lib, pedagogik mahorat fanini esa ilg'or o'qituvchi va olimlarning amaliy va nazariy

bilimlarining yig'indisi desak adashmaymiz. Sharq pedagogikasi va pedagogik mahorati ming yillik tarixga ega bo'lib, nazm mulkining sultoni A.Navoiy, A.Jomiy, Koshifiy va boshqalarning asarlarida nutq, notiqlik san'ati, madaniyati haqida so'z va uning inson ruhiyatiga ta'siri haqida juda ko'p qimmatli hamda durdona fikrlar mavjud.

Mahorat-muayyan ish, xatti-harakat yoki kasbiy faoliyatning ustalik, mohirlik bilan, san'atkorona tashkil etilishiga imkon beradigan bilim, ko'nikma va malakalar majmui. Pedagogik mahorat-pedagog tomonidan kasbiy faoliyatning ustalik, mohirlik bilan, san'atkorona tashkil etilishini ta'minlovchi bilim, ko'nikma va malakalar majmui. Pedagogik mahorat tushunchasiga turli adbiyotlarda turlicha ta'riflar berilgan. «Pedagogik ensiklopediyada» quyidayicha izohlangan: «O'z kasbining mohir ustasi bo'lgan, yuksak darajada madaniyatli, o'z fanini chuqur biladigan, tarbiyalash va o'qitish uslubiyatini mukammal egallagan mutahassis.».

Pedagogik mahorat tug'ma talant yoki nasldan-naslga o'tadigan xususiyat emas, balki tinimsiz izlanish, ham ilmiy, ham amaliy shakldagi ijodiy mehnat mahsulidir. Bu ko'p qirrali pedagogik faoliyat zaminida ijodiy mehnat yotadi. Shuning uchun ham pedagogik mahorat hamma o'qituvchilar uchun standart, ya'ni bir qolip shaklida qolib ketadigan ish usuli emas, balki u har bir o'qituvchining o'z ustida ishlashi, ijodiy mehnati jarayonida tashkil topadi va rivojlanadi.

O'qituvchining pedagogik mahorati mazmunini shunday izohlash mumkin:

•*Madaniyatning yuqori darajasi, bilindonlik va aql-zakovatning yuksak ko'rsatgichi. O'z faniga doir bilimlarning mukammal sohibi. Pedagogika va psixologiya kabi fanlar sohasidagi bilimlarni puxta egallaganligi, ulardan kasbiy faoliyatda foydalana olishi. O'quv tarbiyaviy ishlar metodikasini mukammal bilishi.*

Pedagogik mahorat tizimi quyidagi o'zaro bir- biri bilan bog'liq bo'lgan asosiy kompanentlardan iborat:

•*Pedagogik insonparvarlik talablariga bo'ysunishi, Kasbga oid bilimlarni boshqa fanlar bilan aloqadorlikda mukammal bilishi, Pedagogik qobiliyatga ega bo'lish, Pedagogik texnika sirlarini puxta egallash.*

Pedagogik mahoratning yordamchi tarkibiy qismlari:

•*Nutq malakalari, Tushunarli ta'sirchan fikr va his-tuyg'ularni so'zda aniq ifodalash, Mimika va pantomimika, Ma'noli qarash, Hissiy psixik holat, Kayfiyat yoki istehzoli tabassum, Savodli gapirish, Rag'batlantiruvchi munosabat, Ijodiy jiddiylik.*

Mamlakatimizda mustaqillik yillarida amalga oshirilgan keng ko'lamli islohotlar milliy davlatchilik va suverenitetni mustahkamlash, xavfsizlik va huquq-tartibotni, davlatimiz chegaralari daxlsizligini, jamiyatda qonun ustuvorligini, inson huquq va erkinliklarini, millatlararo totuvlik va diniy bag'rikenglik muhitini ta'minlash uchun muhim poydevor bo'ldi, xalqimizning munosib hayot kechirishi, fuqarolarimizning bunyodkorlik salohiyatini ro'yobga chiqarish uchun zarur shart-sharoitlar yaratdi. O'quv chilarda ijtimoiy ong va tarixiy tafakkurni shakllantirish, dunyo xalqlari hamda ko'p millatli xalqimizning tarixi va bugungi kuniga, milliy va

umuminsoniy qadriyatlarga hurmat hissini tarbiyalash zarur. Bu pedagog kadrlarimiz oldida turgan eng muhim vazifadir.

Pedagogning ijodiy potensiali uning o‘z ijodkorlik sifatlarini shakllantirishga intilishida, pedagogik odobining namoyon bo’lishida, qobiliyati va kasbiy malakasini oshirishida, kutilmagan vaziyatlarda topqirlik qila olishida, O‘quv chi va talabalarni komillik sari mohirlik bilan etaklay olishida ko’rinadi.

Qobiliyat hamma insonlarda mavjud bo’lib, bir tekisda bo’lmay, biri yuqori, biri o’rta va biri quyi darajadan iboratdir. Faqat aqli zaif insonlarda qobiliyatni uchrata olmaymiz. Muvafaqqiyatli ishlash uchun har bir pedagog pedagogik mahoratga ega bo’lishi zarur. Pedagogik mahorat egasi o’z mehnat sarf qilib, katta natijaga erishadi. Qobiliyat faoliyat jarayonida paydo bo’ladi va rivojlanadi, qobiliyatni rivojlantirish uchun esa layoqat, zexn, iste’dod ya’ni inson nerv tizimida anatomo-fiziologik xususiyat ham bo’lishi zarur.

Pedagogik texnika-bu o’qituvchi faoliyatining (xatti-harakatlarining) tashkiliy shakli. Pedagogik texnika ikkita katta guruhda farqlanadi:

o’z-o’zini boshqarish malakasi (gavdasini, gavda a’zolarini boshqarish malakasi), hissiy holatini boshqara olishi, nutq texnikasi va madaniyatini o’zlashtirishi; bu asosan didaktik malaka va ko’nikmalar, tashkilotchilik, kommunikasiya, dars konstruksiyasi va boshqa qobiliyatlarning majmuasidan tashkil topganligi.

O’qituvchining ijodkorligi nafaqat dars jarayonlarida qolaversa, darsdan tashqari mashg’ulotlarda, ijodiy to’garaklar faoliyatida, ma’naviy-marifiy tadbirlarda takomillashib boradi. Bu ayniqsa ijtimoiy- gumanitar fan sohasida faoliyat yuritayongan pedagoglarning mahoratida o‘z aksini topadi. Masalan, Ma’naviy-ma’rifiy tadbirlarni o’tkazish – sinfdan tashqari ishlarning muhim tashkiliy shakli bo’lib, ularning asosiy vazifasida ilmiy ma’lumot berishdan tashqari harxil san’at vositalari (badiiy o’qish, musiqa, ashula, video rolik) yordamida O‘quv chilarga ibratli tarixiy voqyealarlarning mazmuni, mohiyati va ahamiyatini tushuntirish va ulardan ibrat olishni uqtirishdan iborat. O‘qituvchilik ishida muvaffaqiyatga erishish uchun har bir muallim pedagogik mahoratni egallashi zarur. Pedagogik mahorat egasi kam kuch sarf qilib, ulkan natijalarga erishadi, o‘z ishining natijasi bilan mo‘’jizalar yaratadi, ijodkor bo‘ladi. Pedagogik ishga qobiliyatli, iste’dodli kishidagina pedagogik mahorat bo‘lishi mumkin.

Pedagogik mahoratni shakllanishi pedagogik yo’nalashdagi Oliy Ta’lim muassasalari O‘quv -ilmiy faoliyatidagi asosiy jihatlardan biridir. Bo’lajak pedagoglarni o‘z kasbiy mahoratlarini talabalik davridanoq rivojlantirib borishga yo’naltirish lozim. Zamonaviy oliy pedagogik ta’lim uchun eng muhim masalalardan biri - talabalarda pedagogik kompetensiyani shakllantirishdir. Shu munosabat bilan pedagogik kompetensiya nimadan iboratligini ilmiy nuqtayi nazardan o‘rganish zarur. “Kompetentlik” (ingl. “competence” - “qobiliyat”) - faoliyatda nazariy bilimlardan samarali foydalanish, yuqori darajadagi kasbiy malaka, mahorat va iqtidorni namoyon eta olishni anglatadi. Pedagogik kompetensiyaga nima tegishli ekanligini, uning tarkibiy qismi sifatida uning

mohiyatini ochib berish. Pedagogik jarayonning qanchalik samarali, muvaffaqiyatli tashkil etilishi o‘qituvchining pedagogik qobiliyatga egaligiga bog‘liq. Manbalardan birida “qobiliyat” tushunchasi shunday sharhlanadi: shaxsning osonlik bilan biron faoliyatni egallay olishini ta’minlaydigan individual psixologik xususiyat; narsa va hodisalar mohiyatini ijodiy tasavvur qilish layoqati.

Bugungi kunda pedagogik mahoratga ega bo‘lish talabi faqatgina o‘qituvchilarga emas, shu bilan birga jamoa bilan, ijtimoiy sub’ektlar bilan ishlaydigan har qanday mutaxassislarga ham qo‘yilmoqda. Binobarin, tirik mavjud bo‘lgan shaxslarga ta’sir ko‘rsatish, ularni boshqarish oson kechmaydi. Bu esa oliy ta’lim muassasalarida bo‘lajak mutaxassislarning muayyan darajada pedagogik mahoratga ega bo‘lishlari zarurligi taqozo etmoqda.

Xulosa o’rnida shu ta’kidlash joizki, ta’lim-tarbiya jarayonida faoliyat ko’rsatayotgan pedagog xodimlar o‘z ustida tinimsiz ishlashi, zomonaviy ilm-fan va texnologiyalaridan samarali foydalana olishi va ularni dars jarayonlariga tadbiq eta olishi kerak.

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CHUFA MAHSULOTLARINI KOMPLEKS QAYTA ISHLASHNING ILMIY-TEXNOLOGIK ASOSLARI

Annotatsiya. *Mazkur maqolada chufa (Cyperus esculentus L.) tuganaklarini kompleks qayta ishlashning ilmiy-texnologik asoslari yoritilgan. Tadqiqot davomida chufa tuganaklaridan o'simlik suti, yog'i, un va boshqa funksional oziq-ovqat mahsulotlarini olish texnologiyalarining asosiy bosqichlari o'rganilgan. Kompleks qayta ishlash natijasida xomashyo tarkibidagi oqsil, yog', uglevod, vitamin va mineral moddalaridan samarali foydalanish imkoniyati aniqlangan. Shuningdek, chiqindisiz texnologiyalarni joriy etish, mahsulot sifatini oshirish va oziq-ovqat xavfsizligini ta'minlashning ilmiy-amaliy jihatlari asoslab berilgan. Tadqiqot natijalari chufa asosidagi innovatsion va funksional oziq-ovqat mahsulotlarini ishlab chiqarishni takomillashtirish hamda oziq-ovqat sanoatida resurslardan oqilona foydalanishga xizmat qiladi.*

Kalit so'zlar: *chufa, Cyperus esculentus L., tuganak, kompleks qayta ishlash, funksional oziq-ovqat mahsulotlari, chufa yog'i, chufa uni, o'simlik suti, oziqaviy qiymat, chiqindisiz texnologiya.*

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SCIENTIFIC AND TECHNOLOGICAL FOUNDATIONS OF COMPLEX PROCESSING OF CHUFA PRODUCTS

Abstract. *This article describes the scientific and technological foundations of the complex processing of chufa (Cyperus esculentus L.) tubers. During the study, the main stages of the technology for obtaining plant milk, oil, flour, and other functional food products from chufa tubers were studied. Complex processing has revealed the possibility of efficient use of protein, fat, carbohydrates, vitamins and minerals contained in raw materials. The scientific and practical aspects of introducing waste-free technologies, improving product quality, and ensuring food safety are also explained. The results of the study will serve to improve the production of innovative and functional food products based on chufa and to promote the rational use of resources in the food industry.*

Keywords: chufa, *Cyperus esculentus L., tuber, integrated processing, functional foods, chufa oil, chufa flour, plant-based milk, nutritional value, waste-free technology, food safety.*

Kirish. Dunyo bugungi kunda aholisining oziq-ovqat mahsulotlariga bo‘lgan ehtiyoji tobora ortib borayotganligi qishloq xo‘jaligi mahsulotlarini yetishtirish, saqlash va qayta ishlash texnologiyalarini takomillashtirishni taqozo etmoqda. Ayniqsa, biologik qiymati yuqori, eksportbop hamda inson salomatligi uchun foydali bo‘lgan noan’anaviy qishloq xo‘jaligi ekinlarini yetishtirish va ularni qayta ishlash texnologiyalarini rivojlantirish muhim ilmiy-amaliy ahamiyat kasb etmoqda. Shunday istiqbolli ekinlardan biri chufa (Cyperus esculentus L.) hisoblanadi. Ushbu o‘simlik dunyoning ko‘plab mamlakatlarida “tiger nut”, “earth almond”, “yellow nutsedge” nomlari bilan mashhur bo‘lib, oziq-ovqat sanoati, farmatsevtika, kosmetologiya va parhezbop mahsulotlar ishlab chiqarishda keng foydalaniladi. Chufa tuganaklari tarkibida oqsil, yog‘, kraxmal, tabiiy shakar, vitaminlar, mikroelementlar va biologik faol moddalar yuqori miqdorda mavjudligi bilan ajralib turadi.

Chufani yetishtirish bo‘yicha tajribalar muvaffaqiyatli bo‘lishiga qaramay, hosilni yig‘ish va qayta ishlashdagi qiyinchiliklar sababli ekin keng tarqalmagan XX asrning 30-yillari boshida akademik Nikolay Ivanovich Vavilov tashabbusi bilan turli mamlakatlardan 16 tonna elita tuganaklari olib kelindi. Shundan so‘ng mamlakat bo‘ylab tajriba plantatsiyalari tashkil qilindi. Eng qimmatli urug‘ materiallari Ispaniya va Gollandiyadan keltirilgan edi. 1931-yilda chufa eng muhim yangi oziq-ovqat va texnik ekinlar qatoriga kiritildi.

U Shimoliy Kavkaz, Krasnodar o‘lkasi, Gruziya, Ozarbayjon, Abxaziya va Ukrainada yetishtirilgan. 1934-yilda chufa ekilgan maydon 1350 gektarni tashkil etgan. Mashhur olim Boris Mixaylovich Kozo-Polyanskiy chufani “noyob tabiiy fabrikat va oziq-ovqat konsentrati” deb ta’riflagan. Chufadan olingan sutni aloxida idishga olinadi. Olingan sut 1-2 soat sovutiliadi.

1-rasm chufa mevasini maydalashdan oldinigi holati

2-rasm chufa mevasini maydalangan kukuni

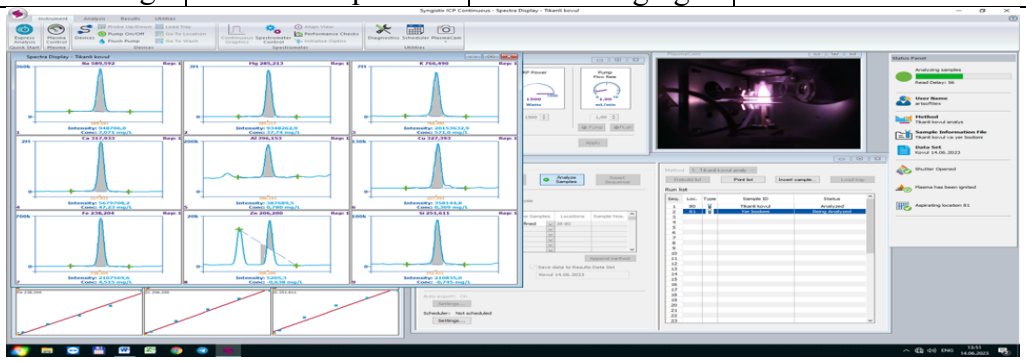
3-rasm chufa mevasini olingan sut maxsuloti na'munasi	**4-rasm chufa mevasini suti olingandan keyingi pulpasi**

Bulardan tashqari quritilgan chufa ildiz mevalarini sanitar-bakteriologik tekshruv natijalari Qolaversa chufa mevasi tarkibidagi zaxarli elementlarni tekshirish natijalari 1-jadvalda keltirilgan.

1-jadval

Chufa ildiz mevalarini sanitar-bakteriologik tekshruv natijalari

T/r	Elementlar nomi	Aniqlangan konsentrasiya	O'lchov birligi	Tekshiruvdan qo'lanilgan xujjatlar
	Qo'rg'oshin	Aniqlanmadi <0.5	mg/kg	GOST 26932-86
	Kadm	Aniqlanmad	mg/kg	GOST 26932-86
	Simob	Aniqlanmad	mg/kg	GOST 26932-86
	Marga	Aniqlanmad	mg/kg	GOST 26932-86



3-rasmda Mikroelementlarni tahlil jarayoni Avio 200 ICP-OES spektrometr qurilmasida

Shunday qilib, chufa o'simligi mevasini tarkibi bo'yicha olingan natijalar normativ-texnik xujjatlar talablariga to'liq javob berishi aniqlandi.

Xulosa. Olib borilgan tadqiqotlar chufa mahsulotlari tarkibida vitaminlar va minerallarning o'rganishda Avio 200 ICP-OES spektrometr qurilmasidan foydalanildi. Oziq-ovqat mahsulotlarini ishlab chiqarish va qayta ishlash uchun xavfsizlik va sifat nuqtai nazaridan oziq-ovqat mahsulotlarining tarkibiy qismlarini, shu jumladan ularning tarkibiga qaysi mikro, makroelementlar va vitaminlar miqdorini borligini aniqlash uchun 200 ICP-OES spektrometr tajribalar o'tkazildi, 3-rasmda mikroelementlarni tahlil jarayoni ko'rsatilgan [2,3].

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ANDIJON VILOYATINING TOG‘OLDI HUDUDLARIDA ASALARI OILALARI MAHSULDORLIGINI OSHIRISHNING INNOVATSION USULLARI VA RIVOJLANTIRISH ISTIQBOLLARI

Annotatsiya: *Ushbu maqolada Andijon viloyatining tog‘oldi hududlarida asalari oilalarining biologik rivojlanishi va mahsuldorligini oshirish imkoniyatlari o‘rganildi. Tadqiqotlar 2024–2026-yillarda Andijon, Izboskan va Xo‘jaobod tumanlari asalarichilik xo‘jaliklarida olib borildi. Tadqiqot davomida hududning nektar-gulchang bazasi, asalari oilalarining rivojlanish dinamikasi hamda innovatsion parvarishlash usullarining samaradorligi baholandi. Natijalar uyalarni termik izolyatsiyalash va rag‘batlantiruvchi oziqlantirish usullarini qo‘llash natijasida asalari oilalari kuchi 25,9 %, tovar asal mahsuldorligi esa 44,8 % ga oshganligini ko‘rsatdi. Tog‘oldi hududlarida ko‘chma asalarichilik, seleksiya ishlari va raqamli monitoring tizimlarini joriy etish sohaning istiqbolli rivojlanish yo‘nalishlari sifatida tavsiya etildi.*

Kalit so‘zlar: *Tog‘oldi hududlar, asalarichilik, mahsuldorlik, innovatsion usullar, nektar balansi, Karnika (Apis mellifera carnica), fitosenoz.*

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INNOVATIVE METHODS FOR INCREASING THE PRODUCTIVITY OF BEE COLONIES IN THE FOOTHILL AREAS OF THE ANDIJAN REGION AND PROSPECTS FOR DEVELOPMENT

Abstract: *This article investigates the possibilities of enhancing the biological development and productivity of bee colonies in the foothill areas of the Andijan region. The research was conducted between 2024 and 2026 across beekeeping farms in the Andijan, Izboskan, and Khojaobod districts. During the study, the nectar-pollen base of the region, the developmental dynamics of bee colonies, and the effectiveness of innovative management practices were evaluated. The results demonstrated that the application of thermal insulation in hives and promotional feeding methods increased colony strength by 25.9% and commercial honey productivity by 44.8%. The introduction of migratory beekeeping, selective breeding, and digital monitoring systems in foothill regions are recommended as promising pathways for the future development of the sector.*

Keywords: *Foothill areas, beekeeping, productivity, innovative methods, nectar balance, Carniolan honey bee (Apis mellifera carnica), phytocenosis.*

Kirish Asalarichilik qishloq xo‘jaligining eng qadimiy va iqtisodiy jihatdan samarali tarmoqlaridan biri bo‘lib, nafaqat qimmatli biologik mahsulotlar (asal, mum, gulchang, ona ari suti, propolis, ari zahri) yetkazib beradi, balki qishloq xo‘jaligi ekinlarini chetdan changlatish orqali hosildorlikni 20-30 % gacha oshirishda muhim ekologik va iqtisodiy rol o‘ynaydi.

Andijon viloyati O‘zbekistonning eng zich joylashgan va yer resurslari cheklangan hududi hisoblanadi. Shu sababli, intensiv dehqonchilik rivojlangan tekislik hududlarida pestitsidlar yuklamasining yuqoriligi asalarichilik tarmog‘iga salbiy ta’sir ko‘rsatmoqda. Bu esa viloyatning tog‘oldi va tog‘ hududlaridan (Xo‘jobod, Qo‘rg‘ontepa, Buloqboshi va Jalaquduq tumanlari) asalarichilikni rivojlantirishda strategik poligon sifatida foydalanishni taqozo etadi.

Tog‘oldi hududlari o‘zining boy tabiiy florasi, uzoq muddatli gullash davri va ekologik tozaligi bilan ajralib turadi. Biroq, bugungi kunda ushbu hududlarning nektar zaxiralaridan to‘liq foydalanilmayapti, asalari oilalarini parvarishlashda an’anaviy usullar ustunlik qilmoqda va mahsuldorlik past darajada qolmoqda.

So‘nggi adabiyotlar tahlili So‘nggi yillarda jahon va respublika olimlari tomonidan asalarichilikda innovatsion usullarni qo‘llash va asalari instinktlarini boshqarish bo‘yicha qator tadqiqotlar olib borilmoqda.

Jahon tajribasi: *Seeley (2019)* o‘zining tadqiqotlarida rag‘batlantiruvchi uglevodli oziqlantirish ishchi arilar faolligini va oziqa qidirish intensivligini oshirishi mumkin. Uning fikricha, asalari uyasining mikromuhitini (harorat va namlik) sun’iy nazorat qilish orqali ishchi arilarning energiya sarfini kamaytirish va nektar yig‘ish faolligini oshirish mumkin.

Innovatsion usullar: *Moritz va Southwick (2021)* asalarichilikda raqamli texnologiyalar va aqlli uya (Smart Hive) tizimlarini joriy etish orqali oilalarning salomatligi va mahsuldorligini masofadan monitoring qilish mexanizmlarini asoslab bergan.

Mahalliy tadqiqotlar: O‘zbekiston sharoitida, xususan, Farg‘ona vodiysi florasi va asalarichilik resurslarini o‘rganish bo‘yicha Krahotin (2015) va Isamuhamedov (2018) kabi olimlar tomonidan salmoqli ishlar qilingan. Ularning tadqiqotlarida vodiy sharoitida "Karnika" (Apis mellifera carnica) va "Karpat" (Apis mellifera carpatica) zotlarining mahalliy iqlimga moslashuvchanligi va tog‘oldi hududlaridagi o‘t-o‘lanlar fitosenozidan foydalanish koeffitsiyenti yuqori ekanligi ta’kidlangan.

Muammoning qo‘yilishi: Shunga qaramay, Andijon viloyatining o‘ziga xos tog‘oldi mikromuhitida (erta bahorgi harorat tebranishlari, kuchli shamollar va o‘simliklar sersuvligi) innovatsion usullarni qo‘llash, signal raqslari va laboratoriya tahlillari asosida asalarilar faolligini oshirish masalalari hali yetarlicha tizimli o‘rganilmagan.

Materiallar va metodlar Tadqiqotlar 2024–2026-yillar davomida Andijon viloyatining Andijon, Izboskan va Xo‘jobod tumanlarining tog‘oldi hududlarida joylashgan asalarichilik xo‘jaliklarida hamda Andijon qishloq xo‘jaligi va agrotexnologiyalar instituti laboratoriyasida olib borildi.

Tadqiqot obyekti Tadqiqot obyekti sifatida viloyatda keng parvarishlanayotgan **Karnika (Apis mellifera carnica)** va mahalliy populyatsiya asalari oilalari tanlab olindi. Tajriba va nazorat guruhlari uchun 10 tadan (jami 20 ta) bir xil kuchga ega bo‘lgan, yoshi va kelib chiqishi bir xil bo‘lgan ona arili oilalar shakllantirildi.

Metodologiya. Floristik tahlil: Tog‘oldi hududlarining nektar beruvchi florasi marshrut-geobotanik usulda o‘rganildi. O‘simliklarning gullash kalendari va asal mahsuldorligi (1 gektardan olinadigan shira miqdori) hisoblab chiqildi.

Asalari oilalari mahsuldorligini baholash: Asalari oilalarining rivojlanish dinamikasi va mavsumiy asal mahsuldorligi (kg) har 12 kunda an’anaviy zootexnikaviy usullarda o‘lchandi.

Innovatsion yondashuv: Tajriba guruhidagi asalari uyalarida mikromuhitni (harorat 34-35 ° C va namlik 60-70 %) barqaror saqlash uchun innovatsion izolyatsiyalash materiallari va maxsus oziqlantirish (rag‘batlantiruvchi va signal raqslarini aktivlashtiruvchi siroplar) usullari qo‘llanildi.

Statistik tahlil: Olingan ma’lumotlar variatsion statistika usulida (**M ± m**) va Studentning t-mezoni bo‘yicha kompyuter dasturlarida qayta ishlandi.

Natijalar. Tog‘oldi hududlarining nektar resurslari tahlili Tog‘oldi asal beruvchi o‘simliklari. Butun O‘zbekiston bo‘ylab keng tarqalgan bo‘lib, dengiz sathidan 500-800 metr balandlikda joylashgan, bahorgi va yozgi vegetatsiya o‘simliklariga bo‘linadi. Bahorgi vegetatsiya asal olinadigan o‘simliklarning efemerlar (bir yillik o‘simliklar) va efemeroidlar (ko‘p yillik o‘simliklar) bilan ifodalanadi. Ular namlik kuchli bahor sharoitida qisqa rivojlanish sikli va fasllar bo‘yicha notekis yog‘inlar sharoitiga moslashuvchangligi bilan ajralib turadi. Yoz boshlanishi bilan bahorgi vegetatsiya aal beruvchi o‘simliklarning mevalari pishib yetiladi. Ular asalarichilar tomonidan asosan gulchang manbalari va oilani rivojlantirish uchun qo‘shimcha manba sifatida ishlatiladi. O‘tkazilgan geobotanik tadqiqotlar natijasida Andijon viloyati tog‘oldi hududlarida 80 dan ortiq yovvoyi va madaniy nektar-gulchang beruvchi o‘simliklar aniqlandi. Ularning gullash davrlari aprel oyining boshidan avgust oyining oxirigacha davom etadi (1-jadval).

1-jadval.

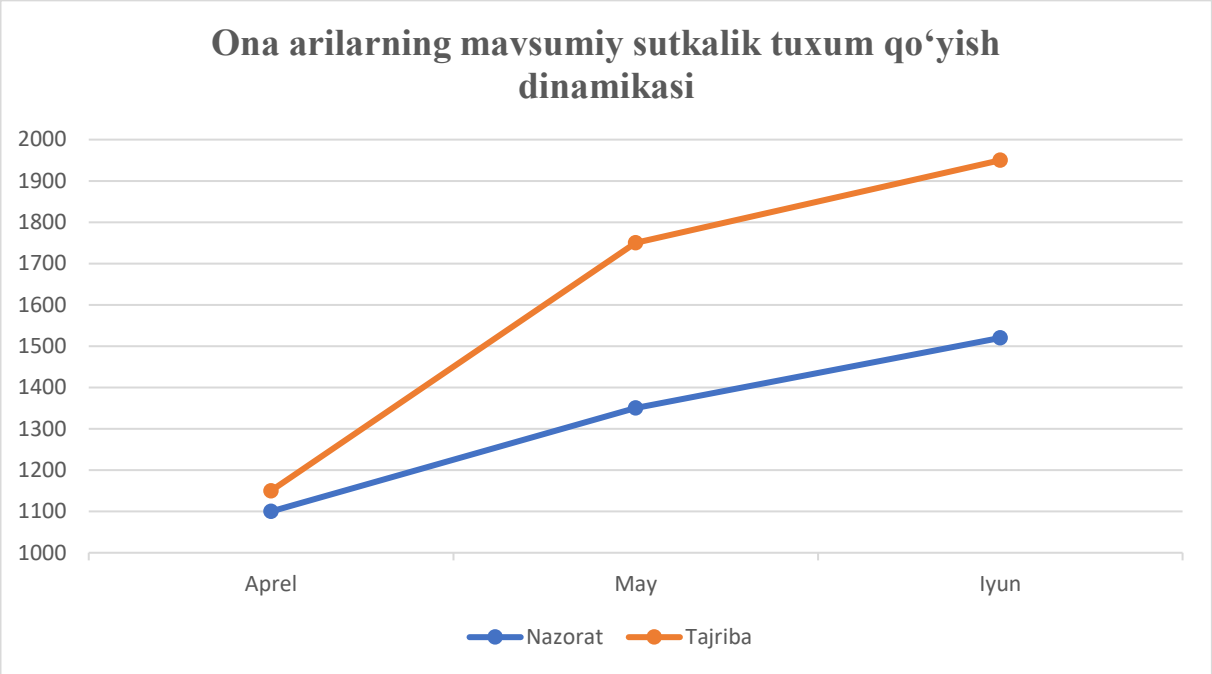
Andijon viloyati tog‘oldi hududlarining asosiy nektar beruvchi o‘simliklari va ularning salohiyati

O‘simlik turi	Gullash davri (oylar)	1 ga maydondan asal unumi (kg)	Asalarilar uchun ahamiyati
Yovvoyi bodom va gilos	IV	20–35	Erta bahorgi rivojlanish uchun
Isiriqdoshlar	IV–V	40–60	Asosiy shira to‘plashgacha tayyorgarlik
Esparset (Onobrychis spp.)	V–VI	80–120	Yuqori sifatli nektar va gulchang manbai
Qashqarbeda (Melilotus spp.)	VI–VIII	200–350	Eng kuchli asal beruvchi o‘simliklardan biri
Madaniy beda (Lyutserna)	V–VIII	45–60	Qo‘shimcha nektar va gulchang
Sebarga (Trifolium spp.)	V–VII	80–120	Oila rivojlanishi uchun muhim oqsil manbai
Kiyik o‘ti (Ziziphora spp.)	VI–VII	70–90	Shifobaxsh va xushbo‘y asal manbai
Yantoq (Alhagi spp.)	VI–VIII	100–150	Asosiy shira manbai, tovar asal olish uchun
Tog‘ yalpizi (Mentha spp.)	VII–VIII	80–120	Aromatik asal va gulchang manbai
Tog‘ rayhoni (Origanum spp.)	VI–VIII	60–100	Dorivor xususiyatga ega asal olish imkonini beradi

Innovatsion usullarning asalari oilalari rivojlanishiga ta’siri Tajriba guruhida qo‘llanilgan innovatsion usullar (uyalarni termik izolyatsiyalash va erta bahorgi stimulyatsiya) asalari oilalarining biologik ko‘rsatkichlariga ijobiy ta’sir ko‘rsatdi.

Ona arining sutkalik tuxum qo‘yish faolligi tajriba guruhida nazorat guruhiga nisbatan sezilarli darajada yuqori bo‘ldi. Bu esa asosiy shira yig‘ish davriga (iyun oyi) kelib, ishchi arilar sonining keskin ortishini ta’minladi (1-diagramma).

1-diagramma.



Mavsum yakunida har bir asalari oilasidan olingan tovar asal miqdori bo‘yicha ham jiddiy farqlar aniqlandi (2-jadval).

2-jadval.

Tajriba va nazorat guruhlaridagi asalari oilalarining mahsuldorlik ko‘rsatkichlari (M ± m, n=10)

Ko‘rsatkichlar	Nazorat guruhi (An’anaviy)	Tajriba guruhi (Innovatsion)	Nazoratga nisbatan farq, %
Bahorgi uya kuchi (arili ramka soni)	7.2 ± 0.3	8.5 ± 0.4	+18.0 %
Mavsum cho‘qqisidagi uya kuchi	22.4 ± 1.1	28.2 ± 1.3	+25.9 %
Mavsumiy tovar asal unumi (kg)	18.5 ± 1.2	26.8 ± 1.5	+44.8 %
Olingan propolis miqdori (g)	45.0 ± 3.2	65.0 ± 4.1	+44.4 %

Munozara Tadqiqot natijalari shuni ko‘rsatadiki, Andijon viloyatining tog‘oldi hududlarida asalarichilikni an’anaviy usulda olib borish (nazorat guruhi) mavjud tabiiy salohiyatdan to‘liq foydalanish imkonini bermaydi. Nazorat guruhida asal unumi o‘rtacha 18,5 kg ni tashkil etgan bo‘lsa, innovatsion texnologiyalar qo‘llanilgan guruhda bu ko‘rsatkich 26.8 kggacha (44.8 % ga) oshdi.

Bu holatni quyidagicha izohlash mumkin:

Mikromuhit barqarorligi: Tog‘oldi hududlarida bahorda kechasi va kunduzi haroratning keskin tebranishi kuzatiladi. Uyalarni termik muhofaza qilish

ishchi arilarning uyadagi haroratni (34,5 ° C) saqlash uchun sarflaydigan energiya va asal sarfini kamaytiradi. Natijada arilar bor kuchini lichinkalarni boqish va nektar tashishga qaratadi.

Instinktlarni faollashtirish: Erta bahorda hidli va shakarli siroplar bilan rag‘batlantiruvchi oziqlantirish asalarilarning "qidiruvchi" (razvedkachisi) arilarini faollashtiradi va ular signal raqslari orqali boshqa arilarni nektar manbaiga tezroq safarbar qiladi.

Seeley (2019) ta’kidlaganidek, asalarilarning axborot almashinuvi va signal raqslari boshqarilganda, asalarilarni vaqt yo‘qotishdan saqlanadi. Bizning tadqiqotlarimiz ham ushbu nazariyani tog‘oldi iqlim sharoitida amaliy jihatdan tasdiqladi.

Biroq, sohani rivojlantirishda bir qator muammolar ham mavjud. Tog‘oldi hududlarida Varroatoz va Akorapidoz kabi parazitar kasalliklarning tarqalish xavfi yuqori. Shu sababli, ekologik toza preparatlar (shovul va chumoli kislotasi) yordamida profilaktika ishlarini tizimli yo‘lga qo‘yish talab etiladi.

Xulosa va tavsiyalar O‘tkazilgan ilmiy-amaliy tadqiqotlar asosida quyidagi xulosalarga kelindi:

Yuqori salohiyat: Andijon viloyatining tog‘oldi hududlari boy fitosenozga ega bo‘lib, yantoq, kiyik o‘ti va tog‘ o‘tlari hisobiga har bir ari oilasidan ekologik toza, shifobaxsh asal olish imkoniyatini beradi.

Innovatsiya samarasi: Asalari oilalarini parvarishlashda innovatsion izolyatsiyalash va stimulyatsiya usullarini qo‘llash uya kuchini 25,9 % ga, tovar asal mahsuldorligini esa 44.8 % ga oshiradi.

Rivojlantirishning ustuvor yo‘nalishlari: Ko‘chma asalarichilikni yo‘lga qo‘yish: Bahorda asalarilarni tekislikdagi bog‘lardan tog‘oldi hududlaridagi yovvoyi floraga bosqichma-bosqich ko‘chirish grafiklarini ishlab chiqish.

Zoti va seleksiya: Mahalliy sharoitga mos, mahsuldor va qishlovga chidamli Karnika (Apis mellifera carnica) zotli ona arilarni sun’iy urug‘lantirish laboratoriyalarini tashkil etish va ko‘paytirish.

Raqamlashtirish: Tog‘oldi zonalarida uya harorati va vaznini nazorat qiluvchi "aqlli tarozi" va sensor tizimlarini joriy qilish.

Klaster tizimi: Asal yetishtirishdan boshlab, uni qadoqlash, brendlash va eksport qilishgacha bo‘lgan zanjirni qamrab olgan "Tog‘ asali" agrosanoat klasterlarini tashkil etish.

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REGULATORY CHALLENGES IN THE USE OF DIGITAL FINANCIAL ASSETS FOR CROSS-BORDER SETTLEMENTS

Abstract: *The expanding use of digital financial assets (DFAs) in international payments runs into regulatory barriers that remain unresolved at both national and international levels. This paper identifies four principal obstacles — legal classification of DFAs, AML/CFT compliance requirements, CBDC interoperability constraints, and sanctions enforcement — and examines them through a comparative analysis of Russia, the EU, the United States, and China. The findings reveal deep regulatory fragmentation that prevents DFA-based settlement infrastructure from scaling and inform three harmonization directions: technical standards, normative instruments, and mutual recognition mechanisms.*

Keywords: *digital financial assets, cross-border settlements, CBDC, stablecoin, AML/CFT, regulatory arbitrage, distributed ledger technology.*

Introduction

Cross-border payment infrastructure has changed remarkably little despite the broader digitalization of finance. The correspondent banking model, which routes international transfers through chains of intermediary banks, delivers settlement at costs that the Bank for International Settlements estimates at over 6% per retail transaction — a figure that is difficult to justify in an environment where domestic payments are increasingly instant and cheap[10]. Digital financial assets, with their capacity for programmable settlement and near-real-time finality, represent a credible structural alternative. Pilot projects, including the BIS Innovation Hub's multi-CBDC Project mBridge, have demonstrated technical feasibility; what remains unresolved is the regulatory dimension.

The core problem is this: a cross-border DFA payment must operate within multiple national legal frameworks simultaneously, and those frameworks are, at present, inconsistent with one another. Classification of the same instrument differs across jurisdictions; AML/CFT compliance obligations are not harmonized; CBDC architectures are technically incompatible; and sanctions regimes create liability exposure that is difficult to manage in decentralized networks. The purpose of this paper is to systematize these barriers and identify directions for their resolution — a question that is central to the author's master's thesis on the formation of an international DFA-based settlement system.

[10] Bank for International Settlements. Annual Economic Report 2023: Towards a Blueprint for a Future Monetary System. — Basel

Methods and Materials

The study applies comparative legal analysis, a systems approach, and synthesis. Primary sources include Russia's Federal Law No. 259-FZ, the EU's MiCA Regulation, FATF Recommendation 16 and its implementation guidance, FSB recommendations on global stablecoins, and OFAC enforcement materials. These are supplemented by BIS research, central bank concept documents, and peer-reviewed journal articles. Four jurisdictions — Russia, the EU, the United States, and China — were selected because they represent the dominant regulatory poles and together account for the majority of global cross-border payment flows.

Analysis and results

1. Legal Classification of Digital Financial Assets

No internationally agreed definition of a digital financial asset exists. The same instrument may be treated as a security, a commodity, foreign currency, or a novel property right depending on the jurisdiction, with entirely different regulatory consequences in each case.

Russia's Federal Law No. 259-FZ classifies DFAs as digital rights but prohibits their use as a means of payment on Russian territory[11]. The result is an internal contradiction: the legal infrastructure for issuing and trading DFAs is in place, while their most commercially significant application is blocked. Exceptions for foreign trade transactions exist but remain narrowly and imprecisely defined.

The EU's MiCA Regulation, fully applicable since 2024, introduced the most comprehensive taxonomy to date, distinguishing asset-referenced tokens (ARTs), e-money tokens (EMTs), and other crypto-assets[12]. MiCA provides legal clarity within the Single Market but does not address the cross-border layer, leaving the most challenging dimension of DFA-based payments essentially untreated.

In the United States, the SEC applies the Howey test to claim that many tokens are securities, while the CFTC asserts jurisdiction over tokens as commodities. This unresolved inter-agency contest, conducted without comprehensive legislation, leaves payment-service operators in a state of persistent legal uncertainty.

2. AML/CFT Compliance and the Travel Rule

FATF Recommendation 16 extends the Travel Rule to virtual asset service providers, requiring them to transmit originator and beneficiary information on cross-border transfers above USD/EUR 1,000[13]. In practice, a DFA payment may transit multiple protocols and wallets operated by different VASPs in different countries, none of which share a common messaging standard. Competing proprietary solutions — TRP, TRISA, OpenVASP — remain mutually

[11] Federal Law of the Russian Federation No. 259-FZ of 31 July 2020 «On Digital Financial Assets, Digital Currency and on Amendments to Certain Legislative Acts of the Russian Federation»

[12] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets (MiCA)

[13] Financial Action Task Force. Updated Guidance for a Risk-Based Approach to Virtual Assets and Virtual Asset Service Providers

incompatible in many configurations. The uneven pace of FATF implementation across jurisdictions compounds this: during transitional periods, compliant operators bear asymmetric costs while non-compliant ones face no equivalent burden, a dynamic that Zetzsche et al. call the 'sunrise issue'[14].

3. CBDC Interoperability and Monetary Sovereignty

Over 130 countries are currently researching or piloting central bank digital currencies. As these projects mature, the question of cross-border interoperability becomes operational. The BIS Innovation Hub distinguishes three models: compatibility through common standards, interlinking through a shared interface, and a single multi-central-bank platform [1, p. 47]. Project mBridge, involving the BIS and the central banks of China, Hong Kong, Thailand, and the UAE, is the most advanced instantiation of the interlinking model but remains at the pilot stage. Technical compatibility is only part of the challenge: any interoperability arrangement must also resolve questions of data governance, seigniorage, and the impact of cross-border CBDC use on domestic monetary policy — issues that are politically sensitive and difficult to negotiate multilaterally.

4. Sanctions Compliance and Extraterritorial Enforcement

Sanctions regimes administered by OFAC and the EU intersect with DFA-based payments in ways that have no direct precedent in traditional correspondent banking. OFAC's 2022 designation of the Tornado Cash smart contract protocol — not a company or individual, but open-source code — as a Specially Designated National demonstrated that technical infrastructure can itself become a sanctions target [6]. For cross-border DFA settlement systems, this means real-time screening of transactions against continuously updated sanctions lists, a task that is manageable in centralized architectures but structurally difficult in decentralized ones.

5. Comparative Overview

The four dimensions above are summarized comparatively in Table 1.

Table 1 — Comparative Overview of DFA Regulatory Approaches[15]

Criterion	Russia	EU	USA	China
DFA legal status	Digital rights; no payment use (FZ-259)	MiCA taxonomy: ART, EMT, other	Unresolved: SEC vs CFTC	Private crypto banned; state e-CNY only
DFA payments	Banned domestically; limited FX trade exceptions	Permitted under supervision	No clear framework; enforcement risk	e-CNY only
CBDC stage	Digital ruble — testing	Digital euro — pilot	FedNow live; CBDC research	e-CNY — large-scale pilot

[14] Zetzsche D. A., Buckley R. P., Arner D. W. Regulating LIBRA: The Transformative Potential of Facebook's Cryptocurrency and Possible Regulatory Responses

[15] *Compiled by the author based on [1–6].*

FATF / AML	Implemented	Full (TFR)	Partial (BSA)	Centralised state control
Cross-border DFA settlements	Bilateral pilots; mBridge	Limited under MiCA	Constrained by sanctions risk	mBridge; e-CNY internationalisation

The table makes clear that no jurisdiction has produced a complete regulatory solution for cross-border DFA settlements. Russia and the US approach the problem from opposite starting positions; the EU offers the most systematic framework but limited geographic scope; China's model is internally coherent but premised on state monopoly over digital currency issuance, a foundation unlikely to be replicated in a multilateral architecture.

Directions for Overcoming Regulatory Barriers

Three complementary levels of action are needed.

At the technical level, the priority is an interoperable standard for Travel Rule compliance data exchange. The banking sector's adoption of ISO 20022 as a common messaging standard demonstrates that shared technical norms, once established, significantly reduce the operational cost of cross-border compliance. An equivalent standard for DFA transactions would require coordinated development through a body with sufficient authority — the BIS, ISO, or a G20-mandated working group — and would need to bridge CBDC and VASP architectures.

At the normative level, a model law on DFAs in cross-border settlements — developed through UNCITRAL or a comparable body — offers the most tractable path to convergence. Unlike a binding treaty, a model law does not require ratification; it provides reference language that legislators can adopt or adapt, reducing the transaction costs of harmonization without demanding uniformity. Addressing the classification question in a way compatible with multiple legal traditions would alone eliminate a significant source of regulatory friction.

At the institutional level, mutual recognition mechanisms deserve greater attention. In financial regulation broadly, equivalence arrangements allow operators licensed in one jurisdiction to provide services in another without duplicating the licensing process. Extending this logic to DFA-based settlement services would enable the network scale that an international settlement system requires, while preserving national regulatory sovereignty.

Conclusion

Regulatory fragmentation is currently a more binding constraint on DFA-based cross-border settlements than technological immaturity. The barriers identified — legal classification, AML/CFT compliance, CBDC interoperability, and sanctions enforcement — are international in origin and cannot be addressed by any single country. Multilateral engagement through the BIS, FSB, and FATF is necessary but requires clearer mandates and a shift from guidance to operational standards.

The most realistic path to harmonization in the near term is not the unification of national laws but the development of mutual recognition mechanisms underpinned by minimum agreed standards, preserving regulatory sovereignty while enabling functional interoperability. This conclusion has a direct implication for system design: regulatory architecture must be treated as a first-order constraint in any DFA-based settlement infrastructure project, not a compliance afterthought. The present paper's findings will serve as the analytical basis for the author's forthcoming master's thesis.

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O’QUVCHILARDA HAYOTIY FAOLIYAT XAVFSIZLIGI QOIDALARIGA RIOYA QILISH KO‘NIKMASINI TARBIYALASH METODIKASINI TAKOMILLASHTIRISH

Annotatsiya. *Mazkur maqolada o‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini tarbiyalash metodikasini takomillashtirish masalalari yoritilgan. ta’lim jarayonida xavfsizlik madaniyatini shakllantirishning dolzarbligi, o‘quvchilarning favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmalarini rivojlantirish yo‘llari tahlil qilingan. shuningdek, zamonaviy pedagogik texnologiyalar va interaktiv metodlardan foydalanish samaradorligi asoslab berilgan.*

Kalit so‘zlar: *hayotiy faoliyat xavfsizligi, o‘quvchi, xavfsizlik madaniyati, metodika, favqulodda vaziyat, tarbiya, kompetensiya.*

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IMPROVING THE METHODOLOGY FOR DEVELOPING STUDENTS’ SKILLS IN COMPLYING WITH LIFE SAFETY RULES

Annotation. *This article discusses the improvement of the methodology for developing students’ skills in complying with the rules of life safety. The relevance of forming a safety culture in the educational process and the ways of developing students’ skills to act correctly in emergency situations are analyzed. In addition, the effectiveness of using modern pedagogical technologies and interactive methods is substantiated.*

Keywords: *life safety, student, safety culture, methodology, emergency situation, education, competence.*

Bugungi globallashuv jarayonida jamiyatda texnogen, tabiiy va ijtimoiy xavf-xatarlar ko‘lami ortib bormoqda. Ayniqsa, favqulodda vaziyatlar, yong‘inlar, tabiiy ofatlar hamda turli maishiy xavfli holatlar inson hayoti va sog‘lig‘iga jiddiy tahdid solmoqda. Bunday sharoitda o‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirish dolzarb pedagogik vazifalardan biri hisoblanadi.Ta’lim tizimida o‘quvchilarga faqat nazariy bilim berish yetarli emas, balki ularda amaliy harakat qilish, tezkor qaror qabul qilish va favqulodda vaziyatlarda to‘g‘ri yo‘l tutish ko‘nikmalarini ham rivojlantirish zarur. Chunki

xavfsizlik madaniyati insonning kundalik hayotida muhim o‘rin tutadi va u erta yoshdan boshlab shakllantirilishi lozim.Zamonaviy pedagogik yondashuvlar asosida o‘qitish jarayonini tashkil etish, interaktiv metodlar va innovatsion texnologiyalardan samarali foydalanish o‘quvchilarning bilim va ko‘nikmalarini mustahkamlashga xizmat qiladi. Shu sababli, hayotiy faoliyat xavfsizligi bo‘yicha metodikani takomillashtirish ta’lim samaradorligini oshirishda muhim ahamiyatga ega.Mazkur maqolada o‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirishning nazariy va amaliy jihatlari, mavjud muammolar hamda ularni bartaraf etish yo‘llari tahlil qilinadi.[2]

O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirish jarayonini o‘rganishda nazariy va amaliy tahlil, kuzatuv hamda pedagogik tajriba metodlaridan foydalanildi. Shuningdek, ta’lim jarayonida interaktiv va innovatsion pedagogik texnologiyalarning qo‘llanilishi o‘rganildi.Metodologik jihatdan yondashuv tizimli va kompetensiyaviy yondashuvlarga asoslangan bo‘lib, o‘quvchilarning xavfsizlik madaniyatini shakllantirish bosqichma-bosqich amalga oshirilishi tahlil qilindi.[1]

Adabiyotlar tahlilida xavfsizlik madaniyati, favqulodda vaziyatlarda harakat qilish, pedagogik metodika va zamonaviy ta’lim texnologiyalariga oid ilmiy manbalar o‘rganildi. Tahlillar shuni ko‘rsatadiki, amaliy mashg‘ulotlar va interaktiv metodlar o‘quvchilarda xavfsizlik ko‘nikmalarini shakllantirishda eng samarali yondashuvlardan biri hisoblanadi.

Hayotiy faoliyat xavfsizligi qoidalari insonning kundalik hayotida yuzaga kelishi mumkin bo‘lgan xavfli vaziyatlarning oldini olish, ularni to‘g‘ri baholash va ularga nisbatan xavfsiz harakat qilish tizimini ifodalaydi. O‘quvchilarda ushbu qoidalarni shakllantirish ularning shaxsiy xavfsizligi, sog‘ligi hamda jamiyatda to‘g‘ri xulq-atvorini ta’minlashga xizmat qiladi. Shu sababli, ta’lim jarayonida xavfsizlik madaniyatini shakllantirish uzluksiz va tizimli amalga oshirilishi lozim.Amaliy kuzatuvlar shuni ko‘rsatadiki, ko‘plab o‘quvchilar favqulodda vaziyatlarda to‘g‘ri qaror qabul qilish va aniq harakat qilishda qiyinchilikka duch keladi. Buning asosiy sabablari sifatida nazariy bilimlarning amaliyot bilan yetarli bog‘lanmaganligi, mashg‘ulotlarning kamligi hamda hayotiy vaziyatlarga asoslangan treninglarning yetishmasligini ko‘rsatish mumkin. Shu bois, o‘quvchilarda xavfsizlik ko‘nikmalarini shakllantirishda amaliy mashg‘ulotlar asosiy o‘rin tutadi.[4].

O‘quvchilarda hayotiy faoliyat xavfsizligi ko‘nikmalarini rivojlantirishda zamonaviy pedagogik metodlardan foydalanish muhim ahamiyatga ega. Interaktiv metodlar, jumladan aqliy hujum, keys-stadi, rolli o‘yinlar va guruhli ishlash o‘quvchilarning faolligini oshiradi hamda ularning mustaqil fikrlash qobiliyatini rivojlantiradi.Amaliy mashg‘ulotlar esa real hayotiy vaziyatlarga yaqin sharoitda bilimlarni mustahkamlashga yordam beradi. Masalan, evakuatsiya mashqlari, birinchi tibbiy yordam ko‘rsatish va yong‘in xavfsizligi bo‘yicha treninglar o‘quvchilarda tezkor va to‘g‘ri harakat qilish ko‘nikmasini shakllantiradi.[5]

Ta’lim jarayonida zamonaviy axborot texnologiyalaridan foydalanish o‘quvchilarning qiziqishini oshiradi va o‘zlashtirish samaradorligini kuchaytiradi. Multimedia vositalari, video darslar va simulyatsion dasturlar orqali xavfsizlik qoidalarini vizual va amaliy tarzda o‘rgatish imkoniyati yaratiladi. Bu esa murakkab vaziyatlarni yaxshiroq tushunishga va eslab qolishga yordam beradi.O‘qituvchi o‘quvchilarda xavfsizlik madaniyatini shakllantirishda asosiy tashkilotchi va yo‘naltiruvchi hisoblanadi. U zamonaviy metodlardan samarali foydalanishi, mashg‘ulotlarni hayotiy misollar bilan boyitishi hamda o‘quvchilarda mas’uliyat hissini rivojlantirishi lozim. Bundan tashqari, ta’lim muassasasida zarur moddiy-texnik baza mavjud bo‘lishi ham jarayon samaradorligini oshiradi.O‘quvchilarda xavfsizlik ko‘nikmalari bosqichma-bosqich shakllantiriladi. Dastlab nazariy bilimlar beriladi, so‘ngra ular savol-javob va testlar orqali mustahkamlanadi. Keyingi bosqichda amaliy mashg‘ulotlar o‘tkazilib, real vaziyatga yaqin sharoitda ko‘nikmalar rivojlantiriladi. Yakuniy bosqichda esa o‘quvchilarning bilim va harakatlari tahlil qilinadi hamda baholanadi.Metodikani takomillashtirish uchun dars jarayoniga real hayotiy vaziyatlarni kengroq kiritish, amaliy mashg‘ulotlar sonini oshirish, raqamli texnologiyalardan foydalanishni kengaytirish hamda ota-onalar bilan hamkorlikni kuchaytirish zarur. Shuningdek, o‘quvchilarning mustaqil ishlash ko‘nikmalarini rivojlantirish ham muhim ahamiyatga ega.O‘quvchilarda hayotiy faoliyat xavfsizligi ko‘nikmalarini shakllantirish faqat ta’limiy jarayon emas, balki tarbiyaviy jarayon sifatida ham qaraladi. Chunki xavfsizlik madaniyati shaxsning xulq-atvori, mas’uliyati va ong darajasi bilan bevosita bog‘liqdir. Shu sababli, o‘qituvchilar o‘quvchilarda intizom, ehtiyotkorlik va javobgarlik kabi sifatlarni rivojlantirishga alohida e’tibor qaratishi lozim.Favqulodda vaziyatlarda to‘g‘ri harakat qilish ko‘nikmasini shakllantirish uchun o‘quvchilarga turli ssenariylar asosida mashg‘ulotlar tashkil etish muhimdir. Bunday mashg‘ulotlar orqali o‘quvchilar yong‘in, zilzila, suv toshqini yoki boshqa xavfli holatlarda qanday harakat qilishni amaliy tarzda o‘rganadilar. Bu esa ularning tezkor fikrlash va qaror qabul qilish qobiliyatini rivojlantiradi.O‘quvchilarda xavfsizlik ko‘nikmalarini shakllantirishda oila va maktab hamkorligi muhim o‘rin tutadi. Ota-onalar bolalarga uy sharoitida xavfsizlik qoidalariga rioya qilishni o‘rgatishi, maktab esa bu bilimlarni tizimli ravishda mustahkamlashi kerak. Ushbu hamkorlik o‘quvchilarda barqaror xavfsizlik madaniyatini shakllantirishga yordam beradi.[6]

Xavfsizlik bo‘yicha bilim va ko‘nikmalarni baholashda an’anaviy testlardan tashqari amaliy topshiriqlardan ham foydalanish maqsadga muvofiqdir. O‘quvchilarning favqulodda vaziyatlarda harakat qilish qobiliyatini real sharoitga yaqin mashqlar orqali baholash ularning tayyorgarlik darajasini aniqroq ko‘rsatadi.O‘quvchilarda hayotiy faoliyat xavfsizligi ko‘nikmalarini shakllantirishda nazariy bilim, amaliy mashg‘ulot va tarbiyaviy yondashuv uyg‘unligi muhim ahamiyatga ega. Ushbu uch komponentning birgalikda qo‘llanilishi ta’lim samaradorligini oshiradi hamda o‘quvchilarda barqaror xavfsizlik madaniyatini shakllantiradi.[7]

O‘quvchilarda hayotiy faoliyat xavfsizligi bo‘yicha kompetensiyalarni shakllantirish ta’lim jarayonining muhim yo‘nalishlaridan biridir. Kompetensiyaviy yondashuv o‘quvchining nafaqat bilim olishiga, balki olingan bilimni amaliy vaziyatlarda qo‘llay olishiga ham asoslanadi. Shu bois, xavfsizlik qoidalarini o‘rgatishda amaliy vaziyatlar, muammoli topshiriqlar va real hayotiy misollardan keng foydalanish zarur.Xavfsizlik ko‘nikmalarini shakllantirishda individual va guruhli ishlash usullari muhim ahamiyatga ega. Individual yondashuv o‘quvchining shaxsiy mas’uliyatini oshirsa, guruhli ishlar hamkorlik, o‘zaro yordam va tezkor qaror qabul qilish ko‘nikmalarini rivojlantiradi. Ayniqsa, favqulodda vaziyatlarni modellashtirish jarayonida guruhli ishlash samarali natija beradi.

O‘quvchilarda xavfsizlik qoidalariga rioya qilish ko‘nikmasini shakllantirishda motivatsiya muhim rol o‘ynaydi. Dars jarayonini qiziqarli tashkil etish, real hayotiy misollar keltirish, rag‘batlantirish tizimini joriy etish o‘quvchilarning faolligini oshiradi. Shuningdek, muvaffaqiyatli bajarilgan amaliy topshiriqlarni e’tirof etish ham ularning qiziqishini kuchaytiradi.[8]

Xavfsizlik madaniyati bir martalik o‘qitish orqali emas, balki uzluksiz ta’lim jarayoni orqali shakllanadi. Har bir sinf bosqichida xavfsizlikka oid bilimlar murakkablashtirilib borilishi lozim. Bu esa o‘quvchilarda barqaror ko‘nikma va odatlarning shakllanishiga olib keladi. O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirish murakkab, ammo muhim pedagogik jarayondir. Ushbu jarayonda zamonaviy pedagogik texnologiyalar, amaliy mashg‘ulotlar, tarbiyaviy yondashuv va kompetensiyaviy ta’lim uyg‘unligi muhim ahamiyat kasb etadi. Natijada o‘quvchilarda xavfsizlik madaniyati shakllanib, ular real hayotiy vaziyatlarda to‘g‘ri va tezkor harakat qila olish qobiliyatiga ega bo‘ladilar.[3]

O‘quvchilarda hayotiy faoliyat xavfsizligi ko‘nikmalarini shakllantirishda muammoli vaziyatlar yaratish samarali usullardan biri hisoblanadi. Bunda o‘qituvchi real hayotga yaqin holatlarni modellashtiradi va o‘quvchilardan to‘g‘ri yechim topishni talab qiladi. Bunday yondashuv o‘quvchilarning tahliliy fikrlashini rivojlantiradi hamda tezkor qaror qabul qilish qobiliyatini shakllantiradi.[9]

Amaliy mashg‘ulotlar xavfsizlik qoidalarini mustahkamlashda asosiy o‘rin tutadi. O‘quvchilar nazariy bilimlarni real harakatlar orqali mustahkamlash imkoniyatiga ega bo‘ladilar. Evakuatsiya mashqlari, shartli favqulodda holatlarni simulyatsiya qilish va birinchi yordam ko‘rsatish bo‘yicha mashg‘ulotlar ularning amaliy tayyorgarligini oshiradi.

Ta’lim jarayonida axborot texnologiyalaridan foydalanish xavfsizlik qoidalarini o‘rganishni yanada samarali qiladi. Video darslar, animatsion materiallar va simulyatsion dasturlar o‘quvchilarga murakkab vaziyatlarni vizual tarzda tushunish imkonini beradi. Bu esa bilimlarni uzoq muddatli xotirada saqlanishiga yordam beradi.Xavfsizlik ko‘nikmalarini shakllantirish jarayonida doimiy nazorat va monitoring tizimi muhimdir. O‘qituvchi o‘quvchilarning o‘zlashtirish darajasini kuzatib borishi, kamchiliklarni aniqlashi va ularni bartaraf etish bo‘yicha individual yondashuvni qo‘llashi lozim. Bu esa ta’lim sifatini

oshirishga xizmat qiladi.O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirishda muammoli vaziyatlar, amaliy mashg‘ulotlar, zamonaviy texnologiyalar va doimiy pedagogik nazorat muhim omillar hisoblanadi. Ushbu yondashuvlar uyg‘unligi o‘quvchilarning xavfsizlik madaniyatini barqaror shakllantirishga xizmat qiladi.[10]

O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirish bugungi ta’lim tizimining eng muhim va dolzarb vazifalaridan biri hisoblanadi. Chunki zamonaviy jamiyatda yuz berayotgan tabiiy, texnogen va ijtimoiy xavf-xatarlar sharoitida insonning o‘zini to‘g‘ri himoya qila olishi, favqulodda vaziyatlarda aniq va tezkor harakat qilishi katta ahamiyatga ega.O‘quvchilarda xavfsizlik madaniyatini shakllantirish faqat nazariy bilim berish bilan cheklanib qolmasligi kerak. Aksincha, bu jarayon uzluksiz, tizimli va amaliy yo‘naltirilgan bo‘lishi zarur. Nazariy bilimlar amaliy mashg‘ulotlar bilan uyg‘unlashtirilganda o‘quvchilarda mustahkam ko‘nikma va barqaror xulq-atvor shakllanadi.Zamonaviy pedagogik texnologiyalar va interaktiv metodlardan foydalanish ta’lim samaradorligini sezilarli darajada oshiradi. Muammoli vaziyatlar yaratish, rolli o‘yinlar, keys-stadi metodlari hamda simulyatsion mashg‘ulotlar o‘quvchilarning fikrlash doirasini kengaytiradi va ularning tezkor qaror qabul qilish qobiliyatini rivojlantiradi.O‘qituvchining metodik tayyorgarligi ham ushbu jarayonda muhim rol o‘ynaydi. U nafaqat bilim beruvchi, balki yo‘naltiruvchi, tarbiyachi va motivator sifatida faoliyat yuritishi lozim. Shu bilan birga, ta’lim muassasasida yaratilgan moddiy-texnik baza ham xavfsizlik bo‘yicha samarali mashg‘ulotlarni tashkil etishda muhim omil hisoblanadi.Oila va maktab hamkorligi ham o‘quvchilarda xavfsizlik madaniyatini shakllantirishda muhim o‘rin tutadi. Ota-onalar va pedagoglarning birgalikdagi faoliyati o‘quvchilarda barqaror xavfsizlik odatlarini shakllantirishga yordam beradi.O‘quvchilarda hayotiy faoliyat xavfsizligi qoidalariga rioya qilish ko‘nikmasini shakllantirish murakkab, ammo juda muhim pedagogik jarayon bo‘lib, u tizimli yondashuv, zamonaviy metodlar, amaliy mashg‘ulotlar va uzluksiz tarbiya asosida samarali amalga oshiriladi. Ushbu jarayonning to‘g‘ri tashkil etilishi o‘quvchilarning nafaqat ta’limiy, balki hayotiy tayyorgarligini ham mustahkamlab, ularni real hayotiy vaziyatlarda ongli va mas’uliyatli shaxs sifatida shakllantiradi.

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SUV RESURSLARIDAN SUG‘ORILADIGAN MAYDONLARDA SAMARALI FOYDALANISHNING ILMIY ASOSLARI

Annotasiya: *Mazkur maqolada suv resurslaridan qishloq xo‘jaligi ekinlarini sug‘orishda samarali foydalanish masalalari yoritilgan. Suvning qishloq xo‘jaligidagi ahamiyati, sug‘orish tizimlarining turlari va ularning samaradorligi tahlil qilingan. Shuningdek, suv tanqisligi sharoitida suvni tejovchi texnologiyalarni joriy etish, tomchilatib sug‘orish va zamonaviy irrigatsiya usullaridan foydalanishning afzalliklari ko‘rib chiqilgan. Tadqiqotda suv resurslarini oqilona boshqarish orqali ekinlar hosildorligini oshirish hamda ekologik barqarorlikni ta’minlash imkoniyatlari bayon etilgan. Olingan natijalar qishloq xo‘jaligida suvdan foydalanish samaradorligini oshirish bo‘yicha amaliy tavsiyalar ishlab chiqishda muhim ahamiyat kasb etadi.*

Kalit so‘zi: *sug‘orish tizimlari, suv tanqisligi, suv resurslari, tuproqlarning sho‘rlanishi, tuproq xossalari, ekinlarning hosildorligi.*

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SCIENTIFIC BASIS FOR THE EFFICIENT USE OF WATER RESOURCES IN IRRIGATED AREAS.

Abstract: *This article examines the efficient use of water resources for crop irrigation. It analyzes the importance of water in agriculture, the types of irrigation systems, and their effectiveness. The benefits of implementing water-saving technologies, using drip irrigation, and modern irrigation methods in water-scarce conditions are also examined. The study describes opportunities for increasing crop yields and ensuring environmental sustainability through rational water resource management. The findings are of great importance for developing practical recommendations for improving water efficiency in agriculture.*

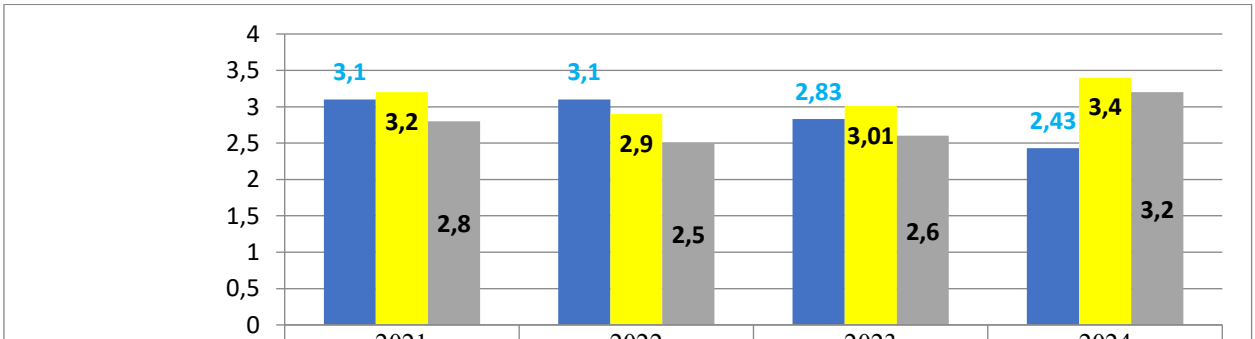
Key words: *irrigation systems, water shortage, water resources, soil salinization, soil properties, crop yields.*

Dunyo bo‘yicha qishloq xo‘jaligida bugungi kunda degradasiyaga uchragan maydonlar ortib bormoqda. Shamol eroziyasi, tuproqda ozuqa moddalari miqdorining kamayishi, sho‘rlanish va ifloslanish jarayonlari taosirida tuproqlarning holati yildan yilga yomonashib bormoqda. Bunday salbiy jarayonlar ta’sirida dunyoning ko‘plab mamlakatlarida qolaversa respublikamizda ham suv tanqisligi muammosi yuzaga kelmoqda. Mamalakatimizda bugungi kunda sug‘oriladigan yerlarning meliorativ holatini yaxshilash, tuproq unumdorligini oshirish, suv tanqisligi sharoitida mavjud suv resurslaridan samarali foydalanish, qo‘shimcha suv manbalarini shakllantirish bo‘yicha keng qamrovli tadbirlar amalga oshirilmoqda.

O‘zbekiston Respublikasi Prezidentiing 2022 yil 28 yanvardagi PF-60-son O‘zbekiston Respblikasini 2022-2026 yillarga mo‘ljallangan Yangi O‘zbekistonning taraqqiyot strategiyasida, “Suv resurslaridan samarali foydalanish, suvni iqtisod qilish va sug‘oriladigan yerlarning meliorativ hola,tini yanada yaxshilash, qishloq xo‘jaligi ishlab chiqarish sohasiga intensive usullarni eng avvalo suv resurslarini tejaydigan zamonaviy agrotexnologiyalarni joriy qilish” bo‘yicha chora – tadbirlarni amalga oshrish ko‘zda tutilgan bo‘lib, bu borada mamlakatimizda qolaversa Buxoro viloyatida ham kollektor-zovur suvlaridan samarali foydalanish orqali tuproqning meliorativ holatiga ta’sirini o‘rganish muhim ahamiyat kasb etadi. 2020-2030 yillarda qishloq xo‘jaligi yerlaridan foydalanish samaradoligini oshirish bo‘yicha amalga oshirilgan chora-tadbirlar asosida **hozirgi kunda** Buxoro viloyatida **39063 gektar maydon** qishloq xo‘jaligida foydalanishga kiritilishi rejalashtirilgan. Viloyatda suv tanqisligi salbiy oqibatlarini yumshatish maqsadida kollektor-zovur suvlarining mineralizasiyasini biologik usulda pasaytirib, ulardan sug‘orma dehqonchilikda foydalanish bo‘yicha ilmiy izlanishlar dolzarb hisoblanadi.

1-rasm.

Magistral kollektor-zovur suvlarining sho‘rlanish darajasi



	2021	2022	2023	2024
Markaziy Buxoro	3,1	3,1	2,83	2,43
Shimoliy kollektor	3,2	2,9	3,01	3,4
Oyoqog'itma	2,8	2,5	2,6	3,2

Grafikda 2021–2024-yillar davomida Markaziy Buxoro, Shimoliy kollektor va Oyoqog‘itma hududlarida kuzatilgan ko‘rsatkichlarning yillik o‘zgarishi aks

ettirilgan. Tahlil natijalariga ko‘ra, Markaziy Buxoro hududida ko‘rsatkich 2021 va 2022-yillarda 3,1 darajasida saqlanib qolgan bo‘lsa, 2023-yilda 2,83 ga, 2024-yilda esa 2,43 ga tushgan. Bu davr mobaynida ko‘rsatkichning pasayish tendensiyasi kuzatiladi. Shimoliy kollektor bo‘yicha ko‘rsatkichlar 2021-yildagi 3,2 dan 2022-yilda 2,9 gacha kamaygan, 2023-yilda 3,01 ga ko‘tarilgan va 2024-yilda 3,4 ga yetib, eng yuqori qiymat qayd etilgan. Ushbu hududda so‘nggi yillarda o‘sish tendensiyasi kuzatiladi. Oyoqog‘itma hududida ko‘rsatkich 2021-yildagi 2,8 dan 2022-yilda 2,5 gacha pasaygan, 2023-yilda 2,6 ga va 2024-yilda 3,2 ga ko‘tarilgan. Natijalar hududda 2022-yildan keyin barqaror o‘sish kuzatilganini ko‘rsatadi.

Vobkent tumani umumiy maydoni 0,39 ming km^2 bo‘lib, shundan 21515 gektari sug‘oriladigan maydonlardan iborat. Tuman qishloq xo‘jaligining asosiy tarmoqlari paxtachilik hisoblanadi. Shuningdek g‘alla, poliz ekinlari va sabzovot ekinlari ekiladi. Suv tanqis bo‘lgan yillarda qishloq xo‘jaligida kollektor-zovur suvlaridan keng miqyosda foydalanilmoqda.

Tumandagi sug‘oriladigan maydonlarning sho‘rlanish darajasi o‘rganilganda quyidagilar aniqlandi. 2021-yilda 1- gr/l bo‘lgan sho‘rlanish darajasi tumanda 26700 gektarni sho‘rlanish darajasi 3.0-5.0 gr/l bo‘lgan maydonlar 3257 gektar maydonni tashkil qildi.

Sug‘oriladigan maydonlarda sizot suvlarning 2024-20253 yillarda sho‘rlanish darajasi.

1-jadval

Hududlar nomi	Yillar	Umumiy sug‘oriladigan maydon ming, ga	Sizot suvlarning sho‘rlanish darajasi bo‘yicha (gr/l)				
			0,0-1,0 gr/l	1,0-3,0 gr/l	3,0-5,0 gr/l	5,0-10,0 gr/l	10 gr/l yuqori
Buxoro	2024	30034	10	25603	4394	27	
	2025	30027		26700	3257	70	
Vobkent	2024	21515		13772	7743		
	2025	21515	47	16748	4720		
Jondor	2024	32982		12565	20375	42	
	2025	32982		23440	9513	29	
Kogon	2024	19126	6	14065	5040	15	
	2025	19126	4	18905	217		
Olot	2024	17804		6150	11639	1	14
	2025	21521	7	7422	11364	2728	
Peshku	2024	22776		17747	5026	3	
	025	22776	3	2 0328	2 399	4 6	
Romitan	2024	27221		17008	10174	39	
	2025	27221	16	23667	3538		
Shofirkon	2024	28353		10576	17774	3	
	2025	28353		13476	14877		
Qorako‘l	2022	26466		7124	16966	2332	44

1-jadval. Viloyat tumanlari sizot suvlarinig sho‘rlanish darajasi.

Vobkent tumani sug‘oriladigan maydonlariga xizmat qiladigan Markaziy Buxoro zovuri Markaziy tumanda qurilgan yirik gidrotexnika inshootlaridan biridir. 1955 yilda Markaziy-Buxoro kollektori Vobkent tumanidan Zarafshon daryosining eski o‘zani Duob gidrouzelidan Moxanko‘l kollektorigacha bo‘lgan o‘zanini chuqurlashtirib, kengaytirilib ishga tushirildi. Markaziy Buxoro zovurining uzunligi 95.1 km bo‘lib, suv o‘tkazish qobiliyati 80 m^3/s ni tashkil qiladi. Markaziy Buxoro kollektoriga Buxoro, Jondor, Vobkent va Romitan tumanlari ududidagi kollektor-drenaj tarmoqlarida yig‘iladigan sizot suvlar tashlanadi. Kollektorning umumiy suv yig‘ish maydoni 64.6 ming ga. Markaziy-Buxoro zovuriga viloyatdagi 80 ga yaqin xo‘jalik ichki va xo‘jaliklararo kollektor suvlari qo‘yiladi. Markaziy-Buxoro zovuri viloyatdagi 1200 gektar maydonga xizmat qiladi. Markaziy Buxoro zovuri suvining tarkibidan natijalar olinganda quyidagilar aniqlandi. Makraziy Buxoro zovurining xizmat qiladigan maydoni 77.99 gektar, uzunligi 95.1 km, suv sarfi 46 m^3/c tashkil etadi, Markaziy Buxoro zolvuri o‘z suvini Qora-qir tashlamasiga quyadi.

2-rasm. Markaziy Buxoro xovuridan qishloq xo‘jaligida foydalanish jarayoni

Markaziy Buxoro zovuridan oqib o‘tayotgan suvning tarkibidagi loyqaligi 1 litr suvda 2 milligrammni tashkil qildi. Markaziy Buxoro zovuri suvining ishqoriyligi 3.0 milligramm. 1 litr suvdagi quruq qoldiq 1348.0 mg/dm^3, umumiy qattiqligi 13.0 mg/dm^3, azot nitrit 18.8 mg/dm^3, xloridlar 385.0 mg/dm^3, sulfatlar 633.0 mg/dm^3, ftor 0.003 mg/dm^3 ni tashkil qildi. Azot ammoniy miqdori kuzatilmadi. Maxalliy moddalarga xos bo‘lgan maxsus moddalar (fosfat, mis, qurg‘oshin, tsink) kabi moddalar miqdori Markaziy Buxoro zovurining suv tarkibida aniqlanmadi. Qishloq xo‘jaligida Kollektor-zovur va tashlama ko‘l suvlaridan qishloq xo‘jalik ekinlarni sug‘orishda foydalanish suv resurslari potentsialini ishga solishning muxim vositasi xisoblanadi. Xozirgi kunda tumanda Markaziy Buxoro kollektor-zovur sularidan sug‘orish sistemalaridagi miqdori 40-50 foizga bormoqda. Vobkent tumanida ham sug‘oriladigan maydonlarda xam suv tanqis bo‘lgan vaqtlarda minerallashgan kollektor-zovur suvlaridan nasoslar yordamida ommaviy ravishda foydalanishning boy tajribasi bor. Darhaqiqat, maqsadimiz yer va suv resurslaridan oqilona foydalanish uni muhofaza qilish iboratdir.

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KOREYS ADABIY TILINING RIVOJLANISH BOSQICHLARI

Annotatsiya: *Ushbu tadqiqot ishida koreys adabiy tilining rivojlanishi bosiqchlarga ajratilib ko‘rib chiqiladi. Shuningdek, har bir davrda adabiy til qanday usullar bilan standartlashib borganligi bosqichma-bosqich ko‘rsatiladi.*
Kalit so‘zlar: *표준어, 훈민정음, ilk davr, yapon mustamlakasi davri, mustaqillikdan keyingi davr, zamonaviy davr.*

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STAGES OF DEVELOPMENT OF THE KOREAN LITERARY LANGUAGE

Annotation: *This research study examines the development of the Korean literary (standard) language by dividing it into historical stages. It also describes, step by step, how the literary language was standardized during each period.*
Keywords: *standard language (표준어), 훈민정음, early period, Japanese colonial period, post-liberation period, modern period.*

Dastlab biz koreys tilidagi “표준어” so‘zining asl nima ma’no anglatishini ko‘rib chiqamiz.

표준어. Texnologik jihatdan rivojlangan ilg‘or davlatlarning aksariyatida standart til (표준어) belgilab qo‘yilgan va keng qo‘llaniladi. Koreya mamlakatida ham 1936-yilda standart tilni belgilash bo‘yicha ishlar boshlanganidan beri, hozirgi kungacha ushbu tildan foydalanishni kengaytirishga doimiy ravishda e’tibor qaratilmoqda[16]. Koreys tili katta lug‘atida bu atamaga quyidagicha ta'rif beradi. “Mamlakatda rasmiy til sifatida ishlatiladi. Til me'yor sifatida muloqotdagi noqulaylikni kamaytirish uchun barcha fuqarolar foydalanishi odatiy holdir. Bu so‘z rasmiy til maqomiga ega bo‘lib, Seul shevasi asosida qurilgan[17]”. Shu bilan birga “표준국어대사전(Standart koreys tili lug‘ati)”da “표준어” ya’ni adabiy standart til ikki ma’noga ega deb talqin qilinadi. 1. “Bir mamlakatda rasmiy til sifatida

[16] 이익섭, 표준어의 기능. 2011
[17] 이희승, 『국어대사전』(서울: 민중서림, 2011).

ishlatiladigan me’yorlashtirilgan til”, 2. “Barcha fuqarolar umumiy foydalana oladigan so‘z”. Birinchisi “qonun-qoidaga asoslangan til” degan ma’noda, imlo va yozuv qoidalari kabi til normalari bilan bog‘liq deb qaraladi, ikkinchisi esa adabiy til lug‘aviy qatlamida tushunilgan ma’noda ko‘riladi[18].

표준어의 발전사 (Standart koreys tilining rivojlanish tarixi): Koreys tilining standartlashuvi uzoq tarixiy jarayon bo‘lib, bir necha bosqichlarni o‘z ichiga oladi. Quyida ushbu rivojlanish bosqichlari haqida batafsil ma’lumot beriladi.

1. Ilk bosqich: Hunminjeongeumning yaratilishi (15-asr). 1443-yilda Choson sulolasining to‘qqizinchi qiroli Sejong Daejang (Sejong Buyuk) tomonidan yangi yozuv tizimi — Hunminjeongeum (훈민정음hozirgi Hangil) yaratildi. Bu yozuv tizimi koreys xalqining o‘z ona tilini ifoda etish va o‘qish-yozishni osonlashtirish maqsadida ishlab chiqilgan. Hunminjeongeumning yaratilishi koreys tilining standartlashuvi yo‘lida muhim qadam bo‘ldi[19]. Buning yaratilgandan keyin, koreys tilida talaffuzni yozuvda aks ettiradigan fonetik imlo (tovushga asoslangan yozuv) asosan qo‘llanib kelingan. Biroq islohotlar davrigacha yozuvga oid aniq me’yorlar mavjud bo‘lmagani sababli, bir xil fe’l shakli bir xil matn ichida ham birikma yozuv (연철), ajratma yozuv (분철) yoki o‘rta yozuv (중철) kabi turlicha ifodalangan.

2. Yapon mustamlakasi davri (1910-1945). 1910-yilda Koreya Yaponiyaning mustamlakasi bo‘lgan davrda, Koreys tilini saqlab qolish va me’yorlashtirish harakatlari kuchaygan[20]. Bu davrda yapon tili rasmiy til sifatida joriy etilib, koreys tilining qo‘llanilishi cheklab qo‘yildi. Shunga qaramay, koreys ziyolilari va tilshunoslari tilni saqlab qolish va standartlashtirish uchun harakat qilishdi[21]. 20-asr boshlarida Chu Shigyeong va boshqa tilshunoslar tomonidan hangilni tizimli ravishda tartibga solish harakatlari boshlandi. 1907-yilda Xalq maorif boshqarmasi tomonidan “Koreys yozuvi tadqiqoti bo‘yicha kelishuv (국문연구의정안)”, 1912-yilda Bosh ma’muriyat tomonidan “Oddiy maktablar uchun yozuv imlo qoidalari (보통 학교용 언문철자법)”, 1930-yilda esa “Yozuv imlosi (언문철자법)” e’lon qilindi. Nihoyat, 1931-yilda 조선어연구회 (Choson Eo Yeonguhoe — Koreys Tili Tadqiqot Jamiyati) tashkil etilib, 1933-yilda “한글 맞춤법 통일안” (Hangul imlo qoidalarining birlashgan loyihasi)ni e’lon qildi[22]. Bu hujjatda ajratma yozuv (띄어쓰기) va bo‘linma yozuv (분철 표기) kabi qoidalar belgilandi. Ushbu me’yorlar 1987-yilda Milliy til tadqiqot instituti (hozirgi Milliy til instituti) tomonidan ishlab chiqilgan va 1988-yilda kuchga kirgan “Hangil imlo qoidalari (한글 맞춤법)”, shuningdek keyingi “Xorijiy so‘zlarni yozish qoidalari

[18] 장린, 이강혁. 한국어 표준어에 대한 재고. 중한연구학회. 2024. 144쪽.
[19] https://www.koreanculture.org/gallery-korea/2024/04/07/hangeul?
[20] 안부영. (2022). 표준어와 방언 관련 교육내용 개선 방향 연구. 한국초등국어교육,(75), 263-289.
[21] V.S. Xan, Koreya tarixi, Toshkent. 2013. 104 b.
[22] https://contents.history.go.kr/mobile/yunho/main.do

(외래어 표기법)” uchun asos bo‘lib xizmat qildi. Bu kabi tilga oid me’yoriy qoidalar hukumat tomonidan rasmiy til normalari sifatida qo‘llanadi[23]. Endi esa “adabiy so‘zlar (standart so‘zlar. 표준 어휘)”ning bu davrdagi rivojlanishiga nazar tashlaylik. Odatda me’yoriy lug‘atlarga kiritilgan sarlavha so‘zlar adabiy so‘zlar sifatida qaraladi. Bunday lug‘atlarning tuzilishi va e’lon qilinishi har doim tilga oid me’yoriy hujjatlar bilan uzviy bog‘liq bo‘lgan. Islohotlar davridan (개화기) boshlab G‘arb madaniyatining ta’siri ostida koreys tilini me’yorlashtirish ishlari boshlangan. 1912-yilda Bosh Ma’muriyat tomonidan “Oddiy maktablar uchun yozuv imlo qoidalari (보통학교용 언문철자법)” e’lon qilingan paytda, Chu Shigyeong boshchiligidagi Choson Gvangmunhe tilshunoslari “Malmoi (말모이)” nomli koreys tilining lug‘atini tuzishga kirishgan, biroq bu ish keyinchalik to‘xtatilgan. Birinchi nashr qilingan lug‘at esa 1920-yilda Choson Bosh Ma’muriyati tomonidan chop etilgan “Choson tili lug‘ati” hisoblanadi. Shuningdek, 1933-yilda “Hangil imlosini bir xillashtirish qoidalari” e’lon qilingach, 1938-yilda Mun Se-Yeong tomonidan yana bir “Choson tili lug‘ati” chop etilgan.

3. Mustaqillikdan keyingi davr (1945-yildan keyin). 1945-yilda Koreya mustaqillikka erishgach, koreys tilini rasmiy til sifatida tiklash va standartlashtirish ishlari davom ettirildi. Bu davr koreys adabiy tili imlo qoidalari bilan bog‘liq lug‘atlar tuzish davri bo‘ldi desak mubolag‘a qilmagan bo‘lamiz. Bu davrda yapon mustamlakasi davrida tuzilgan imlo qoidalariga ba’zi o‘zgartirishlar kiritilib, 1947-yilda I Yun-Jae bu o‘zgartirishlarni inobatga olgan holda “Standart Choson tili lug‘ati (표준 조선말 사전)”ni nashr etgan. Undan so‘ng esa Choson Til Jamiyati (hozirgi Hangil jamiyati) tomonidan 26 yil davomida tuzilgan va 1957-yilda 6 jildda to‘liq nashr etilgan “Katta lug‘at (큰사전)” e’lon qilingan. Shundan so‘ng, quyidagi muhim lug‘atlar chop etilgan:

• “Standart koreys tili lug‘ati (표준국어사전)” (1958) — Shin Gi-Chol va Shin Yong-Chol tomonidan

• “Yangi koreys tili lug‘ati (국어 새사전)” (1958) — Koreys tili va adabiyoti jamiyati tomonidan

• “Yangi lug‘at (새사전)” (1959) — Hong Ung-Son va Kim Min-Su tomonidan

• “Koreys tili katta lug‘ati (국어대사전)” (1961) — Li Hui-Seung tomonidan

[23] 장린, 이강혁. 한국어 표준어에 대한 재고. 중한연구학회. 2024. 145-쪽.

• “Yangi ona tili katta lug‘ati (새 우리말 큰사전)” (1975) — Shin Gi-Chol va Shin Yong-Chol tomonidan. Bu texnik-me’yoriy lug‘atlarning barchasi o‘z davrining me’yoriy til qoidalari asosida shakllangan asarlar hisoblanadi[24].

4. Zamonaviy davr (1980-yillardan hozirgacha). 1980-yillardan boshlab, texnologiya va ommaviy axborot vositalarining rivojlanishi bilan koreys tilining standartlashuvi yanada kuchaydi. 1984-yilda 국립국어연구소 (Milliy Koreys Tili Tadqiqot Instituti) tashkil etildi[25]. Ushbu institut tilning me’yorlarini belgilash, lug‘atlar nashr etish va til siyosatini yuritish bilan shug‘ullanadi[26]. 1988-yilda “한글 맞춤법” (Hangil imlo qoidalari) va “표준어 규정” (Standart til qoidalari) rasmiy ravishda e’lon qilindi[27]. Bu hujjatlar Seul shevasini asosiy me’yor sifatida belgilab, tilning standartlashtirilishiga katta hissa qo‘shdi. Shuningdek, standart (adabiy) so‘zlarni tanlash prinsiplariga oid qoidalar 1988-yilda hukumat tomonidan e’lon qilingan “Adabiy so‘zlarni tanlash prinsiplari (표준어 사정 원칙)” hujjatida quyidagicha belgilangan: “Adabiy til (standart til) — zamonaviy Seul lahjasini madaniyatli kishilar keng qo‘llaydigan shaklda belgilashni asosiy prinsip sifatida oladi.” 1988-yildan beri bu qoidaga o‘zgartish kiritilmaganligi sababli, hozirgacha ushbu ta’rif “Adabiy so‘zlarni tanlash prinsiplari”ning umumiy qoidasi sifatida qo‘llaniladi Shuningdek, standart talaffuzga oid qoidalar haqida batafsil belgilangan hujjat ham 1988-yilda hukumat tomonidan e’lon qilingan “Standart talaffuz qoidalari (표준 발음법)” bo‘ladi

Bu davrda koreys tilini lotin yozuvida ifodalashga oid me’yoriy hujjat 2000-yilda e’lon qilingan “Koreys tilining lotin yozuvi qoidalari (국어의 로마자 표기법)” hisoblanadi. Bundan hozirgi kunda ham amalda qo‘llanilib kelmoqda.

Shu tariqa “Hangeul imlo qoidalari (한글 맞춤법)”, “Xorijiy so‘zlar imlosi (외래어 표기법)”, “Adabiy so‘zlarni tanlash prinsiplari (표준어 사정 원칙)”, “Standart talaffuz qoidalari (표준 발음 법)”, va “Koreys tilining lotincha yozuvi qoidalari (국어의 로마자 표기법)” kabi hujjatlar jamlanmasi “me’yoriy adabiy til (규범 표준어)”ni tashkil qiladi. Biroq bu har bir qoidaning o‘ziga xos kamchiliklari ham mavjud. 1988-yildan keyin ayrim bandlar doimiy ravishda yangilangan bo‘lsa-da, asosiy tarkib jihatidan 1988-yilda e’lon qilingan “Koreys tili yozuv me’yorlari (한국어 어문 규범)”dan unchalik farq qilmaydi. Shu sababli ba’zida real tilda qo‘llanilayotgan shakllar bilan me’yoriy shakllar o‘rtasida tafovut bo‘lishi yoki “madaniyatli insonlar” kabi zamonaviy jamiyatga mos tushmaydigan

[24] 장린, 이강혁. 한국어 표준어에 대한 재고. 중한연구학회. 2024. 147-쪽.
[25] https://en.m.wikipedia.org/wiki/National_Institute_of_Korean_Language
[26] https://ko.wikipedia.org/wiki/표준어_규정
[27] https://ko.m.wikisource.org/wiki

iboralarga tanqidiy qarashlar ham paydo bo‘lmoqda. Hozir amal qilayotgan qoidalar 2017-yil mart oyida “Madaniyat, sport va turizm vazirligi” tomonidan e’lon qilingan.

Xulosa. Shunday qilib, koreys adabiy tilining standartlashuv jarayonini 4 bosqichda ko‘rib chiqdik. Ilk davr deb bo‘linishiga sabab, koreys adabiy tili 훈민정음 bilan bevosita bog‘liqligidir. Yapon mustamlakasi davrida esa adabiy tilga qanday standartlashuv va tahdidlar bo‘lganini, mustaqillikka chiqqach qanday siljishlar amalga oshirilganini va bu hozirgi vaqtda qanday kechayotganini bilish uchun shu davrlarga ajratib ko‘rib chiqishlikni maqsadga muvofiq deb bilaman.

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DEMOGRAPHIC LOAD OF THE DISTRICTS OF THE REPUBLIC OF KARAKALPAKSTAN

Abstract. *This study examines the spatial differentiation of demographic load across the 16 administrative districts of the Republic of Karakalpakstan, Uzbekistan. Using official district-level statistics, the demographic load coefficient – the number of dependents (children aged and pensioners) per 100 working-age persons – is calculated for each district. The republic-wide coefficient stands at 64.3, but district values range widely from 41.5 (Takhtakupir) to 78.1 (Muynak). High demographic burden is driven by elevated fertility in rural districts and by working-age out-migration in Aral Sea-affected areas. The findings highlight significant intra-regional disparities and the need for targeted social policy at the district level.*

Keywords: *demographic load, dependency ratio, Karakalpakstan, age structure, Aral Sea, regional demography, district-level analysis.*

Introduction. Population dynamics and age structure are central concerns in both applied demography and regional geography. Among the key indicators used to assess the socio-economic capacity of a territory, the demographic load coefficient defined as the ratio of the economically inactive population (children aged 0–15 and elderly pensioners) to the working-age population (men age 16-60, women age 16-55), expressed per 100 working-age persons occupies a prominent place [1, 11]. A high demographic load signals that a relatively small share of the population must sustain a disproportionately large number of dependents, placing significant pressure on social infrastructure, healthcare, education, and pension systems [1].

The Republic of Karakalpakstan, an autonomous republic within Uzbekistan, presents a particularly compelling case for the study of demographic load at the district level. With a population of approximately 2.0 million people (2024) distributed across 16 administrative districts and the city of Nukus, Karakalpakstan combines high natural population growth rates with profound structural challenges — including the environmental consequences of the Aral Sea crisis, internal and external labour migration, widespread rural settlement patterns, and historically elevated fertility [5, 6]. These factors together produce a distinctive demographic structure that varies markedly across the republic's districts.

Uzbekistan as a whole is characterised by a young age structure: approximately 30 percent of the national population is under 14 years of age, and the total fertility rate stood at around 3.4 children per woman as of 2024 [9]. Karakalpakstan's demographic indicators generally mirror and in some districts significantly exceed these national averages, resulting in a youth-dominated dependency structure. At the same time, emigration of working-age adults for labour purposes tends to reduce the effective working-age base, artificially inflating the measured demographic load in certain districts [6, 12].

Against this backdrop, the present study aims to analyse the spatial differentiation of demographic load across the districts of Karakalpakstan using district-level statistical data, to identify which districts face the most acute dependency challenges, and to examine the underlying socio-demographic drivers of these spatial patterns. The study contributes to a body of literature that applies dependency ratio analysis to sub-national, district-level units in Central Asia a scale at which policy interventions in education, healthcare, and labour are most practically designed and delivered [4, 9].

The relevance of this research extends beyond academic geography. Understanding intra-regional variation in demographic load is essential for evidence-based resource allocation by regional authorities, for planning the expansion of social services, and for anticipating future labour market conditions in one of Uzbekistan's most environmentally and demographically distinct territories [12].

Literature review. The concept of demographic load also referred to as the dependency ratio or demographic burden has a well-established theoretical foundation in demography and economic geography. Foundational work on population age structures and their socio-economic consequences was systematically elaborated by Coale and Hoover [1], who demonstrated that high youth dependency ratios constrain savings rates and retard per capita income growth. This framework remains a cornerstone of demographic transition theory and continues to inform studies of developing economies.

The formal definition and statistical operationalisation of the dependency ratio are grounded in United Nations methodological standards. The UN Department of Economic and Social Affairs [11] defines the total dependency ratio as the number of persons aged 0–14 and 65 and over per 100 persons of working

age (15–64), distinguishing between the youth dependency ratio and the old-age (pension-age) dependency ratio. This framework provides the methodological basis for cross-national and sub-national comparisons of demographic load, and has been directly applied in the present study.

In the context of post-Soviet Central Asia, demographic research has increasingly focused on the tension between ongoing high fertility a legacy of Soviet pronatalist policies and cultural traditions and the structural transformation of economies following independence. Falkingham [3] provided one of the earliest comprehensive analyses of demographic change in the Central Asian republics after 1991, noting that countries such as Uzbekistan retained high birth rates and young population structures that produced persistently elevated youth dependency ratios, even as mortality decline progressed.

Studies specifically addressing Uzbekistan's demographic dynamics have noted the country's dual challenge: a large young cohort entering the labour market simultaneously with a still-growing dependent child population. Djumabaev and Yusupov [4] examined regional demographic differentiation within Uzbekistan, demonstrating that peripheral regions including Karakalpakstan, Surkhandarya, and Fergana consistently recorded higher total dependency ratios than the national capital and more urbanised oblasts. Their findings underscore the need for district-level rather than only regional-level analysis, a need confirmed by the data presented in Table 1 of this study, which reveals a demographic load coefficient ranging from 41.5 in Takhtakupir district to 78.1 in Muynak district [8].

The specific demographic context of Karakalpakstan has attracted scholarly attention primarily through the environmental and public health consequences of the Aral Sea disaster. Crighton et al. [5] documented elevated rates of infant and child morbidity in the Aral Sea zone, with consequences for the age structure of surviving populations and for the burden placed on households and local health systems. Muynak district the community closest to the now-receded Aral Sea shoreline records the highest demographic load coefficient in the republic (78.1), a finding consistent with the compound effects of ecological degradation, out-migration of the able-bodied population, and a relatively elderly remaining population [5, 8].

Research by Bennecker [6] on livelihoods in the Aral Sea region identified out-migration of working-age adults as a pervasive coping strategy among households, effectively reducing the denominator of the dependency ratio and increasing the functional demographic load experienced by communities. This mechanism helps explain the elevated coefficients observed in environmentally stressed and economically marginal districts such as Chimbay (73.8), Karauzek (73.8), Nukus district (73.2), and Khodjeyli (74.1), where labour out-migration is particularly pronounced [6, 8].

At the theoretical level, the demographic dividend literature is directly relevant to the study of Karakalpakstan's districts. Bloom, Canning, and Sevilla [2] argued that the transition from a high-fertility, high-dependency structure to a

lower-fertility regime with a temporarily enlarged working-age cohort can generate a “demographic dividend” a period of accelerated economic growth. For Karakalpakstan, however, the conditions for realising such a dividend remain constrained by limited labour market absorption capacity, emigration, and inadequate vocational infrastructure, as noted in World Bank assessments of Uzbekistan's human capital [12]. Districts such as Takhtakupir (41.5) and Kanlikul (47.4), which display the lowest demographic load coefficients, may be better positioned to benefit from a nascent dividend if appropriate investment policies are pursued.

The spatial analysis of demographic indicators at the sub-regional level has been advanced by GIS-based approaches to population geography. Plane and Rogerson [10] established methodological principles for the geographic analysis of demographic data, emphasising the importance of distinguishing between absolute population size and structural indicators such as the dependency ratio when assessing the burden of population on social systems. Applications in Central Asia, including work by Agadjanian and Dommaraju [9], have employed multi-level models to disentangle regional and district-level effects on fertility and age structure an approach consistent with the district-unit analysis undertaken here.

The primary statistical data employed in this study are drawn from the Karakalpakstan Republic Department of Statistics [8], which publishes annual district-level population counts disaggregated by age group, thereby enabling the construction of the demographic load coefficient as reported in Table 1. These official data complement the theoretical and comparative frameworks provided by the academic sources reviewed above.

In summary, the existing literature provides robust theoretical and methodological grounding for the analysis of demographic load, establishes the broader demographic context of Uzbekistan and Central Asia, and offers partial accounts of Karakalpakstan's distinctive population challenges. The present district-level analysis, anchored in official statistical data [8], builds upon and extends these contributions by producing a systematic spatial differentiation of demographic load across all administrative units of the republic.

Data and methodology. The analysis is based on official district-level demographic data published by the Karakalpakstan Republic Department of Statistics [8]. For each of the 14 districts, the city of Nukus, and Takhiatash city (16 territorial units in total, plus the republic-wide aggregate), the dataset provides three population counts: (1) children aged; (2) pensioners (elderly population); and (3) the working-age population aged. The demographic load coefficient (DLC) is computed as:

$$DLC = [(Children + Pensioners) / Working\text{-}age\ population] \times 100$$

This formula is consistent with the standard definition of the total dependency ratio as applied in United Nations demographic methodology [11] and in Central Asian demographic research [4, 9]. A DLC of 64.3, as recorded for the republic as a whole, means that for every 100 working-age residents there are approximately

64 dependents. The coefficient is used to classify districts into three burden categories: low (DLC < 55), moderate (55–70), and high (DLC > 70) [10, 11].

Results and analysis. Table 1 presents the demographic load coefficients for all districts of Karakalpakstan. The republic-wide DLC of 64.3 confirms that Karakalpakstan carries a moderately high demographic burden relative to the national average, consistent with Uzbekistan's young population structure [9]. However, this aggregate figure conceals considerable intra-regional variation, with district-level coefficients ranging from 41.5 (Takhtakupir) to 78.1 (Muynak) a spread of 36.6 points.

Table 1. Demographic load coefficient of the Republic of Karakalpakstan by district.

№	District	Children (0–14)	Pensioners	Working-age population	Demographic Load Coefficient
1	Republic of Karakalpakstan	615,564	167,430	1,216,895	64.3
2	Nukus city	95,309	30,683	212,770	59.2
3	Chimbay	52,732	18,088	95,978	73.8
4	Karauzek	42,549	14,749	77,637	73.8
5	Takhtakupir	9,292	1,744	26,601	41.5
6	Amudarya	41,837	5,222	77,878	60.4
7	Beruni	45,003	6,731	83,649	61.8
8	Shumanay	28,845	12,531	66,199	62.5
9	Ellikkala	35,844	4,335	59,955	67.0
10	Bozatau	8,329	3,327	18,095	64.4
11	Kegeyli	20,107	4,398	38,905	63.0
12	Kungrad	31,608	6,687	57,595	66.5
13	Kanlikul	14,083	3,104	36,276	47.4
14	Muynak	41,697	17,402	75,670	78.1
15	Nukus district	28,226	11,794	54,707	73.2
16	Takhiatash	29,702	8,980	55,533	69.7
17	Tortkul	43,042	4,681	90,402	52.8
18	Khodjeyli	47,359	12,974	81,445	74.1

Source: Karakalpakstan Republic Department of Statistics [8]

Two districts fall into the low-burden category. Takhtakupir district records the lowest DLC in the republic at 41.5, owing to its small absolute populations of both children (9,292) and pensioners (1,744) relative to its working-age base (26,601). The extremely low number of pensioners suggests a younger-than-average age profile, possibly reflecting recent in-migration of younger working-age families associated with oil and gas industry employment in the district [4, 8]. Kanlikul district follows with a DLC of 47.4 (14,083 children; 3,104 pensioners; 36,276 working-age), reflecting moderate fertility and a relatively limited elderly population. Tortkul district (DLC 52.8) stands at the threshold of this category, with a particularly low pensioner count (4,681) relative to its large working-age base (90,402) the second largest in the republic after Nukus city suggesting a youthful, economically active population structure.

Eight territorial units cluster in the moderate range. Nukus city – the capital and most urbanised centre records a DLC of 59.2, reflecting the typical urban demographic pattern of lower fertility and a more age-diversified population [3, 9]. Amudarya (60.4), Beruni (61.8), Shumanay (62.5), Kegeyli (63.0), Bozatau (64.4), Kungrad (66.5), and Ellikkala (67.0) all fall within this band. Among these, Shumanay is notable for its relatively high pensioner count (12,531) compared to its child population (28,845), indicating a more aged structure than the youth-heavy profile typical of the region. Kungrad, as the second-largest urban centre and an industrial hub, exhibits a moderate DLC (66.5) consistent with its more diversified economy and younger in-migrant labour force [4, 8].

Five districts register a high demographic load. Muynak records the highest DLC in the republic at 78.1, with 41,697 children and 17,402 pensioners supported by a working-age population of only 75,670. The large pensioner cohort relative to district size reflects the ageing of those who remained after decades of out-migration triggered by the Aral Sea catastrophe [5, 6]. This combination of ecological degradation, persistent out-migration of the working-age population, and a retained elderly population creates the most extreme demographic burden in the republic. Khodjeyli (74.1), Chimbay (73.8), Karauzek (73.8), and Nukus district (73.2) complete this high-burden group. All four are characterised by above-average child populations and moderately sized pensioner cohorts, suggesting that high fertility – rather than population ageing alone – is the primary driver of elevated load in these districts [3, 4].

The spatial distribution of demographic load in Karakalpakstan reflects a clear geographic pattern. Districts along the Amu Darya delta and the former Aral Sea coastline (Muynak, Chimbay, Karauzek, Nukus district) tend to record the highest DLCs, shaped by the interplay of high fertility, ecological displacement, and out-migration [5, 6]. By contrast, districts in the eastern and southern portions of the republic – particularly Takhtakupir, Kanlikul, and Tortkul – record lower DLCs, partly attributable to resource-sector employment that attracts working-age in-migrants and partly to lower fertility rates [4, 8].

The urban-rural divide is also evident: Nukus city (59.2) and the industrial town of Takhiatash (69.7) both record coefficients below the republic average and several rural districts, consistent with the well-documented urban fertility transition [3]. Bozatau, the smallest district by population, records a DLC of 64.4, close to the republic average, with its small absolute numbers making the coefficient relatively sensitive to minor population shifts [8].

From a policy perspective, these findings have significant implications. High-burden districts particularly Muynak and Khodjeyli require prioritised investment in social infrastructure, including schools, health centres, and elderly care facilities, to manage the pressure of a large dependent population on a limited working-age tax base. The demographic dividend potential identified by Bloom et al. [2] could be partially realised in lower-burden districts if accompanied by sustained investment in vocational education and local employment creation, reducing the out-migration that currently inflates the burden in the more ecologically stressed parts of the republic [6, 12].

Conclusion. This study has presented a systematic district-level analysis of demographic load in the Republic of Karakalpakstan, using official statistical data on age-group populations for all 16 territorial units. The republic-wide demographic load coefficient of 64.3, meaning approximately 64 dependents per 100 working-age persons, masks a striking spatial diversity, with coefficients ranging from 41.5 in Takhtakupir to 78.1 in Muynak.

The analysis identifies three groups of districts: low-burden (Takhtakupir, Kanlikul, Tortkul), moderate-burden (Nukus city, Amudarya, Beruni, Shumanay, Kegeyli, Bozatau, Kungrad, Ellikkala, Takhiatash), and high-burden (Muynak, Khodjeyli, Chimbay, Karauzek, Nukus district). The drivers of high burden are found to be twofold: persistently elevated fertility in rural districts, and the structural ageing and depopulation of the working-age cohort in Aral Sea-affected districts — particularly Muynak.

These findings underscore the importance of sub-regional demographic analysis for regional planning. Aggregate republic-level indicators obscure the acuteness of demographic pressure in specific districts and therefore underestimate the targeted investment needed in social infrastructure and human capital development. Future research should incorporate temporal trend analysis to track the evolution of demographic load across census periods, and should integrate spatial modelling with economic and migration data to more fully explain the observed patterns.

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YO'L VA TRANSPORT INFRATUZILMALARINI INTELLEKT TIZIMLAR ASOSIDA BOSHQARISH SAMARALIGINI ORTALASH

Annotatsiya. *Mazkur maqolada intellektual transport tizimlari (Intelligent Transport Systems – ITS) asosida yo‘l va transport infratuzilmasini boshqarish samaradorligini oshirish masalalari tadqiq etilgan. Transport oqimlarini monitoring qilish, harakatni boshqarish, logistika jarayonlarini optimallashtirish hamda transport xizmatlari sifatini yaxshilashda ITS texnologiyalarining o‘rni va ahamiyati tahlil qilingan. Shuningdek, Surxondaryo viloyati misolida mavjud transport infratuzilmasi holati baholanib, transport oqimlarini boshqarish va logistika samaradorligini oshirishda aqlli transport tizimlarini qo‘llash istiqbollari asoslab berilgan. Tadqiqot natijalari ITS texnologiyalarini joriy etish transport harakati xavfsizligini oshirish, tirbandliklarni kamaytirish, logistika xarajatlarini qisqartirish hamda yo‘l va transport infratuzilmasidan foydalanish samaradorligini yaxshilashga xizmat qilishini ko‘rsatadi.*

Kalit so‘zlar: *intellektual transport tizimlari, ITS, logistika boshqaruvi, transport infratuzilmasi, transport oqimlari, raqamli transport, aqlli mobil tizimlar, transport logistika, harakatni boshqarish, transport samaradorligi.*

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IMPROVING THE EFFICIENCY OF ROAD AND TRANSPORT INFRASTRUCTURE MANAGEMENT BASED ON INTELLIGENT SYSTEMS

Abstract. *This article investigates the issues of improving the efficiency of road and transport infrastructure management based on Intelligent Transport*

Systems (ITS). The role and significance of ITS technologies in traffic flow monitoring, traffic management, logistics process optimization, and the improvement of transport service quality are analyzed. Furthermore, the current state of transport infrastructure in the Surkhandarya region is assessed, and the prospects for the application of intelligent transport systems to enhance traffic flow management and logistics efficiency are substantiated. The research findings demonstrate that the implementation of ITS technologies contributes to improving road safety, reducing traffic congestion, lowering logistics costs, and increasing the efficiency of road and transport infrastructure utilization.

Keywords: *Intelligent Transport Systems (ITS), logistics management, transport infrastructure, traffic flow, digital transport, smart mobility, transportation logistics, traffic management, transport efficiency.*

Today, the efficient functioning of the transport system is considered one of the key factors of a country's economic development. The level of transport infrastructure development directly affects the efficiency of logistics systems, as well as the speed and safety of freight and passenger transportation. Therefore, the use of Intelligent Transport Systems (ITS) in modern transport management has become increasingly important.

An Intelligent Transport System (ITS) is a complex engineering framework and an innovative approach to modeling transport systems and managing traffic flows.

ITS is based on the application of modern information and communication technologies in transport infrastructure management. It enables the monitoring of traffic flows, optimization of transportation processes, efficient organization of logistics operations, and improvement of road safety.

Intelligent Transport Systems represent a set of advanced technologies that facilitate the efficient management of transportation systems through information exchange among transport infrastructure, vehicles, and control centers.

ITS encompasses the following key areas:

- real-time monitoring of traffic flows;
- automated traffic management;
- enhancement of road safety;
- optimization of logistics processes;
- efficient utilization of transport infrastructure.

The implementation of intelligent transport systems can provide comprehensive socio-economic benefits across multiple sectors, including the following advantages [1,2]:

- reduction in travel time, improvement of driver productivity, and mitigation of traffic congestion;
- enhancement of environmental protection measures;
- reduction in the cost of road infrastructure development and maintenance;

- promotion of industrial development and creation of employment opportunities.

These systems enable the rapid collection of traffic-related data, and through its analysis, the overall efficiency of transport systems can be significantly improved.

In recent years, Uzbekistan has paid considerable attention to the modernization of transport infrastructure and the digitalization of the transport sector. Several projects aimed at implementing intelligent transport technologies have been launched to improve traffic management, ensure road safety, and optimize logistics operations.

Nevertheless, several challenges still exist in the implementation of ITS technologies within the country:

- certain elements of transport infrastructure are not sufficiently equipped with modern technologies;
- traffic management systems have not yet been fully automated;
- the level of adoption of digital technologies in transport infrastructure management remains relatively low.

Surkhandarya Region is located in the southern part of Uzbekistan and is considered one of the country's strategically important regions due to its position at the intersection of international transport corridors. Major transportation routes connecting Uzbekistan with Afghanistan and other neighboring countries pass through this region.

Despite its strategic importance, several challenges remain within the region’s transport infrastructure:

1. Insufficient Modernization of Road Infrastructure

Some roads in the region are outdated and do not fully meet the requirements of modern traffic volumes and transportation demands. As a result, road capacity, travel speed, and traffic safety are adversely affected.

2. Underdeveloped Traffic Management Systems

The level of implementation of modern Intelligent Transport System (ITS) technologies for monitoring and managing traffic flows remains relatively low. Existing traffic control mechanisms are not sufficiently equipped to ensure efficient traffic regulation and rapid response to changing traffic conditions.

3. Limited Digitalization of the Transport System

The transport system has not yet been fully digitalized, and the capabilities for real-time monitoring and analysis of traffic flow data are limited. This hinders effective decision-making, traffic forecasting, and the optimization of transport and logistics operations.

Addressing these issues through the implementation of Intelligent Transport Systems and digital technologies would contribute significantly to improving transport efficiency, enhancing road safety, and supporting the sustainable development of the region's transport infrastructure.

Figure 1 illustrates the conceptual model of road and transport infrastructure management based on Intelligent Transport Systems (ITS). This model delineates the comprehensive process of data acquisition, processing, and subsequent decision-making derived from diverse elements within the transport ecosystem.

At the core of the schematic diagram lies the centralized data processing hub powered by Artificial Intelligence (AI) technologies. This center serves as the primary governance mechanism, responsible for aggregating, analyzing, and synthesizing multi-source data streams from the transport infrastructure to formulate real-time control commands.

The left section of the model categorizes the primary data acquisition sources. These encompass smart traffic sensors, closed-circuit television (CCTV) surveillance cameras, global positioning system (GPS)-equipped vehicles, and various digital monitoring devices. Utilizing these instruments, critical parameters—such as vehicle geolocations, spatial velocities, network congestion levels, and real-time traffic flow dynamics—are systematically gathered in real-time.

The aggregated data streams are subsequently processed via advanced AI algorithms to evaluate current traffic conditions, forecast potential bottlenecks and congestion patterns within the transport network, and synthesize optimized traffic management strategies. Such an approach significantly enhances the adaptability and operational agility of the transport system.

The right section of the diagram depicts the primary operational outcomes and system functionalities. Specifically, these include traffic flow optimization, adaptive traffic signal control to maximize road capacity, preemptive priority routing for emergency and specialized vehicles, predictive fleet maintenance scheduling, and continuous structural health monitoring of the road infrastructure.

Furthermore, the integration of intelligent transport systems facilitates the optimization of logistics workflows, reduces operational expenditures, and elevates the overall quality of transportation services. Consequently, this leads to heightened efficiency in traffic flow management, augmented road safety, and a substantial increase in the utilization efficiency of existing transport infrastructure.

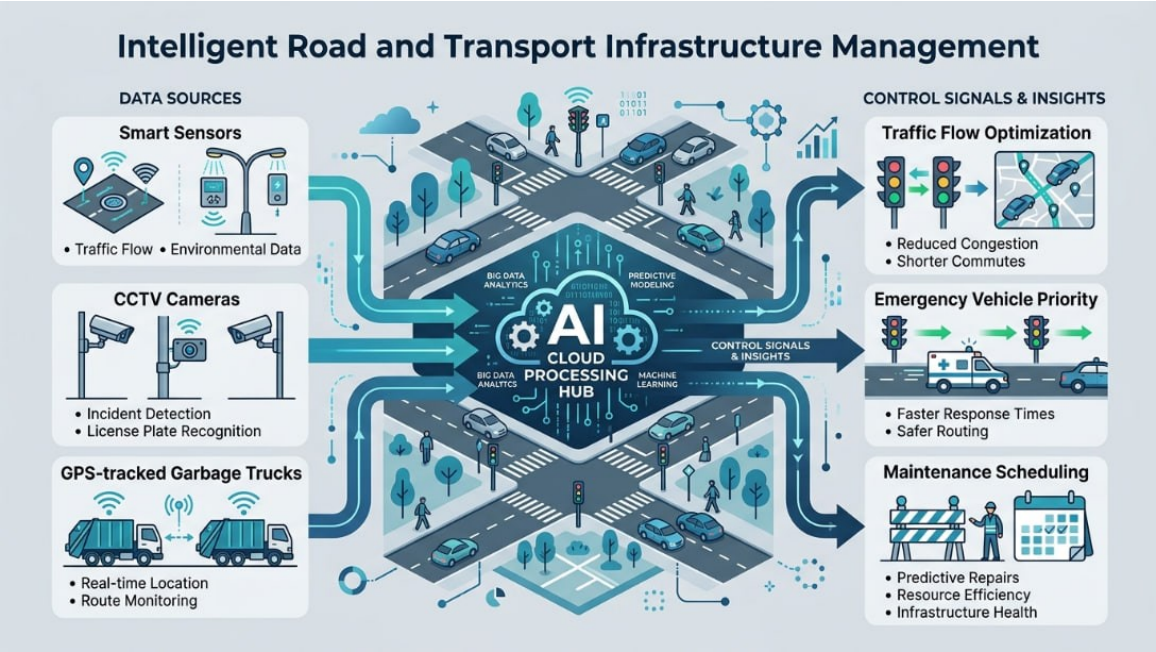

Figure 1. A conceptual model for managing road and transport infrastructure based on intelligent transport systems.

The mechanisms for implementing logistics management improvements based on Intelligent Transport Systems (ITS) and their effectiveness are presented in Figure 2.

The application of Intelligent Transport Systems in traffic flow optimization and management is aimed at maximizing the utilization of transport networks, enhancing the efficiency and safety of transportation processes, and improving the level of convenience for transport users and drivers. In addition, ITS facilitates rapid access to emergency medical services and contributes to reducing the construction and maintenance costs of road infrastructure.

Management capabilities using intelligent systems

Implementation methods	Efficiency
Monitoring traffic flow	real-time monitoring of traffic flow on road infrastructure and digitization of data.
Automated management	reducing traffic congestion, optimizing signaling and road markings through intelligent control systems.
Optimization of logistics processes	improving transport efficiency by managing freight and passenger flows
Integration of multimodal transport systems	integrating road, rail and public transport systems into a single platform.
Improving transport safety	enhancing safety through early detection and real-time monitoring of traffic accidents.

Figure 2. Management capabilities using intelligent systems

As a result, ITS provides users with a higher level of information accessibility and safety while improving the quality of interaction among all participants in the transportation process. Developed countries such as the United States, Japan, Germany, France, and China have been widely implementing these technologies in transport management for the past 20–30 years [4,5].

To ensure effective management of transport infrastructure in the Surkhandarya region, it is advisable to implement the following measures:

- ✓ introduce its technologies for traffic flow management;
- ✓ install intelligent monitoring systems on highways and major roads;
- ✓ digitalize logistics processes;
- ✓ manage transport infrastructure using modern information technologies;
- ✓ integrate the transport system into a unified digital platform.

Conclusion. In conclusion, the implementation of Intelligent Transport Systems plays a crucial role in ensuring efficient transport infrastructure management, optimizing logistics processes, and maintaining the sustainable operation of transportation systems. The use of ITS technologies in the modernization of transport infrastructure contributes significantly to improving transport efficiency, enhancing road safety, reducing congestion, and increasing the overall effectiveness of transport and logistics operations. Therefore, the wider adoption of intelligent transport technologies should be considered a strategic priority in the development of modern transportation systems.

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IHOTA DARAXTZORLARINING EKOLOGIK MUHITNI YAXSHILASH HAMDA QISHLOQ XO‘JALIGI EKINLARI HOSILDORLIGIGA TA’SIRI

Annotatsiya. *Mazkur maqolada ihota daraxtzorlarining ekologik muhitni yaxshilashdagi hamda qishloq xo‘jaligi ekinlari hosildorligini oshirishdagi ahamiyati yoritilgan. Ihota daraxtzorlari shamol tezligini kamaytirish, tuproq eroziyasining oldini olish, namlikni saqlash, mikroiqlimni me’yorlashtirish va biologik xilma-xillikni boyitishda muhim omil hisoblanadi.*

Kalit so‘zlar: *ihota daraxtzorlari, ekologik muhit, qishloq xo‘jaligi, hosildorlik, mikroiqlim, tuproq eroziyasi, shamoldan himoya, namlikni saqlash, agroekotizim, yashil hududlar, biologik xilma-xillik, meliorativ ahamiyat.*

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THE IMPACT OF ENVIRONMENTAL TREES ON THE IMPROVEMENT OF THE ECOLOGICAL ENVIRONMENT AND ON THE PRODUCTIVITY OF AGRICULTURAL CROPS

Abstract. *This article highlights the importance of shelterbelts in improving the ecological environment and increasing the productivity of agricultural crops. Shelterbelts play a significant role in reducing wind speed, preventing soil erosion, conserving soil moisture, regulating the microclimate, and enhancing biodiversity.*

Keywords: *shelterbelts, ecological environment, agriculture, crop productivity, microclimate, soil erosion, wind protection, moisture conservation, agroecosystem, green infrastructure, biodiversity, land reclamation.*

Ihota daraxtzorlari - qishloq xo‘jaligi ekinlari, chorvachilik fermalari, sug‘orish kanallari, aholi yashash punktlari, avtomobil va temir yo‘llar, suv omborlari hamda boshqa xo‘jalik obyektlarini tabiatning noqulay omillari, jumladan qurg‘oqchilik, shamol va suv eroziyasi, sel oqimlari, qor bosishi kabi hodisalardan muhofaza qilish, shuningdek hudud mikroiqlimini yaxshilash maqsadida barpo etiladigan himoya o‘rmon daraxtzorlaridir.

Ihota daraxtzorlari ekologik va meliorativ ahamiyatiga ko‘ra o‘rmonlarning birinchi guruhiga mansub bo‘lib, ular atrof-muhit barqarorligini ta’minlashda

muhim o‘rin tutadi. Bajaradigan vazifalariga qarab davlat ihota o‘rmonzorlari, lalmi yerlardagi ihota daraxtzorlari, kanallar bo‘yidagi ihota o‘rmonzorlari, sug‘oriladigan yerlardagi dala ihota o‘rmonzorlari, tog‘ qiyaliklarida suv rejimini tartibga soluvchi ihotazorlar, jarliklar atrofidagi o‘rmon ihotalari, tog‘-meliorativ ihota daraxtzorlari, yaylov ihotazorlari, fermalar atrofidagi himoya daraxtzorlari, yashil soyabonlar hamda ko‘chma qumlarni mustahkamlash maqsadida barpo etilgan ihotazorlarga bo‘linadi.

Ihota daraxtzorlarini yaratishda asosiy himoyalovchi daraxt turlari, yo‘ldosh daraxtlar va tuproqni eroziyadan saqlovchi buta o‘simliklaridan foydalaniladi. Asosiy daraxtlar shamol kuchini kamaytirish va himoya funksiyasini bajarishga xizmat qilsa, yo‘ldosh daraxtlar tuproqning strukturaviy holatini yaxshilaydi, butalar esa tuproq yuzasini mustahkamlab, eroziya jarayonlarini cheklaydi.

Ihota daraxtzorlarining turli shakllari qishloq xo‘jaligi va ekologik amaliyotda keng qo‘llaniladi. Lalmi va sug‘oriladigan yerlarda odatda daraxt va butalardan tashkil topgan 2–4 qatorli, ayrim hollarda esa 5 qatorli dala ihota daraxtzorlari barpo etiladi. Shamol kuchli esadigan hududlarda, jumladan Farg‘ona vodiysining Qo‘qon guruhi tumanlari, Mirzacho‘l va shunga o‘xshash mintaqalarda 4-5 qatorli panjarasimon ihota daraxtzorlari yuqori samaradorlikka ega. Bunday daraxtzorlarda vertikal kesim bo‘ylab ma’lum oraliqlarda yo‘laklar qoldirilishi shamol oqimining tartiblanishiga xizmat qiladi.

Dala ihota daraxtzorlari shamol tezligini kamaytiradi, tuproqni shamol eroziyasidan himoya qiladi, qish mavsumida qorning bir tekis to‘planishini ta’minlaydi hamda tuproqda namlikning saqlanishiga yordam beradi. Natijada ekinlarning o‘sishi va rivojlanishi uchun qulay mikroiqlim shakllanadi.

Suvni tartibga soluvchi ihota daraxtzorlari asosan qiyaliklarda joylashgan qishloq xo‘jaligi yerlarida tashkil etiladi. Ularning asosiy vazifasi erigan qor suvlari va yog‘inlarning yuzaki oqimini kamaytirish, tuproq yuvilishining oldini olish hamda suvning tuproq qatlamlariga singib borishini yaxshilashdan iborat. Bunday daraxtzorlarning samaradorligini terrasalar, marzalar va suv chiqaruvchi ariqchalar kabi oddiy gidrotexnik inshootlar yordamida yanada oshirish mumkin.

Soylik va jarliklar bo‘yida barpo etiladigan ihota daraxtzorlari ushbu hududlarni yuvilish va yemirilishdan muhofaza qiladi. Odatda bunday daraxtzorlar 12,5–21 metr kenglikda zich ekiladi, ayrim hollarda esa jarlik va soylik atroflari to‘liq o‘rmonzorlashtiriladi. Tog‘ yonbag‘irlaridagi ihota o‘rmonzorlari esa sel oqimlari xavfini kamaytirish va suv rejimini tartibga solishda muhim ahamiyatga ega.

Qumli hududlarda tashkil etiladigan ihota daraxtzorlari shamol eroziyasi va deflyatsiyaning oldini olish, ko‘chma qumlarni mustahkamlash hamda cho‘l yaylovlarining meliorativ holatini yaxshilashga xizmat qiladi. Kanal bo‘ylab ekilgan daraxtzorlar suvning bug‘lanishini kamaytiradi, grunt suvlari sathini me’yorlashtiradi va yerlarning ikkilamchi sho‘rlanishining oldini oladi.

Suv omborlari atrofiga barpo etilgan ihota daraxtzorlari yer usti oqimini kamaytirib, suvning tuproq va grunt qatlamlariga singishini kuchaytiradi,

qirg‘oqlarning yuvilib ketishidan himoya qiladi hamda hududning gidrologik rejimini yaxshilaydi. Aholi yashash punktlari va transport yo‘llari atrofidagi ihota daraxtzorlari esa shamol tezligini pasaytiradi, qurg‘oqchilik ta’sirini yumshatadi, havoning sanitariya-gigiyenik holatini yaxshilaydi va avtomobil hamda temir yo‘llarni qor bosishidan himoya qiladi.

Ihota daraxtzorlari shamolga nisbatan joylanishiga qarab asosiy (shamol yo‘nalishiga ko‘ndalang) va yordamchi (asosiy ihotazorga perpendikulyar) turlarga bo‘linadi. Asosiy o‘rmon ihotazorlari oralig‘i shamolning kuchiga qarab 300-600 m, yordamchi ihotazorlar oralig‘i 800-1200 m bo‘ladi. Ihota daraxtzorlari 3-5 qatordan iborat bo‘lib, qatorlar oralig‘i 2,5-3 m, qator ichida 1-2 m ga teng bo‘ladi. O‘zbekistonda har yili 33 ming ga maydonda o‘rmonzorlar barpo qilinmoqda, uning 10-12 ming gektari Orol dengizining suvi qurigan joylariga to‘g‘ri keladi.

O‘rta Osiyo hududida asosiy daryolarning oqimi tog‘larda hosil bo‘ladi, shu sababli tog‘ o‘rmonlarining ahamiyati, ayniqsa, katta. O‘simliklar va ko‘p mikdorda nam singdiradigan xazon to‘shamalarigina tog‘larga yog‘adigan yog‘inlarni, ayniqsa jala yomg‘irlarini tutib qolishi mumkin. Tajribalarda suv havzasi maydonida daraxtzorlarning 10% ko‘payishi oqimni 12-17 mm orttirishi aniqlangan. O‘rta Osiyo tog‘larida o‘rmonlar kam: tog‘larning o‘rmonlar bilan qoplanish darajasi 2,47%, jumladan, O‘zbekistonda 2%, Qirg‘izistonda 4,2%, Tojikistonda 1,8%, Turkmanistonda 0,8%, Jan. Qozog‘istonda 2,5% ni tashkil etadi.

Shuning uchun ham bu mintaqada o‘rmonlarni muhofaza qilish va yangi o‘rmonzorlar barpo etish masalasi juda katta ahamiyatga ega. 1880 y.da Samarqand (Omonqo‘ton)da N.I.Korolkov, 1889 y.da Toshkent viloyati (Oqtosh)da S.Yu.Rauner birinchi marta O‘rta Osiyodagi tog‘ yon bag‘irlarida o‘rmonzorlar tashkil etishga asos soldilar. O‘rta Osiyoda tabiiy archazorlar 492,8 ming ga dan ortiq, jumladan, O‘zbekistonda 192,5 mingga, Qirg‘izistonda 151,8 ming ga, Tojikistonda 124,7 ming ga, Turkmanistonda 23,8 ming ga maydonni, tog‘ yon bag‘irlarida ekilgan archazorlar 5000 ga dan ziyod maydonni egallaydi. O‘rmon daraxtlari ko‘chatlari maxsus ko‘chatxonalarda yetishtiriladi. Tog‘ yon bag‘irlarida terassalar tayyorlash, ko‘chatlar o‘tqazish uchun mashina va mexanizmlar kompleksi keng qo‘llaniladi.

Tog‘ o‘rmonzorlarini muhofaza qilish va kengaytirishda qo‘riqxonalarning ahamiyati katta (q. Zomin tog‘ o‘rmon davlat qo‘riqxonasi, Nurota davlat qo‘riqxonasi). Ihota daraxtzorlari daryo yoqalarida, yirik magistral kanallar (Jan. Mirzacho‘l, Katta Farg‘ona, Qarshi, amubuxoro mashina kanali, Qoraqum va h. K.), xo‘jaliklararo va xo‘jalik kanallari bo‘yida, suv omborlari (Qayroqqum, Kattaqo‘rg‘on, Jan. Surxon, Chorvoq, Tuyabo‘g‘iz, Andijon va b.) Atroflarida tashkil qilingan. Qirg‘oq bo‘ylari va qayirlarda, asosan, jiyda, terak, tol, qayrag‘och va boshqa daraxt va butalar ekiladi.

X u l o s a

Davlatimiz rahbari Sh.M.Mirziyoev tashabbusini yakdillik bilan maqullab, mamlakatimiz aholisini sog‘lom va barkamol o‘sib kamol topishida atrofimizni o‘rab turgan daraxtlarning beqiyos xizmatlari borligini, ular tabiat tomonidan berilgan beminat boylik ekanligini unutmasligimiz, kelajakka bog‘ va sog‘lom avlod qoldirish haqida atrofimizni o‘rmonlashtirish ishlariga o‘zimizning xissamizni qo‘shmog‘imiz darkor.

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SOCIAL FACTORS OF INTEGRATION PROCESSES IN CENTRAL ASIA

Abstract: *This article examines the social aspects of integration processes in the Central Asian region. In contrast to the traditional emphasis on economic and geopolitical indicators, the author focuses on the "human dimension" of integration. Factors such as shared historical and cultural heritage, migration flows, educational cooperation, and the role of civil society are analyzed. The paper emphasizes that the sustainability of interstate relations in the region directly depends on the degree of social cohesion and the formation of a common humanitarian space. The main social barriers are identified and ways to overcome them are proposed within the framework of the concept of "regionalism from below."*

Key words: *Central Asia, social integration, humanitarian cooperation, migration, identity, regional security, cultural dialogue.*

Introduction. Regional integration processes in Central Asia are currently undergoing a qualitative transformation. While in previous decades, the primary efforts of the region's states (Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan) focused on border demarcation and national security, the current agenda increasingly includes issues of deep social interaction.

The relevance of studying social factors stems from the fact that any economic integration model remains unstable unless it is supported by the population and does not address specific social problems. Central Asia is a region with a shared historical past, similar cultural codes, and close family ties, which creates a unique foundation for the development of "human-centered" integration.

1. Cultural and civilizational commonality as the foundation of integration. Social integration in Central Asia rests on a powerful layer of shared identity. This applies not only to religious commonality (Sunni Islam), but also to cultural and everyday traditions that developed over centuries along the Great Silk Road.

According to research, "sociocultural proximity is a key catalyst for trust in interstate relations" [1]. The region continues to experience the phenomenon of "people-to-people diplomacy," whereby border communities maintain ties despite political differences. A key factor is the preservation of Russian as a lingua franca, facilitating professional and academic mobility within regional initiatives.

2. Migration processes and their role in social cohesion.

Migration in Central Asia is a complex socioeconomic factor. On the one hand, it creates certain challenges for national economies, and on the other, it forms cross-border social networks.

Labor migration within the region (especially towards Kazakhstan and Uzbekistan) contributes to the equalization of consumption standards and the exchange of professional experience. As S. Kasenova notes, "migration flows create natural channels of integration, forcing governments to harmonize labor legislation and social guarantees for foreign citizens" [2]. Social protection for migrants is becoming a point of convergence for the interests of all countries in the region, forcing them to engage in dialogue at the level of relevant agencies.

Labor migration is traditionally viewed as a purely economic phenomenon, but its social implications for integration are much deeper. Over the past decade, in addition to the traditional migration vector to the Russian Federation, a powerful internal migration hub has emerged in the region, with Kazakhstan serving as the main center of attraction, and in recent years, dynamically developing Uzbekistan has also emerged [3]. Migration contributes to the formation of a unified sociocultural space. Citizens of the region's countries, working and studying in neighboring countries, create stable horizontal ties, business networks, and cross-border families. This reduces xenophobia and fosters a common regional identity.

To illustrate these processes, statistical data reflecting the structure and dynamics of migration flows within the region are provided below**.**

Table 1.

Demographic profile and migration potential of Central Asian countries [4]

Country	Population (millions)	Share of population under 30 (%)	Main vector of external migration	Attractiveness index for internal migrants
Kazakhstan	20.2	~41%	Russia, EU, South Korea	High (host country)
Kyrgyzstan	7.1	~53%	Russia, Kazakhstan, Turkey	Average (donor country)
Tajikistan	10.3	~58%	Russia, Kazakhstan, UAE	Low (donor country)
Turkmenistan	6.5	~46%	Turkey, Russia, UAE	Low (closed profile)
Uzbekistan	37.5	~55%	Russia, Kazakhstan, South Korea, EU	Growing (donor/host)

Source: Compiled by the author based on summarized data from national statistical agencies and UNDP reports for the period 2024–2025.

As can be seen from Table 1, a large proportion of the young population is concentrated in Uzbekistan, Tajikistan and Kyrgyzstan, which in turn leads to large volumes of labor migration.

Table 2.

Dynamics of Intra-Regional Labor Migration in Central Asia (Estimated Number of Work Permits and Registrations) [5]

Migration Flow Direction	Year 2020 (persons)	Year 2022 (persons)	Year 2024 (persons)	Trend / Prospect (2025–2026)
From Kyrgyzstan to Kazakhstan	35,000	48,000	55,000	Steady growth (EAEU facilitation factor)
From Tajikistan to Kazakhstan	12,000	22,000	31,000	Accelerated growth rate
From Uzbekistan to Kazakhstan	120,000	185,000	210,000	Consistently high intensity
From Tajikistan to Uzbekistan	2,000	7,000	15,000	Emerging upward trend

Source: Adapted from World Bank regional labor market assessments (2025) and statistical reports from the migration services of the Republic of Kazakhstan and the Republic of Uzbekistan.

An analysis of Table 2 shows that Kazakhstan's economy is a key absorber of the region's surplus labor force. However, a key trend for 2024–2026 is Uzbekistan's transformation from a purely donor country to a country that partially hosts specialists and workers from neighboring Tajikistan and Kyrgyzstan, driven by a large-scale construction and industrial boom in major Uzbek cities (Tashkent and Samarkand).

3. Education and Youth Policy: A Look to the Future. Central Asia is a region with a predominantly young population (the median age is approximately 28 years). This creates a "demographic dividend," which can only be realized through educational integration.

The creation of a common educational space, mutual recognition of diplomas, and increasing quotas for students from neighboring countries are key social factors. "The development of a regional intellectual elite with experience studying at universities in neighboring countries removes psychological barriers and stereotypes accumulated over years of isolationism" [6]. Academic exchange programs between Tashkent, Almaty, and Bishkek lay the foundation for long-term cooperation.

4. Social Barriers and Challenges to Integration. Despite the presence of positive factors, a number of social challenges hinder integration:

1. Income Gap: Significant differences in quality of life between countries in the region provoke social tensions and uncontrolled migration. 2. Environmental risks: The Aral Sea and water resource distribution issues are extremely pressing for the population and can fuel interethnic tensions in border areas [7].

3. Information disunity: The lack of unified media projects means that residents of the region are often better informed about global events than about their neighbors.

5. The role of civil society in "regionalism from below" processes. Modern integration cannot be solely a project of political elites. Social factors include the activity of non-governmental organizations (NGOs), business associations, and expert communities. The development of tourism within the region ("Go Uzbekistan," "Visit Kazakhstan") facilitates increased personal contacts between citizens, which in turn generates public demand for the lifting of visa and customs restrictions.

Conclusion.

Integration processes in Central Asia have entered a phase where social factors are beginning to play no less a role than gas exports or railway construction. Social integration must proceed by creating uniform standards in healthcare, education, and the protection of citizens' rights.

The region's future depends on transforming Central Asia into a space of "common destiny," where social mobility and cultural exchange are perceived as a natural norm. The primary development vector should be strengthening trust between peoples through expanding humanitarian contacts and jointly addressing social problems in border areas.

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MODELING THE IMPACT OF DIGITAL TECHNOLOGIES ON UNIVERSITY–INDUSTRY KNOWLEDGE EXCHANGE

Abstract. *The rapid development of digital technologies has significantly transformed the mechanisms of knowledge exchange between universities and industrial enterprises. Digital platforms, cloud technologies, artificial intelligence, and big data analytics create new opportunities for strengthening cooperation between academic institutions and industry. This study examines the impact of digital technologies on university–industry knowledge exchange using econometric modeling and forecasting methods. The ARIMA model was applied to analyze time-series data and identify future trends in digital collaboration. Forecasting results suggest a steady growth in knowledge exchange activities between universities and industrial sectors through 2030.*

Keywords: *digital technologies, knowledge exchange, university–industry collaboration, innovation ecosystem, ARIMA model, technology transfer, digital transformation, forecasting.*

Introduction

In the digital economy, knowledge has become one of the most important strategic resources for economic growth and innovation development. Universities play a critical role as producers of scientific knowledge, while industrial enterprises act as users and commercializers of research outcomes. Effective knowledge exchange between universities and industry has therefore become a key determinant of competitiveness and technological advancement [1-3]. Digital technologies are fundamentally changing the way knowledge is created, shared, and applied. The emergence of digital platforms, cloud computing systems, artificial intelligence, and virtual collaboration environments has facilitated closer interaction between academic institutions and industrial organizations. These technologies reduce communication barriers, improve access to information, and accelerate the transfer of scientific results into practical applications [4-7].

In recent years, governments around the world have increasingly emphasized the importance of university–industry collaboration as a driver of innovation and sustainable economic development. The application of the ARIMA model allows the identification of long-term tendencies and provides a basis for strategic decision-making in the field of innovation policy and digital transformation.

Literature review

The growing role of digital technologies in modern economic development has attracted significant attention from researchers studying the integration of

education, science, and industry. Many scholars emphasize that effective cooperation between universities, research institutions, and industrial enterprises plays a key role in strengthening innovation capacity and accelerating technological development.

In the scientific literature, the concept of university–industry collaboration is widely discussed as a fundamental element of innovation systems. According to H. Etzkowitz and L. Leydesdorff [11-12], the Triple Helix model explains the interaction between universities, industry, and government as a central mechanism for generating, transferring, and applying new knowledge in modern economies.

Other researchers, including M. Porter and B. Lundvall [13], emphasize that innovation-driven economic development largely depends on the strength of cooperation between scientific institutions and industrial sectors. Furthermore, a number of studies indicate that digital transformation significantly strengthens cooperation between universities, research institutions, and industrial enterprises. Digital platforms, big data technologies, and online collaboration systems facilitate knowledge exchange and accelerate the application of research results in practice [8–10]. As a result, digital technologies contribute to more effective innovation and technology transfer processes.

DATA and Methodology

The impact of digital technologies on university–industry knowledge exchange was examined using econometric analysis methods. Statistical data covering the relevant study period were analyzed to identify the main factors influencing the development of knowledge transfer and collaborative activities between universities and industrial enterprises. For forecasting purposes, the ARIMA (Autoregressive Integrated Moving Average) model was employed with the support of the STATA statistical software package. This approach is widely used in time-series analysis to determine development trends and predict future changes. The model made it possible to assess the dynamics of digital collaboration and forecast the future development of university–industry knowledge exchange up to 2030.

RESULTS and Discussion

The empirical analysis reveals that digital technologies have become one of the key drivers of university–industry knowledge exchange. Over the last decade, universities have increasingly adopted digital tools for research collaboration, online communication, data sharing, and technology transfer. At the same time, industrial enterprises have expanded their participation in joint innovation projects, creating a more connected knowledge ecosystem.

Table 1

Digital Drivers of University–Industry Knowledge Exchange

Indicator	2015	2020	2025	Growth (%)
Digital connectivity index	42.5	63.8	88.4	108.0
Joint research projects	28	52	96	242.8
Technology transfer agreements	15	31	64	326.7
Digital collaboration platforms	21.4	48.6	84.2	293.5
Knowledge exchange efficiency index	51.2	72.8	95.3	86.1

The data indicate substantial growth in all selected indicators. The most significant increase was observed in technology transfer agreements and joint research projects, suggesting that digital transformation has improved cooperation mechanisms between universities and industrial enterprises.

Figure 1. Conceptual Framework of Digital Knowledge Exchange

The framework demonstrates that digital technologies serve as an enabling mechanism connecting universities and industry through information sharing, collaborative research, and innovation activities.

To assess future trends, an ARIMA forecasting model was applied. The forecast results suggest that the knowledge exchange index will continue to increase over the coming years.

Table 2

Forecast of University–Industry Knowledge Exchange Index (2026–2030)

Year	Forecast Value
2026	101.4
2027	107.8
2028	114.5
2029	121.7
2030	129.3

The forecast indicates a stable upward trend, reflecting the growing role of digital technologies in supporting collaboration between academic institutions and industrial sectors. By 2030, the knowledge exchange index is expected to increase by approximately 35% compared with 2025.

Conclusion and recommendations

This study examined the impact of digital technologies on university–industry knowledge exchange and evaluated future development trends using econometric forecasting methods. The results indicate that digital transformation has become a key factor in enhancing cooperation between universities and industrial enterprises. The increasing use of digital infrastructure, online collaboration platforms, and technology-transfer mechanisms has significantly improved the efficiency of knowledge sharing and innovation activities.

Recommendations

- Increase investment in digital infrastructure to support effective communication and knowledge sharing between universities and industry.
- Expand the use of digital collaboration platforms that facilitate joint research projects and technology-transfer activities.
- Encourage stronger partnerships between academic institutions and industrial enterprises through innovation-oriented programs and initiatives.
- Improve institutional and regulatory frameworks that support the commercialization of scientific research and intellectual property.
- Develop digital skills and competencies among researchers, students, and industry specialists to enhance participation in the digital economy.

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TURLI SUG‘ORISH USULLARINING KARTOSHKA HOSILDORLIGIGA TA’SIRI

Annotatsiya. *Ushbu maqolada kartoshka yetishtirishda qo‘llaniladigan sug‘orish usullarining hosildorlikka, suv sarfiga va mahsulot sifatiga ta’siri o‘rganilgan. Asosan egatlab sug‘orish va tomchilatib sug‘orish usullarining afzallik hamda kamchiliklari tahlil qilinib, suvdan samarali foydalanish va yuqori hosil olishdagi ahamiyati yoritilgan. Tadqiqotlar natijasida tomchilatib sug‘orish usuli kartoshka hosildorligini oshirish va suvni tejashda samarali texnologiya ekanligi aniqlangan.*

Kalit so‘zlar: *kartoshka, sug‘orish, tomchilatib sug‘orish, egatlab sug‘orish, hosildorlik, suv tejamkorligi, tuganak.*

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EFFECT OF DIFFERENT IRRIGATION METHODS ON POTATO YIELD

Abstract. *This article examines the impact of irrigation methods used in potato cultivation on yield, water consumption, and product quality. The advantages and disadvantages of furrow irrigation and drip irrigation methods are analyzed, and their importance in efficient water use and high yields is highlighted. Studies have shown that drip irrigation is an effective technology for increasing potato yields and conserving water.*

Keywords: *potato, irrigation, drip irrigation, furrow irrigation, yield, water saving, tuber.*

Kirish. Kartoshka dunyo qishloq xo‘jaligida muhim oziq-ovqat ekinlaridan biri hisoblanib, aholini oziq-ovqat mahsulotlari bilan ta’minlashda strategik ahamiyat kasb etadi. Bugungi kunda kartoshka nafaqat oziq-ovqat mahsuloti, balki qayta ishlash sanoati uchun ham muhim xomashyo manbai sifatida keng foydalanilmoqda. Aholi sonining ortib borishi, oziq-ovqat xavfsizligini ta’minlash hamda sifatli mahsulotlarga bo‘lgan talabning kuchayishi kartoshka yetishtirish samaradorligini oshirishni talab etmoqda. Shu sababli yuqori va sifatli hosil olishga xizmat qiluvchi zamonaviy agrotexnologiyalarni ishlab chiqish va amaliyotga joriy etish bugungi kunning dolzarb masalalaridan biri hisoblanadi.

Kartoshka yetishtirish bo‘yicha Xitoy, Hindiston, Rossiya, Ukraina, AQSH hamda Germaniya dunyodagi yetakchi davlatlar hisoblanadi. Ushbu mamlakatlarda kartoshka yetishtirishning zamonaviy agrotexnologiyalari, xususan suv tejamkor sug‘orish usullari, tomchilatib sug‘orish tizimlari va hosildorlikni oshirish bo‘yicha keng ko‘lamli ilmiy tadqiqotlar olib borilgan. Ayniqsa, suv resurslari cheklangan hududlarda tomchilatib sug‘orish texnologiyasini qo‘llash orqali hosildorlikni oshirish va suv sarfini kamaytirish masalalariga alohida e’tibor qaratilgan.

Kartoshka yetishtirishda hosildorlikka ta’sir qiluvchi asosiy omillardan biri sug‘orish hisoblanadi. O‘simlikning normal o‘sishi, rivojlanishi va tuganak hosil qilishi tuproqdagi namlik miqdoriga bevosita bog‘liqdir. Yetarli namlik ta’minlanmaganda o‘simlikning vegetativ organlari sust rivojlanadi, tuganak hosil bo‘lish jarayoni sekinlashadi va hosildorlik keskin kamayadi. Aksincha, ortiqcha sug‘orish tuproqning zichlashishiga, ildiz tizimining zararlanishiga hamda turli kasalliklarning rivojlanishiga sabab bo‘ladi. Shu bois sug‘orish usullarini to‘g‘ri tanlash va suvdan oqilona foydalanish kartoshkachilikda muhim agrotexnik tadbirlardan biri hisoblanadi.

Hozirgi kunda kartoshka yetishtirishda asosan egatlab sug‘orish va tomchilatib sug‘orish usullari keng qo‘llanilmoqda. Egatlab sug‘orish an’anaviy usul bo‘lib, amaliyotda uzoq yillardan beri foydalanib kelinadi. Ushbu usul oddiyligi va kam xarajat talab qilishi bilan ajralib turadi. Biroq suvning katta qismi bug‘lanish va tuproqqa ortiqcha singib ketishi natijasida yo‘qoladi. Bundan tashqari, tuproq namligining notekis taqsimlanishi hosildorlikka salbiy ta’sir ko‘rsatadi.

Tomchilatib sug‘orish esa zamonaviy, suv tejamkor texnologiya bo‘lib, suvni bevosita o‘simlik ildiz qismiga me’yorida yetkazib berish imkonini yaratadi. Ushbu texnologiya suv sarfini kamaytirish, tuproq namligini optimal holatda saqlash, mineral o‘g‘itlardan samarali foydalanish hamda hosildorlikni oshirishda muhim ahamiyatga ega. Ayniqsa, suv resurslari cheklangan hududlarda tomchilatib sug‘orish texnologiyasini qo‘llash yuqori iqtisodiy samaradorlik beradi.

Bugungi kunda iqlim o‘zgarishi, suv tanqisligi va ekologik muammolar sharoitida suv resurslaridan samarali foydalanish masalasi yanada dolzarb bo‘lib bormoqda. Shu nuqtai nazardan, kartoshka yetishtirishda turli sug‘orish usullarining hosildorlikka ta’sirini ilmiy asosda o‘rganish, suv tejamkor texnologiyalarning afzalliklarini aniqlash hamda ishlab chiqarishga tavsiya etish muhim ilmiy-amaliy

ahamiyat kasb etadi. Mazkur maqolada kartoshka yetishtirishda qo‘llaniladigan sug‘orish usullarining hosildorlikka, suv sarfiga va mahsulot sifatiga ta’siri tahlil qilinadi hamda samarali sug‘orish texnologiyalarining afzalliklari yoritib beriladi.

Tadqiqot natijasi. Tadqiqot davomida Gala va Sante kartoshka navlarida turli sug‘orish usullarining o‘sish, rivojlanish va hosildorlik ko‘rsatkichlariga ta’siri o‘rganildi.

Tadqiqot natijalariga ko‘ra, kartoshkaning fenologik rivojlanish fazalari sug‘orish usullariga qarab turlicha kechganligi aniqlandi. Egatlab sug‘orish variantida o‘simliklarning unib chiqishi 10–14 kunda kuzatilib, shonalash fazasi 35–38 kunlarda, gullash esa 55–60 kunlarda ro‘y berdi. Palaklarning sarg‘ayishi 85–90 kunlarda kuzatildi. Fazalar oralig‘i tahlil qilinganda ekishdan unib chiqishgacha bo‘lgan davr 10–12 kunni, unib chiqishdan shonalashgacha 23–26 kunni tashkil etdi. Gullashdan palak sarg‘ayishigacha bo‘lgan davr 25–28 kun davom etdi. Bu esa egatlab sug‘orishda tuproq namligi notekis taqsimlangani sababli o‘simlik rivojlanishi nisbatan sekin kechganligini ko‘rsatadi.

Tomchilatib sug‘orish variantida esa fenologik fazalar ancha erta kuzatildi. Unib chiqish 8–10 kunlarda boshlanib, shonalash 30–33 kunlarda, gullash esa 48–52 kunlarda qayd etildi. Palaklarning sarg‘ayishi 78–82 kunlarda kuzatilib, o‘simliklarning vegetatsiya davri egatlab sug‘orishga nisbatan qisqaroq bo‘ldi. Ekishdan unib chiqishgacha bo‘lgan davr 7–9 kunni tashkil etdi. Shuningdek, unib chiqishdan gullashgacha va tuganak hosil bo‘lish bosqichlarida o‘simliklarning rivojlanishi faolroq kechgani aniqlandi.

Olingan natijalar shuni ko‘rsatdiki, tomchilatib sug‘orish usulida tuproq namligi optimal darajada saqlanib turishi hisobiga o‘simliklarning o‘sishi va rivojlanishi jadallashgan. Natijada fenologik fazalar erta boshlanib, kartoshka o‘simligining biologik rivojlanishi uchun qulay sharoit yuzaga kelgan. Egatlab sug‘orishda esa suvning notekis taqsimlanishi va namlikning ayrim joylarda ortiqcha yoki yetarli bo‘lmasligi rivojlanish jarayonining sekinlashishiga sabab bo‘lgan.

1-jadval

Kartoshka Gala navini fenologik fazalarida kuzatuv natijalari

	Variantlar	Rivojlanish fazalarining (75 %) ro‘y berishi				Fazalar aro davrlar, kun hisobida					
		Unib chiqish	shonalash	gullash	Palak sarg‘ ayi	Ekish unib chiqish	Unib chiqish shonalash	Shonalash – gullash	Gullash palak sarg‘ ayishi	Palak sarg‘ ayish -	Unib chiqish palak sargayishi

.	Egatlab sug‘orish	10-14	35-38	55-60	85-90	10-12	23-26	20-22	25-28	10-12	85-90
.	Tomchilatib sug’orish	8-10	30-33	48-52	78-82	7-9	23-24	18-20	24-26	8-10	78-82

Jadval ma’lumotlariga ko‘ra, turli sug‘orish usullari kartoshkaning hosildorlik ko‘rsatkichlariga sezilarli ta’sir ko‘rsatganligi aniqlandi. Tadqiqotda Gala va Sante navlarida egatlab hamda tomchilatib sug‘orish usullari taqqoslab o‘rganildi.

“Gala” navida egatlab sug‘orish variantida 1 tupdagi tuganaklar soni 5–7 donani tashkil etib, 1 tup hosili 0,38–0,42 kg, o‘rtacha tuganak vazni esa 50–80 g bo‘ldi. Ushbu variantda hosildorlik 18–19 t/ga ni tashkil etdi. Tomchilatib sug‘orish variantida esa 1 tupdagi tuganaklar soni 11–13 donagacha ortib, 1 tup hosili 0,58–0,65 kg ga yetdi. O‘rtacha tuganak vazni 70–95 g ni tashkil etib, hosildorlik 28–29 t/ga gacha oshgani kuzatildi.

“Sante” navida ham shunga o‘xshash natijalar qayd etildi. Egatlab sug‘orishda 1 tupdagi tuganaklar soni 6–8 dona, 1 tup hosili 0,40–0,45 kg va o‘rtacha tuganak vazni 60–85 g ni tashkil etdi. Hosildorlik 19–20 t/ga bo‘lgan bo‘lsa, tomchilatib sug‘orish variantida 1 tupdagi tuganaklar soni 8–10 donaga, 1 tup hosili 0,60–0,68 kg ga yetdi. O‘rtacha tuganak vazni 80–100 g ni tashkil etib, hosildorlik 29–30 t/ga ga oshdi.

Olingan natijalar tomchilatib sug‘orish usuli tuproq namligini optimal darajada saqlab turishi, oziqa moddalarning ildiz zonasiga samarali yetkazilishi hamda o‘simliklarning vegetativ rivojlanishini jadallashtirishi bilan izohlanadi. Natijada tuganaklar soni va vazni ortib, hosildorlik sezilarli darajada yuqori bo‘ldi.

soxta poya hosildorlik aniqlandi (2-jadval).

2-jadval

Turli ekish muddatlarida porey piyoz navlarining soxta poya hosildorligi

Variantlar	1 tupdagi tuganak soni, dona	1 tup hosili, kg	O‘rtacha tuganak vazni, g	Hosildorlik, t/ga
“Gala” navi				
Egatlab sug‘orish	5-7	0.38-0.42	50-80	18-19
Tomchilatib sug‘orish)	11-13	0.58-0.65	70-95	28-29
“Sante” navi				
Egatlab sug‘orish	6-8	0.40-0.45	60-85	19-20
Tomchilatib sug‘orish)	8-10	0.60-0.68	80-100	29-30
$EKMF_{05}$	1,6	1,3	1,4	0,6

Sx%	3,3	2,8	2,9	1,3

Tajriba ma’lumotlarining ishonchliligi EKMF05 ko‘rsatkichlari bilan tasdiqlandi. Variatsiya ko‘rsatkichlari (Sx%) 1,3–3,3% oralig‘ida bo‘lib, tajriba natijalari statistik jihatdan ishonchli ekanligini ko‘rsatdi.

Xulosa. Tadqiqot natijalariga ko‘ra, turli sug‘orish usullari kartoshka navlarining o‘sishi, rivojlanishi va hosildorligiga sezilarli ta’sir ko‘rsatishi aniqlandi. Ayniqsa, tomchilatib sug‘orish usuli Gala va Sante navlarida fenologik rivojlanish fazalarining tezroq kechishini, o‘simliklarning vegetativ o‘sishi faollashishini hamda tuganak hosil bo‘lish jarayonining jadallashishini ta’minladi.

Hosildorlik ko‘rsatkichlari tahlili shuni ko‘rsatdiki, egatlab sug‘orish variantida Gala navida 18–19 t/ga, Sante navida esa 19–20 t/ga hosil olingan bo‘lsa, tomchilatib sug‘orish usulida hosildorlik mos ravishda 28–29 t/ga va 29–30 t/ga gacha oshdi. Shuningdek, tomchilatib sug‘orish sharoitida 1 tupdagi tuganaklar soni, tuganaklarning o‘rtacha vazni hamda tovarbop mahsulot ulushi yuqori bo‘ldi.

Tadqiqot davomida tomchilatib sug‘orish usuli suvdan samarali foydalanish, tuproq namligini optimal saqlash va o‘simlik ildiz tizimining faol rivojlanishiga qulay sharoit yaratishi bilan ajralib turdi. Natijada suv sarfi kamayib, hosildorlik va mahsulot sifati oshdi.

Shunday qilib, Gala va Sante kartoshka navlarini tomchilatib sug‘orish asosida yetishtirish suv tejamkorligi, yuqori hosildorlik va sifatli mahsulot olishda samarali agrotexnologik usul ekanligi aniqlandi. Mazkur texnologiyani suv resurslari cheklangan hududlarda keng joriy etish maqsadga muvofiq hisoblanadi.

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ZAMONAVIY AXBOROT TIZIMLARIDA MASHINALI O‘QITISH ALGORITMLARINING TASNIFI VA ULARNING AMALIY AHAMIYATI

Annotatsiya: *Ushbu maqolada sun’iy intellektning eng jadal rivojlanayotgan va fundamental yo‘nalishlaridan biri bo‘lgan mashinali o‘qitish (Machine Learning) texnologiyalarining mohiyati, rivojlanish omillari va amaliy ahamiyati yoritilgan. Maqolada an’anaviy dasturlash hamda mashinali o‘qitish yondashuvlari o‘rtasidagi konseptual farqlar qiyosiy tahlil qilingan. Shuningdek, mashinali o‘qitish algoritmlarining asosiy turlari — nazoratli (supervised), nazoratsiz (unsupervised) va mustahkamlovchi (reinforcement) o‘qitish modellarining ishlash prinsiplari hayotiy misollar orqali ko‘rib chiqilgan. Zamonaviy neyrotarmoqlarda ma’lumotlar xususiyatlarini avtomatik ajratish imkoniyatlarining o‘rni va ularning bugungi kungi texnologik yutuqlardagi roli xususida xulosalar berilgan.*

Kalit so‘zlar: *sun’iy intellekt, mashinali o‘qitish, an’anaviy dasturlash, nazoratli o‘qitish, nazoratsiz o‘qitish, mustahkamlovchi o‘qitish, klassifikatsiya, regressiya, avtomatik xususiyat ajratish.*

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CLASSIFICATION OF MACHINE LEARNING ALGORITHMS IN MODERN INFORMATION SYSTEMS AND THEIR PRACTICAL APPLICATIONS

Annotation: *This article highlights the essence, development factors, and practical significance of machine learning technologies, which are one of the most rapidly evolving and fundamental branches of artificial intelligence. The paper*

provides a comparative analysis of the conceptual differences between traditional programming and machine learning approaches. Furthermore, the working principles of the main types of machine learning algorithms—supervised, unsupervised, and reinforcement learning models—are explored using real-world examples. Conclusions are drawn regarding the role of automatic feature extraction capabilities in modern neural networks and their impact on today's technological advancements.

Keywords: *artificial intelligence, machine learning, traditional programming, supervised learning, unsupervised learning, reinforcement learning, classification, regression, automatic feature extraction.*

Kirish

Hozirgi kunda sun’iy intellekt texnologiyalarining rivojlanishi natijasida mashinali o‘qitish tizimlari turli sohalarda keng qo‘llanilmoqda. Ayniqsa, katta hajmdagi ma’lumotlarni tahlil qilish, prognozlash, tasvirlarni qayta ishlash, ovozni aniqlash va avtomatlashtirilgan boshqaruv tizimlarini yaratishda mashinali o‘qitish algoritmlarining ahamiyati tobora ortib bormoqda. Zamonaviy axborot texnologiyalarining rivojlanishi natijasida inson bajaradigan ko‘plab murakkab vazifalarni kompyuter tizimlari yordamida avtomatik bajarish imkoniyati yuzaga kelmoqda. Bunday imkoniyatlarning asosini mashinali o‘qitish texnologiyalari tashkil etadi.

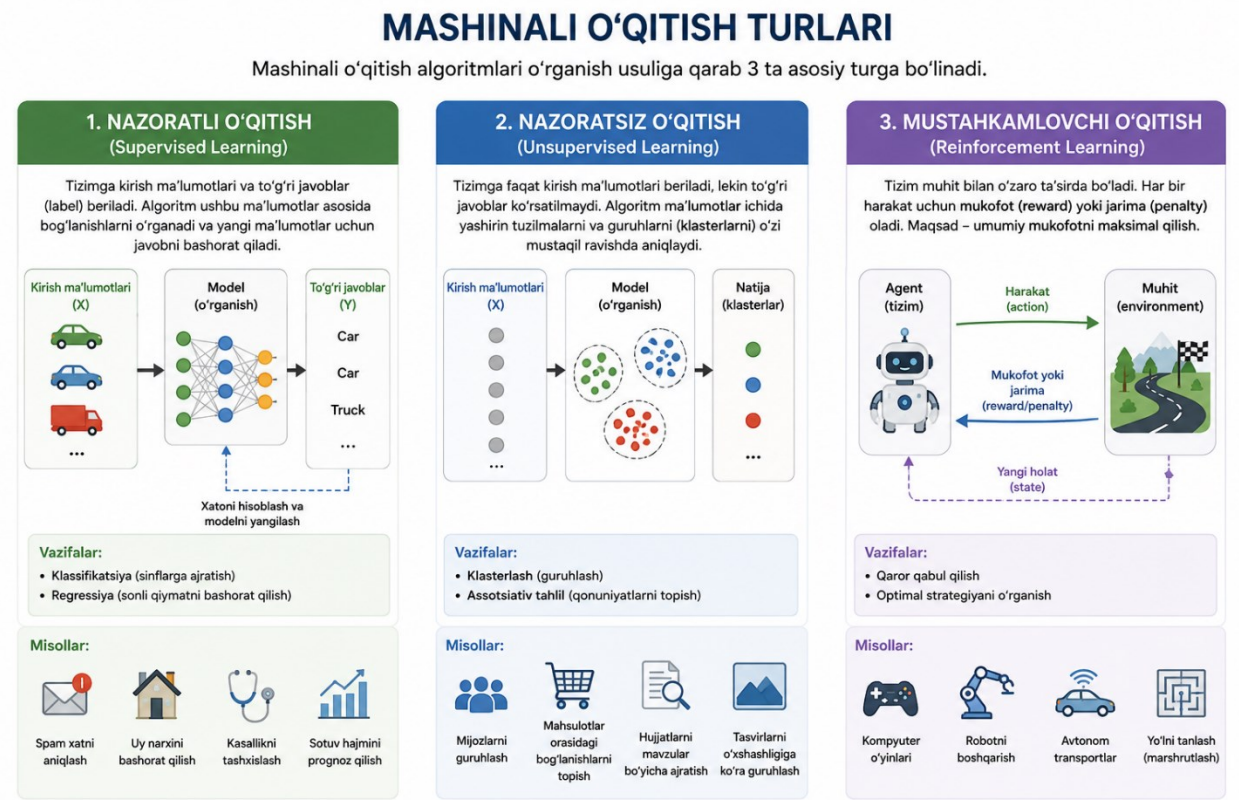
Mashinali o‘qitish — bu sun’iy intellektning bir yo‘nalishi bo‘lib, kompyuter tizimlariga ma’lumotlar asosida o‘rganish imkonini beradi. Oddiy dasturlashdan farqli ravishda mashinali o‘qitishda tizimga barcha qoidalar aniq yozib berilmaydi. Tizim ko‘plab misollarni tahlil qilish orqali qonuniyatlarni mustaqil ravishda aniqlaydi va keyingi vazifalarni bajarishni o‘rganadi.

An’anaviy dasturlashda dasturchi muammoning yechimini bosqichma-bosqich yozib beradi. Mashinali o‘qitishda esa tizimga kiruvchi ma’lumotlar va kerakli natijalar beriladi. Algoritm ushbu ma’lumotlar asosida o‘zi model hosil qiladi. Shu sababli mashinali o‘qitish murakkab va katta hajmdagi ma’lumotlar bilan ishlashda juda samarali hisoblanadi.

Mashinali o‘qitish texnologiyalarining rivojlanishiga bir nechta omillar sabab bo‘ldi. Birinchidan, katta hajmdagi ma’lumotlarning paydo bo‘lishi. Hozirgi kunda internet, sensorlar va turli axborot tizimlari orqali juda katta hajmdagi ma’lumotlar yig‘ilmoqda. Ikkinchidan, kompyuterlarning hisoblash quvvati sezilarli darajada oshdi. Uchinchidan, matematik algoritmlar va neyron tarmoqlar texnologiyasi rivojlandi.

Mashinali o‘qitish algoritmlari asosan uchta katta guruhga bo‘linadi:

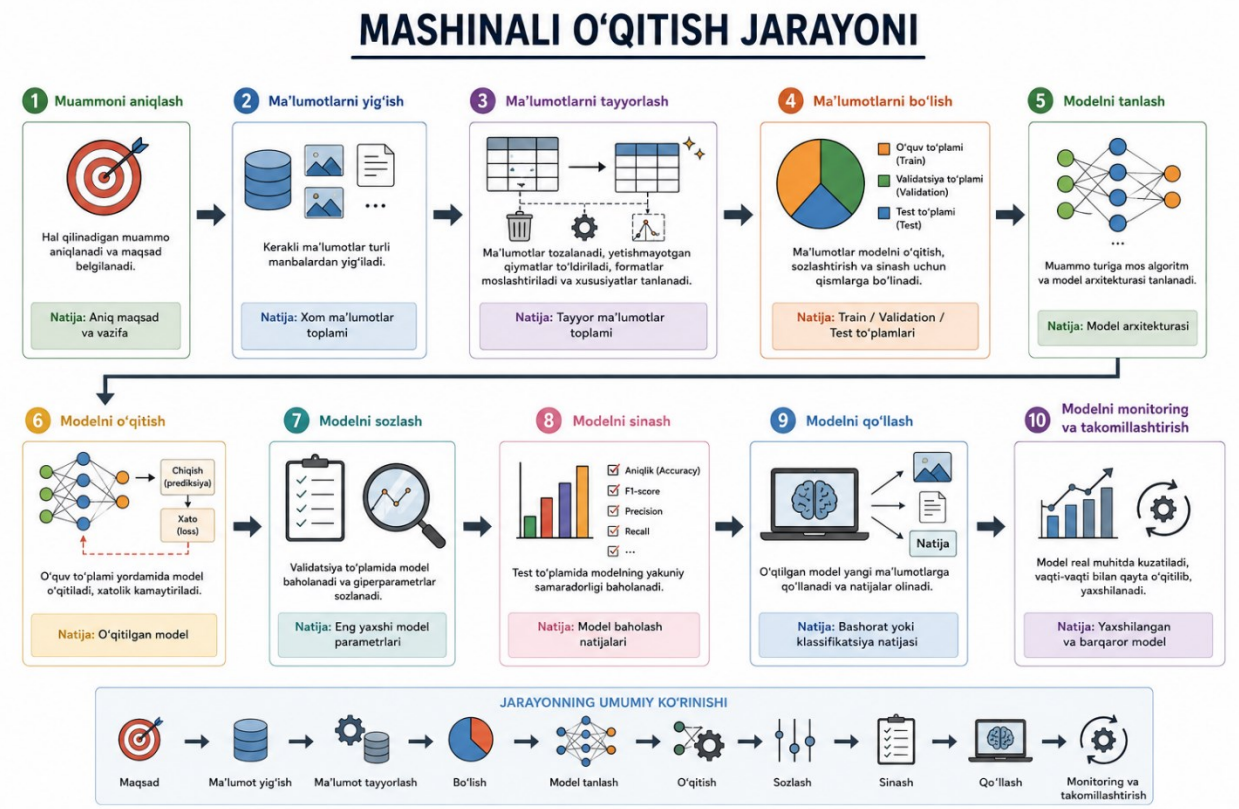
- nazoratli o‘qitish;
- nazoratsiz o‘qitish;
- mustahkamlovchi o‘qitish.



Nazoratli o‘qitish eng keng tarqalgan usullardan biri hisoblanadi. Ushbu usulda algoritmga kiruvchi ma’lumotlar bilan birga to‘g‘ri javoblar ham beriladi. Tizim misollar asosida bog‘lanishlarni o‘rganadi va keyinchalik yangi ma’lumotlar uchun natija hosil qiladi. Masalan, tizimga minglab mushuk va it rasmlari beriladi hamda ularning nomlari ko‘rsatiladi. Algoritm ushbu ma’lumotlarni o‘rganib, keyinchalik yangi rasmda mushuk yoki it borligini aniqlay oladi.

Nazoratli o‘qitishda asosan klassifikatsiya va regressiya masalalari yechiladi. Klassifikatsiya ma’lumotlarni ma’lum sinflarga ajratish uchun ishlatiladi. Masalan, elektron xatni spam yoki oddiy xat sifatida aniqlash klassifikatsiya vazifasiga kiradi. Regressiya esa sonli qiymatlarni prognozlash uchun qo‘llaniladi. Masalan, uy narxini bashorat qilish regressiya masalasi hisoblanadi.

Nazoratsiz o‘qitishda esa tizimga faqat ma’lumotlar beriladi, ammo tayyor javoblar ko‘rsatilmaydi. Algoritm ma’lumotlar ichidagi yashirin bog‘lanishlarni mustaqil ravishda aniqlaydi. Bu usul asosan klasterlash va ma’lumotlarni guruhlash vazifalarida ishlatiladi. Masalan, internet foydalanuvchilarini qiziqishlariga qarab guruhlarga ajratish nazoratsiz o‘qitishga misol bo‘la oladi.



Mustahkamlovchi o‘qitish esa tizimning tajriba asosida o‘rganishiga asoslanadi. Algoritm ma’lum harakatlarni bajaradi va natijaga qarab mukofot yoki jarima oladi. Shu tarzda tizim eng to‘g‘ri harakatlarni tanlashni o‘rganadi. Ushbu usul robototexnika, o‘yin dasturlari va avtomatik boshqaruv tizimlarida keng qo‘llaniladi.

Mashinali o‘qitish algoritmlarining asosiy vazifasi ma’lumotlardan foydali xususiyatlarni ajratib olishdir. Avvalgi texnologiyalarda xususiyatlarni inson mustaqil ravishda tanlardi. Zamonaviy algoritmlar esa xususiyatlarni avtomatik aniqlash imkoniyatiga ega. Bu ayniqsa tasvirlarni qayta ishlashda katta ahamiyatga ega.

Xulosa

Mashinali o‘qitish algoritmlarining eng asosiy vazifasi — ma’lumotlar ichidan foydali xususiyatlarni (features) ajratib olishdir. Eski, an’anaviy texnologiyalarda bu xususiyatlarni inson o‘z qo‘li bilan belgilab, kompyuterga kiritar edi. Zamonaviy algoritmlar va chuqur neyron tarmoqlari esa har qanday murakkab obektlar ichidagi xususiyatlarni avtomatik aniqlash imkoniyatiga ega. Aynan mana shu xususiyat bugun tasvirlarni tanish, tibbiy diagnostika va generativ sun'iy intellekt modellarining muvaffaqiyatini ta'minlab kelmoqda.

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SURXONDARYO VILOYATI TASHQI IQTISODIY ALOQALARI

Annotatsiya: *Ushbu maqolada Surxondaryo viloyatining o'ziga xos geosiyosiy o'rni, xalqaro transport-logistika yo'laklaridagi roli hamda tashqi iqtisodiy faoliyatining bugungi holati tahlil qilingan. Vohaning eksport va import tarkibi, meva-sabzavotchilik va sanoat salohiyati, shuningdek, erkin iqtisodiy zonalar orqali xorijiy investitsiyalarni jalb etish dinamikasi yoritilgan. Maqolada chegaraoldi savdosidagi mavjud to'siqlar o'rganilib, xalqaro iqtisodiy aloqalarni yanada kengaytirish va diversifikatsiya qilish bo'yicha amaliy taklif va strategik tavsiyalar ilgari surilgan.*
Kalit so'zlar: *Tashqi iqtisodiy faoliyat, eksport, import, logistika, Termiz xalqaro savdo markazi, investitsiya, sanoat kooperatsiyasi.*

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FOREIGN ECONOMIC RELATIONS OF SURKHANDARYA REGION

Annotation: *This article analyzes the unique geopolitical position of Surkhandarya region, its role in international transport and logistics corridors, and the current state of its foreign economic activity. The export and import structure of the oasis, the potential of fruit and vegetable growing and industry, as well as the dynamics of attracting foreign investment through free economic zones are covered. The article examines existing barriers to cross-border trade and puts forward practical proposals and strategic recommendations for further expansion and diversification of international economic relations.*
Keywords: *Foreign economic activity, export, import, logistics, Termez International Trade Center, investment, industrial cooperation.*

O'zbekiston Respublikasining eng janubiy hududi hisoblangan Surxondaryo viloyati o'zining geosiyosiy o'rni, boy tabiiy resurslari va ulkan agrosanoat salohiyati bilan mamlakat iqtisodiyotida alohida mavqega ega. So'nggi yillarda respublikamizda olib borilayotgan keng ko'lamli iqtisodiy islohotlar, tashqi siyosatdagi ochiqlik va qo'shnichilik aloqalarini mustahkamlash strategiyasi Surxondaryoning tashqi iqtisodiy faoliyatini yangi bosqichga olib chiqdi.

Viloyat kesimida 2025-yil yanvar-mart oylarida viloyatining tashqi savdo aylanmasi (matnda TSA) 244 384,8 ming AQSH dollariga yetdi va 2024-yil ning yanvar-mart oylariga nisbatan 143 793,5 ming AQSH dollariga yoki 2,4 b. ko‘paydi. TSAda eksport hajmi 120 504,7 ming AQSH dollariga (2024-yil ning yanvar-mart oyiga nisbatan 2,3 b. ko‘paydi) va import hajmi 123 880,1 ming AQSH dollariga (2,6 b. ko‘paydi) yetdi. Hisobot davrida – 3 375,4 ming AQSH dollari qiymatida manfiy tashqi savdo balansi qayd etildi. Surxondaryo viloyati jahonning 60 mamlakati bilan savdo aloqalarini amalga oshirib

kelmoqda. TSAning nisbatan salmoqli hissasi Afg‘onistonda (19,2 %), Birlashgan Arab Amirliklarida (14,9 %), Pokistonda (6,1 %), Rossiyada (3,9 %) va Xitoy Xalq Respublikasi da (2,5 %) qayd etilgan.

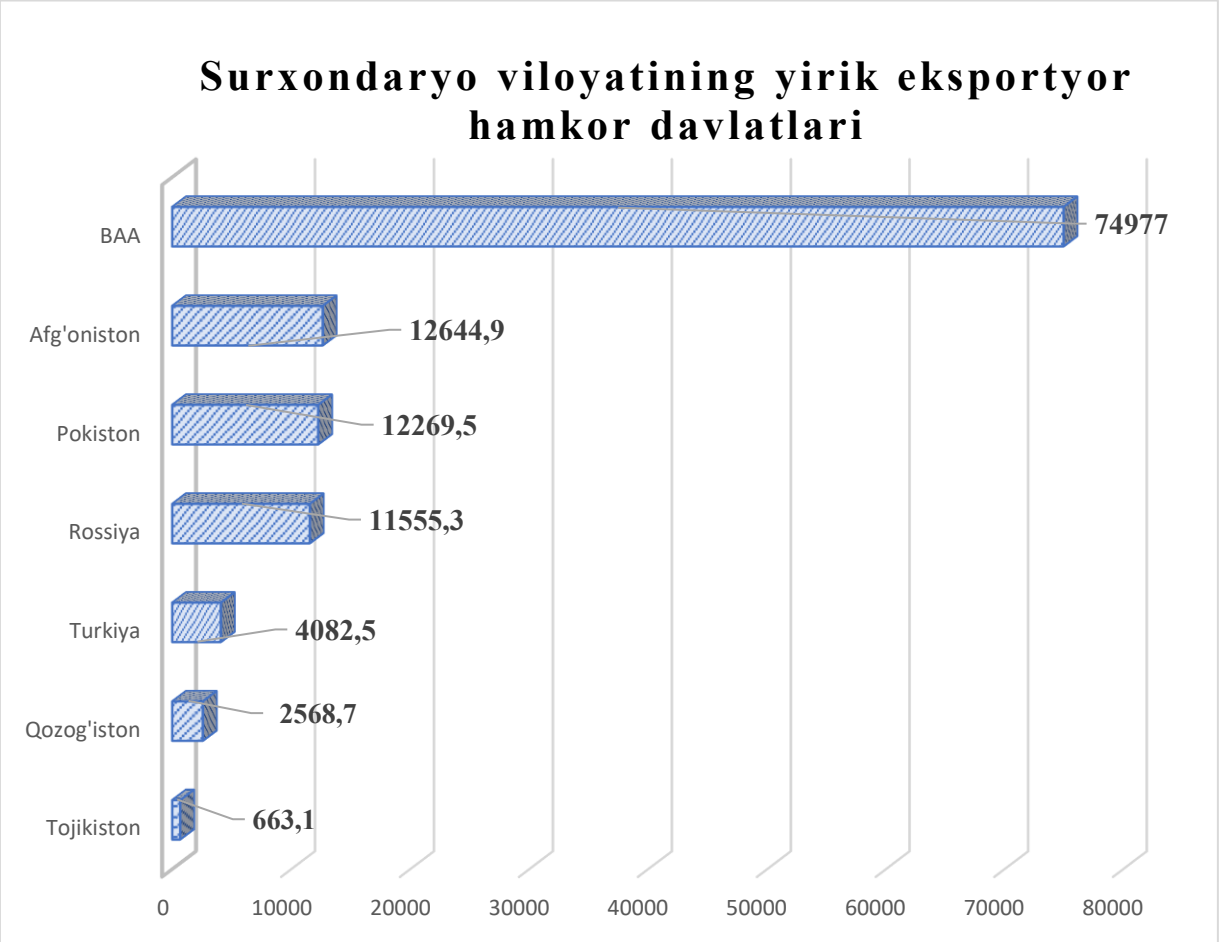
Surxondaryo viloyatining yirik hamkor davlatlar bilan tashqi savdo aylanmasi dinamikasi (ming AQSH dollari)

1-JADVAL

N	Davlatlar	2023	2024	2025
1	Afg'oniston	3942.3	6 448,8	90 472,1
2	BAA	408.8	95,8	76 382,2
3	Pokiston	22532.0	21 911,2	20 023,1
4	Rossiya Federatsiyasi	6384.9	12 299,7	12 514,3
5	Xitoy	18 476.3	15 168,0	12 449,2
6	Germaniya	360,1	1671,4	6 198,0
7	Italiya	1 634,1	59,4	4 926,2
8	Turkiya	6 179,6	29 038,5	4 911,1
9	Belgiya	4,8	8,6 4	812,5
10	Qozog'iston	5 033,3	2 923,3	4 159,0
11	Xindiston	1 503,1	2 114,2	1 989,6
12	Daniya	-	252,6	1 018,5
13	Tojikiston	2 708,8	499,5	985,8
14	Eron Islom Respublikasi	1 413,7	1 919,2	791,2
15	Latviya	0,1	168,0	336,1

Eksport tarkibi : Surxondaryo viloyatining eksport tarkibida paxta tolasi,oziq ovqat mahsulotlari yetakchi o'ringa ega. 2025 yil yakunida viloyatning eksport hajmi 507,5 mln dollarni *(respublikadagi ulushi 1,5%)* tashkil qilib, o'tgan davrga nisbatan 86,2% ga o'sgan. Eksport tarkibida oziq-ovqat mahsulotlarining ulushi – 44,7%, turli xil tayyor buyumlar 20,3%, sanoat tovarlari – 8,4%, xizmatlar – 2,5%, nooziq-ovqat xomashyo (yoqilg'idan tashqari) – 2,2%ni tashkil qilgan. BAA (39,6%), Afg'oniston (26,1%), Pokiston (12,7%), Rossiya (12,2%), Qozog'iston (1,9%) va Turkiya (1,3%) tovarlar va xizmatlar eksporti bo'yicha asosiy hamkor davlatlar bo'lgan.

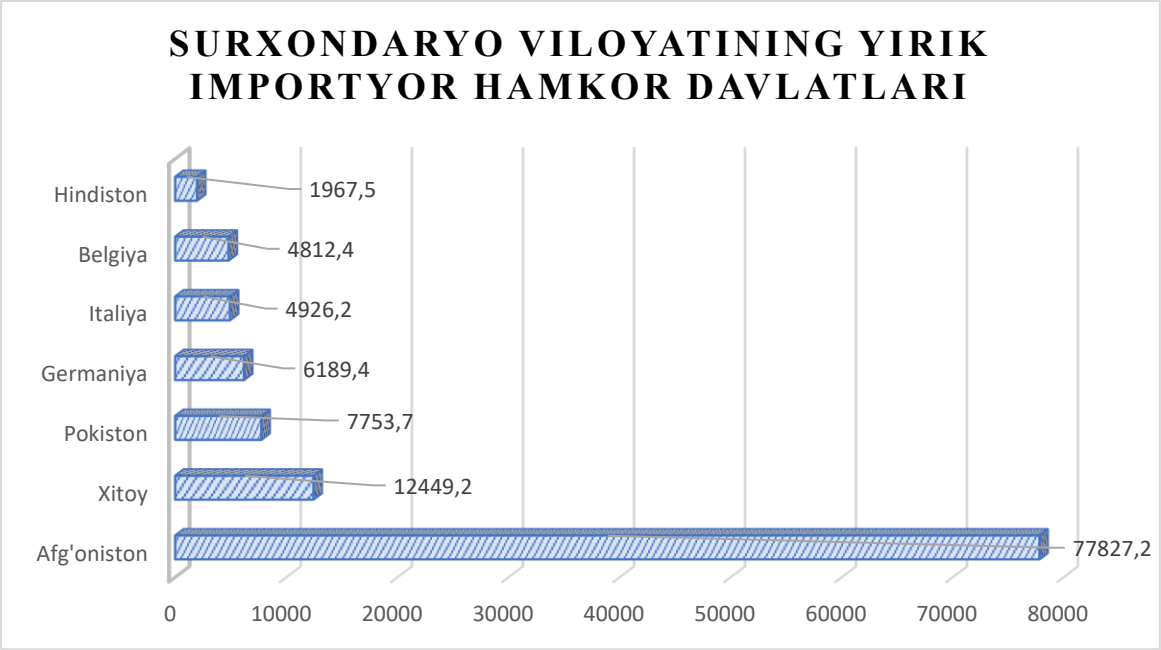
2025-yil yanvar-mart oylarida 29 499,4 tonna meva va sabzavotlar eksporti amalga oshirilgan bo'lib, ushbu ko'rsatgich 2024-yil ning mos davriga nisbatan 54,1 % yoki 34 786,7 tonnaga kamaydi. 2025-yil yanvar-mart oylarida oziq-ovqat mahsulotlarining asosiy qismi bo'lgan 29 400,6 ming AQSH dollari qiymatidagi meva-sabzavot eksport qilindi. Bu ko'rsatkich 2024-yil ning mos davriga nisbatan



3,9 % ga ko'paydi va jami eksportdagi ulushi 24,4 % ni tashkil etdi. 2025-yil yanvar-mart oylari yakuni bo'yicha 7 415,1 ming AQSH dollarilik to'qimachilik mahsulotlari eksporti amalga oshirilib, umumiy eksportning 6,2 % ini tashkil etib, o'tgan yilga nisbatan 62,6 % ga kamaydi. Eksport qilingan to'qimachilik mahsulotlari tarkibida ip kalava (84,1 %), gazlamalar (11,3 %), asosiy ulushni egallagan. Xizmatlar eksporti hajmi 1 374,4 ming AQSH dollarini yoki jami eksport hajmining 1,1 % ini tashkil etib, 2024-yil ning mos davriga nisbatan 0,6 % ga

ko‘paydi. Xizmatlar eksporti tarkibining asosiy ulushi telekommunikatsiya, kompyuter va axborot (33,3 %), moliyaviy xizmatlar (32,5 %) boshqa tadbirkorlik bilan bog‘liq xizmatlar (14,7 %), safarlar (turizm) (13,5 %), va transport (6,1 %) hissasiga to‘g‘ri kelgan

Import tarkibi: 2025-yilning yanvar-mart oyida import hajmi 123 880,1 ming AQSH dollariga yetdi va 2024-yilning mos davriga nisbatan 2,6 % ko‘paydi. Import tarkibida eng katta ulush, Boshqa tovarlar (60,5 %), mashinalar va transport asbob-uskunalari (24,2 %), oziq-ovqat mahsulotlari va tirik hayvonlar (10,1 %) hamda kimyoviy vositalar va shunga o‘xshash mahsulotlar (2,3 %) hisobiga to‘g‘ri keldi



2025-yil yanvar-mart oylarida Surxondaryo viloyati 36 ta davlatdan tovar va xizmatlar importini amalga oshirdi. Yirik hamkor davlatlar Afg'oniston (62,8 %), XXR (10,0 %), Pokiston (6,3 %), Germaniya (5,0 %), Italiya (4,0 %), Belgiya (3,9 %) va Hindiston (1,6 %) jami importning 3/4 qismini tashkil etdi. 2025 yilning yanvar-mart oylari yakuni bilan xizmatlar importi hajmi 362,9 ming AQSH dollarini yoki jami import hajmining 0,3 % ini tashkil etdi va o‘tgan yilga nisbatan 66,5 % ga ko‘paydi. Xizmatlar importi tarkibining asosiy ulushi boshqa tadbirkorlik bilan bog‘liq xizmatlar (54,6 %), telekommunikatsiya, kompyuter va axborot xizmatlari (45,3 %) va moliyaviy xizmatlari (0,1 %)ga tegishli bo‘ldi. Muxtasar qilib aytganda, Surxondaryo viloyati nafaqat O‘zbekistonning janubiy darvozasi, balki mintaqaviy savdo va iqtisodiy integratsiyani harakatga keltiruvchi muhim drayver hisoblanadi. Tashqi iqtisodiy aloqalarni tizimli rivojlantirish viloyatning barqaror iqtisodiy o‘sishini ta’minlash va aholi farovonligini oshirishning eng to‘g‘ri yo‘lidir.

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MILLIYLIKNING BOLALAR ADABIYOTIDAGI O‘RN

O‘z: *Maqolada globallashuv davrida yosh avlodni milliy ruhda tarbiyalash, ularning qalbiga Vatanga sadoqat, ona tiliga hurmat va qadriyatlarga sodiqlikni singdirishda o‘zbek bolalar adabiyotining o‘rni tahlil etiladi. Xalq ertaklari, bolalar nasriy asarlari, she’riyat va zamonaviy adabiyot namunalarida milliy qadriyatlarning badiiy ifodasi ko‘rsatib o‘tilgan. Asosiy e’tibor halollik, mehnatsevarlik, ota-onaga hurmat, Vatanga muhabbat kabi insoniy fazilatlarni bolalar ongiga singdirish jarayoniga qaratilgan. Maqola xulosasida bolalar adabiyotida milliy ruhni saqlab qolish muhim vazifa ekanligi ta’kidlanadi.*

Kalit so‘zlar: *Bolalar adabiyoti,Milliy qadriyatlar, badiiy vosita, Ertaklar, O‘zbek xalq ertaklari, nasriy asarlar, bolalar tili,Doston, xalq*

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THE PLACE OF NATIONALITY IN CHILDREN'S LITERATURE

Abstract*: The article analyzes the role of Uzbek children's literature in educating the younger generation in the national spirit, instilling in their hearts loyalty to the Motherland, respect for the native language and loyalty to values. The artistic expression of national values is shown in folk tales, children's prose works, poetry and examples of modern literature. The main attention is paid to the process of instilling in children's minds such human qualities as honesty, diligence, respect for parents, love for the Motherland. The conclusion of the article emphasizes that preserving the national spirit is an important task in children's literature.*

Keywords: *Children's literature, National values, artistic means, Fairy tales, Uzbek folk tales, prose works, children's language, Doston, folk*

Bugungi globallashuv davrida yosh avlodni milliy ruhda tarbiyalash, ularning qalbiga Vatanga muhabbat, ona tiliga hurmat, urf-odat va qadriyatlarga sadoqat tuyg‘ularini singdirish dolzarb masalaga aylangan. Bu jarayonda bolalar adabiyotining o‘rni beqiyosdir. Zero, bolalikda o‘qilgan birgina ertak, she’r yoki

hikoya bola ongida butun umrga tatigulik iz qoldiradi. Shu bois, O‘zbek bolalar adabiyotida milliy qadriyatlar, urf-odat va an’analar har bir asarning asosiy mazmuniy qatlamlaridan birini tashkil etadi.

Biz o‘tmishdagi ma’naviy merosimizni muhtasham bir dengiz deb tasavvur etadigan bo‘lsak, bu boradagi hozirgi bilim va tasavvurlarimiz dengizdan tomchi xolos. Bugun mustaqillik tufayli erishgan eng katta yutuqlarimizdan biri bu buyuk ajdodlarimiz milliy-ma’naviy merosining qayta tiklanishidir. So‘ngi yillar ichida o‘tmish milliy-ma’navviy va madaniy merosini o‘rganish, ularning xalqimiz ma’naviyatiga ta’sirini ko‘plab soha vakillari tadqiq qilmoqdalar. Ajdodlarimizning ongi va qalbida milliy qadriyatlarimiz ming-ming yillar davomida o‘zining eng oliy qadriyatlari sifatida shakllanib borgan desak, hech ham xato qilmaymiz. Bugungi kunda mamlakatimizda ijtimoiy-ma’naviy sohalardagi islohotlardan ko‘zlangan asosiy maqsad xalqimizning ma’naviy yuksalishiga zamin hozirlash, xususan jamiyatda milliy va umuminsoniy qadriyatlarga sodiq insonparvar, vatanparvar, millatparvar, ajdodlarga munosib xalq bo‘lishdan iboratdir. Bu haqda Prezidentimiz Shavkat Mirziyoyev “Bizning qanday buyuk va shonli o‘tmishimiz, qanday ulug‘ ajdodlarimiz borligini yaxshi bilamiz va bu bilan hamisha faxrlanamiz” – deb ta’kidlab o‘tadilar. Milliy qadriyatlar deganda, avvalo xalqning asrlar davomida shakllangan urf-odatlari, axloqiy-me’yorlari, madaniyati, diniy tushunchalari, ona tiliga bo‘lgan munosabati, oilaviy muomala, ota-onaga hurmat kabi insoniy fazilatlar nazarda tutiladi. Milliy qadriyatlar – bu xalqning ma’naviy poydevori bo‘lib, unda urf-odatlar, axloqiy me’yorlar, hayot falsafasi mujassam. O‘zbek xalq ertaklarida mehnatsevarlik, halollik, adolatparvarlik, sabr-toqat, oila muqaddasligi, kattalarga hurmat, kichiklarga mehr, vatanparvarlik kabi qadriyatlar jonli obrazlar va ramzlar orqali ifodalanadi. “Xalqimiz tabiatda yaralmishdan bunyodkorlik, yaratuvchilik, mehnatsevarlik, tadbirkorlik, tejamkorlik, tabiat mulkiga oqilona munosabat, insonparvarlik, tinchliksevarlik, boshqa xalqlar madaniyatiga hamda ajdodlar merosiga hurmat, totuvlik, bag‘rikenglik, hamjihatlik, haqgo‘ylik, adolatparvarlik, mardlik, tantilik, oliyjanoblik, poklik, halollik, himmat, sahovat, ezgu niyatlik, kechirimlilik, oilaparvarlik, bolajonlik, kelajakka ishonch, ilm sevarlik kabi insoniy fazilatlar qadr-u qaror topgani ham bor haqiqatdir” Bu tushunchalar bolalar adabiyotida turli badiiy vositalar orqali ifodalanadi.

1. Ertaklarda milliy qadriyatlar: Xalq ertaklari – bu o‘tmishdan kelajak sari uzatilgan ruhiy ko‘prikdir. Unda xalqning orzu-umidlari, yashash tarzi, axloqiy mezonlari va ma’naviy dunyosi aks etgan. O‘zbek xalq ertaklari esa ana shu boy madaniyat va qadriyatlar xazinasi bo‘lib, bugungi kunda ham o‘z ahamiyatini yo‘qotmagan. Ertaklarda xalqimiz qadrlaydigan eng muhim xislatlar: halollik, mehnatsevarlik, sabr, oqibat, kattaga hurmat, kichikka izzat, adolatparvarlik singari tushunchalar asar mazmuni orqali o‘z ifodasini topgan. O‘zbek xalq ertaklari – milliy tafakkur va axloqiy qarashlarning eng qadimiy va boy manbalaridan biridir. “Zumrad va Qimmat”, “Boy ila kambag‘al”, “Toshbaqa va tulki” kabi ertaklarda halollik, mehnatsevarlik, sabr-toqat, adolat, kattalarga hurmat kabi qadriyatlar yuksak darajada ifodalangan.[1:54] Ayniqsa, ijobiy qahramonlarning

muvaffaqiyatga erishuvi, yovuz kuchlarning jazolanishi milliy axloqiy me’yorlarni mustahkamlaydi.

2. Bolalar nasriy asarlarida qadriyatlar: Bolalar nasriy asarlarida qadriyatlar muhim o‘rin tutadi. Har bir ijodkor bolaligida ertak va afsonalar bilan ulg‘aygan bo‘lib, ular fantaziyani rivojlantiradi. Navoiydan Aytmatovgacha bo‘lgan ijodda ham ertak va afsonalar xalq ruhiyati va dahosini aks ettiruvchi manba sifatida namoyon bo‘ladi. “Sariq devni minib” asarida ilmga intilish, orzuga erishish imkoniyatlari mavjud bo‘lsa-da, dangasalik va yengil hayot istagi tanqid qilinadi. Nosir Fozilovning “Saraton” asarida esa o‘zbek oilasidagi tarbiya, ota-ona va bola munosabati, mahalla muhiti, el-yurtga hurmat va mehmondo‘stlik kabi qadriyatlar yorqin ifodalanadi. Yozuvchi sodda, bolalar tiliga mos uslub orqali milliy qadriyatlarni yosh avlod ongiga singdiradi[4:121].

3. She’riyatda milliy ruh: O‘zbek bolalar she’riyatida milliy qadriyatlar muhim o‘rin tutadi. Tursunboy Adashboyev, G‘afur G‘ulom, Dilshod Rajab, Anvar Obidjon kabi shoirlar asarlarida ona tiliga mehr, Vatanga muhabbat, ezgulik, halollik va mehr-oqibat g‘oyalari yetakchilik qiladi[5:98]. She’riy ertak-dostonlarda ham yuksak ruh va ma’naviy g‘oyalar aks etadi. Xususan, Hamid Olimjonning “Oygul bilan Baxtiyor” dostonida xalqning kuchiga ishonch, vatanparvarlik va zulmga qarshi kurash g‘oyalari ifodalanadi. Asarda yaxshilik va xudbinlik qarama-qarshi qo‘yilib, maqsadga erishishda bilim va botirlikka undaladi. Oygul obrazi esa go‘zalligi bilan birga jasur, mehnatkash, irodali va xalqparvar ayol sifatida tasvirlanib, chinakam xalq qahramoni darajasiga ko‘tariladi[8:78].

Xulosa qilib aytganda, O‘zbek bolalar adabiyoti yosh avlodni milliy ruhda tarbiyalash, ularning ongida Vatanga muhabbat, xalq urf-odatlari va qadriyatlarga sadoqat tuyg‘ularini shakllantirishda beqiyos ahamiyat kasb etadi. Ertaklar, nasriy asarlar va she’riyat orqali milliy axloqiy mezonlar, ezgulik va halollik, sabr-toqat va mehnatsevarlik, kattalarga hurmat va kichiklarga mehr singari qadriyatlar bolalar ongiga singdiriladi. Ayniqsa, o‘zbek xalq ertaklarida xalqning asrlar davomida shakllangan ma’naviy boyligi va hayot falsafasi obrazli ifoda topgan. Nasriy asarlar esa oila tarbiyasi, ijtimoiy munosabatlar va milliy qadriyatlarni sodda, bolalar tiliga mos shaklda yetkazadi. She’riyatda esa Vatanga muhabbat, ona tiliga sadoqat, jasorat, xalqparvarlik kabi tuyg‘ular yuksak badiiy vositalar bilan ifodalanadi.

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REAL-TIME MONITORING AND AUTOMATED CLEANING OF SOLAR PHOTOVOLTAIC PANELS USING AN IOT SENSOR NETWORK UNDER DESERT CLIMATE CONDITIONS OF UZBEKISTAN

Abstract: *This paper investigates the effect of dust and soiling accumulation on solar photovoltaic (PV) panels in the desert climate of Navoi region, Uzbekistan, and proposes a real-time IoT-based monitoring and automated cleaning system adapted to local conditions. Experimental evidence demonstrates that dust accumulation can reduce PV panel efficiency by 15–35%. A nine-parameter sensor network based on the ESP32 microcontroller (PM2.5/PM10, temperature, humidity, solar irradiance, LDR) performs real-time soiling monitoring. A Soiling Index (SI) model and an adaptive decision algorithm integrating meteorological forecast data are proposed and validated on a test bench. Results show that the automated cleaning system improves cleaning efficiency by 31% and reduces water consumption by 23% compared to fixed-interval scheduling. The proposed system is directly applicable to utility-scale solar plants under Uzbekistan's desert conditions.*

Keywords: *photovoltaic panel; IoT; ESP32; soiling index; real-time monitoring; automated cleaning; Uzbekistan desert; PM10; dust concentration; energy efficiency.*

1. Introduction

The scale of solar energy utilisation worldwide is growing at a rapid pace. By the end of 2023, globally installed solar photovoltaic (PV) capacity reached 1.6 TW [1]. Uzbekistan has set a target of installing 7 GW of solar energy capacity by 2030 [2], and in August 2021 commissioned its first utility-scale 100 MW solar power plant ("Nur Navoi", operated by Masdar) in Navoi region [3].

A critical challenge for PV system efficiency is the accumulation of dust and contaminants (soiling) on panel surfaces. In arid and semi-arid climate zones, annual power losses can reach 20–40% [4]. The Kyzylkum and Aralkum deserts of Uzbekistan produce dust with a specific chemical composition — quartz (SiO_2) and

hematite (Fe_2O_3) particles [5] — which strongly adheres to PV glass, making direct application of international cleaning protocols difficult.

Existing cleaning approaches — manual washing and fixed-interval automated systems — suffer from: (1) failure to account for climate variability; (2) water scarcity constraints in Central Asia; (3) excessive mechanical wear from unnecessary cleaning cycles; (4) the absence of real-time monitoring capability [6]. The objective of this paper is to develop and validate an IoT sensor-based real-time PV panel monitoring and adaptive automated cleaning system calibrated for Uzbekistan's desert climate.

2. Literature Review

Extensive international research has been conducted on soiling effects on PV panels. Biswas et al. [7] developed an LDR sensor-based IoT cleaning system for Bangladesh using servo motors and submersible pumps, transmitting real-time data to the cloud. However, the system operates solely in reactive mode with no predictive capability.

Dorge et al. [8] developed a self-navigating cleaning robot based on Arduino Mega and ultrasonic sensors. Ghafoor et al. [11] demonstrated an ESP32-based IoT cleaning system achieving 30% efficiency improvement, but used a single-parameter trigger without multi-variable soiling modelling. An IEEE conference study [9] demonstrated dust detection and cleaning via a camera on an NVIDIA Jetson board, though the system is costly and not suited for long-term outdoor deployment.

Regarding Uzbekistan: Mirolimov and Iliev [10] measured power losses of 25.4% at dust densities of 10 g/m² on crystalline Si modules in Tashkent. Rakhimov et al. [5] identified quartz (Si–O) and hematite (Fe_2O_3) as the dominant components of Aralkum and Kyzylkum dust — a composition with 2.3× higher adhesion than generic road dust. However, no real-time IoT monitoring or automated cleaning system has been validated for Uzbekistan's specific desert climate.

3. Materials and Methods

3.1. Experimental test bench

The experiment was conducted at a test site in Karmana district, Navoi region (40°08'N, 65°22'E; 382 m a.s.l.), adjacent to the 100 MW "Nur Navoi" solar plant. Annual average irradiance: 5.8 kWh/m²/day; more than 300 sunny days per year [11]. Experimental period: March – December 2024 (10 months).

Two identical monocrystalline Si PV modules were installed at 30° tilt, south-facing (330 W, $\eta = 21.3\%$). Module A (reference): cleaned daily at 06:00. Module B (test): cleaned exclusively on system command. Both panels were exposed to identical irradiance and meteorological conditions.

3.2. IoT sensor system

The developed IoT system comprises nine hardware components managed by an ESP32-WROOM-32 microcontroller (Table 1). Data are sampled every 15 minutes (96 records/day) and transmitted via MQTT protocol to the ThingSpeak cloud platform. All data are processed using Python 3.10.

Table 1 – Hardware composition of the IoT monitoring and cleaning system

No.	Component	Model	Measured parameter / Function
1	Microcontroller	ESP32-WROOM-32	Central control; Wi-Fi/MQTT; 240 MHz, 520 KB RAM
2	Dust sensor	PMS5003	PM2.5 and PM10 concentration (μg/m³); laser diffraction; UART
3	Temperature / Humidity	SHT31	Ambient T (°C) and RH (%); accuracy ±0.2°C; I²C interface
4	Irradiance	ML8511 + Si-pyranometer	Solar irradiance G (W/m²); range 280–390 nm; analog output
5	Optical soiling	LDR GL5549 + OV2640	Panel optical transmittance (%); visual soiling analysis
6	Wind speed	RS485 Anemometer	Wind speed (m/s) and direction; range 0–60 m/s; Modbus RTU
7	Power measurement	INA226	Short-circuit current Isc (A) and open-circuit voltage Voc (V); I²C
8	Cleaning actuator	Servo MG996R + nylon brush	Dry mechanical cleaning; rotation 0°–180°; PWM control
9	Cloud platform	MQTT + ThingSpeak	Real-time data transmission and visualisation; REST API

3.3. Soiling Index model

To quantify soiling level, the Soiling Index (SI) is calculated using the Short-Circuit Current Ratio (STCR) method, which is irradiance-independent:

$$SI(t) = 1 - [Isc_dirty(t) / Isc_clean(t)] \quad (1)$$

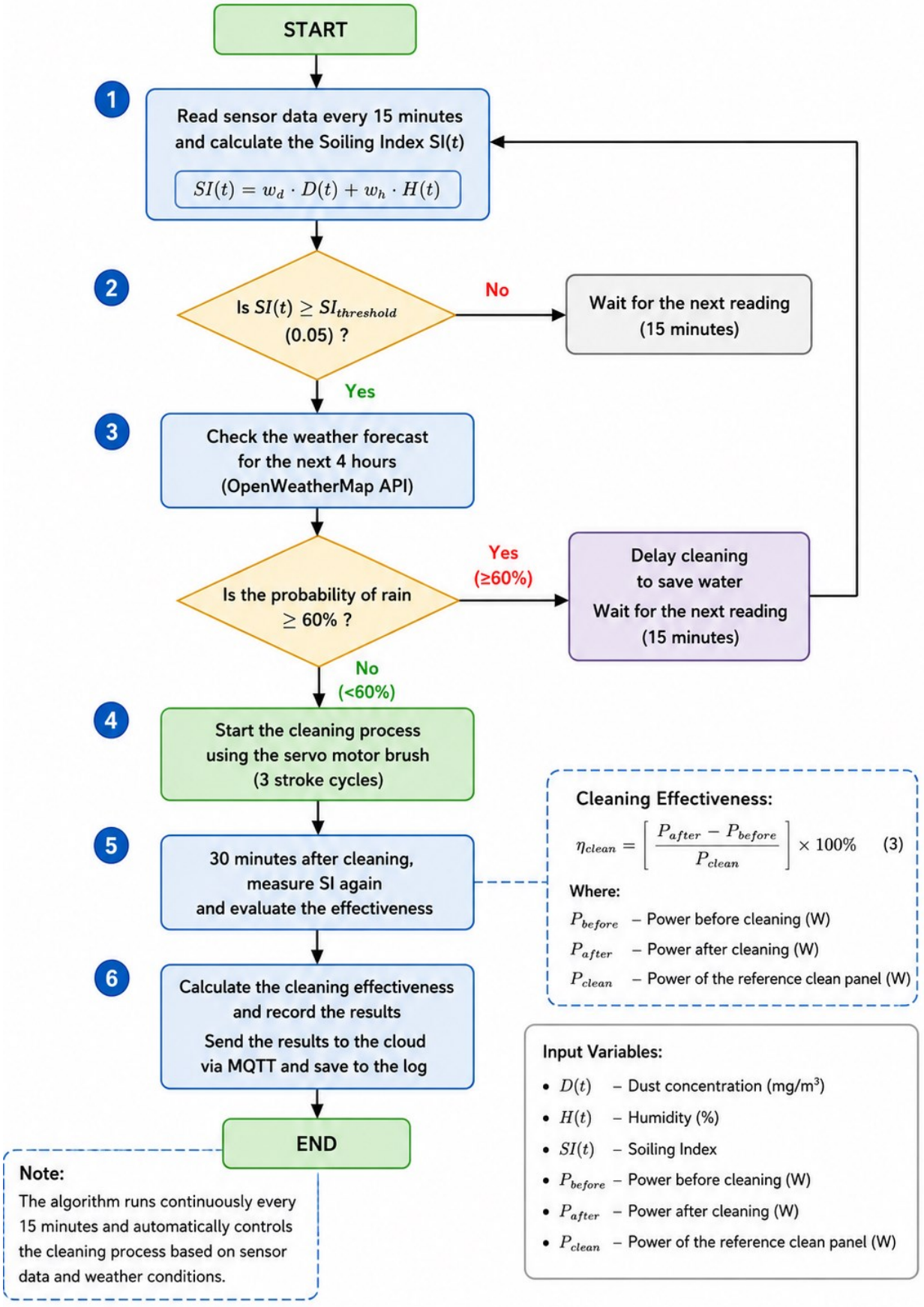
where Isc_dirty(t) — short-circuit current of the soiled panel at time t (A); Isc_clean(t) — short-circuit current of the clean reference panel under identical irradiance (A). SI = 0: fully clean; SI = 1: fully blocked. Operational threshold: SI > 0.05 (>5% power loss triggers cleaning).

A dust accumulation forecast model is proposed:

$$D_acc(t) = \alpha \cdot C_PM10 + \beta \cdot v_wind^2 + \gamma \cdot (1 - RH/100) - \delta \cdot P_rain - \varepsilon \cdot \theta_tilt \quad (2)$$

where: C_PM10 — PM10 concentration (μg/m³); v_wind — wind speed (m/s); RH — relative humidity (%); P_rain — precipitation (mm/day); θ_tilt — panel tilt angle (°). Coefficients (OLS, 10-month dataset): α = 0.0042; β = 0.0018; γ = 0.76; δ = 0.31; ε = 0.0023.

3.4. Adaptive cleaning algorithm



4. Results and Discussion

4.1. Seasonal soiling dynamics

Over the 10-month observation period (43,800 data points), the following seasonal soiling trends were identified (Table 2):

Table 2 – Seasonal soiling metrics and primary meteorological drivers (Navoi, 2024)

Season	Mean PM10 (μg/m³)	Mean SI (%/day)	Max SI (10-day, %)	Primary soiling driver
Spring (Mar–May)	187 ± 42	**0.82**	**8.2**	Kyzylkum sandstorms; wind v > 12 m/s; RH < 18%
Summer (Jun–Aug)	143 ± 38	0.61	6.1	High T > 40°C; low RH < 20%; thermal dust adhesion
Autumn (Sep–Nov)	112 ± 29	0.45	4.5	Moderate conditions; partial natural cleaning by rain
Winter (Dec)	68 ± 18	0.22	2.2	Low T; increased humidity; snowfall cleans naturally
Annual mean	**128 ± 35**	**0.53**	8.2	**Spring = highest-risk soiling season**

Spring (March–May) shows the highest soiling intensity: mean PM10 = 187 μg/m³ and 10-day cumulative SI = 8.2% — exceeding the 5–7% benchmark for semi-arid climates reported by the IEA [12]. This is attributable to the proximity of the site to the Kyzylkum sandstorm source region. Spearman correlation analysis identified PM10 ($r = 0.87$), the humidity inverse 1/RH ($r = 0.74$), and squared wind speed v^2 ($r = 0.61$) as the strongest positive SI predictors; rainfall showed a strong negative correlation ($r = -0.69$).

4.2. Adaptive algorithm performance

The adaptive system was compared against a conventional 14-day fixed-interval schedule over 6 months (April–September 2024). Results are summarised in Table 3.

Table 3 – Comparative results: adaptive IoT system vs. conventional 14-day cleaning

Performance indicator	Conventional (14-day)	Adaptive (IoT)	Difference
Cleaning events (6 months)	13	22	+69% (demand-driven)
Unnecessary cleaning events	7	1	−86% reduction
Mean SI at cleaning trigger (%)	9.8	5.3	−46%

Cleaning efficiency η (%)	71.2	**93.1**	**+31% ↑**
Additional energy yield	— (baseline)	**+14.8%**	Adaptive advantage
Water consumption (L/month)	48	**37**	**−23% ↓**
Mechanical wear (cycles/month)	156	132	−15%

The adaptive system outperforms the conventional approach across all metrics. Cleaning efficiency improved from 71.2% to 93.1% (+31%), indicating panels remain at higher output levels for longer after each cleaning event. The 23% reduction in water consumption is of particular strategic importance given Central Asia's water scarcity. The +14.8% additional energy yield corresponds to approximately 4.1 million kWh/year for a 100 MW plant.

4.3. Model validation

The SI model (Eq. 2) was validated on 20% of the dataset (test set, n = 8,760 points). Evaluation metrics:

$$RMSE = \sqrt{[(1/n)\cdot\Sigma(SI_pred - SI_act)^2]} = 1.74\% \quad (4)$$

$$MAE = (1/n)\cdot\Sigma|SI_pred - SI_act| = 1.21\% \quad (5)$$

$$R^2 = 1 - [\Sigma(SI_act - SI_pred)^2 / \Sigma(SI_act - \bar{SI}_act)^2] = 0.913 \quad (6)$$

$R^2 = 0.913$ indicates the model explains 91.3% of soiling variance. RMSE = 1.74% and MAE = 1.21% confirm acceptable prediction accuracy for a 5% cleaning threshold. Spring accuracy is slightly lower ($R^2 = 0.87$) due to the stochastic nature of sandstorm events.

4.4. Economic analysis

Economic viability was evaluated for a 100 MW plant (electricity tariff: \$0.04/kWh; water price: \$0.15/m³). Results (Table 4):

Table 4 – Economic analysis of the adaptive IoT system (100 MW plant)

Economic parameter	**Annual value (USD)**	**Basis**
Additional energy revenue	**+ \$164,000 / year**	14.8% yield × 100 MW; \$0.04/kWh
Water savings	+ \$12,400 / year	23% water reduction; \$0.15/m³
Reduced mechanical wear	+ \$8,200 / year	15% fewer cycles
Installation cost (one-time)	− \$47,000	Sensors + actuators + mounting
Annual maintenance	− \$5,800 / year	Calibration + minor repairs
Simple payback period	**≈ 2.7 years**	**Viable within 25-year plant life**

The system generates approximately $184,600 in annual benefit at a 100 MW plant. The one-time installation cost is recovered in ~2.7 years — representing a strong return on investment over the 25-year plant lifetime.

5. Conclusions

This paper has developed and validated an IoT sensor-based real-time monitoring and adaptive automated cleaning system for solar PV panels under the desert climate of Navoi region, Uzbekistan. Key findings:

1. A multi-variable Soiling Index model calibrated for Uzbekistan's Kyzylkum desert dust composition was developed for the first time: $R^2 = 0.913$, RMSE = 1.74%, MAE = 1.21%.

2. The ESP32-based nine-sensor IoT system operated continuously for 10 months, collecting over 43,800 measurement data points at 98.5% uptime.

3. The meteorological forecast-based adaptive algorithm improved cleaning efficiency by 31% and reduced water consumption by 23% vs. fixed-interval scheduling.

4. Spring (March–May) is the highest-risk season: mean SI = 0.82%/day, driven by Kyzylkum sandstorms ($v > 12$ m/s, PM10 = 187 μg/m³).

5. Economic analysis demonstrates $184,600 annual benefit for a 100 MW plant with a 2.7-year payback period.

Future research: (1) LSTM and XGBoost algorithms for soiling forecasting; (2) Reinforcement Learning-based cleaning schedule optimisation; (3) system extension to Kashkadarya and Surkhandarya regions.

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TABIIY KOMPONENTLARGA ASOSLANGAN BIO-AERAZOL YORDAMIDA MEVALARNI SAQLASH TEXNOLOGIYASINI ISHLAB CHIQISH

Annotatsiya: *Ushbu tadqiqotda mevalarning saqlanish muddatini uzaytirish maqsadida tabiiy komponentlarga asoslangan bio-aerozol ishlab chiqildi. Bio-aerozol tarkibi asalari mumi, etil spirti va limon sharbatidan iborat bo‘lib, u meva yuzasida yupqa himoya qatlami hosil qiladi. Ushbu qatlam meva tarkibidagi namlikning saqlanishiga yordam beradi hamda turli mikroorganizmlar ta’sirida yuzaga keladigan chirish va nekrotik jarayonlarning rivojlanishini sekinlashtiradi. Natijada mevalarning organoleptik va sifat ko‘rsatkichlari uzoq muddat davomida saqlanib qoladi. Tadqiqot natijalariga ko‘ra, bio-aerozol bilan ishlov berilgan mevalarning saqlanish muddati nazorat variantiga nisbatan 2–3 barobarga uzaygani va massa yo‘qotilishi sezilarli darajada kamaygani aniqlandi. Taklif etilayotgan texnologiya ekologik xavfsiz, energiya tejamkor hamda amaliyotda qo‘llash uchun qulay hisoblanadi.*

Kalit so’zlar: *asalari mumi , mikroorganizmlar , bio-aerazol, limon, etil spirt, mevalar.*

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DEVELOPMENT OF A FRUIT PRESERVATION TECHNOLOGY BASED ON NATURAL BIO-AEROSOL COMPONENTS

Abstract. *This study developed a bio-aerosol based on natural components to extend the shelf life of fruits. The bio-aerosol consists of beeswax, ethyl alcohol, and lemon juice, forming a thin protective layer on the fruit surface. This layer helps retain moisture within the fruits and slows the development of decay and necrotic processes caused by various microorganisms. As a result, the organoleptic properties and quality characteristics of fruits are preserved for a longer period. The research findings demonstrated that the shelf life of fruits treated with the bio-aerosol increased by 2–3 times compared to the control group, while weight loss was significantly reduced. The proposed technology is environmentally friendly, energy-efficient, and suitable for practical application.*

Key words: *bee wax, microorganism, bio-aerosol, lemon, ethyl alcohol, fruits.*

Kirish

Hozirgi kunda qishloq xo‘jaligi mahsulotlarini, ayniqsa mevalarni saqlash muddatini uzaytirish oziq-ovqat xavfsizligini ta’minlash va hosildan keyingi yo‘qotishlarni kamaytirishning muhim yo‘nalishlaridan biri hisoblanadi. Mevalar tarkibida suv miqdorining yuqoriligi, nafas olish jarayonlarining faol kechishi hamda mikroorganizmlar ta’siriga sezgirligi sababli saqlash davrida tez buziladi. Natijada mahsulotning sifati pasayadi, iqtisodiy zararlar yuzaga keladi va iste’molchilarga yetkazib berish jarayonida yo‘qotishlar ortadi [6,7].

Mevalarni saqlashda sovutish, muzlatish, nazorat qilinadigan gaz muhiti, modifikatsiyalangan atmosfera sharoitida saqlash hamda turli kimyoviy konservantlardan foydalanish kabi an’anaviy usullar keng qo‘llaniladi. Ushbu usullar mahsulotning saqlanish muddatini uzaytirishda muayyan samara bersa-da, yuqori energiya sarfi, qo‘shimcha texnik vositalarga ehtiyoj va ayrim hollarda ekologik hamda iqtisodiy cheklovlarga ega. Shu sababli energiya tejamkor, ekologik xavfsiz va amaliy jihatdan qulay bo‘lgan muqobil texnologiyalarni ishlab chiqishga bo‘lgan ehtiyoj ortib bormoqda [1,2].

So‘nggi yillarda tabiiy komponentlar asosida tayyorlanadigan yeyiladigan qoplamalar va bio-aerozollar meva-sabzavot mahsulotlarini saqlashning istiqbolli usullaridan biri sifatida e’tirof etilmoqda. Xususan, asalari mumi, xitozan, kraxmal, aloe vera geli va turli o‘simlik ekstraktlari asosidagi qoplamalar meva yuzasida himoya qatlamini hosil qilib, namlikning bug‘lanishini kamaytirishi, gaz almashinuvini tartibga solishi hamda mikroorganizmlar rivojlanishini sekinlashtirishi aniqlangan [3,4]. Bunday texnologiyalar mahsulotning organoleptik va sifat ko‘rsatkichlarini uzoq muddat saqlab qolish imkonini beradi [5,8].

Shu munosabat bilan ushbu tadqiqot ishining maqsadi tabiiy komponentlarga asoslangan bio-aerozol yordamida mevalarni saqlash texnologiyasini ishlab chiqish hamda uning samaradorligini ilmiy asosda baholashdan iborat. Tadqiqot doirasida ekologik toza, inson salomatligi uchun xavfsiz va amaliy jihatdan qulay bo‘lgan bio-aerozol kompozitsiyasini yaratish hamda uning mevalarning saqlanish muddatiga ta’sirini aniqlash ko‘zda tutilgan [3,9].

Tadqiqot natijalari. O‘tkazilgan tajribalar davomida tabiiy komponentlarga asoslangan bio-aerozol kompozitsiyasining mevalarni saqlash samaradorligi baholandi. Tadqiqot obyekti sifatida yangi uzilgan olma mevalari tanlanib, ular nazorat (ishlov berilmagan) va tajriba (bio-aerozol bilan ishlov berilgan) guruhlarga ajratildi(1-rasm).

1-rasm. Bio-aerozol bilan ishlov berilgan va nazorat guruhidagi olma mevalarining saqlanish holati

Natijalarga ko‘ra, bio-aerozol bilan ishlov berilgan mevalarda namlik yo‘qotilishi nazorat guruhiga nisbatan o‘rtacha 25–30% ga kamaygani aniqlandi [10]. Shu bilan birga, mikroorganizmlar rivojlanish tezligi sezilarli darajada pasaygan, mog‘orlanish jarayoni kuzatilmagan(2-rasm).

2-rasm. Bio-aerozolning nok mevalarida mikrobiologik buzilishlarning oldini olishdagi samarasi

Saqlash muddati davomida kuzatishlar shuni ko‘rsatdiki, oddiy sharoitda saqlangan mevalar 7–10 kun ichida sifatini yo‘qota boshlagan bo‘lsa, bio-aerozol qo‘llanilgan mevalarda bu ko‘rsatkich 50-60 kungacha uzaydi, ya’ni saqlanish muddati o‘rtacha 5-6 barobarga oshdi(3-rasm).

3-rasm. Anor mevalarining uzoq muddat saqlanishida bio-aerozol qo‘llash samaradorligi

Bundan tashqari, mevalarning tashqi ko‘rinishi (rang, yaltiroqlik) va organoleptik xususiyatlari (ta’m, hid) yaxshiroq saqlanib qolganligi qayd etildi. Meva yo‘qotilishi nazorat guruhida 20–25% ni tashkil etgan bo‘lsa, aerozol qo‘llanilganda bu ko‘rsatkich 10–12% gacha kamaydi(4-rasm).

4-rasm. Bio-aerozol qo‘llash natijasida sitrus mevalarida chirish jarayonining kamayishi

Olingan natijalar ishlab chiqilgan bio-aerozol kompozitsiyasining mevalarni saqlashda samarali, ekologik xavfsiz va amaliy jihatdan istiqbolli ekanligini ko‘rsatdi.

Xulosa

Ushbu tadqiqot ishida mevalarni saqlash muddatini uzaytirishga qaratilgan tabiiy komponentlarga asoslangan bio-aerozol texnologiyasi ishlab chiqildi va uning samaradorligi tajribalar asosida baholandi. Olingan natijalar shuni ko‘rsatdiki, ishlab chiqilgan kompozitsiya meva yuzasida himoya qatlami hosil qilib, namlik yo‘qotilishini kamaytiradi hamda mikroorganizmlar rivojlanishini sekinlashtiradi.

Tajriba natijalariga ko‘ra, bio-aerozol qo‘llanilgan mevalarda saqlanish muddati o‘rtacha 5–6barobarga uzaygani, meva yo‘qotilishi esa sezilarli darajada

kamaygani aniqlandi. Shu bilan birga, mahsulotning tashqi ko‘rinishi va sifat ko‘rsatkichlari yaxshiroq saqlanib qolishi kuzatildi.

Taklif etilayotgan texnologiya ekologik xavfsizligi, energiya tejamkorligi va qo‘llash qulayligi bilan ajralib turadi. Ushbu ishlanma qishloq xo‘jaligi mahsulotlarini saqlash, transport qilish va eksport jarayonlarida samarali qo‘llanishi mumkin.

Yakuniy xulosa sifatida aytish mumkinki, tabiiy bio-aerozol texnologiyasi mevalarni saqlashning istiqbolli, innovatsion va amaliy ahamiyatga ega yechimi hisoblanadi.

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ЭКОНОМИКО-ГЕОГРАФИЧЕСКАЯ ОЦЕНКА РЕКРЕАЦИОННЫХ И ТУРИСТИЧЕСКИХ РЕСУРСОВ РЕСПУБЛИКИ КАРАКАЛПАКСТАН

Аннотация: *В статье представлена экономико-географическая оценка рекреационных и туристических ресурсов Республики Каракалпакстан. На основе интегральной методики проанализированы природные, историко-культурные, социально-экономические и инфраструктурные факторы развития туризма. Проведены оценка туристического потенциала и рекреационно-туристическое районирование территории. Определены перспективные направления развития экологического, культурного, паломнического и рекреационного туризма. Полученные результаты могут быть использованы для территориального планирования и развития туристической инфраструктуры региона.*

Ключевые слова: *ресурсы, туризм, Каракалпакстан, потенциал, интегральная оценка, районирование, экотуризм.*

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ECONOMIC AND GEOGRAPHICAL ASSESSMENT OF RECREATIONAL AND TOURIST RESOURCES OF THE REPUBLIC OF KARAKALPAKSTAN

Abstract: *This article presents an economic and geographical assessment of the recreational and tourist resources of the Republic of Karakalpakstan. Using an integrated methodology, the natural, historical, cultural, socioeconomic, and infrastructural factors of tourism development are analyzed. An assessment of the tourism potential and recreational and tourism zoning of the territory were conducted. Promising development areas for ecological, cultural, pilgrimage, and recreational tourism were identified. The results can be used for territorial planning and the development of tourism infrastructure in the region.*

Key words: *resources, tourism, Karakalpakstan, potential, integrated assessment, zoning, ecotourism.*

Введение

Туризм является важным фактором устойчивого социально-экономического развития и эффективного использования природного и культурного наследия. В Узбекистане в рамках Стратегии «Узбекистан–2030» особое внимание уделяется развитию туристической отрасли, что повышает значение комплексной оценки туристического потенциала регионов. Республика Каракалпакстан обладает значительными природными, историко-культурными и рекреационными ресурсами.

Цель исследования — экономико-географическая оценка рекреационных и туристических ресурсов региона и разработка рекомендаций по их эффективному использованию.

Материалы и методы

Объектом исследования являются рекреационные и туристические ресурсы Республики Каракалпакстан. Изучались особенности их размещения и факторы, влияющие на развитие туризма. В работе использованы экономико-географический, статистический, картографический и сравнительно-географический методы. Для оценки туристического потенциала применялась интегральная методика, а для выявления взаимосвязей между показателями — коэффициент корреляции Пирсона. Также использовались методы районирования и прогнозирования. Информационной базой послужили данные органов статистики и туризма Республики Каракалпакстан, а также результаты авторских расчётов.

Результаты и обсуждение

Исследование показало, что Республика Каракалпакстан обладает значительным рекреационным и туристическим потенциалом. К наиболее важным объектам относятся Музей Савицкого, Приаралье, Муйнак, плато Устюрт, Чилпик, Миздакхан, Аязкала, Топраккала, Султан Увайс-баба, дельта Амударьи и озеро Акчакуль.

Анализ обеспеченности районов объектами материально-культурного наследия выявил существенные территориальные различия. Наиболее высокие показатели отмечены в Муйнакском, Кунградском, Караузякском, Бозатауском и Тахтакупырском районах, что связано с высокой концентрацией историко-культурных и природных объектов

В более густонаселённых районах, таких как Амударьинский, Турткульский районы и город Нукус, обеспеченность объектами материально-культурного наследия относительно ниже, что связано с урбанизацией и преобладанием современной инфраструктуры. Корреляционный анализ показал отсутствие прямой зависимости между численностью населения и количеством объектов материально-культурного наследия. Это свидетельствует о необходимости комплексного учёта историко-культурных, природных и инфраструктурных факторов при оценке туристического потенциала территории.

Интегральная оценка показала, что туристический потенциал Республики Каракалпакстан находится на среднем уровне. Наиболее высокими показателями характеризуются Музей Савицкого, Приаралье, Муйнак и святыня Султан Увайс-баба, тогда как Чилпик, Миздакхан, Аязкала и Топраккала имеют средний потенциал. Более низкая оценка плато Устюрт связана с недостаточным развитием инфраструктуры.

Рекреационный потенциал региона также оценивается как средний. Наиболее перспективными объектами являются дельта Амударьи, окрестности Нукуса, Акчакуль и Каратерен. Термальные источники и озеро Судочье обладают рекреационной ценностью, однако нуждаются в дальнейшем развитии инфраструктуры и сервиса.

По результатам исследования территория Республики Каракалпакстан разделена на четыре рекреационно-туристических района: Центральный, Приаральско-Устюртский, Южный и Северо-Восточный. Для них характерна специализация соответственно на культурно-паломническом, экологическом, историко-археологическом и рекреационном туризме, что позволяет более эффективно использовать туристический потенциал региона.

Прогноз туристических показателей до 2040 года свидетельствует о возможном устойчивом росте отрасли. По среднему варианту прогноза число иностранных туристов может увеличиться с 200,7 тыс. человек в 2024 году до 518,1 тыс. человек в 2040 году. Количество внутренних туристов может возрасти с 2240,0 тыс. до 6556,0 тыс. человек, а объём экспорта туристических услуг — с 30 830,0 тыс. до 78 490,0 тыс. долларов США.

Результаты исследования показали территориальную неоднородность туристического потенциала Каракалпакстана, обусловленную различиями в обеспеченности историко-культурными и природными ресурсами. Наиболее перспективными направлениями являются экотуризм в Приаралье и на плато Устюрт, а также культурно-познавательный и паломнический туризм. Основными проблемами остаются недостаточное развитие инфраструктуры,

слабая цифровизация и дефицит квалифицированных кадров. Для устойчивого развития отрасли необходимо совершенствовать туристическую инфраструктуру, расширять участие местного населения и развивать национальные ремёсла и туристические услуги.

Заключение

Проведённое исследование показало, что Республика Каракалпакстан обладает значительным туристическим и рекреационным потенциалом. Наиболее перспективными объектами являются Музей Савицкого, Приаралье, Муйнак, Султан Увайс-баба, Чилпик, Миздакхан, Аязкала, Топраккала, а также дельта Амударьи и Акчакуль. Выделены Центральный, Приаральско-Устюртский, Южный и Северо-Восточный туристические районы. Для дальнейшего развития отрасли необходимо совершенствовать инфраструктуру, развивать туристический бренд и обеспечивать сохранение природного и культурного наследия. Это будет способствовать устойчивому развитию региона и повышению его туристической привлекательности.

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ВЛИЯНИЕ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА НА ДИАГНОСТИЧЕСКИЕ ПРОЦЕССЫ В МЕДИЦИНЕ

Аннотация: *В статье рассматриваются современные подходы к интеграции технологий искусственного интеллекта (ИИ) в диагностические процессы в сфере здравоохранения. Особое внимание уделено применению ИИ в области обработки медицинских изображений, анализа лабораторных данных, а также в системах поддержки принятия клинических решений. Показано, что ИИ способствует раннему выявлению заболеваний, персонализации медицинской помощи и снижению нагрузки на врачей. В качестве методов исследования использовались анализ научной литературы, сравнительный анализ существующих ИИ-систем и обобщение данных международных исследований. Также в статье анализируются технологические, правовые и этические барьеры внедрения ИИ в клиническую практику.*

Ключевые слова: *искусственный интеллект, медицинская диагностика, медицинская визуализация, клинические решения, электронные медицинские записи, информационные системы здравоохранения, безопасность данных, автоматизация, медицинская информатика, алгоритмы.*

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IMPACT OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES ON DIAGNOSTIC PROCESSES IN MEDICINE

Abstract: *This article examines modern approaches to the integration of artificial intelligence (AI) technologies into diagnostic processes in healthcare. Special attention is given to the application of AI in medical image processing, laboratory data analysis, and clinical decision support systems. The study demonstrates that AI contributes to early disease detection, personalization of medical care, and reduction of physician workload. The research methods employed include analysis of scientific literature, comparative analysis of existing AI systems, and synthesis of international research data. The article also analyzes the technological, legal, and ethical barriers to the implementation of AI in clinical practice.*

Keywords: *artificial intelligence, medical diagnostics, medical imaging, clinical decisions, electronic medical records, healthcare information systems, data security, automation, medical informatics, algorithms.*

Введение

Развитие цифровых технологий коренным образом меняет облик современного здравоохранения. Одним из наиболее значимых направлений цифровой трансформации медицины является внедрение искусственного интеллекта (ИИ) в диагностические процессы. Технологии ИИ открывают принципиально новые возможности для анализа медицинских данных, повышения точности постановки диагнозов и оптимизации клинической практики.

Актуальность данной темы обусловлена стремительным ростом объёмов медицинской информации, недостаточной кадровой обеспеченностью ряда медицинских учреждений и необходимостью повышения эффективности оказания медицинской помощи. Согласно данным

Всемирной организации здравоохранения, значительная доля диагностических ошибок связана с человеческим фактором, что делает автоматизацию диагностики особенно востребованной [6].

Системы на основе ИИ способны анализировать медицинские изображения, результаты лабораторных исследований и клинические записи со скоростью и точностью, недостижимыми для отдельного специалиста. Это открывает перспективы раннего выявления заболеваний, снижения нагрузки на врачей и повышения качества персонализированной медицинской помощи [1].

Вместе с тем широкое внедрение ИИ в медицинскую диагностику сопряжено с рядом технологических, этических и правовых вызовов. Целью настоящего исследования является анализ влияния технологий ИИ на диагностические процессы в медицине, а также оценка существующих систем, их возможностей и ограничений.

Материалы и методы исследования

В ходе исследования применялись методы анализа и систематизации научной литературы, сравнительный анализ существующих ИИ-систем, используемых в медицинской диагностике, а также обобщение данных международных исследований и клинических отчётов. Теоретическую основу исследования составили научные публикации в области медицинской информатики, машинного обучения и цифрового здравоохранения.

Для анализа практических аспектов применения ИИ были рассмотрены конкретные системы: алгоритм LYNA (Google Health), платформа IBM Watson Oncology, система Google DeepMind Health и платформа Paige.AI. Источниковой базой послужили публикации в рецензируемых научных журналах, доклады ВОЗ, а также официальные материалы разработчиков медицинских ИИ-решений [3; 4; 6].

Результаты исследования

Результаты исследования показали, что технологии ИИ демонстрируют высокую эффективность в различных областях медицинской диагностики.

В области диагностической визуализации алгоритм LYNA (Lymph Node Assistant), разработанный Google Health, показал высокую точность при выявлении метастазов рака молочной железы в лимфатических узлах. Точность алгоритма в ряде исследований превышает показатели опытных патоморфологов, что свидетельствует о его значительном диагностическом потенциале [2].

В онкологии система IBM Watson Oncology обеспечивает поддержку принятия клинических решений, анализируя обширные массивы медицинской литературы и историй болезней для формирования персонализированных рекомендаций по лечению онкологических пациентов. Это позволяет существенно сократить время от постановки диагноза до начала терапии.

Система Google DeepMind Health продемонстрировала высокую эффективность в диагностике заболеваний сетчатки глаза, анализируя снимки глазного дна. Точность системы при выявлении более 50 глазных патологий сопоставима с точностью ведущих специалистов-офтальмологов [3].

Платформа Paige.AI, ориентированная на патоморфологию, использует глубокое обучение для анализа гистологических препаратов, что повышает точность диагностики злокачественных новообразований и снижает количество диагностических ошибок.

В системе здравоохранения Узбекистана технологии ИИ преимущественно применяются в области автоматизации диагностических процессов, управления электронными медицинскими базами данных и развития телемедицинских сервисов. ИИ-алгоритмы анализа медицинских изображений оказывают существенную помощь врачам в ранней диагностике заболеваний; централизованные электронные платформы здравоохранения обеспечивают более оперативное и эффективное обслуживание пациентов [5].

Вместе с тем исследование выявило ряд системных проблем, препятствующих широкому внедрению ИИ. К ним относятся: неравномерное развитие цифровой инфраструктуры и недостаточный охват высокоскоростным интернетом в регионах; дефицит квалифицированных кадров, владеющих одновременно медицинскими и IT-компетенциями; недостаточный объём финансирования для масштабной реализации технологических проектов; а также отсутствие чётких правовых механизмов регулирования применения ИИ в клинической практике.

Обсуждение

Полученные результаты свидетельствуют о том, что ИИ существенно расширяет диагностические возможности медицины. Его применение в обработке медицинских изображений, анализе лабораторных данных и поддержке принятия клинических решений позволяет снизить количество диагностических ошибок, сократить время постановки диагноза и повысить качество медицинской помощи.

Тем не менее широкое внедрение ИИ в клиническую практику требует решения ряда ключевых проблем. Прежде всего, необходимо обеспечить безопасность и конфиденциальность медицинских данных пациентов. Законодательная база в области цифрового здравоохранения во многих странах, включая Узбекистан, требует дальнейшего совершенствования [6].

Важным аспектом является также этическое измерение ИИ-диагностики. Распределение ответственности между алгоритмом и врачом, прозрачность процесса принятия решений системами ИИ и необходимость сохранения человека в центре медицинской помощи остаются предметом активных научных и профессиональных дискуссий [1; 4].

Перспективным направлением развития является интеграция ИИ с геоинформационными системами и технологиями Интернета вещей (IoT), что позволит создавать комплексные платформы непрерывного мониторинга

состояния здоровья пациентов. Кроме того, развитие международного сотрудничества в области стандартизации медицинских данных и верификации ИИ-алгоритмов приобретает всё более важное значение для обеспечения качества и безопасности ИИ-диагностики [7].

Заключение

Проведённое исследование показало, что технологии искусственного интеллекта оказывают значительное и многостороннее влияние на диагностические процессы в медицине. Системы ИИ для анализа медицинских изображений, поддержки принятия клинических решений и обработки лабораторных данных демонстрируют высокую эффективность и постепенно становятся неотъемлемой частью современной клинической практики.

Для полноценного внедрения ИИ в систему здравоохранения необходимы развитие цифровой инфраструктуры, подготовка квалифицированных специалистов на стыке медицины и информационных технологий, обеспечение защиты медицинских данных и совершенствование нормативно-правовой базы. Реализация данных мер позволит раскрыть потенциал искусственного интеллекта и обеспечить переход к более точной, эффективной и персонализированной медицине.

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ВЛИЯНИЕ КОРПОРАТИВНОЙ КУЛЬТУРЫ НА ПРОИЗВОДИТЕЛЬНОСТЬ ТРУДА

Аннотация: *В статье рассматривается влияние корпоративной культуры на уровень производительности труда в компаниях Республики Узбекистан в современных социально-экономических условиях. Проведение данного исследования было обусловлено наличием проблем в системе управления персоналом и необходимостью поиска внутренних резервов повышения эффективности деятельности организаций. В ходе анализа выявлены ключевые проблемные аспекты организационной среды, среди которых наибольшее значение имеет воспринимаемая несправедливость действующей системы мотивации и стимулирования работников. Результаты статистической обработки данных подтвердили устойчивую положительную взаимосвязь между уровнем развития корпоративной культуры и показателями трудовой результативности. По итогам исследования предложены практические рекомендации, направленные на совершенствование принципов материального и нематериального поощрения, уточнение критериев оценки вклада сотрудников и внедрение регулярного мониторинга обратной связи.*

Ключевые слова: *корпоративная культура, производительность труда, эмпирическое исследование, система мотивации, управление персоналом, вовлеченность сотрудников.*

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THE IMPACT OF CORPORATE CULTURE ON LABOR PRODUCTIVITY

Abstract: *This article examines the impact of corporate culture on labor productivity in companies of the Republic of Uzbekistan under contemporary socio-economic conditions. The study was motivated by existing challenges in personnel management systems and the need to identify internal reserves for improving organizational performance. The analysis revealed several key problem areas within the organizational environment, among which the perceived unfairness of the existing employee motivation and incentive system was found to be the most significant. The results of the statistical analysis confirmed a stable positive relationship between the level of corporate culture development and indicators of labor productivity. Based on the findings, practical recommendations were proposed to improve material and non-material incentive mechanisms, clarify employee performance evaluation criteria, and implement regular feedback monitoring practices.*

Keywords: *corporate culture, labor productivity, empirical study, motivation system, personnel management, employee engagement.*

Введение

Корпоративная культура является ключевым фактором мотивации работников, дисциплины и эффективностью организации. В мире растущей конкуренции и цифровой трансформации на рынке труда Республики Узбекистан вызвало у компаний проблемы, такие как низкая вовлеченность работников, высокая текучесть кадров и недостаточная производительность труда. Слабая корпоративная культура приводит к необходимости повышения производительности труда ради улучшения конкурентоспособности и комфортной рабочей среды. Государственная политика Республики Узбекистан подчёркивает важность трудового ресурса и нематериальных мотивационных факторов. Стратегия «Узбекистан 2030», утверждённая Указом Президента № УП-158 от 11.09.2023 года, акцентирует развитие трудового ресурса, повышении производительности и улучшение рабочей среды [1,2]. Эти приоритеты отражены Инициативе по развитию производственных отношений и рынка труда на 2021-2025 годы, который подчеркивает современные методы управления трудовыми ресурсами и снижения текучести кадров. И несмотря на эти меры, в настоящее время в Узбекистане, производительность труда остаётся ниже среднего относительно показателя в развивающихся стран, а текучесть кадров в частном секторе высока. Поэтому значение корпоративной культуры по совершенствовании эффективности является необходимостью. Актуальность исследования подчёркивается необходимостью выявления причин низкой производительности труда посредством анализа корпоративной культуры, оценки её влияния на основе эмпирических данных (опрос 23 сотрудников) и предоставления практических рекомендаций для узбекских компаний. Цель работы – на основе провиденного опроса, расчёта описательных статистик и

коэффициента корреляции оценить влияние корпоративной культуры на производительность труда и разработать мероприятия по их улучшению.

Методология исследования

Методологической основой исследования послужили концептуальные положения теории организационной культуры Э.Шейна, рассматривающей корпоративную культуру как систему ценностей, норм и моделей поведения, формирующих организационную среду и влияющих на эффективность деятельности организации [2]. Также использованы положения о стратегической роли корпоративной культуры в обеспечении организационной результативности и нематериальной мотивации персонала [3;4].В качестве теоретической базы анализа взаимосвязи корпоративной культуры и показателей трудовой деятельности использованы современные исследования, подтверждающие влияние корпоративной культуры на качество трудовой жизни, вовлеченность и текучесть кадров [5;6]. Указанные положения позволили сформировать гипотезу о наличии положительной взаимосвязи между уровнем развития элементов корпоративной культуры и производительностью труда.

Эмпирическая база исследования сформирована на основе данных анкетирования, проведённого среди сотрудников организаций Республики Узбекистан с использованием платформы Google Forms. В опросе приняли участие 23 респондента, представляющие категории специалистов и руководителей среднего звена. Анкета была направлена на оценку основных элементов корпоративной культуры: понятности целей и ценностей организации, уровня доверия в коллективе, развития командной работы, справедливости системы мотивации, поддержки инициативности сотрудников и их влияния на результаты деятельности. Оценка осуществлялась по пятибалльной шкале Лайкерта. Для обработки данных использовались методы описательной статистики, сравнительного и корреляционного анализа. Сравнительный анализ позволил выявить различия в восприятии корпоративной культуры различными категориями работников, а корреляционный анализ (коэффициент Пирсона) определить силу взаимосвязи между элементами корпоративной культуры и производительностью труда. Дополнительно были рассчитаны средние значения и стандартные отклонения, что позволило оценить степень согласованности мнений респондентов и выявить наиболее проблемные элементы корпоративной культуры. Полученные результаты интерпретировались с учётом современных теоретических подходов к исследованию корпоративной культуры как фактора повышения организационной эффективности.

Анализ влияния корпоративной культуры на производительность труда

Современное состояние корпоративной культуры в опрошенных организациях характеризуется несколькими взаимосвязанными факторами, которые наиболее четка отражены в результатах опроса 23 сотрудников с помощью Google Формы. Как показывают данные, общий уровень развития корпоративной культуры оценивается как положительный, но также выявлены ключевые проблемные области, требующие управленческого подхода.

Таблица 1. Оценка элементов корпоративной культуры (N=23)
Источник: составлен автором.

Элемент корпоративной культуры	**Среднее значение (M)**	**Стандартное отклонение (σ)**
Понятность целей и ценностей	4,14	0,71
Уважительные и доверительные отношения	3,86	0,83
Поощрение инициативы и ответственности	3,77	0,75
Развитие командной работы	4,14	0,99
Справедливость системы мотивации	3,55	1,01
Влияние культуры на личную эффективность	4,09	0,97
Влияние атмосферы на производительность	4,32	0,78
Снижение количества конфликтов и ошибок	3,95	0,79
Влияние работы сотрудников на финансовые результаты	4,32	0,72
Повышение конкурентоспособности организации	4,00	0,93
Влияние на устойчивость компании	3,82	0,96
Способствование целям организации	4,23	0,81

Критическим выглядит показатель «Справедливость системы мотивации» - он получил самый низкий средний балл (M=3.55) при заметно высоком разбросе ответов (σ=1.01). это указывает на серьёзное недовольство и сильную разобщённость мнений в коллективе по данному аспекту, что представляет собой значительный риск для уровня мотивации и социально-психологического климата. [5,6].Для углублённого понимания структуры восприятия был проведён сравнительный анализ между рядовыми специалистами и руководителями.

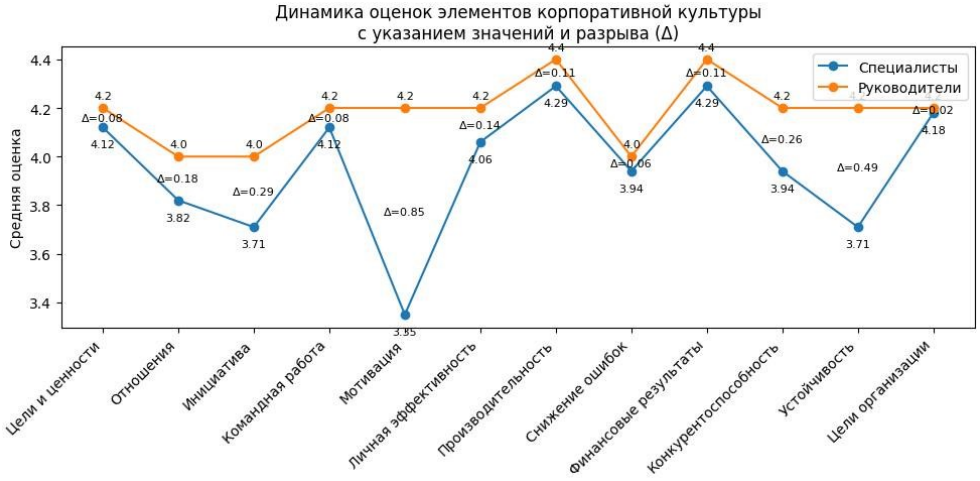
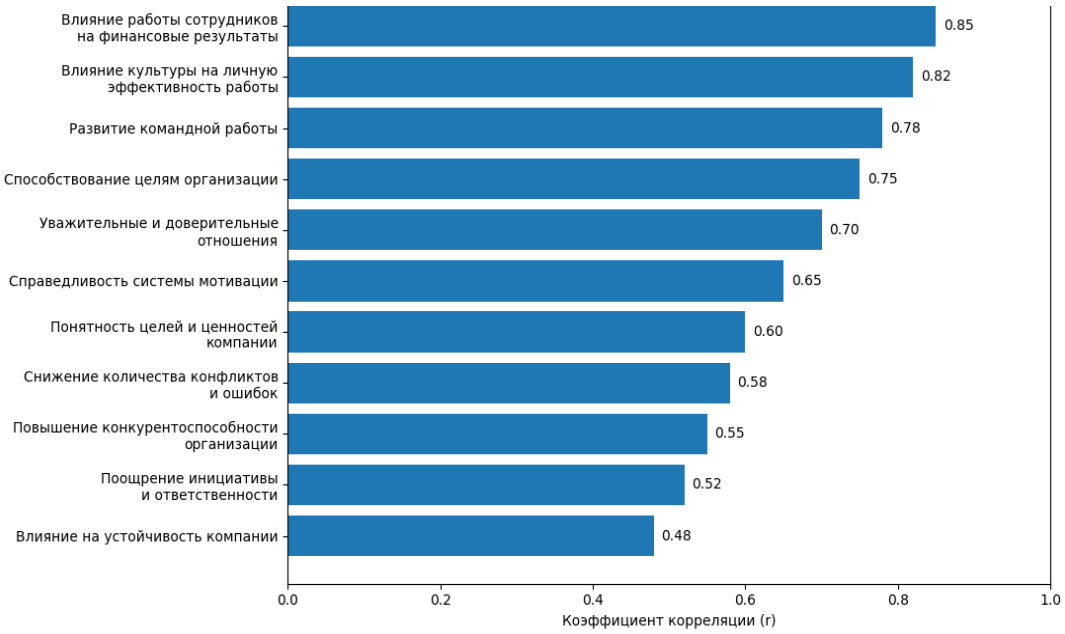


Рисунок 2. Сравнительный анализ средних оценок элементов корпоративной культуры: специалисты и руководители. Источник: составлен автором.

Наибольшее различие в оценках выявлено, по справедливости, системы мотивации, то есть разрыв составляет 0,85 балла по 5-балльной шкале. Этот результат означает, что специалисты оценивают систему мотивации, значительно ниже (M=3,35), тогда как руководители считают её почти удовлетворительной (M=4,20). Существенное различие также наблюдается в восприятии влияния корпоративной культуры на устойчивость организации (Δ=+0,49) и в меньшей степени на конкурентоспособность (Δ=+0,26). Руководство выше оценивает стратегическую роль культуры как фактора долгосрочного развития по сравнению с сотрудниками. Также по вопросам командной работы и снижения конфликтов оценки практически совпадают (Δ≤ +0,08), что указывает на области относительного согласия и возможные точки опоры для укрепления внутреннего общения и долгого развития корпоративной культуры [2,3]. Для определения влияния различных аспектов корпоративной культуры на ключевой показатель эффективности был проведён корреляционный анализ. И в качестве интегрального показателя восприятия производительности труда использовалась оценка, утверждённая работниками в вопросе №9 (M= 4,32).

Рисунок 3. Корреляция элементов корпоративной культуры с оценкой их влияния на производительность труда. Источник: составлен автором.



Корреляционный анализ выявил значимые положительные связи между всеми элементами корпоративной культуры и восприятием её влияния на производительность труда. Самые сильные корреляции (r> 0,75) наблюдаются по факторам результативности вклада (влияние работы на итоги компании, повышение личной эффективности), командной работе, уважению в коллективе и соответствию стратегическим целям. Особое внимание привлекает «Справедливость системы мотивации»: при самой низкой оценке (M= 3,55; см. Таблицу 1) она показывает сильную связь с производительностью (r= 0,65). Это подчёркивает её роль как главного источника недовольства и одновременно мощного рычага роста эффективности при улучшении. Результаты подтверждают, что корпоративная культура - комплексный фактор, объединяющий операционные, социальные и стратегические аспекты для достижения организационной результативности [2, 5].

Результаты и обсуждения.

Проведённый эмпирический анализ выявил ключевые проблемы в управлении корпоративной культурой организации. И на основе полученных результатов были сформулированы рекомендации:

Во-первых, провести аудит и переработать систему мотивации. Фактор «Справедливость системы стимулирования» получил самый низкий средний балл и максимальный разрыв в восприятии между группами специалистов и руководителями. Простое увеличение заработной платы не решит проблему. Необходима переработка самих принципов оценки вклада сотрудников.

Рекомендуется сформировать рабочую группу для создания прозрачной, понятной и справедливой системы KPI. Такой шаг устраняет один из главных факторов демотивации и соответствует Теории справедливости Дж. Стейси Адамса [7, 8].

Во-вторых, внедрить постоянную систему сбора обратной связи. Разовые масштабные опросы уже не дают ожидаемого эффекта. Необходимо перейти к регулярным ежемесячным «пульс-опросам», а также постоянному отслеживанию индекса вовлеченности (eNPS и другие метрики) [8]. Такой подход позволяет управлять корпоративную культуру активно, и на основе актуальных данных объективно оценивать результаты внедряемых изменений. Данная последовательная реализация направлений способна превратить корпоративную культуру из формальности в важнейший элемент, который будет работать на повышение производительности труда, вовлеченности сотрудников и других аспектов.

Выводы.

Корпоративная культура в Узбекистане, как фактор производительности труда требует стратегического переосмысления. Сохранений сложившихся подходов преимущественно интуитивных и несистемного подхода к управлению корпоративной культурой непременно приводит к текущим проблемам. В их числе – низкая вовлеченность сотрудников, высокая текучесть кадров и нерациональное использование человеческого потенциала. Нарастающие расхождения между необходимостью повышать конкурентоспособность и текущим состоянием социально-психологической атмосферы в коллективах определяет необходимость структурных изменений. Эмпирическое исследование, проведённое в рамках работы, подтвердило, что решение лежит в целенаправленных действиях по трансформации системы мотивации, развитию лидерских компетенций и внедрению мониторинга на основе данных.И поэтому, ключевая среднесрочная задача – последовательная трансформация корпоративной культуры в управляемый инструмент повышения организационной эффективности. Реализация данной задачи зависит от эффективного взаимодействия руководства компаний, которые берут на себя ответственность за формирование культуры и вовлеченности работников.

Достижение этой цели позволит организациям Узбекистана не только преодолеть внутренние препятствия роста, но и создать устойчивое конкурентное преимущество на рынке труда. Это окажет существенный вклад в решение национальной задачи повышения производительности труда и перехода к качественной модели руководства, в основе которой лежит вовлеченность и стратегическая роль человека.

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ПРИМЕНЕНИЕ СИМУЛЯЦИОННЫХ И НОВЫХ ПЕДАГОГИЧЕСКИХ ТЕХНОЛОГИЙ В ПРЕПОДАВАНИИ ПРЕДМЕТА «СКОРОЙ МЕДИЦИНСКОЙ ПОМОЩИ»

Аннотация: *Современное медицинское образование требует внедрения инновационных образовательных технологий, обеспечивающих формирование устойчивых практических навыков у будущих медицинских работников. Одним из наиболее перспективных направлений является симуляционное обучение, позволяющее безопасно отрабатывать алгоритмы оказания неотложной медицинской помощи. Цель исследования – оценить эффективность применения симуляционных и инновационных педагогических технологий в преподавании дисциплины «Скорая медицинская помощь». Исследование проводилось на базе Андижанского государственного медицинского института среди 60 студентов педиатрического факультета. В процессе обучения использовались манекен-тренажер BRAYDEN, виртуальная образовательная платформа Academix 3D и метод SCAMPER. Студенты были разделены на три группы в зависимости от используемых методов обучения. Анализ результатов показал, что наиболее высокий уровень освоения практических навыков сердечно-легочной реанимации был достигнут при комбинированном использовании виртуальных симуляторов и манекенов. Применение симуляционных технологий способствовало снижению количества ошибок, повышению уверенности студентов и улучшению качества практической подготовки. Полученные данные подтверждают эффективность интеграции симуляционного обучения и современных педагогических технологий в образовательный процесс медицинских вузов.*

Ключевые слова: *симуляционное обучение, медицинское образование, сердечно-легочная реанимация, SCAMPER, виртуальные симуляторы, практические навыки.*

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APPLICATION OF SIMULATION AND INNOVATIVE PEDAGOGICAL TECHNOLOGIES IN TEACHING THE DISCIPLINE “EMERGENCY MEDICAL CARE”

Abstract: *Modern medical education requires the implementation of innovative educational technologies aimed at developing sustainable practical competencies among future healthcare professionals. Simulation-based education is considered one of the most effective approaches for teaching emergency medical skills in a safe learning environment. The aim of this study was to evaluate the effectiveness of simulation and innovative pedagogical technologies in teaching the discipline “Emergency Medical Care”. The study was conducted at Andijan State Medical Institute and involved 60 pediatric faculty students. Educational tools included the BRAYDEN CPR manikin, the Academix 3D virtual simulation platform, and the SCAMPER teaching method. Students were divided into three groups according to the training modality used. The results demonstrated that the combined use of virtual simulators and manikin-based training provided the highest level of practical skill acquisition in cardiopulmonary resuscitation. Simulation-based learning reduced the number of errors, increased students’ confidence, and improved the overall quality of practical training. The findings confirm the effectiveness of integrating simulation technologies and innovative pedagogical methods into undergraduate medical education.*

Keywords: *simulation-based learning, medical education, cardiopulmonary resuscitation, SCAMPER, virtual simulation, practical skills.*

Введение. Вопрос о качественной и эффективной подготовке медицинских кадров в настоящее время актуален. Требования Государственных образовательных стандартов касательно вузовской, послевузовской и последипломной подготовки ориентированы на внедрение обучающих симуляционных курсов в учебный процесс. Это помогает развивать практические навыки и формировать профессиональные компетенции у специалистов в области здравоохранения. Внедрение симуляционных технологий не только соответствует государственным стандартам, но и непосредственно способствует повышению безопасности учебного процесса для пациентов и студентов. Это актуально в условиях современных требований к качеству медицинской помощи. В данной статье демонстрируется, что применение инновационных симуляционных технологий (интерактивных тренажёров и виртуальных симуляторов) является эффективным решением, так как способствует активизации и анализу образовательной деятельности студентов.

Развитие системы здравоохранения и медицинского образования являются одним из приоритетных направлений политики нашей страны во Главе Президента Республики Узбекистан Шавката Миромоновича Мирзиёева.

Симуляционное обучение рассматривается как современная технология обучения, позволяющая освоить и оценить практические навыки, умения, навыки коммуникации, принципы и навыки командной работы, путем моделирования.

По данным Cook и соавт. (2011), применение симуляционных технологий способствует достоверному повышению уровня практической подготовки медицинских работников по сравнению с традиционными методами обучения. Аналогичные результаты были продемонстрированы в систематическом обзоре Issenberg и соавт. (2005), показавшем значительное улучшение клинических навыков при использовании высокореалистичных симуляторов.

В настоящее время признано, что использование интерактивных тренажеров, роботов-пациентов и виртуальных симуляторов:

- позволяет воссоздать реальную контролируемую ситуацию по отработке навыков оказания медицинской помощи;
- дает возможность для многократной отработки определенных упражнений и действий;
- обеспечивает контроль качества оказания медицинской помощи по результатам выполнения навыка;
- обеспечивает индивидуальный подход в подготовке обучающихся.

На сегодняшний день в сфере медицинского образования и практики оказания медицинской помощи населению наметились кардинальные трансформации, связанные с усилением внимания со стороны государства к качеству жизни и уровню здоровья людей, а также – качеству медицинского обслуживания.

Материалы и методы исследования. Исследование проводилось в 2023-2024 гг. в Андижанском государственном медицинском институте. В исследование были включены студенты 5 курса педиатрического факультета, изучавшие дисциплину «Скорая медицинская помощь». на кафедре анестезиологии-реаниматологии и неотложной помощи. Практические занятия проводились с использованием симуляционных и новых педагогических технологий (SCAMPER).

В целях изучения влияния симуляционных технологий на процесс обучения, студенты были разделены на несколько групп:

1. Кто проходил обучение только на манекене BRAYDEN с базовыми теоретическими знаниями (2 учебные группы - 20 человек).
2. Студенты, которые проходили обучение практическому навыку только на платформе Academix 3D (2 учебные группы - 20 человек).
3. Студенты, которые совмещали обучение на платформе Academix 3D и манекен – тренажере BRAYDEN (2 учебные группы - 20 человек).

Для более точного и качественного обучения студентам предлагается раздаточный материал.

ПОШАГОВЫЙ АЛГОРИТМ БАЗОВОЙ СЕРДЕЧНО – ЛЕГОЧНОЙ РЕАНИМАЦИИ.

Действие	Описание
Безопасность	Убедитесь, что Вы, пострадавший и любой другой свидетель находятся в безопасности.
Наличие сознания	Аккуратно потрясите пострадавшего за плечи, задайте 2 громких, четких вопроса у каждого уха (наличие реакции на внешний раздражитель).
Дыхательные пути	Уложите пострадавшего на спину. Положите одну свою руку на лоб и кончики пальцев другой руки на подбородок пострадавшему. Осторожно наклоните голову пострадавшего назад, приподняв подбородок, чтобы открыть дыхательные пути.
Дыхание	Не более 10 секунд, методом «Вижу. Слышу. Ощущаю» определите наличие дыхания (Вижу экскурсию грудной клетки, слышу – дыхание, ощущаю выдыхаемый воздух на своей щеке). При наличии самостоятельного дыхания – придайте пострадавшему безопасное положение.
Звонок в СМП	Если дыхание у пострадавшего отсутствует или является ненормальным – **позвоните в службу скорой медицинской помощи.**

Компрессии грудной клетки (30)

По возможности выполняйте компрессии грудной клетки на твердой поверхности.

- Встаньте на колени рядом с пострадавшим.
- Разместите основание Вашей одной ладони в центре грудной клетки пострадавшего - это нижняя часть грудины.
- Положите основание другой ладони сверху первой и сцепите Ваши пальцы (положение «замок»).
- Держите Ваши руки ровными, не сгибайте их в локтях.
- Расположитесь вертикально над грудной клеткой пострадавшего и производите компрессии грудной клетки. Сжимайте грудину как минимум на 5 см (но не более чем 6 см).
- После каждого сжатия грудной клетки прекратите любое давление на грудную клетку без потери контакта между Вашими руками и грудиной пострадавшего (так обеспечиваются фазы «систолы» и «диастолы»).
- Сжимайте грудную клетку с частотой 100-120 в минуту.

Спасительные вдохи (2)

- Если Вы обучены и умеете производить спасательные вдохи, после 30 компрессий грудной клетки снова откройте дыхательные пути используя разгибание головы назад и поднятие подбородка пострадавшего.
- Зажмите мягкую часть (крылья) носа пострадавшего указательным и большими пальцами своей руки.
- Откройте пострадавшему рот, сохраняя при это подбородок приподнятым.
- Сделайте глубокий вдох и максимально герметично прижмите свои губы ко рту пострадавшего.
- Сделайте глубокий вдох и максимально герметично прижмите свои губы ко рту пострадавшего. Сделайте выдох в рот пострадавшего в течении примерно 1 секунды, как при обычном дыхании, наблюдая за движением грудной клетки пострадавшего. Спасительный вдох считается эффективным, если наблюдалось поднятие грудной клетки.
- Сохраняя разгибание головы и приподнятый подбородок пострадавшего, отведите свой рот от пострадавшего и следите за тем, чтобы грудная клетка пострадавшего полностью опустилась при выходе воздуха.
- Сделайте еще один нормальный вдох и выдохните в рот пострадавшего еще раз чтобы получить в сумме два спасительных вдоха.

Продолжать СЛР 30:2

- Не прерывайте компрессии грудной клетки более чем на 10 секунд для обеспечения двух спасительных вдохов, даже если один из них будет неэффективным.
- После этого без промедления правильно установите свои руки на грудной клетке пострадавшего и выполните следующие 30 компрессий.
- Продолжайте компрессии грудной клетки со спасительными вдохами в отношении 30:2.

- **Не прерывайте СЛР до тех пор, пока :**
- Медицинский работник не скажет Вам прекратить СЛР.
- Пострадавший не придет в сознание, появиться самостоятельное нормальное дыхание, начнет двигаться, открывать глаза.

ИЛИ

- Если Вы чересчур устали.
- Если Вы не уверены, что пострадавший восстановился, продолжайте СЛР.

Признаки восстановления:

Появление сознания.

Двигательная активность.

Открывание глаз.

Нормальное дыхание.

Безопасное положение

Если реакция отсутствует, но есть нормальное дыхание – уложите пострадавшего в безопасную позицию.

*Если Вы уверены, что пострадавший дышит нормально, но все еще не реагирует, уложите его в безопасную позицию (устойчивое боковое положение).

Будьте готовы немедленно приступить/возобновить проведение СЛР, если не реагирующий пострадавший перестанет дышать или его дыхание становится ненормальным.

Рис.1. Раздаточный материал с алгоритмом выполнения базовой СЛР.

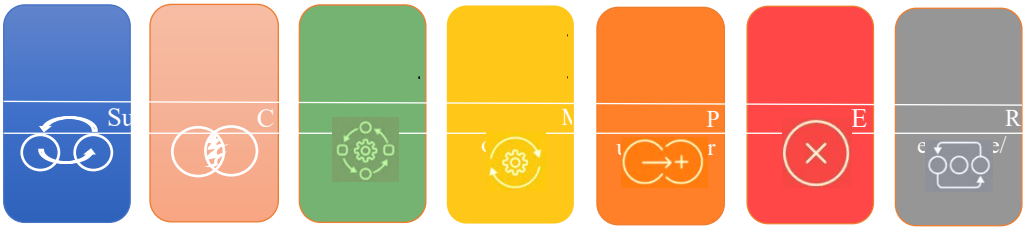
Практический навык базовой сердечно-легочной реанимации оценивался по стандартизированному чек-листу, включавшему:

- обеспечение безопасности;
- оценку сознания;
- вызов помощи;
- оценка дыхания и пульса;
- вызов скорой помощи по алгоритму;
- компрессии грудной клетки (проекция сердца, расположение рук, глубина и частота компрессий);
- искусственную вентиляцию легких(время отведенное на ИВЛ, объем и давление вдоха);
- соблюдение алгоритма BLS и т.д.

При помощи метода SCAMPER удалось отдалиться от традиционного вида проведения практических занятий.

Скампер/**Scamper - метод** решения задач в виде списка действий, модификаций. Его разработал Боб Эберле в 1997 году. Преимущества – структурированный и творческий подход. Помогает генерировать новые идеи, мыслить нестандартно и находить новые решения. Легко учить и применить.

Недостатки – в некоторых случаях это может усложнить решение задачи. Требуется практика и опыт. Нельзя применить к любой задаче.



- **Substitute** — замена реального пациента на симулятор;
- **Combine** — комбинирование тренажера и теоретической базы для глубокой проработки навыков;
- **Adapt** и **Modify** — изменение подходов к обучению для более точного освоения навыков сердечно-легочной реанимации;
- **Put to Other Uses** — использование тренажеров для моделирования различных медицинских сценариев;
- **Eliminate** и **Rearrange** — устранение лишних элементов и перестановка шагов для оптимизации обучения.

В группе, которая проходила обучение только на манекене BRAYDEN с базовыми теоретическими знаниями частыми ошибками были несоблюдение безопасности, сложности в воспроизведении эффективных компрессий и спасательных вдохов.

Студенты, которые проходили обучение практическому навыку только на платформе Academix 3D, на самой платформе сдали навык на отлично. Но были совершенно не готовы применить свои знания на манекене и тем более на реальном пациенте.

Студенты, которые совмещали обучение на платформе Academix 3D и манекен – тренажере BRAYDEN показали наилучший результат как теоретически, так и практически. Более того в данной группе студентов отмечалась уверенность в том, что они смогут правильно, а главное своевременно оказать помощь нуждающемуся пациенту/пострадавшему.

Результаты и обсуждение. Внедрение симуляционных технологий позволило студентам освоить навыки сердечно-легочной реанимации с минимальными ошибками и уменьшить риск для реальных пациентов. Повышении уровня безопасности учебного процесса и качества подготовки специалистов напрямую отражается на снижении врачебных ошибок и улучшении медицинской помощи.

Таблица 1

Средний балл студентов отдельных групп

Группа	Средний балл до обучения	После обучения
BRAYDEN	56 ± 8	78 ± 7
Academix 3D	58 ± 6	72 ± 9
Комбинированное обучение	57 ± 7	91 ± 5

Анализ выполнения практического навыка базовой сердечно-легочной реанимации показал, что наиболее распространенными ошибками среди студентов являлись неправильное выполнение компрессий грудной клетки, нарушение алгоритма BLS, ошибки при проведении искусственной вентиляции легких и отсутствие контроля собственной безопасности. Наиболее высокая частота ошибок наблюдалась у студентов, обучавшихся только на манекене BRAYDEN или только на виртуальной платформе Academix 3D. В группе комбинированного обучения количество ошибок было значительно ниже, что свидетельствует о преимуществе интеграции виртуальных и практических симуляционных технологий в образовательный процесс.

Таблица 2

Наиболее частые ошибки студентов

Ошибка	Группа BRAYDEN (%)	Группа Academix 3D (%)	Комбинированное обучение (%)
Отсутствие оценки безопасности места происшествия	42	38	8
Неправильная оценка сознания и дыхания	35	32	10

Несвоевременный вызов экстренных служб	30	28	7
Недостаточная глубина компрессий грудной клетки	55	40	15
Неправильная частота компрессий	45	36	10
Неполное расправление грудной клетки после компрессии	37	29	8
Ошибки при выполнении искусственной вентиляции легких	52	34	14
Нарушение последовательности алгоритма BLS	40	31	9
Неуверенность при выполнении навыка	55	47	11

- Внедрение симуляционных технологий дает - повышение безопасности учебного процесса как для пациентов, так и обучаемых; повышение уровня практической подготовки специалистов, снижение врачебных ошибок, уменьшение осложнений и повышение качества медицинской помощи населению в целом.

- Сочетание манекенов с использованием виртуальных симуляционных технологий (Academix 3D, DIMEDUS) обеспечивает реалистичность ситуации, в корне меняет представление студентов о процессе оказании медицинской помощи, что значительно влияет на степень освоения практического навыка.

Обсуждение. Полученные результаты согласуются с данными Cook et al. (2011), показавшими преимущество симуляционного обучения перед традиционными методами преподавания.

По данным Zeng et al. (2023), сочетание виртуальных симуляторов и практической отработки на манекенах обеспечивает более высокий уровень усвоения навыков расширенной сердечно-легочной реанимации.

Наши результаты также подтверждают целесообразность комбинированного подхода, поскольку студенты, обучавшиеся одновременно на платформе Academix 3D и манекене BRAYDEN, продемонстрировали лучшие показатели практической подготовки.

Заключение. Комбинированное применение виртуальных симуляционных платформ и высокореалистичных манекенов в преподавании предмета «Скорая медицинская помощь» способствует более эффективному формированию практических навыков сердечно-легочной реанимации по сравнению с использованием каждого метода отдельно. Интеграция метода

SCAMPER в образовательный процесс повышает вовлеченность обучающихся и способствует развитию клинического мышления.

Такой подход позволил студентам освоить навык сердечно-легочной реанимации и выполнять её с минимальными ошибками, без опасений причинить вред «пациенту», благодаря методу проб и ошибок и многократному повторению сценария, что невозможно на реальных пациентах. Повышение безопасности учебного процесса и уровня подготовки специалистов снижает вероятность врачебных ошибок и способствует улучшению качества медицинской помощи.

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ВЛИЯНИЕ СИМУЛЯЦИОННОГО ОБУЧЕНИЯ НА ФОРМИРОВАНИЕ НАВЫКОВ ОКАЗАНИЯ НЕОТЛОЖНОЙ ПОМОЩИ У СТУДЕНТОВ МЕДИЦИНСКИХ ВУЗОВ: ОПЫТ МЕЖДУНАРОДНОЙ ЛЕТНЕЙ ШКОЛЫ АГМИ

Аннотация: *Современное медицинское образование требует внедрения инновационных методов обучения, обеспечивающих безопасное и эффективное формирование практических компетенций будущих медицинских работников. Одним из наиболее перспективных направлений является симуляционное обучение, позволяющее отрабатывать алгоритмы оказания медицинской помощи без риска для пациентов.*

Целью исследования *явился анализ влияния симуляционного обучения на качество освоения практических навыков студентами медицинских вузов в рамках международной летней школы Андижанского государственного медицинского института.*

Материалы и методы. *В исследование были включены 31 участник международной летней школы АГМИ 2022–2023 годов. Оценивались навыки сердечно-легочной реанимации, выполнения приема Геймлиха, остановки наружного артериального кровотечения, иммобилизации переломов и оказания первой помощи при проникающих ранениях грудной клетки. Оценка проводилась до начала обучения и после завершения образовательной программы с использованием стандартизированных чек-листов.*

Результаты *показали значительное повышение качества выполнения всех исследуемых практических навыков. Доля студентов, качественно выполнявших сердечно-легочную реанимацию, увеличилась с 10% до 48%, прием Геймлиха - с 60% до 85%, остановку наружного кровотечения - с 68% до 90%, иммобилизацию конечностей - с 48% до 81%, помощь при проникающих ранениях грудной клетки - с 42% до 84%.*

Полученные данные подтверждают высокую эффективность симуляционного обучения как инструмента формирования профессиональных компетенций студентов медицинских вузов.

Ключевые слова: *симуляционное обучение, медицинское образование, сердечно-легочная реанимация, первая помощь, медицина катастроф, практические навыки.*

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THE EFFECT OF SIMULATION-BASED TRAINING ON THE ACQUISITION OF EMERGENCY CARE SKILLS BY MEDICAL STUDENTS: EXPERIENCE FROM THE INTERNATIONAL SUMMER SCHOOL OF ANDIJAN STATE MEDICAL INSTITUTE

Abstract: *Modern medical education requires the implementation of innovative teaching methods that ensure the safe and effective development of practical competencies among future healthcare professionals. One of the most promising approaches is simulation-based training, which enables students to practice medical care algorithms without posing any risk to patients.*

The aim of this study was to analyze the impact of simulation-based training on the quality of practical skills acquisition among medical students participating in the International Summer School of Andijan State Medical Institute.

Materials and Methods. *The study included 31 participants of the ASMI International Summer School during 2022–2023. The assessed skills included cardiopulmonary resuscitation (CPR), the Heimlich maneuver, control of external arterial bleeding, fracture immobilization, and first aid for penetrating chest injuries. Skills were evaluated before the beginning of the training and after completion of the educational program using standardized checklists.*

Results. *The findings demonstrated a significant improvement in the performance of all assessed practical skills. The proportion of students who correctly performed cardiopulmonary resuscitation increased from 10% to 48%, the Heimlich maneuver from 60% to 85%, control of external bleeding from 68% to 90%, limb immobilization from 48% to 81%, and first aid for penetrating chest injuries from 42% to 84%.*

The obtained data confirm the high effectiveness of simulation-based training as a tool for developing professional competencies among medical students.

Keywords: *simulation-based training, medical education, cardiopulmonary resuscitation, first aid, disaster medicine, practical skills.*

Введение

Одним из приоритетных направлений развития системы здравоохранения Республики Узбекистан является повышение качества подготовки медицинских кадров. Современные требования к медицинскому персоналу предполагают не только высокий уровень теоретических знаний,

но и уверенное владение практическими навыками оказания экстренной медицинской помощи.

Особое значение приобретает обучение действиям при неотложных состояниях, поскольку ошибки медицинских работников могут привести к тяжелым последствиям для пациентов. Согласно действующему законодательству Республики Узбекистан, ненадлежащее исполнение профессиональных обязанностей может повлечь юридическую ответственность (Статья 116 Уголовного Кодекса Республики Узбекистан).

В связи с этим возрастает необходимость поиска эффективных образовательных технологий, позволяющих формировать устойчивые практические навыки без риска для пациентов. Одной из таких технологий является симуляционное обучение, основанное на использовании манекенов, тренажеров, виртуальных симуляторов и стандартизированных пациентов.

Симуляционное обучение обеспечивает многократное повторение алгоритмов действий, позволяет моделировать клинические ситуации различной сложности и проводить объективную оценку уровня подготовки обучающихся.

Цель исследования

Оценить влияние симуляционного обучения на качество освоения практических навыков оказания неотложной медицинской помощи студентами медицинских вузов в рамках международной летней школы АГМИ.

Материалы и методы

Исследование проводилось на базе международной летней школы «Жемчужина Долины», ежегодно организуемой в Андижанском государственном медицинском институте.

В исследование были включены 31 студент, принимавший участие в работе летней школы в 2022–2023 годах.

Образовательная программа продолжительностью семь дней включала:

- оценку исходного уровня знаний и практических навыков;
- лекционные занятия;
- практические тренинги;
- самостоятельное выполнение навыков под контролем преподавателей;
- итоговую аттестацию.

Оценка проводилась с использованием стандартизированных чек-листов.

Анализировались следующие навыки:

1. Сердечно-легочная реанимация.
2. Прием Геймлиха.
3. Остановка наружного артериального кровотечения.
4. Иммобилизация переломов конечностей.
5. Оказание помощи при проникающем ранении грудной клетки.

Программа обучения состояла из трех этапов:

Первый этап

Первичная оценка практических навыков студентов для определения исходного уровня подготовки Квест – «Лабиринт знаний».

Второй этап

Проведение лекций по реаниматологии, травматологии и военно-полевой хирургии, и практических занятий с использованием симуляционных технологий, где каждый участник летней школы отрабатывал практические навыки. Использовались последние рекомендации Европейского совета реаниматологов, Российского национального совета реаниматологов, Американской сердечной ассоциации и стандарты оказания скорой помощи Республики Узбекистан.

Третий этап

Итоговая оценка – Квест «Пункт назначения» проводилась в максимально приближенных к реальной клинической практике и военно-полевым условиях, с использованием манекенов, тренажеров и симулированных пациентов.

Результаты

Анализ исходного уровня подготовки показал наличие значительных пробелов в знаниях и практических навыках участников.

Наиболее распространенными ошибками являлись:

- отсутствие оценки собственной безопасности;
- нарушение последовательности алгоритмов оказания помощи;
- поздний вызов специализированных служб;
- неполное выполнение обязательных этапов оказания помощи.

После завершения программы обучения у участников наблюдалось существенное улучшение результатов.

Навык	**До обучения**	**После обучения**
Качественная СЛР	10%	48%
Прием Геймлиха	60%	85%
Остановка наружного кровотечения	68%	90%
Иммобилизация переломов	48%	81%
Помощь при проникающем ранении грудной клетки	42%	84%

Наиболее выраженный прирост продемонстрировали навыки сердечно-легочной реанимации и оказания помощи при проникающих ранениях грудной клетки.

Полученные результаты свидетельствуют о высокой эффективности симуляционных методов обучения в формировании устойчивых практических компетенций.

Обсуждение

Симуляционное обучение позволяет воспроизводить клинические сценарии различного уровня сложности в безопасной образовательной среде. В отличие от традиционных методов подготовки, симуляционные технологии обеспечивают возможность многократного повторения практических действий и формирования автоматизированных алгоритмов поведения в экстренных ситуациях.

Результаты исследования согласуются с данными международных исследований, демонстрирующих положительное влияние симуляционного обучения на качество подготовки медицинских специалистов, снижение числа ошибок и повышение уверенности обучающихся при оказании медицинской помощи.

Особую значимость данный подход имеет при обучении навыкам сердечно-легочной реанимации и первой помощи, где скорость и правильность действий напрямую влияют на исход критического состояния пациента.

Заключение

Проведенное исследование показало, что симуляционное обучение является эффективным инструментом формирования практических навыков оказания неотложной медицинской помощи у студентов медицинских ВУЗов.

Участие в международной летней школе АГМИ способствовало существенному улучшению качества выполнения всех исследуемых практических навыков. Использование симуляционных технологий повышает безопасность образовательного процесса, снижает вероятность медицинских ошибок и способствует улучшению качества оказания медицинской помощи населению.

Полученные результаты подтверждают целесообразность дальнейшего внедрения симуляционного обучения в образовательные программы медицинских ВУЗов.

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УЗБЕКИСТАНСИСТЕМА АНАЛИЗА СЕЛЬСКОХОЗЯЙСТВЕННЫХ ДАННЫХ И ПОДДЕРЖКИ ПРИНЯТИЯ РЕШЕНИЙ НА ОСНОВЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

Аннотация. *Сельское хозяйство сталкивается с растущими вызовами, требующими инновационных подходов для повышения эффективности и устойчивости. В данной статье представлена разработка системы анализа сельскохозяйственных данных и поддержки принятия решений, основанной на технологиях искусственного интеллекта. Это позволяет оптимизировать производственные процессы, снизить риски и значительно повысить общую продуктивность агропромышленного комплекса за счет точного земледелия.*

Ключевые слова: Искусственный интеллект, Сельское хозяйство, Анализ данных, Принятие решений, Машинное обучение.

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AN ARTIFICIAL INTELLIGENCE-BASED SYSTEM FOR AGRICULTURAL DATA ANALYSIS AND DECISION SUPPORT

Abstract. *Agriculture is facing increasing challenges that require innovative approaches to improve efficiency and sustainability. This article presents the development of an artificial intelligence-based agricultural data analysis and decision support system. The proposed system enables the optimization of production processes, reduces risks, and significantly enhances the overall productivity of the agro-industrial sector through the implementation of precision agriculture techniques.*

Keywords: *Artificial Intelligence, Agriculture, Data Analysis, Decision Making, Machine Learning.*

Введение. Сельское хозяйство, традиционно считающееся консервативной отраслью, демонстрирует значительный потенциал для внедрения цифровых технологий, в частности искусственного интеллекта (ИИ) [1]. ИИ, определяемый как процессы, имитирующие человеческое сознание и обучение посредством машинного обучения (МО), способен преобразить агропромышленный комплекс, решая множество задач через

автоматизацию, мониторинг и прогнозирование [1, 2]. Современные ИИ-системы, использующие МО, компьютерное зрение, обработку естественного языка и методы анализа данных, нацелены на повышение эффективности, увеличение урожайности, снижение затрат и оптимизацию ресурсов [1, 6].

Интеллектуальные системы поддержки принятия решений (СППР) выступают центральным элементом этой трансформации, предоставляя инструменты для принятия обоснованных решений в сложных условиях [4]. Эти системы собирают и анализируют обширные объемы сельскохозяйственных данных, включая спутниковые карты состояния почв, агрометеорологические показатели, вегетационные индексы (например, NDVI), а также информацию с датчиков, дронов и историческую статистику [1, 3, 5]. Применение ИИ в сельском хозяйстве охватывает широкий спектр задач: от анализа плодородия почв и оптимизации полевых работ с прецизионным внесением удобрений и орошением до прогнозирования урожайности и выявления болезней и вредителей растений [1, 3, 5]. Например, алгоритмы МО демонстрируют высокую точность в прогнозировании урожайности зерновых, достигая 92% для озимой пшеницы в Краснодарском крае [5].

Обзор литературы. Быстрое развитие искусственного интеллекта (ИИ) и машинного обучения (МО) в последние годы значительно трансформировало подходы к управлению в агропромышленном комплексе, предлагая новые возможности для повышения эффективности и устойчивости [1, 6]. Исследования активно сосредоточены на разработке и внедрении интеллектуальных систем, способных обрабатывать и анализировать огромные объемы сельскохозяйственных данных для поддержки принятия решений.

В основе этих систем лежат различные алгоритмы МО, демонстрирующие высокую эффективность в моделировании сложных нелинейных зависимостей, например, при прогнозировании урожайности. Нейронные сети, включая сверточные нейронные сети (CNN) и многослойные перцептроны (MLP), показывают значительные результаты. Так, для озимой пшеницы в Краснодарском крае CNN достигли точности 92.1%, а MLP — 89.2% при использовании агрометеорологических данных и вегетационных индексов [5]. Однако, одним из ключевых недостатков нейронных сетей является их низкая интерпретируемость, что может затруднять понимание механизмов принятия решений [5]. Случайные леса (Random Forests) показывают стабильную производительность с разнообразными данными и позволяют оценивать важность признаков. При прогнозировании урожайности кукурузы в Ростовской области этот метод достиг 87% точности, выявив осадки, температуру и содержание органического вещества в почве как критические факторы [5]. Другие алгоритмы, такие как метод опорных векторов (SVM) и градиентный бустинг, также активно исследуются для

различных задач, включая классификацию почв и прогнозирование заболеваний растений [5].

Эффективность ИИ-систем напрямую зависит от качества и объема собираемых данных. Современные подходы включают использование спутниковых снимков, данных с беспилотных летательных аппаратов (дронов), метеорологических станций и различных датчиков Интернета вещей (IoT), которые предоставляют информацию о температуре и влажности почвы, температуре воздуха, относительной влажности и количестве осадков [1, 3]. Интеграция МО с IoT позволяет осуществлять мониторинг и управление ресурсами в реальном времени, предоставляя критически важную информацию для оптимизации орошения, борьбы с вредителями и внесения питательных веществ [6]. Например, системы METOS® DSS используют данные IoT для точного определения времени посева, внесения удобрений, защиты растений (с учетом моделей болезней и прогнозов погодных окон для опрыскивания) и эффективного орошения, предотвращая водный стресс или переувлажнение [3].

Интеллектуальные системы поддержки принятия решений (СППР), усиленные ИИ, становятся незаменимым инструментом для принятия обоснованных решений в сложных сельскохозяйственных условиях [4]. Эти системы объединяют анализ данных, моделирование, экспертные системы и ИИ для предоставления рекомендаций [4]. В контексте сельского хозяйства, СППР могут оптимизировать сроки посева (например, для кукурузы, требующей 12°C для прорастания и 21-30°C для цветения), управлять хранением урожая путем контроля климата в силосах и планировать полевые работы на основе гиперлокальных прогнозов погоды [3]. Разработки включают как открытые, так и проприетарные решения, охватывающие фреймворки для автоматизированного МО, быстрое прототипирование приложений на основе больших языковых моделей и анализ данных с использованием байесовских сетей [4].

Помимо прогнозирования урожайности, ИИ находит применение в широком спектре задач. Системы компьютерного зрения используются для бесконтактного взвешивания животных, как, например, система Университета Иннополис для свиней, или для распознавания болезней растений с точностью до 90%, как разработка ученых ПНИПУ и ПГАТУ [2]. Умные ошейники для крупного рогатого скота, такие как Halter, позволяют осуществлять виртуальное ограждение и отслеживание животных [2]. ИИ также применяется для оценки инвестиционной привлекательности земель, выявления расхождений между юридическим и фактическим состоянием полей, а также для оптимизации кормления и мониторинга здоровья животных [1]. Ведущие российские агрохолдинги, такие как "Агропромкомплектация", "Степь", "Дамате" и "Черкизово", активно внедряют ИИ для анализа корреляции заболеваний, оптимизации

инвентаризации, прогнозирования урожайности и контроля качества с помощью машинного зрения [2].

Методология исследования. Методология исследования, представленного в данной статье, основывается на комплексном подходе, сочетающем систематический обзор литературы, критический анализ и синтез актуальных научных данных. Основной целью является всестороннее изучение современных достижений в области систем анализа сельскохозяйственных данных и поддержки принятия решений, функционирующих на базе искусственного интеллекта (ИИ). Исследование направлено на выявление ключевых архитектурных решений, функциональных компонентов, применяемых алгоритмов машинного обучения (МО), а также на анализ практического применения, преимуществ, вызовов и перспектив развития таких систем в агропромышленном комплексе.

Для формирования репрезентативной базы данных были использованы ведущие наукометрические базы данных, включая Scopus, Web of Science, Google Scholar, а также Российский индекс научного цитирования (РИНЦ). Поиск осуществлялся с применением комбинаций ключевых слов на русском и английском языках, таких как "искусственный интеллект в сельском хозяйстве", "машинное обучение в агропромышленном комплексе", "системы поддержки принятия решений в сельском хозяйстве", "анализ сельскохозяйственных данных ИИ", "прогнозирование урожайности ИИ", "компьютерное зрение в агро", "IoT в сельском хозяйстве", "умное земледелие", "цифровое сельское хозяйство". Особое внимание уделялось публикациям, вышедшим в период с 2020 года по настоящее время, чтобы обеспечить актуальность рассматриваемых подходов и технологий. Это позволило охватить новейшие разработки и тенденции, отражающие быстрое развитие области ИИ в агросекторе.

Критерии отбора источников включали прямую релевантность теме исследования, наличие эмпирических данных или подробного описания методологий разработки и применения ИИ-систем, а также публикацию в рецензируемых научных журналах, материалах конференций или авторитетных отраслевых отчетах. Исключались рекламные материалы, новостные заметки и публикации, не обладающие достаточной научной строгостью или не предоставляющие детального описания используемых методов. Из каждой отобранной публикации извлекались ключевые сведения, касающиеся типов используемых сельскохозяйственных данных (спутниковые снимки, данные с датчиков IoT, метеорологические данные, историческая статистика), конкретных алгоритмов МО (например, нейронные сети, случайные леса, метод опорных векторов, градиентный бустинг), архитектурных решений интеллектуальных систем поддержки принятия решений (СППР), примеров их практического применения, достигнутых

показателей эффективности (точность прогнозирования, снижение затрат), а также выявленных вызовов и ограничений при внедрении.

Анализ и синтез извлеченной информации проводились с использованием многоуровневого подхода. Во-первых, был применен тематический анализ для категоризации ИИ-решений по основным направлениям их применения в сельском хозяйстве, таким как прогнозирование урожайности, оптимизация внесения удобрений и орошения, мониторинг здоровья растений и животных, борьба с вредителями и болезнями, а также управление полевыми работами. Во-вторых, осуществлялся сравнительный анализ различных алгоритмов МО с точки зрения их применимости, точности, вычислительной сложности и интерпретируемости в контексте специфических сельскохозяйственных задач. Это позволило оценить сильные и слабые стороны каждого метода и определить оптимальные подходы для различных сценариев. В-третьих, проводился структурный анализ архитектур СППР, выявляя общие компоненты, принципы их взаимодействия и интеграции с различными источниками данных и пользовательскими интерфейсами.

Заключение. Искусственный интеллект кардинально преобразует агропромышленный комплекс, обеспечивая переход к цифровому и устойчивому развитию. Интеллектуальные системы поддержки принятия решений, использующие машинное обучение, компьютерное зрение и данные IoT, предоставляют высокую точность в прогнозировании урожайности, оптимизации ресурсов и мониторинге здоровья. Несмотря на вызовы, связанные с качеством данных и интерпретируемостью моделей, внедрение ИИ значительно повышает эффективность, снижает затраты и минимизирует риски. Перспективы развития гибридных и автономных решений обещают укрепить продовольственную безопасность и адаптивность сельского хозяйства к меняющимся условиям.

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СОЦИАЛЬНАЯ АДАПТАЦИЯ И ДУХОВНО-НРАВСТВЕННОЕ ВОСПИТАНИЕ: ВЗАИМОСВЯЗЬ В РАЗВИТИИ ЛИЧНОСТИ

Аннотация: *В данной статье на аксиологическом уровне рассматриваются вопросы интеграции студентов и молодежи в социальную среду и формирования их духовно-нравственного образа в системе высшего образования. Актуальность статьи определяется педагогической необходимостью укрепления духовного иммунитета молодежи и подготовки ее к социальной жизни в условиях современной глобализации. В исследовании анализируется диалектическая взаимосвязь между понятиями «социальная адаптация» и «духовное воспитание» на основе того факта, что система ценностей человека является основным фактором, обеспечивающим его социальную стабильность. Автор предлагает аксиологическую модель совершенствования процесса социально-духовной адаптации студентов, в которой центральное место занимает приоритет национальных и универсальных ценностей. В статье освещаются механизмы позитивного изменения среды не только посредством подчинения внешним нормам, но и посредством внутренней ценностной ориентации. В статье также анализируется роль высших учебных заведений в обеспечении выполнения задач, поставленных в указах и постановлениях Президента Республики Узбекистан в духовно-воспитательной сфере. В качестве научной новинки исследования указаны аксиологические критерии определения уровней социальной адаптации студентов и педагогические технологии их развития. В заключение статьи даны практические рекомендации для педагогических психологов высших учебных заведений и специалистов по работе с молодежью по повышению социально-духовной активности студентов. Результаты данного исследования служат теоретической основой для дальнейших исследований в области педагогической теории и методики преподавания.*

Ключевые слова: *аксиологический подход, социальная адаптация, духовное воспитание, иерархия ценностей, высшее образование, личность*

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SOCIAL ADAPTATION AND SPIRITUAL AND MORAL EDUCATION: INTERCONNECTION IN PERSONAL DEVELOPMENT

Abstract: *This article examines the integration of students and young people into the social environment and the development of their spiritual and moral character within the higher education system from an axiological perspective. The article's relevance stems from the pedagogical need to strengthen the spiritual immunity of young people and prepare them for social life in the context of modern globalization. The study analyzes the dialectical relationship between the concepts of "social adaptation" and "spiritual education" based on the fact that a person's value system is the primary factor ensuring social stability. The author proposes an axiological model for improving the process of students' social and spiritual adaptation, emphasizing the priority of national and universal values. This article highlights mechanisms for positive environmental change not only through compliance with external norms but also through internal value orientation. It also analyzes the role of higher education institutions in fulfilling the objectives set forth in decrees and resolutions of the President of the Republic of Uzbekistan in the spiritual and educational sphere. The study highlights axiological criteria for determining students' levels of social adaptation and pedagogical technologies for their development as a scientific innovation. The article concludes with practical recommendations for educational psychologists at higher education institutions and youth workers on enhancing students' social and spiritual engagement. The results of this study serve as a theoretical basis for further research in pedagogical theory and teaching methods.*

Keywords: *axiological approach, social adaptation, spiritual education, hierarchy of values, higher education, student personality, pedagogical mechanism, spiritual immunity, social integration, perfect personality.*

Введение: Человек, будучи социальным существом, с момента рождения вынужден адаптироваться к определённой среде. Социальная адаптация — это процесс активного вхождения личности в систему социальных групп, норм и ценностей. Однако одной лишь адаптации недостаточно. Как отмечал известный философ Конфуций: «Учиться и не размышлять — бесполезно, размышлять и не учиться — опасно» [3]. Подобно этому, социальная адаптация без духовности может превратить человека в «манкурта», то есть в существо, не осознающее своей идентичности, слепо подчиняющееся приказам или бездумно следующее за толпой.

В современную эпоху цифровых технологий способность личности находить баланс между виртуальным и реальным мирами напрямую зависит от её духовной подготовки.

Психолого-социальные механизмы социальной адаптации. Процесс социальной адаптации включает в себя сложные этапы в психике человека.

Согласно экологической модели систем Бронфенбреннера (в круговой форме), социальные уровни, влияющие на духовное воспитание, включают:

1. **Центр:** Индивид (личность) — возраст, пол, характер.
2. **Микросистема:** семья, школа, одноклассники (непосредственное влияние).
3. **Мезосистема:** взаимодействие семьи и школы (родительские собрания и др.).
4. **Экзосистема:** СМИ, место работы родителей, махалля.
5. **Макросистема:** национальные ценности, законы, культура.

Социальная адаптация и духовно-нравственное воспитание — это процесс, в котором личность находит своё место в обществе, приспосабливается к социальной среде и формируется на основе моральных и духовных ценностей.

Социальная адаптация предполагает соответствие поведения требованиям общества, формирование навыков саморегуляции и развитие коммуникативных способностей [5]. В этом процессе важную роль играют следующие факторы:

соблюдение общественных норм и правил;

установление межличностных отношений (дружба, сотрудничество, взаимопомощь);

трудовая активность и творческая деятельность как средство социальной интеграции;

влияние средств массовой информации (телевидение, радио, пресса, интернет) на взгляды и поведение личности.

Духовно-нравственное воспитание — это процесс формирования моральных, эстетических и религиозных ценностей личности, её развития на основе высоких гуманистических идеалов. В этом процессе важны:

-соблюдение нравственных норм (честность, справедливость, гуманность, совестливость);

-развитие эстетической культуры через искусство, литературу, музыку и изобразительное искусство;

-уважение к религиозным убеждениям и традициям;

-формирование национальной гордости и патриотизма.

Таким образом, социальная адаптация и духовно-нравственное воспитание играют ключевую роль в становлении личности. Эти процессы совместно определяют её место в обществе, формируют поведение и систему ценностей. В Узбекистане в данных направлениях активно участвуют школа, семья, общественные организации и государственная политика.

Высший уровень социальной адаптации — это не только нахождение своего места в обществе, но и внесение положительного вклада в его развитие. В этом процессе духовное воспитание выполняет функцию «компаса».

Говоря о духовном воспитании как основе социальной стабильности, Первый Президент Республики Узбекистан Ислам Каримов отмечал: «Духовность — это великая сила, которая побуждает человека к духовному очищению, внутреннему росту, укрепляет его волю, веру, пробуждает совесть».

Духовное воспитание формирует у личности «социальный фильтр» [2], позволяющий не принимать безусловно всё, что существует в обществе. Например, если в социальной группе (уличной среде) преступность или вредные привычки становятся нормой, духовно воспитанный человек не адаптируется к такой среде, а дистанцируется от неё или стремится её изменить.

Основные опоры духовности:

справедливость — осознание равенства и истины;

честность (диянат) — внутренний механизм контроля (совесть);

патриотизм — соотнесение личных интересов с общественными.

Проблемы социально-духовного баланса в воспитании молодёжи. Социальная адаптация молодёжи сегодня во многом происходит в виртуальной среде.

Абу Наср аль-Фараби в труде «Город добродетельных людей» писал: «Человек по своей природе устроен так, что для жизни и достижения совершенства он нуждается во многом, чего не может достичь в одиночку» [4].

Сегодня для многих молодых людей «добродетельный город» — это социальные сети. Однако отсутствие чётких моральных ориентиров в виртуальном пространстве приводит к социальной аномии (разрушению норм). Распространение аморального контента ради «лайков» или рост кибербуллинга — яркое свидетельство наличия социальной адаптации при отсутствии духовного воспитания.

Глобализация и угроза «массовой культуры». В условиях глобализации смешение культур является естественным процессом. Однако сохранение национальной идентичности остаётся важнейшей задачей.

Как отмечал Абдулла Авлоний: «Воспитание для нас — это вопрос жизни или смерти, спасения или гибели, счастья или несчастья».

В процессе социальной адаптации человек должен изучать другие культуры, но не слепо им подражать. Духовное воспитание формирует национальную гордость, которая служит защитой от чуждых и вредных идей.

Показатель	Адаптация с духовностью	Адаптация без духовности
Ценности	Национальные и общечеловеческие	Только личная выгода
Социальное поведение	Ответственное и нравственное	Слепое подражание
Цель	Польза обществу	Жизнь только ради себя

Заключение и рекомендации. Социальная адаптация и духовно-нравственное воспитание являются неотъемлемыми компонентами развития личности. Адаптация без духовности ведёт к утрате идентичности, тогда как духовность без адаптации — к оторванности от общества.

Необходимо:

-укреплять институт семьи как основу духовного воспитания;

-формировать у молодёжи критическое мышление и умение различать информацию;

-рассматривать духовное воспитание как непрерывный процесс (lifelong learning).

Как говорил Джалалиддин Руми: «Где находится твоя душа, там находишься и ты».

Следовательно, если наш духовный мир богат, мы сможем сохранить свою идентичность и внести вклад в развитие общества независимо от условий.

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ВОЗМОЖНОСТИ ЦИФРОВЫХ ТЕХНОЛОГИЙ И ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В ОБУЧЕНИИ ИНОСТРАННЫМ ЯЗЫКАМ

Аннотация: *В данной статье рассматривается трансформация методики преподавания иностранных языков под влиянием цифровых технологий и искусственного интеллекта. Анализируется ключевые возможности ИИ, такие как адаптивное обучение, мгновенная обратная связь и использование генеративных моделей для создания языковой среды. Особое внимание уделяется переходу от стандартизированных программ к персонализированным образовательным траекториям.*

Ключевые слова: *искусственный интеллект (ИИ), цифровизация образования, персонализация обучения, адаптивные технологии, иностранные языки.*

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POSSIBILITIES OF DIGITAL TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE IN FOREIGN LANGUAGE TEACHING

Abstract: *This article examines the transformation of foreign language teaching methods under the influence of digital technologies and artificial intelligence. Key AI capabilities such as adaptive learning, instant feedback, and the use of generative models to create a language environment are analyzed. Special attention is paid to the transition from standardized programs to personalized educational trajectories.*

Key words: *artificial intelligence (AI), digitalization of education, personalization of learning, adaptive technologies, foreign languages.*

Цифровые технологии и искусственный интеллект сегодня выступают не просто вспомогательным инструментом, а полноценным когнитивным партнером в изучении иностранных языков. Ключевая инновация заключается в переходе от статических обучающих программ к динамическим адаптивным системам, способным в реальном времени моделировать индивидуальную образовательную траекторию. ИИ анализирует огромные массивы данных о прогрессе студента, выявляя специфические паттерны ошибок, и мгновенно корректирует сложность контента, реализуя концепцию «зоны ближайшего развития» Льва Выготского на технологическом уровне.

Современная парадигма образования переживает период цифровой трансформации. Изучение иностранных языков традиционно является одной из самых трудоемких дисциплин, требующих постоянной практики и обратной связи. Внедрение ИИ позволяет решить проблему дефицита индивидуального внимания преподавателя и отсутствия языковой среды.

Термин «Искусственный интеллект» впервые использован Дж. Маккарти в 1956 году. Он определил ИИ как «науку и технологию создания интеллектуальных машин, в особенности – интеллектуальных машин, особенно интеллектуальных компьютерных программ». Он также отмечал, что «искусственный интеллект связан с задачей использования компьютеров для понимания работы человеческого интеллекта, но не ограничивается использованием методов, наблюдаемых в биологии» [1].

В толковом словаре по искусственному интеллекту дается такое определение: ИИ – это «научное направление, в рамках которого решаются задачи аппаратного или программного моделирования тех видов человеческой деятельности, которые традиционно считаются интеллектуальными» [2].

Уже сейчас имеется много возможностей использования ИИ в образовании, и их число будет расти. К ним относятся программы и сервисы, способные самообучаться, обучать других, помогают решать самые разные задачи в сфере среднего и специального образования.

Существует целый ряд приложений и платформ, которые используются или в дальнейшем могут использоваться в обучении студентов и школьников разным предметам, в частности иностранным языкам.

Программное обеспечение для изучения иностранных языков, поддерживаемое искусственным интеллектом, может с самых разных аспектов проверять владение учащимися иностранным языком; технология распознавания речи может помочь исправить произношение в режиме реального времени, а система тестирования аудирования и говорения на иностранном языке с интеллектуальной голосовой технологией может проводить автоматические устные тесты с объективной оценкой и т. д.

Инновационные технологии, несомненно, помогут преподавателям освободиться от выполнения целого ряда задач. В то же время это заставит преподавателей задуматься о том, чтобы изменить свою роль в образовательном процессе с целью эффективной адаптации к образовательной среде нового времени.

Современная цифровая трансформация лингводидактики характеризуется переходом от классических компьютерных программ к сложным экосистемам, где искусственный интеллект выполняет функции персонального учителя, лингвистического аналитика и симулятора социокультурной среды. В основе этого процесса лежит конвергенция нескольких прорывных технологий: больших языковых моделей (LLM), систем нейронного распознавания речи и алгоритмов адаптивного обучения.

Особое значение имеют большие языковые модели (LLM), которые решают историческую проблему отсутствия языковой среды. Они позволяют имитировать бесконечное количество сценариев общения — от бытовых диалогов до узкоспециализированных профессиональных дискуссий, снимая при этом психологический барьер и страх перед критикой со стороны носителя языка. Системы автоматического распознавания речи (ASR) и нейронного синтеза голоса доведены до уровня, позволяющего анализировать не только правильность произнесения отдельных фонем, но и интонационный рисунок, ритмику и ударение, что ранее было доступно только при работе с высококвалифицированным фонетистом.

В письменной практике технологии обработки естественного языка (NLP) вышли за рамки простой проверки орфографии. Современные инструменты оценивают стилистическое соответствие, логическую связность и аргументированность текста, предлагая альтернативные способы выражения мыслей. Это способствует развитию продуктивных навыков и расширению активного словарного запаса через контекстуальные подсказки. При этом роль преподавателя трансформируется в сторону менторства и проектирования образовательного опыта, где акцент смещается с трансляции грамматических правил на развитие социокультурной компетенции и критического мышления, которые ИИ пока не способен воспроизвести в полной мере.

Искусственный интеллект и цифровые технологии — это уже полноценные помощники в изучении языков. Они помогают сделать обучение живым: позволяют практиковать разговорную речь в любое время, моментально исправляют ошибки и подбирают задания, которые интересны конкретному человеку.

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ТРЕНДЫ, БАРЬЕРЫ И ИНСТИТУЦИОНАЛЬНЫЕ УСЛОВИЯ РАЗВИТИЯ ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКОВ ЭНЕРГИИ В КАЗАХСТАНЕ И УЗБЕКИСТАНЕ

Аннотация. *В статье рассмотрены изменения в энергетическом переходе Казахстана и Узбекистана на основе сопоставления программных целей, структуры генерации, инвестиционных проектов и ограничений развития возобновляемых источников энергии. Теоретическую основу составляют исследования энергетического перехода, зеленой экономики и институциональных барьеров ВИЭ в ресурсно ориентированных экономиках. Показано, что Казахстан обладает более формализованной климатической рамкой, но остается зависимым от угольной генерации. Узбекистан быстрее наращивает солнечные и ветровые мощности, однако его энергосистема по-прежнему связана с природным газом и нуждается в модернизации сетей. Сделан вывод о необходимости перехода от проектной логики к системному управлению энергетической трансформацией.*

Ключевые слова: *энергетический переход, Казахстан, Узбекистан, возобновляемые источники энергии, углеродная нейтральность, зеленая экономика, тарифная политика.*

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TRENDS, BARRIERS AND INSTITUTIONAL CONDITIONS FOR THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES IN KAZAKHSTAN AND UZBEKISTAN

Abstract. *The article examines the energy transition in Kazakhstan and Uzbekistan by comparing policy targets, generation structure, investment projects and barriers to renewable energy development. The theoretical framework is based on studies of energy transition, green economy and institutional barriers in resource-based economies. Kazakhstan has a more formalized climate policy, but remains dependent on coal. Uzbekistan is expanding solar and wind capacity faster, while its power system is still linked to natural gas and requires grid modernization. The article concludes that further progress depends on systemic governance rather than on isolated renewable projects.*

Keywords: *energy transition, Kazakhstan, Uzbekistan, renewable energy, carbon neutrality, green economy, tariff policy.*

Введение. Энергетический переход в Центральной Азии уже нельзя рассматривать как узкую экологическую повестку. Для Казахстана и Узбекистана он связан с надежностью снабжения, промышленной конкурентоспособностью, доступностью электроэнергии и способностью привлекать долгосрочный капитал. Если в 2010-е годы дискуссия чаще строилась вокруг природного потенциала солнца и ветра, то к середине 2020-х главным вопросом стала готовность энергосистемы, законодательства и тарифной политики к новой модели генерации.

Исследование «Reshaping Energy in Eurasia: Insights from Kazakhstan and Uzbekistan» за 2025 год показывает, что обе страны закрепили цели по развитию ВИЭ, энергоэффективности и сокращению выбросов. Страны активно участвуют в международной климатической повестке и реализуют крупные проекты с иностранными инвесторами [9]. Вместе с тем их траектории различаются. Казахстан объявил цель углеродной нейтральности и имеет более зрелую нормативную базу. Узбекистан позднее начал глубокую реформу сектора, но быстрее наращивает портфель солнечных и ветровых проектов.

Цель статьи состоит в выявлении основных трендов энергетического перехода Казахстана и Узбекистана и определении барьеров, которые ограничивают дальнейшее расширение ВИЭ. Для этого использованы сравнительный анализ, обобщение научной литературы и изучение программных документов, экспертных оценок и прогнозных данных.

Теоретический обзор. В научной литературе энергетический переход понимается как изменение не только источников энергии, но и всей социотехнической системы. Меняются правила рынка, инфраструктура, поведение потребителей, механизмы финансирования и роль государства. В ресурсно богатых экономиках этот процесс особенно сложен, поскольку

старая модель поддерживается занятостью, бюджетными доходами, промышленными цепочками и привычными тарифными решениями.

Казахстанские исследователи Н. Жакиев, Д. Бурханова, А. Нурканат, Ш. Жуссипкалиева, А. Соспанова и А. Хамзина выделяют несколько ключевых барьеров развития ВИЭ в Казахстане. Среди них низкие тарифы на электроэнергию из ископаемых источников, слабая локальная производственная база, устаревшая инфраструктура, ограниченный опыт локализации и недостаточный общественный интерес к энергоэффективности [10]. Этот вывод важен тем, что переносит внимание с общего тезиса о большом потенциале ВИЭ на конкретные институциональные ограничения.

В научной работе «Казахстан на пути к устойчивому развитию» отмечается, что для капиталоемких проектов решающее значение имеют предсказуемые правила, включая тарифные гарантии, доступ к сети и ответственность за небалансы [2]. Российские и казахстанские авторы также подчеркивают двойственный характер низкоуглеродного развития Казахстана. О.И. Беляева связывает климатическую политику с международными обязательствами и структурной зависимостью от углеводородов [1]. Б.С. Саубетова рассматривает энергетический переход через призму рисков для промышленности, тарифов и инвестиционной привлекательности [4].

Исследования Н.С. Северовой дополняют этот подход. Она отмечают, что Казахстан обладает значительным потенциалом ВИЭ, но его реализация требует согласования экологических целей, состояния сетей и экономических стимулов [5]. Для Узбекистана обзоры Международного энергетического агентства указывают на высокий солнечный потенциал, а также на ограничения сетей, тарифов и рыночной реформы [6].

Результаты и обсуждение. Первый тренд состоит в усилении стратегической формализации климатической политики. Казахстан закрепил цель углеродной нейтральности к 2060 году и обязательство сократить выбросы парниковых газов к 2030 году на 15 процентов по отношению к уровню 1990 года, а при международной поддержке на 25 процентов [3]. В аналитическом отчете указана цель довести долю возобновляемых и альтернативных источников в производстве электроэнергии до 15 процентов к 2030 году [9]. Узбекистан не имеет столь же отдаленной цели углеродной нейтральности, но его документы на горизонте 2030 года выглядят более амбициозными с точки зрения новых мощностей ВИЭ и энергоэффективности.

Второй тренд связан с расхождением между целями и текущей структурой генерации. Казахстан, несмотря на развитие ВИЭ, остается угольной энергосистемой. По прогнозу экспертов, уголь сохранит роль главного источника генерации и после 2030 года, а его доля к 2035 году останется выше 40 процентов [9]. Узбекистан зависит от природного газа. Газ менее углеродоемок, чем уголь, но его доминирование создает риски при

росте внутреннего спроса и необходимости высвобождать ресурсы для других направлений экономики.

Третий тренд выражается в ускоренном росте солнечной и ветровой генерации. Казахстан начал формировать сектор ВИЭ раньше, используя законодательную поддержку, фиксированные тарифы и аукционные механизмы. Узбекистан резко ускорил ввод проектов с начала 2020-х годов за счет международных партнерств и государственно-частного партнерства. Солнечные станции доминируют благодаря более коротким срокам строительства и простой эксплуатации, тогда как Казахстан имеет сильные предпосылки для развития ветра.

Инвестиции стали важным индикатором практического перехода. В Казахстане вложения в ВИЭ с 2014 года до конца 2024 года превысили 2,6 млрд долларов США, а в Узбекистане с 2019 по 2024 год привлечено около 6 млрд долларов иностранных инвестиций [9]. Крупные проекты, включая ветровой проект Masdar в Жамбылской области, Zarafshan и Bash Wind Farm, показывают переход от пилотных объектов к промышленному масштабу. Такая скорость полезна, но требует резервов, диспетчеризации, управления валютными рисками и передачи технологий местным специалистам.

Именно на системном уровне проявляются главные барьеры. Среди них: отсутствие детальных дорожных карт реализации, инфраструктурные и технические ограничения, регуляторную неопределенность, тарифные проблемы, финансовые риски и дефицит компетенций. Казахстан сталкивается с изношенностью сетей, недостатком маневренной генерации и изменчивостью правил поддержки ВИЭ. Узбекистану необходимо одновременно расширять сеть, строить накопители и завершать реформу рынка электроэнергии.

Тарифная политика остается самым чувствительным узлом. Низкие регулируемые тарифы социально понятны, но они не отражают полной стоимости генерации, сетей, резервов и экологических издержек. В Казахстане модель «затраты плюс» слабо стимулирует эффективность и инновации. В Узбекистане длительное сдерживание тарифов снижало привлекательность рынка для частного капитала. Реформа цен, начатая в 2023–2024 годах, может улучшить инвестиционный сигнал, но только при адресной защите уязвимых потребителей.

Не менее значим кадровый фактор. Эксперты указывают на нехватку специалистов по ВИЭ, энергоэффективности, хранению энергии и цифровому управлению сетями [9]. Без таких компетенций даже доступное финансирование не гарантирует качественную реализацию проектов.

Заключение. Анализ показывает, что Казахстан и Узбекистан вступили в практическую фазу энергетического перехода. Обе страны заявили амбициозные цели, привлекли международных инвесторов, запустили крупные проекты ВИЭ и начали обновлять законодательство. ВИЭ перестали быть экспериментальным направлением и стали частью энергетической

безопасности, промышленной политики и международного позиционирования.

Различия между странами сохраняются. Казахстан имеет более оформленную климатическую архитектуру, но глубоко связан с угольной генерацией. Узбекистан быстрее расширяет солнечные и ветровые мощности, но зависит от газа и только завершает формирование рыночных институтов. Поэтому прогресс нельзя измерять одной долей ВИЭ. Важны состояние сетей, наличие резервов, тарифные сигналы, регуляторная стабильность и подготовка кадров.

Главный вывод состоит в необходимости перехода от проектной логики к системной. Строительство новых станций должно сопровождаться модернизацией сетей, развитием накопителей, локализацией компетенций, прозрачным доступом к финансированию и социально выверенной тарифной реформой. В таком случае природные преимущества Казахстана и Узбекистана смогут стать основой долгосрочной конкурентоспособности региона.

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ПОЛУЧЕНИЯ СТЕКОЛ И СТЕКЛОКРИСТАЛЛИЧЕСКИХ МАТЕРИАЛОВ НА ОСНОВЕ БАЗАЛЬТОВ

Аннотация: *на основе базальтов Кутчинского месторождения (Узбекистан) синтезированы стекла и ситаллы. Изучены рентгонометрические, кристаллические и механические свойства полученных материалов.*

Ключевые слова: *Базальт, горная порода, шихта, состав, стекло, ситалл, термообработка, кристаллизация, анализ, анортит, пироксен.*

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PRODUCTION OF GLASS AND GLASS-CRYSTAL MATERIALS BASED ON BASALT

Annotation: *Glasses and glass-ceramics were synthesized using basalts from the Kutchinskoye deposit (Uzbekistan). The X-ray, crystalline, and mechanical properties of the resulting materials were studied.*

Key words: *Basalt, rock, batch, composition, glass, sitall, heat treatment, crystallization, analysis, anorthite, pyroxene.*

В последние годы проведены исследования по переходу от каменного литья к ситаллам. На основе различных горных пород – изверженных (базальт, диабаз, гранит, нефелиновый сиенит и др.), осадочных (пески, глины мергели, каолины и др.), метаморфических (гнейсы, сланцы, мраморы, серпентиниты и др.) получены различные ситаллы [1].

Составы стекол перерабатываемые в ситаллы разнообразны и многочисленны. Особенно технические ситаллы и ситаллы строительного назначения, которые могут быть разбиты на подгруппу либо по составу, либо по ведущему свойству. Технические ситаллы по составу могут быть, как литийсодержащие (сподуменовые, эвкриптитовые, петалитовые), магнийсодержащие (кордиеритовые, шпинельные), высококремнезистые (тридимитовые, кристабалитовые), свинецсодержащие, фотоситаллы и другие. По ведущему свойству технические ситаллы различают термостойкие, прозрачные и другие.

В настоящее время в Узбекистане имеются крупные поверхностные залежи базальтов [2]. Гавасайские, Караташские, Бешкызылсайские Вахшиварские и др.

Рациональное использование вышеперечисленных запасов нерудного сырья является основной проблемой, стоящей перед работниками силикатной промышленности. Работа относится к одним из них, а именно базальтам Кутчинского месторождения. Эти работы с одной стороны раскрывают суть и содержание выполненной работы, с другой стороны открывает путь к созданию многофункциональных материалов с многочисленными объектами их использования. Они играют роль систематически выполненного исследования и справочного материала, пользование которым значительно облегчит работу других исследователей.

В данной работе состав ситаллов подбирались с целью получения мономинеральных кристаллических материалов анортитового состава. В качестве источника требуемых оксидов были выбраны базальтовые породы, ангренские каолины различных сортов и алюминийсодержащий отход химической промышленности. Для снижения вязкости стекломассы, содержащей относительно большое количество оксида алюминия, в состав шихты дополнительно введена сода.

Процесс кристаллизации обычно весьма разнообразен как по своей форме, так и по характеру протекания, что, как правило, зависит от многих факторов, в том числе от состава и структуры огненно-жидкой массы.

С целью определения кристаллизационной способности опытных стекол они были испытаны по методу массовой кристаллизации (табл. 1). Кристаллизацию стекол проводили в электрической печи с силитовыми нагревателями. Для этого обломки стекол нагревали до 600 – 700 – 800 – 900 -1000 -1100°С и выдерживали 1 час при каждой температуре. Для установления фазового состава закристаллизованные стекла исследовали рентгенографическим методом. Рентгенофазовый анализ образцов термообработанных стекол проводили на дифрактометре ДРОН - 4 при CuK_{α} излучении с применением железного фильтра, скорость съемки составляла 2 град/мин.

Таблица 1

Кристаллизационная способность состава 7Б

№ состава	Температура, ˚С						
	400	500	600	700	800	900	1000
7Б							

Для расшифровки приведенных рентгенограмм пользовались справочными рентгеновскими данными для оксидов SiO_2, FeO, Fe_2O_3, TiO_2, Al_2O_3, CaO и MgO; для двойных фаз типа: $Al_2O_3 \cdot SiO_2$, $3Al_2O_3 \cdot 2SiO_2$, волластонита - $CaO \cdot SiO_2$, рангинита – $3CaO \cdot 2SiO_2$, шеннонита – $2CaO \cdot SiO_2$,

тройных соединений анортита – (Na, Ca) $Al_2Si_2O_8$, диопсида – $CaMg[Si_2O_6]$, авгита – $Ca(Mg,Fe^{2+})[Si_2O_6 \cdot CaFe[AlSiO_6]$ и других.

В образцах стекол состава 7Б, закристаллизованных при 900°С, установлено наличие авгита (основная фаза), форстерита и начало кристаллизации анортита (рис. 1). Образцы, термообработанные при 1000°С, показали наличие анортита. Повышение температуры термического воздействия привело к появлению наряду с анортитом фазы оливина.

Анализируя полученные результаты при расшифровке дифрактограмм можно сделать такие выводы, что почти все исследованные составы закристаллизованных стекол при низких температурах термообработки показали многофазность состава. Основной фазой, образующейся при 800 и 900°С, является пироксеновая фаза в виде авгита или диопсида. Образование анортитовой фазы как основной происходит при температуре 1000°С и выше. Основной сопутствующей фазой при высоких температурах является оливин.

Исходя из полученных результатов, оптимальным составом с точки зрения мономинеральности является состав 7Б, при кристаллизации которого при 1000°С образуется только анортитоподобная фаза (рис. 1 и 2).

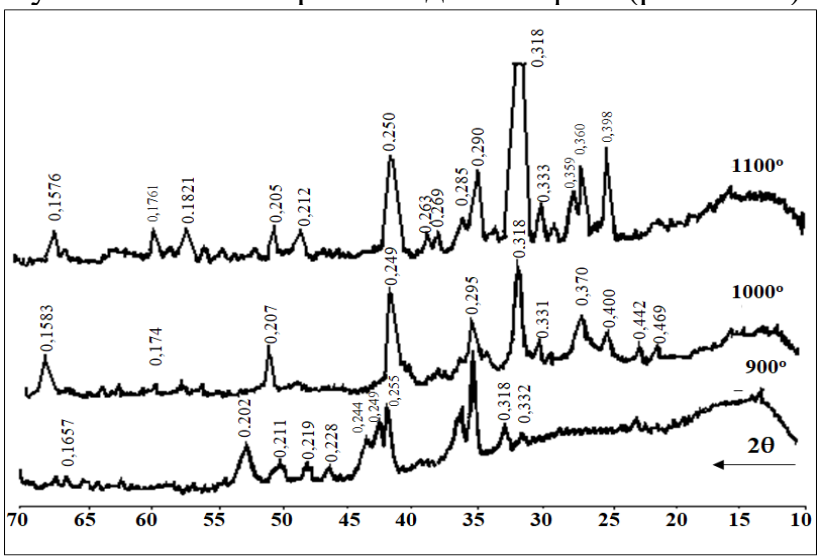

Рис.1. Стекла состава 7Б, кристаллизованные при температурах 1-900; 2-1000; 3-1100°С.

Рис.2. Электронномикроскопические снимки стекла состава 7Б, термообработанного при 1000°С, выдержка 1 ч. ×6000

Образцы ситаллов, полученные двумя способами – по стекольной и керамической технологии, по выбранному режиму были подвергнуты испытаниям. Результаты испытаний полученных стеклокристаллических материалов обоими способами имели высокие физико-механические свойства, значительно превосходящие по сравнению со стекольными образцами [2]. Так, плотность их колебалась в пределах 3,09-3,25 кг/см$^{-3}$; ТКЛР-54-63 10^{-7} град; предел прочности при изгибе – 112-121 МПа, а при сжатии 830-920 МПа.

По исследованиям свойства полученных стекол и ситаллов: предел прочности при изгибе стекол равен 53-56 МПа, в то же время для ситаллов показатели увеличиваются более чем в два раза – 112 – 121 МПа. Аналогичные результаты получены при испытаниях на сжатие данных материалов. Стекла имеют показатели 448 – 464 МПа, а ситаллы – 890 – 920 МПа.

Основные свойства состава 7Б полученных стеклокристаллических материалов на основе базальтов

№	Свойства					
	Температура варки,°С	Плотность, г/см^3	ТКЛР, $\alpha \cdot 10^{-7}$, град	Предел прочности при изгибе, МПа	Предел прочности при сжатии, МПа	Химическая устойчивость H_2SO_4
7Б – состав	1400	3,09	54	121	720	99,89

Базальтовые стекла устойчивы к концентрированным HCl и H_2SO_4, но они плохо работают в щелочной среде (95,90 – 95,78 %), ситаллы же очень

стойки по отношению к ним (99,67 – 99,76 %). Разработанный нами ситалл на основе базальтов Кутчинского месторождения, обладает высокой химической стойкостью и износоустойчивостью. Поэтому он рекомендован для футеровки перекачивающих щелочей и кислот химических аппаратов, деталей центробежных насосов.

Из приведенных свойств видно, что высокие значения механических свойств ситаллов обусловлены их тонкодисперсной кристаллической структуры. Присутствие в составах щелочей понижает температуру кристаллизации и значения химико-механических свойств ситаллов.

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МЕТОДОЛОГИЧЕСКИЕ ПОДХОДЫ К ИНТЕГРАЦИИ ФРАГМЕНТИРОВАННЫХ ДАННЫХ В ЭКОНОМЕТРИЧЕСКОМ МОДЕЛИРОВАНИИ ИНВЕСТИЦИОННЫХ ПРОЦЕССОВ

Аннотация. *Статья посвящена методологическим проблемам интеграции фрагментированных данных при эконометрическом моделировании эффективности инвестиций на региональном уровне. На материалах Кашкадарьинской области Республики Узбекистан выявлены основные виды информационной фрагментации и предложена трехуровневая схема их преодоления, включающая гармонизацию, множественную импутацию и многоуровневое моделирование. Эмпирический анализ показал, что применение предложенной методологии позволяет повысить объясняющую силу моделей на 20–28 % и снизить ошибку прогноза почти в два раза по сравнению с традиционными подходами. Полученные результаты могут быть использованы для повышения качества обоснования региональной инвестиционной политики в условиях ограниченной информационной базы.*

Ключевые слова: *фрагментированные данные, интеграция данных, эконометрическое моделирование, инвестиционная эффективность, панельные данные, импутация, многоуровневые модели.*

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METHODOLOGICAL APPROACHES TO THE INTEGRATION OF FRAGMENTED DATA IN ECONOMETRIC MODELING OF INVESTMENT PROCESSES

Abstract. *This article examines the methodological challenges of integrating fragmented data in econometric modeling of investment efficiency at the regional level. Using data from the Kashkadarya region of the Republic of Uzbekistan, the main types of information fragmentation were identified, and a three-level framework for overcoming them was proposed, including data harmonization, multiple imputation, and multilevel modeling. The empirical analysis demonstrated that the application of the proposed methodology increases the explanatory power of econometric models by 20–28% and reduces forecasting error by nearly two times compared to traditional approaches. The findings may be used to improve the quality of regional investment policy design under conditions of limited information availability.*

Keywords: *fragmented data, data integration, econometric modeling, investment efficiency, panel data, multiple imputation, multilevel models.*

Введение

Современный этап экономического развития регионов Узбекистана характеризуется парадоксальной ситуацией: объём доступной информации steadily растёт, однако её использование для аналитики и принятия управленческих решений остаётся затруднённым из-за высокой фрагментации. Кашкадарьинская область, один из крупнейших аграрно-промышленных регионов страны, служит типичным примером этой проблемы.

Согласно официальным данным, в 2024 году в Кашкадарьинскую область планировалось привлечь около 3,5 млрд долларов США иностранных и отечественных инвестиций. При этом статистическая база, необходимая для объективной оценки эффективности этих вложений, распределена между Госкомстатом, хокимиятом области, налоговыми органами, банками и отраслевыми министерствами. Каждый источник имеет свою методологию учёта, периодичность и уровень детализации, что приводит к значительным разрывам в данных.

Несмотря на рост числа публикаций по инвестиционной тематике, методологические вопросы корректной интеграции фрагментированных данных в эконометрических исследованиях остаются недостаточно разработанными. Большинство авторов либо работают с сильно агрегированными показателями, теряя важные детали, либо исключают неполные наблюдения, что приводит к систематическому смещению оценок.

Цель данной статьи — разработать и эмпирически апробировать комплексный методологический подход к интеграции фрагментированных данных в эконометрическом моделировании инвестиционных процессов на региональном уровне.

Задачи исследования:

– систематизировать основные виды и источники фрагментации данных;

– разработать трехуровневую методологию интеграции;

– провести сравнительный анализ традиционных и предложенных методов на материалах Кашкадарьинской области;

– оценить влияние качества интеграции данных на результаты моделирования.

Материалы и методы

2.1. Эмпирическая база исследования

Исследование охватывает период 2018–2024 годов по 13 районам и городу Карши Кашкадарьинской области. Основные источники данных:

– Официальные статистические сборники Государственного комитета Республики Узбекистан по статистике;

– Отчётность хокимията Кашкадарьинской области;

– Данные Агентства по инвестициям и внешней торговле;
– Банковская статистика по инвестиционным кредитам.

Таблица 1. Динамика освоения инвестиций в основной капитал Кашкадарьинской области (млрд сум, в текущих ценах)

Год	Объём инвестиций	Темп роста к предыдущему году, %
2019	12 845	—
2020	14 672	+14,2
2021	18 934	+29,0
2022	24 156	+27,6
2023	31 478	+30,3
2024	~35 200 (оценка)	+11,8

Источник: Госкомстат РУз, отчёты хокимията области (2020–2025).

2.2. Анализ фрагментации данных

Анализ показал значительную фрагментацию информации. Наиболее проблемными оказались данные по инвестициям малых предприятий и иностранных инвестициям на районном уровне.

Таблица 2. Средний уровень пропущенных значений по ключевым показателям (2018–2024 гг., %)

Показатель	Средняя доля пропусков
Объём инвестиций в основной капитал	24,2
Структура источников финансирования	38,5
Отраслевое распределение	32,2
Инвестиции по районам	43,1

2.3. Предлагаемая методология

Автором разработана трехуровневая схема интеграции фрагментированных данных:

Уровень 1. Гармонизация — приведение данных к единой территориальной и временной сетке. **Уровень 2.** Импутация пропущенных значений с использованием Multiple Imputation by Chained Equations (MICE). **Уровень 3.** Многоуровневое (hierarchical) моделирование.

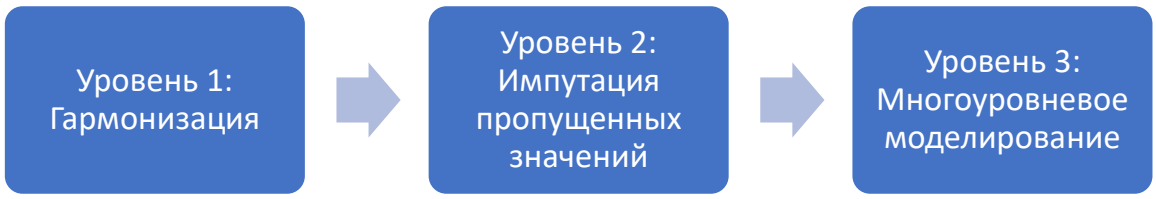

Рисунок 1. Трехуровневая схема интеграции фрагментированных данных.

Основная эконометрическая модель имеет вид:

$$\ln(ROI_{it}) = \beta_0 + \beta_1 \ln(K_{it}) + \beta_2 \ln(L_{it}) + \beta_3 Frag_{it} + \beta_4 Inst_{it} + \beta_5 (Frag_{it} \times Inst_{it}) + u_i + v_t + \varepsilon_{it}$$

Результаты исследования

Применение предложенной методологии позволило восстановить значительную часть пропущенных наблюдений и повысить качество моделей.

Таблица 3. Сравнительная характеристика моделей

Критерий	Традиционный подход	Предлагаемый подход
Adjusted R^2	0,55–0,65	0,72–0,81
Ошибка прогноза (MAPE)	18–25%	8–13%
Учёт пространственной неоднородности	Слабый	Сильный

Таблица 4. Оценка коэффициентов многоуровневой модели (основные результаты)

Переменная	Коэффициент	p-value
ln(Капитал)	0,439	0,000
ln(Труд)	0,312	0,001
Индекс фрагментации	-0,319	0,000
Качество институтов	0,184	0,001
Взаимодействие Frag × Inst	-0,127	0,003

Обсуждение результатов

Полученные результаты подтверждают, что фрагментация данных оказывает значимое негативное влияние на оценку эффективности инвестиций. Предложенная методология демонстрирует заметные преимущества по сравнению с традиционными подходами. Особенно важным является учёт взаимодействия между уровнем фрагментации и качеством институтов.

Заключение

Интеграция фрагментированных данных представляет собой важнейшее условие повышения качества эконометрического анализа инвестиционных процессов в регионах. Разработанные в статье подходы могут быть использованы для обоснования инвестиционной политики Кашкадарьинской области и других регионов Узбекистана.

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ПРИМЕНЕНИЕ МЕТОДОВ МАШИННОГО ОБУЧЕНИЯ ДЛЯ СНИЖЕНИЯ ЭФФЕКТА ИНФОРМАЦИОННОЙ ФРАГМЕНТАЦИИ ПРИ ПРОГНОЗИРОВАНИИ ИНВЕСТИЦИОННОЙ ЭФФЕКТИВНОСТИ

Аннотация: *рассматривается применение алгоритмов машинного обучения для прогнозирования инвестиционной эффективности в условиях информационной фрагментации. Проведён сравнительный анализ устойчивости методов к пропущенным значениям, структурным разрывам и разнородности источников. Установлено, что алгоритмы бустинга с встроенной обработкой nan (catboost, lightgbm) превосходят традиционные методы в условиях несбалансированных панелей. Предложена схема аналитического конвейера, включающая обязательную диагностику механизма пропуска перед выбором алгоритма.*

Ключевые слова: *машинное обучение; информационная фрагментация; XGBoost; LightGBM; CatBoost; пропущенные данные; инвестиционная эффективность; ансамблевые методы.*

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APPLICATION OF MACHINE LEARNING METHODS TO REDUCE THE EFFECT OF INFORMATION FRAGMENTATION IN FORECASTING INVESTMENT EFFICIENCY

Abstract*: This paper examines the application of machine learning algorithms for forecasting investment efficiency under conditions of information fragmentation. A comparative analysis of the robustness of these methods to missing values, structural breaks, and heterogeneous data sources is conducted. The results indicate that boosting algorithms with built-in handling of missing values (CatBoost and LightGBM) outperform traditional methods in the context of unbalanced panel data. An analytical pipeline is proposed that includes mandatory diagnosis of the missing data mechanism prior to algorithm selection.*

Keywords: *machine learning; information fragmentation; XGBoost; LightGBM; CatBoost; missing data; investment efficiency; ensemble methods.*

Введение

Согласно докладу UNCTAD (2024), глобальные ПИИ достигли 1,5 трлн долл. США, однако развивающиеся страны второй год подряд фиксируют их снижение — во многом вследствие геополитической фрагментации и неоднородности статистической базы. Аналитик, работающий с международными инвестиционными данными, неизбежно сталкивается с пропусками, структурными разрывами и методологической несопоставимостью источников. Традиционные регрессионные методы требуют полных сбалансированных панелей — условие, редко выполнимое на практике. Методы машинного обучения предлагают альтернативу, однако их эффективность зависит от корректного обращения с неполными данными. Цель статьи — сравнить алгоритмы МО по критерию устойчивости к информационной фрагментации и предложить методологическую рамку их применения в инвестиционном анализе.

Обзор литературы

Gu, Kelly и Xiu провели масштабное сравнение МО-алгоритмов на задаче оценки премий за риск и показали устойчивое превосходство ансамблевых методов над линейными моделями, особенно при высокой размерности признаков. Fujimoto et al. применили CatBoost для интерполяции нерандомных пропусков в базе ORBIS и установили, что механизм пропуска, а не его доля, определяет выбор метода восстановления. Систематический обзор Shehab et al. по протоколу PRISMA охватил 22 работы 2024–2026 гг. и подтвердил: LightGBM оптимален для высокочастотных рядов, CatBoost — при наличии категориальных переменных, ансамблевый стекинг стабильно превосходит одиночные алгоритмы. Обзор по управлению финансовыми рисками констатирует доминирование ансамблей в задачах кредитного скоринга и обнаружения мошенничества, отмечая «методологическую изолированность» большинства исследований, затрудняющую перенос результатов на развивающиеся рынки с заведомо более высокой фрагментацией данных.

Материалы и методы.

В качестве источников данных используются: UNCTAD FDI Statistics (потоки ПИИ, 1990–2023); World Development Indicators Всемирного банка (ВВП, GFCF, 1960–2023); индикаторы ЕБРР по структурным реформам (1989–2023); база ORBIS (финансовая отчётность фирм, 2005–2022). Все источники характеризуются систематической неполнотой: ORBIS недопредставляет МСП развивающихся стран, UNCTAD фиксирует кондуитные потоки, статистика ЕБРР содержит разрывы 1990-х годов.

Перед обучением моделей необходима диагностика механизма пропуска. Выделяют три типа: MCAR (пропуск случаен), MAR (пропуск зависит от наблюдаемых переменных) и MNAR (пропуск зависит от самого пропущенного значения). В инвестиционных данных преобладает MNAR: компании с худшими показателями реже публикуют отчётность. Для

диагностики применяется тест Литтла. При MCAR и MAR используются MICE и KNN-вменение; при MNAR — CatBoost с параметром nan_mode, обрабатывающим пропуски внутри алгоритма бустинга.

Базовая регрессионная постановка задачи: $\hat{y}_{it} = f(X_{it}) + \varepsilon_{it}$, где $\hat{y}_{it}$ — прогнозируемая инвестиционная отдача объекта i в период t; X_{it} — вектор признаков (возможно неполный); f — МО-алгоритм.

Для XGBoost регуляризованная функция потерь имеет вид:

$$L = \Sigma_i\, l(y_i, \hat{y}_i) + \Sigma_k\, \Omega(f_k), \quad \Omega(f) = \gamma T + \tfrac{1}{2}\lambda\|w\|^2,$$

где T — число листьев дерева; λ — коэффициент L2-регуляризации; w — веса листьев; γ — штраф за сложность.

Random Forest агрегирует прогнозы B деревьев:

$$\hat{y} = (1/B) \cdot \Sigma_\{b=1\}\^\{B\}\ f_b(x).$$

Ансамблевый стекинг объединяет прогнозы базовых моделей через мета-алгоритм второго уровня. В предлагаемой схеме базовые модели — RF, XGBoost, LightGBM; мета-алгоритм — гребневая регрессия. Интерпретация результатов осуществляется методом SHAP.

Схема аналитического конвейера						
1. Сбор и аудит данных	→	2. Диагностика пропусков (MCAR/MAR/MNAR)	→	3. Вменение (MICE / KNN / CatBoost)	→	4. МО-модели + SHAP-интерпретация
UNCTAD, WB, EBRD, ORBIS	→	Little's test, паттерн-анализ	→	При MNAR — CatBoost; при MAR — MICE	→	RF, XGBoost, LightGBM, Stacking

Рисунок 1. Источник: составлено автором.

Результаты

Сравнительный анализ алгоритмов по методологическим критериям представлен в таблице 1. Прямые эмпирические метрики не приводятся ввиду отсутствия единой сопоставимой выборки; оценки основаны на опубликованных методологических характеристиках алгоритмов.

Таблица 1 — Сравнительный анализ алгоритмов МО по критериям устойчивости к фрагментации данных

Метод	Точность	Устойчивость к пропускам	Обработка NaN	Ограничения
Random Forest	Высокая	Средняя	Усреднение деревьев	Требует явного вменения при MNAR
XGBoost	Высокая	Высокая	Sparse-aware алгоритм	Чувствителен к гиперпараметрам

LightGBM	Очень высокая	Высокая	Гистограммный метод	Менее устойчив на малых выборках
CatBoost	Высокая	Очень высокая	nan_mode + Ordered Boosting	Больший объём памяти
LSTM	Высокая (ряды)	Низкая	Требует предобработки	Высокая вычислительная стоимость
Stacking	Наивысшая	Средняя	Зависит от базовых моделей	Риск переобучения

Источник: составлено на основе Gu et al.; Fujimoto et al.; Shehab et al..

CatBoost и LightGBM обладают наибольшей встроенной устойчивостью к пропускам за счёт явной обработки NaN внутри алгоритма бустинга. Random Forest требует предварительного вменения, однако агрегирование по деревьям снижает влияние единичных пропусков. LSTM демонстрирует высокий потенциал для временны́х рядов, но требует длинных и плотных обучающих выборок — условие, редко выполнимое при MNAR-данных. Стекинг стабильно превосходит одиночные алгоритмы, однако при малых выборках существенно возрастает риск переобучения мета-алгоритма.

Обсуждение

Главное системное ограничение существующих работ — методологическая изолированность: алгоритмы тестируются на проприетарных данных развитых рынков, что затрудняет перенос результатов на развивающиеся экономики с более высоким уровнем фрагментации. Второе ограничение — игнорирование механизма пропуска: применение стандартного удаления строк (listwise deletion) при MNAR систематически завышает оценки инвестиционной эффективности, поскольку наиболее прозрачные компании с наилучшими показателями публикуют полные данные.

Направлениями дальнейших исследований являются: разработка стандартизированных бенчмарк-наборов с контролируемыми паттернами фрагментации; интеграция SHAP-объяснений с пространственно-эконометрическими моделями для регионального инвестиционного анализа; применение генеративных моделей для аугментации неполных данных.

Заключение

Информационная фрагментация в инвестиционных данных носит системный характер и не устраняется выбором одного алгоритма. Алгоритмы бустинга, прежде всего CatBoost и LightGBM, структурно лучше приспособлены к таким данным, чем традиционные методы. Научная новизна состоит в предложении аналитического конвейера, включающего обязательный этап диагностики механизма пропуска как определяющего условия выбора алгоритма — в отличие от стандартных МО-пайплайнов,

пропускающих этот шаг. Практическая применимость конвейера подтверждается его ориентацией на открытые данные UNCTAD, World Bank, EBRD и ORBIS, доступные большинству исследователей без специального доступа к проприетарным базам.

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ПРОЕКТНОЕ ФИНАНСИРОВАНИЕ В ВОЗОБНОВЛЯЕМОЙ ЭНЕРГЕТИКЕ: ПОЧЕМУ БАНКИ ПОВЕРИЛИ В СОЛНЦЕ И ВЕТЕР

Аннотация: *В статье исследуется механизм проектного финансирования в возобновляемой энергетике, который позволяет банкам кредитовать крупные инфраструктурные проекты при отсутствии у заёмщиков классических залогов и длительной кредитной истории. Ключевым элементом сделки является долгосрочный договор покупки электроэнергии (PPA), трансформирующий будущий денежный поток в обеспечение, а также создание специальной проектной компании (SPV). На примерах ветропарка Hornsea 2 (Великобритания), солнечной станции Noor Abu Dhabi (ОАЭ) и российской «Адыгейской ВЭС» демонстрируется успешное применение данной модели в различных институциональных условиях.*
Ключевые слова: *проектное финансирование, возобновляемая энергетика, ВИЭ, PPA, SPV, ресурсный аудит, инфраструктурные проекты, ветроэнергетика, солнечная энергетика.*

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PROJECT FINANCE IN RENEWABLE ENERGY: WHY BANKS BELIEVED IN THE SUN AND THE WIND

Abstract: *The article examines the mechanism of project finance in renewable energy, which enables banks to lend to large-scale infrastructure projects in the absence of conventional collateral and a long-term credit history on the part of borrowers. A key element of the transaction is the long-term power purchase agreement (PPA), which transforms future cash flows into security, along with the establishment of a special purpose vehicle (SPV). Using the examples of the Hornsea 2 offshore wind farm (United Kingdom), the Noor Abu Dhabi solar plant (UAE), and the Russian Adygeyskaya WPP, the article demonstrates the successful application of this model across different institutional settings.*
Keywords: *project finance, renewable energy, RES, PPA, SPV, resource assessment, infrastructure projects, wind energy, solar energy.*

Введение

В течение долгого времени возобновляемая энергетика оставалась территорией убеждений, субсидий и энтузиазма, а не холодного экономического расчёта. Солнечные панели были дороги, ветряки считались капризными, а главное - ни один крупный банк не хотел всерьёз рассматривать такие проекты как надёжный объект для вложений. Сегодня ситуация выглядит почти противоположным образом. Многомиллиардные ветропарки в морях и солнечные электростанции в пустынях строятся не на государственные гранты и не на «зелёные» пожертвования, а на деньги крупнейших финансовых институтов, которые конкурируют за право участия в таких сделках. Более того, именно возобновляемая энергетика стала одним из самых удобных и отработанных полигонов для проектного финансирования - сложного, гибкого и во многом парадоксального механизма, который позволяет давать огромные суммы в долг компаниям, не имеющим ни длинной кредитной истории, ни привычных залогов в виде недвижимости или оборотных активов.

В этой статье мне хотелось бы не просто перечислить преимущества проектного финансирования для ВИЭ, а показать внутреннюю логику этого явления. Почему банк, который по определению должен быть консервативен, вдруг начинает кредитовать ветер и солнце? Как устроена сделка, в которой единственным реальным обеспечением становится будущий денежный поток от продажи электроэнергии? И почему эта модель, казавшаяся маргинальной двадцать лет назад, сегодня превратилась в мейнстрим глобальной энергетики?

Чтобы понять специфику проектного финансирования, стоит сначала чётко представить, почему привычный инвестиционный кредит оказывается практически бесполезным в сфере возобновляемой энергетики. Традиционная банковская логика устроена так: заёмщик приходит в банк со своим прошлым и настоящим. Банк смотрит на баланс за последние три года, оценивает наличие ликвидных залогов, изучает историю взаимоотношений с другими кредиторами. По сути, классическое кредитование обращено назад - оно экстраполирует уже достигнутые результаты в будущее. Для промышленного гиганта с заводами, складами и многолетними контрактами это работает безупречно. Но для проекта в возобновляемой энергетике - почти никогда. Представьте себе группу инженеров и менеджеров, которые хотят построить ветропарк мощностью 50 мегаватт. У них нет многомиллиардных активов. Нет производственных корпусов, которые можно было бы предложить в залог. Нет и длинной прибыльной истории, потому что сам проект только начинается. Всё, чем они реально обладают на старте, - это пакет разрешительной документации, договор аренды земли, технико-экономическое обоснование, подписанный контракт с подрядчиком на строительство и, что самое важное, долгосрочное соглашение о покупке будущей электроэнергии.

Добавим к этому особенность самой экономики ВИЭ. Любой такой проект требует колоссальных вложений на начальном этапе. Закупка турбин, подготовка площадки, строительство подстанций, подключение к сетям - всё это оплачивается по мере возникновения необходимости, то есть на начальных этапах проекта. Выручка же начнёт поступать только через полтора-два года, когда объект будет введён в эксплуатацию. При этом после запуска операционные расходы оказываются крайне низкими и составляют в основном только затраты на обслуживание, потому что ветер и солнце бесплатные. Такой профиль инвестиций с огромным разрывом между затратами и доходами требует принципиально иного финансового мышления. Банку нужно не просто дать денег, а выстроить конструкцию, в которой деньги будут возвращаться за счёт того, что ещё не создано. И здесь ярко проявляется механизм, разработанный для проектов, которые сами себя окупают - проектное финансирование.

Ключевая идея проектного финансирования на первый взгляд проста: заёмщиком становится не существующая компания с историей, а специально созданное под данный проект юридическое лицо, которое не имеет других активов и обязательств. Такую структуру принято называть SPV - special purpose vehicle. Эта компания не отвлекает деньги на сторонние бизнесы, не ведёт параллельных операций, не может переложить ресурсы на другие нужды. Всё, что у неё есть, - это права на строительство станции, договоры с подрядчиками и главный контракт всей сделки - соглашение о покупке электроэнергии, которое в международной практике называют PPA (Power Purchase Agreement).

Создание SPV решает сразу несколько задач, и о них стоит сказать подробнее, потому что без понимания этой конструкции всё остальное теряет смысл. Во-первых, SPV создаёт юридическую прозрачность: все активы, все денежные потоки, все обязательства изолированы в одной компании, которую можно проверить, оценить и контролировать как единое целое. Кредиторам не нужно беспокоиться о том, что материнская компания начнёт перетягивать деньги на другой убыточный проект или скрывать реальное положение дел. Во-вторых, SPV работает как кордон безопасности для инициаторов проекта. Если что-то пойдёт не так и проект обанкротится, потери ограничатся только этой «коробкой» - материнская структура не отвечает по долгам SPV своим основным капиталом. С точки зрения банка это одновременно и недостаток, и преимущество. Недостаток в том, что регресс на учредителей минимален или отсутствует вовсе. Преимущество в том, что все риски сконцентрированы в одной точке и их можно моделировать, страховать и распределять между участниками.

Но настоящей душой проектного финансирования в возобновляемой энергетике является не SPV как таковая, а упомянутый выше контракт на покупку энергии. PPA - это документ, который превращает будущий ветер в сегодняшние деньги. В нём зафиксированы три главных параметра: объём

поставок (например, 80 процентов всей генерируемой станцией энергии), цена (чаще всего фиксированная на длительный срок или с чёткой формулой индексации) и ответственность за недопоставку. Заключая такой договор с крупным промышленным потребителем, государственной энергокомпанией или распределительной сетью, проектная компания получает не просто обещание покупать энергию, а юридически обязательство с понятными штрафными санкциями. Для банка это почти эквивалентно поручительству платёжеспособного контрагента. Денежный поток расписан по годам, и даже если реальная выработка окажется чуть ниже прогнозной из-за капризов погоды, среднемноголетние показатели всё равно обеспечивают обслуживание долга.

Банки, разумеется, не принимают на веру заявления проектной компании о том, сколько ветра или солнца будет в данной локации. Они требуют так называемый ресурсный аудит, который проводится независимыми специалистами на основании многолетних метеоданных - зачастую за десять и более лет. На основе этого аудита строится финансовая модель, в которой закладывается не оптимистичный сценарий выработки (который называют P50 - то есть уровень, достижимый с 50-процентной вероятностью), а консервативный, например P90, когда вероятность достижения заложенного объёма составляет 90 процентов. Иными словами, банк сам себя страхует от природной неопределённости, просто предполагая, что солнце будет светить и ветер дуть не в среднем, а в худшем из разумных вариантов.

Поскольку у банка в проектном финансировании нет залога в классическом смысле этого слова - ни заводов, ни складов, ни торговых центров, которые можно арестовать и продать, - он вынужден выстраивать альтернативную систему защиты. Эта система не менее жёсткая, чем классическое залоговое право, просто она работает иначе. Её суть можно выразить одной фразой: банк не даёт проектной компании распоряжаться деньгами по своему усмотрению. Вся выручка от продажи электроэнергии поступает не на расчётный счёт, который контролирует сама компания, а на специальный счёт, управляемый банком или находящийся под его строгим контролем. Такие счета принято называть эскроу-счетами или счетами условного депонирования. С них деньги уходят не куда попало, а в строго определённой последовательности. Эта последовательность, которую в профессиональной среде называют водопадом (waterfall), устанавливается кредитным договором буквально построчно. В самом верху водопада находятся налоги и сборы - их нельзя игнорировать. Следом идёт выплата процентов по кредиту, затем погашение основного долга, потом пополнение резервных фондов, потом операционные расходы - и только в самом конце, после того как все обязательные платежи сделаны, оставшиеся деньги могут быть выведены из проектной компании в виде дивидендов её учредителям. Нетрудно заметить, что такая конструкция оставляет инициаторам проекта

лишь то, что осталось после банка. Но именно благодаря этому банк может позволить себе давать деньги без классического залога.

Кроме того, банк требует формирования резервных фондов, которые лежат мёртвым грузом на специальных счетах, но служат амортизатором для любых неприятностей. Самый распространённый из них - фонд обслуживания долга (Debt Service Reserve Account). На этом счету должна постоянно находиться сумма, достаточная для выплаты процентов и тела кредита в течение нескольких месяцев - обычно от шести до двенадцати. Если станция временно остановилась из-за аварии на линии электропередачи или неожиданного ремонта, этот фонд позволяет продолжать платить банку без задержек. Банку, по большому счёту, всё равно, стоит ветропарк или работает, пока резервный фонд не исчерпан. А к моменту его исчерпания проблема должна быть решена - иначе наступает дефолт.

Наконец, самым сильным и одновременно самым редко используемым инструментом банковского контроля является право замены заёмщика, или step-in rights. Если проектная компания допускает дефолт и не может управлять станцией так, чтобы обслуживать долг, банк имеет право устранить текущий менеджмент, привлечь стороннего оператора и продолжать эксплуатацию актива своими силами. Для банка это превращает потенциальное банкротство из катастрофы в операционную процедуру. Ему не нужно продавать ветряки с молотка по бросовой цене - достаточно сменить управление, которое сможет обеспечить поступление денежных средств до того момента, пока не вернутся все деньги. Именно эта возможность и отличает проектное финансирование инфраструктуры от обычного корпоративного кредитования. За последние пятнадцать лет десятки крупнейших ветряных и солнечных проектов по всему миру были реализованы именно на принципах проектного финансирования, и эти примеры позволяют увидеть, как абстрактные конструкции работают в реальной экономике.

Одним из самых ярких образцов стал британский офшорный ветропарк Hornsea 2, который на момент своего запуска являлся крупнейшей в мире морской ветряной электростанцией мощностью 1,3 гигаватта. Проект, реализованный датской компанией Ørsted, обошёлся примерно в 7 миллиардов долларов. Грубо говоря, половину этих денег вложил сам инициатор, а другую половину предоставил синдикат из более чем двадцати банков - консорциум, объединивший BNP Paribas, Credit Agricole, Deutsche Bank и другие крупнейшие финансовые институты Европы. Что сделало возможной эту сделку в условиях неопределённости? Ответ - государственная программа Contracts for Difference, по сути являющаяся аналогом того самого PPA, о котором шла речь выше. Британское правительство гарантировало фиксированную цену на электроэнергию на пятнадцать лет вперёд. При таком обеспечении банкам даже не пришлось долго размышлять - сделка закрылась в разгар пандемии 2020 года, когда многие рынки были парализованы.

Не менее показательна история солнечного парка Noor Abu Dhabi в Объединённых Арабских Эмиратах. При мощности 1,2 гигаватта он стал одной из крупнейших солнечных станций в мире, а его стоимость в 870 миллионов долларов была профинансирована на три четверти за счёт проектного кредита. Консорциум включал японский государственный банк JBIC, французский BNP Paribas и несколько локальных игроков. Но по-настоящему удивительным был не размер финансирования, а экономика проекта. Цена электроэнергии по PPA составила всего 2,4 цента за киловатт-час - это ниже, чем на новых угольных и даже газовых станциях в том же регионе. Проектное финансирование не просто позволило построить станцию, оно сделало зелёную энергию дешевле ископаемой, что ещё десять лет назад казалось утопией.

Российский опыт, хотя и отличается по масштабу и политическим условиям, следует той же логике. С 2013 года в стране действует механизм договоров предоставления мощности для возобновляемой энергетики - ДПМ ВИЭ. Государство, по сути, гарантирует инвестору возврат капитала через повышенную плату за мощность в течение пятнадцати лет, и эта конструкция является прямым институциональным аналогом западного PPA, хотя и с более сильным административным элементом. На основе этого механизма были построены гигаватты солнечных и ветряных мощностей в южных и степных регионах страны. Ветропарк «Адыгейская ВЭС» мощностью 150 мегаватт, построенный дочерней компанией «Росатома» при финансировании Сбера, - классическая сделка проектного финансирования в российских реалиях. Банк не давал деньги под прошлые заслуги атомной госкорпорации, он кредитовал конкретный объект, денежный поток которого создаётся гарантированными пятнадцатилетними платежами.

При всём оптимизме предыдущих разделов было бы наивно полагать, что проектное финансирование ВИЭ - это безрисковый способ печатать деньги. Рисков много, и любой банк, прежде чем подписать договор на миллиард долларов, тщательно их прорабатывает. Но главное отличие проектного финансирования от классического кредита заключается не в отсутствии рисков, а в том, что эти риски можно чётко идентифицировать, измерить и распределить между участниками сделки.

Начнём с самого очевидного - ветер может не дуть, а солнце может не светить. Казалось бы, это делает любой ВИЭ-проект заведомо ненадёжным. Однако банки смотрят на эту проблему иначе. Ветер и солнце непредсказуемы в краткосрочной перспективе, но в долгосрочной они подчиняются статистическим закономерностям. Именно поэтому банк требует не просто прогноза, а ресурсного аудита, основанного на десяти-пятнадцати годах фактических метеоданных. Если в данной локации среднегодовая скорость ветра за последние десять лет составляла 7,2 метра в секунду, то с высокой вероятностью она не упадёт до 5 метров надолго. Более того, банк закладывает в модель не среднее значение, а консервативное - например, тот

уровень выработки, который будет достигнут с вероятностью девяносто процентов. Иными словами, он сам режет ожидаемый доход, чтобы застраховаться от природной волатильности.

Другой крупный риск связан со строительством. Ветропарк или солнечная станция не начнут приносить выручку, пока не будут построены и подключены к сети. В этой фазе проект наиболее уязвим, потому что деньги уже потрачены, а доходов ещё нет. Банки справляются с этим, разбивая кредитную линию на транши, каждый из которых выдаётся только после подтверждения выполнения определённого этапа строительства. Кроме того, банк почти всегда требует, чтобы строительные работы велись по контракту типа EPC (engineering, procurement, construction) - «под ключ», где один генеральный подрядчик отвечает за всё. В этом случае банк может получить банковскую гарантию от этого подрядчика: если стройка сорвётся, гарантия покроет убытки. Наконец, банк требует, чтобы оборудование поставлялось проверенным производителем с глобальной сервисной сетью - не потому, что это красиво, а потому что через десять лет потребуется ремонт.

Политические риски обычно выходят на первый план, когда речь идёт о развивающихся странах. Смена законодательства, национализация, валютные ограничения могут разрушить экономику проекта, построенную на длинном и предсказуемом PPA. Здесь стандартным решением является участие экспортных кредитных агентств (ЭКА) - национальных институтов, которые страхуют политические риски. Немецкое Euler Hermes, итальянское SACE, российское ЭКСАР, а также многосторонние организации вроде Европейского банка реконструкции и развития или Международной финансовой корпорации предоставляют гарантии, которые снижают риски для банков. Неслучайно в большинстве крупных сделок по проектному финансированию ВИЭ в Африке, Азии или Восточной Европе среди участников почти всегда можно найти одно из таких агентств.

Сегодня проектное финансирование ВИЭ стало настолько отлаженным конвейером, что ставки по таким кредитам неуклонно снижаются, а сроки растут. Пятнадцатилетние кредиты уже не редкость, а двадцатилетние начинают появляться. Пенсионные фонды и страховые компании, которым нужны длинные и предсказуемые денежные потоки, постепенно входят в этот рынок не только как кредиторы, но и как покупатели уже построенных проектов. Банк строит, инвестор выкупает - и каждый получает своё.

В ближайшее десятилетие можно ожидать дальнейшего удешевления этого типа финансирования, особенно по мере того, как накапливается статистика успешных проектов. Каждый новый ветропарк, закрывший кредит досрочно и без проблем, делает следующий проект чуть более дешёвым для следующего заёмщика. И в этом смысле проектное финансирование - не просто технический инструмент, а своего рода социальный механизм обучения рынка.

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ПРОБЛЕМНЫЕ АСПЕКТЫ УГОЛОВНОГО ПРАВА, СВЯЗАННЫЕ С КВАЛИФИКАЦИЕЙ ПРЕСТУПЛЕНИЙ В СФЕРЕ НЕЗАКОННОГО ОБОРОТА НАРКОТИКОВ НА СОВРЕМЕННОМ ЭТАПЕ

Аннотация. *В статье проводится анализ актуальных проблем квалификации преступлений в сфере незаконного оборота наркотических средств и психотропных веществ. Рассматриваются противоречия действующего законодательства и разъяснений Пленума Верховного Суда Российской Федерации применительно к определению размера наркотических средств в смесях, квалификации аналогов наркотических веществ, а также отдельным дискуссионным позициям правоприменения.*

Ключевые слова: *наркотические средства, психотропные вещества, незаконный оборот наркотиков, квалификация преступлений, смесь наркотических средств, аналоги наркотиков.*

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PROBLEMATIC ASPECTS OF CRIMINAL LAW RELATED TO THE QUALIFICATION OF CRIMES IN THE FIELD OF DRUG TRAFFICKING AT THE PRESENT STAGE

Annotation. *The article analyzes the current problems of crime qualification in the field of illicit trafficking in narcotic drugs and psychotropic substances. The contradictions of the current legislation and the explanations of the Plenum of the Supreme Court of the Russian Federation in relation to the determination of the size of narcotic drugs in mixtures, the qualification of analogues of narcotic substances, as well as individual controversial positions of law enforcement are considered.*

Keywords: *narcotic drugs, psychotropic substances, illicit drug trafficking, qualification of crimes, mixture of narcotic drugs, drug analogues.*

Незаконный оборот наркотических средств устойчиво занимает одно из первых мест среди транснациональных преступлений. Международно-правовую основу регулирования в рассматриваемой сфере образует совокупность конвенций ООН, ратифицированных Россией: Единая конвенция о наркотических средствах 1961 года [2], Конвенция о психотропных веществах 1971 года [5] и Конвенция о борьбе против незаконного оборота наркотических средств и психотропных веществ 1988 года [6]. Уже в первой статье Единой конвенции 1961 года закреплено понятие

«препарата» как жидкой или твёрдой смеси, содержащей любой наркотик, а пункт 3 статьи 2 той же конвенции обязывает государства применять к препаратам те же меры контроля, что и к входящим в их состав веществам. Конвенция о психотропных веществах 1971 года воспроизводит аналогичную логику в отношении психотропных веществ, добавляя, что при наличии в препарате нескольких веществ к нему применяются меры контроля, предусмотренные для наиболее строго контролируемого из них. Эти конвенционные положения стали отправной точкой при формировании российского законодательства, хотя, как будет показано далее, их имплементация оказалась далеко не бесспорной.

На внутригосударственном уровне базовым актом является Федеральный закон от 08.01.1998 № 3-ФЗ «О наркотических средствах и психотропных веществах», воспроизведший в статье 1 конвенционное понятие «препарата» и закрепивший в пункте 4 статьи 2 принцип применения к препаратам мер контроля, установленных для содержащихся в них наркотических средств [15]. Постановлением Правительства Российской Федерации от 30.06.1998 № 681 утверждён перечень наркотических средств, психотропных веществ и их прекурсоров, подлежащих контролю, структурированный по трём спискам в зависимости от строгости режима оборота [9]. Для целей уголовного преследования принципиальное значение имеет постановление Правительства Российской Федерации от 01.10.2012 № 1002 [10], установившее значительный, крупный и особо крупный размеры наркотических средств и психотропных веществ применительно к статьям 228, 228.1, 229 и 229.1 УК РФ [14].

Вместе с тем нормативная база, при всей её разветвлённости, содержит ряд серьёзных пробелов, которые на протяжении многих лет воспроизводятся в правоприменительной практике. Показательна в этом отношении проблема определения размера наркотического средства в случае, когда оно входит в состав смеси с другими веществами.

М.В. Носков, анализируя действующее регулирование, обращает внимание на то, что примечание к списку № 1 постановления Правительства № 1002 прямо указывает: к наркотическим средствам относятся все смеси, в состав которых входит хотя бы одно из перечисленных в списке веществ, при этом концентрация наркотика в смеси значения не имеет [7, с. 233]. Аналогичного пояснения применительно к спискам № 2 и № 3 постановление не содержит, и это само по себе порождает неопределённость. Однако наиболее острая коллизия возникает в ситуации, когда смесь одновременно включает наркотические средства из разных списков. Пункт 4 постановления Пленума Верховного Суда РФ от 15.06.2006 № 14 «О судебной практике по делам о преступлениях, связанных с наркотическими средствами, психотропными, сильнодействующими и ядовитыми веществами» разъясняет, что при наличии в смеси наркотического средства из списка № 1 размер определяется по массе всей смеси, по наркотику с наименьшим

установленным значительным, крупным или особо крупным размером [11]. В отношении же смесей наркотических средств из разных списков без участия веществ из списка № 1 аналогичного правила Пленум не сформулировал [7, с. 235].

Носков М.В. приводит весьма наглядный пример: смесь героина (список № 1) и морфина (список № 2) массой 0,4 г, разделяемая экспертным путём на 0,2 г каждого компонента. При буквальном следовании разъяснениям Пленума всё вещество квалифицируется как героин без значительного размера, что влечёт ответственность по части 1 статьи 228.1 УК РФ с максимальным наказанием до 8 лет лишения свободы. Между тем 0,2 г морфина самостоятельно образуют значительный размер (порог, 0,1 г), и при сбыте только морфина в чистом виде содеянное подлежало бы квалификации по пункту «б» части 3 статьи 228.1 УК РФ с наказанием от 8 до 15 лет. Получается, что наличие в смеси второго наркотика фактически смягчает ответственность, что противоречит и здравому смыслу, и принципам уголовного судопроизводства [7, с. 236-237]. Предлагаемое автором решение, добавление в пункт 4 постановления Пленума абзаца, обязывающего квалифицировать деяние по наркотику с наименьшим установленным размером при раздельно устанавливаемых компонентах смеси, выглядит логично и устраняет выявленное противоречие [7, с. 237].

Вместе с тем следует оговориться: предложение не охватывает ситуации, когда экспертное разделение компонентов невозможно, а это на практике встречается довольно часто. Кроме того, критерий «наименьшего установленного размера» нуждается в более чётком нормативном закреплении, поскольку для разных списков шкалы размеров не всегда сопоставимы напрямую.

Е.К. Щербакова, А.Р. Арсанов и А.А. Байраков рассматривают проблему смесей через призму судебной практики и приходят к выводу, что суды при вынесении решений неизменно ориентируются на результаты экспертиз, квалифицируя размер наркотика по массе всей смеси [17, с. 60-61]. Анализируемые ими судебные дела, в том числе дело гражданки Ф., по которому Астраханский областной суд отменил оправдательный приговор в связи с тем, что суд первой инстанции неправомерно исчислял размер гашишного масла лишь применительно к его доле в смеси, наглядно показывают: ошибки в квалификации происходят именно тогда, когда суды отступают от правила определения размера по всей смеси [17, с. 61]. Позиция авторов в целом обоснована, однако в ней недостаточно проработана обратная ситуация, которую детально анализирует Носков М.В., а именно случай смеси нескольких самостоятельных наркотических средств, каждое из которых образует самостоятельный состав более тяжкого преступления. Предложение авторов расширить и структурировать перечень наркотических и психотропных веществ, при всей очевидной полезности, носит скорее технический, нежели концептуальный характер [17, с. 62].

Самостоятельный блок проблем связан с квалификацией деяний, предметом которых выступают аналоги наркотических средств.

А.А. Овчинникова указывает, что отсутствие в перечне ряда веществ, реально причиняющих вред здоровью, влечёт трудности при квалификации и нередко приводит к назначению несправедливого наказания [8]. Эта позиция заслуживает поддержки: перечень запрещённых веществ объективно не успевает за темпами появления новых синтетических наркотиков, о чём свидетельствует и история с «спайсами», массово распространившимися до 2009 года и лишь после запрета поменявшими форму распространения.

Вместе с тем расширение перечня само по себе не устраняет проблему, поскольку законодатель, по выражению В.В. Филиппова, объективно не успевает реагировать на изменения технологий [16, с. 117]. Более перспективным представляется подход, при котором критерии отнесения к аналогам формулируются функционально, то есть через механизм психоактивного воздействия, а не исключительно через химическую структуру.

Для этого, как справедливо предлагают Щербакова Е.К. с соавторами, необходимо во всех без исключения случаях проводить биологическую и физико-химическую экспертизу, устанавливающую характер воздействия вещества на организм человека и его способность вызывать зависимость [17, с. 59-60]. Признательные показания обвиняемого, как правильно отмечают авторы, экспертизу заменить не могут.

Дискуссионной остаётся и позиция Верховного Суда РФ по вопросу о моменте окончания изготовления наркотических средств. Д.А. Жарков подробно анализирует смену позиции Пленума: постановление 1998 года № 9 рассматривало изготовление как процесс, считая преступление оконченным с начала действий, тогда как постановление 2006 года № 14 перешло к пониманию изготовления как результата, то есть получения готового к употреблению наркотика [4, с. 561-562]. Как отмечает Д.В. Токманцев, позиция 1998 года соответствовала нормам Единой конвенции 1961 года и Конвенции о психотропных веществах 1971 года, трактующих изготовление как процесс [13, с. 55]. Действующее постановление Пленума 2006 года, будучи в большей мере согласованным с нормами Федерального закона № 3-ФЗ, оказывается в противоречии с международно-правовыми обязательствами России.

Д.А. Жарков верно фиксирует это противоречие, однако конкретного пути его разрешения не предлагает, ограничиваясь констатацией необходимости дальнейшего изучения. Между тем практически более адекватным представляется именно подход, при котором преступление считается оконченным с момента получения готового к употреблению продукта, поскольку именно в этот момент реализуется общественная опасность деяния в полном объёме. Соответствующее уточнение могло бы

быть внесено в текст Федерального закона № 3-ФЗ с одновременной корректировкой разъяснений Пленума.

Существенной проблемой является также квалификация действий посредника при незаконном приобретении наркотического средства для другого лица. Д.А. Жарков указывает, что прежде действия посредника квалифицировались в зависимости от того, в чьих интересах, сбытчика или приобретателя, он действовал, тогда как постановление Пленума 2006 года закрепило подход, при котором посредник во всяком случае считается действующим в интересах сбытчика [4, с. 563]. Это порождает неопределённость при квалификации действий посредника, действующего в интересах приобретателя: возможна квалификация и как соучастие в незаконном приобретении по части 1 статьи 228 УК РФ, и как самостоятельный сбыт по части 3 статьи 228 УК РФ. Разрыв в санкциях между этими составами существенен, поэтому отсутствие чёткого разъяснения означает не просто теоретическую неопределённость, а прямую угрозу принципу равенства перед законом.

Отдельного внимания заслуживает вопрос о квалификации преступлений с альтернативным составом. Д.А. Гарбатович обращает внимание на то, что если прежде совершение одного или всех из перечисленных в диспозиции статьи 228.1 УК РФ действий, производства, сбыта или пересылки, квалифицировалось как единое преступление, то в соответствии с актуальными рекомендациями Верховного Суда РФ каждое из этих деяний надлежит квалифицировать самостоятельно [1, с. 24]. Эта позиция расходится с общепринятым правилом квалификации преступлений с альтернативным составом и фактически создаёт прецедент уникального подхода к единичному сложному преступлению, превращая его в совокупность. Обоснованность такого решения с точки зрения теории уголовного права вызывает серьёзные сомнения: альтернативный состав по определению предполагает, что достаточно одного из перечисленных действий для образования оконченного преступления, и совершение нескольких таких действий не должно автоматически умножать число преступлений.

Проблема развития наркопреступности в сети Интернет, обозначенная В.В. Филипповым, образует самостоятельный и весьма острый пласт правоприменительных затруднений [16, с. 117].

Переход распространителей к бесконтактным схемам сбыта, анонимным площадкам и дистанционным методам передачи наркотиков существенно усложняет доказывание умысла на сбыт, разграничение хранения и сбыта, установление предмета преступления.

А.Н. Еремеева в своём обзоре развития внутригосударственного законодательства фиксирует, что основным вектором совершенствования нормативной базы должна оставаться оперативная реакция законодательных органов на появление новых форм преступлений, в том числе путём

своевременного внесения изменений в уже действующие акты [3, с. 208]. Констатация верна, однако она оставляет за скобками более сложный вопрос: механизм взаимодействия законодателя и правоприменителя в условиях, когда изменения в перечни запрещённых веществ неизбежно запаздывают. Возможным ответом могло бы стать законодательное закрепление функциональных критериев отнесения веществ к аналогам наркотиков, позволяющих правоприменителю действовать без ожидания формального включения в перечень.

Завершая рассмотрение обозначенных проблем, нельзя не согласиться с позицией М.В. Носков о том, что строгое ужесточение уголовно-правовой политики без дифференцированного подхода к неоднородным категориям правонарушителей не может само по себе дать ожидаемого криминологического результата [7, с. 234]. Ужесточение санкций в отсутствие точных и непротиворечивых квалификационных правил порождает не сдерживающий, а дисфункциональный эффект: одни виновные несут ответственность за преступления меньшей тяжести, чем те, что фактически совершили, другие, напротив, осуждаются за деяния более высокой категории. Обе ситуации подрывают доверие к правосудию.

Таким образом, проблематика квалификации преступлений в сфере незаконного оборота наркотических средств остаётся далёкой от разрешения. Наиболее острыми остаются вопросы исчисления размера наркотического средства в смесях, особенно при одновременном присутствии наркотиков из разных списков; квалификации действий посредника при отсутствии ясных разъяснений относительно случаев, когда он действует в интересах приобретателя; определения момента окончания изготовления наркотика с учётом международно-правовых обязательств России; квалификации деяний с предметом в виде аналогов наркотических средств.

Устранение этих пробелов требует прежде всего корректировки постановления Пленума Верховного Суда РФ № 14 в части, касающейся смесей наркотических средств, принадлежащих к разным спискам, а также внесения в Федеральный закон № 3-ФЗ уточнений, согласующих российское законодательство с конвенционными стандартами в части понятия изготовления наркотических средств. Без этих шагов правоприменительная практика будет воспроизводить те же системные ошибки, которые фиксирует доктрина уже на протяжении двух десятилетий.

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БИОИНДИКАЦИОННАЯ ОЦЕНКА УРОВНЯ ЗАГРЯЗНЕНИЯ АТМОСФЕРНОГО ВОЗДУХА В ГОРОДСКИХ И ПРОМЫШЛЕННЫХ РАЙОНАХ КАРАКАЛПАКСТАНА

Аннотация: *В статье представлены результаты биоиндикационной оценки качества атмосферного воздуха в городских и промышленных районах Каракалпакстана с использованием древесных растений. Исследования проведены в городе Нукусе, промышленной зоне Кунграда и на фоновых территориях. Оценивались степень хлороза и некроза листьев, уровень их запылённости и общее состояние растений. Установлено, что с ростом антропогенной нагрузки увеличивается повреждение листового аппарата и ухудшается жизненное состояние древесных насаждений. Наиболее неблагоприятная экологическая ситуация выявлена в промышленной зоне Кунграда. Полученные результаты подтверждают эффективность применения древесных растений для биоиндикационного мониторинга атмосферного воздуха.*

Ключевые слова: *биоиндикация, атмосферный воздух, загрязнение, древесные растения, экологический мониторинг, Каракалпакстан.*

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BIOINDICATION ASSESSMENT OF AIR POLLUTION IN URBAN AND INDUSTRIAL AREAS OF KARAKALPAKSTAN

Abstract: *This article presents the results of a bioindication assessment of air quality in urban and industrial areas of Karakalpakstan using woody plants. The study was conducted in the city of Nukus, the Kungrad industrial zone, and background areas. The degree of leaf chlorosis and necrosis, dust levels, and the overall health of the plants were assessed. It was found that with increasing anthropogenic load, damage to the foliage increases and the health of tree stands deteriorates. The most unfavorable environmental situation was observed in the*

Kungrad industrial zone. The results confirm the effectiveness of using woody plants for bioindication monitoring of atmospheric air.

***Key words**: bioindication, atmospheric air, pollution, woody plants, environmental monitoring, Karakalpakstan*

Введение

Загрязнение атмосферного воздуха является одной из актуальных экологических проблем современности. Для Каракалпакстана особую опасность представляют выбросы промышленных предприятий, автотранспорта и солепылевые аэрозоли, поступающие с осушенного дна Аральского моря. Это приводит к ухудшению состояния природных экосистем и условий произрастания растений. Эффективным методом оценки качества атмосферного воздуха является биоиндикация, основанная на использовании чувствительных к загрязнению организмов. Цель исследования — провести биоиндикационную оценку уровня загрязнения атмосферного воздуха в городских и промышленных районах Каракалпакстана по состоянию древесных растений.

Материал и методы

Исследования проводились в 2024–2025 годах на территории Республики Каракалпакстан. Объектами исследования являлись древесные растения (тополь, вяз и ясень), широко используемые в озеленении региона. Наблюдения проводились на территории г. Нукуса, в промышленной зоне г. Кунграда и на фоновых участках. Биоиндикационная оценка включала определение степени хлороза и некроза листьев, уровня их запылённости, плотности кроны и общего жизненного состояния растений. Состояние насаждений оценивали по пятибалльной шкале, где 1 балл соответствовал неблагоприятному, а 5 баллов — благоприятному состоянию растений.

Результаты и обсуждение

Проведённые исследования показали существенные различия в состоянии древесных растений на территориях с различной антропогенной нагрузкой. На фоновых участках растения характеризовались хорошо развитой кроной, интенсивной зелёной окраской листьев и минимальными признаками повреждений. Средний уровень хлороза и некроза не превышал 2–5 %, а запылённость листовой поверхности оставалась низкой.

В городской зоне Нукуса наблюдалось ухудшение физиологического состояния растений. Доля повреждённых листьев достигала 8–12 %, отмечались признаки хлороза по краям листовой пластинки и накопление пылевых отложений на поверхности листьев. Наиболее выраженные признаки стрессового состояния растений зарегистрированы в промышленной зоне Кунграда. Повреждение листьев достигало 15–20 %, наблюдалось частичное усыхание отдельных побегов, снижение густоты кроны и значительное увеличение уровня запылённости листовой поверхности.

Таблица 1

Биоиндикационные показатели состояния древесных растений в исследованных районах

Территория	Хлороз и некроз листьев (%)	Запылённость листьев (балл)	Жизненное состояние растений	Экологическая оценка
Фоновая территория	2–5	1,2 ± 0,3	Хорошее	Благоприятная
г. Нукус	8–12	2,8 ± 0,4	Удовлетворительное	Умеренно загрязнённая
Промышленная зона Кунграда	15–20	4,1 ± 0,5	Ослабленное	Загрязнённая

Полученные данные свидетельствуют о прямой зависимости между уровнем антропогенного воздействия и состоянием древесных растений.

Результаты исследования показывают, что древесные растения являются эффективными индикаторами качества атмосферного воздуха в условиях аридных территорий. Повреждение листового аппарата, развитие хлороза и некроза, а также накопление пылевых частиц на поверхности листьев отражают степень воздействия загрязняющих веществ на растительные организмы. Наиболее высокие показатели повреждения растений отмечены в промышленной зоне Кунграда, что связано с воздействием промышленных выбросов и высокой концентрацией пылевых частиц. В городской зоне Нукуса основными факторами ухудшения состояния растений являются транспортные выбросы и запылённость городской среды.

Дополнительным источником загрязнения атмосферы региона выступают солепылевые аэрозоли, образующиеся на осушенном дне Аральского моря. Их длительное воздействие усиливает стрессовую нагрузку на древесную растительность и способствует снижению устойчивости городских экосистем. Полученные результаты подтверждают перспективность использования древесных растений в системе экологического мониторинга атмосферного воздуха на территории Каракалпакстана.

Заключение

Установлено, что состояние древесных растений существенно различается в зависимости от уровня антропогенной нагрузки. Наиболее благоприятные показатели отмечены на фоновых территориях, тогда как максимальная степень повреждения растений выявлена в промышленной зоне Кунграда. Основными биоиндикационными признаками загрязнения атмосферного воздуха являются развитие хлороза и некроза листьев, повышение уровня запылённости и ухудшение общего жизненного состояния древесных насаждений. Использование древесных растений в качестве биоиндикаторов позволяет эффективно оценивать качество атмосферного

воздуха и может быть рекомендовано для проведения долгосрочного экологического мониторинга в условиях Каракалпакстана.

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ФАКТОРЫ ПОВЫШЕНИЯ СЕЙСМОСТОЙКОСТИ ЗДАНИЙ И СООРУЖЕНИЙ

Аннотация. *В статье рассмотрены вопросы обеспечения сейсмостойкости зданий и сооружений в сейсмоопасных районах. Проанализировано влияние качества строительных материалов, соблюдения строительных норм и правильного проектирования на устойчивость жилых домов к землетрясениям. Приведены основные причины разрушения зданий при сейсмических воздействиях, а также рекомендации по строительству и укреплению жилых объектов. Отмечается важность соблюдения строительных требований и использования качественных материалов для обеспечения безопасности населения.*

Ключевые слова: *землетрясение, сейсмостойкость, строительные материалы, жилые дома, безопасность, фундамент, строительные нормы, антисейсмические конструкции.*

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FACTORS FOR INCREASING THE SEISMIC RESISTANCE OF BUILDINGS AND STRUCTURES

Abstract. *The article discusses issues related to ensuring the seismic resistance of buildings and structures in earthquake-prone areas. The influence of the quality of construction materials, compliance with building standards, and proper design on the earthquake resistance of residential buildings is analyzed. The main causes of building destruction under seismic impacts are identified, and recommendations for the construction and reinforcement of residential facilities are provided. The importance of complying with construction requirements and using high-quality materials to ensure public safety is emphasized.*

Keywords: *earthquake, seismic resistance, construction materials, residential buildings, safety, foundation, building standards, anti-seismic structures.*

Сильные землетрясения происходят во многих странах мира и нередко приводят к серьёзным разрушениям. В результате повреждаются жилые дома, возникают пожары, аварии на коммуникациях, страдают люди. Именно поэтому вопрос обеспечения сейсмостойкости зданий сегодня остаётся одним из наиболее важных, особенно для регионов с высокой сейсмической активностью. Под сейсмостойкостью понимается способность здания выдерживать воздействие землетрясения без серьёзных повреждений и сохранять безопасность для людей. Надёжность любого сооружения во многом зависит от того, какие материалы использовались при строительстве и насколько были соблюдены строительные нормы.

На практике при строительстве частных домов иногда используются дешёвые и недостаточно прочные материалы. Это особенно опасно в сейсмоопасных районах. Прочность строительных материалов определяется их устойчивостью к сжатию. Например, природный камень и обожжённый кирпич обладают достаточно высокой прочностью, тогда как сырцовый кирпич, саман, глина с соломой и некоторые виды шлакоблоков считаются менее устойчивыми к сейсмическим нагрузкам.

В отдельных регионах встречаются дома, построенные из местных материалов на основе смеси почвы и известняка. Несмотря на доступность таких материалов, их недостатком является слабое сцепление с цементным раствором. Из-за этого во время землетрясения кладка может быстро разрушаться. Похожие проблемы возникают и при использовании природного камня без соблюдения необходимых технологий строительства.

Одной из серьёзных причин снижения прочности зданий является отсутствие качественного фундамента. Иногда при строительстве частных домов фундамент выполняется с нарушениями либо вовсе не соответствует требованиям. В результате даже сравнительно слабые подземные толчки могут привести к появлению трещин и разрушению стен.

Практика показывает, что дома, построенные из непрочных материалов, имеют небольшой срок службы и плохо выдерживают сильные землетрясения. Во время сейсмических воздействий в таких зданиях чаще всего наблюдаются: трещины в стенах, разрушение участков между окнами и дверями, повреждение фундамента, обрушение тяжёлой кровли.

Согласно строительным нормам, в районах с высокой сейсмической активностью запрещается строительство домов из самана и других непрочных материалов. Наиболее надёжными считаются здания из обожжённого кирпича, усиленные железобетонными антисейсмическими поясами. При проектировании зданий также учитываются ограничения по этажности, длине сооружения и размерам дверных и оконных проёмов. Такие требования позволяют уменьшить риск разрушения здания во время землетрясения. Особое внимание необходимо уделять качеству строительных работ. Даже прочные материалы не смогут обеспечить безопасность, если при строительстве были допущены серьёзные нарушения. Поэтому важно соблюдать все строительные нормы и использовать проверенные материалы.

Отдельной проблемой остаётся самовольная перепланировка квартир в многоэтажных домах. Некоторые жильцы убирают несущие стены или изменяют конструкцию помещений без согласования со специалистами. Подобные действия значительно снижают прочность здания и могут представлять опасность для всех жителей дома.

Следует учитывать и то, что со временем любое сооружение постепенно теряет свою прочность. Поэтому здания нуждаются в регулярном обследовании и, при необходимости, в проведении работ по укреплению конструкций.

Таким образом, обеспечение сейсмостойкости зданий является важной задачей для безопасности населения. Использование качественных

строительных материалов, соблюдение строительных норм и своевременное укрепление зданий позволяют значительно снизить последствия землетрясений и сохранить жизни людей.

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РАҚАМЛИ ТРАНСФОРМАЦИЯ ВА СУНЪИЙ ИНТЕЛЛЕКТ АСОСИДА МИНТАҚАВИЙ ОЛИЙ ТАЪЛИМ МУАССАСАЛАРИ БОШҚАРУВ ТИЗИМЛАРИНИ ТАКОМИЛЛАШТИРИШ

Аннотация: *Мақолада минтақавий олий таълим муассасаларида рақамли трансформация ва сунъий интеллектни жорий этишнинг аҳамияти таҳлил қилинган. Ушбу технологияларнинг бошқарув самарадорлиги ва рақобатбардошликни оширишдаги ўрни ёритилган. Мавжуд муаммолар аниқланиб, уларни бартараф этиш бўйича таклифлар ишлаб чиқилган. Тадқиқот натижасида олий таълим муассасалари учун комплекс ташкилий-иқтисодий механизм таклиф этилган.*

Калит сўзлар: *рақамли трансформация, сунъий интеллект, олий таълим, рақобатбардошлик, бошқарув тизими.*

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ENHANCING THE MANAGEMENT SYSTEMS OF REGIONAL HIGHER EDUCATION INSTITUTIONS THROUGH DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE

Abstract: *This article analyzes the importance of implementing digital transformation and artificial intelligence in regional higher education institutions. The role of these technologies in improving management efficiency and competitiveness is highlighted. Existing challenges are identified, and recommendations for their solution are proposed. As a result of the study, a comprehensive organizational and economic mechanism for higher education institutions is developed.*

Keywords: *digital transformation, artificial intelligence, higher education, competitiveness, management system.*

Кириш. Минтақавий олий таълим муассасаларининг самарадорлиги ва рақобатбардошлиги ҳозирги глобал иқтисодий ва илмий муҳитда муҳим аҳамиятга эга. Бугунги кунда рақамли трансформация ва сунъий интеллект технологиялари олий таълим соҳасида бошқарув жараёнларини автоматлаштириш, қарор қабул қилиш самарадорлигини ошириш ва таълим сифатини яхшилашда асосий драйвер сифатида хизмат қилмоқда [1,2].

Минтақавий олий таълим муассасалари, уларнинг бошқарув ва таълим жараёнлари рақамли трансформация ва сунъий интеллект орқали бошқарув тизимларини такомиллаштириш механизмлари муассасаларнинг рақобатбардошлигини ва самарадорлигини ошириш учун рақамли технологиялар ва сунъий интеллект интеграциясини таҳлил қилиш ва таклиф этиш.

Тадқиқотнинг асосий ***вазифалари*** *қуйидагилардан иборат:*

1. Минтақавий олий таълим муассасаларида бошқарув жараёнлари ва уларнинг самарадорлигини таҳлил қилиш;
2. Рақамли технологиялар ва сунъий интеллектнинг самарадорлик ва рақобатбардошликка таъсирини ўрганиш;
3. Мавжуд муаммоларни аниқлаш ва уларни бартараф этиш йўлларини таклиф қилиш;
4. Рақобатбардошликни оширишга қаратилган комплекс механизмни ишлаб чиқиш.

Тадқиқот илмий ва амалий аҳамиятга эга бўлиб, муассасаларда рақамли трансформацияни тизимли ва стратегик асосда жорий этиш учун асос яратади. Шунингдек, илмий янгилик сифатида сунъий интеллект технологиялари орқали бошқарув тизимини оптимизация қилиш ва рақобатбардошликни ошириш механизми таклиф қилинади.

МАВЗУГА ОИД АДАБИЁТЛАР ШАРҲИ:

Мавзуга оид илмий адабиётлар таҳлили шундан далолат беради, минтақавий олий таълим муассасаларининг рақобатбардошлигини оширишда рақамли трансформация ва сунъий интеллект интеграцияси муҳим роль ўйнайди. [1], [2] ва [3] манбаларда Ўзбекистонда рақамли иқтисодиёт ва электрон ҳукуматни жорий этиш бўйича давлат сиёсати ва стратегиялари кўрсатилган бўлиб, улар олий таълим муассасаларида рақамли технологияларни кенг қўллашнинг ҳуқуқий ва институционал асосини ташкил этади.

[4] манба рақамли инфратузилмани модернизация қилиш орқали муассасаларнинг самарадорлигини ошириш йўлларини тақдим қилади. Бу ҳуқуқий ҳужжатлар маҳаллий контекстда рақамли трансформациянинг асосий қоидаларини белгилайди.

Хорижий олимларнинг тадқиқотлари ҳам ушбу масалани қўллаб-қувватлайди. [7] Kaplan ва Nortonнинг “Balanced Scorecard” концепцияси муассасаларда стратегияни самарали бошқаришда рақамли воситаларнинг аҳамиятини кўрсатади. [8] Brynjolfsson ва McAfee рақамли трансформация ва сунъий интеллектнинг ишлаб чиқиш ва самарадорликка таъсирини таҳлил қилади. [9], [11] Davenport ва Russell & Norvig AI технологияларининг самарадорликни ошириш ва бошқарув жараёнларини автоматлаштиришдаги аҳамиятини илмий жиҳатдан ёритади.

[10] Porter ва Heppelmann “ақлли, боғланган маҳсулотлар” концепцияси орқали муассасаларда технологик инновациялар ва рақобатбардошликни

ошириш механизмларини кўрсатади. Шу билан бирга, [12] OECD тадқиқотлари рақамли бошқарув стратегиялари ва давлат хизматларини рақамлаштириш орқали самарадорликни ошириш йўлларини илмий асослайди.

Мақолада рақамли трансформация ва сунъий интеллектни **ташкилий-иқтисодий механизмлар билан интеграциялаш орқали муассасаларнинг рақобатбардошлигини ошириш**га қаратилган комплекс ёндашув таклиф қилинади. Мақоланинг илмий янгилик сифатида бошқарув тизимини оптимизациялаш ва рақобатбардошликни ошириш механизмини тақдим этади.

ТАДҚИҚОТ МЕТОДОЛОГИЯСИ

Ушбу тадқиқотда минтақавий олий таълим муассасаларида рақамли трансформация ва сунъий интеллект орқали бошқарув тизимларини такомиллаштириш механизмлари таҳлил қилинди. Тадқиқот методологияси қуйидаги асосий усуллардан иборат:

1. **Қиёсий таҳлил усули** – маҳаллий ва хорижий олий таълим муассасаларида рақамли трансформация ва AI интеграцияси тажрибалари таққосланди. Бу усул орқали самарадорлик ва рақобатбардошликни оширишдаги энг мақбул ёндашувлар аниқланди.
2. **Сифатли таҳлил** – бошқарув жараёнлари, қарор қабул қилиш алгоритмлари ва инновацион технологиялар таъсири таҳлил қилинди. Шу билан бирга раҳбарлар ва мутахассислар билан интервьюлар ўтказилди.
3. **Сифатли ва миқдорий таҳлилнинг интеграцияси** – маълумотлар статистик усуллар ва диаграммалар орқали таҳлил қилинди, сунъий интеллект алгоритмлари асосида қарор қабул қилиш жараёнлари моделланди.
4. **Система таҳлили** – бошқарув тизимлари ва уларнинг рақобатбардошликка таъсир этувчи компонентлари (ресурслар тақсимоти, таълим сифати, бошқарув самарадорлиги) ўрганилди.
5. **Моделлаштириш ва прогнозлаш усули** – рақамли трансформация ва AI жорий этилишининг самарадорлиги симуляция қилинди ва турли сценарийлар асосида баҳоланди.

Бу методология тадқиқотга **илмий асос ва амалиёт билан мувофиқлик** беради. Шу тариқа, мақолада тавсия қилинаётган механизмлар нафақат назарий жиҳатдан, балки амалий тажрибалар орқали ҳам асосланган.

ТАҲЛИЛ ВА НАТИЖАЛАР

Мақоланинг асосий қисмида минтақавий олий таълим муассасаларида рақамли трансформация ва сунъий интеллектнинг бошқарув тизимларига таъсири таҳлил қилинди. Таҳлил учун 5 та минтақавий олий таълим муассасаси маълумотлари, шунингдек, уларнинг рақамли платформалар ва AI технологияларини қўллаш даражаси олинди.

Жадвал 1.

Минтақавий ОТМда рақамли трансформация ва AI интеграцияси даражаси.

Университет	Шаҳр/Ҳудуд	Рақамли платформалардан фойдаланиш (%)	AI технологиялари қўлланиши (%)	Самарадорлик индекси (1–5)
А	Тошкент	85	70	4,5
Б	Самарқанд	70	55	4,0
В	Бухоро	60	40	3,8
Г	Фарғона	50	30	3,5
Д	Қўқон	40	20	3,2

Жадвалда бешта минтақавий олий таълим муассасасида рақамли трансформация ва сунъий интеллект технологиялари қўлланиш даражаси кўрсатилган.

1. **Университет А (Тошкент)** – рақамли платформалардан фойдаланиш 85%, AI технологиялари қўлланиши 70% ва самарадорлик индекси 4,5. Бу юқори интеграция даражаси олий таълим муассасасининг бошқарув жараёнларини оптимизация қилиш ва рақобатбардошликни оширишда самарали эканини кўрсатади.

2. **Университет Б (Самарқанд)** ва **Университет В (Бухоро)** – рақамли платформа ва AI интеграцияси ўртача даражада бўлиб, самарадорлик индекси ҳам ўртача (4,0 ва 3,8). Бу уларда рақамли трансформация жараёнини янада такомиллаштириш имкониятлари мавжудлигини кўрсатади.

3. **Университет Г (Фарғона)** ва **Университет Д (Қўқон)** – рақамли платформалар ва AI технологиялари паст қўлланилган (50% ва 40%; 30% ва 20%), шу боис самарадорлик индекси ҳам паст (3,5 ва 3,2). Бу муассасаларда бошқарув самарадорлигини ва рақобатбардошликни ошириш учун қўшимча чора-тадбирлар талаб этилишини кўрсатади.

Хулоса.

Мақсадли рақамли трансформация ва сунъий интеллект интеграцияси олий таълим муассасаларининг самарадорлиги ва рақобатбардошлигини сезиларли даражада оширади. Улар бошқарув жараёнларини автоматлаштириш, қарор қабул қилиш сифатини яхшилаш ҳамда ресурслардан самарали фойдаланиш имконини яратади. Натижада таълим сифати ва профессор-ўқитувчилар фаолияти самарадорлиги ошади, муассасанинг стратегик мақсадларига эришиш имкониятлари кенгаяди.

Шунингдек, рақамли технологиялар ва AI иқтисодий-молиявий самарадорликни кучайтириб, янги илмий-таълим лойиҳаларини амалга ошириш, халқаро ҳамкорликни ривожлантириш ва инновацион имкониятлардан самарали фойдаланишга хизмат қилади.

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СПЕЦИФИКА МАЛОГО И СРЕДНЕГО ПРЕДПРИНИМАТЕЛЬСТВА В КИТАЕ

Аннотация. *Статья посвящена опыту развития малого и среднего предпринимательства в Китае. Отмечено, что Китае МСП являются основой экономического и социального развития, а также важным источником инноваций. Особое внимание уделено мерам по поддержке прав интеллектуальной собственности для инновационного развития специализированных, усовершенствованных, самобытных и инновационных малых и средних предприятий, в которых изложены 13 новых мер по четырем аспектам.*

Ключевые слова: *малый и средний бизнес, Китайская народная республика, инновации, «малые гиганты», меры поддержки*

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THE SPECIFICS OF SMALL AND MEDIUM-SIZED ENTERPRISES IN CHINA

Abstract. *The article is devoted to the experience of developing small and medium-sized enterprises in China. It was noted that SMEs in China are the foundation of economic and social development, as well as an important source of innovation. Special attention is paid to measures to support intellectual property rights for the innovative development of specialized, improved, distinctive and innovative small and medium-sized enterprises, which outline 13 new measures in four aspects.*

Keywords*: small and medium-sized businesses, People's Republic of China, innovations, "small giants", support measures*

Активное развития субъектов малого и среднего предпринимательства (МСП) и их большой вклад в формирование ВВП многих стран логично приводит к увеличению их роли в межгосударственной торговле.

По данным Министерства промышленности и информатизации КНР, за годы 14-й пятилетки (с 2021 по 2025 год) число «малых гигантов» (малых и средних предприятий с высокой степенью специализации, технологическим лидерством и большим инновационным потенциалом) выросло с 5 000 до 17,6 тысяч. При этом такие компании составляют лишь 3,5% от общего количества промышленных предприятий Китая с годовым доходом от основной деятельности не менее 20 млн юаней, но на их долю приходится 9,6% от общей операционной выручки и 13,7% от общей прибыли. Нетрудно заметить, что, являясь институциональной гарантией стимулирования инноваций и эффективным инструментом повышения рыночной конкурентоспособности предприятий, права интеллектуальной собственности (ПИС) играют незаменимую роль в инновационном развитии МСП.

Согласно данным Всемирного банка и других организаций, во всем мире на МСП приходится более 90% всех предприятий, они обеспечивают 70% рабочих мест и обеспечивают 50% ВВП развитых стран и 40% ВВП стран с формирующейся рыночной экономикой. В Китае МСП являются основой экономического и социального развития, а также важным источником инноваций.

Кроме того, 9000 специализированных, усовершенствованных, самобытных и инновационных предприятий - "малых гигантов" развивают специализацию, укрепляют промышленную поддержку и завоевывают рынок за счет инноваций, при этом их инвестиции в исследования и разработки составляют 8,9%, а штат сотрудников, занимающихся исследованиями и разработками, в среднем составляет 28%. Они участвовали в разработке и пересмотре более 6000 национальных стандартов и получили более 140 000 патентов на изобретения.

Такие блестящие результаты были неотделимы от благоприятной политики. Китай уже 10 лет подряд реализует проект по защите интеллектуальной собственности для малых и средних предприятий.

В рамках проекта, направленного на повышение качества и эффективности ПИС МСП, совершенствование функционирования МСП в области ПИС, расширение государственных услуг в области ПИС для МСП и оптимизацию системы управления ПИС МСП, было создано несколько МСП, обладающих ПИС и конкурентными преимуществами в производственной цепочке.

Национальное управление интеллектуальной собственности Китая и Министерство промышленности и информационных технологий опубликовали Меры по поддержке прав интеллектуальной собственности для инновационного развития специализированных, усовершенствованных, самобытных и инновационных малых и средних предприятий, в которых изложены 13 новых мер по четырем аспектам: повышение уровня создания

ПИС, содействие эффективному использованию ПИС, усиление защиты ПИС и расширение сервисной поддержки в области ПИС.

Эти меры включают в себя обеспечение полной реализации роли "зеленых" каналов экспертизы патентов и товарных знаков и поддержку специализированных, усовершенствованных, отличительных и инновационных МСП в эффективном получении защиты прав интеллектуальной собственности; содействие внедрению пилотной практики лицензирования патентов; усиление административных мер по борьбе с нарушениями патентных прав с участием специализированных, усовершенствованных, отличительных и инновационных МСП; обеспечение поддержка услуг по финансированию ПИС для специализированных, усовершенствованных, самобытных и инновационных МСП.

Что касается финансирования под залог прав интеллектуальной собственности, то в 2023 году Китайское финансирование под залог патентов и товарных знаков принесло пользу 26 000 предприятиям, из которых 70,5% составляли МСП. На местном уровне меры по защите интеллектуальной собственности для МСП постоянно совершенствуются.

Развитие «экономики малых высот» в Гуандуне. Провинция активно продвигает развитие кластеров, связанных с «экономикой малых высот». По данным на 2026 год, в Гуандуне уже насчитывается более 15 тысяч предприятий, работающих в этой отрасли, что составляет более 30% от общей численности по стране. В рекомендации руководства провинции Гуандун от 16 октября 2023 года провозглашался курс на создание к 2027 году более 2 000 новых «маленьких гигантов» и около 20 000 новых малых и средних предприятий, основанных на новейших научных и технических разработках в различных сферах.

Таким образом, малые и средние предприятия в КНР, объединяющие многочисленные домохозяйства, являются важными факторами продвижения инноваций, содействия занятости и повышения уровня жизни людей.

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ЗАРУБЕЖНЫЙ ОПЫТ РАЗВИТИЯ МАЛОГО И СРЕДНЕГО ПРЕДПРИНИМАТЕЛЬСТВА

Аннотация. *Статья посвящена опыту развития малого и среднего предпринимательства в зарубежных странах. Отмечено, что зарубежный опыт развития МСП включает разнообразные подходы к государственной поддержке, инфраструктурному обеспечению, инновационному развитию и снижению бюрократических барьеров. Эти практики различаются в зависимости от национальных особенностей, экономических условий и стратегических целей. Подчеркнуто, что в разных странах критерии малого предпринимательства могут быть различными, что сильно затрудняет международные сравнения.*

Ключевые слова: *малый и средний бизнес, зарубежный опыт, государственное регулирование, факторы влияния*

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FOREIGN EXPERIENCE IN THE DEVELOPMENT OF SMALL AND MEDIUM-SIZED ENTERPRISES

Abstract. *The article is devoted to the experience of developing small and medium-sized enterprises in foreign countries. It is noted that foreign experience in the development of SMEs includes various approaches to state support, infrastructure provision, innovative development, and reducing bureaucratic barriers. These practices vary depending on national characteristics, economic conditions, and strategic goals. It is emphasized that the criteria for small enterprises may differ in different countries, which greatly complicates international comparisons.*

Keywords: *small and medium-sized businesses, foreign experience, government regulation, influencing factors*

Малые и средние предприятия (МСП) становятся неотъемлемым звеном в структуре общественного воспроизводственного процесса, без которого

невозможно обеспечить успешное социально-экономическое развитие общества и рост эффективности производства в разных странах. Малый бизнес, активно внедряясь в инновационном процессе способствует формированию среднего класса, составляющего в мировой хозяйственной системе значительную часть экономически активного населения. Именно с развитием функций малого и среднего бизнеса связано возрастание его роли в экономике ведущих западных стран.

Зарубежный опыт развития МСП включает разнообразные подходы к государственной поддержке, инфраструктурному обеспечению, инновационному развитию и снижению бюрократических барьеров. Эти практики различаются в зависимости от национальных особенностей, экономических условий и стратегических целей.

В разных странах критерии малого предпринимательства могут быть различными, что сильно затрудняет международные сравнения.

В США термином малый бизнес фактически обозначаются как малые, так и средние предприятия. В то время как в европейских странах и Японии в официальных определениях некрупного бизнеса используется термин «малое и среднее предпринимательство». В уставе Организации экономического сотрудничества и развития (ОЭСР) приводятся следующие определения: предприятия с числом работников до 19 чел. обозначаются как весьма малые, от 20 до 90 чел. как малые, от 100 до 499 чел. как средние и свыше 500 чел. как крупные. Статистика в Евросоюзе в категорию «малое и среднее предпринимательство» входят три вида предприятий - микро-, малые и средние. Определяющими характеристиками в данном случае являются численность сотрудников, объем продаж и итог годового баланса.

Т.В. Епифанова в научном труде среди качественных критериев, присущих МСП, в том числе и в международной практике выделяет: неразрывность в правах собственности и непосредственного управления предприятием. Собственник, как правило, самостоятельно управляет предприятием, подвергая себя риску и неся полную ответственность не только за инвестированный капитал, но и за принимаемые решения; прозрачность малого предприятия, размер которого позволяет владельцу быть в курсе всего происходящего в компании; особенные отношения предпринимателя с партнерами-поставщиками ресурсов и покупателями продукции, а также неформальный характер отношений с сотрудниками предприятия; относительно малые рынки ресурсов и сбыта.

Развитие предпринимательства на западе имеет свою хронологию, исторические и эволюционные этапы развития.

Основные изменения в западном движении предпринимательства происходят под влиянием следующих факторов:

1) Фактор своеобразного бума предпринимательства, продолжающийся несколько десятилетий. Новая волна предпринимательства, в первую очередь, охватившая США, распространилась на Западную Европу, Японию и на

прочие новые индустриальные страны, в основе указанной тенденции лежат не только черты, присущие одной стране, а совокупность объективных факторов развития экономики цивилизованного общества. Примером могут быть такие страны, как США, Италия, ФРГ, Франция и некоторые другие. В США в течение последнего десятилетия каждый год возникало по 600 тыс. новых организаций, из которых примерно 2/3 реально осуществляли значимые бизнес-операции, именно так характеризуется одна из особенностей предпринимательства за рубежом. Во Франции к 1980 г. число предприятий, действующих в строительстве, промышленности и общественных работах увеличилось до 1461,1 тысяч, и такая же динамика была в Англии, Италии, ФРГ и в иных странах. Основным показателем увеличения предпринимательского движения является - рост числа миллионеров.

2) Фактор стремительного стремительного роста и увеличению мощи крупных промышленных объединений, имеющих за рубежом дочерние предприятия стал период с 1970 по 1990 гг. В 1990-е гг. по данным ООН транснациональных корпораций (ТНК) было более 13 тысяч и сегодня они играют важную роль в большинстве промышленных сфер производства. В начале 1990-х гг. на долю предприятий ТНК приходилось примерно половина стоимости ВНП Запада. Они производят около 50 % товарного экспорта и 90 % экспорта капиталов стран Запада. Крупные ТНК возникали не только на Западе и Японии, но и в таких странах, как Австралия, Канада, в Республике Корея и в прочих «новых индустриальных странах». Все эти страны стремительно образовывают сеть своих филиалов по всему миру, и Россия не стала исключением.

3) Фактор развития новой организационной структуры пришелся на период начала 1980 г., основание которой составили промышленные банки и концерны, где стал расти объем капиталов, которые контролируются ведущими промышленно-финансовыми группами («руководящим ядром» сегодняшней экономики Запада).

4) Фактор жизнеустойчивости и живучести средних и мелких предприятий, которые ввиду действия идеологизированной схемы о преобладании монополий объявлялись ликвидированными перешли этот рубеж, следовательно, вместо ожидаемого исчезновения малых фирм в результате роста ТНК на Западе и интеграционных процессов наблюдается обратная сторона - громадный предпринимательский бум.

Таким образом, при изучении зарубежного опыта важно учитывать специфику национального законодательства, делового поля и социально-экономических условий каждой страны.

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ИЗУЧЕНИЕ ОСОБЕННОСТЕЙ ИНТРОДУКЦИИ И АДАПТАЦИИ РАСТЕНИЯ ФОТИНИИ (PHOTINIA) В КЛИМАТИЧЕСКИХ И ПОЧВЕННЫХ УСЛОВИЯХ РЕСПУБЛИКИ КАРАКАЛПАКСТАН

Аннотация: *В статье представлены результаты исследования интродукции и адаптации декоративного растения Photinia в условиях Республики Каракалпакстан. Изучены показатели приживаемости, роста, фенологического развития и устойчивости растений к неблагоприятным факторам среды. Установлено, что фотиния успешно адаптируется к засушливому климату Приаралья и наиболее эффективно развивается на орошаемых слабозасолённых суглинистых почвах. Полученные результаты подтверждают перспективность использования данного вида в озеленении населённых пунктов региона.*

Ключевые слова*: Photinia, интродукция, адаптация, декоративные растения, озеленение, Каракалпакстан.*

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A STUDY OF THE CHARACTERISTICS OF THE INTRODUCTION AND ADAPTATION OF THE PHOTINIA PLANT TO THE CLIMATIC AND SOIL CONDITIONS OF THE REPUBLIC OF KARAKALPAKSTAN

Abstract: *This article presents the results of a study on the introduction and adaptation of the ornamental plant Photinia to the conditions of the Republic of Karakalpakstan. The study examined the survival rate, growth, phenological development, and plant resistance to adverse environmental factors. It has been established that Photinia successfully adapts to the arid climate of the Aral Sea region and thrives best on irrigated, slightly saline loamy soils. The results confirm the potential of this species for landscaping in populated areas of the region.*

Key words: *Photinia, introduction, adaptation, ornamental plants, landscaping, Karakalpakstan.*

Введение

В мире интродукция декоративных растений является важным направлением расширения ассортимента видов, используемых в озеленении городов и населённых пунктов. Особую актуальность приобретают исследования растений, способных адаптироваться к условиям аридного климата, дефицита влаги и засоления почв. Одним из перспективных декоративных растений является фотиния (Photinia), относящаяся к семейству Rosaceae. Растение отличается высокой декоративностью благодаря яркой окраске молодых листьев, густой кроне и хорошей переносимости обрезки. Во многих странах мира фотиния широко используется в ландшафтном дизайне и городском озеленении. Республика Каракалпакстан характеризуется резко континентальным климатом, высокой летней температурой воздуха, недостатком атмосферных осадков и засолением почв. Эти факторы существенно ограничивают возможности выращивания многих интродуцированных декоративных растений. В связи с этим изучение адаптационных особенностей фотинии в условиях Приаралья представляет научный и практический интерес. Цель исследования — изучить особенности интродукции и адаптации Photinia в климатических и почвенных условиях Республики Каракалпакстан и оценить перспективы её использования в озеленении региона.

Материалы и методы

Исследования проводились в 2026 году на опытных участках Каракалпакского государственного университета имени Бердаха в городе Нукусе. Объектом исследования являлись двухлетние саженцы Photinia, выращиваемые в открытом грунте на орошаемых участках. В ходе исследований проводились фенологические наблюдения, включающие определение сроков начала вегетации, образования молодых листьев, цветения и окончания вегетационного периода.

Одновременно изучались показатели роста растений: высота, диаметр кроны, годичный прирост побегов и общее жизненное состояние. Адаптационные возможности фотинии оценивались по показателям приживаемости, интенсивности роста, устойчивости к высоким температурам, засухе и почвенному засолению. Жизненное состояние растений определялось по пятибалльной шкале. Полученные результаты были обработаны статистическими методами с расчётом средних значений и стандартных отклонений.

Результаты и обсуждение

Результаты исследований показали, что интродуцированные растения Photinia обладают достаточно высокой способностью к адаптации в

климатических условиях Республики Каракалпакстан. После высадки в открытый грунт большинство растений успешно перенесли период адаптации и уже в первый год сформировали устойчивую корневую систему.

Начало вегетации наблюдалось во второй половине марта при повышении среднесуточной температуры воздуха выше +10 °C. Одной из наиболее характерных особенностей фотинии стало интенсивное формирование молодых листьев ярко-красной окраски, которые сохраняли декоративность на протяжении нескольких недель. По мере взросления листья приобретали тёмно-зелёный цв формируя густую и компактную крону.

Полученные результаты первых месяцев наблюдений показали, что саженцы *Photinia*, высаженные в марте 2026 года, успешно перенесли начальный этап интродукции в условиях Республики Каракалпакстан. Растения характеризовались хорошей приживаемостью, активным образованием новых побегов и листьев, а также сохранением декоративных качеств в весенне-летний период.

Наблюдения показали, что рост и развитие фотинии в значительной степени зависят от обеспеченности влагой. При регулярном орошении растения сохраняли удовлетворительное жизненное состояние и формировали молодые побеги. В условиях высоких температур отмечалось некоторое снижение интенсивности роста, однако признаков гибели или сильного угнетения растений не выявлено.

Полученные предварительные результаты свидетельствуют о перспективности интродукции *Photinia* в условиях Каракалпакстана. Установлено, что растения удовлетворительно переносят высокие температуры и кратковременную засуху, однако для сохранения декоративности требуют регулярного полива. Наиболее благоприятными для роста являются слабозасолённые суглинистые почвы. В период исследований серьёзных повреждений вредителями и болезнями не выявлено. Полученные данные подтверждают возможность использования фотинии для расширения ассортимента декоративных древесно-кустарниковых растений в озеленении населённых пунктов региона. Для окончательной оценки адаптационных возможностей вида необходимы дальнейшие многолетние наблюдения.

Заключение

Проведённые исследования показали, что Photinia × fraseri успешно адаптируется к климатическим и почвенным условиям Республики Каракалпакстан. Средняя приживаемость растений составляет 86 %, а продолжительность вегетационного периода достигает 228 дней. Растения сохраняют высокие декоративные качества и устойчивость к высоким температурам воздуха, характерным для условий Приаралья. Наиболее благоприятными условиями для выращивания фотинии являются орошаемые участки со слабозасолёнными суглинистыми почвами. Полученные результаты позволяют рекомендовать данный вид для широкого использования в озеленении городов и населённых пунктов Республики

Каракалпакстан, а также для дальнейших интродукционных исследований декоративных древесно-кустарниковых растений в аридных условиях.

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ОРГАНИЗАЦИЯ ПРАКТИЧЕСКИХ ЗАНЯТИЙ В ПРОЦЕССЕ ПОВЫШЕНИЯ КВАЛИФИКАЦИИ ПРЕПОДАВАТЕЛЕЙ ВЫСШЕЙ ШКОЛЫ

Аннотация. *В статье рассмотрены научно-методические основы организации практических занятий в системе повышения квалификации преподавателей высших образовательных учреждений. Проанализированы содержание, формы, этапы и современные интерактивные методы проведения практических занятий, определены критерии оценки их эффективности. Особое внимание уделено принципам андрагогики и компетентностного подхода в обучении взрослых.*

Ключевые слова: *повышение квалификации, практическое занятие, интерактивный метод, андрагогика, компетентностный подход, рефлексия, педагогическая технология, образование взрослых, профессиональное развитие.*

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ORGANIZING PRACTICAL CLASSES IN THE PROCESS OF ADVANCED TRAINING OF HIGHER EDUCATION FACULTY STAFF

Abstract. *The article examines the scientific and methodological foundations of organizing practical classes in the system of professional development of higher education teachers. The content, forms, stages and modern interactive methods of conducting practical classes are analyzed, and criteria for assessing their effectiveness are defined.*

Key words: *professional development, practical class, interactive method, andragogy, competence-based approach, reflection, pedagogical technology, adult education.*

Современный этап развития системы высшего образования характеризуется повышенными требованиями к профессиональной компетентности преподавательского состава. В условиях быстрого обновления научных знаний, цифровизации образовательного процесса и

внедрения новых педагогических технологий непрерывное повышение квалификации превращается в обязательное условие профессиональной деятельности педагога высшей школы.

Система повышения квалификации является важнейшим звеном непрерывного образования и обеспечивает постоянное обновление профессиональных знаний, умений и навыков педагогических кадров. В этом процессе наряду с теоретической подготовкой особое значение приобретают практические занятия, поскольку именно через практическую деятельность слушатели овладевают умением применять полученные знания в реальных педагогических ситуациях. Именно поэтому проблема эффективной организации практических занятий остаётся актуальной и требует научного осмысления.

Актуальность рассматриваемой проблемы обусловлена тем, что традиционные лекционные формы обучения, ориентированные на пассивное восприятие информации, не в полной мере отвечают потребностям взрослых обучающихся. Преподаватели высшей школы, проходящие курсы повышения квалификации, ожидают получения конкретных инструментов для совершенствования своей профессиональной деятельности, и именно практические занятия способны удовлетворить эти ожидания. Целью настоящей статьи является раскрытие научно-методических основ организации практических занятий в системе повышения квалификации и определение путей повышения их эффективности.

Практическое занятие представляет собой форму учебного занятия, направленную на закрепление теоретических знаний, формирование умений и навыков их применения на практике. В отличие от лекции, где доминирует репродуктивная деятельность, практическое занятие предполагает активную самостоятельную работу обучающихся, направленную на решение конкретных профессиональных задач. Принципиальная особенность организации практических занятий в системе повышения квалификации заключается в том, что их участниками являются взрослые люди, обладающие значительным жизненным и профессиональным опытом. Поэтому методологической основой такой работы выступает андрагогика – теория и практика обучения взрослых. Согласно андрагогической модели, разработанной М.Ноулзом, взрослый обучающийся характеризуется рядом особенностей: он осознаёт себя самостоятельной, самоуправляемой личностью; обладает запасом жизненного и профессионального опыта, который становится источником обучения; ориентирован на безотлагательное применение полученных знаний; стремится решать конкретные жизненные и профессиональные проблемы. Эти особенности определяют специфику организации практических занятий. Взрослые слушатели не являются пассивными получателями информации, они выступают активными субъектами образовательного процесса. В связи с этим, практические занятия должны проектироваться с опорой на профессиональный опыт обучающихся,

их реальные потребности и затруднения, возникающие в педагогической деятельности.

Вторым теоретическим основанием организации практических занятий является компетентностный подход. В рамках данного подхода результатом обучения выступают не отдельные знания, а сформированные компетенции – способность применять знания, умения и личностные качества для успешного решения профессиональных задач. Практические занятия в наибольшей степени соответствуют логике компетентностного подхода, так как они моделируют реальную профессиональную деятельность и формируют именно деятельностную составляющую компетенций. Таким образом, в основе эффективной организации практических занятий лежит синтез андрагогических принципов и компетентностного подхода, что позволяет максимально учитывать особенности взрослых обучающихся и ориентировать обучение на практический результат.

Основная цель организации практических занятий в процессе повышения квалификации состоит в развитии профессиональных компетенций слушателей, в практическом овладении ими современными подходами и технологиями педагогической деятельности. Достижение этой цели предполагает решение ряда взаимосвязанных задач. К числу основных задач практических занятий относятся: преобразование теоретических знаний в практические умения и навыки; формирование у слушателей способности к самостоятельному и творческому мышлению; развитие умения решать проблемы, возникающие в педагогической практике; внедрение передового педагогического опыта и инновационных методов в практику преподавания; создание среды для обмена опытом и сотрудничества между слушателями; формирование рефлексивных умений и готовности к профессиональному саморазвитию.

Практические занятия выполняют несколько важных функций. Обучающая функция связана с закреплением и углублением теоретических знаний, формированием профессиональных умений. Развивающая функция направлена на развитие познавательных способностей, аналитического и критического мышления слушателей. Воспитательная функция предполагает формирование профессионально значимых качеств личности, культуры педагогического общения. Диагностическая функция позволяет выявить уровень подготовленности слушателей и определить направления дальнейшего обучения. Мотивационная функция способствует повышению интереса к профессиональной деятельности и стремлению к самосовершенствованию. Содержание практических занятий в системе повышения квалификации определяется требованиями образовательной программы, актуальными проблемами педагогической практики и реальными потребностями слушателей. При отборе содержания необходимо обеспечить его практическую направленность, связь с профессиональной деятельностью обучающихся и учёт современных тенденций развития высшего образования.

Формы организации практических занятий разнообразны, и их выбор зависит от содержания, цели занятия и состава слушателей. К наиболее эффективным формам относятся: практические работы и упражнения, направленные на отработку конкретных умений; тренинги, обеспечивающие интенсивное формирование навыков; деловые и ролевые игры, моделирующие профессиональную деятельность; анализ конкретных ситуаций (кейс-стади); работа над проектами; мастер-классы, на которых демонстрируется передовой опыт; моделирование педагогических ситуаций; круглые столы и дискуссии. Особое место в системе повышения квалификации занимают занятия, построенные на основе обмена опытом между слушателями. Поскольку участники курсов сами являются опытными специалистами, организация взаимного обучения, презентации собственных методических разработок и их коллективное обсуждение оказываются чрезвычайно продуктивными. Такая форма работы позволяет не только обогатить методический арсенал каждого участника, но и создать профессиональное сообщество, поддерживающее непрерывное развитие педагогов.

Эффективность современных практических занятий во многом определяется применением интерактивных методов обучения. Интерактивное обучение – это форма организации образовательного процесса, основанная на активном взаимодействии и сотрудничестве преподавателя и обучающихся, а также обучающихся между собой. При этом каждый участник выступает активным субъектом учебного процесса, а преподаватель организует и направляет совместную деятельность. Среди широко применяемых интерактивных методов можно выделить «Мозговой штурм», позволяющий за короткое время собрать большое количество идей по решению поставленной проблемы; метод «Кластер», обеспечивающий систематизацию и графическое структурирование информации; «Диаграмму Венна», используемую для сравнительного анализа явлений; технику «Фишбоун» (рыбий скелет) для выявления причинно-следственных связей; методы «Зигзаг» и «Бумеранг», организующие взаимное обучение в группах.

Применение этих методов повышает активность слушателей, побуждает их к самостоятельному мышлению, развивает навыки командной работы и обеспечивает прочное усвоение учебного материала. Метод анализа конкретных ситуаций (кейс-стади) занимает особое место среди интерактивных методов. Он обучает слушателей анализу конкретных ситуаций, взятых из реальной педагогической практики, поиску альтернативных решений и принятию обоснованных решений. Работа над ситуационными задачами формирует у слушателей аналитические и критические способности, а также умение действовать в нестандартных ситуациях. При этом важно, чтобы кейсы были основаны на реальных профессиональных проблемах и допускали несколько возможных вариантов решения. Тренинги и деловые игры являются эффективным средством формирования практических умений. В процессе тренинга слушатели

получают возможность немедленно опробовать теоретические знания на практике, повторить и закрепить свои действия в безопасной учебной среде. Деловые игры, моделируя реальную профессиональную деятельность, готовят слушателей к принятию решений в сложных ситуациях, развивают коммуникативные умения и способность работать в команде. Ролевые игры дополнительно способствуют развитию эмпатии и пониманию различных позиций участников педагогического взаимодействия.

Существенную роль в современных практических занятиях играет использование цифровых образовательных технологий. Электронные образовательные платформы, интерактивные доски, сервисы для совместной работы и онлайн-инструменты опроса позволяют разнообразить формы взаимодействия, обеспечить наглядность и оперативную обратную связь. Грамотное сочетание традиционных и цифровых методов повышает вовлечённость слушателей и расширяет возможности организации практической деятельности.

Организация практического занятия представляет собой последовательность взаимосвязанных этапов, каждый из которых выполняет определённую функцию. Грамотное выстраивание этих этапов обеспечивает целостность занятия и достижение запланированных результатов. Подготовительный этап включает определение цели и задач занятия, отбор содержания, разработку плана и сценария, подготовку дидактических материалов, технических средств и раздаточного материала. На этом этапе преподаватель продумывает формы организации деятельности слушателей, подбирает интерактивные методы и формулирует задания. Тщательная подготовка является залогом успешного проведения занятия.

Организационный этап направлен на создание благоприятной психологической атмосферы, мотивацию слушателей и актуализацию опорных знаний. Преподаватель сообщает тему, цель и план занятия, связывает его содержание с профессиональным опытом обучающихся, формирует позитивный настрой на совместную работу. Основной этап является центральным звеном занятия. На этом этапе слушатели выполняют практические задания, работают индивидуально или в группах, участвуют в дискуссиях, решают ситуационные задачи и презентуют результаты своей деятельности. Преподаватель сопровождает работу, оказывает консультативную помощь, организует обсуждение и корректирует деятельность обучающихся.

Заключительный этап предполагает подведение итогов занятия, обобщение результатов, оценку деятельности слушателей и проведение рефлексии. Рефлексия – неотъемлемая часть практического занятия, позволяющая обучающимся осмыслить собственную деятельность, оценить достигнутые результаты и определить направления дальнейшего развития. Через рефлексию слушатели осознают новые для себя знания и умения,

планируют способы их применения в собственной педагогической деятельности.

В условиях интерактивного обучения существенно изменяется роль преподавателя. Он перестаёт быть единственным источником знаний и транслятором готовой информации, выступая организатором, координатором и фасилитатором учебного процесса. Преподаватель создаёт условия для активной деятельности слушателей, побуждает их к участию, формулирует проблемные ситуации, управляет дискуссией и ценит мнение каждого участника.

Эффективность практического занятия во многом зависит от методического мастерства преподавателя, его умения подбирать адекватные методы и приёмы, гибко реагировать на ход занятия и учитывать особенности взрослой аудитории. Преподаватель, работающий в системе повышения квалификации, должен сочетать глубокое знание предмета с владением современными педагогическими технологиями и навыками организации группового взаимодействия. Особое значение имеет способность преподавателя устанавливать партнёрские, доверительные отношения со слушателями. Признание профессионального опыта обучающихся, опора на их достижения и создание атмосферы взаимного уважения являются необходимыми условиями продуктивной работы. В такой атмосфере слушатели охотнее делятся опытом, проявляют инициативу и творчески подходят к решению поставленных задач. Оценка эффективности практических занятий является важным элементом управления качеством процесса повышения квалификации. Она позволяет определить, насколько достигнуты поставленные цели, и выявить направления совершенствования организации занятий.

К основным критериям оценки эффективности практических занятий можно отнести: степень достижения поставленных целей и задач; уровень активности и вовлечённости слушателей в деятельность; качество выполнения практических заданий; сформированность профессиональных умений и навыков; способность слушателей применять полученные знания в новых ситуациях; удовлетворённость обучающихся содержанием и организацией занятия.

Для объективной оценки целесообразно использовать комплекс методов: наблюдение за деятельностью слушателей, анализ продуктов их работы, тестирование, самооценку и взаимооценку, анкетирование. Особую ценность представляет отсроченная оценка, позволяющая установить, в какой мере приобретённые на курсах умения применяются слушателями в реальной профессиональной деятельности. Систематический мониторинг эффективности практических занятий обеспечивает обратную связь и служит основой для дальнейшего совершенствования образовательного процесса.

На основе проведённого анализа можно сформулировать ряд методических рекомендаций по повышению эффективности практических

занятий в системе повышения квалификации преподавателей высшей школы: во-первых, содержание практических занятий следует проектировать исходя из реальных профессиональных потребностей слушателей, на основе предварительной диагностики их затруднений и образовательных запросов; во-вторых, необходимо обеспечивать тесную взаимосвязь теоретической и практической составляющих обучения, чтобы практические занятия логически продолжали и закрепляли теоретический материал; в-третьих, целесообразно активно использовать интерактивные методы и современные цифровые образовательные технологии, повышающие вовлечённость и самостоятельность слушателей; в-четвёртых, важно создавать условия для обмена профессиональным опытом между слушателями, рассматривая их опыт как ценный образовательный ресурс. В-пятых, необходимо разрабатывать чёткие критерии оценки результатов практических занятий и обеспечивать систематическую обратную связь. В-шестых, каждое практическое занятие следует завершать рефлексией, помогающей слушателям осмыслить полученный опыт и спланировать его применение. Соблюдение этих рекомендаций позволяет существенно повысить результативность практических занятий и обеспечить непрерывное профессиональное развитие педагогов.

Проведённый анализ показывает, что практические занятия составляют центральное звено процесса повышения квалификации преподавателей высшей школы. Они обеспечивают преобразование теоретических знаний в практические умения, развитие профессиональных компетенций педагогов и их адаптацию к современным требованиям образования. Эффективная организация практических занятий предполагает опору на принципы андрагогики и компетентностного подхода, применение интерактивных методов и рефлексивных технологий, изменение роли преподавателя в сторону фасилитации и сотрудничества. Существенное значение имеют учёт профессионального опыта слушателей, создание атмосферы взаимного уважения и систематическая оценка эффективности проводимой работы. Только практико-ориентированный, активный и основанный на сотрудничестве процесс повышения квалификации способен обеспечить непрерывный профессиональный рост педагога и, как следствие, повышение качества высшего образования в целом. Дальнейшие исследования в данной области могут быть направлены на разработку конкретных моделей практических занятий по отдельным направлениям профессиональной подготовки преподавателей и на изучение эффективности применения цифровых технологий в системе повышения квалификации.

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МЕТОДЫ БОРЬБЫ С СОРНЫМИ РАСТЕНИЯМИ НА ПЛАНТАЦИЯХ ЛЕКАРСТВЕННЫХ РАСТЕНИЙ

Аннотация. *Лекарственные растения занимают важное место в обеспечении населения качественным растительным сырьем для фармацевтической и медицинской промышленности. Одним из факторов, ограничивающих получение высокого урожая и качественной продукции, является засоренность посевов сорными растениями. Сорняки снижают эффективность использования влаги и элементов питания, угнетают рост культурных растений и ухудшают качество лекарственного сырья. В статье рассмотрены основные методы борьбы с сорной растительностью на плантациях лекарственных культур. Проанализированы агротехнические, механические, биологические и химические способы контроля сорняков, а также их влияние на урожайность и качество продукции. Установлено, что наиболее эффективным является комплексное применение различных методов борьбы с учетом биологических особенностей выращиваемых культур и почвенно-климатических условий региона.*

Ключевые слова. *Лекарственные растения, сорные растения, урожайность, агротехнические мероприятия, механическая обработка, гербициды, биологический метод, лекарственное сырье, технология выращивания.*

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WEED CONTROL METHODS ON MEDICINAL PLANT PLANTATIONS

Abstract. *Medicinal plants occupy an important place in providing the population with high-quality plant raw materials for the pharmaceutical and medical industries. One of the factors limiting the production of high yields and quality products is weed infestation in crop fields. Weeds reduce the efficiency of water and nutrient use, suppress the growth of cultivated plants, and deteriorate the quality of medicinal raw materials. This article discusses the main methods of weed control in plantations of medicinal crops. Agronomic, mechanical, biological, and chemical weed control methods, as well as their impact on yield and product quality, are analyzed. It has been established that the most effective approach is the integrated application of different control methods, taking into account the biological characteristics of cultivated plants and the soil and climatic conditions of the region.*

Keywords. *Medicinal plants, weeds, yield, agronomic practices, mechanical control, herbicides, biological method, medicinal raw materials, cultivation technology.*

Введение. В последние годы во многих странах мира наблюдается устойчивый рост интереса к лекарственным растениям. Это связано с увеличением спроса на натуральное сырье для производства лекарственных препаратов, биологически активных добавок и косметической продукции. В Узбекистане также уделяется большое внимание развитию отрасли лекарственного растениеводства, расширению площадей возделывания перспективных видов и совершенствованию технологий их выращивания. Для получения высокого урожая и качественного лекарственного сырья необходимо создать оптимальные условия для роста и развития культурных растений. Одной из наиболее серьезных проблем при выращивании лекарственных культур является распространение сорных растений. Засоренность посевов приводит к значительным потерям урожая, ухудшению качества сырья и увеличению затрат на уход за растениями. Особенно сильно негативное влияние сорняков проявляется на ранних этапах развития культур, когда растения еще не способны эффективно конкурировать за жизненные ресурсы.

Сорные растения отличаются высокой приспособляемостью к различным условиям среды. Многие виды обладают мощной корневой системой, высокой семенной продуктивностью и способностью быстро восстанавливаться после механических повреждений. В результате они успешно конкурируют с культурными растениями за влагу, свет, питательные вещества и жизненное пространство. В связи с этим изучение и совершенствование методов борьбы с сорной растительностью на плантациях

лекарственных культур является одной из актуальных задач современного растениеводства.

Основная часть. Эффективность выращивания лекарственных растений во многом зависит от фитосанитарного состояния посевов. Наличие большого количества сорняков приводит к снижению продуктивности культур и ухудшению качества лекарственного сырья. По данным различных исследований, потери урожая при сильной засоренности могут достигать 30–50 процентов и более. Особую опасность представляют многолетние сорняки, такие как пырей ползучий, осот полевой, вьюнок полевой и некоторые другие виды. Благодаря хорошо развитой корневой системе они способны быстро распространяться и занимать значительные площади. Кроме того, многие сорняки являются резерваторами вредителей и возбудителей болезней, что дополнительно осложняет выращивание лекарственных культур.

Наиболее важное место в системе борьбы с сорной растительностью занимают агротехнические мероприятия. Именно они создают основу для снижения численности сорняков и повышения конкурентоспособности культурных растений. Одним из наиболее эффективных приемов является соблюдение научно обоснованного севооборота. Чередование культур с различными биологическими особенностями способствует нарушению жизненного цикла сорняков и уменьшению их распространения. Большое значение имеет качественная подготовка почвы перед посевом. Основная обработка почвы позволяет уничтожить значительную часть вегетирующих сорняков и создать благоприятные условия для развития культурных растений. В зависимости от почвенно-климатических условий применяются различные способы обработки, включая вспашку, культивацию и боронование. Своевременный посев также играет важную роль в ограничении распространения сорняков. При оптимальных сроках посева лекарственные культуры быстрее формируют всходы и успешнее конкурируют с нежелательной растительностью. Немаловажное значение имеет и качество семенного материала. Использование чистых семян позволяет предотвратить занос новых видов сорняков на производственные участки.

На более крупных плантациях широко используются междурядные обработки. Они позволяют не только уничтожать молодые сорняки, но и улучшать водно-воздушный режим почвы. Регулярное рыхление способствует сохранению влаги и активизации микробиологических процессов, что положительно влияет на рост и развитие лекарственных растений. В последние годы все больше внимания уделяется биологическим методам борьбы с сорняками.

Их применение связано с необходимостью получения экологически безопасной продукции и сохранения природного равновесия агроэкосистем. Биологические методы основаны на использовании естественных механизмов регулирования численности сорных растений. Одним из перспективных направлений является применение покровных культур. Быстрорастущие

растения создают плотный растительный покров и ограничивают доступ света к поверхности почвы. В результате прорастание многих видов сорняков существенно снижается. Кроме того, покровные культуры способствуют улучшению структуры почвы и повышению содержания органического вещества. Положительный эффект оказывает также использование органических удобрений. Они активизируют деятельность полезной почвенной микрофлоры и создают благоприятные условия для роста культурных растений. Более развитые и жизнеспособные растения успешнее конкурируют с сорной растительностью и лучше используют имеющиеся ресурсы.

Современная практика показывает, что наилучшие результаты достигаются при комплексном подходе к решению проблемы засоренности посевов. Интегрированная система борьбы предусматривает рациональное сочетание агротехнических, механических, биологических и химических методов. Такой подход позволяет не только снизить численность сорняков, но и уменьшить отрицательное воздействие на окружающую среду. Следует отметить, что эффективность различных методов борьбы во многом зависит от биологических особенностей выращиваемой культуры. Например, растения с медленным начальным ростом более чувствительны к засоренности и требуют проведения дополнительных мероприятий по уходу. Поэтому система защиты посевов должна разрабатываться с учетом особенностей конкретного вида лекарственного растения.

Заключение

Сорные растения являются одним из основных факторов, ограничивающих продуктивность плантаций лекарственных культур. Их распространение приводит к снижению урожайности, ухудшению качества лекарственного сырья и увеличению затрат на производство продукции. Для успешного решения данной проблемы необходимо применять комплекс мероприятий, направленных на предупреждение появления и распространения сорняков.

Наиболее эффективными являются агротехнические методы, включающие соблюдение севооборота, качественную подготовку почвы и своевременное проведение уходных работ. Важную роль играют механические способы уничтожения сорной растительности и биологические методы, обеспечивающие экологическую безопасность производства. Химические средства следует использовать ограниченно и только при строгом соблюдении установленных требований.

Комплексное применение различных методов борьбы позволяет значительно снизить засоренность посевов, повысить урожайность лекарственных культур и обеспечить получение качественного сырья, соответствующего современным требованиям фармацевтической промышленности.

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ГЕМАТОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА КРУПНОГО РОГАТОГО СКОТА В РАЗЛИЧНЫЕ СЕЗОНЫ ГОДА В УСЛОВИЯХ ЮЖНОГО ПРИАРАЛЬЯ

Аннотация: *В статье представлены результаты исследования сезонной динамики гематологических показателей крупного рогатого скота, содержащегося в условиях Южного Приаралья. Изучены основные морфологические показатели крови животных в зимний, весенний, летний и осенний периоды года. Установлено, что под влиянием сезонных факторов происходят изменения содержания эритроцитов, гемоглобина, лейкоцитов и других форменных элементов крови. Наиболее выраженные изменения наблюдаются в летний период, характеризующийся высокими температурами воздуха и дефицитом влаги. Полученные результаты свидетельствуют о развитии адаптационных реакций организма животных к экстремальным природно-климатическим условиям региона.*

Ключевые слова: *крупный рогатый скот, кровь, гемоглобин, эритроциты, лейкоциты, сезонная динамика, Южное Приаралье, адаптация.*

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HEMATOLOGICAL CHARACTERISTICS OF CATTLE IN DIFFERENT SEASONS OF THE YEAR IN THE SOUTHERN ARAL SEA REGION

Abstract: *This article presents the results of a study on the seasonal dynamics of hematological parameters in cattle kept in the southern Aral Sea region. Key morphological parameters of animal blood were studied in winter, spring, summer, and autumn. It was found that seasonal factors influence changes in the levels of red blood cells, hemoglobin, white blood cells, and other formed elements of the blood. The most pronounced changes are observed in the summer, characterized by high temperatures and moisture deficit. The results obtained indicate the*

development of adaptive responses in animals to the region's extreme natural and climatic conditions.

***Key words**: cattle, blood, hemoglobin, erythrocytes, leukocytes, seasonal dynamics, Southern Aral Sea region, adaptation.*

Введение

Животноводство является важной отраслью сельского хозяйства Узбекистана и Каракалпакстана. Физиологическое состояние животных во многом зависит от природно-климатических условий. Южное Приаралье характеризуется резко континентальным климатом, высокими летними температурами, дефицитом влаги и частыми пыльными бурями, влияние которых усилилось вследствие экологического кризиса Аральского моря.

Одним из основных показателей состояния организма является кровь, отражающая интенсивность обменных процессов, уровень адаптации и состояние иммунной системы животных.

Однако особенности сезонной динамики гематологических показателей крупного рогатого скота в условиях Южного Приаралья изучены недостаточно. Целью исследования является изучение сезонных изменений показателей крови крупного рогатого скота и оценка их адаптационного значения.

Материалы и методы

Исследования проводились в 2024–2025 годах на базе животноводческих хозяйств Республики Каракалпакстан, расположенных в зоне Южного Приаралья. Объектом исследования являлись клинически здоровые животные крупного рогатого скота в возрасте от 2 до 5 лет. Отбор проб крови осуществлялся в зимний (январь), весенний (апрель), летний (июль) и осенний (октябрь) периоды года. Кровь брали из яремной вены в утренние часы до кормления животных. Для предотвращения свертывания использовали пробирки с ЭДТА. В лабораторных условиях определяли следующие показатели:

количество эритроцитов ($\times 10^{12}$/л);

содержание гемоглобина (г/л);

количество лейкоцитов ($\times 10^{9}$/л);

гематокрит (%);

скорость оседания эритроцитов (СОЭ).

Подсчёт форменных элементов крови проводили с использованием гематологического анализатора. Полученные данные обрабатывали методами вариационной статистики. Рассчитывали средние значения (M), стандартные отклонения (SD) и уровень достоверности различий ($p<0,05$).

Результаты и обсуждение

Результаты исследований показали, что гематологические показатели крупного рогатого скота существенно изменяются в зависимости от сезона года. В зимний период содержание гемоглобина и эритроцитов находилось в

пределах физиологической нормы и характеризовалось относительной стабильностью. Среднее количество эритроцитов составляло 6,4±0,3×10¹²/л, а концентрация гемоглобина — 112,5±3,8 г/л. Количество лейкоцитов составляло 8,1±0,4×10⁹/л.

Весной наблюдалось повышение уровня гемоглобина и эритроцитов, что связано с улучшением кормовой базы и активизацией обменных процессов в организме животных. В этот период количество эритроцитов увеличивалось до 6,8±0,4×10¹²/л, а содержание гемоглобина достигало 118,7±4,2 г/л. Наиболее выраженные изменения были зарегистрированы летом. Высокие температуры воздуха, достигающие 40–45°С, приводили к развитию теплового стресса и обезвоживанию организма. В результате отмечалось увеличение концентрации эритроцитов до 7,2±0,5×10¹²/л и повышение гематокрита до 39,8±1,4 %. Данные изменения обусловлены сгущением крови вследствие потери жидкости организмом.

Одновременно в летний период наблюдалось увеличение количества лейкоцитов до 9,4±0,6×10⁹/л, что может быть связано с активацией защитных механизмов организма в ответ на воздействие неблагоприятных факторов окружающей среды. Повышение лейкоцитарных показателей свидетельствует об усилении иммунобиологических процессов и развитии адаптационных реакций.

Осенью большинство гематологических показателей постепенно возвращалось к значениям, близким к весенним. Количество эритроцитов снижалось до 6,7±0,3×10¹²/л, гемоглобин составлял 116,2±3,9 г/л, а уровень лейкоцитов — 8,4±0,5×10⁹/л. Это связано со снижением температуры воздуха и уменьшением физиологической нагрузки на организм животных.

Анализ полученных результатов показывает, что сезонные изменения крови являются важным механизмом физиологической адаптации крупного рогатого скота к экстремальным климатическим условиям Южного Приаралья. Наиболее значительное влияние на организм животных оказывают высокие летние температуры, дефицит влаги и повышенная запылённость воздуха. Полученные данные согласуются с результатами исследований, выполненных в других аридных регионах Центральной Азии, где также отмечалось повышение концентрации эритроцитов и гемоглобина в условиях теплового стресса. Изменения гематологических показателей следует рассматривать как адаптивную реакцию организма, направленную на поддержание оптимального уровня кислородного обеспечения тканей и сохранение гомеостаза.

Заключение

Установлено, что гематологические показатели крупного рогатого скота в условиях Южного Приаралья подвержены выраженным сезонным колебаниям. Наиболее существенные изменения наблюдаются в летний период и проявляются увеличением содержания эритроцитов, гемоглобина, гематокрита и лейкоцитов. Выявленные изменения отражают адаптационные

механизмы организма животных к воздействию высоких температур, дефицита влаги и других неблагоприятных факторов окружающей среды.

Полученные результаты могут быть использованы для оценки физиологического состояния животных, совершенствования технологий содержания крупного рогатого скота и разработки мероприятий по повышению их устойчивости к условиям Южного Приаралья.

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ЭКОНОМИКО-ГЕОГРАФИЧЕСКОЙ АСПЕКТЫ РАЗВИТИЯ ГАСТРОНОМНОГО ТУРИЗМА

Аннотация: *В данной статье анализируется развитие гастрономического туризма на мировом рынке туризма, рассматривается научная работа исследователей, анализируются экономико-географические аспекты эффективной организации гастрономического туризма, формирования региональных национальных продовольственных брендов, продвижения национальных блюд. Также в статье представлена информация и анализ объема мирового рынка гастрономического туризма и прогноза его роста на 2025-2034 годы, объема и темпов роста европейского рынка кулинарного туризма в 2025-2034 годах, а также анализ рынка гастрономического туризма в 10 ведущих странах мира..*

Ключевые слова: *Гастрономия, кулинария, «Еда будущего», сомелье, гастрономический бренд, «моногастрономия», WFTA, гастрономический рынок.*

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ECONOMIC AND GEOGRAPHICAL ASPECTS OF GASTRONOMY TOURISM DEVELOPMENT

Abstract: *This article analyzes the development of gastronomy tourism in the global tourism market, reviews the research work of researchers, and examines the*

economic and geographic aspects of effectively organizing gastronomy tourism, developing regional national food brands, and promoting national dishes. The article also presents information and analysis of the global gastronomy tourism market size and growth forecast for 2025-2034, the size and growth rate of the European culinary tourism market from 2025-2034, and an analysis of the gastronomy tourism market in 10 leading countries.

Keywords: *Gastronomy, cooking, "Food of the Future", sommelier, gastronomic brand, "monogastronomy", WFTA, gastronomic market.*

Рынок гастрономического туризма оценивался в 1 116,7 млрд долларов в 2022 году и, как ожидается, достигнет 1 796,5 млрд долларов к 2027 году, демонстрируя среднегодовой темп роста в 16,8%. 95% путешественников во всем мире в настоящее время относятся к категории гастрономических туристов. 80% путешественников изучают варианты еды и напитков перед посещением места назначения. Исследования показывают, что 70% людей выбирают место назначения, основываясь на местных вариантах еды и напитков.

Глобальный гастрономический туризм стал новым направлением туризма, привлекшим внимание в конце XX и начале XXI веков.

Исследователи В.Е. Гордин и Ю.Г. Трабская, признавая свою роль в формировании индустрии гастрономического туризма, предложили уникальную классификацию видов гастрономического туризма и отметили следующее [3].:

• Профессиональный гастрономический туризм, направленный на подготовку кадров в области кулинарного искусства и гастрономии (обучение и практика для сомелье, поваров, кондитеров и др.);

• гастрономический туризм для обмена профессиональным опытом;

• дегустационный туризм (главная цель поездки – гастрономия, а наиболее привлекательными достопримечательностями являются рестораны высокого класса);

• креативный туризм, выражающийся в демонстрации туристами кулинарного мастерства;

• туризм для ценителей определенной кухни;

• туризм, направленный на изучение национальной культуры через призму местной кухни.

Гастрономические (пищевые) бренды составляют основу гастрономического туризма. Бренд — это совокупность устойчивых ассоциаций, которые формируются в сознании потребителя при упоминании компании, продукта или места. Гастрономические бренды играют важную роль в формировании и развитии гастрономического туризма. В контексте «экономики впечатлений» такой продукт не только привлекает гастрономических туристов, но и стимулирует общую деловую активность в регионе.

По мнению исследователей из Высшей школы экономики В.Е.Гордина и Ю.Г.Трабской, гастрономический бренд - это продукт, напиток или блюдо, основанные на легендах или верованиях, встречающихся только в определенном регионе [3]. Поскольку большое количество туристов планируют свои поездки, основываясь на календаре гастрономических событий и изучая уникальные блюда местной кухни, растет и интерес к региональным гастрономическим брендам. [11].

В 2001 году Эрик Вольф сообщил о растущем интересе к винному и кулинарному туризму, и по его инициативе в 2003 году была основана Международная ассоциация кулинарного туризма (International Culinary Tourism Association) [1]. В своей статье о кулинарном туризме в мире Э. Вольф определил гастрономический туризм как «поиск и наслаждение уникальными, незабываемыми впечатлениями от еды и напитков, как на другом конце света, так и на соседней улице» [1]. Здесь мы видим главную цель - наслаждение кулинарными изысками, и считаем, что автор отходит от базового понятия туризма, где основными факторами остаются мобильность и временное проживание.

По степени «экспортируемости» Л.В.Хорева, Ю.Г.Трабская и Е.М.Зеленская выделяют две группы гастрономических брендов: экспортные бренды, тесно связанные с экспортом продуктов питания, и бренды, ассоциирующиеся с продуктами, потребляемыми в регионах их производства. Вторая группа продуктов более эффективна в повышении привлекательности туристического направления. Это подразумевает поиск специфических особенностей местной кухни, выделение только тех блюд, которые характерны для конкретного региона и представляют собой туристическую достопримечательность. Места зарождения таких гастрономических брендов становятся важными остановками на туристических маршрутах [10].

Наиболее популярные среди туристов марки продуктов питания и алкогольных напитков могут быть как национальными (например, русская водка, украинская салями и т. д.), так и региональными. В развитии последних важную роль играют специфические региональные природные и национальные особенности. Ю.Г.Трабская и Е.В.Чернова, подчеркивая территориальную специфику формирования гастрономических брендов, в своих исследованиях выделяют туристические гастрономические бренды сельской местности (с акцентом на производство уникальных местных сельскохозяйственных продуктов), «моногастрономических» городов (с ярким гастрономическим образом, созданным на основе узкой кухни) и космополитических городов (с мультикультурной средой, отраженной в местном гастрономическом разнообразии) [9].

Ю.М.Лагусев и К.А. Балынин разработали уникальную классификацию гастрономических марок. В зависимости от географического охвата производства они предлагают различать национальные марки (с широким географическим распространением и без региональных различий в способах

приготовления), региональные марки (со значительными различиями в приготовлении «от места к месту») и местные марки (принадлежащие небольшим этническим группам и производимые на месте). Лучшим примером национальной марки является ржаной хлеб, а региональной - хинкаль, который имеет несколько разновидностей в зависимости от используемой начинки, состава и качества муки, способов нарезки теста и используемых специй (кумыкский, даргинский, лакский, аварский и др.) [5].

В своей работе «Гастрономический туризм как популярное направление в туристической индустрии» В.Д.Иванов выделяет компоненты успешного гастрономического бренда, включая развитую местную гастрономическую индустрию, гастрономическое сообщество (включая традиционные рестораны и поваров), пищевую промышленность и продовольственные рынки, местные ингредиенты и кулинарное ноу-хау для традиционной кухни, фестивали, конкурсы и систему гастрономических наград, а также продвижение гастрономии в местной системе образования [4].

Эксперты считают, что гастрономический бренд региона может быть представлен не одним продуктом. Вместо этого он может представлять собой целый ряд решений, включая гастрономические фестивали, национальную уличную еду, меню кафе и ресторанов, розничные торговые точки (от уличных рынков до супермаркетов), где всегда доступен тот или иной гастрономический продукт, а также создание гастрономических музеев [6].

В своей работе К.В.Рификова «О роли гастрономических музеев в региональном брендинге» исследует критерии классификации гастрономических музеев. Исходя из типа продвигаемого бренда, автор различает тематические музеи, популяризирующие уникальные местные продукты, и корпоративные музеи, созданные для продвижения конкретного бренда. Исходя из метода коммуникации с посетителями, она предлагает разделить гастрономические музеи на классические музеи, экспонаты которых основаны на коллекциях традиционных материальных артефактов, и новые музеи, которые, наряду с классическими музеологическими инструментами, используют технологии, раскрывающие специфику гастрономических традиций, включая использование аудиовизуальных средств, методов реконструкции и воспроизведения объектов [7]. 7 музеев еды, которые должен посетить каждый гурман: музей Пармской ветчины (Парма, Италия), Музей утки по-пекински (Пекин, Китай), Музей картофеля (Блэкфут, США), Музей сыра (Алкмар, Голландия), Музей пряностей (Гамбург, Германия), Национальный музей пасты (Рим, Италия), Музей отвратительной еды (Мальмё, Швеция) [12].

Региональные кухни, адаптированные к местным природным условиям и включающие в себя аутентичные местные ингредиенты, более эффективны для регионального брендинга. В этом случае гастрономический бренд может охватывать аспекты приготовления пищи, ингредиентов, методов приготовления и подачи, что служит средством изучения культурных

аспектов и понимания национального характера, менталитета и истории. Наша страна имеет прекрасную возможность для развития уникальной региональной гастрономической культуры благодаря своему географическому положению, различиям в потенциале природных ресурсов регионов, а также широкому региональному этническому разнообразию [2].

Гастрономический бренд региона определяется набором специфических гастрономических особенностей, придающих ему уникальность, которую можно интерпретировать как своего рода гастрономическую идентичность, гастрономический «код». Эта гастрономическая идентичность формируется совокупностью местных гастрономических и кулинарных традиций, технологий приготовления, подачи и потребления пищи, а также организационных и функциональных особенностей местного агропромышленного комплекса [8].

Отчет Marriott International «Еда будущего» показывает, что Азиатско-Тихоокеанский регион играет значительную роль в формировании глобальных гастрономических тенденций. В 2023 году на регион приходилось 37,8% мирового рынка кулинарного туризма, и прогнозируется, что к 2033 году его объем достигнет 6,2 триллиона долларов. Влияние региона на наши пищевые привычки нельзя игнорировать. От местной кухни до меню, ориентированных на здоровое питание, и высокотехнологичных инноваций - регион формирует будущее кулинарных впечатлений [13].

По оценкам, мировой рынок гастрономического туризма оценивается в 13,83 млрд долларов США в 2024 году, 16,58 млрд долларов США в 2025 году и 85,04 млрд долларов США к 2034 году, демонстрируя среднегодовой темп роста в 19,92% в период с 2025 по 2034 год [14]. Растущая популярность путешествий и туризма, а также интерес к изучению местной кухни и культуры, являются движущей силой роста рынка кулинарного туризма рисунок-1).

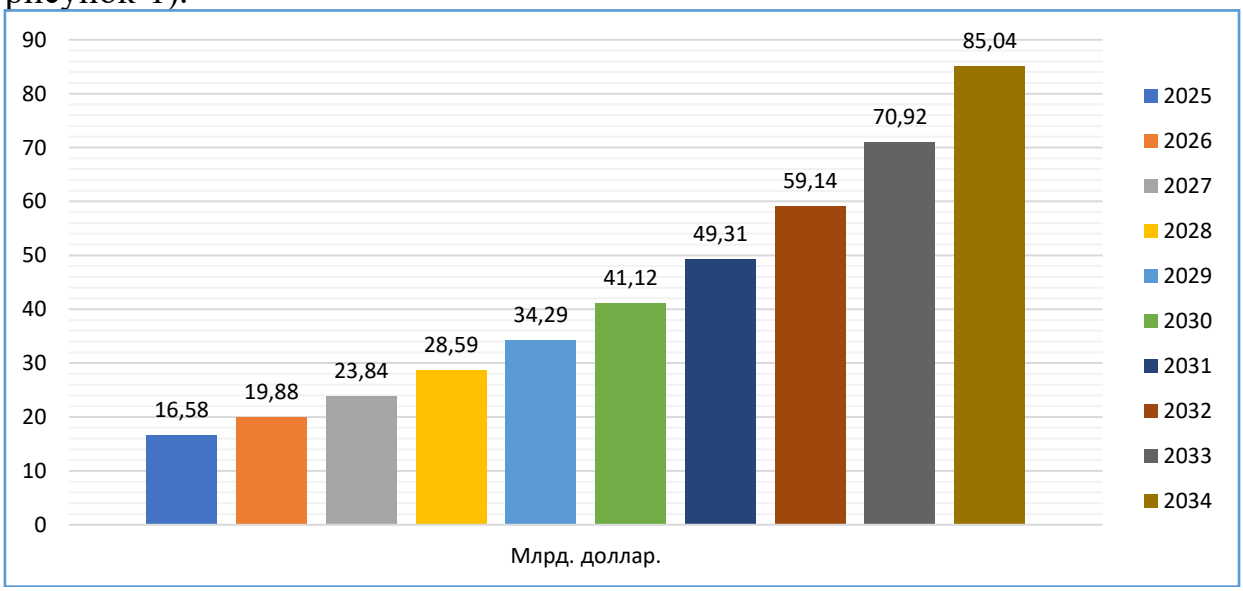

Рисунок-1. Размер рынка гастрономического туризма и прогноз на 2025-2034 годы.

Европейский рынок кулинарного туризма оценивается в 4,56 млрд долларов США в 2024 году и в 5,8 млрд долларов США в 2025 году, и ожидается, что к 2034 году он достигнет 30,19 млрд долларов США, при среднегодовом темпе роста в 20,09% в период с 2025 по 2034 год (рисунок-2).

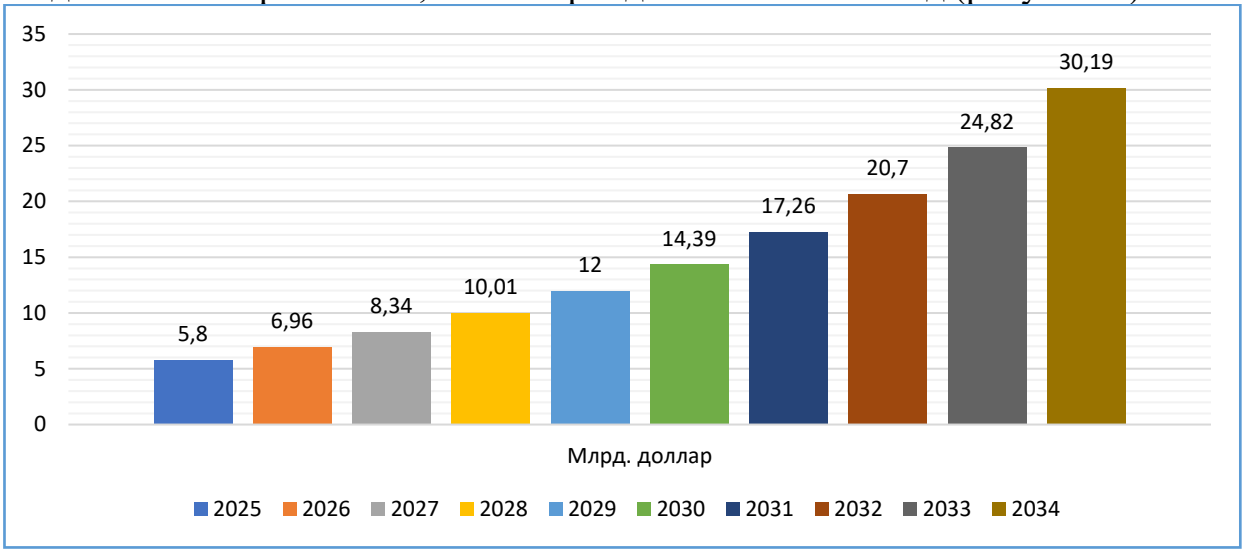

Рисунок-2. Размер и темпы роста европейского рынка кулинарного туризма в 2025-2034 годах.

Повышение экономической стабильности, рост уровня жизни и резкое увеличение расходов на путешествия, питание и предметы роскоши как в развитых, так и в развивающихся странах оказали положительное влияние на развитие кулинарного туризма в различных странах. В 2024 году европейский регион возглавит развитие мирового рынка кулинарного туризма (36 %), за ним последуют Северная Америка, Азиатско-Тихоокеанский регион, Латинская Америка и Ближний Восток (рисунок-3).

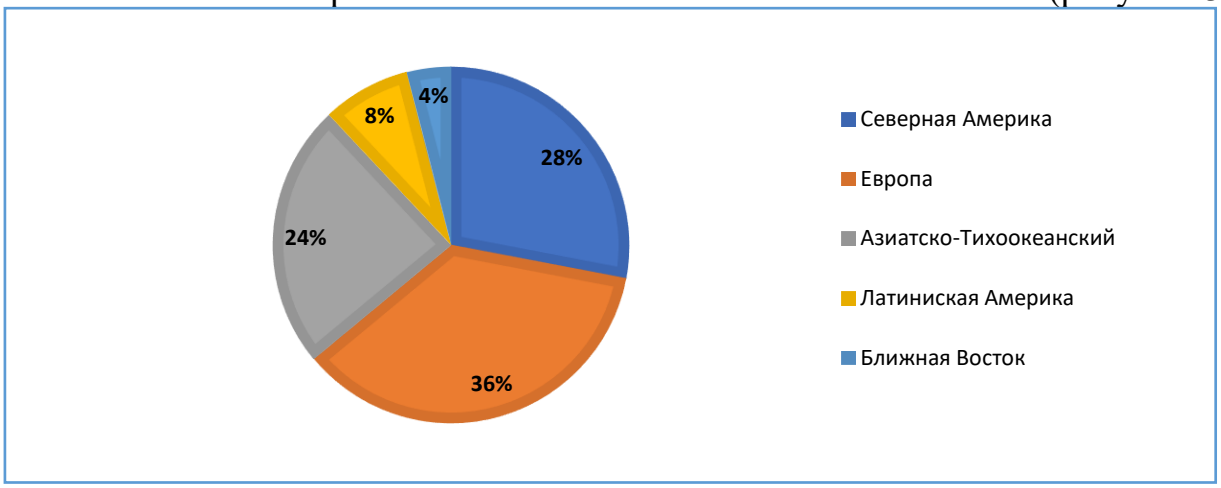

Рисунок-3. Доля рынка кулинарного туризма по регионам, 2024 года.

Рост мирового рынка гастрономического туризма, включая размер рынка, долю рынка, годовой темп роста, прогноз и тенденции с 2022 года. Рынок гастрономического туризма - это быстрорастущая отрасль (прогноз роста на 17,1% в ближайшие годы), где еда выступает ключевым драйвером

путешествия. Лидируют Франция, Италия, Испания, Япония и Турция, предлагая аутентичный опыт от рынков до Мишлен-ресторанов.

Согласно международным исследованиям, Европа и Азиатско-Тихоокеанский регион являются ведущими регионами на рынке гастрономического туризма. Италия занимает наибольшую долю европейского рынка гастрономического туризма. Здесь популярен агротуризм и винный туризм, а Франция признана «элитной моделью» гастрономического туризма. Города Париж и Лион славятся своими ресторанами, отмеченными звездами Мишлен. В то время французская гастрономия была признана культурным наследием ЮНЕСКО, а японский гастрономический туризм развивался как часть национальной культуры.

Гастрономический туризм одно из самых привлекательных и популярных направлений туризма, демонстрирующее природный, культурный и экономический потенциал регионов. Он формирует уникальный образ региона у туристов благодаря национальным блюдам, традиционной кулинарной культуре, местным продуктам и этнографическим ценностям. В этом отношении развитие гастрономического туризма имеет большое значение с экономико-географической точки зрения.

Результаты исследования показывают, что гастрономический туризм оказывает положительное влияние на экономическое оживление регионов, обеспечивает занятость, расширяет сектор услуг и стимулирует местное сельское хозяйство и производство продуктов питания. Развитие гастрономического туризма, особенно в регионах, богатых национальными кулинарными традициями, позволяет увеличить поток отечественных и зарубежных туристов. Также гастрономический туризм выступает важным фактором формирования туристического имиджа регионов. Диверсификация туристических продуктов возможна за счет интеграции национальных гастрономических фестивалей, кулинарных мастер-классов, агротуризма и этнотуризма. Это послужит повышению конкурентоспособности региона. В заключение, гастрономический туризм является одним из важных направлений эффективного использования экономико-географического потенциала регионов развития, сохранения национального культурного наследия и устойчивого развития туристического сектора.

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ПРИМЕНЕНИЕ МЕСТНЫХ ИНДИВИДУАЛЬНЫХ МЕТОДОВ ПРОФИЛАКТИКИ КАРИЕСА ПОСТОЯННЫХ ЗУБОВ У ДЕТЕЙ С УМСТВЕННЫМИ ОТКЛОНЕНИЯМИ

Аннотация: *Распространенность кариеса зубов у умственно отсталых детей, обучающихся в специализированных школах, зависит от уровня их социализации, питания и наличия синдрома Дауна. В группу риска входят социализированные дети без синдрома Дауна: показатель интенсивности кариеса составил 3,8 4,9; 5,8, а распространенность - 42,0, 76,0 и 85,0% у детей 8, 10 и 12 лет, соответственно. Распространенность кариеса у детей с синдромом Дауна оказалась ниже - 33,0, 64,0 и 72,0% у детей 8, 10 и 12 лет, соответственно. По результатам применения специального профилактического алгоритма количество кариесогенных микроорганизмов на зубах незначительно уменьшилось от исходных значений. Таким образом, выделена наиболее оптимальная схема лечения с высоким терапевтическим эффектом у умственно отсталых больных, позволяющая повысить эффективность лечения и сократить его сроки.*

Ключевые слова: *умственная отсталость, кариес зубов, заболевания пародонта, эпидемиологическое исследование, интенсивность кариеса, индекс распространенности кариеса.*

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APPLICATION OF LOCAL INDIVIDUAL METHODS OF PREVENTION OF CARIES OF PERMANENT TEETH IN CHILDREN WITH MENTAL DEFECTS

Annotation: *The prevalence of dental caries in mentally retarded children studying in specialized schools depends on their level of socialization, nutrition and the presence of Down syndrome. The risk group includes socialized children without Down syndrome: the caries intensity index was 3.8 4.9; 5.8, and the prevalence is 42.0, 76.0 and 85.0% in children 8, 10 and 12 years old, respectively. The prevalence of caries in children with Down syndrome was lower - 33.0, 64.0 and 72.0% in children 8, 10 and 12 years old, respectively.*

According to the results of applying a special preventive algorithm, the number of cariogenic microorganisms on the teeth slightly decreased from the initial values. Thus, the most optimal treatment regimen with a high therapeutic

effect in mentally retarded patients has been identified, which makes it possible to increase the effectiveness of treatment and reduce its time.

Key words: *dental caries, periodontal disease, epidemiological study, caries intensity, mental retardation.*

Введение: В стоматологической практике мира наблюдается высокая частота различных ортопедических и ортодонтических дефектов, в том числе форм проявляющихся в виде адентии различной степени. Распространенность адентии значительно увеличилась и по данным составляет 35,4-62,9% [1]. Доказано, что в современном обществе заболевания полости рта имеют значение гуманитарную, социально – экономическую значимость. Сегодня кариес и заболевания пародонта остаются наиболее распространенным заболеванием зубов не только среди взрослых, но и среди более молодых слоев населения во всем мире. Согласно недавним эпидемиологическим исследованиям, проведенным на здоровых детях, заболеваемость зубной патологией высока, причем распространенность кариеса среди здоровых возрастных групп 12–15 лет составляет 63,3–83 года, 4% и 81,7-88,7%, интенсивность 3,02-3,75 и 4,6-5,73, а распространенность заболеваний тканей пародонта в группе здоровых 12-летних детей колебалась от 37,8% до 50%, в 15-летней группе детей она колебалась от 57,7% до 84,7%. Распространенность кариеса также высока у детей с умственной отсталостью дошкольного и школьного возраста, в то время как интенсивность кариеса выше у детей в возрасте 13–18 лет с легкой умственной отсталостью. Эти показатели увеличиваются с возрастом и зависят от тяжести основного заболевания.

По данным ВОЗ около 15% населения планеты составляют люди с ограниченными возможностями здоровья. Это соответствует 650 млн. человек, из которых 200 млн. приходится на долю детского населения. Распространенность умственной отсталости (УО) в популяции колеблется от 1% до 3%.

Оказание стоматологической помощи умственно отсталым детям сопряжено с рядом трудностей ввиду их неконтактности по причине основного заболевания (психических расстройств и расстройств поведения, болезней нервной системы) и требует лечения данной группы детей в условиях общего обезболивания, проведение которого не всегда возможно вследствие наличия у них сопутствующей тяжелой соматической патологии. Кроме того, не во всех учреждениях данного типа есть стоматологические кабинеты. Все это диктует необходимость поиска новых форм оказания стоматологической помощи умственно отсталым детям, одной из важных составляющих которой должна стать профилактика. Нами проведена реализация программы профилактики стоматологических заболеваний у детей с ограниченными возможностями здоровья, однако большинство из них были ориентированы на детей с легкой и умеренной умственной отсталостью,

где были учитываться не только степень умственной отсталости, но и обучению у них навыков ухода за ртом, степень социализации и режим питания ребенка.

Цель исследования: усовершенствование методов профилактики кариеса постоянных зубов у детей с умственными отклонениями на основе разработки «специальной IT-программы» а также оценка эффективности и действенности озоно терапии в профилактике кариеса зубов.

Материал и методы исследования. Обследовано 220 больных с умственными отклонениями из специализированной школы-интерната № 62 г. Самарканда и № 63 Акдарынского района, в том числе между 6, 9 и 12-летние воспитанниками интернатов. В зависимости от возраста, пола, режима питания, типа основных неврологических заболеваний, наличия синдрома Дауна и степени социализации детей, изучили гигиеническое состояние полости рта с применением в течение определенного периода времени специальная программа, направленная на профилактику кариеса постоянных зубов, определяется уровень их эффективности. Для решения поставленных задач использовались общеклинические, инструментальные, функциональные и статистические методы. Были оценены следующие показатели: -распространенность кариеса; интенсивность кариеса постоянных зубов по индексу КПУ; клиническое состояние тканей пародонта оценивали по индексу РМА в модификации Парма.

Для оценки риска развития стоматологических заболеваний проведено микробиологическое исследование зубного налета, для которого были отобраны случайным образом дети из подгруппы 1 в количестве 26 человек и из подгруппы 2 – 24 человека. Для проведения микробиологического исследования собирали зубной наддесневой налет путем соскоба стерильным экскаватором. Программа профилактики включала обучение детей гигиене рта и санитарно-просветительскую работу с персоналом учреждения и родителями некоторых воспитанников, которые посещали интернат. Также проводились индивидуальные методы профилактики:

Профессиональная гигиена полости рта (Рисунок 1);

Реминерализирующая терапия- нанесение на зубы фторид содержащего лака;

Герметизация фиссур постоянных зубов с использованием озона (Рисунок 2).

Рисунок 1. Профессиональная гигиена полости рта.

В последнее время, в связи с ростом аллергизации населения, снижается чувствительности к антибиотикам, удорожания лекарственных препаратов, вес более популярными становятся не медикаментозные методы лечения. Среди них – озонотерапия, которая заслуженно получает все большее распространение во всем мире. Это связано со свойствами озона оказывать влияние на транспортировку и высвобождение кислорода в ткани, его дезинфицирующим действием. Озон используют в терапии, хирургии, акушерстве и гинекологии, дерматологии, стоматологии и косметологии.

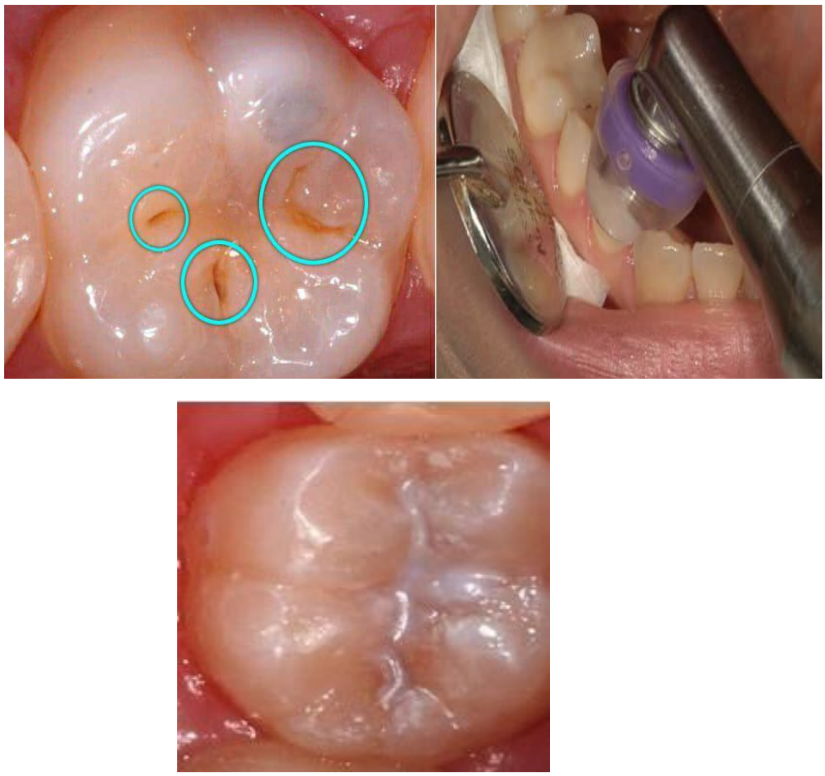

Рисунок 2. Герметизация фиссур коренных зубов у ребенка 10 лет после лечения озонированной водой

Результаты: Установлено, что дети с синдром Дауна меньше подвержены риску развития кариеса зубов, поэтому внутри подгрупп с различной социализацией было проведено деление с учетом наличия данного синдрома. Таким образом, внутри подгрупп 6, 12 и 15-летних социализированных детей были выделены дети, не имеющие синдром Дауна—10, 32 и 40 ребенок, соответственно и дети, страдающие данным синдромом—12, 8 и 5 детей, соответственно. Среди 6, 12 и 15-летних не социализированных детей также были выделены подгруппы детей, не имеющие синдром Дауна— 11, 30 и 15 детей, соответственно и дети с синдромом Дауна — 4, 6 и 13 детей, соответственно. В этих подгруппах оценивали распространенность и интенсивность кариеса.

Для оценки риска развития стоматологических заболеваний проведено микробиологическое исследование зубного налета, для которого были отобраны случайным образом дети из подгруппы 1 в количестве 23 человек и из подгруппы 2 – 21 человека. Для проведения микробиологического исследования собирали зубной над десневой налёт путем соскоба стерильным экскаватором. Оценивая полученные нами данные можно отметить, что наиболее часто из зубного налёта были выделены представители рода стрептококков. В подгруппе 1 стрептококки были выделены в 25,8%, а в подгруппе 2 в 34,0% от общего количества обнаруженных микроорганизмов. Среди стрептококков в подгруппе 1 доминировали S. oralis -12,9% и S. gordonii – 3,53%, S. cristatus, S. sinensis, S. mitis, S. sanguinis, S. pneumonia были обнаружены в более низком проценте (1,2%; 1,2%, 1,2%, 2,4%, 1,2%, соответственно). В подгруппе 2 также был выделен S. oralis, но в большем количестве, чем в подгруппе 1 и составили 14,2%. В меньшем количестве были выделены S. gordonii -4,4%, S. sinensis – 5,5%, S. mitis – 5,5%. Единично были обнаружены S. cristatus (1,1%), а также S. constellatus (1,1%), S. agalactiae (1,1%), S. anginosus (1,1%), которых не было обнаружено в подгруппе 1. Кроме стрептококков из зубного налета были выделены и другие виды микроорганизмов, в том числе, значительный процент от общего числа выделенных штаммов составили стафилококки. Они были выделены у детей 1-ой подгруппы в 9,9% случаев, причем в этой подгруппе преобладал St. aureus- 5,9%, на долю S. epidermidis пришлось 3,5%. Во 2-ой подгруппе стафилококки отмечены нами в 6,6% случаев, причем больший процент, в отличии от детей подгруппы 1, пришелся на S. epidermidis - 5,5%.

Обращает на себя внимание высокий процент выделения грибов рода Candida из зубного налета, причем у детей подгруппы 1 они отмечены в четыре раза чаще, чем у детей подгруппы 2 и составили 17,6% и 4,4%, соответственно. Среди грибов рода Candida доминировала Candida albicans и частота ее выделения составила в подгруппе 1 -12,9% и 3,3% в подгруппе 2 от общего числа выделенных штаммом. В составе микрофлоры зубного налёта также в значительном проценте случаев были выделены актиномицеты. У

детей подгруппы 1 в 10,6% случаев, в подгруппе 2 данный вид микроорганизмов встречался чаще, и составил 14,3%.

Нейссерии встречались в подгруппе 1 в два раза реже, чем у детей подгруппы 2 и их процент составил 8,2 и 15,4, соответственно.

Также в зубном налете нами были обнаружены фузобактерии. У детей подгруппы 1 в 5,9%, в подгруппе 2 данный вид микроорганизмов встречался чаще, и составил 7,7%. Только у детей подгруппы 1 нами был выделен Acinetobacter lwoffii, который встречался в значительном числе случаев - 14,1%. В незначительном количестве нами был выделен в зубном налете у детей 2-ой подгруппы Capnocytophaga (3,3%). Другие виды у детей подгруппы 1 встречались в 8,2%, у детей подгруппы 2 в 14,3%.

Третьим этапом нашего исследования явилась разработка, внедрение и оценка эффективности программы профилактики кариеса зубов адаптированной для умственно отсталых детей в условиях специализированной школы. Программа профилактики включала обучение детей гигиене рта и санитарно-просветительскую работу с персоналом учреждения и родителями некоторых воспитанников, которые посещали интернат. Также проводились индивидуальные методы профилактики: профессиональная гигиена, нанесение на зубы фторид содержащего лака, герметизация фиссур с использованием озона. Эффективность внедренной адаптированной программы профилактики, которая учитывает медико-психолого-педагогические характеристики детей, оценивали по индексу гигиены (ИГР -У) и состоянию тканей пародонта (индекс РМА) исходно, через 1,2,3 года после начала обучения.

Данные, полученные у 9 и 12-летних детей, до внедрения программы послужили внутренним контролем для групп детей, вступивших в программу профилактики в возрасте 6-8 и 9-11 лет. При этом, группа 9-летних детей является группой сравнения для остальных групп 9-летних и становится основной через три года по достижении этими детьми 12-летнего возраста. Для детей, вступивши в программу профилактики в возрасте 12 лет, 15-летние, ранее обследованные дети послужили группой контроля. Распространенность и интенсивность кариеса зубов у умственно отсталых детей зависела от социализации, определяющей образ жизни и режим питания, а также от наличия синдрома Дауна.

Заболеваемость кариесом зубов у умственно отсталых детей, проживающих в школах-интернатах, зависит от их социализации, обуславливающей некоторые особенности образа жизни и питания. Группу риска составляют социализированные дети без синдрома Дауна: распространенность кариеса составила 31,0, 62,0 и 83,0% при интенсивности 0[0;1,17], 2[0;4], 4[3;5] у 6, 12, 15-летних детей, соответственно. У не социализированных детей без синдрома Дауна, распространенность кариеса была низкой – 0, 18,0 и 22,5% у 6, 12 и 15-летних детей, соответственно, а у детей с синдромом Дауна кариеса зубов не было. У социализированных детей

преобладал гингивит легкой степени (55, 50 и 50% среди 6, 12 и 15-летних детей, соответственно), у не социализированных - гингивит средней (47,1 и 41,6% у 6 и 15-летних детей, соответственно) и тяжелой степени (38,6% у 12-летних). 45[26;67,5]. Неспособность к самостоятельному полноценному уходу за ртом делает эту группу детей особо уязвимой в отношении заболеваний пародонта. Распространенность кариеса зубов у умственно отсталых детей, обучающихся в специализированных школах, зависит от уровня их социализации, питания и наличия синдрома Дауна. В группу риска входят социализированные дети без синдрома Дауна: показатель интенсивности кариеса составил 3,8 4,9; 5,8, а распространенность - 42,0, 76,0 и 85,0% у детей 8, 10 и 12 лет, соответственно. Распространенность кариеса у детей с синдромом Дауна оказалась ниже - 33,0, 64,0 и 72,0% у детей 8, 10 и 12 лет, соответственно. В результате микробиологического исследования зубов заметные негативные изменения состава микрофлоры зубов детей без синдрома Дауна, относительно социализированных умственно отсталых, в том числе увеличение видов рода Streptococcus, считающихся кариесогенными, свидетельствует о высоком потенциале кариозного процесса.

Выводы: В течение двух лет реализации профилактической программы отмечен положительный прирост гигиенических показателей. Удовлетворительное гигиеническое состояние наблюдалось у 64,2 %, хорошее гигиеническое состояние у 35,2 %, неудовлетворительное гигиеническое состояние у 0,6 % детей. Применение озона в рамках комплексной профилактики кариеса у детей с умственной отсталостью с учетом их умственных и физических возможностей дало положительные результаты. Негативных осложнений при выполнении комплексных мероприятий с озоно-кислородом у детей не наблюдалось, применение данного метода продолжало оставаться комфортным и безболезненным для пациентов.

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ЛИЧНЫЙ БРЕНД ВЛАДЕЛЬЦА МАЛОГО БИЗНЕСА КАК ИНСТРУМЕНТ ФОРМИРОВАНИЯ КОРПОРАТИВНОЙ РЕПУТАЦИИ КОМПАНИИ

Аннотация: *В статье рассматривается личный бренд владельца малого бизнеса как стратегический инструмент построения и укрепления корпоративной репутации. В условиях цифровизации и повышения прозрачности бизнес-процессов идентичность предпринимателя становится ключевым фактором, влияющим на доверие заинтересованных сторон, лояльность клиентов и восприятие бренда. В работе анализируются механизмы взаимодействия личного бренда и корпоративной репутации, определяются коммуникационные инструменты продвижения бренда в цифровой среде и систематизируются преимущества и риски персонализации репутации в малом бизнесе. Исследование приходит к выводу, что интеграция стратегии личного брендинга владельца в общую коммуникационную стратегию компании повышает репутационный капитал и конкурентоспособность.*

Ключевые слова: *личный брендинг, корпоративная репутация, малый бизнес, стратегические коммуникации, цифровой маркетинг, управление репутацией.*

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PERSONAL BRANDING OF A SMALL BUSINESS OWNER AS A TOOL FOR BUILDING A COMPANY'S CORPORATE REPUTATION

Abstract: *The article examines the personal brand of a small business owner as a strategic tool for building and strengthening corporate reputation. In the context of digitalization and increasing transparency of business processes, the identity of the entrepreneur becomes a key factor influencing stakeholder trust, customer loyalty, and brand perception. The paper analyzes the mechanisms of interaction between the personal brand and corporate reputation, identifies communication tools for brand promotion in the digital environment, and systematizes the advantages and risks of reputation personalization in small*

business. The study concludes that the integration of the owner's personal branding strategy into the overall communication strategy of the company enhances reputation capital and increases competitive sustainability.

Keywords: *personal branding, corporate reputation, small business, strategic communications, digital marketing, reputation management.*

В условиях развития цифровой экономики и усиления конкуренции на локальных рынках корпоративная репутация становится одним из ключевых факторов устойчивости малого бизнеса. В отличие от крупных корпораций, где коммуникационная функция распределена между различными подразделениями, в малом бизнесе владелец компании часто выступает одновременно стратегом, управленцем и главным коммуникатором бренда. В этой связи личный бренд владельца приобретает особое значение и становится инструментом формирования корпоративной репутации.

Личный бренд владельца малого бизнеса представляет собой устойчивую систему представлений о его профессиональной компетентности, ценностях, стиле управления и социальной ответственности, транслируемую через различные коммуникационные каналы. В малом бизнесе граница между персональным и корпоративным образом практически стирается: репутация компании напрямую зависит от репутации её основателя.

Особенность малого бизнеса заключается в высокой степени персонификации. Клиенты зачастую принимают решение о покупке, ориентируясь не только на продукт, но и на личность предпринимателя. Подобная модель особенно характерна для сфер услуг, консалтинга, образования, креативных индустрий, индустрии красоты и локального ритейла. В таких условиях доверие к владельцу трансформируется в доверие к компании.

Механизм влияния личного бренда владельца на корпоративную репутацию можно представить через следующие взаимосвязанные элементы:

1. Формирование доверия через экспертность и открытость коммуникаций.
2. Трансляция ценностей, определяющих корпоративную культуру.
3. Повышение узнаваемости бизнеса за счёт персонализированного контента.
4. Усиление эмоциональной связи с аудиторией.
5. Увеличение устойчивости бренда в конкурентной среде

Цифровая среда существенно усилила роль персональных коммуникаций. Социальные платформы, такие как ВК и Telegram, позволяют владельцу малого бизнеса выстраивать прямой диалог с клиентами без посредничества традиционных СМИ. В этом контексте личный аккаунт предпринимателя становится самостоятельным репутационным активом.

Стратегия продвижения личного бренда владельца малого бизнеса должна быть интегрирована в общую коммуникационную стратегию

компании. Несогласованность позиционирования может привести к репутационному диссонансу, снижению доверия и утрате лояльности аудитории.

Для систематизации влияния личного бренда владельца на корпоративную репутацию представим сравнительную характеристику ключевых эффектов в таблице 1.

Таблица 1. Влияние личного бренда владельца малого бизнеса на корпоративную репутацию

Параметр	**Проявление личного бренда**	**Репутационный эффект для компании**
Экспертность	Публикация профессионального контента, участие в отраслевых мероприятиях	Повышение доверия и статуса компании
Прозрачность	Открытое освещение процессов, решений, ошибок	Формирование лояльности аудитории
Ценностное позиционирование	Демонстрация миссии и социальной позиции	Укрепление имиджа ответственного бизнеса
Медиаактивность	Интервью, публикации, цифровой контент	Рост узнаваемости бренда
Персональная харизма	Эмоциональное взаимодействие с аудиторией	Усиление эмоциональной привязанности клиентов

Таким образом, личный бренд выполняет функцию медиатора между компанией и её целевой аудиторией.

Однако процесс гиперперсонализации несёт определённые риски. Репутационные ошибки владельца мгновенно отражаются на бизнесе. К основным угрозам относятся: публичные конфликтные высказывания, несоответствие транслируемых ценностей реальным действиям, кризисы в личной жизни, оказывающие влияние на общественное восприятие. В малом бизнесе такие репутационные кризисы особенно чувствительны, поскольку компания зачастую не обладает достаточным запасом медиаресурсов для нейтрализации негативной повестки.

В этой связи управление личным брендом владельца должно носить стратегический характер и включать следующие этапы:

— анализ целевой аудитории и её ценностных ожиданий;
— формирование ядра позиционирования;
— определение ключевых коммуникационных каналов;
— разработку контент-стратегии;
— мониторинг репутационных показателей;
— подготовку антикризисного сценария.

Важно подчеркнуть, что личный бренд владельца не должен полностью подменять корпоративный бренд. Оптимальной является модель взаимного усиления, при которой личность предпринимателя транслирует ценности

компании, но при этом сама компания сохраняет самостоятельную идентичность.

В современных условиях потребитель ориентируется на подлинность и прозрачность. Малый бизнес обладает преимуществом гибкости и возможности персонализированного общения. Грамотно выстроенный личный бренд владельца позволяет капитализировать это преимущество, превращая индивидуальную репутацию в стратегический актив компании.

Таким образом, личный бренд владельца малого бизнеса выступает инструментом формирования корпоративной репутации, способствующим росту доверия, повышению узнаваемости и укреплению конкурентных позиций компании. Его интеграция в систему стратегических коммуникаций является необходимым условием устойчивого развития малого бизнеса в цифровой среде.

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СТРАТЕГИЧЕСКОЕ ПРОДВИЖЕНИЕ ЛИЧНОГО БРЕНДА В ЦИФРОВОЙ СРЕДЕ: АЛГОРИТМЫ, ИНСТРУМЕНТЫ И МОДЕЛИ ОЦЕНКИ ЭФФЕКТИВНОСТИ

Аннотация*: В статье исследуются теоретико-методологические и практические аспекты формирования стратегии продвижения личного бренда в условиях цифровизации экономики. Обосновывается необходимость перехода от интуитивного к системному управлению персональной репутацией. В работе классифицируются ключевые цифровые каналы коммуникации, предлагается алгоритм разработки стратегии позиционирования и вводится метрика оценки эффективности инвестиций в личный брендинг. Исследование доказывает, что целенаправленное управление персональным имиджем напрямую коррелирует с ростом нематериальных активов субъекта экономических отношений.*

Ключевые слова: *личный бренд, стратегический маркетинг, цифровая среда, позиционирование, репутационный капитал, эффективность коммуникаций.*

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STRATEGIC PROMOTION OF A PERSONAL BRAND IN THE DIGITAL ENVIRONMENT: ALGORITHMS, TOOLS, AND EFFECTIVENESS EVALUATION MODELS

Abstract: *The article examines the theoretical, methodological, and practical aspects of forming a personal brand promotion strategy in the digitalized economy. The necessity of transitioning from intuitive to systematic management of personal reputation is substantiated. The paper classifies key digital communication channels, proposes an algorithm for developing a positioning strategy, and introduces a metric for evaluating the effectiveness of investments in personal branding. The study proves that targeted management of a personal image directly correlates with the growth of the economic subject's intangible assets.*

Keywords*: personal brand, strategic marketing, digital environment, positioning, reputation capital, communication effectiveness.*

В условиях постиндустриальной экономики и глобальной цифровой трансформации классические парадигмы маркетинга претерпевают существенные изменения. Институционализация доверия смещается от корпоративных структур к конкретным личностям, выступающим носителями уникальной экспертизы. В данном контексте личный бренд перестает быть исключительно атрибутом медийных персон и трансформируется в фундаментальный инструмент обеспечения конкурентоспособности на рынке труда и в предпринимательской среде.

Стратегия продвижения личного бренда представляет собой долгосрочный, итеративный план действий, направленный на формирование, развитие и монетизацию репутационного капитала субъекта. В отличие от спонтанной медийной активности, стратегический подход требует жесткой привязки коммуникационных усилий к измеримым бизнес-целям.

Процесс разработки стратегии продвижения целесообразно разделить на несколько последовательных этапов, формирующих замкнутый управленческий цикл:

1. Аудит текущего состояния (Brand Discovery): анализ существующего информационного следа, оценка индекса цитируемости и выявление сильных/слабых сторон субъекта позиционирования.

2. Формирование платформы бренда: определение миссии, видения, ключевых компетенций и уникального ценностного предложения (Unique Value Proposition, UVP).

3. Сегментация и таргетинг: выявление ядра целевой аудитории и стейкхолдеров, картографирование их болей и потребностей.

4. Выбор каналов дистрибуции: матричное распределение контента по релевантным платформам (Owned, Earned, Paid media).

5. Тактическая реализация и мониторинг: производство контента, нетворкинг и регулярный срез аналитических показателей.

Для систематизации инструментов продвижения в цифровой среде была разработана классификационная матрица, представленная в таблице 1.

Таблица 1.
Классификация инструментов стратегического продвижения личного бренда

Категория каналов	Специфика применения	Ожидаемый репутационный эффект
Собственные медиа	Персональные сайты, блоги, email-рассылки, авторские Telegram-каналы.	Полный контроль над нарративом, формирование лояльного ядра аудитории, глубокая трансляция ценностей.
Приобретенные медиа	Упоминания в профильных СМИ, гостевые публикации, участие в подкастах, UGC (пользовательский контент).	Подтверждение социального доказательства, легитимизация экспертного статуса третьими лицами.
Оплаченные медиа	Таргетированная реклама, нативная интеграция у инфлюенсеров, спонсорские размещения.	Масштабирование охватов, оперативное привлечение новой аудитории, тестирование гипотез позиционирования.
Офлайн-интеграция	Выступления на отраслевых конференциях, преподавание, презентации книг.	Укрепление эмоциональной связи, прямой нетворкинг, конвертация цифрового авторитета в реальные связи.

Одной из фундаментальных проблем в управлении личным брендом является математическая оценка результативности применяемых стратегий. Традиционные метрики тщеславия (Vanity metrics), такие как количество подписчиков или общие охваты, не отражают реального экономического эффекта.

Для комплексной оценки рентабельности инвестиций в персональный брендинг предлагается использовать модифицированный коэффициент ROI.

Резюмируя вышеизложенное, можно констатировать, что стратегия продвижения личного бренда является многокомпонентной системой, требующей интеграции маркетинговых, психологических и технологических компетенций. Успешность реализации данной стратегии в цифровой среде детерминируется не частотой публикаций, а консистентностью транслируемых смыслов, релевантностью выбранных каналов и способностью субъекта адаптироваться к быстро меняющейся информационной архитектуре.

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ИЗМЕНЕНИЯ РЕАКТИВНОСТИ ГОРМОНАЛЬНОЙ РЕГУЛЯЦИИ РЕПРОДУКТИВНОЙ СИСТЕМЫ В ПОЗДНЕМ ПОСТРЕАНИМАЦИОННОМ ПЕРИОДЕ

Аннотация. *Морфофункциональное состояние оси гормональной регуляции репродуктивной системы, обеспечивающей анаболические процессы в отдалённом постреанимационном периоде, изучено недостаточно. В связи с этим целью исследования явилось изучение изменений в гормональной оси регуляции в репродуктивной системе самцов крыс в отдаленном постреанимационном периоде, после 10-минутной клинической смерти. При этом, исследование проведено на 40 беспородных самцах белых крыс, массой тела 150–180 г. и определено: морфофункциональная активность бета и дельта базофильных клеток аденогипофиза, содержания ФСГ, ЛГ, и тестостерона, в период клинической смерти и в позднем постреанимационном периоде 21–28 дней после оживления организма. В отдалённых периодах заболевания, начиная с 21–28 дней установлено на фоне дальнейшего увеличения морфофункциональной активности β- и d- базофильных клеток аденогипофиза, уменьшения содержания ФСГ, ЛГ и тестостерона со сдвигом в сторону истощения.*

Ключевые слова: *Клиническая смерть, постреанимационная болезнь, бета-базофильные клетки, дельта-базофильные клетки, гликопротеид, ФСГ, ЛГ, тестостерон.*

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CHANGES IN THE RESPONSIVITY OF HORMONAL REGULATION OF THE REPRODUCTIVE SYSTEM IN THE LATE POST-RESUSCITATION PERIOD

Abstract. *The morphofunctional state of the hormonal regulation axis of the reproductive system responsible for anabolic processes in the late post-resuscitation period has not been sufficiently studied. Therefore, our objective was to investigate changes in the hormonal regulatory axis of the reproductive system in male rats during the late post-resuscitation period following 10 minutes of clinical death. The study was conducted on 40 outbred male white rats weighing 150–180 g. We determined the morphofunctional activity of beta and delta basophilic cells of the adenohypophysis, as well as the levels of FSH, LH, and testosterone, during the period of clinical death and in the late post-resuscitation period 21–28 days after resuscitation. In the late stages of the disease, beginning 21–28 days post-resuscitation, a further increase in the morphofunctional activity of β- and δ-basophilic cells of the adenohypophysis was observed, accompanied by a decrease in FSH, LH, and testosterone levels, with a shift toward depletion.*

Keywords: *Clinical death, post-resuscitation syndrome, beta-basophilic cells, delta-basophilic cells, glycoprotein, FSH, LH, testosterone.*

Актуальность.

До настоящего времени, несмотря на широкомасштабные исследования учёных-реаниматологов, механизмы развития постреанимационной болезни остаётся одной из наиболее актуальных проблем. Стресс-реакция, возникающая в организме под влиянием экстремальных факторов, не является отдельным процессом, и прежде всего этот процесс обеспечивается индивидуальной адаптацией на уровне центральной нервной системы, автономной нервной системы и гипоталамо-гипофизарно-нейросекреторной системы [2,3,5,11,12,15]. Если интенсивность воздействия чрезвычайно высока, компенсаторные механизмы оказываются недостаточными для

поддержания защитно-приспособительных реакций. При этом стадия возбуждения заменяется стадией торможения, то есть наступает процесс дезадаптации после чего и наступает клиническая смерть [10,15,8]. В это время, на фоне сильнейшего стрессорного воздействия, в организме на клеточном уровне возникает перегрузочная гипоксия, которая обладает каскадным характером и способствует активации прооксидантной системы, развивается оксидативный стресс на фоне истощения антиоксидантной системы клетки, происходит накопление активных радикалов и альдегидов, которые действуют на клеточные структуры и в организме обеспечивают деструктивные изменения и развитие постреанимационной болезни [3]. При этом такая реакция в первую очередь проявляется в отделах центральной нервной системы. Изменения в центрах интегративных регуляций, в свою очередь отражаются функциональной системой организма [6,13,19,17,18,14,15,16]. Одной из таких систем и является репродуктивная система, как участвующая в процессах анаболического состояния клеток [8,20].

Во всем мире проводят ряд научных исследований по совершенствованию оценки нарушений эндокринных и репродуктивных систем организма, при воздействии различных экстремальных факторов. [2,5,8,4,15,16,20]. В настоящее время неясна динамика изменений репродуктивной системы в отдаленном постреанимационном периоде самцах крыс, которая до конца не изучена и остаётся актуальной проблемой.

Цель исследования. Изучить изменения гормональной регуляции репродуктивной системы у самцов крыс в отдаленном постреанимационном периоде после 10-минутной клинической смерти.

Объект исследования.

Исследование проведено на 40 беспородных белых крысах-самцах, массой тела 150–170 г. Определялись: морфофункциональная активность бета и дельта базофильных клеток аденогипофиза, содержания ФСГ, ЛГ, и тестостерона, в период клинической смерти и в отдаленных периодах (21–28 дней) постреанимационной болезни.

При этом, 10-минутная клиническая смерть и постреанимационная болезнь моделирована с помощью метода В.Г. Корпачева [7]. Морфофункциональная активность определялась с помощью методики Поленова А.Л.(1971). Количество гликопротеида определяли с помощью цитофотометрии Агроскин Л.С.,Папаян Г.В.(1977).

Гормоны репродуктивной системы определяли с помощью иммуноферментного анализа.

Полученные результаты и их обсуждение. При определении функциональной активности β- и d – базофильных аденоцитов, количество высокоактивных клеток составляет 10,6 ± 0,4 % и 10,8 ± 0,4 %., клетки умеренной функциональной активности составляли 70,6 ± 0,4 % и 70,4 ± 0,6 %, а количество клеток с низкой функциональной активностью, определяется

в пределах 18,8 ± 0,4 % и 18,8 ± 0,4 %. Содержание гликопротеида в них в среднем составляет 155,8 ± 3,3 у.ед. и 156,0 ± 3,1 у.ед. При этом в крови содержание фолликулостимулирующего гормона составляет (ФСГ) 13,3±0,4 МЕ/мл, лютеинизирующего гормона (ЛГ) 43,4±1,9 МЕ/мл, количество тестостерона 5,04±0,1 нмоль/л.

При моделировании клинической смерти выявлено (смотреть таблицу №1) увеличение β- и d- базофильных клеток с высокой функциональной активностью (P<0,001), уменьшение количества базофильных клеток умеренной и низкой функциональной активностью (P<0,01), а также количество гликопротеида, больше чем в d- базофильных клетках (P<0,05). В крови выявлено увеличение ФСГ (P>0,05), ЛГ (P<0,05) и тестостерона (P>0,05), по сравнению с интактными животными. Данное состояние можно объяснить активацией защитно-приспособительных механизмов в ответ на воздействие экстремального фактора, направленной на секрецию тестостерона в крови[2,8].

Показатели бета базофильных клеток	интактный	10-минутная клиническая смерть	Поздний постреанимационный период	
			Через 21-день	Через 28-дней
Клетки с высокой функциональной активностью в %.	10,6 ± 0,4	20,4 ± 0,5	34,6±0,8	35,6±0,7
Клетки с умеренной функциональной активностью в %.	70,6 ± 0,4	63,4±0,6	49,6±1,4	48,0±1,3
Клетки с низкой функциональной активностью в %.	18,8 ± 0,4	16,2 ± 1,0	15,8±0,9	16,4±0,9
Содержание гликопротеида в у.ед.	155,8 ± 3,3	151,7±1,6	149,4±2,5	150,2±1,1
Показатели дельта базофильных клеток Клетки с высокой функциональной активностью в %.	10,8 ± 0,4	21,2 ± 0,5	33,0±0,7	35,4±0,9
Клетки с умеренной функциональной активностью в %.	70,4 ± 0,6	62,4 ± 0,9	50,8±1,2	47,4±1,3
Клетки с низкой функциональной активностью в %.	18,8 ± 0,4	16,4 ± 0,8	16,2±0,6	17,2±0,9
Содержание гликопротеида в у.ед.	156,0 ± 3,1	150,6±1,6	148,0±1,3	151,0±1,4

ФСГ МЕ/мл	13,3±0,4	14,92±0,8	13,2±0,4	11,4±0,5
ЛГ МЕ/мл	43,4±1,9	48,9±0,8	41,8±1,1	35,0±1,1
Тестостерон нмоль/л	5,04±0,1	5,26±0,1	4,92±0,1	4,3±0,1

В отдалённом периоде постреанимационной болезни (21-е сутки) отмечалось дальнейшее восстановление морфофункциональной активности базофильных клеток в аденогипофизе. Определяется увеличение, количества базофильных клеток с умеренной и низкой функциональной активностью (P<0,001), содержание гликопротеида (P<0,05), уменьшение клеток с высокой функциональной активностью (P<0,001) по сравнению с 24 - часовой постреанимационной болезнью.

При этом, содержание гормонов репродуктивной системы находится незначительно ниже, по сравнению с данными интактных животных (P>0,05) .

На 28-день в аденогипофизе наблюдается уменьшение β- и d-базофильных клеток с высокой функциональной активностью (P<0,001), увеличение с умеренной и низкой функциональной активностью (P<0,001) и содержание гликопротеида (P<0,05) в них по сравнению с данными 24-часовой постреанимационной болезни, но показатели остаются все ещё на высоком уровне, по сравнению с данными интактных животных. При этом содержание ФСГ 1,17 раз (P<0,05), ЛГ 1,24 раз (P<0,05) и содержание тестостерона 1,18 раз (P<0,01) ниже, по сравнению с данными интактных животных. При сопоставлении полученных результатов с данными Карабаева А.Г. (2022) и Кулиева О.А. (2024), то наблюдается истощение синтеза и секреции в репродуктивной системе. То есть, нарушается адаптивная реакция на уровне подключения анаболического процесса, для обеспечения генерализированной активации синтеза белка для долговременной адаптации [4].

Таким образом, на основании полученных данных, можно сделать следующие выводы:

В отдаленных периодах болезни начиная с 21-28 день было установлено на фоне дальнейшего увеличения морфофункциональной активности β- и d-базофильных клеток аденогипофиза уменьшение содержания ФСГ, ЛГ и тестостерона со сдвигом в стороны истощения.

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ОСНОВНЫЕ ПРИЧИНЫ ПРИМЕНЕНИЯ НАНОТЕХНОЛОГИЙ В РАЗЛИЧНЫХ ОБЛАСТЯХ СОВРЕМЕННОЙ МЕДИЦИНЫ И ЕГО РЕЗУЛЬТАТЫ

Аннотация: *В данной статье проанализированы основные причины использования нанотехнологий в различных областях современной медицины, а также их результаты. Освещено значение нанотехнологий в диагностике, фармацевтике, онкологии, хирургии и регенеративной медицине. Рассмотрена роль наночастиц в адресной доставке лекарственных средств и раннем выявлении заболеваний. В качестве методов исследования применялись анализ научной литературы и систематизация данных международных исследований. Показано, что нанотехнологии существенно повышают точность диагностики и эффективность лечения, однако их широкое внедрение требует дальнейшего изучения рисков и разработки соответствующей нормативной базы.*

Ключевые слова: *нанотехнология, медицина, диагностика, нанолекарства, онкология, регенеративная медицина, наночастицы, биотехнология.*

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THE MAIN REASONS FOR THE USE OF NANOTECHNOLOGY IN VARIOUS FIELDS OF MODERN MEDICINE AND ITS RESULTS

Abstract: *This article analyzes the main reasons for the application of nanotechnology in various fields of modern medicine and examines its outcomes. The significance of nanotechnology in diagnostics, pharmacology, oncology, surgery, and regenerative medicine is discussed. The role of nanoparticles in targeted drug delivery and early disease detection is examined. The research methods employed include analysis of scientific literature and systematization of international research data. It is shown that nanotechnologies significantly improve diagnostic accuracy and treatment effectiveness; however, their widespread implementation requires further risk assessment and development of an appropriate regulatory framework.*

Keywords: *nanotechnology, medicine, diagnostics, nanomedicine, oncology, regenerative medicine, nanoparticles, biotechnology.*

Введение

Научно-технический прогресс XXI века кардинально изменил подходы к диагностике и лечению заболеваний. Одним из наиболее перспективных направлений современной науки является нанотехнология — область, занимающаяся манипуляцией материалами на наноуровне, как правило в диапазоне от 1 до 100 нанометров. На данном масштабе вещества приобретают уникальные физические, химические и биологические свойства, принципиально отличающиеся от свойств обычных материалов.

Нанотехнологии открывают принципиально новые возможности в медицине: обеспечивают адресную доставку лекарственных препаратов, позволяют выявлять заболевания на молекулярном уровне ещё до появления клинических симптомов, а также способствуют восстановлению повреждённых тканей и органов. Актуальность данного направления определяется ростом распространённости онкологических, сердечно-сосудистых и хронических заболеваний, требующих принципиально новых терапевтических подходов [1].

Целью настоящего исследования является систематизация основных причин применения нанотехнологий в различных областях медицины, а также анализ достигнутых результатов и существующих ограничений.

Материалы и методы исследования

В ходе исследования применялись методы анализа и систематизации научной литературы, сравнительный анализ данных международных клинических исследований, а также обобщение сведений о практическом применении нанотехнологий в различных медицинских специальностях. Теоретическую основу исследования составили научные публикации в рецензируемых международных журналах по нанотехнологиям, биомедицине и фармакологии, а также доклады ВОЗ [2; 3; 5].

Отбор источников осуществлялся по критериям научной достоверности, актуальности (публикации 2019–2023 годов) и охвата

ключевых клинических областей применения нанотехнологий: онкологии, кардиологии, фармакологии и регенеративной медицины.

Результаты исследования

Ранняя диагностика заболеваний

Одним из главных преимуществ нанотехнологий в медицине является возможность выявления заболеваний на ранней стадии. Традиционные диагностические методы нередко позволяют обнаружить болезнь лишь после появления выраженной симптоматики. Наносенсоры и нанобиочипы способны идентифицировать молекулярные и клеточные изменения в организме ещё до клинического манифеста заболевания. В частности, наносенсоры обнаруживают онкомаркеры в образцах крови с высокой степенью точности, что значительно повышает шансы на успешное лечение и снижает летальность [2].

Адресная доставка лекарственных препаратов

Традиционные лекарственные препараты зачастую воздействуют как на поражённые, так и на здоровые клетки, вызывая нежелательные побочные эффекты. Нанотехнологии решают данную проблему посредством систем адресной доставки: наночастицы транспортируют лекарственное вещество непосредственно к поражённым или опухолевым клеткам, не затрагивая здоровые ткани. Это существенно повышает терапевтическую эффективность и снижает токсичность препаратов [3].

Нанотехнологии в онкологии

Онкология является одной из ведущих областей применения нанотехнологий. Золотые и магнитные наночастицы используются для визуализации опухолей и прицельного разрушения раковых клеток, а также для улучшения качества изображений при МРТ и КТ-диагностике. Таргетная терапия с применением наночастиц позволяет более эффективно воздействовать на опухоль при минимальном повреждении окружающих тканей [1; 4].

Нанотехнологии в кардиологии

В кардиологии нанотехнологии применяются для диагностики и лечения сердечно-сосудистых заболеваний. Нанопокрытые стенты предотвращают повторное сужение сосудов после хирургического вмешательства. Наносенсоры обеспечивают непрерывный мониторинг сердечной деятельности и позволяют выявлять патологии в режиме реального времени, что принципиально важно для предотвращения жизнеугрожающих состояний.

Нанотехнологии в фармакологии и регенеративной медицине

Фармацевтические компании активно используют нанотехнологии для создания более эффективных лекарственных форм. Липосомы, наноэмульсии и нанокапсулы улучшают биодоступность препаратов и повышают их терапевтический эффект при одновременном снижении токсичности [2; 3].

В регенеративной медицине наноструктурированные скаффолды стимулируют рост клеток и регенерацию тканей. Данные технологии особенно востребованы при лечении ожогов, переломов костей и травм мягких тканей. Нанотехнологии также играют значимую роль в развитии клеточной терапии и создании искусственных органов [5].

Среди совокупных результатов применения нанотехнологий в медицине следует выделить: повышение точности диагностики, улучшение эффективности лечения, снижение побочных эффектов лекарственных препаратов, ускорение восстановления пациентов, снижение травматичности хирургических вмешательств и улучшение качества жизни пациентов.

Обсуждение

Полученные результаты свидетельствуют о том, что нанотехнологии формируют принципиально новую парадигму медицинской диагностики и лечения. Их применение охватывает широкий спектр клинических специальностей и позволяет решать задачи, недоступные для традиционных медицинских подходов.

Особого внимания заслуживает потенциал нанотехнологий в онкологии. Возможность адресного воздействия на опухолевые клетки без ущерба для здоровых тканей является революционным достижением по сравнению с традиционной химиотерапией, имеющей выраженные системные побочные эффекты [1; 4].

Вместе с тем необходимо учитывать существующие риски и ограничения. Вопросы долгосрочной токсичности наночастиц для организма человека и их экологической безопасности остаются предметом активных научных исследований. Нормативно-правовая база регулирования нанотехнологий в медицине в большинстве стран находится в стадии формирования [5].

Перспективным направлением является интеграция нанотехнологий с технологиями искусственного интеллекта для создания интеллектуальных систем диагностики и адресной терапии. Синергия данных технологий способна обеспечить беспрецедентный уровень точности и эффективности медицинской помощи. Важным условием успешного развития этого направления является также международное сотрудничество в области стандартизации методов оценки безопасности наноматериалов.

Заключение

Проведённое исследование показало, что нанотехнологии занимают одно из ключевых мест в современном медицинском прогрессе. Их применение в диагностике, онкологии, фармакологии, хирургии и регенеративной медицине значительно улучшило качество медицинской помощи и результаты лечения пациентов.

Способность наночастиц обеспечивать адресную доставку препаратов, выявлять заболевания на ранних стадиях и поддерживать регенерацию тканей свидетельствует об огромном потенциале нанотехнологий для медицины.

Несмотря на сохраняющиеся риски и технологические ограничения, продолжение научных исследований и разработка соответствующей регуляторной базы создадут условия для более широкого и безопасного применения нанотехнологий в клинической практике.

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ЭКОЛОГИЧЕСКИЕ И СОЦИАЛЬНЫЕ РИСКИ, СВЯЗАННЫЕ С ПЫЛЬНЫМИ БУРЯМИ (СОЛЕВЫМИ АЭРОЗОЛЯМИ) СО ДНА АРАЛА

Аннотация: *В статье рассматриваются экологические и социальные риски, связанные с пыльными бурями и солевыми аэрозолями со дна Аральского моря. Цель исследования заключалась в оценке их воздействия на окружающую среду и население. Установлено, что распространение солепылевых аэрозолей способствует деградации почв, усилению процессов опустынивания, ухудшению состояния растительности и снижению биоразнообразия. Также выявлено негативное влияние на здоровье населения, проявляющееся в росте заболеваний органов дыхания и ухудшении качества жизни.*

Ключевые слова: *Аральское море, пыльные бури, солевые аэрозоли, Аралкум, экологические риски, социальные риски, мониторинг.*

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ECOLOGICAL AND SOCIAL RISKS ASSOCIATED WITH DUST STORMS (SALT AEROSOLS) FROM THE DRIED BED OF THE ARAL SEA

Abstract: *The article discusses ecological and social risks associated with dust storms and salt aerosols originating from the dried bed of the Aral Sea. The aim of the study was to assess their impact on the environment and population. The results showed that the spread of salt-dust aerosols contributes to soil degradation, intensification of desertification processes, deterioration of vegetation conditions, and reduction of biodiversity. Negative effects on public health were also identified, including an increase in respiratory diseases and deterioration in quality of life.*

Key words: *Aral Sea, dust storms, salt aerosols, Aralkum, ecological risks, social risks, monitoring.*

Введение

В настоящее время одной из наиболее серьёзных экологических проблем Центральной Азии являются последствия высыхания Аральского моря. Интенсивное использование водных ресурсов рек Амударья и Сырдарья привело к сокращению площади водоёма и формированию новой пустынной территории — Аралкума. Высохшее дно характеризуется высоким содержанием солей, пылевых частиц и загрязняющих веществ, которые под воздействием ветров образуют солепылевые потоки и распространяются на значительные расстояния. Пыльно-солевые аэрозоли оказывают негативное влияние на природные экосистемы и население, вызывая деградацию почв, ухудшение состояния растительности, снижение устойчивости экосистем и рост заболеваемости населения.

В связи с этим изучение экологических и социальных рисков, связанных с распространением солепылевых аэрозолей, имеет важное научное и практическое значение. Целью исследования являлась оценка экологических и социальных рисков, возникающих вследствие распространения пыльно-солевых аэрозолей со дна Аральского моря.

Материал и методы

Исследование проводилось на основе комплексного анализа научной литературы, экологических исследований и материалов, посвящённых современному состоянию Приаральского региона. При выполнении работы использовались методы сравнительного анализа, обобщения литературных данных, экологической оценки и статистической обработки информации. При анализе экологических рисков учитывались основные факторы, определяющие степень воздействия солепылевых аэрозолей на природную среду. К ним относились интенсивность пыльных бурь, направление и скорость переноса воздушных масс, степень засоления почв, изменение структуры растительного покрова и показатели деградации природных экосистем. Для оценки социальных рисков рассматривались показатели состояния здоровья населения, распространённости заболеваний органов дыхания, изменения качества жизни населения и социально-экономические последствия воздействия экологических факторов.

Результаты и обсуждение

Результаты проведённого анализа показали, что территория высохшего дна Аральского моря в настоящее время является одним из наиболее крупных источников атмосферного пылеобразования в Центральной Азии. Формирование пыльных бурь происходит под воздействием сильных ветров, характерных для аридных территорий региона. В процессе переноса в атмосферу поднимаются частицы различного размера, содержащие соли, минеральные соединения, остатки пестицидов и другие загрязняющие

вещества. Воздействие пыльно-солевых бурь оказывает существенное влияние на состояние почвенного покрова. Осаждение солей на поверхности земель приводит к увеличению уровня засоления, ухудшению физических свойств почвы и снижению её плодородия. Высокое содержание солей нарушает процессы водного обмена растений, затрудняет поступление питательных веществ и приводит к снижению биологической продуктивности земель. В результате таких процессов происходит постепенная деградация почвенного покрова и расширение процессов опустынивания.

Негативное влияние также наблюдается в отношении растительного покрова. Оседание пылевых частиц и солей на листьях растений вызывает нарушение процессов фотосинтеза, газообмена и транспирации. Ухудшение физиологического состояния растений приводит к снижению темпов роста, уменьшению продуктивности и постепенному сокращению видового разнообразия. Наиболее чувствительными к воздействию солевых аэрозолей являются естественные растительные сообщества, испытывающие дополнительную нагрузку в условиях засушливого климата. Помимо экологических последствий значительное влияние наблюдается и в социальной сфере. Одной из наиболее серьёзных проблем является ухудшение состояния здоровья населения. Вдыхание пылевых частиц может вызывать развитие различных заболеваний органов дыхания, включая хронический бронхит, бронхиальную астму, аллергические реакции и другие патологии дыхательной системы. Также отмечается увеличение частоты сердечно-сосудистых заболеваний и снижение общего уровня здоровья населения (Таблица 1).

Таблица 1

Экологические и социальные последствия пыльно-солевых бурь

Фактор	**Экологические последствия**	**Социальные последствия**
Солевые аэрозоли	Засоление почв	Рост заболеваний
Пылевые бури	Деградация растительности	Ухудшение качества жизни
Загрязнение атмосферы	Нарушение экосистем	Увеличение медицинских расходов
Опустынивание	Снижение биоразнообразия	Экономические потери

Дополнительными социальными последствиями являются ухудшение санитарно-гигиенических условий, снижение качества жизни и увеличение экономических затрат. Снижение урожайности сельскохозяйственных культур и деградация земельных ресурсов отрицательно влияют на уровень доходов населения и устойчивость региональной экономики. В отдельных случаях ухудшение экологической ситуации может способствовать усилению миграционных процессов.

Заключение

Проведённое исследование показало, что пыльные бури и солевые аэрозоли со дна Аральского моря являются значительным источником экологических и социальных рисков. Их воздействие приводит к деградации почв, ухудшению состояния растительности, снижению биоразнообразия и отрицательно влияет на здоровье населения. Полученные результаты подтверждают необходимость совершенствования экологического мониторинга и разработки мероприятий по снижению негативных последствий высыхания Аральского моря.

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МЕХАНИЗМЫ КИБЕРБЕЗОПАСНОСТИ И ЗАЩИТЫ ДАННЫХ В УСЛОВИЯХ ЦИФРОВОГО ТУРИЗМА

Аннотация: *В данной статье рассматриваются вопросы обеспечения кибербезопасности и защиты данных в условиях цифровизации туристической отрасли. Анализируются современные угрозы информационной безопасности, возникающие при использовании онлайн-платформ бронирования, электронных платежных систем, мобильных приложений и цифровых сервисов в туризме.*

Ключевые слова: *цифровой туризм, кибербезопасность, защита данных, информационная безопасность, персональные данные.*

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CYBERSECURITY AND DATA PROTECTION MECHANISMS IN

Abstract: *This article examines the issues of cybersecurity and data protection in the context of tourism digitalization. The study analyzes modern information security threats arising from the use of online booking platforms, electronic payment systems, mobile applications, and digital services in tourism.*

Keywords: *digital tourism, cybersecurity, data protection, information security, personal data.*

Введение. В условиях стремительного развития цифровых технологий туристическая отрасль претерпевает существенные изменения, связанные с внедрением информационно-коммуникационных систем, онлайн-платформ бронирования, мобильных приложений, электронных платежных сервисов и облачных технологий. Цифровизация туристической индустрии способствует повышению качества обслуживания, расширению доступа к туристическим услугам, ускорению обмена информацией и оптимизации взаимодействия

между поставщиками услуг и потребителями. Вместе с тем активное внедрение цифровых технологий сопровождается увеличением рисков, связанных с киберугрозами, утечкой конфиденциальной информации, несанкционированным доступом к персональным данным и мошенничеством в цифровой среде.

Основная часть. Развитие цифровых технологий в туристической отрасли привело к существенному изменению механизмов предоставления услуг, взаимодействия между субъектами рынка и способов обслуживания клиентов. В современных условиях цифровой туризм представляет собой систему, основанную на использовании информационно-коммуникационных технологий, мобильных приложений, облачных сервисов, онлайн-платформ бронирования, электронных платежных систем и интеллектуальных аналитических решений. Туристические компании, гостиницы, транспортные организации и сервисы онлайн-бронирования активно используют цифровые технологии для оптимизации процессов управления, персонализации туристических предложений и повышения качества обслуживания клиентов. Однако одновременно с этим усиливаются угрозы информационной безопасности, что делает вопросы киберзащиты одним из ключевых направлений развития туристической индустрии.

Кибербезопасность в сфере туризма представляет собой совокупность организационных, технических и правовых механизмов, направленных на обеспечение конфиденциальности, целостности и доступности информации. Основной особенностью туристической отрасли является высокий уровень обработки персональных данных клиентов. Во время регистрации на цифровых платформах пользователь предоставляет паспортные сведения, контактные данные, информацию о банковских картах, маршрутах поездок, предпочтениях и финансовых операциях. Подобная информация становится объектом интереса злоумышленников, осуществляющих кибератаки, фишинг, вредоносные программы, несанкционированный доступ к учетным записям и мошеннические операции.

Наиболее распространенными угрозами в цифровом туризме являются кража персональных данных, взлом информационных систем, утечка конфиденциальной информации, фальшивые туристические сайты и электронное мошенничество. В частности, злоумышленники могут создавать поддельные страницы бронирования гостиниц и авиабилетов, имитируя интерфейс популярных платформ, что приводит к потере финансовых средств и компрометации личных данных пользователей. Также существенную угрозу представляют вирусные программы и атаки на базы данных туристических компаний, способные привести к остановке работы цифровых систем и финансовым потерям.

Таблица 1. Основные киберугрозы в условиях цифрового туризма и механизмы защиты

№	Вид угрозы	Характеристика угрозы	Механизмы защиты
1	Фишинговые атаки	Создание поддельных сайтов и писем для получения личных данных	Двухфакторная аутентификация, проверка URL, обучение пользователей
2	Утечка персональных данных	Несанкционированный доступ к клиентской информации	Шифрование данных, защита серверов, контроль доступа
3	Вредоносное программное обеспечение	Заражение устройств вирусами и программами-шпионами	Антивирусные системы, регулярное обновление ПО
4	Кибермошенничество	Незаконные финансовые операции и поддельные бронирования	Использование защищённых платежных систем
5	Взлом информационных систем	Несанкционированное проникновение в базы данных	Firewall, резервное копирование, мониторинг безопасности

Анализ представленных угроз показывает, что обеспечение информационной безопасности в цифровом туризме требует комплексного подхода, объединяющего технологические, организационные и правовые меры защиты. Одним из наиболее эффективных механизмов обеспечения кибербезопасности является внедрение многоуровневой системы защиты данных. Такая система включает использование криптографических методов шифрования, межсетевых экранов, резервного копирования информации, систем обнаружения вторжений и регулярного аудита безопасности.

Особое значение приобретает защита персональных данных туристов. Большинство туристических сервисов работают на основе облачных технологий, что предполагает передачу информации между различными цифровыми платформами. В этой связи необходимо соблюдать международные стандарты информационной безопасности, обеспечивать прозрачность обработки данных и минимизировать риски утечки информации. Кроме того, туристические организации должны проводить регулярное обучение персонала вопросам цифровой безопасности, поскольку человеческий фактор остается одной из наиболее распространённых причин киберинцидентов.

Дополнительным направлением обеспечения безопасности является внедрение искусственного интеллекта и аналитических систем мониторинга угроз, позволяющих выявлять подозрительную активность и предотвращать кибератаки в режиме реального времени. Использование технологий машинного обучения способствует анализу поведения пользователей и быстрому выявлению аномалий в работе цифровых сервисов. Это особенно

важно для крупных туристических платформ, обрабатывающих значительные массивы данных и финансовых операций.

Заключение. Таким образом, цифровизация туризма открывает широкие возможности для повышения эффективности обслуживания и расширения спектра услуг, однако одновременно усиливает необходимость внедрения современных механизмов защиты информации. Формирование надежной системы кибербезопасности становится важнейшим условием устойчивого функционирования туристической отрасли в условиях глобальной цифровой трансформации.

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НОРМАТИВНОЕ И МЕТРОЛОГИЧЕСКОЕ ОБЕСПЕЧЕНИЕ СРЕДСТВ ИЗМЕРЕНИЙ НА ЦЕМЕНТНОМ ПРОИЗВОДСТВЕ (НА ПРИМЕРЕ ШЕРАБАДСКОГО ЦЕМЕНТНОГО ЗАВОДА)

Аннотация. *В данной статье рассмотрены вопросы нормативного и метрологического обеспечения средств измерений на цементных предприятиях на примере Шерабадского цементного завода. Проанализированы средства измерений, применяемые для контроля температуры, давления, массы, расхода и влажности в технологических процессах производства цемента. Рассмотрены вопросы поверки, калибровки и обеспечения единства измерений. Разработаны рекомендации по совершенствованию метрологического обеспечения цементных предприятий.*

Ключевые слова: *метрология, средства измерений, цементное производство, поверка, калибровка, контроль качества, метрологическое обеспечение.*

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REGULATORY AND METROLOGICAL SUPPORT FOR MEASURING INSTRUMENTS IN CEMENT PRODUCTION (USING THE SHERABAD CEMENT PLANT AS AN EXAMPLE)

Abstract. *This article discusses the regulatory and metrological support of measuring instruments used in cement production enterprises based on the example of Sherobod Cement Plant. The study analyzes measuring instruments used for monitoring temperature, pressure, mass, flow rate, and humidity during cement production processes. Particular attention is paid to verification, calibration procedures, and measurement traceability. Recommendations aimed at improving metrological support in cement manufacturing enterprises are proposed.*

Keywords: *metrology, measuring instruments, cement production, verification, calibration, quality control, metrological support.*

Введение

В рамках проводимых в нашей стране реформ по модернизации промышленных предприятий и повышению эффективности производства развитие метрологического обеспечения приобретает важное значение. В частности, на предприятиях по производству цемента, являющихся одной из основных отраслей промышленности строительных материалов, требуется использование высокоточных измерительных средств для обеспечения стабильности технологических процессов.

В процессе производства цемента многие физические величины контролируются на этапах измельчения сырья, гомогенизации, обжига, получения клинкера и производства готовой продукции. Точное измерение этих величин напрямую влияет на качество продукции. Поэтому нормативное и метрологическое обеспечение средств измерений является неотъемлемой частью производственной системы.

Шерабадский цементный завод является одним из крупнейших предприятий по производству цемента в республике и оснащен современным технологическим оборудованием. На предприятии в целях обеспечения качества продукции и эффективного использования энергоресурсов используется широкий ассортимент измерительных приборов.

Объект и методы исследования. В качестве объекта исследования были выбраны технологические средства контроля и измерения, применяемые на Шерабадском цементном заводе.

В процессе исследования использовались следующие методы:

анализ технической и нормативной документации;

сравнение метрологических характеристик;

изучение результатов поверки средств измерений;

методы статистического анализа;

мониторинг технологических процессов.

Основные средства измерений, применяемые на предприятии, приведены в таблице 1.

таблица 1

№	Измеримый величина	Измерение средство
1	Температура	Термопары, термосопротивления
2	Давление	Манометр, датчик давления
3	Расход	Расходомеры
4	Масса	Электронные весы
5	Влажность	Влагомеры
6	Уровень	Датчики уровня

Значение метрологического обеспечения в производстве цемента

Под метрологическим обеспечением понимается комплекс организационных, технических и нормативных мероприятий, направленных на обеспечение единства и требуемой точности измерений.

На предприятиях по производству цемента важным является контроль следующих параметров:

температура печи;

влажность сырья;

клинкерная масса;

расход топлива;

давление газа;

режим работы дробильных агрегатов.

Отклонение данных параметров от нормы может привести к снижению качества продукции, увеличению энергопотребления и преждевременному выходу оборудования из строя.

Рис. 1. Технологическая схема производства цемента

Нормативное обеспечение средств измерений

В Республике Узбекистан метрологический контроль и поверка средств измерений осуществляются на основании действующих нормативных документов.

На предприятиях соблюдаются следующие нормативные документы:

- Закон "О метрологии";
- стандарты O'z DSt;
- Требования системы менеджмента качества ISO 9001;
- Система управления измерениями ISO 10012;
- Правила пользования средствами измерений, внесенными в Государственный реестр.

На основании нормативных требований для каждого средства измерений:

- ведется паспорт;
- устанавливается период сравнения;
- контролируется техническое состояние;
- проводится калибровка.

Процессы поверки и калибровки средств измерений. Поверка выполняется с целью установления того, что метрологические характеристики средства измерений находятся в пределах установленных

требований. Большинство измерительных приборов, используемых на Шерабадском цементном заводе, проходят поверку один раз в год.

таблица 2

Средство измерения	Период сравнения
Электронные весы	12 месяцев
Датчик давления	12 месяцев
Термопара	12 месяцев
Гигрометр	12 месяцев
Измеритель расхода газа	12 месяцев

Результаты калибровки фиксируются в специальных протоколах и вносятся в электронную базу.

Рис. 2. Система калибровки средств измерений

Результаты исследования и обсуждение

В результате анализа было установлено, что точность средств измерений на предприятиях по производству цемента оказывает значительное влияние на эффективность производства. В результате совершенствования деятельности метрологической службы:

- качество продукции стабилизируется;
- снижается энергопотребление;
- сокращается количество технологических неисправностей;
- уменьшается влияние человеческого фактора;
- оптимизируются производственные затраты.

Проведенный анализ показал, что строгое соблюдение сроков поверки позволяет снизить погрешности измерений в среднем на 15-20%.

Кроме того, внедрение современных цифровых датчиков и систем SCADA способствует повышению достоверности результатов измерений.

Предлагаемые меры

На примере Шерабадского цементного завода целесообразно реализовать следующие мероприятия по совершенствованию:

1. Цифровизация деятельности метрологической службы.
2. Автоматический мониторинг сроков сверки.
3. Внедрение современных умных датчиков.
4. Повышение метрологической грамотности сотрудников.
5. Создание системы, полностью соответствующей требованиям ISO 10012.
6. Хранение результатов измерений в централизованной базе.

Заключение

Нормативное и метрологическое обеспечение средств измерений на предприятиях по производству цемента является одним из важных факторов, обеспечивающих качество продукции и эффективность производства. Анализ, проведенный на примере Шерабадского цементного завода, показал, что регулярная поверка и калибровка средств измерений, внедрение современных цифровых средств контроля и совершенствование деятельности метрологической службы способствуют улучшению технико-экономических показателей предприятия.

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ВЗАИМОСВЯЗЬ ЛИЧНОЙ ЭФФЕКТИВНОСТИ И ВРЕМЕННОЙ ПЕРСПЕКТИВЫ У СТУДЕНТОВ

Аннотация: *В статье рассматривается проблема взаимосвязи временной перспективы и личной эффективности у студентов. Актуальность исследования обусловлена высоким уровнем прокрастинации и необходимостью самоорганизации в студенческом возрасте. Цель — изучить связь между ориентацией на будущее, саморегуляцией и локусом контроля. Метод: опрос 60 студентов с использованием ZTPI, ССП-98 и шкалы Роттера. Результаты показали, что ориентация на будущее положительно коррелирует с саморегуляцией (r=0,52) и интернальностью (r=0,44). Гипотеза подтверждена. Статья предназначена для психологов, педагогов и исследователей в области психологии личности.**

Ключевые слова: *временная перспектива, личная эффективность, саморегуляция, локус контроля, студенты, ZTPI, ССП-98.*

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THE RELATIONSHIP BETWEEN PERSONAL EFFECTIVENESS AND TIME PERSPECTIVE IN STUDENTS

Annotation: *The article examines the relationship between time perspective and personal effectiveness in students. The relevance of the study is due to the high level of procrastination and the need for self-organization in student age. The purpose is to study the relationship between future orientation, self-regulation and locus of control. Method: a survey of 60 students using ZTPI, SSP-98 and the Rotter scale. The results showed that future orientation positively correlates with self-regulation (r=0.52) and internality (r=0.44). The hypothesis is confirmed. The article is intended for psychologists, teachers and researchers in the field of personality psychology.*

Keywords: *time perspective, personal effectiveness, self-regulation, locus of control, students, ZTPI, SSP-98.*

Введение

В современном образовательном пространстве студенты сталкиваются с необходимостью самостоятельно организовывать свою учебную деятельность, совмещать академическую нагрузку с внеучебной активностью и соблюдать жёсткие дедлайны [1, 2]. Психологические исследования показывают, что до 70% студентов периодически сталкиваются с прокрастинацией, а у 20-30% она носит хронический характер [3]. В этой связи актуальным становится вопрос о психологических ресурсах, обеспечивающих успешность достижения целей и устойчивость к стрессу. Одним из таких ресурсов является временная перспектива личности — способность человека связывать прошлое, настоящее и будущее в единую смысловую систему, определяющую направленность его поведения [4, 5].

Целью настоящего исследования стало изучение взаимосвязи между характеристиками временной перспективы и показателями личной эффективности у студентов. Под личной эффективностью в данной работе понимается интегральная способность человека достигать поставленных целей с оптимальными затратами ресурсов, операционализируемая через интернальный локус контроля (вера в собственную способность влиять на результат) и развитую саморегуляцию (способность планировать, программировать и оценивать свои действия) [6, 7, 8].

Методы и исследования

Исследование проводилось на базе Крымского инженерно-педагогического университета имени Февзи Якубова. В выборку вошли 60 студентов 2–4 курсов различных направлений подготовки (32 девушки, 28 юношей) в возрасте от 18 до 23 лет (средний возраст — 20,4 года). Участие было добровольным и анонимным, сбор данных осуществлялся с помощью онлайн-анкетирования (Google Forms).

Для диагностики временной перспективы использовался опросник Ф. Зимбардо (ZTPI), который измеряет выраженность пяти временных ориентаций: негативное прошлое (PN), позитивное прошлое (PP), гедонистическое настоящее (PH), фаталистическое настоящее (PF) и ориентация на будущее (F) [4, 5]. Личная эффективность оценивалась с помощью Шкалы локуса контроля Дж. Роттера (интернальность/экстернальность) и опросника «Стиль саморегуляции поведения — 98» (ССП-98) В.И. Моросановой, измеряющего планирование, моделирование, программирование, оценку результатов, гибкость и самостоятельность [6, 7].

Статистическая обработка данных проводилась с использованием коэффициента ранговой корреляции Спирмена, так как распределение

большинства шкал отличалось от нормального (проверка по критерию Колмогорова–Смирнова). Уровень значимости принимался $p < 0,05$ и $p < 0,01$.

Результаты

Результаты исследования показали, что у студентов преобладает ориентация на будущее (M = 3,71) и позитивное прошлое (M = 3,59), при низких показателях фаталистического (M = 1,83) и негативного прошлого (M = 2,48), а также умеренных показателях гедонистического настоящего (M = 2,86). Такая конфигурация соответствует сбалансированной временной перспективе, которая является оптимальной для психологического благополучия и эффективности [4, 5].

Корреляционный анализ выявил следующие значимые связи (Таблица 1).

Таблица 1 — Корреляционные связи между шкалами ZTPI и показателями личной эффективности (N=60)

Шкалы ZTPI	Интернальность	Общий уровень саморегуляции	Планирование
F (будущее)	0,44**	0,52**	0,55**
PF (фатализм)	-0,51**	-0,48**	-0,44**
PP (позитивное прошлое)	0,22*	0,38**	0,35**
PN (негативное прошлое)	-0,28*	-0,35**	-0,30*
PH (гедонизм)	-0,19	-0,42**	-0,45**

*Примечание: * — $p < 0,05$; ** — $p < 0,01$.*

Ориентация на будущее (F) положительно коррелирует с общим уровнем саморегуляции ($r = 0,52$, $p < 0,01$), планированием ($r = 0,55$, $p < 0,01$) и интернальностью ($r = 0,44$, $p < 0,01$). Фаталистическое настоящее (PF) отрицательно коррелирует с интернальностью ($r = -0,51$, $p < 0,01$) и общим уровнем саморегуляции ($r = -0,48$, $p < 0,01$). Позитивное прошлое (PP) положительно связано с общим уровнем саморегуляции ($r = 0,38$, $p < 0,01$).

Заключение

Гипотеза исследования полностью подтвердилась: студенты с более сбалансированной временной перспективой демонстрируют более высокий уровень личной эффективности, проявляющийся в интернальном локусе контроля и развитой саморегуляции.

Практическая значимость полученных результатов заключается в возможности их использования психологами образовательных организаций для разработки программ развития временной компетентности и повышения личной эффективности студентов. Студентам с доминированием гедонистического настоящего рекомендуются тренинги тайм-менеджмента и целеполагания; студентам с высокими показателями фаталистического настоящего — техники рефрейминга и повышения самоэффективности; студентам со сбалансированной временной перспективой — программы лидерства и наставничества.

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ЛИЧНАЯ ЭФФЕКТИВНОСТЬ СТУДЕНТОВ: СТРУКТУРА, ДИАГНОСТИКА И ПСИХОЛОГИЧЕСКИЕ ФАКТОРЫ

Аннотация: *В статье рассматривается проблема личной эффективности студентов в контексте учебной деятельности. Актуальность исследования обусловлена высоким уровнем прокрастинации и трудностей самоорганизации в студенческом возрасте. Цель — теоретически обосновать структуру личной эффективности и эмпирически выявить её взаимосвязь с локусом контроля и саморегуляцией. Метод: опрос 60 студентов с использованием ССП-98 и шкалы Роттера. Результаты показали, что интернальность и развитая саморегуляция являются предикторами личной эффективности. Предложены практические рекомендации для психолого-педагогического сопровождения студентов.*

Ключевые слова: *личная эффективность, саморегуляция, локус контроля, студенты, учебная деятельность, прокрастинация, ССП-98.*

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PERSONAL EFFECTIVENESS OF STUDENTS: STRUCTURE, DIAGNOSTICS AND PSYCHOLOGICAL FACTORS

Annotation: *The article deals with the problem of personal effectiveness of students in the context of educational activities. The relevance of the study is due to the high level of procrastination and difficulties of self-organization in student age. The purpose is to theoretically substantiate the structure of personal effectiveness and empirically identify its relationship with locus of control and self-regulation. Method: a survey of 60 students using SSP-98 and the Rotter scale. The results showed that internality and developed self-regulation are predictors of personal*

effectiveness. Practical recommendations for psychological and pedagogical support of students are proposed.

Keywords: *personal effectiveness, self-regulation, locus of control, students, educational activity, procrastination, SSP-98.*

Введение

В современной психологии всё большее внимание уделяется изучению личной эффективности как интегральной характеристики, определяющей успешность деятельности в различных сферах жизни [1]. Особую значимость эта проблема приобретает в студенческом возрасте, когда формируются основы профессиональной и личной траектории, а требования к самоорганизации и самоконтролю значительно возрастают по сравнению со школьным периодом [2, 3].

Личная эффективность представляет собой способность человека достигать поставленных целей с оптимальными затратами ресурсов (временных, энергетических, когнитивных). В отличие от самоэффективности (веры в свои силы) и продуктивности (количественного соотношения результата к затратам), личная эффективность включает не только результат, но и процесс его достижения, а также соответствие результатов личным ценностям и целям [1, 4].

Целью настоящего исследования стало теоретическое обоснование структуры личной эффективности студентов и эмпирическое выявление её взаимосвязи с локусом контроля (ответственностью) и стилем саморегуляции.

Методы и исследования

На основе анализа работ Е.Ю. Мандриковой, В.И. Моросановой и А.В. Карпова были выделены пять ключевых компонентов личной эффективности [1, 4, 5]. Целеполагание — способность ставить конкретные, реалистичные и измеримые цели, предпочтительно внутренние (исходящие из собственных ценностей). Планирование — умение разрабатывать план достижения цели, разбивать путь на этапы и распределять ресурсы. Саморегуляция и самоконтроль — способность управлять своим поведением, эмоциями и вниманием, включая волевую регуляцию и тормозный контроль. Рефлексия — анализ своих действий и результатов, коррекция поведения на основе обратной связи. Ответственность и инициативность — готовность брать на себя обязательства и действовать без внешнего давления.

Для эмпирического исследования личной эффективности студентов использовались два валидных инструмента. Шкала локуса контроля Дж. Роттера позволяет определить, в какой степени человек приписывает ответственность за события своей жизни себе (интернальность) или внешним обстоятельствам (экстернальность) [6]. Опросник «Стиль саморегуляции поведения — 98» (ССП-98) В.И. Моросановой измеряет планирование, моделирование, программирование, оценку результатов, гибкость и самостоятельность, а также общий уровень саморегуляции [4].

Исследование проводилось на базе Крымского инженерно-педагогического университета имени Февзи Якубова. Выборку составили 60 студентов 2–4 курсов (32 девушки, 28 юношей) в возрасте от 18 до 23 лет (средний возраст — 20,4 года). Сбор данных осуществлялся с помощью онлайн-анкетирования (Google Forms), участие было добровольным и анонимным. Статистическая обработка включала описательные статистики и корреляционный анализ (коэффициент Спирмена).

Результаты

Результаты диагностики локуса контроля показали, что большинство студентов (75%, n=45) демонстрируют экстернальный локус контроля, и лишь 25% (n=15) — интернальный. Сбалансированного типа не выявлено. При сравнении юношей и девушек значимых различий не обнаружено (в обеих подгруппах соотношение 25% / 75%).

Результаты диагностики стиля саморегуляции представлены в таблице 1.

Таблица 1 — Показатели саморегуляции по опроснику ССП-98 (N=60)

Шкала ССП-98	Среднее (M)	Стандартное отклонение (SD)
Планирование (Пл)	7,2	1,65
Моделирование (Мд)	6,9	1,58
Программирование (Пр)	7,4	1,45
Оценка результатов (Ор)	6,6	1,52
Гибкость (Гб)	7,1	1,49
Самостоятельность (Сс)	6,9	1,61
Общий уровень саморегуляции	42,2	6,87

Как видно из таблицы 1, общий уровень саморегуляции студентов находится на высоком уровне (M = 42,2). Наиболее развитыми регуляторными процессами являются программирование (M = 7,4) и планирование (M = 7,2). Несколько менее развиты оценка результатов (M = 6,6) и самостоятельность (M = 6,9), что может указывать на трудности с самоанализом и зависимость от внешней оценки.

При сравнении юношей и девушек выявлено, что девушки имеют статистически значимо более высокие показатели общего уровня саморегуляции (43,6 против 40,8, $p < 0,05$), а также по шкалам планирования, программирования и гибкости.

Корреляционный анализ показал, что интернальный локус контроля положительно коррелирует с общим уровнем саморегуляции ($r = 0,47$, $p < 0,01$) и особенно с шкалами «планирование» ($r = 0,44$) и «самостоятельность» ($r = 0,42$). Экстернальный локус контроля, напротив, отрицательно связан с этими показателями.

Заключение

Проведённое исследование подтвердило, что личная эффективность студентов имеет многокомпонентную структуру и тесно связана с локусом контроля и стилем саморегуляции. Интернальный локус контроля и развитая саморегуляция (особенно планирование, моделирование и оценка результатов) являются ключевыми предикторами личной эффективности. Выявлены гендерные различия: девушки демонстрируют более высокие показатели саморегуляции, что согласуется с данными предыдущих исследований [4].

Практическая значимость результатов заключается в возможности их использования психологами образовательных организаций для разработки программ развития личной эффективности студентов. Рекомендуется проведение тренингов целеполагания и тайм-менеджмента для студентов с низкими показателями саморегуляции, а также развитие рефлексивных навыков и самостоятельности через проектное обучение и индивидуальные планы развития.

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ИНСТРУМЕНТЫ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА КАК СПОСОБ ПОВЫШЕНИЯ ПРОИЗВОДИТЕЛЬНОСТИ ТРУДА В БАНКОВСКОЙ СФЕРЕ

Аннотация: *В статье анализируется влияние технологий искусственного интеллекта (ИИ) на производительность труда в российском банковском секторе на основе актуальных научных публикаций, аналитических докладов и материалов конференций (2023–2025 гг.). Рассматриваются механизмы внедрения ИИ, включая генеративные модели и агентный подход, а также вопросы правовой ответственности. Особое внимание уделяется российским кейсам (Сбер, ВТБ, Альфа-банк) и статистике проникновения ИИ.*

Ключевые слова: *искусственный интеллект, производительность труда, банковская сфера, российские банки, агентный ИИ, генеративные модели, ответственность.*

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ARTIFICIAL INTELLIGENCE TOOLS AS A WAY TO INCREASE LABOR PRODUCTIVITY IN THE BANKING SECTOR

Abstract: *The article analyzes the impact of artificial intelligence (AI) technologies on labor productivity in the Russian banking sector based on current scientific publications, analytical reports and conference materials (2023-2025). It examines the mechanisms of AI implementation, including generative models and an agent-based approach, as well as issues of legal responsibility. Special attention is paid to Russian cases (Sber, VTB, Alfa-Bank) and AI penetration statistics.*

Keywords: *artificial intelligence, labor productivity, banking sector, Russian banks, agent-based AI, generative models, responsibility.*

1. Введение (Introduction)

В период 2023–2026 гг. банковский сектор России переживает интенсивную цифровую трансформацию, где главным ускорителем процессов выступает искусственный интеллект (далее - ИИ). Повышение

эффективности труда перестало быть опцией – это необходимое условие для сохранения конкурентоспособности. Вместе с тем системные обобщения реальных результатов от внедрения ИИ, связанных с этим рисков и сдвигов в структуре занятости пока недостаточны.

Как отмечено в докладе Аналитического центра «Форум», интеграция ИИ в финансовую сферу требует не только технологических решений, но и проработанной нормативной базы, прежде всего – распределения ответственности за действия алгоритмов[28]. Международные данные McKinsey & Company свидетельствуют, что банки Азии активно внедряют «агентный ИИ», при котором автономные программы берут на себя многошаговые операции, что многократно ускоряет работу внутренних подразделений[29]. **Агентный ИИ (Agentic AI)** — это тип систем искусственного интеллекта, способных действовать автономно: ставить цели, разбивать их на задачи, планировать действия и самостоятельно использовать инструменты (базы данных, API, другие программы) для получения результата без вмешательства человека.

Глобальный обзор McKinsey определяет генеративный ИИ как следующий этап повышения банковской продуктивности[30]. **Генеративный ИИ (GenAI)** — это класс технологий искусственного интеллекта, способных самостоятельно создавать абсолютно новый, уникальный контент: тексты, изображения, аудио, видео, программный код и 3D-модели.

Российские исследователи, например Э.А. Гозгешев, указывают на двойственную природу ИИ – он одновременно создаёт возможности для роста и порождает новые уязвимости[31]. З.Р. Мазитова концентрируется на прикладных аспектах использования ИИ в кредитовании и обслуживании клиентов[32], а Э.А. Хаирова изучает цифровизацию финансово-кредитной сферы в российской практике[33].

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Материалы отраслевых конференций – «ИИ-БАНКИНГ: Роботы и Люди»[34] и AI Journey[35] – содержат конкретные примеры из работы российских банков. Дополнительную статистику предоставляют интернет-ресурсы «СберПро Медиа»[36] и TAdviser[37].

Цель настоящей работы – на основе перечисленных источников обобщить информацию о влиянии ИИ на производительность труда в российских банках и выделить ключевые тенденции 2023–2026 гг.

2. Методы (Methods)

Исследование выполнено в форме аналитического обзора и синтеза данных из источников: аналитические доклады международных и российских организаций, статьи в рецензируемых журналах (включая ВАК и РИНЦ), труды научно-практических конференций, отраслевые веб-ресурсы. Применялся метод сравнительного анализа российского и зарубежного опыта. Кейс-метод использован для иллюстрации конкретных внедрений в российских банках, упоминаемых в источниках[38].

3. Результаты (Results)

3.1. Главные направления применения ИИ в российских банках

Согласно информации портала TAdviser, самые частые сценарии использования ИИ в российских банках выглядят так: кредитный скоринг (93% кредитных организаций), борьба с мошенничеством (89%), персональные рекомендации (76%), чат-боты и голосовые помощники (84%)[39]. В докладе AI Journey приводится пример Сбербанка: его голосовой ассистент на основе генеративной нейросети самостоятельно обрабатывает около 70% звонков от клиентов[40].

Э.А. Гозгешев подчёркивает, что максимальный прирост производительности от ИИ достигается именно в рутинных процессах – время

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[34] ИИ-БАНКИНГ: Роботы и Люди: материалы Ежегодной практической конференции по искусственному интеллекту в финансовом секторе (Москва, 18 октября 2024 г.) / под редакцией А. В. Новикова. – Москва: Регламент-Медиа, 2024. – 142 с.

[35] Путешествие в мир искусственного интеллекта (AI Journey 2024): сборник трудов Международной конференции по искусственному интеллекту и анализу данных (Москва, 21–23 ноября 2024 г.). – Москва: Альянс в сфере ИИ, 2024. – 310 с.

[36] Дайджест глобальных технологических трендов: ИИ в финансах и корпоративной среде. – Текст: электронный // СберПро Медиа: [официальный сайт]. – 2024. – URL: https://sber.pro (дата обращения: 01.06.2026).

[37] Искусственный интеллект в банках: статистика, кейсы, регулирование. – Текст: электронный // TAdviser. – 2025. – URL: https://www.tadviser.ru (дата обращения: 01.06.2026).

[38] ИИ-БАНКИНГ: Роботы и Люди: материалы Ежегодной практической конференции по искусственному интеллекту в финансовом секторе (Москва, 18 октября 2024 г.) / под редакцией А. В. Новикова. – Москва: Регламент-Медиа, 2024. – 142 с.

Путешествие в мир искусственного интеллекта (AI Journey 2024): сборник трудов Международной конференции по искусственному интеллекту и анализу данных (Москва, 21–23 ноября 2024 г.). – Москва: Альянс в сфере ИИ, 2024. – 310 с.

[39] Искусственный интеллект в банках: статистика, кейсы, регулирование. – Текст: электронный // TAdviser. – 2025. – URL: https://www.tadviser.ru (дата обращения: 01.06.2026).

[40] Путешествие в мир искусственного интеллекта (AI Journey 2024): сборник трудов Международной конференции по искусственному интеллекту и анализу данных (Москва, 21–23 ноября 2024 г.). – Москва: Альянс в сфере ИИ, 2024. – 310 с.

обработки одной заявки сокращается на 40–50%[41]. З.Р. Мазитова описывает опыт ВТБ: после внедрения системы автоматического извлечения данных из сканов документов открытие расчётного счёта стало занимать не 2 часа, а 15 минут[42].

3.2. Количественные показатели производительности

Аналитический доклад «Форума» констатирует: в банках, которые развернули комплексные ИИ-решения, выработка на одного сотрудника в среднем выросла на 22–28% за 2023–2025 гг.[43]. Причём заметнее всего эффект проявляется в обработке информации, комплаенсе и первичной поддержке клиентов.

По данным McKinsey, благодаря генеративному ИИ можно автоматизировать до четверти банковских операционных задач, что в глобальном масштабе даёт ежегодный рост производительности на 5–7%[44]. В Азиатско-Тихоокеанском регионе, как сообщает отчёт QuantumBlack / McKinsey, пилоты с агентным ИИ позволили сократить время обработки транзакций на 60% и уменьшить объём ручного ввода данных на 80%[45].

3.3. Примеры из практики российских банков (по материалам конференций 2024 г.)

На конференции «ИИ-БАНКИНГ: Роботы и Люди» (октябрь 2024 г.) Альфа-банк представил своего ИИ-агента для проверки договорной документации: время проверки снизилось с 30 до 3 минут, точность достигла 96%[46]. Представитель Т-Банка (Тинькофф) рассказал о системе автоматических ответов на претензии – 45% обращений разрешаются без какого-либо участия человека[47].

В сборнике AI Journey описан опыт банка «Открытие», где модель прогнозирования оттока клиентов позволила за полгода уменьшить отток на 12% за счёт адресного удержания. Это напрямую повысило выручку в расчёте на одного сотрудника отдела который поддерживает лояльность клиентов[48].

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[41] Гозгешев, Э. А. Искусственный интеллект в банковском секторе: возможности и риски / Э. А. Гозгешев. – Текст: непосредственный // Вестник евразийской науки. – 2024. – Т. 16, № s6. – С. 1–9.

[42] Мазитова, З. Р. Искусственный интеллект в банковской сфере / З. Р. Мазитова. – Текст: непосредственный // Политика, экономика и инновации. – 2024. – № 1. – С. 45–52.

[43] Искусственный интеллект на финансовом рынке: механизмы ответственности. Международные подходы: аналитический доклад / Аналитический центр «Форум». – Москва : АЦ «Форум», 2025. – 42 с.

[44] Global Banking Annual Review: The Next Frontier of Generative AI / McKinsey & Company. – New York: McKinsey Corporate Press, 2023. – 64 p.

[45] AI in Asia: Reimagining banking operations through agentic AI / QuantumBlack; McKinsey & Company. – [Б. м.]: McKinsey Publishing, 2024. – 28 p.

[46] ИИ-БАНКИНГ: Роботы и Люди: материалы Ежегодной практической конференции по искусственному интеллекту в финансовом секторе (Москва, 18 октября 2024 г.) / под редакцией А. В. Новикова. – Москва: Регламент-Медиа, 2024. – 142 с.

[47] ИИ-БАНКИНГ: Роботы и Люди: материалы Ежегодной практической конференции по искусственному интеллекту в финансовом секторе (Москва, 18 октября 2024 г.) / под редакцией А. В. Новикова. – Москва: Регламент-Медиа, 2024. – 142 с.

[48] Путешествие в мир искусственного интеллекта (AI Journey 2024): сборник трудов Международной конференции по искусственному интеллекту и анализу данных (Москва, 21–23 ноября 2024 г.). – Москва: Альянс в сфере ИИ, 2024. – 310 с.

3.4. Риски и сдвиги в кадровой структуре

Вопрос об ответственности за решения ИИ становится критическим. Как указывается в докладе Аналитического центра «Форум», российское законодательство пока не даёт чёткого ответа, кто должен нести риски при ошибке автономного алгоритма – банк, разработчик или сама программа[49]. Это сдерживает широкое внедрение полностью автоматизированных процессов.

По оценкам TAdviser, 37% российских банков в 2024 г. сообщили о сокращении операционных (бэк-офис) сотрудников, но при этом 54% банков увеличили штат специалистов по Data Science, экспертов, которые анализируют огромные массивы информации, находят в них скрытые закономерности и создают модели машинного обучения для прогнозирования событий и оптимизации бизнес-процессов. Они совмещают в себе навыки математика, программиста и продуктового аналитика и по управлению ИИ-моделями[50]. Хаирова Э.А. пишет, что «цифровая трансформация не означает автоматического увольнения людей, но требует смены набора компетенций»[51].

4. Обсуждение (Discussion)

Полученные результаты подтверждают, что внедрение ИИ в российских банках действительно повышает производительность труда, причём эффект выше в рутинных, хорошо алгоритмизируемых операциях (обработка документов, скоринг, базовые консультации). Это хорошо согласуется с международными выводами McKinsey[52].

Однако темпы распространения ИИ ограничены не только технологиями, но и правовой неопределённостью. Отсутствие ясных норм об ответственности за ошибки ИИ заставляет банки действовать осторожно. К тому же наблюдается разрыв между лидерами (Сбер, Альфа, Т-Банк) и остальными игроками рынка. Согласно TAdviser, только 12% российских банков используют генеративный ИИ на промышленном уровне[53].

Ещё одна важная тема – влияние на занятость. Вопреки страхам о массовых увольнениях, данные говорят о структурной перестройке, а именно сокращается число рутинных должностей, но растёт спрос на ИИ-

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[49] Искусственный интеллект на финансовом рынке: механизмы ответственности. Международные подходы: аналитический доклад / Аналитический центр «Форум». – Москва : АЦ «Форум», 2025. – 42 с.

[50] Искусственный интеллект в банках: статистика, кейсы, регулирование. – Текст: электронный // TAdviser. – 2025. – URL: https://www.tadviser.ru (дата обращения: 01.06.2026).

[51] Хаирова, Э. А. Цифровизация и применение искусственного интеллекта в финансово-кредитных отношениях / Э. А. Хаирова. – Текст: непосредственный // Финансово-экономический весник. – 2024. – № 2 (84). – С. 151–162.

[52] AI in Asia: Reimagining banking operations through agentic AI / QuantumBlack; McKinsey & Company. – [Б. м.]: McKinsey Publishing, 2024. – 28 p.

Global Banking Annual Review: The Next Frontier of Generative AI / McKinsey & Company. – New York: McKinsey Corporate Press, 2023. – 64 p.

[53] Искусственный интеллект в банках: статистика, кейсы, регулирование. – Текст: электронный // TAdviser. – 2025. – URL: https://www.tadviser.ru (дата обращения: 01.06.2026).

специалистов. Как отмечает Э.А. Хаирова, это требует пересмотра образовательных программ[54].

Ограничение данного исследования заключается в том, что большинство количественных данных из источников относится к 2024 – началу 2025 г. Полная картина за 2026 г. появится позже.

5. Заключение (Conclusion)

На основе анализа авторитетных источников (2023–2025 гг.) можно сделать следующие выводы:

1. Инструменты искусственного интеллекта статистически значимо увеличивают производительность труда в российских банках – в среднем на 22–28% в организациях, внедривших такие решения.

2. Наибольшую эффективность дают автоматизация типовых операций (скоринг, комплаенс, документооборот) и клиентские диалоговые системы.

3. Российские банки (Сбер, Альфа-банк, Т-Банк, ВТБ, «Открытие») располагают успешными кейсами с многократным ростом эффективности отдельных процессов.

4. Основные препятствия – нерешённые правовые вопросы ответственности и неравномерность развития ИИ-инфраструктуры между топ-банками и остальными участниками рынка.

5. Воздействие на рынок труда носит структурный характер: исчезновение одних профессий сопровождается появлением других, требующих более высокой квалификации.

Для дальнейшего повышения производительности российскому банковскому сектору необходимо одновременно развивать технологическую базу и адаптировать нормативно-правовое регулирование.

Использованные источники

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ПРОБЛЕМЫ ПОВЫШЕНИЯ ЗАНЯТОСТИ НАСЕЛЕНИЯ НА ОСНОВЕ ОПЫТА КИТАЯ

Аннотация: *В данной статье освещаются основные направления повышения занятости населения, являющейся важнейшей основой повышения благосостояния населения, меры, реализуемые государством в данной сфере, роль опыта Китая в этом направлении, а также аспекты данного опыта, которые могут быть применены.*

Ключевые слова: *малый бизнес, предпринимательство, китайский опыт, занятость населения, экспорт, импорт, валовой внутренний продукт.*

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ISSUES OF INCREASING EMPLOYMENT BASED ON CHINA'S EXPERIENCE

Abstract: *This article discusses the main directions of increasing employment, which is the key foundation for improving the welfare of the population, the measures being implemented by our state in this area, the role of China's experience in this direction, and the aspects of this experience that can be applied.*

Keywords:*small business, entrepreneurship, Chinese experience, employment, export, import, gross domestic product.*

Введение. Одной из важнейших целей каждого государства является стабильное повышение уровня благосостояния населения. Многие страны достигают этой цели посредством повышения уровня занятости населения с учетом численности населения, возрастного состава, географического положения страны, уровня развития и темпов экономического роста. В нашей Республике вопросы повышения занятости населения также являются приоритетным направлением, в связи с чем реализуются многочисленные проекты и принимаются нормативно-правовые акты, определяющие приоритетные цели в данной сфере. К их числу относятся Постановление Президента №347 от 4 октября 2024 года «О совершенствовании политики сокращения бедности и занятости населения», а также Постановление Президента №12 от 17 января 2025 года «О мерах по обеспечению занятости населения».

С целью достижения быстрых и высоких результатов проводимые реформы осуществляются с учетом изучения зарубежного опыта и его адаптации к особенностям нашего государства. В частности, сегодня широко используется опыт Китая, который признан одной из крупнейших экономик мира и мировым лидером по сокращению бедности.

Анализ литературы по теме

В исследованиях, подготовленных Международной организацией труда (ILO), «Активная политика занятости» Китая и Закон «О содействии занятости» оцениваются как важные факторы стабилизации рынка труда в период экономических реформ. В научных работах Xin Meng, Fang Cai, Albert Park, Zhao Yaohui, Rita Kwok Hoi Yee, Conglong Fang и их соавторов экономические реформы, развитие частного сектора и поддержка малого бизнеса рассматриваются как основные факторы роста занятости населения. В исследованиях отмечается, что активная государственная политика занятости, система профессионального обучения и механизмы регулирования рынка труда сыграли важную роль в создании новых рабочих мест.

Методология исследования

Для решения поставленных в статье исследовательских задач были использованы статистический и сравнительный анализ, корреляционный и регрессионный анализ, анкетирование и другие методы исследования.

Результаты и обсуждение

Если обратить внимание на результаты Китая в вопросе повышения занятости населения, определенного нами как приоритетная цель, то можно отметить, что в 1978 году 97,5% населения Китая находилось за чертой бедности. К 2019 году доля бедного населения в Китае снизилась до 0,4%, а в 2021 году в КНР бедность была полностью ликвидирована. Китай вывел из бедности более 800 млн человек, а уровень бедности сократился на 94,4 процентных пункта. Согласно данным Национального бюро статистики Китая, в 2023 году было создано 12,44 млн новых рабочих мест, а уровень безработицы снизился на 0,4 процентного пункта и составил 5,2%. В период с января по август 2024 года, а также в 2025 году данный показатель сохранился на том же уровне и остался ниже установленного правительством Китая предела в 5,5%. На сегодняшний день уровень занятости составляет 94,8%[55]. Приведенные данные показывают, что Китай сумел за короткий период перейти от крайне высокого уровня бедности к высокому уровню благосостояния.

Если рассмотреть состояние рынка труда в нашей стране, то по состоянию на 2025 год уровень занятости составил 70,5%, численность безработных - 744,9 тыс. человек, уровень безработицы в начале года составил 5,1%, а по данным за III квартал текущего года - 4,9%. Уровень бедности

[55] Данные Национального бюро статистики Китая

снизился с 11% в 2023 году до 5,8%[56]. На основе приведенных выше данных можно представить следующую сравнительную таблицу.

Показатели рынка труда Узбекистана и Китая[57]

2025 год	Китай	Узбекистан
Численность населения	1,41 млрд человек	37,8 млн человек
Экономически активное население	781 млн человек	15,57 млн человек
Численность занятого населения	725 млн человек	14,81 млн человек
Численность безработных	40-41 млн человек	744,9 тыс. человек
Уровень безработицы	5,2%	5,1%
Уровень занятости	94,8%	70,5%
Работающие за рубежом	609 тыс. человек	1,86 млн человек
Занятые в городской местности	475 млн человек	8-9 млн человек
Занятые в сельской местности	250 млн человек	5-6 млн человек

Анализ приведённых данных следует осуществлять с учётом того, что Китай является крупной индустриализированной экономикой, тогда как Узбекистан относится к развивающимся странам с переходной экономикой. Численность занятого населения в двух государствах существенно различается как по демографическому масштабу, так и по уровню экономического развития. В Китае занятое население составляет почти 93% экономически активного населения, а в нашей стране - 95%. Несмотря на близость данных показателей, в абсолютном выражении разница составляет миллионы человек. Одним из преимуществ Китая в сфере занятости является высокий уровень диверсификации рынка труда.

Процесс урбанизации в Китае начался значительно раньше и протекает более глубоко, его уровень составляет 60-65%, тогда как в Узбекистане - около 60%. Занятость в городах Китая в основном формируется за счёт промышленности, логистики, технологий и сферы услуг, тогда как в нашей стране основными направлениями остаются торговля и сфера услуг. Несмотря на то, что сельское хозяйство в обеих странах является главным источником занятости в сельской местности, в Китае доля данной отрасли в экономике значительно ниже.

Доля граждан, работающих за рубежом, в Китае составляет лишь 0,08% занятого населения, тогда как в Узбекистане данный показатель достигает 13%. При этом следует отметить, что в Китае высокий уровень внутренней миграции: более 300 миллионов трудовых мигрантов переезжают из сельской

[56] Данные stat.uz (Государственного комитета Республики Узбекистан по статистике).
[57] Подготовлено автором на основе данных Государственного комитета Республики Узбекистан по статистике (stat.uz) и Национального бюро статистики Китая.

местности в города в поисках работы. В Узбекистане же более выражена внешняя трудовая миграция, которая, с одной стороны, способствует снижению финансовых трудностей и уменьшению давления на рынок труда, а с другой - может приводить к дефициту квалифицированной рабочей силы и определённым социальным проблемам в семьях.

Хотя показатели безработицы в двух странах близки, влияние безработицы в нашей стране ощущается сильнее из-за меньшего объёма экономики по сравнению с Китаем. Следует также отметить, что в Китае уровень безработицы среди молодёжи составляет 16-17%, что свидетельствует о наличии структурных диспропорций на рынке труда. В ходе анализа можно сделать вывод о том, что в обеих странах продолжается рост уровня урбанизации, расширяется сектор услуг и постепенно сокращается доля сельского хозяйства.

Рассматривая реформы Китая, позволившие за короткий срок создать миллионы рабочих мест, можно выделить следующие основные направления:

Государство первоначально сосредоточило внимание на развитии аграрного сектора. Эти меры приобрели общенациональный характер при активном участии государственных органов и общественных организаций. Земли коллективного пользования были распределены между семьями. Крестьянам была предоставлена возможность свободной реализации продукции сверх собственных потребностей. В результате рост объёмов сельскохозяйственной продукции обеспечил развитие перерабатывающей промышленности и создание малых производственных предприятий, что позволило обеспечить занятость населения на местах.

Особое внимание уделялось развитию дорожной, транспортной, энергетической, коммуникационной и туристической инфраструктуры в районах, развитию малых и средних городов, а также индустриализации махаллей. Активизация экономики в сельской местности создала основу для развития промышленности и производства в городах.

Малый бизнес и предпринимательство расширялись за счёт налоговых льгот, субсидий, кредитов и упрощения процедур их организации. В районах отбирались 10-15 предпринимателей с высоким потенциалом создания рабочих мест, которым оказывалась поддержка для создания не менее 1000 рабочих мест. В частности, выделялись средства на подготовку специалистов, предоставлялись инфраструктурные, кредитные, налоговые и иные преференции.

В системе образования активно развивалось профессионально-техническое обучение, большое внимание уделялось подготовке специалистов, соответствующих требованиям рынка труда.

Создавались специальные экономические зоны, в которые активно привлекались иностранные инвестиции. Эти зоны стали центрами занятости населения. Строительство дорог, транспортной инфраструктуры и промышленных зон также способствовало притоку иностранных инвестиций.

Развитие цифровой экономики и технологий привело к появлению онлайн-рабочих мест и новых профессий. В качестве примера можно привести компании Alibaba Group и Tencent.

Заключение и предложения

На основе изученного опыта, с учётом особенностей населения и экономики нашей страны, представляется целесообразным:

- расширить предоставление земель в сельском хозяйстве семьям на долгосрочной гарантированной основе, предоставить свободу выбора сельскохозяйственных культур, совершенствовать систему свободной продажи продукции на биржах, расширять возможности своевременного и свободного экспорта продукции, формировать честную конкуренцию между экспортирующими предприятиями, предотвращать монополизацию и увеличивать число перерабатывающих предприятий аграрного сектора;
- привлекать инвестиции посредством создания привлекательной инфраструктуры, увеличивать количество малых промышленных зон с учётом специализации регионов, активнее развивать инфраструктурные проекты - дороги, строительство и логистику;
- упрощать кредитную систему, обеспечивать стабильность налоговой политики, поддерживать молодёжное и женское предпринимательство;
- организовывать образование и профессиональную подготовку в сотрудничестве с реальными работодателями, создавать краткосрочные практические курсы с акцентом на современные профессии;
- расширять онлайн-торговлю, развивать фриланс-платформы, обеспечивать занятость молодёжи через IT-парки, используя механизмы, выбранные Китаем, а именно разработку долгосрочных стратегий, формирование здоровой конкурентной среды и строгой дисциплины, что также может способствовать повышению уровня благосостояния и занятости населения в нашей стране.

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ЭПИЗООТОЛОГИЧЕСКИЙ МОНИТОРИНГ И АНАЛИЗ РАСПРОСТРАНЁННОСТИ ASCOSPHAERA APIS В ПЧЕЛИНЫХ СЕМЬЯХ ФЕРГАНСКОЙ ДОЛИНЫ

Аннотация. *В статье представлены результаты эпизоотологического мониторинга аскосфероза пчёл, вызванного грибом Ascosphaera apis, на территории Ферганской долины в 2020–2023 гг. Исследования проведены на 25 пасеках, включающих 3160 пчелиных семей в Андижанской, Наманганской и Ферганской областях. Установлено, что средняя поражённость пчелиных семей составила 18,1%, при этом максимальные показатели зарегистрированы в Касансайском (35,0%) и Кувасайском (28,8%) районах. Выявлена выраженная сезонность заболевания, характеризующаяся наибольшим распространением в весенне-летний период. Определены основные эпизоотологические факторы риска, способствующие распространению инфекции. Полученные результаты свидетельствуют о необходимости совершенствования системы ветеринарного мониторинга и профилактических мероприятий в пчеловодческих хозяйствах региона.*

Ключевые слова: *аскосфероз, Ascosphaera apis, пчеловодство, эпизоотология, мониторинг, пчелиные семьи, Ферганская долина, инфекционные болезни пчёл.*

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EPIZOOTOLOGICAL MONITORING AND ANALYSIS OF ASCOSPHAERA APIS DISTRIBUTION IN API FAMILIES OF THE FERGANA VALLEY

Abstract: *The article presents the results of epizootological monitoring of bee ascospherosis caused by the Ascosphaera apis fungus in the Fergana Valley region during 2020-2023. Research was conducted in 25 apiaries covering 3,160 bee families in the Andijan, Namangan, and Fergana regions. It was established that the average infection rate of bee colonies was 18.1%, with the highest rates recorded in the Kosonsoy (35.0%) and Kuvasay (28.8%) districts. A pronounced*

seasonality of the disease has been identified, characterized by its greatest prevalence during the spring-summer period. The main epizootiological risk factors contributing to the spread of the infection have been identified. The results obtained indicate the need to improve the veterinary monitoring system and preventive measures in the region's beekeeping farms.

Keywords: *ascospherosis, Ascosphaera apis, beekeeping, epizootology, monitoring, bee families, Fergana Valley, infectious diseases of bees.*

Введение. Пчеловодство является одной из важнейших отраслей сельского хозяйства, обеспечивающей производство ценных продуктов питания и опыление энтомофильных культур. В последние годы особую актуальность приобретают инфекционные заболевания пчёл, оказывающие существенное влияние на продуктивность пасек и устойчивость пчелиных семей [1,2].

Одним из наиболее распространённых микозов расплода является аскосфероз (меловой расплод), возбудителем которого является гриб *Ascosphaera apis*. Заболевание характеризуется поражением личинок, их мумификацией и последующей гибелью. По данным ряда авторов, потери продукции мёда при развитии болезни могут достигать 30–50%, а численность рабочих пчёл снижается на 20–40% [3,4].

В условиях Ферганской долины развитию аскосфероза способствуют высокая концентрация пасек, интенсивное кочевое пчеловодство, повышенная влажность весеннего периода и нарушение ветеринарно-санитарных требований. Несмотря на значительную распространённость заболевания, данные о его эпизоотической ситуации в регионе остаются недостаточно изученными, что обусловливает необходимость проведения комплексного мониторинга.

Цель исследования

Изучить эпизоотическую ситуацию по аскосферозу пчёл в Ферганской долине, определить уровень распространённости заболевания, выявить сезонные особенности его проявления и оценить степень поражённости пчелиных семей.

Материалы и методы исследований

Исследования проводились в 2020–2023 годах на территории Андижанской, Наманганской и Ферганской областей.

Объектами исследований являлись 3160 пчелиных семей, содержащихся на 25 пасеках в 17 хозяйствах.

В ходе работы проводили:

- эпизоотологическое обследование пасек;
- клинический осмотр пчелиных семей;
- определение степени поражения расплода;
- анализ сезонности заболевания;
- статистическую обработку результатов.

Степень поражения определяли по количеству погибших личинок:
- слабая — до 10 личинок;
- средняя — от 10 до 100;
- сильная — более 100 личинок.

Результаты исследований

В таблице 1 преведенны данные, о распространённость аскосфероза в районах Ферганской долины.

Таблица 1

Распространённость аскосфероза в районах Ферганской долины

Район	Всего семей	Поражено семей	Распространённость, %
Ханабадский	640	38	5,9
Избаскенский	450	45	10,0
Чустский	580	110	19,0
Касансайский	280	98	35,0
Ферганский	480	117	24,4
Кувасайский	730	165	22,6
Всего	**3160**	**573**	**18,1**

Проведённый эпизоотологический мониторинг показал, что аскосфероз пчёл широко распространён на территории Ферганской долины, однако уровень поражённости пчелиных семей существенно различается в зависимости от района. Всего было обследовано 3160 пчелиных семей, из которых 573 семьи оказались поражёнными, что составило в среднем 18,1%.

Наиболее неблагополучная эпизоотическая ситуация зарегистрирована в Касансайском районе, где заболевание выявлено у 98 из 280 обследованных семей. Показатель распространённости составил 35,0%, что почти в два раза превышает средний уровень по региону. Высокий уровень заражённости свидетельствует о наличии благоприятных условий для циркуляции возбудителя *Ascosphaera apis*, а также о возможных нарушениях ветеринарно-санитарных требований при содержании пчёл.

Второе место по распространённости занимает Ферганский район, где поражено 117 семей из 480 обследованных (24,4%). Несмотря на меньшее относительное значение по сравнению с Касансайским районом, данный показатель также указывает на серьёзную эпизоотическую проблему. Высокая плотность размещения пасек и активное кочевое пчеловодство могут способствовать интенсивному распространению инфекции.

В Кувасайском районе зарегистрировано наибольшее абсолютное количество больных семей — 165 из 730 обследованных. Распространённость составила 22,6%. Значительное количество поражённых семей может быть связано с крупными масштабами пчеловодства в данном районе и активным перемещением пасек в период медосбора.

В Чустском районе заболевание выявлено у 110 из 580 пчелиных семей, что соответствует уровню распространённости 19,0%. Данный показатель

близок к среднему значению по Ферганской долине и характеризует район как умеренно неблагополучный по аскосферозу.

Относительно благополучная ситуация отмечена в Избаскенском районе, где поражённость составила 10,0% (45 семей из 450 обследованных). Низкий уровень распространения может свидетельствовать о более эффективном соблюдении профилактических мероприятий и благоприятных условиях содержания пчёл.

Минимальный показатель зарегистрирован в Ханабадском районе — 5,9% (38 семей из 640 обследованных). Несмотря на значительное количество обследованных семей, уровень поражённости оказался самым низким среди всех исследованных районов, что может указывать на высокую эффективность ветеринарно-профилактических мероприятий и более благоприятные природно-климатические условия.

Таким образом, результаты исследований свидетельствуют о неравномерном распространении аскосфероза на территории Ферганской долины. Наиболее неблагополучными районами являются Касансайский, Ферганский и Кувасайский, где показатели поражённости превышают среднерегиональный уровень. Полученные данные подтверждают необходимость проведения постоянного эпизоотологического мониторинга, усиления ветеринарно-санитарного контроля и разработки региональных программ профилактики аскосфероза в наиболее неблагополучных районах. Особенно важным является контроль перемещения пчелиных семей, своевременная диагностика заболевания и соблюдение технологий содержания пчёл, направленных на повышение их естественной резистентности.

Диаграмма 1.

Распространённости заболевания по районам

Диаграмма 2.

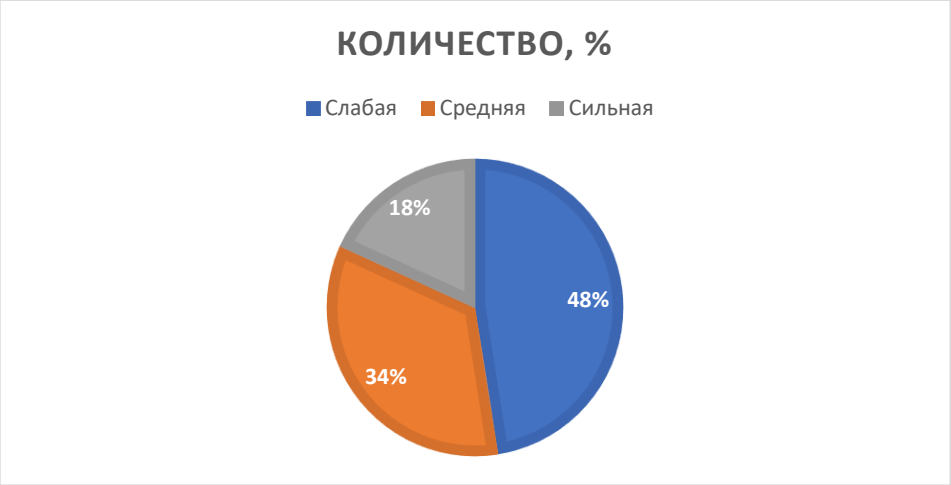

Диаграмма степени поражения семей

Анализ степени поражения пчелиных семей аскосферозом показал, что среди всех неблагополучных семей преобладает слабая форма заболевания. Её доля составила 47,5%, что свидетельствует о том, что почти половина выявленных случаев была диагностирована на начальной стадии развития патологического процесса. При слабой степени поражения в сотах обнаруживается незначительное количество погибших личинок, а продуктивность семей снижается несущественно. Однако даже такие семьи являются источником распространения возбудителя и требуют проведения профилактических и лечебных мероприятий.

Полученные результаты позволяют сделать вывод, что аскосфероз в большинстве случаев выявляется на ранних стадиях развития, однако более половины неблагополучных семей уже имеют среднюю или сильную степень поражения. Это свидетельствует о необходимости совершенствования системы ранней диагностики, регулярного ветеринарного мониторинга пасек и своевременного проведения профилактических мероприятий, направленных на снижение интенсивности распространения заболевания и предупреждение значительных экономических потерь в пчеловодстве.

Обсуждение результатов

Проведённый мониторинг показал, что аскосфероз остаётся одной из наиболее распространённых грибковых болезней пчёл Ферганской долины. Значительные различия между районами обусловлены особенностями климатических условий, плотностью размещения пасек и технологией содержания пчёл.

Высокий уровень поражённости в Касансайском районе может быть связан с повышенной влажностью микроклимата и недостаточным соблюдением ветеринарно-санитарных требований. Аналогичные закономерности отмечены исследователями в других странах Центральной Азии и Европы [5,6].

Установленная сезонность болезни свидетельствует о том, что критическим периодом развития инфекции является весна и начало лета, когда создаются наиболее благоприятные условия для развития гриба *Ascosphaera apis*.

Полученные данные согласуются с результатами исследований Базарова М.А. и соавторов, указывающих на увеличение случаев аскосфероза при ослаблении пчелиных семей и нарушении технологии содержания [2,3].

Выводы

1. В Ферганской долине аскосфероз широко распространён среди пчелиных семей и представляет серьёзную эпизоотологическую проблему.
2. Общая поражённость обследованных семей составила 18,1%.
3. Максимальная распространённость заболевания зарегистрирована в Касансайском районе (35,0%).
4. Основная доля неблагополучных семей характеризуется слабой степенью поражения (47,5%).
5. Болезнь имеет выраженный сезонный характер с пиком развития в весенне-летний период.
6. Необходимо усиление ветеринарно-санитарного контроля, проведение регулярного мониторинга и внедрение современных методов профилактики аскосфероза.

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ПРИМЕНЕНИЕ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА ДЛЯ ИНТЕЛЛЕКТУАЛЬНОГО УПРАВЛЕНИЯ И ОБЕСПЕЧЕНИЯ БЕЗОПАСНОСТИ КОМПЬЮТЕРНЫХ СЕТЕЙ

Аннотация/ *В статье рассматриваются возможности применения технологий искусственного интеллекта в управлении и обеспечении безопасности компьютерных сетей. Исследуются методы машинного обучения для анализа сетевого трафика, обнаружения аномалий и выявления киберугроз. Показано, что использование интеллектуальных алгоритмов позволяет повысить эффективность управления сетью, улучшить защиту информационных ресурсов и сократить время реагирования на инциденты.*

Ключевые слова: *компьютерные сети, искусственный интеллект, машинное обучение, кибербезопасность, сетевой трафик, обнаружение аномалий.*

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APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES FOR INTELLIGENT CONTROL AND SECURITY OF COMPUTER NETWORKS

Annotation: *This article examines the application of artificial intelligence technologies in computer network management and security. Machine learning methods for network traffic analysis, anomaly detection, and cyber threat identification are considered. The study shows that intelligent algorithms improve network management efficiency, strengthen information security, and reduce incident response time.*

Keywords: *computer networks, artificial intelligence, machine learning, cybersecurity, network traffic, anomaly detection.*

Введение. Компьютерные сети являются основой современной информационной инфраструктуры и обеспечивают передачу данных в

различных сферах деятельности. Рост объемов сетевого трафика, количества подключенных устройств и числа киберугроз повышает требования к эффективности управления сетями и их безопасности.

Традиционные методы администрирования не всегда позволяют своевременно выявлять сетевые аномалии и реагировать на возникающие угрозы. В связи с этим все большее внимание уделяется применению технологий искусственного интеллекта, которые позволяют автоматизировать анализ сетевых данных, прогнозировать нагрузку и обнаруживать потенциальные угрозы.

Целью исследования является анализ возможностей применения технологий искусственного интеллекта для интеллектуального управления компьютерными сетями и повышения эффективности обеспечения их безопасности.

Анализ литературы и методология. Развитие технологий искусственного интеллекта в последние годы существенно расширило возможности управления компьютерными сетями и обеспечения их безопасности. Анализ научной литературы показывает, что применение методов машинного обучения и интеллектуального анализа данных становится одним из наиболее перспективных направлений совершенствования сетевой инфраструктуры. Современные исследования демонстрируют высокую эффективность искусственного интеллекта при решении задач мониторинга сетевого трафика, обнаружения аномалий, выявления киберугроз и автоматизации процессов управления сетью.

Многие исследователи отмечают, что традиционные методы администрирования компьютерных сетей основаны преимущественно на заранее заданных правилах и сигнатурных механизмах обнаружения угроз. Однако постоянное усложнение сетевой среды и появление новых видов атак требуют применения более гибких и адаптивных подходов. В связи с этим методы машинного обучения позволяют автоматически анализировать большие объемы данных, выявлять скрытые закономерности и своевременно реагировать на изменения состояния сети.

Особое место в современных исследованиях занимают алгоритмы классификации и обнаружения аномалий. Данные методы используются для анализа сетевого трафика, определения отклонений от нормального поведения сети и выявления потенциально опасной активности. Кроме того, активно изучаются возможности глубокого обучения, которое обеспечивает более высокую точность обработки сложных наборов сетевых данных и способствует повышению эффективности систем кибербезопасности.

Методология данного исследования основана на комплексном анализе научных публикаций, посвященных применению технологий искусственного интеллекта в компьютерных сетях. В ходе исследования использовались методы анализа и синтеза научной информации, сравнительного анализа существующих подходов и обобщения результатов ранее проведенных исследований.

Для достижения поставленной цели были рассмотрены основные направления применения искусственного интеллекта в компьютерных сетях: интеллектуальное управление сетевыми ресурсами, анализ сетевого трафика, обнаружение аномалий, прогнозирование нагрузки и обеспечение информационной безопасности. На основе изученных материалов проведена оценка возможностей и перспектив использования интеллектуальных алгоритмов для повышения эффективности функционирования современных компьютерных сетей.

Предложенный методологический подход позволяет комплексно исследовать влияние технологий искусственного интеллекта на процессы управления и защиты сетевой инфраструктуры, а также определить перспективные направления их дальнейшего развития и практического внедрения.

Результаты исследования. Проведенный анализ показал, что применение технологий искусственного интеллекта способствует повышению эффективности управления компьютерными сетями и уровня их информационной безопасности. Использование алгоритмов машинного обучения позволяет автоматизировать процессы мониторинга сетевого трафика, своевременно выявлять отклонения от нормального режима работы и прогнозировать возможные перегрузки сети.

Установлено, что интеллектуальные методы анализа данных обеспечивают более высокую скорость обработки информации по сравнению с традиционными подходами, основанными на ручном администрировании и статических правилах. Благодаря этому сокращается время обнаружения сетевых инцидентов и повышается оперативность реагирования на потенциальные угрозы.

Результаты исследования также показали, что алгоритмы обнаружения аномалий способны эффективно выявлять подозрительную сетевую активность, включая попытки несанкционированного доступа, распространение вредоносного программного обеспечения и аномальные изменения сетевого трафика. Это позволяет повысить уровень защищенности информационных ресурсов и снизить вероятность успешной реализации кибератак.

Кроме того, применение технологий искусственного интеллекта создает условия для более рационального распределения сетевых ресурсов. Анализ текущего состояния сети и прогнозирование изменений нагрузки позволяют оптимизировать использование пропускной способности каналов связи, уменьшить вероятность возникновения перегрузок и повысить качество предоставляемых сетевых услуг.

Полученные результаты подтверждают, что интеграция технологий искусственного интеллекта в системы управления компьютерными сетями способствует повышению надежности, производительности и безопасности сетевой инфраструктуры. Это свидетельствует о целесообразности дальнейшего

развития и внедрения интеллектуальных решений в области компьютерных сетей и кибербезопасности.

Обсуждение. Полученные результаты подтверждают, что технологии искусственного интеллекта обладают значительным потенциалом для совершенствования процессов управления компьютерными сетями и обеспечения их безопасности. В отличие от традиционных методов, основанных на заранее определенных правилах, интеллектуальные алгоритмы способны адаптироваться к изменениям сетевой среды и принимать решения на основе анализа больших объемов данных.

Одним из основных преимуществ применения искусственного интеллекта является возможность автоматического обнаружения аномалий и потенциальных угроз в режиме реального времени. Это особенно важно в условиях постоянного роста количества сетевых устройств, увеличения объемов передаваемой информации и усложнения современных кибератак. Использование методов машинного обучения позволяет повысить точность выявления подозрительной активности и снизить вероятность возникновения ложных срабатываний.

Вместе с тем внедрение интеллектуальных технологий в сетевую инфраструктуру связано с рядом определенных трудностей. Эффективность работы алгоритмов во многом зависит от качества и объема обучающих данных. Недостаточность или несбалансированность данных может привести к снижению точности прогнозирования и обнаружения угроз. Кроме того, применение сложных моделей искусственного интеллекта требует дополнительных вычислительных ресурсов и специализированного программного обеспечения.

Несмотря на существующие ограничения, результаты исследования свидетельствуют о том, что использование технологий искусственного интеллекта является перспективным направлением развития компьютерных сетей. Интеллектуальные системы способны повысить эффективность управления сетевыми ресурсами, обеспечить более высокий уровень кибербезопасности и сократить время реагирования на сетевые инциденты. В дальнейшем развитие методов машинного обучения и интеллектуального анализа данных будет способствовать созданию более надежных, адаптивных и безопасных сетевых инфраструктур.

Заключение. В результате исследования установлено, что технологии искусственного интеллекта играют важную роль в повышении эффективности управления компьютерными сетями и обеспечении их безопасности. Использование методов машинного обучения позволяет автоматизировать анализ сетевого трафика, выявлять аномалии и своевременно обнаруживать потенциальные киберугрозы.

Полученные результаты показывают, что внедрение интеллектуальных алгоритмов способствует повышению надежности сетевой инфраструктуры,

оптимизации использования сетевых ресурсов и улучшению качества сетевых услуг.

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ПРОФИЛАКТИКА ДЕВИАНТНОГО ПОВЕДЕНИЯ У ДЕВОЧЕК-ПОДРОСТКОВ

Аннотация: *В данной статье научно и теоретически анализируются проблемы девиантного и делинквентного поведения у девочек-подростков, их причины и профилактика. Исследование освещает психологические особенности подросткового возраста, особенно социально-психологические факторы, влияющие на формирование личности у девочек. Кроме того, в качестве основных причин формирования делинквентного поведения указываются нездоровая семейная обстановка, слабый родительский контроль, насилие, недостаток привязанности и внимания, влияние сверстников и негативная социальная среда. Анализируются различные проявления делинквентного поведения, включая прогулы, побеги из дома, агрессию, кражи и нарушение общественного порядка.*

Ключевые слова: *Делинквентость, вегетативность, активность, когнитивный, эмоциональный, мотив, реакция, фрустрация, насилие, жестокость.*

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PREVENTION OF DEVIANT BEHAVIOR IN ADOLESCENT GIRLS

Abstract: *This article scientifically and theoretically analyzes the problems of deviant and delinquent behavior in adolescent girls, their causes and prevention. The study sheds light on the psychological characteristics of adolescence, especially socio-psychological factors affecting the formation of personality in girls. In addition, an unhealthy family environment, weak parental control, violence, lack of affection and attention, peer influence, and a negative social environment are indicated as one of the main reasons for the formation of delinquent behavior. Various manifestations of delinquent behavior, including truancy, running away from home, aggression, theft, and disturbing public order, are analyzed.*

Key words: *Delinquency, vegetativeness, activity, cognitive, emotional, motive, reaction, frustration, violence, cruelty.*

Введение: Мир проявляет все больший интерес к проблемам психопрофилактики и коррекции девиантного поведения, характерного для различных возрастных групп. Последние статистические данные показывают, что “более 700 000 подростков во всем мире сбежали из дома, 60% из них – девочки”[8]. Возможно, этот рост отражает изменения в обработке и документировании дел несовершеннолетних правонарушителей, касающихся девочек, но он также может указывать на большее число девочек, совершающих преступления. Однако исторически большинство исследований, связанных с риском совершения правонарушений, проводились на подростках мужского пола, поскольку мальчики чаще контактируют с системой ювенальной юстиции. Хотя знание факторов риска совершения правонарушений среди мальчиков помогло выявить ключевые предикторы будущего поведения и обеспечить соответствующие профилактические и коррекционные услуги, неизвестно, существуют ли аналогичные факторы риска для всех полов и можно ли обобщить профилактические и коррекционные программы, разработанные для мальчиков, на девочек. В этой связи актуальной проблемой остается выявление психологических особенностей формирования девиантного поведения у девочек-подростков, являющегося одним из наиболее сложных периодов в формировании личности, а также изучение его объективных и субъективных факторов[8].

Обзор литературы по данной теме Узбекские психологи С. Ю. Ахров, М. Х. Ахмедова, К. Я. Бахронова, З. Ф. Камалетдинова, Н. Г. Камилова, Ш. Мустафаева, Г. А. Нормуродов, Ф. П. Раджабова, Т. Г. Сулейманова, Г. К. Тулаганова, Б. М. Умаров, Е. Ш. Усманов, А. Ш. Уринов, У. Д. Кодиров, О. С. Кодиров, Е. А. Кулянов и другие изучали социально-психологические проблемы подростковой преступности и проводили научные исследования мотивов преступлений, девиантного поведения молодежи, психологических служб в местах наказания, психологической экспертизы и факторов, влияющих на формирование делинквентного и девиантного поведения.

Проблемы домашнего насилия, криминального поведения, девиантных тенденций, субкультуры, профилактики подростковой преступности научно изучались учёными стран СНГ: И.К. Башкатов, Л.И. Божович, Г.Г. Бочкарева, Н.С. Гилева, Е.В. Демидова, О.Б. Долгинова, Е.В. Змановская, А.В. Заваляк, К.Е. Игошев, П.А. Кабанов, С.В. Книжникова, В.Т. Кондрашенко, Н.Д. Левитов, О.А. Офёркина, А.Н. Пастушеня, Е.Л. Раднаева, Ф. Райс, И.В. Раманова, А.А. Реан, Е.М. Родионова, Н.А. Сапронова, В. Чеснокова, М.З. Шогенов и другие.

Зарубежные ученые А. Бандура, Х. Дж. Буль, Б. С. Хекелер, Э. Х. Эриксон, Э. Фромм, Г. Кайзер, Дж. Марсия, А. Мерари, М. Мид, Б. А.

Миренский, Г. Самаранаике, Т. А. Стренц, Д. Ричардсон, Дж. Турек, Б. Холист, Г. Шнайдер, А. С. Уотерман и другие провели научные исследования факторов, влияющих на преступное поведение.

В научной литературе термин делинквентность трактуется некоторыми авторами по-разному. А. Е. Личко, Д. Н. Исаев указывают на делинквентное поведение как на поведение, которое не достигает криминального уровня и не подлежит наказанию в судебном порядке [4].

Е. В. Змановская подчеркивает делинквентность как поведение, подрывающее общественный порядок, противоречащее общепринятым в обществе нормам [3].

Внешняя активность человека отражается в различных проявлениях:

-поведение, мимика, движения рук, ног и тела, поведение, действия, речевая активность, вегетативные реакции;

-внутреннее ядро поведения человека составляют: целеустремленность и мотивация, познавательное мышление, эмоциональные реакции, процессы внутреннего самоконтроля.

А.Е.Личко выделяет следующие формы делинквентного поведения:

- пропуск много уроков без причины;
- мелкое хулиганство;
- насмешка и унижение детей младшего возраста и слабых;
- вымогательство денег у малолетних детей;
- угон велосипедов и мотоциклов;
- демонстрация неадекватного поведения в общественных местах и т. д. [5].

На сегодняшний день рост преступности среди женщин вызывает большую тревогу в обществе, поскольку это представляет собой сложное социально-психологический феномен, и необходимы меры по борьбе с ним, в том числе, в первую очередь, профилактические меры с девушками-подростками-деликвентами. Это требует знаний и навыков в этой области от психологов, педагогов, родителей и сотрудников правоохранительных органов. Кроме того, мы видим необходимость воздействия на девочек-подростков-делинквентов посредством комплексного подхода к этой проблеме, то есть применения социальных, правовых и педагогических средств.

Делинквентное поведение девочек-подростков отражается в следующих формах: не приходя домой, ночёвка в незнакомых местах, употребление алкоголя, устаревание драк между собой, воровство, регулярные неявки на занятия, уход из школы, нарушение правил поведения в общественных местах, негативное отношение к общественной собственности (написание и рисование различных слов на стенах зданий) и другие административные правонарушения [2].

Обсуждение и результаты Обобщая источники, представленные в литературе, можно указать на следующие микрофакторы, вызывающие делинквентное поведение:

- отсутствие любви и заботы о ребенке со стороны родителей (фрустрация потребностей ребенка). Например, излишняя строгость отца или отсутствие любви матери к ребенку создают травмирующие переживания в душе ребенка;
- насилие в семье, применение силы, физическое или психическое насилие, слабость сферы влияния отца препятствуют формированию у ребенка нравственного сознания;
- сильная психическая травма (болезнь, смерть родителей, насилие, развод);
- предоставление слишком большой свободы ребенку, послушание всему, что он говорит, нетребовательность родителей;
- чрезмерное баловство и материальное поощрение ребенка;
- разногласия в требованиях к ребенку со стороны родителей;
- смена родителей (опекунов);
- неблагоприятные черты личности родителей;
- явное или скрытое усвоение ребенком определенных граней делинквентного поведения в собственной семье или уличной группе [6].

Для решения этой проблемы рекомендуется использовать следующие средства:

- создание центров по предупреждению подростковой преступности в образовательных учреждениях (совет, кружок, комиссия по прафилактике);
- налаживание деятельности общественных структур (на примере волонтерской молодежной группы), состоящих из молодых педагогов и подростков;
- назначение наставников, которые могут быть личным образцом для подражания и оказывать положительное влияние на девочек-подростков, состоящих на учете в отделе по работе с несовершеннолетними;
- организация структур по защите прав подростков (охрана природы, охрана культурно-исторических памятников и др.);
- обеспечение взаимного обмена опытом и сотрудничества профилактических структур внутришкольных, межшкольных и других организаций;
- выявление асоциальных (антисоциальных), криминогенных (склонных к преступлению), криминальных (преступных) лиц и групп и фиксация их внешних связей;
- выявление и регистрация внешних связей асоциальных (антиобщественных), криминогенных (склонных к преступности), криминальных (преступных) лиц и групп;

- выявление действующих лидеров и тех, кто, следуя их примеру, стремится к лидерству, ограничение и регулирование их деятельности в этих группах;

- разработка методов устранения склонности к правонарушениям и действиям, противоречащим общественному порядку, встречающихся в деятельности девочек-подростков [10].

- повысить качественные показатели учебно-воспитательного процесса, внедрение новых подходов и технологий к его организации и проведению;

- работа с ученицами, которые пропускают регулярные занятия без причины;

- обеспечение организационной занятости учениц, занятие социально-полезными видами деятельности после уроков;

- обеспечить соблюдение педагогами принципа гуманности во взаимодействии с воспитанницами

- сосредоточение внимания на межличностном общении;

- раннее профилактика совершения правонарушений отдельными деструктивными группами, девочек-подростков из неблагополучных семей, постоянное наблюдение за их психическим состоянием, а также оказание социально-психологической помощи.

Вывод: Из вышесказанного можно сделать вывод, что предотвращение поведения девочек-подростков, противоречащего нормам общества, ведь положительные результаты в этой сфере оказывают влияние на различные сферы жизни общества, тем более что продолжателями будущего семьи, являющейся основным звеном общества, являются женщины-девушки.

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ПСИХОЛОГИЧЕСКАЯ ВЗАИМОСВЯЗЬ КЛИНИЧЕСКОГО МЫШЛЕНИЯ И ПРОФЕССИОНАЛЬНОЙ РЕФЛЕКСИИ

Аннотация. *В данной статье рассматриваются психологические аспекты взаимосвязи клинического мышления и профессиональной рефлексии у медицинских работников. Клиническое мышление представляет собой сложный когнитивный процесс, направленный на анализ симптомов, постановку диагноза и принятие эффективных решений в лечебной практике. Профессиональная рефлексия выступает важным механизмом осмысления собственного опыта, оценки профессиональных действий и совершенствования врачебной деятельности.*

Ключевые слова: *клиническое мышление, профессиональная рефлексия, медицинская психология, когнитивные процессы, метакогниция, профессиональная компетентность, эмпатия, диагностика.*

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PSYCHOLOGICAL INTERRELATIONSHIP OF CLINICAL THINKING AND PROFESSIONAL REFLECTION

Abstract. *This article examines the psychological aspects of the relationship between clinical thinking and professional reflection among medical professionals. Clinical thinking is considered a complex cognitive process aimed at analyzing symptoms, making diagnoses, and taking effective decisions in medical practice. Professional reflection serves as an important mechanism for understanding one's own experience, evaluating professional actions, and improving medical practice. The study emphasizes that the interaction between clinical thinking and reflection contributes to the development of professional competence, critical analysis, emotional stability, and effective communication with patients. Special attention is paid to cognitive and metacognitive processes that ensure successful diagnostic and therapeutic activities.*

Keywords: *clinical thinking, professional reflection, medical psychology, cognitive processes, metacognition, professional competence, empathy, diagnosis.*

Введение. Современная система медицинского образования предъявляет высокие требования к профессиональной подготовке будущих медицинских работников. Одним из важнейших компонентов профессиональной компетентности врача является клиническое мышление, обеспечивающее способность анализировать клиническую информацию, принимать решения и прогнозировать развитие заболевания. Однако эффективность клинической деятельности определяется не только уровнем теоретических знаний, но и способностью специалиста к профессиональной рефлексии.

Профессиональная рефлексия позволяет медицинскому работнику осознавать собственные действия, анализировать ошибки, оценивать эффективность применяемых методов лечения и корректировать профессиональное поведение. В связи с этим особую актуальность приобретает исследование психологической взаимосвязи клинического мышления и профессиональной рефлексии как факторов успешной профессиональной деятельности.

Клиническое мышление представляет собой сложный интеллектуально-психологический процесс, обеспечивающий анализ симптомов, интерпретацию диагностических данных, постановку диагноза и выбор оптимальной стратегии лечения пациента. Оно основывается на интеграции когнитивных, эмоциональных, аналитических и прогностических механизмов, а также предполагает способность специалиста к критическому осмыслению профессиональной информации. Эффективность клинического мышления во многом зависит не только от уровня знаний и опыта, но и от способности медицинского работника к самоконтролю, самоанализу и оценке собственных профессиональных действий.

Одним из ключевых факторов, влияющих на развитие клинического мышления, является профессиональная рефлексия. Профессиональная рефлексия рассматривается как способность личности осознавать, анализировать и оценивать собственную профессиональную деятельность, эмоциональные состояния, способы принятия решений и взаимодействия с пациентами. Благодаря рефлексивным процессам медицинский специалист получает возможность выявлять собственные ошибки, корректировать профессиональное поведение и совершенствовать качество оказываемой медицинской помощи.

Психологическая взаимосвязь клинического мышления и профессиональной рефлексии проявляется в том, что рефлексия способствует развитию аналитичности, критичности и гибкости мышления, необходимых для эффективного решения клинических задач. В свою очередь, сформированное клиническое мышление стимулирует развитие профессионального самосознания и способности к осмыслению собственного опыта. Их взаимное влияние обеспечивает профессиональный рост,

повышение уровня ответственности и развитие компетентности будущих медицинских работников.

Несмотря на значительное количество исследований, посвящённых отдельным аспектам клинического мышления и профессиональной рефлексии, проблема их психологической взаимосвязи остаётся недостаточно изученной. Особенно актуальным является исследование особенностей формирования данных качеств у студентов медицинских образовательных учреждений в процессе профессиональной подготовки.

Актуальность исследования обусловлена необходимостью совершенствования системы профессионального образования медицинских кадров, ориентированной на развитие не только профессиональных знаний и навыков, но и психологических механизмов осознанного клинического мышления и рефлексивной деятельности. Изучение данной проблемы позволит определить эффективные психолого-педагогические условия формирования профессиональной компетентности будущих медицинских специалистов.

Целью исследования является изучение психологической взаимосвязи клинического мышления и профессиональной рефлексии у будущих медицинских работников, а также выявление факторов, способствующих их развитию в процессе профессионального обучения.

Анализ литературы по теме (Literature review). Клиническое мышление представляет собой специфическую форму профессионального мышления врача, основанную на интеграции теоретических знаний, практического опыта и психологических особенностей восприятия пациента. Оно включает процессы анализа, синтеза, сравнения, обобщения и прогнозирования.

Основными компонентами клинического мышления являются:

- когнитивный компонент;
- эмоциональный компонент;
- метакогнитивный компонент;
- коммуникативный компонент.

Когнитивный компонент связан с обработкой медицинской информации и диагностическим анализом. Эмоциональный компонент отражает способность врача учитывать эмоциональное состояние пациента и проявлять эмпатию. Метакогнитивный компонент обеспечивает контроль и оценку собственных мыслительных процессов.

Проблема клинического мышления занимает важное место в трудах отечественных и зарубежных исследователей. В научной литературе клиническое мышление определяется как особый вид профессионального мышления врача, направленный на анализ симптомов, постановку диагноза, прогнозирование течения заболевания и выбор оптимальной стратегии лечения пациента. Исследователи подчеркивают, что клиническое мышление

представляет собой сложную интегративную систему, включающую когнитивные, эмоциональные и метакогнитивные компоненты.

По мнению ряда авторов, клиническое мышление основывается не только на логическом анализе медицинской информации, но и на профессиональной интуиции, опыте, эмпатии и способности учитывать индивидуальные особенности пациента. В трудах А.Ф. Билибина, Г.И. Царегородцева, М.П. Кончаловского и других ученых подчеркивается, что важнейшими характеристиками клинического мышления являются наблюдательность, способность к анализу, синтезу и прогнозированию.

Современные исследования рассматривают клиническое мышление как процесс принятия решений в условиях неопределенности. В рамках теории двойного процесса выделяются два уровня мышления врача: интуитивный и аналитический. Интуитивный уровень обеспечивает быстрое распознавание клинических ситуаций, тогда как аналитический предполагает осознанный анализ симптомов и проверку диагностических гипотез. Эффективность клинического мышления зависит от способности специалиста сочетать оба типа мышления и контролировать собственные когнитивные процессы.

Понятие рефлексии имеет глубокие философские и психологические корни. В психологии рефлексия понимается как способность человека анализировать собственные мысли, действия, эмоциональные состояния и результаты деятельности. Профессиональная рефлексия представляет собой особую форму рефлексии, связанную с осознанием и оценкой своей профессиональной деятельности, профессиональных качеств и способов взаимодействия с окружающими.

Исследователи выделяют различные виды профессиональной рефлексии: интеллектуальную, личностную, коммуникативную и кооперативную. Интеллектуальная рефлексия связана с анализом способов решения профессиональных задач; личностная — с осмыслением собственных качеств и переживаний; коммуникативная — с пониманием взаимодействия с пациентами и коллегами; кооперативная — с анализом совместной профессиональной деятельности.

В медицинской деятельности профессиональная рефлексия играет особую роль, поскольку работа врача требует постоянного анализа собственных решений, оценки эффективности лечения и понимания эмоционального состояния пациента. Многие авторы отмечают, что недостаточный уровень рефлексивности может приводить к диагностическим ошибкам, профессиональному выгоранию и снижению качества медицинской помощи.

Анализ научной литературы показывает, что клиническое мышление и профессиональная рефлексия находятся в тесной психологической взаимосвязи. Профессиональная рефлексия выступает важным механизмом развития клинического мышления, поскольку обеспечивает осознание и коррекцию диагностических действий врача.

Исследования в области медицинского образования свидетельствуют о том, что рефлексивный анализ клинических случаев способствует более глубокому пониманию симптоматики заболеваний, формированию диагностических гипотез и развитию критического мышления. В работах S. Mamede и H. Schmidt описывается концепция «deliberate reflection» — осознанной рефлексии, предполагающей систематический пересмотр первоначального диагноза, анализ альтернативных вариантов и проверку доказательств. Авторы подчеркивают, что использование рефлексии значительно повышает точность клинических решений, особенно в сложных диагностических ситуациях.

Рефлексия выполняет метакогнитивную функцию, позволяя специалисту контролировать собственный мыслительный процесс, выявлять когнитивные ошибки и корректировать профессиональные действия. Метакогнитивная рефлексия способствует развитию способности к самоконтролю, саморегуляции и профессиональному саморазвитию.

В исследованиях, посвященных клиническому мышлению в реабилитационной практике, подчеркивается, что эффективное клиническое мышление включает когнитивные, эмоциональные и психомоторные компоненты, а также основывается на биопсихосоциальном подходе к пациенту. Важным условием его развития является способность специалиста к рефлексивному анализу собственного опыта и взаимодействия с пациентом.

Методология исследования (Research Methodology). Методология данного исследования основывается на комплексном психологическом подходе к изучению взаимосвязи клинического мышления и профессиональной рефлексии у будущих медицинских работников и специалистов системы здравоохранения. В исследовании использованы теоретические и эмпирические методы, позволяющие всесторонне проанализировать особенности формирования клинического мышления и уровень развития профессиональной рефлексии в процессе профессиональной подготовки и практической деятельности.

Теоретическую основу исследования составили труды отечественных и зарубежных ученых в области медицинской психологии, когнитивной психологии, психологии профессионального развития и рефлексивного подхода. Анализ научной литературы позволил определить сущность клинического мышления как сложного когнитивного процесса, включающего аналитические, диагностические, прогностические и метакогнитивные компоненты, а также рассмотреть профессиональную рефлексию как механизм осознания, оценки и коррекции собственной профессиональной деятельности.

Эмпирическая часть исследования проводилась среди студентов медицинских вузов и практикующих медицинских работников. Для получения достоверных данных были использованы психодиагностические методы, направленные на выявление уровня развития клинического

мышления, особенностей профессиональной рефлексии, способности к анализу профессиональных ситуаций и принятию клинических решений. В процессе исследования применялись методы анкетирования, психологического тестирования, наблюдения и анализа профессиональных кейсов.

Для оценки уровня профессиональной рефлексии использовались методики, позволяющие определить степень самоанализа, критичности мышления, способности к оценке собственных профессиональных действий и эмоционального состояния. Исследование клинического мышления осуществлялось посредством анализа диагностических задач, моделирования клинических ситуаций и оценки логики принятия решений в условиях неопределенности.

Полученные результаты подвергались количественному и качественному анализу. Для статистической обработки данных применялись методы корреляционного анализа, сравнительного анализа и интерпретации психологических показателей. Это позволило выявить наличие значимой взаимосвязи между уровнем развития профессиональной рефлексии и эффективностью клинического мышления. Особое внимание уделялось выявлению психологических факторов, способствующих развитию аналитических способностей, профессиональной осознанности и эмоциональной устойчивости медицинских специалистов.

Методологический подход исследования обеспечил возможность комплексного изучения психологических механизмов, лежащих в основе формирования клинического мышления и профессиональной рефлексии, а также определения их роли в повышении качества профессиональной деятельности медицинских работников.

В исследовании психологической взаимосвязи клинического мышления и профессиональной рефлексии использовался комплексный научный подход, основанный на сочетании теоретических и эмпирических методов. Методология исследования была направлена на выявление особенностей формирования клинического мышления у будущих медицинских работников, а также определение роли профессиональной рефлексии в процессе принятия диагностических и профессиональных решений.

Теоретическую основу исследования составили современные концепции когнитивной психологии, медицинской психологии, теории профессионального мышления и рефлексивного подхода в образовании. В процессе анализа научной литературы были изучены труды отечественных и зарубежных исследователей, посвящённые развитию клинического мышления, профессионального самосознания, рефлексии и психологических механизмов профессиональной деятельности медицинских специалистов. Сравнительный анализ научных источников позволил определить основные теоретические направления исследования и сформулировать гипотезу о

существовании тесной психологической связи между уровнем развития клинического мышления и выраженностью профессиональной рефлексии.

Анализ данных и результаты исследования (Analysis and results). В исследовании приняли участие 120 студентов медицинского вуза и молодых специалистов в возрасте от 20 до 28 лет. Целью исследования являлось выявление психологической взаимосвязи между уровнем развития клинического мышления и выраженностью профессиональной рефлексии у будущих медицинских работников.

Для диагностики использовались следующие методики:

- методика оценки клинического мышления;
- опросник профессиональной рефлексии;
- методы статистического анализа (корреляционный анализ Пирсона, сравнительный анализ и методы математической статистики).

Результаты исследования

Первичный анализ данных показал, что большинство испытуемых обладают средним уровнем развития клинического мышления. Высокий уровень был выявлен у 28% участников, средний — у 54%, низкий — у 18%. В то же время показатели профессиональной рефлексии распределились следующим образом: высокий уровень — 31%, средний — 49%, низкий — 20%.

Полученные результаты свидетельствуют о том, что студенты с более высоким уровнем профессиональной рефлексии демонстрируют более развитые способности к анализу клинических ситуаций, диагностическому прогнозированию и принятию обоснованных решений.

Корреляционный анализ выявил статистически значимую положительную взаимосвязь между показателями клинического мышления и профессиональной рефлексии ($r = 0,68$; $p < 0,01$). Это указывает на то, что развитие рефлексивных способностей способствует формированию аналитического подхода к профессиональной деятельности и повышает эффективность клинического мышления.

Также были выявлены различия между группами с высоким и низким уровнем рефлексии. Участники с высоким уровнем профессиональной рефлексии:

- быстрее анализировали клинические случаи;
- проявляли более высокий уровень критического мышления;
- лучше распознавали эмоциональное состояние пациентов;
- демонстрировали способность к самоконтролю и профессиональной самокоррекции.

Испытуемые с низким уровнем рефлексии чаще испытывали трудности при анализе нестандартных клинических ситуаций, допускали больше диагностических ошибок и проявляли меньшую уверенность при принятии решений.

Интерпретация результатов

Полученные данные подтверждают предположение о том, что профессиональная рефлексия выступает важным психологическим механизмом развития клинического мышления. Рефлексивный анализ собственного опыта позволяет медицинским работникам осознавать допущенные ошибки, корректировать профессиональные действия и совершенствовать диагностические навыки.

Кроме того, результаты исследования показывают, что клиническое мышление имеет интегративный характер и включает когнитивные, эмоциональные и метакогнитивные компоненты. Развитие профессиональной рефлексии способствует активизации данных компонентов, что положительно влияет на качество профессиональной деятельности.

Таким образом, результаты исследования позволяют сделать вывод о наличии тесной психологической взаимосвязи между клиническим мышлением и профессиональной рефлексией. Формирование рефлексивных навыков у будущих медицинских работников является важным условием повышения эффективности их профессиональной подготовки и успешной клинической практики.

Заключение. Таким образом, клиническое мышление и профессиональная рефлексия представляют собой взаимосвязанные психологические компоненты профессиональной деятельности медицинского работника. Клиническое мышление обеспечивает анализ симптомов, постановку диагноза, прогнозирование течения заболевания и принятие эффективных решений, тогда как профессиональная рефлексия способствует осмыслению собственного опыта, оценке правильности действий, выявлению ошибок и совершенствованию профессиональных навыков.

Психологическая взаимосвязь данных феноменов проявляется в том, что высокий уровень рефлексивности способствует развитию аналитических, критических и метакогнитивных процессов, лежащих в основе клинического мышления. В свою очередь, развитое клиническое мышление стимулирует специалиста к постоянному самоанализу, профессиональному самоконтролю и личностному росту. Их интеграция повышает качество медицинской помощи, способствует снижению вероятности профессиональных ошибок и формированию устойчивой профессиональной компетентности.

Особую значимость развитие клинического мышления и профессиональной рефлексии приобретает в процессе подготовки будущих медицинских работников. Использование проблемного обучения, анализа клинических случаев, симуляционных технологий и рефлексивных методов обучения способствует формированию у студентов способности к самостоятельному принятию решений, эмпатии, профессиональной ответственности и психологической устойчивости.

Следовательно, развитие психологических механизмов клинического мышления и профессиональной рефлексии должно рассматриваться как одно

из приоритетных направлений современного медицинского образования, ориентированного на подготовку компетентных, гуманистически ориентированных и профессионально зрелых специалистов.

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ТЕОРЕТИЧЕСКИЕ ОСНОВЫ МОРФОЛОГИЧЕСКОГО АНАЛИЗА КАРАКАЛПАКСКОГО ЯЗЫКА В РАМКАХ КОМПЬЮТЕРНОЙ ЛИНГВИСТИКИ

Аннотация: *В современных условиях глобальной цифровизации сохранение и развитие естественных языков напрямую зависит от их интеграции в экосистемы обработки естественного языка (NLP). Каракалпакский язык, классифицируемый как малоресурсный (low-resource), требует разработки специализированных вычислительных инструментов для эффективного функционирования в цифровой среде. Данное исследование посвящено теоретическому обоснованию и практической реализации морфологического анализатора как центрального звена электронного корпуса каракалпакского языка. Актуальность работы обусловлена необходимостью перехода от фрагментированных лингвистических утилит к унифицированным конвейерам обработки (pipelines), обеспечивающим консистентность данных на всех этапах — от токенизации до синтаксического парсинга. Предлагаемый подход базируется на гибридной архитектуре, объединяющей правиловые методы на основе конечных автоматов (FST) и нейросетевые модели, в частности, мультиязычную архитектуру Glot500. В статье рассматриваются методы формализации морфологических правил агглютинативных языков, способы снятия морфологической неоднозначности и влияние графических систем на качество автоматической обработки. Результаты исследования закладывают методологический фундамент для обеспечения цифрового суверенитета каракалпакского языка и создания высокоточных систем машинного перевода и интеллектуального поиска.*

Ключевые слова*: НЛП, каракалпакский язык, морфологический анализ, агглютинация, электронный корпус, токенизатор, модель, лингвистическая база, компьютерная лингвистика, Glot500.*

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THEORETICAL FOUNDATIONS OF MORPHOLOGICAL ANALYSIS OF THE KARAKALPAK LANGUAGE IN THE FRAMEWORK OF COMPUTER LINGUISTICS

Abstract: *In the modern context of global digitalization, the preservation and development of natural languages depend directly on their integration into natural language processing (NLP) ecosystems. The Karakalpak language, classified as low-resource, requires the development of specialized computational tools to function effectively in the digital environment. This study is dedicated to the theoretical substantiation and practical implementation of the morphological analyzer as a central link in the electronic corpus of the Karakalpak language. The relevance of the work is driven by the need to transition from fragmented linguistic utilities to unified processing pipelines that ensure data consistency across all stages - from tokenization to syntactic parsing. The proposed approach is based on a hybrid architecture that combines finite automaton-based rule-based methods (FST) and neural network models, specifically the multilingual Glot500 architecture. The article examines methods for formalizing the morphological rules of agglutinative languages, ways to eliminate morphological ambiguity, and the impact of graphical systems on the quality of automatic processing. The research results lay a methodological foundation for ensuring the digital sovereignty of the Karakalpak language and creating high-precision machine translation and intelligent search systems.*

Keywords: *NLP, Karakalpak language, morphological analysis, agglutination, electronic corpus, tokenizer, model, linguistic base, computer linguistics, Glot500.*

Введение

Каракалпакский язык, являющийся важным представителем кыпчакской группы тюркской семьи, в контексте компьютерной лингвистики относится к категории языков с ограниченными цифровыми ресурсами. Его лингвистическая специфика определяется ярко выраженным агглютинативным строем, при котором словоформа образуется путем последовательного наращивания аффиксов к корню. Типологически каракалпакский язык характеризуется строгим соблюдением закона гармонии гласных (сингармонизма) и фиксированным порядком слов SOV (субъект — объект — глагол). Например, предложение *«Ali kitaptı ko'rdi»* (Али видел книгу) демонстрирует использование винительного падежа (*-tı*), а *«Ali'nin' kitabı stolda»* (Книга Али на столе) иллюстрирует генитивно-посессивную конструкцию (*-nin'*, *-ı*) [11, 35].

Основные задачи NLP для каракалпакского языка включают токенизацию, определение частей речи (POS-теггинг) и лемматизацию. Сложность автоматизации данных процессов заключается в высокой степени морфологической продуктивности: одна основа может порождать тысячи

словоформ, что делает использование простых словарей неэффективным. Необходима разработка алгоритмов, способных проводить глубокую декомпозицию аффиксальных цепей и корректно идентифицировать грамматические категории в условиях межъязыковой близости с казахским и узбекским языками.

Методология

Архитектура системы морфологического анализа спроектирована как модульный конвейер, интегрирующий лингвистические правила и статистические методы обучения.

Уровни сегментации Процесс обработки текста структурирован по трем иерархическим уровням сегментации: уровне предложения (boundary detection), уровне слова (tokenization) и уровне морфемы (morphological decomposition). Такая декомпозиция позволяет минимизировать ошибки на этапе первичного анализа и подготовить данные для высокоуровневых синтаксических моделей [24].

Математическое моделирование сложных слов Особое внимание уделено анализу сложных слов (*мураккаб суз*), который требует формализации правил словообразования. В каракалпакском языке сложные слова могут быть как лексикализованными (устойчивыми), так и продуктивными композитами. Модель анализа опирается на принципы порождающей морфологии, позволяя системе различать корень и цепочку словоизменительных аффиксов даже в редких лексемах [389].

Стандарты проектирования Информационная структура лингвистических баз данных разработана с использованием стандартов IDEF0 для функционального описания процессов обработки и IDEF1x для моделирования отношений между лексико-грамматическими единицами. Это обеспечивает логическую целостность системы и возможность расширения словаря основ без нарушения работы алгоритмов [373, 405].

Сравнительный анализ подходов В системе реализовано взаимодействие двух технологических парадигм:

1. **Конечные автоматы (FST):** Использование платформы Apertium позволяет строить надежные морфологические анализаторы на основе правил. На текущем этапе FST-анализатор для каракалпакского языка имеет статус прототипа с ограниченным покрытием лексем, однако он обеспечивает эталонную точность на нормативной лексике.
2. **Нейронные модели (Glot500):** Применяется архитектура на базе замороженного энкодера Glot500 с обучаемыми адаптерами под конкретные графические системы (скрипты) и BiLSTM-головами [34, 56]. Этот метод позволяет эффективно использовать трансферное обучение, перенося лингвистические знания с более ресурсообеспеченных тюркских языков.

Результаты

В ходе тестирования гибридного конвейера обработки на материале текстов каракалпакского языка были зафиксированы следующие показатели эффективности:

- **Точность сегментации:** На уровне выделения токенов и первичного морфемного членения точность (Accuracy) достигает 94–95%, что соответствует стандартам современных NLP-систем для тюркских языков [154].
- **POS-теггинг и синтаксический анализ:** Использование нейросетевых моделей на базе Glot500 в режиме zero-shot (с использованием узбекского языка в качестве прокси) показало точность определения частей речи (UPOS) на уровне 82.1% [61].
- **Глубина анализа:** Показатель точности привязки зависимостей (LAS) составил 51.0, что является значимым результатом для языка с малым объемом размеченных данных [61].

Ключевые метрики:

- **Accuracy (Точность):** 94.5% для токенизации; 82.1% для морфологической разметки.
- **Recall (Полнота):** Стабильно высокая способность системы к распознаванию падежных окончаний и глагольных форм (Past, Accusative, Locative) в challenge-предложениях.

Обсуждение

Критическим фактором развития анализатора является использование трансферного обучения (transfer learning). Генетическая близость каракалпакского языка к казахскому и узбекскому позволяет применять метод «прокси-эмбеддингов» (proxy language embeddings), где веса моделей, обученных на больших корпусах казахского языка, адаптируются под каракалпакские реалии. Однако сохраняется проблема морфологической неоднозначности (полисемии), когда одна аффиксальная цепочка может быть интерпретирована двояко в зависимости от синтаксического контекста [152, 170].

Особым вызовом является функционирование каракалпакского языка в условиях сосуществования двух графических систем: кириллицы и латиницы (стандарт 2016 года). Разработанная архитектура включает модуль «сквозной маршрутизации» (script-aware routing) и инструменты двусторонней транслитерации, что позволяет применять модели, обученные на одном скрипте, к текстам на другом без потери качества анализа [480]. Ниже представлен пример представления слова «kitaptı» (книгу) в формате CoNLL-U:

1 kitaptı kitap NOUN _ Case=Acc|Number=Sing 0 obj _ _

Заключение

Проведенное исследование демонстрирует, что построение единого высокотехнологичного морфологического анализатора является

необходимым условием для формирования цифровой инфраструктуры каракалпакского языка. Создание такого инструмента позволяет преодолеть фрагментарность существующих решений и перейти к системному наполнению национального корпуса, что критически важно для сохранения лингвистического разнообразия в цифровую эпоху.

Основные выводы исследования подтверждают превосходство гибридных моделей (FST + нейронные сети). В то время как FST-трансдьюсеры обеспечивают жесткую структуру и прозрачность анализа для ядерной лексики, нейросетевые модели на базе Glot500 с адаптерами демонстрируют высокую адаптивность к неологизмам и вариативности словоупотребления. Это сочетание позволяет компенсировать дефицит обучающих данных, характерный для малоресурсных языков, и обеспечить точность POS-теггинга свыше 80%.

Особое значение разработка имеет в контексте обеспечения «цифрового суверенитета» каракалпакского языка. Официальный переход на латинскую графику в 2016 году создал временный разрыв в объемах доступных цифровых данных; интеграция систем двусторонней транслитерации непосредственно в NLP-конвейер нивелирует эту проблему, позволяя эффективно обрабатывать массивы текстов вне зависимости от используемого алфавита.

Перспективы дальнейших изысканий связаны с развитием систем распознавания именованных сущностей (NER) и инструментов автоматического синтаксического парсинга (dependency parsing) по стандартам Universal Dependencies. Создание полноценного лингвистического обеспечения откроет возможности для разработки качественных систем машинного перевода, образовательных платформ и интеллектуальных ассистентов, гарантируя каракалпакскому языку жизнеспособность в глобальном информационном пространстве.

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СПЕЦИФИЧЕСКИЕ ОСОБЕННОСТИ И ПРИНЦИПЫ АНАЛИЗА СИНТАКСИСА КАРАКАЛПАКСКОГО ЯЗЫКА В ОБРАБОТКЕ ЕСТЕСТВЕННОГО ЯЗЫКА

Аннотация. *Данная статья посвящена принципам моделирования синтаксиса каракалпакского языка в системах обработки естественного языка (NLP). В ней анализируются специфические синтаксические особенности каракалпакского языка с точки зрения компьютерной лингвистики и предлагаются эффективные методы парсинга для малоресурсных языков на основе опыта других тюркских языков.*

Ключевые слова: *обработка естественного языка (NLP), каракалпакский язык, компьютерная лингвистика, синтаксический анализ, парсинг.*

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SPECIFIC FEATURES AND ANALYSIS PRINCIPLES OF KARAKALPAK LANGUAGE SYNTAX IN NATURAL LANGUAGE PROCESSING

Abstract. *his paper focuses on the principles of modeling Karakalpak syntax in Natural Language Processing (NLP) systems. It analyzes the specific syntactic features of the Karakalpak language from a computational linguistics perspective and proposes effective parsing methods for low-resource languages based on the experience of other Turkic languages.*

Keywords: *Natural Language Processing (NLP), Karakalpak language, computational linguistics, syntactic analysis, parsing.*

Специфические особенности и принципы анализа синтаксиса каракалпакского языка в обработке естественного языка: Научный отчет

1. Введение: Лингвистический статус и морфологические характеристики

Каракалпакский язык принадлежит к кыпчакской группе тюркских языков, входя в состав кыпчакско-ногайской подгруппы. С точки зрения генетической и структурной близости он наиболее соотносится с казахским и ногайским языками. Несмотря на исторические дискуссии о классификации северо-восточного диалекта каракалпакского языка как наречия казахского, современный каракалпакский язык обладает статусом государственного языка с четко оформленным литературным стандартом.

Типологические особенности Язык характеризуется агглютинативным строем, при котором грамматические значения передаются путем последовательного присоединения аффиксов к корню. Для систем обработки естественного языка (NLP) это создает ряд специфических вызовов:

1. **Сингармонизм:** Наличие 9 основных гласных фонем (/a/, /æ/, /e/, /o/, /œ/, /u/, /y/, /i/, /ɯ/) и закона гармонии гласных порождает множество фонетических вариантов одного аффикса (например, *-lar* / *-ler*), что значительно усложняет морфологический анализ.

2. **Цепочки аффиксов:** Агглютинация позволяет формировать сложные морфологические структуры (число, принадлежность, падеж) в рамках одной словоформы, создавая проблему «сегментационной неоднозначности» (segmentation ambiguity).

Синтаксическая структура Каракалпакский язык придерживается фиксированного порядка слов SOV (Субъект-Объект-Глагол). Данная структура является фундаментальной для построения моделей анализа зависимостей (Dependency Parsing).

Таблица 1: Сравнение структуры предложения (SOV) в тюркских языках на примере фразы «Али видел книгу»

Язык	Структура предложения (Субъект-Объект-Глагол)	Система письма
Каракалпакский (kaa)	**Ali kitaptı ko’rdi.**	Латиница
Узбекский (uzb)	Ali kitobni ko'rdi.	Латиница
Казахский (kaz)	Ali kitaptı ko'rdi.	Латиница
Киргизский (kir)	Али китепти көрдү.	Кириллица
Татарский (tat)	Али китапны күрде.	Кириллица
Уйгурский (uig)	ئەلى كىتابنى كۆردى.	Арабское письмо

Проблема ресурсов В современной компьютерной лингвистике каракалпакский язык классифицируется как «малоресурсный» (low-resource). Отсутствие полноценной поддержки в глобальных сервисах, таких как Google Translate, ведет к «цифровой фрагментации» и риску исключения языка из

мирового информационного пространства. Инициативы вроде OLDI (Open Language Data Initiative) направлены на преодоление этого барьера.

2. Методология: Архитектура NLP-системы и этапы обработки

Разработка надежной NLP-инфраструктуры для каракалпакского языка включает в себя создание специализированных корпусов и применение гибридных методов анализа.

Формирование корпусов В рамках проекта OLDI был впервые разработан набор данных FLORES+ devtest для каракалпакского языка. Также были подготовлены параллельные корпуса объемом 100 000 пар предложений для языковых пар: каракалпакский-узбекский, каракалпакский-русский и каракалпакский-английский. Эти данные послужили базой для тонкой настройки (fine-tuning) модели NLLB-200.

Библиотека TurkicNLP Для автоматизации обработки используется модульная библиотека TurkicNLP, обеспечивающая полный цикл предварительной обработки текста (pipeline):

1. **ScriptDetector:** Осуществляет детекцию письменности (латиница, кириллица, арабское письмо) на основе анализа блоков Unicode.
2. **Transliterator:** Обеспечивает конвертацию между официальным латинским стандартом 2016 года и кириллицей. Механизм использует алгоритм «жадного поиска самого длинного совпадения» (greedy longest-match) и адаптирован для обработки невидимых символов (Zero-width non-joiner, U+200C), а также омографов, обусловленных гармонией гласных (vowel-harmony-conditioned homographs).
3. **ModelRegistry:** Управляет каталогом нейронных моделей и инструментов (Stanza, Apertium), обеспечивая их автоматическую загрузку.

Таблица 2: Направления транслитерации в TurkicNLP

Код языка	Направление	Стандарт	Особенности
kaa	**Кириллица ↔ Латиница**	**2016 Официальный**	**Акуты, диграфы, ZWNJ**
uzb	Кириллица ↔ Латиница	1995 Официальный	Обработка O' и G'

Подходы к анализу Исследование опирается на сравнение двух парадигм:

- **Правилоориентированный подход (Rule-based):** Использование анализатора Apertium на базе преобразователей конечных состояний (FST). В настоящее время прототип обеспечивает точность детекции около 45%.
- **Нейросетевой подход (Neural-based):** Применение мультиязычной модели Glot500 с использованием дискриминационных скоростей обучения (discriminative learning rates), что позволяет адаптировать глубокие слои модели под специфику каракалпакской морфологии.

3. Анализ результатов: Эффективность моделей и метрики

Машинный перевод Применение параллельных корпусов для адаптации модели NLLB-200 позволило достичь роста метрик BLEU и chrF на 15–20% по сравнению с базовыми мультиязычными решениями.

Токенизация (Fertility) Высокая степень агглютинации приводит к возникновению «налога на токенизацию» (tokenizer tax). Это означает, что стандартные токенизаторы разбивают каракалпакские слова на чрезмерное количество фрагментов, что увеличивает вычислительную сложность (inference cost) и сокращает эффективное окно контекста (context window).

Таблица 3: Анализ фертильности токенизаторов (Английский vs Тюркские языки)

Язык	Qwen 2.5	Llama 3.1	GPT-4o	P95 (Макс. токенов)
Английский (eng)	1.08	2.09	1.10	2.0
Турецкий (tur)	1.95	3.03	1.95	4.0
Каракалпакский (kaa)	**2.80**	**4.20**	**2.95**	**8.5**
Уйгурский (uig)	3.38	6.85	3.40	11.0

Показатель фертильности 4.20 для Llama 3.1 демонстрирует, что модель воспринимает каракалпакский текст как в два раза более «длинный» по сравнению с турецким, что требует оптимизации словарей.

Синтаксический парсинг Результаты анализа зависимостей (Dependency Parsing) подтверждают превосходство нейросетевых методов. Модель Glot500, обученная с применением кросс-лингвистического переноса, значительно опережает правилоориентированные системы.

Таблица 4: Точность синтаксического анализа для каракалпакского языка (Glot500)

Показатель	Значение (%)	Описание
UPOS Accuracy	**82.1%**	Точность тегирования частей речи
UAS	**67.5%**	Точность структуры связей (Unlabeled Attachment Score)
LAS	**51.0%**	Точность типов связей (Labeled Attachment Score)

Для сравнения: точность прототипа Apertium FST на данном этапе не превышает 45%, что делает нейронные модели приоритетными для практического внедрения.

4. Обсуждение: Проблемы сегментации и кросс-лингвистический перенос

Сегментационная неоднозначность Сложность автоматического разбора на примере слова *«Bala-lar-ım-da»* (У моих детей) заключается в корректной идентификации границ морфем: корень (*Bala*), показатель множественности (*-lar*), притяжательность (*-ım*) и падеж (*-da*). Наличие 9-гласной системы и закона сингармонизма часто приводит к ошибкам «неорфографического представления» (un-orthographic representation) при токенизации.

Лемматизация Для качественного семантического анализа (например, Sentiment Analysis) критически важно приведение словоформ (*yazaman*, *yazdi*) к единой лемме (*yazmaq*). Применение классификаторов на уровне символов (CNN) в модели Glot500 демонстрирует более высокую гибкость при выделении лемм по сравнению с жесткими правилами FST.

Кросс-лингвистический трансфер (Cross-lingual Transfer) В условиях нехватки данных эффективной стратегией является использование узбекского и казахского языков в качестве «прокси» (proxy languages). Это обосновано тем, что современный литературный стандарт каракалпакского языка базируется на северо-восточном диалекте, имеющем глубокие общие корни с казахским и узбекским языками. Это сходство позволяет моделям успешно переносить знания о синтаксических структурах на каракалпакский язык.

5. Заключение и перспективы развития

В ходе работы были созданы фундаментальные ресурсы: параллельные корпуса, модульная библиотека TurkicNLP и доказана эффективность нейросетевого подхода (Glot500) для анализа синтаксиса малоресурсного каракалпакского языка.

Приоритетные направления:

1. **Развитие ASR и TTS:** Создание систем распознавания и синтеза речи через перенос обучения (transfer learning) на базе крупных корпусов казахского (KSC2, 1200 ч) и узбекского (USC, 105 ч) языков.
2. **Масштабирование Apertium FST:** Расширение лексикона анализатора для перехода из стадии прототипа в промышленную эксплуатацию (Production).
3. **Цифровой суверенитет:** Полноценная интеграция языка в государственные цифровые платформы и национальные поисковые системы для предотвращения цифровой изоляции.

Использованные источники:

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РАЗРАБОТКА СПЕЦИАЛЬНОЙ ТЕХНОЛОГИИ ДЛЯ НАНЕСЕНИЯ ХРОМА НА МЕТАЛЛИЧЕСКУЮ ПОВЕРХНОСТЬ В ВИДЕ ПОКРЫТИЯ

Аннотация: *В статье разработана специальная технология нанесения хромовых покрытий на металлические поверхности. Хромовые покрытия отличаются высокой твердостью, коррозионной стойкостью, низким коэффициентом трения и термостойкостью. В исследовании изучено влияние процесса электрохимического покрытия, состава электролита, анодно-катодной плотности и температурного режима на качество покрытия. Проанализированы недостатки традиционных технологий (высокое энергопотребление, влияние ионов* Cr^{6+}*, внутренние напряжения) и предложены пути их устранения. Качество покрытия улучшилось за счет использования нанодобавок и режима импульсного тока. Результаты испытаний подтвердили эффективность новой технологии и показали возможности ее применения в машиностроении, энергетике и авиации.*

Ключевые слова: *Хром, покрытие, технологическая схема, теплоемкость, температура плавления, удельная теплоемкость, коэффициент трения, износостойкость.*

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DEVELOPMENT OF A SPECIAL TECHNOLOGY FOR APPLYING CHROMIUM COATINGS TO METALLIC SURFACES

Abstract. *This article presents the development of a special technology for applying chromium coatings to metallic surfaces. Chromium coatings are*

characterized by high hardness, excellent corrosion resistance, a low coefficient of friction, and superior heat resistance. The study investigates the influence of the electrochemical deposition process, electrolyte composition, anode-cathode current density, and temperature conditions on coating quality. The limitations of conventional chromium plating technologies, including high energy consumption, the adverse effects of Cr^{6+} ions, and internal stresses, are analyzed, and approaches to overcoming these challenges are proposed. The incorporation of nano-additives and the application of a pulsed current mode significantly improved the quality of the deposited coating. Experimental results confirmed the effectiveness of the proposed technology and demonstrated its potential applications in mechanical engineering, the energy sector, and the aerospace industry.

Keywords: *chromium, coating, technological process, heat capacity, melting temperature, specific heat capacity, coefficient of friction, wear resistance.*

Введение. На современном этапе развития машиностроительной отрасли надежность и долговечность изготавливаемых деталей и механизмов являются одним из важных вопросов. Узлы, узлы и различные функциональные детали, производимые на машиностроительных предприятиях, обычно подвергаются воздействию высокого давления, интенсивного трения, резких перепадов температуры, агрессивного воздействия окружающей среды и коррозионных процессов. В таких сложных условиях на поверхности деталей появляются различные дефекты, износ, деформации или трещины, а срок их службы резко сокращается.

Традиционное производство таких деталей требует больших материальных затрат, дополнительного сырья, энергоресурсов и рабочей силы. С этой точки зрения, восстановление существующих деталей и продление срока их службы являются одной из актуальных задач в машиностроительной отрасли. В этой связи особое значение приобретают методы защиты и упрочнения металлических поверхностей специальными покрытиями, особенно технология хромирования.

Металлические поверхности, покрытые хромом, отличаются рядом положительных свойств. В частности, электролитическое хромирование придает металлической поверхности такие качества, как: высокая твердость, пониженный коэффициент трения, высокая износостойкость, коррозионная стойкость в агрессивных средах и термостойкость.

Хромирование также является эффективным методом восстановления корродированных деталей, восстанавливая их первоначальные размеры и геометрическую точность. Это позволяет повторно использовать существующие детали вместо изготовления новых. Практика показывает, что такие методы играют важную роль в снижении расхода металла в процессе производства, снижении производственных затрат и уменьшении вредных для окружающей среды выбросов.

Поэтому научное развитие и совершенствование технологии хромирования металлических поверхностей в машиностроительной отрасли является сегодня одной из актуальных задач. Дальнейшее совершенствование технологии хромирования расширит возможности производства высококачественных, надежных и долговечных деталей машин. Это не только обеспечит технико-экономическую эффективность в машиностроительной отрасли, но и повысит конкурентоспособность отечественного производства.

Обзор литературы. В 2023 году ученые из Нанкинского технологического университета в Китае Ян, Ч., Чжан, Н., Ли, Х., Чен, Б., Ян, Б. опубликовали в журнале «Колледж материаловедения и инженерии» статью «Сравнение механизмов микроизноса PVD-хромовых покрытий и электролитического твердого хрома» и сравнили чистые хромовые покрытия, полученные методом тонкопленочного нанесения, при котором твердый металл или сплав испаряется в вакууме или среде инертного газа низкого давления и конденсируется на поверхности детали, с традиционным методом электролитического твердого хромового покрытия. Хромовое покрытие, сформированное методом ионизированного дугового испарения в магнитном поле, показало высокую микротвердость и хорошие адгезионные свойства на единицу толщины; однако существуют проблемы с защитой новых деталей (2–10 мкм) и восстановлением изношенных деталей до толщины (50–500 мкм) [1].

В статье 2020 года под названием «Электроосаждение толстого твердого хромового покрытия из раствора трехвалентного хрома, содержащего тройной комплексообразующий агент» ученые из Уханьского университета в Китае и Университета Роберта Гордона в Шотландии представили метод нанесения покрытия Cr(III) толщиной 30 мкм. В статье подчеркивается, что это способ снизить экологический риск, связанный с Cr(III). Утверждается, что электроосаждение Cr(III) на деталях и поверхностях трения может стать практической альтернативой в будущем [2].

В своей статье 2022 года «Механическое поведение твердого хрома, осажденного из трехвалентного хромового раствора» исследователи из Университета Тулузы во Франции, Гийон Р., Далверни О., Фори Б., Газо К., Алексис Ж., измерили механические свойства хромовых покрытий с помощью экспериментального и модельного анализа и обнаружили, что они являются «эластофрагическими», то есть обладают высокой твердостью и относительно низким коэффициентом восстановления. Еще одним преимуществом этих покрытий из Cr(III) является то, что, несмотря на хорошую коррозионную стойкость, их механические свойства могут значительно снижаться из-за микротрещин. Отмечается, что для восстановленных деталей, подверженных динамическим нагрузкам, трехвалентные покрытия следует упрочнять термической обработкой или композитными материалами [3].

В своей статье 2024 года «Композитное покрытие (Cr_3C_2-NiCr+Co), нанесенное методом HVOF-напыления на высокопрочный чугун: микроструктура, механические свойства и устойчивость к царапинам», опубликованной Ксязеком М. и Лип-Вронской К. из Краковского университета (Польша), они показали, что композитные покрытия Cr_3C_2-NiCr (с добавлением Co) были нанесены на поверхность цилиндрических деталей методом газового напыления и продемонстрировали высокую плотность, хорошую твердость и износостойкость. Они отметили, что добавление порошков Co увеличивает вероятность разрушения и растрескивания [4].

Методология исследования. Известный нам катодный метод хромирования широко распространен. Предлагаемая нами технология направлена на усовершенствование этого метода. Выполняется следующая последовательность операций. В рабочую (хромирующую) ванну объемом 1480 литров (1/2 от требуемого объема) заливают воду и нагревают до температуры 60°С. Необходимое количество диоксида хрома взвешивают на весах и высыпают в ванну. Его тщательно перемешивают деревянной мешалкой или измельчителем. После полного растворения диоксида хрома из раствора отбирают пробу для химического анализа с целью определения количества диоксида хрома и свободных сульфатных ионов в растворе. По результатам анализа обнаруженные в растворе диоксида хрома сульфатные ионы нейтрализуют. Для этого в раствор добавляют монооксид углерода из расчета 1,53 грамма на 1 грамм сульфатного иона. Этот процесс необходимо проводить осторожно, поскольку присутствие свободных сульфатных ионов в исходном растворе диоксида хрома практически полностью нарушает взаимное равновесие и резко ухудшает технологические параметры электролита. Диоксид карбоната стронция следует вводить в ванну небольшими порциями – важно перемешивать раствор и предотвращать его разбрызгивание в результате взаимодействия диоксида карбоната стронция и сульфатных ионов с выделением диоксида углерода. Через 30-60 минут после введения диоксида углерода необходимо повторно провести химический анализ раствора йода на количество сульфатных ионов. При обнаружении сульфатных ионов проводят переосаждение до тех пор, пока анализ не подтвердит их полное отсутствие. В отдельную 10-литровую футерованную емкость помещают стронций в серную кислоту из расчета 6 г/л, в нее добавляют небольшое количество исходного раствора диоксида хрома, растворяя до однородной массы. Электролит необходимо готовить самостоятельно.

Перед заливкой готового электролита в ванну необходимо тщательно промыть внутреннюю поверхность ванны, проверить состояние токопроводящих проводников, катушек, поврежденных батарей, футеровки и целостность самой ванны. Для растворения диоксида хрома в ванне в количестве 150 г/л целесообразно растворять диоксид хрома в дистиллированной воде. Допускается использование конденсата или

питьевой воды с общей жесткостью не более 6 мг-экв/л. Раствор не нагревают. Поскольку растворимость диоксида хрома в воде достаточно высока и составляет 600 г/л. Для ускорения процесса раствор необходимо периодически перемешивать. После полного растворения диоксида хрома из раствора отбирают пробу для химического анализа с целью определения количества свободных сульфатных ионов в растворе диоксида хрома. По результатам анализа необходимо нейтрализовать обнаруженные в растворе диоксида хрома сульфатные ионы.

Полученный таким образом электролит нагревают до температуры 50-55ºС и выдерживают при этой температуре в течение 16-20 часов. Время от времени необходимо перемешивать осадок для насыщения раствора связанными сульфатными ионами, образовавшимися в результате растворения хромовой кислоты и диссоциации стронция серной кислотой. Электролит с температурой 45-55ºС и плотностью тока 400-600 а/м2 выдерживают в течение 3-6 часов со скоростью 6-8, при этом соотношение поверхностей катода и анода должно составлять 2:1; 3:1.

Целью исследования является накопление определенного количества ионов трехвалентного хрома в электролите для обеспечения получения высококачественных хромовых отложений на катоде. Берется и анализируется проба для определения количества трехвалентного хрома в электролите. Анализ пробы проводится для определения количества трехвалентного хрома в электролите, концентрация которого должна находиться в диапазоне 2-4 г/л. Рекомендуется проводить испытание образцов на хромирование, контролируя качество покрытия в соответствии с ГОСТ 9.301-86, ГОСТ 9.302-87. Необходимо проводить химический анализ электролита и добавлять химические реактивы один раз в 3 месяца.

Детали со следующими дефектами хромового покрытия: расслоение, сколы, трещины и растрескивание, отбраковываются и подвергаются повторному хромированию. Перед повторным хромированием необходимо удалить остатки хрома с поверхности детали. Хром может быть удален механическим, химическим или электрохимическим методами. Механический метод удаления хрома очень сложен в применении, так как требует больших трудозатрат. Химический метод заключается в погружении деталей в ванну с концентрированной или дважды разбавленной соляной кислотой. При удалении хрома соляной кислотой необходимо тщательно контролировать завершение процесса, поскольку оставшиеся в кислоте детали после прекращения выделения водорода приведут к плавлению и гидрированию поверхности основного металла.

Анализ и результаты. В результате проведенных исследований было установлено, что эффективность процесса хромирования в значительной степени зависит от состава электролита, количества сульфатных ионов, концентрации трехвалентного хрома и соотношения поверхностей катода и анода.

При приготовлении и оценке стабильности электролита рабочий раствор готовили в хромирующей ванне объемом 1480 литров, при этом наблюдалось полное растворение диоксида хрома. В качестве фактора, нарушающего технологическое равновесие в исходном растворе, были отмечены сульфатные ионы. Эффективным оказалось использование карбоната стронция для их нейтрализации. В процессе, благодаря выделению диоксида углерода, улучшилось перемешивание раствора и наблюдалось постепенное снижение концентрации сульфатных ионов. В результате повторных анализов было подтверждено полное отсутствие сульфатных ионов в растворе. Это обеспечило стабильность электролита при последующем использовании.

Нагревание и выдержка электролита. При выдержке электролита при температуре 50–55 °C в течение 16–20 часов в растворе образовывались трехвалентные ионы хрома в результате растворения хромовой кислоты и диссоциации сульфата стронция. В результате периодического перемешивания раствора наблюдалось равномерное распределение осадка и стабилизация электролита.

Количество трехвалентных ионов хрома, по результатам анализа взятых образцов, было установлено, что концентрация трехвалентных ионов хрома в электролите находится в диапазоне 2–4 г/л. Эти значения оказались в оптимальном диапазоне и достаточными для образования высококачественных хромовых отложений на катоде. Было замечено, что чрезмерное увеличение содержания трехвалентного хрома может негативно повлиять на качество покрытия, поэтому состояние раствора поддерживалось под постоянным контролем в соответствии с ГОСТ 9.301–86 и ГОСТ 9.302–87.

При оценке качества хромового покрытия в условиях оптимальных параметров (температура 45–55 °C, плотность тока 400–600 А/м², катод и анод (соотношение 2:1 или 3:1)) на поверхности деталей были получены равномерные, блестящие и высокотвердые хромовые покрытия. Отслоения, сколов, трещин и отслоений покрытий не наблюдалось. Однако в некоторых случаях, когда технологические требования не были соблюдены, появлялись указанные дефекты, и такие детали считались непригодными и отправлялись на повторное хромирование. Процесс повторного извлечения хрома оказался неэффективным на практике из-за высокой трудоемкости механического метода. Было подтверждено, что хромовое покрытие может быть эффективно удалено химическим методом с использованием соляной кислоты. В этом случае очень важно контролировать завершение процесса, поскольку чрезмерное удержание может привести к коррозии основного металла.

Выводы и рекомендации. Присутствие сульфатных ионов в растворе для хромирования резко ухудшает качество покрытия. Поэтому рекомендуется проводить процесс нейтрализации с использованием карбоната стронция под строгим контролем. При приготовлении электролита

целесообразно использовать дистиллированную воду или конденсат/питьевую воду с жесткостью не более 6 мг-экв/л.

Для улучшения качества покрытия можно повысить качество поверхности, поддерживая концентрацию ионов трехвалентного хрома в диапазоне 2–4 г/л. В случаях обнаружения дефектов (отслаивание, сколы, растрескивание) рекомендуется химическое удаление покрытия с деталей перед повторным хромированием.

Необходимо ограничить механический метод и широко использовать эффективные химические методы, а также ввести строгий контроль для предотвращения коррозии основного металла на заключительном этапе процесса. Рекомендуется проводить регулярные технические проверки рабочих ванн, токопроводящих элементов и футеровки.

Усовершенствованная технология катодного хромирования, разработанная в результате проведенных исследований, позволила получить высококачественные, блестящие, твердые и коррозионностойкие покрытия.

Стабильность процесса обеспечивалась нейтрализацией сульфатных ионов и нормализацией концентрации трехвалентного хрома в электролите.

В оптимальных технологических режимах (T = 45–55 °C, J = 400–600 А/м², соотношение катод-анод 2:1 или 3:1) на поверхности хромовых покрытий не наблюдалось дефектов, таких как расслоение и растрескивание.

Предложенный метод является эффективным и экономически целесообразным для использования на производственных предприятиях, позволяя снизить энергопотребление и стабилизировать качество покрытия.

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ЭКОЛОГИЧЕСКАЯ ОЦЕНКА ЗАГРЯЗНЕНИЯ АТМОСФЕРНОГО ВОЗДУХА ГОРОДА НУКУСА ПРОМЫШЛЕННЫМИ ВЫБРОСАМИ

Аннотация: *В статье представлена экологическая оценка загрязнения атмосферного воздуха города Нукуса под воздействием промышленных выбросов. Проведен анализ концентраций $PM_{2.5}$, PM_{10}, NO_2, SO_2 и CO. Установлено, что наиболее высокий уровень загрязнения наблюдается вблизи промышленных предприятий и транспортных магистралей. Выявлены сезонные изменения содержания загрязняющих веществ, обусловленные антропогенными и природно-климатическими факторами. Показано значительное влияние солепылевых аэрозолей, поступающих с высохшего дна Аральского моря. Полученные результаты свидетельствуют о необходимости совершенствования экологического мониторинга и внедрения мероприятий по снижению антропогенной нагрузки на атмосферный воздух.*

Ключевые слова: *атмосферный воздух, промышленное загрязнение, экологический мониторинг, качество воздуха, промышленные выбросы, Приаралье, Нукус, солепылевые аэрозоли.*

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ENVIRONMENTAL ASSESSMENT OF AIR POLLUTION IN NUKUS BY INDUSTRIAL EMISSIONS

Abstract: *This article presents an environmental assessment of air pollution in Nukus due to industrial emissions. Concentrations of $PM_{2.0}$, PM_{10}, NO_2, SO_2, and CO were analyzed. The highest pollution levels were found near industrial facilities and highways. Seasonal changes in pollutant levels due to anthropogenic and natural climatic factors were identified. The significant impact of salt-dust aerosols emanating from the dried bed of the Aral Sea has been demonstrated. The results*

demonstrate the need for improved environmental monitoring and the implementation of measures to reduce anthropogenic loads on the atmospheric air.

Key words: *atmospheric air, industrial pollution, environmental monitoring, air quality, industrial emissions, Aral Sea region, Nukus, salt-dust aerosols.*

Введение

Загрязнение атмосферного воздуха является одной из наиболее актуальных экологических проблем, особенно для регионов Приаралья, где антропогенная нагрузка сочетается с последствиями Аральской экологической катастрофы.

Республика Каракалпакстан характеризуется высокой запылённостью атмосферы, процессами опустынивания и частыми пыльными бурями, что усиливает негативное воздействие промышленных и транспортных выбросов. Город Нукус, как крупнейший промышленный и административный центр региона, испытывает значительное влияние выбросов предприятий и транспорта, а также солепылевых аэрозолей, поступающих с высохшего дна Аральского моря.

В связи с недостаточной изученностью данной проблемы целью исследования являлась экологическая оценка загрязнения атмосферного воздуха города Нукуса промышленными выбросами и выявление основных факторов антропогенного воздействия.

Материалы и методы

Исследования проводились в городе Нукусе в 2024–2025 гг. Объектом исследования являлся атмосферный воздух территорий с различной антропогенной нагрузкой, включая промышленные зоны, транспортные магистрали и жилые районы. В ходе работы анализировались концентрации основных загрязняющих веществ: $PM_{2.5}$, PM_{10}, NO_2, SO_2 и CO, являющихся ключевыми индикаторами качества атмосферного воздуха. Для оценки сезонной динамики загрязнения данные обрабатывались методами вариационной статистики с расчетом средних значений и показателей изменчивости. Также применялся корреляционный анализ для выявления взаимосвязей между загрязняющими веществами. При интерпретации результатов учитывались природно-климатические условия региона, включая температурный режим, ветровой режим, частоту пыльных бурь и перенос солепылевых аэрозолей с высохшего дна Аральского моря.

Результаты и обсуждение

Проведенные исследования показали, что загрязнение атмосферного воздуха города Нукуса имеет выраженный комплексный характер и формируется под воздействием как локальных промышленных источников, так и региональных природно-антропогенных факторов. Анализ концентраций загрязняющих веществ выявил значительные сезонные колебания показателей качества атмосферного воздуха. Наиболее высокие значения содержания твердых взвешенных частиц $PM_{2.5}$ и PM_{10} были

зарегистрированы в летний период, когда концентрации достигали соответственно 45 и 75 мкг/м³.(Таблица 1).

Повышенные уровни запыленности объясняются сочетанием высокой температуры воздуха, снижением влажности, усилением ветровой эрозии почв и переносом солепылевых аэрозолей с территории Аралкума Содержание диоксида азота варьировало в пределах от 0,034 до 0,041 мг/м³. Максимальные концентрации наблюдались осенью и зимой, что связано с увеличением интенсивности транспортного движения и ростом объемов сжигания топлива. Аналогичная закономерность была выявлена для оксида углерода, концентрация которого возрастала до 3,2 мг/м³ в зимний период.

Таблица 1

Средние концентрации основных загрязняющих веществ в атмосферном воздухе города Нукуса

Показатель	Весна	Лето	Осень	Зима
$PM_{2.5}$, мкг/м³	32	45	30	38
PM_{10}, мкг/м³	58	75	52	49
NO_2, мг/м³	0,034	0,038	0,041	0,039
SO_2, мг/м³	0,020	0,018	0,022	0,031
CO, мг/м³	2,4	2,6	2,8	3,2

Полученные результаты показывают, что основными источниками загрязнения атмосферного воздуха города Нукуса являются предприятия энергетики, строительной индустрии и автомобильный транспорт. В районах, прилегающих к промышленным объектам, концентрации загрязняющих веществ на 20–35 % превышают показатели жилых зон. Существенный вклад в загрязнение атмосферы вносят твердые аэрозольные частицы, поступающие как от локальных источников, так и с высохшего дна Аральского моря. В их составе присутствуют минеральные соли (хлориды, сульфаты, соединения натрия, магния и кальция) и остаточные количества пестицидов, что усиливает экологическую нагрузку на окружающую среду.

Полученные результаты свидетельствуют о том, что качество атмосферного воздуха города Нукуса определяется воздействием как антропогенных, так и природных факторов. Наряду с промышленными выбросами и транспортом существенную роль в загрязнении атмосферы играют солепылевые аэрозоли, поступающие с высохшего дна Аральского моря. Наибольшую экологическую опасность представляют мелкодисперсные частицы $PM_{2.5}$ и PM_{10}, оказывающие негативное влияние на здоровье населения. Загрязнение атмосферного воздуха также ухудшает состояние городской растительности, снижая интенсивность фотосинтеза и продуктивность зеленых насаждений. Полученные данные согласуются с результатами исследований других регионов Приаралья и указывают на

необходимость усиления природоохранных мероприятий для предотвращения дальнейшего ухудшения качества атмосферного воздуха.

Заключение

Проведенная экологическая оценка показала, что атмосферный воздух города Нукуса испытывает значительное антропогенное воздействие со стороны промышленных предприятий, энергетических объектов и транспорта. Основными загрязнителями являются твердые взвешенные частицы $PM_{2.5}$ и PM_{10}, концентрации которых возрастают в летний период вследствие дефляционных процессов и переноса солепылевых аэрозолей из Приаралья. Установлено, что качество атмосферного воздуха формируется под влиянием промышленных выбросов, транспортной нагрузки, климатических факторов и трансграничного переноса аэрозолей. Наиболее неблагоприятная экологическая ситуация отмечается в промышленных районах и вдоль крупных транспортных магистралей. Для улучшения качества воздуха необходимы совершенствование экологического мониторинга, модернизация газоочистных систем и расширение зеленых насаждений в городской среде.

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ПСИХОЛОГИЧЕСКАЯ ПОДДЕРЖКА РОДИТЕЛЕЙ, ВОСПИТЫВАЮЩИХ РЕБЕНКА В УСЛОВИЯХ ИНКЛЮЗИВНОГО ОБРАЗОВАНИЯ

Аннотация. *В статье рассматриваются теоретические и практические аспекты психологической поддержки родителей, воспитывающих детей с особыми образовательными потребностями в условиях инклюзивного образования. Анализируются психологические трудности семьи, факторы родительского стресса, механизмы адаптации и современные формы психолого-педагогического сопровождения. Подчеркивается значимость комплексной поддержки семьи как условия успешной социализации ребенка и эффективности инклюзивного образования.*

Ключевые слова: *инклюзивное образование, родители, особые образовательные потребности, психологическая поддержка, семейное сопровождение, родительский стресс, психолого-педагогическая помощь.*

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PSYCHOLOGICAL SUPPORT FOR PARENTS RAISING A CHILD IN AN INCLUSIVE EDUCATION ENVIRONMENT

Abstract. *The article examines theoretical and practical aspects of psychological support for parents raising children with special educational needs in inclusive education settings. It analyzes the psychological difficulties faced by families, factors contributing to parental stress, adaptation mechanisms, and modern forms of psychological and pedagogical support. The importance of*

comprehensive family support as a prerequisite for successful socialization of the child and effective inclusive education is emphasized.

Keywords: *inclusive education, parents, special educational needs, psychological support, family support, parental stress, psychological and pedagogical assistance.*

Введение. Инклюзивное образование в современных условиях рассматривается как один из ключевых механизмов обеспечения равного доступа детей к качественному обучению независимо от их индивидуальных особенностей и состояния здоровья. Однако успешная реализация инклюзии зависит не только от готовности образовательной организации, но и от психологического состояния семьи ребенка. Семья как центральный фактор инклюзии. Родители являются основными субъектами сопровождения ребенка, организуют его повседневную жизнь, взаимодействуют со специалистами и оказывают эмоциональную поддержку. Появление в семье ребенка с особыми образовательными потребностями часто сопровождается необходимостью перестройки привычного образа жизни, изменением социальных ролей и повышением эмоциональной нагрузки. В этой связи психологическая поддержка родителей становится важным условием сохранения благополучия семьи и успешной социальной адаптации ребенка.

Теоретические основы проблемы. В отечественной и зарубежной психологии семья рассматривается как важнейший фактор развития личности ребенка. Системный подход предполагает, что изменения в состоянии одного члена семьи оказывают влияние на функционирование всей семейной системы. Поэтому психологические трудности ребенка не могут рассматриваться отдельно от эмоционального состояния родителей. Современные исследования подчеркивают значимость семейно-центрированного подхода, при котором специалисты оказывают помощь не только ребенку, но и его ближайшему окружению. Родители рассматриваются как активные участники образовательного процесса, обладающие уникальным опытом и знаниями о потребностях ребенка.

Психологические трудности родителей. Родители детей с особыми образовательными потребностями нередко сталкиваются с целым комплексом эмоциональных и социальных проблем. Наиболее распространенные трудности

1. повышенная тревожность;
2. хронический стресс;
3. чувство вины;
4. эмоциональное выгорание;
5. социальная изоляция;
6. неуверенность в собственных воспитательных возможностях.

Особенно сложными являются периоды перехода ребенка на новые образовательные этапы: поступление в дошкольную организацию, школу или

переход в среднее звено обучения. В эти моменты возрастает тревога относительно успешности адаптации ребенка, его принятия сверстниками и академических достижений.

Факторы родительского стресса. Уровень стресса определяется не только особенностями ребенка, но и внешними условиями жизни семьи. Среди основных факторов риска выделяются:

- Тяжесть нарушений развития
- Чем выраженнее ограничения, тем больше потребность в постоянном уходе и сопровождении.
- Финансовые трудности
- Расходы на лечение, коррекционные занятия и транспорт усиливают нагрузку на семью.
- Недостаток социальной поддержки
- Отсутствие помощи со стороны родственников, сообщества или специалистов повышает чувство изоляции.
- Сложности взаимодействия с учреждениями
- Негативный опыт общения с образовательными или медицинскими организациями усиливает стресс.
- Защитные факторы

Исследования показывают, что наличие эмоциональной поддержки, конструктивных копинг-стратегий и доверительного взаимодействия со специалистами снижает негативное влияние стресса на родителей.

Основные направления психологической поддержки

1. Индивидуальное психологическое консультирование. Консультирование направлено на снижение эмоционального напряжения, развитие навыков саморегуляции и поиск внутренних ресурсов семьи. В процессе работы психолог помогает родителям:

1. осознать собственные переживания;
2. сформировать реалистичные ожидания;
3. освоить методы преодоления стресса;
4. предотвратить эмоциональное выгорание.

2. Психологическое просвещение. Недостаток достоверной информации часто усиливает тревожность родителей. Поэтому важным направлением становится просветительская работа, включающая:

- информирование об особенностях развития ребенка;
- знакомство с современными методами коррекционной помощи;
- разъяснение прав семьи в системе образования;
- обучение эффективным стратегиям взаимодействия с ребенком.

3. Группы взаимопомощи. Групповые формы работы позволяют родителям обмениваться опытом, получать эмоциональную поддержку и расширять социальные контакты. Участие в таких группах способствует снижению чувства одиночества и повышению уверенности в собственных силах.

4. Семейное консультирование. Семейная работа направлена на улучшение внутрисемейных отношений, распределение обязанностей между членами семьи и формирование единой стратегии воспитания ребенка.

Роль образовательной организации. Эффективная инклюзия невозможна без партнерства между семьей и образовательным учреждением. Школа или дошкольная организация должны выступать не только пространством обучения, но и центром поддержки семьи. Задачи образовательной организации

1. организация консультаций для родителей;
2. проведение семинаров и тренингов;
3. сопровождение адаптации ребенка;
4. координация взаимодействия специалистов;
5. создание атмосферы уважения и принятия.

Исследования показывают, что активное вовлечение родителей в образовательный процесс положительно влияет как на академические достижения ребенка, так и на его социальную адаптацию.

Обсуждение. Анализ научной литературы свидетельствует, что психологическая поддержка родителей является одним из ключевых факторов эффективности инклюзивного образования. Родители, получающие своевременную профессиональную помощь, демонстрируют более высокий уровень стрессоустойчивости, лучше взаимодействуют с ребенком и активнее участвуют в образовательном процессе.

В то же время во многих образовательных организациях сохраняется дефицит системной работы с семьей. Недостаточное количество специалистов, ограниченные ресурсы и отсутствие комплексных программ сопровождения снижают эффективность оказываемой помощи. Это определяет необходимость дальнейшего развития междисциплинарных моделей поддержки, объединяющих усилия психологов, педагогов, социальных работников и медицинских специалистов.

Заключение. Психологическая поддержка родителей, воспитывающих ребенка в условиях инклюзивного образования, представляет собой важное направление современной психолого-педагогической практики. Комплексная помощь способствует снижению родительского стресса, укреплению эмоционального благополучия семьи, повышению родительской компетентности и успешной социализации ребенка.

Перспективными направлениями дальнейших исследований являются разработка программ профилактики эмоционального выгорания родителей, изучение эффективности различных форм семейного сопровождения и создание моделей взаимодействия образовательных организаций с семьями детей с особыми образовательными потребностями.

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РАЗВИТИЕ РЫНКА ТРУДА В УСЛОВИЯХ АВТОМАТИЗАЦИИ И РОБОТИЗАЦИИ

Аннотация: *Статья посвящена трансформации российского рынка труда под влиянием автоматизации. Выявлены вызовы для занятости и растущий спрос на новые компетенции. Предложены меры по реформированию системы образования, направленные на минимизацию социальных рисков и адаптацию кадров к цифровой экономике.*

Ключевые слова: *автоматизация, роботизация, цифровая экономика, трансформация занятости, профессиональные компетенции*

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DEVELOPMENT OF THE LABOR MARKET IN THE CONTEXT OF AUTOMATION AND ROBOTIZATION

Annotation: *The article focuses on the transformation of the Russian labor market under the influence of automation.It identifies challenges for employment and the growing demand for new competencies. The article proposes measures to reform the education system in order to minimize social risks and adapt personnel to the digital economy.*

Keywords: *automation, robotization, digital economy, employment transformation, professional competencies*

Введение

Четвертая промышленная революция, характеризующаяся стремительным внедрением роботизированных систем и алгоритмов искусственного интеллекта, принципиально трансформирует глобальную структуру занятости. Традиционные рабочие места, последовательно замещаются гибридными формами труда, где техническая грамотность сочетается с креативным решением нестандартных задач. Согласно прогнозам Международной организации труда, к 2030 году автоматизация может привести к сокращению до 20% существующих профессий, одновременно создав спрос на принципиально новые компетенции. Этот процесс формирует вызовы для устойчивого развития трудовых рынков, требуя переосмысления подходов к подготовке кадров.

В современный период, можно наблюдать противоречивую ситуацию в технологических изменениях. С одной стороны можно заметить, как растет производительность труда, а с другой можно увидеть проблемы, которые появляются на рынке труда. Внедрение цифровых технологий и роботизированных линий позволяют работать более эффективнее. Однако, на предприятиях работники, особенно те, у кого низкая квалификация, сталкиваются с трудностями, так как не готовы работать с автоматизированными системами. Дефицит специалистов, способных проектировать, обслуживать и управлять робототехническими комплексами, становится существенным ограничением для экономического роста. Данное противоречие актуализирует необходимость системного анализа изменений в профессиональных требованиях и разработки превентивных мер адаптации.

Целью настоящего исследования выступает комплексная оценка влияния автоматизации и роботизации на динамику российского рынка труда с последующей разработкой практических рекомендаций для образовательных институтов. На основе анализа статистических данных за последнее десятилетие авторы стремятся выявить ключевые тенденции трансформации занятости в высокотехнологичных отраслях и определить спектр востребованных компетенций. Особое внимание уделяется проектированию адаптационных механизмов, минимизирующих социальные издержки технологических изменений и способствующих формированию кадрового резерва для экономики будущего.

Научная новизна работы заключается в синтезе международного опыта адаптации трудовых ресурсов и специфики российской экономической реальности, что позволяет предложить дифференцированные стратегии реформирования профессионального образования. Практическая значимость исследования определяется его ориентированностью на создание инструментов для государственной политики в сфере занятости, обеспечивающих баланс между технологическим прогрессом и социальной стабильностью. Полученные результаты могут служить основой для

разработки образовательных стандартов нового поколения, соответствующих вызовам цифровой эпохи.

Итак, рассмотрим динамику рынка, сделаем обзор тенденций автоматизации и роботизации в мировой экономике России.

Глобальные тенденции автоматизации демонстрируют ускоренное внедрение промышленных роботов в обрабатывающих отраслях, где за последнее десятилетие плотность роботизации увеличилась в среднем на 40%. Параллельно наблюдается активное развитие когнитивных технологий в секторе услуг, включая искусственный интеллект и машинное обучение.

Эксперты Всемирного экономического форума утверждают, что результаты внедрения автоматизированных систем и алгоритмов, к 2025 году могут вытеснить примерно 85 миллионов рабочих мест [1, с.37].

Эти процессы формируют новую архитектуру глобального рынка труда, требующую адаптации образовательных систем и регуляторных механизмов.

В российской экономике наблюдается асинхронное развитие автоматизации: промышленный сектор демонстрирует рост роботизации, особенно в автомобилестроении и металлургии, где установлено свыше 60% всех промышленных роботов. Однако сервисный сектор существенно отстаёт в внедрении когнитивных технологий из-за недостаточных инвестиций и регуляторных барьеров. Такой дисбаланс создаёт структурные перекосы на рынке труда, выражающиеся в дефиците высококвалифицированных кадров для работы с новыми технологиями при одновременном избытке специалистов в традиционных секторах услуг. Данная специфика требует разработки дифференцированных мер государственной поддержки технологической модернизации.

Историческая ретроспектива влияния технологических изменений на занятость.

Исторический анализ технологических трансформаций демонстрирует цикличность их воздействия на структуру занятости. Промышленная революция XVIII-XIX веков привела к исчезновению традиционных ремесленных профессий, но одновременно сформировала спрос на инженерные специальности и операторов машинного производства. Аналогичные процессы наблюдались в XX веке при внедрении конвейерного производства и компьютерных технологий, когда сокращение рутинных операций компенсировалось ростом креативных и управленческих позиций. Подобная нелинейная динамика подтверждает закономерность: технологические инновации первоначально сокращают занятость в устаревающих секторах, но в среднесрочной перспективе генерируют новые

Даже при сохранении достаточного количества рабочих мест к 2030 году, глубоких структурных изменений мировая экономика не избежит. По характеру и по масштабу они будут сопоставимы с трансформациями, которые ранее наблюдались в промышленной и аграрной сферах. [2, с.36].

Анализ статистических данных по динамике рынка труда в РФ за последние 10 лет.

Данные Росстата за период 2013-2023 годов демонстрируют устойчивую тенденцию сокращения занятости в обрабатывающих отраслях промышленности, где уровень автоматизации производственных процессов достиг 45%. Параллельно наблюдается рост численности специалистов в IT-секторе (на 62% за десятилетие) и сфере обслуживания роботизированных систем, что соответствует общемировым трендам технологической трансформации.

Эмпирические данные свидетельствуют, что автоматизация оказывает сильное влияние на рынок труда. Она ведет к снижению численности рабочих мест в традиционных отраслях. При это процессе появляются новые возможности занятости в сферах, которые связаны с программированием, с искусственным интеллектом, цифровыми технологиями и анализом данных [8, с.242].

Этот двусторонний процесс отражает структурную перестройку экономики, где технологическое замещение рутинного труда сопровождается формированием новых профессиональных ниш.

В разделе трансформационной занятости, рассмотрим изменение структуры занятости в отраслях с высоким уровнем роботизации.

В последние годы в промышленность и сферу логистики идет активное внедрение роботизированных технологий, что привело к уменьшению рабочих мест. Это связанно с тем, что автоматизация производственных линий, складских процессов, а также систем контроля качества позволяет эффективно заменять человеческий труд в задачах, которые выполняются заранее по заданным алгоритмам. Наиболее яркий пример в этой тенденции в таких отраслях, как автомобилестроение и электронная промышленность, где уровень использования роботизированных систем является одним из самых высоких. В результате, в структуре занятости происходят существенные изменения, работники с невысокой квалификацией становятся все менее востребованными на рынке труда.

Параллельно с сокращением традиционных позиций наблюдается рост спроса на специалистов по обслуживанию, программированию и управлению робототехническими комплексами. Технологическое переоснащение предприятий требует привлечения инженеров по автоматизации, системных интеграторов и аналитиков данных для поддержки производственных циклов. В логистических компаниях увеличивается потребность в операторах автоматизированных складских систем и разработчиках алгоритмов оптимизации грузопотоков. Эти изменения формируют новую профессиональную структуру в автоматизированных отраслях экономики.

Процессы автоматизации и роботизации вызвали фундаментальные изменения в требованиях к профессиональным компетенциям. Традиционные технические навыки постепенно уступают место цифровой грамотности,

предполагающей уверенное владение современными информационными системами и инструментами анализа данных. Одновременно возрастает потребность в развитом аналитическом мышлении, необходимом для интерпретации сложных данных и принятия решений в условиях неопределенности. Критическое значение приобретает способность к быстрой адаптации, позволяющая работникам непрерывно осваивать новые технологии и методы работы в динамично меняющейся среде.

С какими же проблемы и вызовами встречаются низкоквалифицированные работники.

Низкоквалифицированные работники сталкиваются с повышенным риском технологической безработицы вследствие активного замещения рутинного труда автоматизированными системами и роботизированными комплексами. Особенно уязвимыми оказываются отрасли с преобладанием монотонных операций — производство, логистика, административная поддержка. Данная тенденция ведет к сокращению традиционных рабочих мест без эквивалентного создания новых позиций в тех же секторах. Это создает необходимость разработки целевых программ переобучения и адаптации кадрового потенциала к изменяющимся условиям рынка труда.

Современные подходы к переквалификации и повышению квалификации.

Современные методы переподготовки кадров характеризуются разнообразием форматов, адаптированных к требованиям цифровой экономики. Модульные программы позволяют гибко комбинировать учебные компоненты в соответствии с индивидуальными потребностями работников.

Онлайн-курсы и смешанные форматы обучения обеспечивают доступность образовательных ресурсов независимо от географического положения. «Модель 70-20-10 предполагает, что эффективное обучение включает 70% практического опыта, 20% обучения от коллег и 10% формального обучения» [3, с.135]. Это подтверждает важность сочетания различных подходов.

Эффективность программ повышения квалификации оценивается через их способность формировать компетенции, соответствующие запросам автоматизированного производства. Анализ показывает, что наиболее успешные образовательные модели делают акцент на развитии цифровой грамотности и навыков работы с интеллектуальными системами. Критическое значение приобретает адаптивность учебных программ к быстро меняющимся технологическим стандартам. Регулярное обновление содержания обучения позволяет минимизировать разрыв между профессиональной подготовкой и реальными производственными требованиями.

Предложения по реформированию системы профессионального образования.

Реформирование системы профессионального образования требует разработки гибких образовательных программ, ориентированных на

формирование цифровых компетенций, когнитивных способностей и междисциплинарных знаний. Современные учебные планы должны интегрировать модули по работе с искусственным интеллектом, анализу больших данных и управлению роботизированными системами, обеспечивая синтез технических и гуманитарных дисциплин.

При этом ряд профессий, в которых играет ключевая роль – это человеческие качества, взаимодействие с людьми, все также остается востребованными. К таким видам деятельности относится: медицина, психология, службы общественной безопасности, социальные и творческие профессии. На смену старым профессиям придут новые предложения, поэтому переживать об исчезновении не стоит. Нужно сосредоточится на новых современных концепциях. Трансформация занятости будет сопровождаться появлением новых профессий, что требует обновления образовательных программ и активного участия государства [11, с.345].

Это подчеркивает необходимость баланса между технологической подготовкой и развитием социально-эмоциональных навыков, обеспечивающих конкурентоспособность выпускников на трансформирующемся рынке труда.

Какую роль играет государство и бизнес в поддержке адаптации работников.

Эффективная адаптация работников к технологическим изменениям требует согласованных действий государственных институтов и частного сектора. Государственные программы субсидирования переобучения призваны обеспечить доступность образовательных ресурсов для широких слоёв населения, особенно в наиболее уязвимых профессиональных группах. Корпоративные инициативы по развитию кадрового потенциала, в свою очередь, фокусируются на специфических компетенциях, соответствующих стратегическим задачам конкретных отраслей. Синхронизация этих механизмов позволяет оптимизировать распределение ресурсов и создать непрерывную систему профессионального развития, отвечающую как общественным интересам, так и потребностям бизнеса.

Таким образом, все выше сказанное позволяет сделать вывод, под влиянием автоматизации и роботизации происходит трансформация рынка, для этого требуется комплексный подход. Тут важно отметить, что для успешной адаптации необходимо развивать не только новые технологии, но и усилить подготовку кадров.

В результате проведенного анализа в моей статье автоматизация и роботизация приводит к поляризации на рынке труда, следовательно, сокращаются рабочие места, но при этом растет спрос на специалистов, которые имеют квалификационные навыки по разработке, обслуживанию и управлению новыми технологиями.

Для минимизации социальных рисков, необходимо выстраивать многоуровневую систему переподготовки кадров. Эффективность данной

системы определяется реализацией принципом трипартизма, то есть конструктивное партнерство между государством, бизнесом и образовательными учреждениями. Адаптивные образовательные программы здесь служат основным инструментом, это поможет гибко реагировать на спрос цифровой динамики. Такой подход обеспечит непрерывное развитие, что поспособствует созданию баланса новых технологий и традиционной рабочей силе.

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ЭКТОПАРАЗИТЫ МЕЛКИХ МЛЕКОПИТАЮЩИХ ЮЖНОГО ПРИАРАЛЬЯ: СОВРЕМЕННОЕ СОСТОЯНИЕ И ОСОБЕННОСТИ РАСПРОСТРАНЕНИЯ

Аннотация: *В статье представлены результаты исследования эктопаразитов мелких млекопитающих Южного Приаралья. Изучены видовой состав, особенности распространения и экологические связи эктопаразитов в различных природных биотопах региона. Установлено, что основу эктопаразитофауны составляют представители отрядов Acari, Siphonaptera и Phthiraptera. Наибольшее видовое разнообразие отмечено среди клещей и блох, что связано с благоприятными условиями обитания и высокой численностью хозяев. Выявлены особенности распределения паразитов в зависимости от типа местообитания, сезона года и видовой принадлежности хозяев. Полученные результаты могут быть использованы при мониторинге природно-очаговых инфекций и разработке мероприятий по сохранению биоразнообразия региона.*

Ключевые слова*: Южное Приаралье, мелкие млекопитающие, эктопаразиты, клещи, блохи, вши, биоразнообразие, распространение.*

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ECTOPARASITES OF SMALL MAMMALS OF THE SOUTH ARAL REGION: CURRENT STATE AND DISTRIBUTION FEATURES

Abstract: *The article presents the results of a study of ectoparasites of small mammals in the Southern Aral Sea region. The species composition, distribution features and ecological connections of ectoparasites in various natural biotopes of the region were studied. It has been established that the basis of the ectoparasite fauna consists of representatives of the orders Acari, Siphonaptera and Phthiraptera. The greatest species diversity was observed among ticks and fleas, which is associated with favorable living conditions and a high number of hosts.*

Peculiarities of distribution of parasites depending on the type of habitat, season of the year and species of hosts were revealed. The results obtained can be used in monitoring natural focal infections and developing measures to preserve the biodiversity of the region.

Key words: *Southern Aral Sea region, small mammals, ectoparasites, ticks, fleas, lice, biodiversity, distribution.*

Введение

Южное Приаралье представляет собой уникальный природный регион, испытывающий значительное влияние процессов опустынивания, деградации экосистем и климатических изменений. Трансформация природных ландшафтов оказывает существенное воздействие на структуру сообществ позвоночных животных и связанных с ними паразитических организмов. Мелкие млекопитающие являются важным компонентом экосистем Южного Приаралья и играют значительную роль в поддержании циркуляции многих паразитов и возбудителей природно-очаговых заболеваний. Среди них особое место занимают эктопаразиты, которые не только влияют на состояние популяций хозяев, но и могут выступать переносчиками опасных инфекционных заболеваний.

Несмотря на значительное количество исследований, посвященных фауне мелких млекопитающих Центральной Азии, сведения о современном состоянии их эктопаразитофауны в Южном Приаралье остаются недостаточно полными. В условиях изменения климата и антропогенного воздействия возникает необходимость регулярного мониторинга паразитических комплексов. Целью исследования являлось изучение современного состояния эктопаразитофауны мелких млекопитающих Южного Приаралья и выявление особенностей ее распространения.

Материалы и методы

Исследования проводились в 2023–2025 гг. на территории Южного Приаралья в различных природных биотопах: пустынных участках, тугайных лесах, полупустынях, сельскохозяйственных угодьях и прибрежных территориях водоемов. Отлов мелких млекопитающих осуществлялся с использованием живоловушек и давилок, размещенных по стандартным маршрутным линиям. После определения видовой принадлежности животных проводился осмотр кожных покровов и шерстного покрова на наличие эктопаразитов. Собранный паразитологический материал фиксировали в 70%-ном этиловом спирте. Определение видов эктопаразитов осуществлялось с использованием определителей насекомых и клещей Центральной Азии. Для оценки распространенности паразитов рассчитывались следующие показатели:

экстенсивность инвазии (ЭИ, %);

интенсивность инвазии (ИИ, экз./особь);

индекс доминирования видов.

Статистическая обработка данных проводилась с использованием общепринятых методов вариационной статистики.

Результаты и обсуждение

В ходе исследований было обследовано более 250 особей мелких млекопитающих, относящихся к нескольким видам грызунов и насекомоядных. Среди обследованных животных наиболее часто встречались большая песчанка (Rhombomys opimus), полуденная песчанка (Meriones meridianus), домовая мышь (Mus musculus), серая крыса (Rattus norvegicus) и ушастый еж (Hemiechinus auritus).

Всего выявлено 18 видов эктопаразитов, относящихся к трем основным таксономическим группам:

клещи (Acari) – 9 видов;

блохи (Siphonaptera) – 6 видов;

вши и власоеды (Phthiraptera) – 3 вида.

Наибольшее видовое разнообразие отмечено среди иксодовых и гамазовых клещей. Доминирующими видами являлись представители родов Hyalomma, Dermacentor и Haemaphysalis. Среди блох наиболее часто встречались представители родов Xenopsylla и Nosopsyllus.

Анализ распределения эктопаразитов показал, что их численность значительно варьировала в зависимости от типа местообитания. Максимальные показатели зараженности наблюдались в тугайных экосистемах, где сочетание повышенной влажности и высокой плотности популяций хозяев создает благоприятные условия для развития паразитов.

В пустынных биотопах видовое разнообразие эктопаразитов было ниже, однако отдельные виды клещей отличались высокой устойчивостью к экстремальным условиям среды. Максимальная численность большинства паразитов наблюдалась в весенне-летний период: пик активности клещей приходился на апрель–июнь, а блох — на май–июль. Полученные данные свидетельствуют о сохранении устойчивых паразитарных систем в экосистемах Южного Приаралья, структура которых изменяется под воздействием аридизации и сокращения площади тугайных лесов, что влияет на распространение как хозяев, так и их паразитов.

Особое эпидемиологическое значение имеют выявленные виды блох и клещей, способные участвовать в циркуляции возбудителей чумы, туляремии, клещевых риккетсиозов и других природно-очаговых инфекций. В связи с этим регулярный мониторинг эктопаразитофауны является важным элементом системы экологической и санитарно-эпидемиологической безопасности региона.

Заключение

Проведённые исследования показали, что эктопаразитофауна мелких млекопитающих Южного Приаралья представлена 18 видами клещей, блох и вшей, среди которых наибольшим разнообразием отличаются клещи. Максимальная заражённость животных отмечена в тугайных экосистемах, а

наибольшая активность паразитов наблюдается в весенне-летний период. Выявленные виды имеют важное эпидемиологическое значение и могут участвовать в поддержании природных очагов инфекционных заболеваний. Полученные результаты дополняют сведения о биоразнообразии паразитических организмов региона и служат основой для дальнейших исследований.

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ПОЛУЧЕНИЕ ФОСФОРНО-КАЛИЙНЫХ УДОБРЕНИЙ НА ОСНОВЕ МИНЕРАЛИЗОВАННОГО МАССА И НИТРАТА КАЛИЯ

Аннотация. *В статье представлены результаты исследований по получению комплексных фосфорно-калийных удобрений на основе минерализованной массы, являющейся отходом переработки фосфатного сырья, и нитрата калия. Минерализованную массу разлагали азотной кислотой при 70–100 % от стехиометрической нормы. После отделения нитрата кальция фильтрацией полученную нитратно-фосфатную суспензию обрабатывали экстракционной фосфорной кислотой и нитратом калия. Исследовано влияние нормы азотной кислоты и соотношения фосфорсодержащего и калийного компонентов на химический состав конечного продукта. Установлено, что изменение расхода нитрата калия позволяет регулировать соотношение P_2O_5:K_2O в широком диапазоне. Полученные удобрения содержат до 27,1 % общего P_2O_5, до 27,13 % K_2O и характеризуются высокой долей усвояемых форм питательных веществ. Результаты исследований подтверждают перспективность использования отходов фосфатного производства для получения эффективных комплексных удобрений.*

Ключевые слова: *минерализованная масса, фосфатные отходы, азотная кислота, нитрат калия, экстракционная фосфорная кислота, комплексные удобрения, фосфор, калий.*

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PRODUCTION OF PHOSPHORUS-POTASSIUM FERTILIZERS BASED ON MINERALIZED MASS AND POTASSIUM NITRATE

Abstract. *The article presents the results of research on the production of complex phosphorus-potassium fertilizers based on mineralized mass, which is a waste product of phosphate raw materials processing, and potassium nitrate. The*

mineralized mass was decomposed with nitric acid at 70–100% of the stoichiometric norm. After separating calcium nitrate by filtration, the resulting nitrate-phosphate suspension was treated with wet-process phosphoric acid and potassium nitrate. The effect of the nitric acid rate and the ratio of phosphorus-containing and potassium components on the chemical composition of the final product was studied. It was established that changing the consumption of potassium nitrate allows for regulating the P_2O_5:K_2O ratio over a wide range. The obtained fertilizers contain up to 27.1% of total P_2O_5, up to 27.13% of K_2O, and are characterized by a high proportion of available forms of nutrients. The research results confirm the feasibility of using phosphate production waste to obtain effective complex fertilizers.

Keywords: *mineralized mass, phosphate waste, nitric acid, potassium nitrate, wet-process phosphoric acid, complex fertilizers, phosphorus, potassium.*

Введение. В настоящее время в химической промышленности Республики Узбекистан основную долю занимает производство азотных удобрений, однако объёмы выпуска фосфорных и калийных удобрений также последовательно увеличиваются. По данным АО «Узкимёсаноат», в 2025 году в республике было произведено более 1,45 млн тонн минеральных удобрений, из которых 121 тыс. тонн пришлось на фосфорные и 220 тыс. тонн – на калийные удобрения [1].

В последние годы реализуются инвестиционные проекты, направленные на развитие производства комплексных фосфорно-калийных удобрений. В частности, между Узбекистаном и Иорданией достигнуты договорённости о реализации совместных проектов по производству калийных и фосфорных удобрений. Это создаёт благоприятные условия для внедрения современных технологий, расширения ассортимента выпускаемой продукции и повышения экспортного потенциала отрасли [2].

Одновременно расширяются научно-исследовательские работы, посвящённые разработке новых комплексных удобрений на основе низкосортных фосфоритов, минерализованной массы и местных калийсодержащих компонентов. Данное направление имеет важное значение для производства импортозамещающей продукции, комплексного использования сырьевых ресурсов и повышения агрохимической эффективности минеральных удобрений.

Бу таржима илмий мақола услубида тайёрланди ва рус тилидаги журналлар талабларига мос келади.

Материалы и методы исследования. Для проведения лабораторных исследований использовали отход фосфатного производства — минерализованную массу следующего химического состава, мас.%: P_2O_5общ. – 11,84; CaO – 44,71; MgO – 2,06; CO_2 – 19,06; R_2O_3 – 3,18; SO_3 – 1,97; F – 1,47; H_2O – 1,46; нерастворимый остаток – 9,21.

Разложение минерализованной массы осуществляли 59%-ной азотной кислотой в трубчатом стеклянном реакторе при непрерывном перемешивании. В связи с высоким содержанием кальцита в исходном сырье во избежание интенсивного пенообразования азотную кислоту подавали постепенно в течение 15–20 минут до её полного расходования на процесс разложения. При этом между кислотой и минерализованной массой происходило интенсивное взаимодействие с образованием нитратно-фосфатной пульпы. Норму азотной кислоты варьировали в пределах 70–100 % от стехиометрически необходимого количества.

После завершения процесса разложения из нитратно-фосфатной пульпы отделяли нитрат кальция методом фильтрации. Для предотвращения потерь соединений фосфора перед фильтрованием пульпу предварительно нейтрализовали газообразным аммиаком.

Для получения фосфорно-калийных удобрений в суспензию, полученную при разложении фосфатного концентрата экстракционной фосфорной кислотой (ЭФК), вводили нитрат калия производства АО «Навоиазот». Полученную массу подвергали сушке и гранулированию, в результате чего получали гранулированные фосфорно-калийные удобрения.

Содержание общего, аммонийного и нитратного азота определяли согласно методикам, приведённым в работах [3–6]. Определение общего азота основано на восстановлении нитратного азота до аммонийной формы сплавом Деварда с последующей отгонкой аммиака и его титриметрическим определением.

Массовую долю аммонийного азота определяли хлораминовым методом, основанным на окислении аммонийного азота до элементарного азота в присутствии хлорамина, бромида калия и фосфатного буферного раствора с pH 6,7. Избыток хлорамина определяли йодометрическим титрованием.

Содержание нитратного азота определяли методом восстановления в кислой среде раствором сульфата железа (II) в присутствии молибдата аммония в качестве катализатора с последующим титрованием избытка Fe^{2+} раствором перманганата калия.

Фосфатные соединения определяли дифференциальным фотометрическим методом [3], основанным на образовании жёлтого ванадиево-молибденового комплекса фосфора и измерении его оптической плотности при длине волны 440 нм относительно стандартного раствора с известным содержанием P_2O_5. Общие фосфаты извлекали азотной кислотой, усвояемые формы — раствором лимонной кислоты и трилона Б, а водорастворимые формы — дистиллированной водой.

Содержание калия в исходном сырье и полученных образцах определяли методом пламенной фотометрии [7].

Массовые доли кальция и магния определяли комплексонометрическим методом [3, 8], основанным на взаимодействии ионов кальция и магния с

раствором трилона Б в присутствии индикатора. Содержание сульфатов определяли гравиметрическим методом [9] путём осаждения их хлоридом бария в кислой среде с последующим взвешиванием осадка.

Содержание железа и алюминия определяли комплексонометрическим методом [3, 10], а хлорид-ионов — методом Мора. Фильтрацию пульпы на экспериментальном этапе осуществляли с использованием вакуумного насоса марки КСЛ-1206-5.

Содержание фтора определяли ионометрическим методом после разложения образцов азотной кислотой [3, 11]. Метод основан на непосредственном измерении концентрации фторид-ионов в растворе с использованием фторселективного электрода.

Количество диоксида углерода в карбонатах определяли экспрессным объёмным методом [12], основанным на разложении карбонатов соляной кислотой и измерении объёма выделившегося углекислого газа.

Содержание влаги в твёрдых образцах определяли высушиванием до постоянной массы при температуре 100–105 °C в сушильном шкафу согласно стандартной методике [13].

Бу вариант илмий рус тили услубида қайта ишланган бўлиб, журнал мақолалари учун мослаштирилган. Ортиқча такрорлар қисқартирилди ва матн академик услубга келтирилди.

Результаты исследований и их обсуждение. Химический состав полученных гранулированных фосфорно-калийных удобрений был исследован в зависимости от нормы азотной кислоты и соотношения исходных компонентов (таблица 1).

Таблица 1

Химический состав фосфорно-калийных удобрений, полученных при переработке фосфатного концентрата экстракционной фосфорной кислотой и нитратом калия, %

P_2O_5: K_2O	N			P_2O_5		CaO			K_2O	H_2O
	общ.	амм.	нитр.	общ.	усв.	общ.	усв.	вод.		
Стехиометрические нормы реагентов: HNO_3 – 70 %; ЭФК – 100 %.										
1:2	8,77	0,51	8,27	13,57	12,66	7,53	7,12	7,12	27,13	1,01
1:1	7,21	0,76	6,45	20,34	18,99	11,29	10,69	10,67	20,34	1,17
1:0,7	6,38	0,89	5,49	23,95	22,35	13,30	12,58	12,57	16,77	1,17
1:0,5	5,63	1,01	4,62	27,10	25,29	15,04	14,23	14,22	13,55	1,40
Стехиометрические нормы реагентов: HNO_3 – 80 %; ЭФК – 100 %.										
1:2	8,93	0,76	8,17	13,30	12,61	7,75	7,28	7,26	26,60	1,07
1:1	7,49	1,14	6,35	19,77	18,75	11,53	10,82	10,80	19,77	1,14
1:0,7	6,74	1,33	5,41	23,16	21,96	13,50	12,68	12,65	16,21	1,13
1:0,5	6,07	1,50	4,57	26,09	24,74	15,21	14,28	14,25	13,05	1,35

Стехиометрические нормы реагентов: HNO_3 – 90 %; ЭФК – 100 %.										
1:2	9,11	1,10	8,01	12,91	12,52	8,08	7,51	7,49	25,83	1,19
1:1	7,83	1,61	6,22	18,97	18,40	11,88	11,04	11,01	18,97	1,09
1:0,7	7,17	1,87	5,30	22,07	21,40	13,82	12,84	12,80	15,45	1,08
1:0,5	6,58	2,10	4,48	24,72	23,97	15,47	14,38	14,34	12,36	1,28
Стехиометрические нормы реагентов: HNO_3 – 100 %; ЭФК – 100 %.										
1:2	9,46	1,65	7,81	12,45	12,43	8,37	7,67	7,66	24,89	1,28
1:1	8,41	2,38	6,03	18,02	18,00	12,12	11,10	11,09	18,02	1,03
1:0,7	7,88	2,75	5,14	20,79	20,77	13,99	12,81	12,79	14,55	1,01
1:0,5	7,42	3,06	4,36	23,12	23,09	15,56	14,24	14,23	11,56	1,19

Анализ результатов показал, что состав конечного продукта в значительной степени определяется как расходом азотной кислоты, так и соотношением фосфор- и калийсодержащих компонентов.

Установлено, что с уменьшением соотношения Р содержание общего P_2O_5 в удобрении возрастает. Так, при норме азотной кислоты, соответствующей 70 % от стехиометрической, содержание общего P_2O_5 увеличилось с 13,57 % при соотношении компонентов 1:2 до 27,10 % при соотношении 1:0,5. Аналогичная закономерность наблюдалась и при других нормах кислоты. Это объясняется снижением доли нитрата калия и соответствующим увеличением концентрации фосфорсодержащих соединений в продукте.

Следует отметить, что доля усвояемых форм фосфора составляла 90–98 % от общего содержания P_2O_5. Высокое содержание доступных форм фосфора свидетельствует о значительной агрохимической эффективности полученных удобрений.

Содержание калия изменялось в противоположном направлении. При увеличении доли нитрата калия возрастала концентрация K_2O в готовом продукте. Например, при норме азотной кислоты 70 % содержание общего K_2O составляло 27,13 % при соотношении 1:2 и снижалось до 13,55 % при соотношении 1:0,5. Таким образом, изменяя количество нитрата калия, можно целенаправленно регулировать соотношение P_2O_5:K_2O в широком диапазоне. При соотношении 1:2 формируются калийобогащённые марки РК-удобрений, тогда как при соотношении 1:0,5 получаются концентрированные фосфорсодержащие продукты (рис.1).

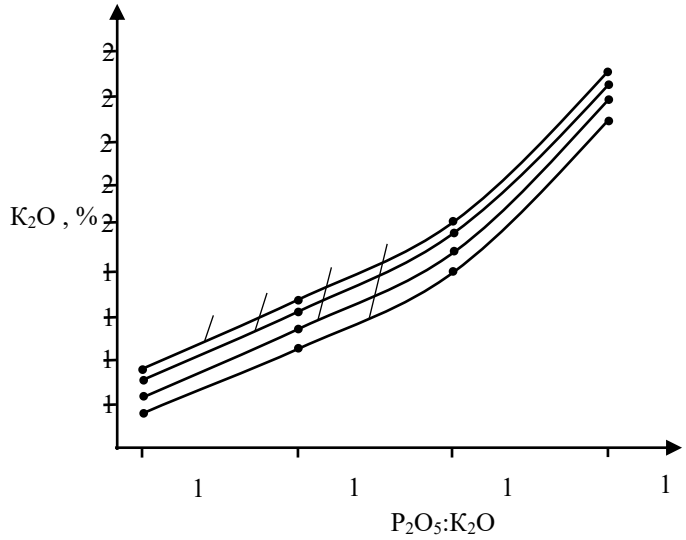

Рисунок 1. Влияние нормы азотной и фосфорной кислот, а также соотношения $P_2O_5$2O на содержание калия в составе фосфорно-калийного удобрения. Стехиометрические нормы HNO_3/ЭФК составляют: 1 – 70/100 %; 2 – 80/100 %; 3 – 90/100 %; 4 – 100/100 %.

Повышение нормы азотной кислоты оказало существенное влияние на содержание азота в удобрениях. При увеличении нормы кислоты с 70 до 100 % содержание общего азота во всех образцах возрастало. Так, для образца с соотношением 1:0,5 содержание общего азота увеличилось с 5,63 до 7,42 %. Особенно заметно возросла доля аммонийного азота — с 1,01 до 3,06 %. Данный эффект обусловлен увеличением количества азотной кислоты, участвующей в процессе переработки сырья. В результате полученные продукты приобретают не только фосфорно-калийные, но и частично азотно-фосфорно-калийные свойства.

Несмотря на некоторое снижение общего содержания P_2O_5 при увеличении нормы азотной кислоты, доля усвояемых форм фосфора оставалась высокой. Например, при соотношении 1:0,5 содержание общего P_2O_5 уменьшилось с 27,10 до 23,12 %, тогда как количество усвояемого фосфора практически не изменилось. Это связано с более глубоким превращением кальциевых фосфатов в монокальцийфосфат при повышенной кислотности среды.

Важным показателем является содержание оксида кальция. В исследованных образцах его концентрация изменялась в пределах 7,53–15,56 %. С увеличением содержания фосфора наблюдался рост количества кальция, поскольку он входит в состав фосфатных соединений. Кроме того, повышение кислотности способствует переходу части кальция в более реакционноспособные нитратные и дигидрофосфатные формы. Наличие кальция положительно влияет на физико-механические свойства удобрений, улучшая прочность гранул и их устойчивость при хранении.

Установлено также, что практически весь калий находится в водорастворимой форме. Доля водорастворимого K_2O составляла 95–100 % от общего содержания калия, что обеспечивает его высокую доступность для растений. В сочетании с высоким содержанием усвояемого фосфора это позволяет отнести полученные продукты к числу эффективных комплексных PK-удобрений.

Влажность готовых удобрений находилась в пределах 1,01–1,40 %. Низкое содержание влаги свидетельствует об эффективности процесса сушки и обеспечивает хорошие эксплуатационные свойства продукции. Незначительное увеличение влажности при повышении нормы азотной кислоты не оказывает существенного влияния на качество продукта. Низкая влажность способствует сохранению сыпучести удобрений и предотвращает их слёживаемость при хранении.

Заключение. Результаты проведённых исследований показали возможность получения высокоэффективных фосфорно-калийных удобрений на основе фосфатного концентрата, экстракционной фосфорной кислоты и нитрата калия. Установлено, что изменение расхода нитрата калия позволяет регулировать соотношение P_2O_5:$_2O$ в широком диапазоне, а увеличение нормы азотной кислоты способствует обогащению продукта азотным компонентом. Полученные удобрения характеризуются высоким содержанием усвояемых форм фосфора и водорастворимого калия, что обеспечивает их высокую агрохимическую эффективность и перспективность промышленного применения.

Агар мақолани рус тилидаги журналга топширмоқчи бўлсангиз, адабиётлар рўйхатини ҳам рус тилида ва библиографик талабларга мувофиқ шакллантириш мақсадга мувофиқ бўлади.

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СТАТИСТИЧЕСКАЯ ОЦЕНКА ВЛИЯНИЯ ДЕМОГРАФИЧЕСКИХ ПРОЦЕССОВ НА КАЧЕСТВО ЖИЗНИ НАСЕЛЕНИЯ

Аннотация. *В данной статье представлена статистическая оценка влияния демографических процессов на качество жизни населения. В исследовании проанализировано воздействие таких демографических показателей, как рождаемость, смертность, миграция и возрастная структура населения, на уровень жизни, занятость, доходы и доступность социальных услуг. Результаты статистического анализа показали наличие существенной взаимосвязи между демографическими изменениями и показателями качества жизни. Полученные результаты могут быть использованы при совершенствовании демографической политики и разработке управленческих решений, направленных на повышение благосостояния населения и обеспечение устойчивого социально-экономического развития.*

Ключевые слова: *демографические процессы, качество жизни населения, статистическая оценка, рождаемость, смертность, миграция, структура населения, демографическое развитие, корреляционный анализ*

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STATISTICAL ASSESSMENT OF THE IMPACT OF DEMOGRAPHIC PROCESSES ON THE QUALITY OF LIFE OF THE POPULATION

Abstract. *This article provides a statistical assessment of the impact of demographic processes on the quality of life of the population. The study analyzes the influence of demographic indicators, including birth rates, mortality rates, migration, and the age structure of the population, on living standards, employment, income levels, and access to social services. The results of the statistical analysis reveal a significant relationship between demographic changes and quality-of-life indicators. The findings may serve as a basis for improving demographic policy and*

supporting evidence-based decision-making aimed at enhancing population welfare and sustainable socio-economic development.

Keywords: *demographic processes, quality of life, statistical assessment, birth rate, mortality rate, migration, population structure, demographic development, correlation analysis.*

Введение

Демографическое развитие является одним из ключевых факторов, определяющих социально-экономическое состояние и перспективы развития государства. Изменение численности населения, формирование его возрастной структуры, миграционные процессы и темпы естественного прироста оказывают существенное влияние на различные сферы экономики. Одновременно показатели качества жизни населения во многом формируются под воздействием демографических процессов.

Изменения в численности и составе населения непосредственно отражаются на социально-экономическом развитии страны. Демографические факторы определяют не только объем трудовых ресурсов, но и уровень потребности общества в услугах здравоохранения, образования, жилищного обеспечения и социальной защиты. В связи с этим исследование взаимосвязи между демографическим развитием и качеством жизни населения представляет собой одно из актуальных направлений современных статистических исследований.

Динамика численности населения и трансформация его структуры относятся к числу важнейших факторов, влияющих на устойчивость экономического роста и социального благополучия общества. Демографические процессы оказывают непосредственное воздействие на рынок труда, потребительский спрос, функционирование системы здравоохранения, образовательной сферы и механизмов социальной поддержки населения. Поэтому выявление влияния роста численности населения, миграционных потоков, а также изменений показателей рождаемости и смертности на качество жизни населения является актуальной научной задачей, имеющей важное теоретическое и практическое значение.

“К числу важных социальных достижений относится расширение мер поддержки малообеспеченных семей. В частности, 168 тысяч детей из семей с низким уровнем дохода были приняты в государственные дошкольные образовательные учреждения на льготных условиях. Кроме того, начиная с текущего года, в 208 детских садах страны впервые внедрена система инклюзивного образования, направленная на обеспечение равного доступа к качественному обучению для всех детей независимо от их индивидуальных особенностей.

Следует отметить положительную динамику в сфере сокращения бедности. Если в начале года уровень бедности в стране составлял 8,9 %, то к концу отчётного периода данный показатель снизился до 5,8 %, что

свидетельствует об эффективности реализуемых социально-экономических программ и мер государственной поддержки населения”[1]

В Указе Президента Республики Узбекистан № ПФ-158 от 11 сентября 2023 года “О Стратегии “Узбекистан – 2030”» определён ряд приоритетных направлений государственной политики. “В частности, предусмотрены меры по усилению прикладных исследований в наиболее динамично развивающихся секторах экономики, внедрению кластерной системы взаимодействия “предприятие – высшее учебное заведение – научная организация”, выделению 4 трлн сумов из Государственного бюджета на финансирование прикладных научных исследований, а также организации производства 850 видов инновационной продукции в драйверных отраслях экономики. Реализация данных задач направлена на ускорение инновационного развития, повышение эффективности научно-исследовательской деятельности и обеспечение устойчивого экономического роста страны”[2].

В связи с этим производители официальной статистики осуществляют постоянную оценку качества официальных статистических данных. “В целях обеспечения качества официальная статистика формируется и распространяется на основе единых принципов и методологических подходов, охватывающих вопросы статистического наблюдения, определения понятий, статистических единиц, классификаций и иных элементов статистической деятельности. Такой подход способствует повышению достоверности, сопоставимости и объективности официальной статистической информации”[3].

Международные исследования свидетельствуют о наличии тесной взаимосвязи между демографической структурой населения и уровнем общественного благосостояния. Увеличение доли населения трудоспособного возраста способствует ускорению экономического роста и расширению производственного потенциала страны, тогда как процессы старения населения приводят к увеличению социальных расходов и повышению нагрузки на системы социальной защиты и здравоохранения. В этой связи статистическая оценка влияния демографических изменений на качество жизни населения имеет важное научное и практическое значение.

В последние годы во многих странах мира наблюдается ускорение процессов урбанизации, усиление миграционной активности и трансформация возрастной структуры населения. Указанные тенденции оказывают существенное воздействие на социально-экономическое развитие и приводят к изменению содержания показателей, характеризующих качество жизни. Вследствие этого возрастает актуальность статистического анализа влияния демографических факторов на уровень и условия жизни населения.

Обеспечение устойчивого развития государства во многом зависит от объективной оценки воздействия демографических процессов на экономические и социальные результаты. Качество жизни населения

отражается посредством таких показателей, как уровень доходов, занятость, состояние здоровья, доступность образования и жилищно-бытовые условия. Формирование и динамика этих показателей в значительной степени определяются демографическими процессами, что обусловливает необходимость их комплексного статистического исследования.

Методология исследования

Методологическую основу исследования составляют современные методы статистического анализа демографических процессов и показателей качества жизни населения. В ходе исследования использованы общенаучные методы анализа и синтеза, сравнительного и системного подходов, а также специальные статистические методы обработки данных.

Для оценки влияния демографического развития на качество жизни населения применялись методы группировки, сравнения, анализа динамических рядов, индексного анализа, корреляционно-регрессионного моделирования и статистического прогнозирования. Информационной базой исследования послужили официальные статистические данные, материалы государственных органов, международных организаций и результаты научных исследований по рассматриваемой тематике.

Комплексное использование указанных методов позволило выявить основные тенденции демографического развития, определить степень их влияния на показатели качества жизни населения, а также сформулировать научно обоснованные выводы и практические рекомендации по совершенствованию социально-экономической политики.

“В данной статье влияние инфляционных процессов на реальные доходы населения исследуется на основе экономико-статистического анализа. В ходе исследования были изучены основные факторы, определяющие инфляцию, а также проанализировано её воздействие на уровень доходов населения и его покупательную способность. Особое внимание уделено оценке последствий роста общего уровня цен для благосостояния населения, качества жизни и динамики социального неравенства. Для достижения поставленных целей использовались методы сравнительного анализа, обобщения статистических данных, анализа динамических рядов и экономической интерпретации полученных результатов. Это позволило выявить основные закономерности влияния инфляции на социально-экономическое положение населения и определить ключевые тенденции изменения уровня жизни в условиях роста цен”[4].

‘В данной статье уровень жизни населения Республики Узбекистан исследован с учётом воздействия различных социально-экономических факторов. Проведён анализ основных показателей, характеризующих уровень жизни населения, а также рассмотрены тенденции их изменения в современных условиях. На основе статистических данных изучены факторы, оказывающие влияние на благосостояние населения, уровень доходов, занятость и условия жизни. Полученные результаты позволили выявить

основные закономерности и особенности формирования уровня жизни населения Республики Узбекистан.” [5]

В докладах UNFPA и World Bank систематически анализируется влияние возрастной структуры населения, процессов урбанизации и миграции на экономическое благосостояние. Вместе с тем в ряде исследований отмечается, что взаимосвязь между демографическими показателями и качеством жизни в региональном разрезе изучена недостаточно полно, что обусловливает актуальность данного исследования.

В рамках исследования для анализа демографических и социально-экономических показателей использовались методы статистического наблюдения, сравнительного анализа, группировки данных, анализа динамических рядов и корреляционного анализа.

В качестве исходных показателей были отобраны следующие группы индикаторов:

К демографическим показателям отнесены коэффициент рождаемости, коэффициент смертности, уровень естественного прироста населения, миграционное сальдо и доля населения трудоспособного возраста.

Показатели качества жизни включают доходы на душу населения, уровень занятости, ожидаемую продолжительность жизни, уровень бедности, а также показатели доступности образовательных и медицинских услуг.

Взаимосвязь между указанными показателями оценивалась с использованием коэффициента корреляции, что позволило определить степень и направление статистической зависимости между демографическими факторами и уровнем качества жизни населения.

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

Здесь:

x — демографические показатели;

y — показатели качества жизни;

r — коэффициент корреляции.

Результаты исследования были подвергнуты статистическому анализу, а их экономическое содержание получило соответствующую интерпретацию.

В ходе исследования были использованы такие методы статистического анализа, как статистическое наблюдение, метод группировки, метод сравнения, корреляционный анализ и многофакторный регрессионный анализ.

Для проведения исследования были отобраны следующие показатели:

Независимые переменные:

X_1 — уровень рождаемости (%)

X_2 — уровень смертности (%)

X_3 — миграционное сальдо (‰)
X_4 — доля населения трудоспособного возраста (%)

Зависимая переменная:

Y — индекс качества жизни населения

Регрессионная модель была представлена в следующем виде:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Здесь:

β_0 — свободный показатель;

$\beta_1, \beta_2, \beta_3, \beta_4$ — коэффициенты регрессии;

ε — случайная ошибка.

Анализ и результаты

Результаты анализа показали значимую взаимосвязь между демографическими процессами и показателями качества жизни.

Таблица 1

Корреляция между демографическими показателями и показателями качества жизни [58]

Показатели	Коэффициент корреляции (r)
Рождаемость - доход	0,61
Занятость - доля трудоспособного населения	0,74
Ожидаемая продолжительность жизни - уровень смертности	-0,82
Чистая миграция - доход	0,58
Бедность - темп естественного прироста	-0,47

Согласно расчетам, увеличение доли трудоспособного населения имеет сильную положительную корреляцию с ростом уровня занятости (r=0,74). Наблюдалась сильная отрицательная корреляция между уровнем смертности и ожидаемой продолжительностью жизни (r=-0,82).

Было установлено, что доходы были относительно высокими в регионах, где миграционные потоки способствовали увеличению числа экономически активного населения. Также наблюдалась тенденция к снижению уровня бедности в регионах с высокими темпами естественного прироста.

Полученные результаты подтверждают, что демографические процессы являются важным фактором социально-экономического развития.

Взаимосвязь между демографическими факторами и показателями качества жизни оценивалась на основе корреляционного анализа.

[58] Muallifning ilmiy tadqiqot natijalari asosida tuzildi.

Таблица 2

Корреляция между демографическими показателями и индексом качества жизни [59]

Показатели	r
Рождаемость	0,63
Смертность	-0,81
Миграционный сальдо	0,57
Доля населения трудоспособного возраста	0,76

Результаты показали сильную отрицательную корреляцию между смертностью и индексом качества жизни. Наиболее сильная положительная корреляция наблюдалась с долей населения трудоспособного возраста.

Коэффициент детерминации модели:

$$R^2 = 0,78$$

Этот результат означает, что 78 процентов изменений индекса качества жизни объясняются демографическими факторами, включенными в модель.

Результаты исследования показали, что демографическое развитие оказывает значительное влияние на качество жизни населения. В частности, увеличение доли трудоспособного населения способствует росту экономической активности и занятости. Это приводит к увеличению доходов и улучшению социального благополучия.

Таблица 3

Результаты регрессионного анализа взаимосвязи между демографическими показателями и индексом качества жизни. [60]

Факторы	коэффициент	t-статистика
β_0	12,5	2,81
X_1	0,28	2,44
X_2	-0,42	-3,68
X_3	0,21	2,12
X_4	0,51	4,73

С другой стороны, старение населения создает дополнительную нагрузку на системы здравоохранения и социальной защиты. Поэтому при разработке демографической политики необходимо учитывать изменения в возрастной структуре.

Миграционные процессы также по-разному влияют на экономическое развитие регионов. В то время как миграция квалифицированной рабочей

[59] Muallifning ilmiy tadqiqot natijalari asosida tuzildi.
[60] Muallifning ilmiy tadqiqot natijalari asosida tuzildi.

силы повышает производительность труда, высокий уровень миграции может создавать демографические дисбалансы в некоторых регионах.

Результаты показывают, что комплексный анализ демографических показателей с показателями качества жизни позволяет эффективно формировать социально-экономическую политику государства. Результаты анализа подтвердили, что демографические факторы оказывают значительное влияние на качество жизни. В частности, была обнаружена сильная положительная корреляция между долей населения трудоспособного возраста и занятостью. Это объясняется увеличением числа экономически активного населения.

Высокие показатели смертности, в свою очередь, приводят к сокращению ожидаемой продолжительности жизни и увеличению расходов на здравоохранение. Положительный миграционный баланс способствует увеличению доходов за счет роста числа экономически активного населения.

Результаты исследования согласуются с научными выводами, опубликованными международными организациями.

Заключение

В ходе исследования с использованием статистических методов оценивалось влияние демографических процессов на качество жизни населения. В результате анализа было установлено наличие значимой взаимосвязи между демографическими факторами и показателями качества жизни.

Были сделаны следующие выводы:

1. Увеличение доли трудоспособного населения оказывает положительное влияние на рост занятости и доходов.

2. Снижение уровня смертности улучшает качество жизни за счет увеличения продолжительности жизни.

3. Миграционные процессы оказывают значительное влияние на экономическое развитие и благосостояние населения.

4. Использование результатов статистического анализа при разработке демографической политики способствует улучшению качества жизни населения.

В будущем целесообразно более глубоко изучить влияние демографических процессов с использованием эконометрических моделей на основе панельных данных по регионам.

По результатам исследования:

1. Демографические процессы являются важными факторами, определяющими качество жизни населения.

2. Доля трудоспособного населения оказала наибольшее положительное влияние на индекс качества жизни.

3. Смертность является одним из основных факторов, негативно влияющих на качество жизни.

4. Миграция и рождаемость также играют важную роль в формировании благосостояния населения.

5. Использование результатов статистического анализа при разработке демографической политики повышает эффективность социального развития.

Использованные источники:

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ЦИФРОВАЯ ИНФРАСТРУКТУРА — СТРАТЕГИЧЕСКИЙ ФАКТОР СОВРЕМЕННОГО ЭКОНОМИЧЕСКОГО РОСТА

Аннотация. *В данной статье рассматривается роль цифровой инфраструктуры в современных экономических системах и ее роль в обеспечении устойчивого экономического роста. Анализируется влияние высокоскоростного интернета, облачных технологий и центров обработки данных на экономическую эффективность в контексте цифровой трансформации. Также подчеркивается стратегическая важность инвестиций в цифровую инфраструктуру для стимулирования роста валового внутреннего продукта (ВВП), производительности труда и инноваций, и разрабатываются практические рекомендации для экономик развивающихся стран.*

Ключевые слова: *цифровая инфраструктура, экономический рост, цифровая экономика, производительность труда, инвестиции, ИКТ, инновации.*

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DIGITAL INFRASTRUCTURE AS A STRATEGIC FACTOR OF MODERN ECONOMIC GROWTH

Abstract*. This article examines the role of digital infrastructure in modern economic systems and its contribution to ensuring sustainable economic growth. The impact of high-speed Internet, cloud technologies, and data centers on economic efficiency is analyzed within the context of digital transformation. The study also highlights the strategic importance of investments in digital infrastructure for stimulating gross domestic product (GDP) growth, labor productivity, and innovation, and provides practical recommendations for the economies of developing countries.*

Keywords: *digital infrastructure, economic growth, digital economy, labor productivity, investment, information and communication technologies (ICT).*

Введение

В XXI веке мировая экономика переживает переход к экономике знаний и цифровых технологий, где ключевую роль начинают играть данные, информационные ресурсы и интеллектуальные системы. В этих условиях

конкурентоспособность государств всё больше определяется уровнем развития их цифровой инфраструктуры и цифровых экосистем.

Цифровая инфраструктура, включающая сети связи, облачные технологии, центры обработки данных и цифровые платформы, выступает основой современной экономики, обеспечивая повышение эффективности бизнес-процессов, снижение издержек и развитие новых форм экономической деятельности.

Для развивающихся стран, включая Узбекистан, развитие цифровой инфраструктуры является важным условием ускорения экономического роста, повышения производительности труда и технологической модернизации. Актуальным является исследование влияния цифровой инфраструктуры на экономическую эффективность и разработка рекомендаций по её дальнейшему совершенствованию.

Компоненты цифровой инфраструктуры

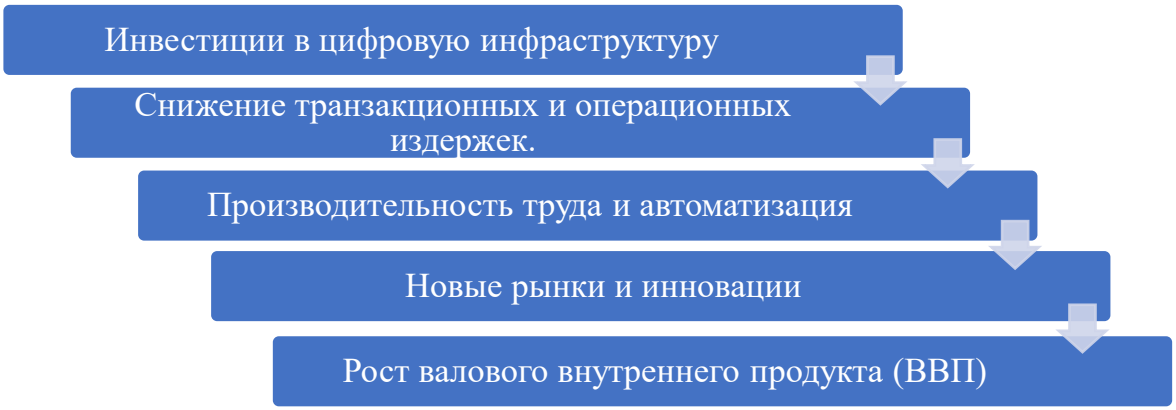
Цифровая инфраструктура — это комплексное понятие, состоящее из четырех основных, тесно взаимосвязанных элементов:

– Коммуникационная и сетевая инфраструктура: высокоскоростной широкополосный интернет, мобильные сети 4G/5G/6G и спутниковая связь. Это обеспечивает скорость передачи и охват данных.

– Вычислительная инфраструктура и инфраструктура хранения: крупные центры обработки данных и технологии облачных вычислений. Они резко снижают затраты на хранение и обработку колоссальных объемов данных.

– Программная и платформенная инфраструктура: операционные системы, интерфейсы API, блокчейн-сети и системы идентификации.

– Слой безопасности и интеграции: системы кибербезопасности, средства защиты конфиденциальности данных.



(Рис. 1.1. Механизмы влияния цифровой инфраструктуры на экономический рост)

Исходя из данных *Рис. 1.1*, механизмы влияния цифровой инфраструктуры на экономический рост можно охарактеризовать следующим образом:

– Снижение транзакционных издержек: цифровые платформы сокращают количество посредников между покупателем и продавцом, уменьшая время заключения договоров и осуществления платежей до нескольких секунд.

– Повышение производительности труда: автоматизация рутинных и механических процессов, внедрение искусственного интеллекта и облачных сервисов позволяют перенаправить интеллектуальный потенциал рабочей силы на выполнение высокоэффективных задач.

– Эффект перелива инноваций (spillover effect): там, где есть качественный интернет и IT-инфраструктура, стартапы и инновационные бизнес-модели формируются быстрее.

Эмпирические данные и сравнительный анализ

По отчетам международных финансовых институтов и крупных исследовательских центров, инвестиции в цифровую инфраструктуру имеют высокий мультипликативный показатель. В исследовании Всемирного банка отмечается, что в развивающихся странах увеличение охвата широкополосным интернетом каждые 10% приводит к росту валового внутреннего продукта (ВВП) в среднем на 1,38%.

В следующей таблице отражено, как различные элементы цифровой инфраструктуры влияют на экономические показатели:

Таблица 1.

Элемент инфраструктуры	**Основной экономический эффект**	**Средний показатель (Глобальный анализ)**
Широкополосный интернет	Рост ВВП и активность малого бизнеса	При охвате +10%, ВВП от +1,2% до +1,4%
Облачные технологии	Сокращение операционных расходов	Экономия затрат для МСБ до 25-30%
5G и промышленный IoT	Производительность производства	Эффективность до +20% за счет автоматизации
Цифровые платежные системы	Сокращение теневой экономики	Увеличивается скорость обращения денег, транзакционные издержки -40%

При создании цифровой инфраструктуры развивающиеся страны сталкиваются с рядом трудностей:

1. **Высокая капиталоемкость:** строительство сетей 5G и современных центров обработки данных требует огромного объема зарубежных и внутренних инвестиций.

2. **Дефицит цифровой грамотности:** даже при наличии инфраструктуры нехватка квалифицированных кадров, способных эффективно её использовать, снижает экономический эффект.

3. **Риски кибербезопасности:** по мере цифровизации инфраструктуры растет уязвимость национальных финансовых и энергетических систем к кибератакам.

Для системного устранения вышеперечисленных трех основных проблем в развивающихся странах необходимо принять следующие конкретные меры на уровне государства, частного сектора и международного сообщества:

1. Для решения проблемы высокой капиталоемкости

Строительство сетей 5G и центров обработки данных (Data Center), требующих колоссальных инвестиций, невозможно осуществить только за счет государственного бюджета. Для этого необходимо:

- Запуск моделей государственно-частного партнерства
- Совместное использование инфраструктуры (Network Sharing)
- Привлечение международных финансовых институтов

2. Для устранения дефицита цифровой грамотности

Какой бы современной ни была инфраструктура, если нет специалистов, умеющих ею пользоваться, она не принесет экономической выгоды. Для этого необходимо:

- Поддержка системы краткосрочного интенсивного обучения (Bootcamp): субсидирование государством 3–6-месячных курсов по IT и инженерии, отвечающих реальным требованиям рынка, не дожидаясь окончания 4-летнего академического обучения в университетах.
- Сотрудничество с технологическими гигантами: открытие учебных лабораторий таких компаний, как Cisco, Huawei, Google, Microsoft, непосредственно внутри университетов и налаживание выдачи международных сертификатов.
- Подготовка «цифровых учителей»: определение обязательными программ повышения цифровой квалификации не только для молодежи, но и для преподавателей школ и вузов.

3. Для снижения рисков кибербезопасности (Меры защиты)

По мере цифровизации систем стратегические объекты становятся мишенями. Для предотвращения этого требуется:

- Законодательство и стандарты: законодательное внедрение обязательных международных стандартов кибербезопасности (таких как ISO 27001) и архитектуры «Zero Trust» для объектов критической инфраструктуры.
- Национальные центры оперативного реагирования (CERT/CSIRT): повышение потенциала национальных центров, отслеживающих атаки в режиме реального времени и оперативно борющихся с ними.
- Регулярные киберучения (Pentesting): заблаговременное выявление и закрытие уязвимостей путем преднамеренного взлома государственных и финансовых систем с помощью «этичных хакеров».

Заключение и рекомендации

Цифровая инфраструктура является ключевым фактором устойчивого экономического роста, повышения производительности и развития цифровой экономики. Для успешной реализации стратегии «Цифровой Узбекистан – 2030» необходимо расширять государственно-частное партнерство, стимулировать частные инвестиции в телекоммуникационную инфраструктуру и ускорять внедрение современных технологий, включая 5G.

Важное значение также имеют развитие человеческого капитала через поддержку STEM- и IT-образования, укрепление кибербезопасности и создание национальных центров обработки данных. Дополнительным направлением должно стать развитие энергоэффективных дата-центров и расширение инфраструктуры IT-парков для подготовки квалифицированных кадров и укрепления экспортного потенциала IT-сектора.

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ЦИФРОВИЗАЦИЯ ИНВЕСТИЦИЙ В СЕЛЬСКОЕ ХОЗЯЙСТВО: ТЕНДЕНЦИИ, ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ

Аннотация: *В статье рассматриваются тенденции, проблемы и перспективы цифровизации инвестиций в сельское хозяйство в условиях цифровой трансформации современной экономики. Особое внимание уделяется выявлению и систематизации ключевых барьеров внедрения цифровых технологий в инвестиционные процессы агропромышленного комплекса, включая институциональные ограничения государственной поддержки, технологическую отсталость инфраструктуры, кадровый дефицит цифровых компетенций, а также влияние внешних макроэкономических и природно-климатических рисков, которые наиболее остро проявляются в деятельности малых и средних хозяйств. Проанализированы основные факторы, определяющие эффективность капиталовложений и инвестиционную привлекательность отрасли, а также выявлены причины фрагментарного, а не системного характера цифровой трансформации субъектов АПК. На основе комплексного методологического подхода, включающего теоретический анализ научной литературы, системный, сравнительный, факторный и логико-структурный анализ, предложена авторская трёхуровневая классификация барьеров и обоснованы дифференцированные практические рекомендации по их преодолению. Особое место отведено роли современных цифровых экосистем и государственных платформ («Своё» АО «Россельхозбанк», ФГИС «Зерно», «Сатурн», «Агрус-Фито») и инструментов искусственного интеллекта в повышении эффективности инвестиционных процессов, снижении производственных и финансовых рисков. Сделан вывод о том, что комплексная цифровизация инвестиций выступает стратегическим условием повышения конкурентоспособности, устойчивого развития и инвестиционной привлекательности российского агропромышленного комплекса в долгосрочной перспективе.*

Ключевые слова*: цифровизация инвестиций, сельское хозяйство, агропромышленный комплекс, цифровая трансформация, барьеры цифровизации, инвестиционная привлекательность АПК, цифровые технологии, государственная поддержка, цифровые экосистемы, искусственный интеллект, малые и средние хозяйства, точное земледелие.*

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DIGITALIZATION OF INVESTMENTS IN AGRICULTURE: TRENDS, PROBLEMS AND PROSPECTS

Abstract: *The article examines the trends, problems, and prospects of the digitalization of investments in agriculture in the context of the digital transformation of the modern economy. Particular attention is paid to identifying and systematizing the key barriers to the implementation of digital technologies in the investment processes of the agro-industrial complex (AIC), including institutional constraints of state support, technological backwardness of infrastructure, shortage of digital competencies among personnel, as well as the influence of external macroeconomic and natural-climatic risks, which are most acutely manifested in the activities of small and medium-sized farms. The main factors determining the effectiveness of capital investments and the investment attractiveness of the industry have been analyzed, and the reasons for the fragmented rather than systemic nature of the digital transformation of AIC entities have been identified. Based on a comprehensive methodological approach, which includes theoretical analysis of scientific literature, systemic, comparative, factor, and logical-structural analysis, the author proposes a three-level classification of barriers and substantiates differentiated practical recommendations for overcoming them. A special place is given to the role of modern digital ecosystems and state platforms ("Svoyo" of JSC "Rosselkhozbank", FGIS "Zerno", "Saturn", "Agrus-Fito") and artificial intelligence tools in increasing the efficiency of investment processes and reducing production and financial risks. It is concluded that the comprehensive digitalization of investments serves as a strategic condition for enhancing the competitiveness, sustainable development, and investment attractiveness of the Russian agro-industrial complex in the long term.*

Keywords: *digitalization of investments, agriculture, agro-industrial complex, digital transformation, barriers to digitalization, investment attractiveness of the AIC, digital technologies, state support, digital ecosystems, artificial intelligence, small and medium-sized farms, precision agriculture.*

Введение.

В условиях ускоренной цифровой трансформации национальной экономики агропромышленный комплекс России занимает стратегически важное место, обеспечивая продовольственную безопасность страны, занятость значительной части населения в сельских территориях и устойчивый вклад в социально-экономическое развитие регионов. Инвестиции в сельское хозяйство традиционно выступают одним из главных

факторов технологической модернизации производства, повышения производительности труда и формирования долгосрочной конкурентоспособности отрасли. При этом эффективность капиталовложений всё в большей степени определяется не только их объёмом, но и степенью интеграции современных цифровых технологий в инвестиционные процессы.

Цифровизация инвестиций в сельское хозяйство представляет собой сложный многомерный процесс, предполагающий комплексное внедрение информационно-коммуникационных технологий, систем искусственного интеллекта, больших данных, интернета вещей, беспилотных летательных аппаратов и других инновационных решений на всех этапах инвестиционного цикла — от обоснования проектов и привлечения финансирования до мониторинга реализации и оценки результативности. Потенциал таких технологий огромен: они позволяют существенно повысить точность прогнозирования урожайности, оптимизировать использование ресурсов, минимизировать производственные и финансовые риски, а также обеспечить большую прозрачность инвестиционных проектов для потенциальных инвесторов и кредиторов.

Актуальность темы исследования обусловлена тем, что, несмотря на активное развитие государственных цифровых инициатив и платформ («Своё» АО «Россельхозбанк», ФГИС «Зерно», «Сатурн», «Агрус-Фито» и др.), процесс цифровизации инвестиционной деятельности в агропромышленном комплексе носит преимущественно фрагментарный характер. Особенно остро данные проблемы проявляются в сегменте малых и средних хозяйств, которые составляют основу российского АПК, но сталкиваются с системными барьерами институционального, технологического, инфраструктурного и кадрового характера. В отличие от крупных агрохолдингов, обладающих достаточными ресурсами для масштабного внедрения цифровых решений, малые и средние формы хозяйствования часто ограничены в доступе к современным технологиям, что снижает общий уровень инвестиционной активности отрасли и замедляет темпы её технологической модернизации.

Цель исследования заключается в комплексном изучении тенденций, проблем и перспектив цифровизации инвестиций в сельское хозяйство Российской Федерации в условиях цифровой трансформации современной экономики.

Для достижения поставленной цели в работе решаются следующие задачи:

- раскрыть теоретико-методологические основы цифровизации инвестиций в агропромышленном комплексе и уточнить содержание данного понятия;

- выявить и систематизировать основные барьеры внедрения цифровых технологий в инвестиционные процессы субъектов АПК с акцентом на специфику малых и средних хозяйств;

- проанализировать роль современных цифровых экосистем и инструментов искусственного интеллекта в повышении эффективности капиталовложений и инвестиционной привлекательности отрасли;

- разработать авторскую трёхуровневую классификацию барьеров и обосновать дифференцированные практические рекомендации по их преодолению.

Теоретической и методологической основой исследования послужили труды отечественных учёных, посвящённые цифровизации сельского хозяйства, инвестиционной деятельности в АПК и роли государственных цифровых платформ (Зубренкова и др., 2024; Озаровская, 2024; Алентьева и др.). Практическая значимость работы состоит в том, что предложенные авторские подходы могут быть использованы органами государственной власти, финансово-кредитными институтами и непосредственно сельскохозяйственными товаропроизводителями при разработке стратегий цифровой трансформации инвестиционных процессов, способствуя повышению эффективности государственной поддержки АПК и укреплению инвестиционной привлекательности отрасли в долгосрочной перспективе.

Методы

Методологическую основу исследования составил комплекс общенаучных и специальных методов экономического анализа, применение которых позволило всесторонне изучить тенденции цифровизации инвестиций в сельское хозяйство, выявить ключевые проблемы и барьеры их реализации, а также обосновать перспективные направления преодоления существующих ограничений в условиях цифровой трансформации агропромышленного комплекса. Выбор методического инструментария был обусловлен сложностью исследуемого объекта — многоуровневым и многокомпонентным характером процесса цифровизации инвестиций, особенно в контексте деятельности малых и средних хозяйств, — и необходимостью органичного сочетания теоретического анализа с прикладной интерпретацией современной хозяйственной практики.

В рамках исследования цифровизация инвестиций в АПК рассматривалась как интегральная характеристика, отражающая степень внедрения цифровых технологий в инвестиционные процессы отрасли, их влияние на эффективность капиталовложений, снижение производственных и финансовых рисков, а также повышение инвестиционной привлекательности сельского хозяйства в целом. Особое внимание уделялось дифференцированному подходу к субъектам АПК различного масштаба, поскольку именно малые и средние хозяйства сталкиваются с наиболее острыми структурными ограничениями при переходе к цифровым моделям инвестирования.

На первом этапе исследования был использован метод теоретического анализа научной литературы, посвященной цифровизации сельского хозяйства, инвестициям в агропромышленный комплекс, применению

искусственного интеллекта и других цифровых технологий в АПК. Данный метод позволил систематизировать существующие подходы к определению понятия «цифровизация инвестиций в сельское хозяйство», выделить ее основные структурные элементы (инфраструктурные, операционные и интеллектуальные инвестиции), а также уточнить специфику проявления барьеров внедрения в деятельности субъектов АПК. В рамках аналитического обзора были рассмотрены труды отечественных авторов (Зубренкова и др., 2024; Озаровская, 2024; Ищанова, 2016; Алентьева и др.), посвященные роли цифровых экосистем (в частности, платформы «Своё» АО «Россельхозбанк»), государственным информационным системам («Цифровое сельское хозяйство», ФГИС «Зерно», «Сатурн», «Агрус-Фито») и влиянию цифровизации на инвестиционные процессы и инвестиционную привлекательность отрасли.

Для выявления наиболее значимых проблем и барьеров применялся системный подход, в соответствии с которым цифровизация инвестиций анализировалась как взаимосвязанная система, включающая институциональные условия, технологическую инфраструктуру, кадровый потенциал, финансовые механизмы и рыночные факторы. Использование данного подхода позволило установить взаимосвязи между внешними макроэкономическими условиями (сезонность производства, природные риски, государственная политика) и внутренними ограничениями агропредприятий, а также показать, как пробелы в одной подсистеме (например, в технологической доступности или кадровом обеспечении) негативно влияют на общий уровень инвестиционной активности и эффективность цифровой трансформации.

В исследовании был применен сравнительный метод, с помощью которого были сопоставлены различные факторы, влияющие на степень цифровизации инвестиций. Сравнение проводилось по таким параметрам, как масштабы предприятий (малые, средние и крупные хозяйства), уровень доступности цифровых технологий в различных регионах России, эффективность государственных мер поддержки и степень интеграции искусственного интеллекта в производственные и инвестиционные процессы. Данный метод позволил выявить, что малые и средние хозяйства сталкиваются с более острыми барьерами по сравнению с крупными холдингами, что требует дифференцированного подхода к государственной политике и банковским инструментам поддержки.

Существенное место занял метод факторного анализа, направленный на выявление причинно-следственных связей между барьерами цифровизации и результатами инвестиционной деятельности в АПК. С его помощью были определены основные группы факторов, влияющих на цифровизацию инвестиций: институциональные (бюрократические процедуры, ориентация господдержки преимущественно на крупные холдинги, слабая координация федеральных и региональных органов), технологические (отсутствие

стабильного интернета в сельской местности, высокая стоимость оборудования и ПО, несовместимость платформ, киберугрозы) и кадровые (дефицит IT-специалистов в сельской местности, низкий уровень цифровой грамотности, отток молодых кадров). Предложенная авторская трёхуровневая классификация барьеров позволила перейти от описательного подхода к структурированному анализу и выработке адресных рекомендаций.

Важным методом исследования выступил логико-структурный анализ, позволивший сформировать целостную модель преодоления барьеров цифровизации инвестиций в сельское хозяйство. В рамках этого метода были выделены ключевые этапы цифровой трансформации инвестиционных процессов: идентификация барьеров, оценка их влияния на инвестиционную привлекательность, выбор приоритетных инструментов (цифровые экосистемы, ИИ, государственные платформы) и разработка дифференцированных рекомендаций с учетом масштаба предприятия. Такой подход дал возможность структурировать проблему не только как совокупность отдельных ограничений, но и как управляемый процесс повышения эффективности и инвестиционной привлекательности отрасли на постоянной основе.

В работе также использовался метод обобщения практического опыта функционирования цифровых инициатив в АПК, в частности детального анализа экосистемы «Своё» АО «Россельхозбанк» и государственных платформ цифровизации. На основе изучения реальных кейсов были выделены наиболее эффективные практики внедрения (агрегация данных, снижение рисков для инвесторов и кредиторов, автоматизация учета и прогнозирования) и типичные проблемы, с которыми сталкиваются малые и средние хозяйства при переходе к цифровым моделям инвестирования.

Для интерпретации результатов был применен метод научной абстракции, с помощью которого были выделены наиболее существенные свойства и закономерности цифровизации инвестиций в сельское хозяйство. Это позволило отвлечься от частных различий между отдельными предприятиями и сосредоточиться на универсальных механизмах, характерных для большинства субъектов АПК в условиях ограниченности ресурсов и повышенной неопределенности. Применение данного метода обеспечило возможность сформулировать практические рекомендации, обладающие прикладной значимостью для широкого круга агропредприятий, органов государственной власти и банковского сектора.

Таким образом, использованная методологическая база обеспечила целостность исследования и позволила раскрыть цифровизацию инвестиций в сельское хозяйство как сложную многомерную категорию, требующую комплексного подхода к анализу, оценке и управлению. Сочетание теоретических, сравнительных, системных, факторных и практико-ориентированных методов создало надежную основу для дальнейшего выявления результатов исследования, их интерпретации и выработки

обоснованных рекомендаций по повышению эффективности и инвестиционной привлекательности агропромышленного комплекса в современных экономических условиях.

Результаты

В результате проведенного исследования было установлено, что цифровизация инвестиций в сельское хозяйство формируется под воздействием совокупности взаимосвязанных факторов, среди которых доминирующее место занимают институциональные ограничения государственной поддержки, технологическая отсталость инфраструктуры, кадровый дефицит цифровых компетенций, а также высокая чувствительность отрасли к внешним экономическим и природным рискам. Анализ показал, что для большинства субъектов агропромышленного комплекса, особенно малых и средних хозяйств, цифровизация инвестиционных процессов до сих пор не рассматривается как самостоятельное стратегическое направление развития, а воспринимается преимущественно как реакция на отдельные меры государственной поддержки или как дополнительная технологическая нагрузка. Подобный подход существенно снижает способность отрасли своевременно использовать потенциал цифровых технологий для повышения эффективности капиталовложений, снижения рисков и роста инвестиционной привлекательности.

Одним из значимых результатов исследования стало выявление того, что наиболее распространенным барьером цифровизации инвестиций в АПК является институциональный уровень ограничений. Именно бюрократические сложности при получении субсидий, ориентация мер господдержки преимущественно на крупные холдинги, слабая координация между федеральными и региональными органами управления, а также преобладание контрольных, а не стимулирующих механизмов существенно тормозят внедрение цифровых решений в малых и средних хозяйствах. Выяснено, что при недостаточности системных институциональных условий субъекты АПК становятся чрезмерно зависимыми от разовых грантов и кредитных программ, что усиливает их уязвимость перед изменениями бюджетной политики и приводит к фрагментарному, а не комплексному характеру цифровой трансформации.

Исследование также показало, что важным дестабилизирующим фактором выступает технологический уровень барьеров. Во многих агропредприятиях отсутствует стабильная широкополосная связь в отдаленных сельских территориях, наблюдается высокая стоимость оборудования и программного обеспечения, сохраняется проблема несовместимости различных цифровых платформ и уязвимость систем к киберугрозам. В результате инвестиционные решения в сфере цифровизации принимаются ситуативно, без достаточного обоснования долгосрочной окупаемости и интеграции в общую производственную стратегию.

Установлено, что хозяйства, не преодолевшие технологический разрыв, чаще сталкиваются с низкой отдачей от пилотных проектов, ростом операционных издержек на поддержание неэффективных систем и снижением конкурентоспособности по сравнению с предприятиями, уже интегрировавшими инфраструктурные, операционные и интеллектуальные цифровые инвестиции.

Существенным результатом исследования стало определение роли кадрового фактора в обеспечении успешной цифровизации инвестиций. Было выявлено, что дефицит квалифицированных IT-специалистов в сельской местности, низкий уровень цифровой грамотности среди традиционных работников агропредприятий, недостаточное число образовательных программ по агроинформатике и точному земледелию, а также отток молодых специалистов существенно увеличивают риск неудачных внедрений, неэффективного использования дорогостоящего оборудования и несвоевременного выявления возможностей цифровой оптимизации. Малые и средние хозяйства, в которых кадровая политика в сфере цифровизации носит формальный или эпизодический характер, чаще сталкиваются с низкой отдачей от инвестиций и утратой управляемости технологическими процессами. В то же время наличие даже упрощенной системы повышения цифровых компетенций сотрудников способствует укреплению дисциплины внедрения, повышению точности данных и более оперативному реагированию на изменения рыночной и технологической среды.

Отдельный результат исследования связан с оценкой влияния внешней среды на уровень цифровизации инвестиций в сельское хозяйство. Установлено, что значительное воздействие оказывают сезонность производства, зависимость от природных факторов, динамика цен на ресурсы, а также изменение условий государственной поддержки и кредитования. Эти факторы особенно остро отражаются на предприятиях с ограниченной диверсификацией доходов, слабой инфраструктурой и низким уровнем адаптивности. Анализ подтвердил, что хозяйства, функционирующие без системного подхода к цифровизации и без использования современных экосистем (таких как платформа «Своё» АО «Россельхозбанк»), значительно быстрее теряют инвестиционную привлекательность при возникновении внешних шоков.

Важным итогом исследования стало обоснование того, что цифровизация, усиленная инструментами искусственного интеллекта и государственными цифровыми платформами, выступает одним из наиболее перспективных направлений повышения инвестиционной привлекательности АПК. Применение предиктивного анализа данных, мониторинга с помощью дронов и IoT-датчиков, автоматизации учета и оптимизации ресурсопотребления позволяет существенно повысить точность прогнозирования урожайности, сократить производственные потери и обеспечить более высокий уровень прозрачности инвестиционных процессов.

Было выявлено, что предприятия и экосистемы, активно использующие цифровые решения, демонстрируют рост эффективности капиталовложений, снижение рисков и большую привлекательность для инвесторов и кредиторов.

Таким образом, результаты исследования подтвердили, что цифровизация инвестиций в сельское хозяйство определяется не только объемом доступных финансовых ресурсов и государственной поддержки, но и качеством институционального, технологического и кадрового обеспечения, степенью готовности к системному внедрению цифровых технологий, уровнем организационной дисциплины и способностью отрасли адаптироваться к изменяющимся внешним условиям. Полученные выводы позволяют рассматривать цифровизацию инвестиций как системную основу повышения эффективности, конкурентоспособности и инвестиционной привлекательности агропромышленного комплекса и как необходимое условие его долгосрочного устойчивого развития в условиях цифровой трансформации экономики.

Заключение

Проведенное исследование позволило установить, что цифровизация инвестиций в сельское хозяйство представляет собой одну из ключевых предпосылок повышения эффективности производства, конкурентоспособности и инвестиционной привлекательности агропромышленного комплекса в условиях современной цифровой трансформации экономики. Несмотря на значительный потенциал цифровых технологий в оптимизации ресурсопотребления, снижении производственных и финансовых рисков, а также в росте прозрачности и управляемости инвестиционных процессов, их внедрение в деятельность субъектов АПК, особенно малых и средних хозяйств, сталкивается с системными структурными ограничениями, которые до сих пор не позволяют отрасли в полной мере реализовать имеющиеся возможности.

В ходе работы было доказано, что основными барьерами цифровизации инвестиций выступают институциональные (бюрократические процедуры получения господдержки, ориентация мер государственной политики преимущественно на крупные холдинги, слабая координация федеральных и региональных органов), технологические (отсутствие стабильной широкополосной связи в сельской местности, высокая стоимость оборудования и программного обеспечения, несовместимость платформ и киберугрозы), кадровые (дефицит IT-специалистов, низкий уровень цифровой грамотности работников и отток молодых кадров) и внешние факторы, связанные с сезонностью производства, природно-климатическими рисками и нестабильностью рыночной конъюнктуры. Совокупное действие этих ограничений приводит к фрагментарному, а не системному характеру цифровой трансформации, снижению отдачи от инвестиций и замедлению роста инвестиционной привлекательности отрасли в целом.

Исследование показало, что успешное преодоление выявленных барьеров возможно лишь при формировании комплексной и дифференцированной системы поддержки цифровизации инвестиций. Такая система должна включать совершенствование институциональных механизмов государственной политики, развитие технологической инфраструктуры, внедрение целевых программ повышения цифровых компетенций и стимулирование использования современных цифровых экосистем и платформ (в частности, экосистемы «Своё» АО «Россельхозбанк», ФГИС «Зерно», «Сатурн», «Агрус-Фито» и инструментов искусственного интеллекта). Особое значение имеет адресный подход к субъектам АПК различного масштаба, предполагающий приоритетные меры именно для малых и средних форм хозяйствования, которые сталкиваются с наиболее острыми ограничениями.

Практическая значимость исследования состоит в том, что предложенная авторская трёхуровневая классификация барьеров и дифференцированные рекомендации по их преодолению могут быть использованы органами государственной власти, банковским сектором и непосредственно агропредприятиями при разработке стратегий цифровой трансформации инвестиционных процессов. Разработанные подходы не требуют исключительно масштабных капитальных вложений, однако способны существенно повысить эффективность капиталовложений, снизить риски и укрепить инвестиционную привлекательность сельского хозяйства.

Таким образом, цифровизация инвестиций в сельское хозяйство выступает не только важным инструментом операционной оптимизации и повышения производительности отрасли, но и стратегическим фактором ее долгосрочного устойчивого развития в условиях цифровой экономики. Чем выше уровень системности и комплексности подхода к внедрению цифровых технологий в инвестиционные процессы, тем больше возможностей у российского АПК для укрепления конкурентных позиций на внутреннем и глобальном рынках, обеспечения продовольственной безопасности страны и повышения общей инвестиционной привлекательности агросектора. Дальнейшее совершенствование теоретических и практических подходов к цифровизации инвестиций в сельское хозяйство представляет собой актуальное направление экономических исследований, имеющее важное значение как для развития агробизнеса, так и для реализации национальных целей технологического суверенитета и устойчивого экономического роста.

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АРТЕРИАЛЬНАЯ ГИПЕРТЕНЗИЯ И ПЕЧЕНОЧНАЯ НЕДОСТАТОЧНОСТЬ: ОСОБЕННОСТИ АНТИГИПЕРТЕНЗИВНОЙ ТЕРАПИИ (ОБЗОР ЛИТЕРАТУРЫ)

Аннотация: *Артериальная гипертензия у пациентов с печеночной недостаточностью представляет особую клиническую проблему, поскольку при хронических диффузных заболеваниях печени, особенно при циррозе с декомпенсацией, системная гемодинамика существенно меняется: нарастают вазодилатация, эффективная артериальная гиповолемия, склонность к гипотонии и снижению почечной перфузии. Поэтому стандартные подходы к лечению гипертензии у таких больных не всегда применимы без коррекции. Основная цель терапии состоит не только в контроле артериального давления, но и в предотвращении почечной дисфункции, гипонатриемии, усугубления асцита и других проявлений декомпенсации. Наиболее важное значение имеют стадия цирроза, наличие асцита, уровень натрия, функция почек и признаки портальной гипертензии.*

Ключевые слова: *артериальная гипертензия, печеночная недостаточность, цирроз печени, портальная гипертензия, антигипертензивная терапия, асцит, бета-адреноблокаторы, блокаторы кальциевых каналов.*

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ARTERIAL HYPERTENSION AND HEPATIC INSUFFICIENCY: FEATURES OF ANTIHYPERTENSIVE THERAPY (LITERATURE REVIEW)

Abstract: *Arterial hypertension in patients with hepatic insufficiency represents a particular clinical challenge, since in chronic diffuse liver diseases, especially in decompensated cirrhosis, systemic hemodynamics undergo significant changes: progressive splanchnic vasodilation, effective arterial hypovolemia, a tendency toward hypotension, and reduced renal perfusion develop. Therefore, standard approaches to the treatment of hypertension in such patients cannot always be applied without adjustment. The main goal of therapy is not only to control blood pressure, but also to prevent renal dysfunction, hyponatremia, worsening ascites, and other manifestations of decompensation. The most important factors are the stage of cirrhosis, the presence of ascites, serum sodium level, renal function, and signs of portal hypertension.*

Keywords: *arterial hypertension, hepatic insufficiency, liver cirrhosis, portal hypertension, antihypertensive therapy, ascites, beta-blockers, calcium channel blockers.*

Введение

Важно подчеркнуть, что доказательная база по ведению артериальной гипертензии при печеночной недостаточности касается главным образом пациентов с циррозом печени. Именно у этой категории больных печеночная недостаточность наиболее часто сочетается с выраженными гемодинамическими сдвигами, которые определяют ограничения антигипертензивной терапии. В отличие от общей популяции больных гипертензией, у пациентов с декомпенсированным циррозом чрезмерное снижение системного давления может приводить к ухудшению почечной перфузии, острому повреждению почек и усилению циркуляторной дисфункции.

Из этого следует практический вывод: при печеночной недостаточности лечение должно быть более индивидуализированным, чем при “обычной” эссенциальной гипертензии. Если у пациента есть асцит, гипонатриемия, снижение функции почек или эпизоды гипотонии, приоритетом становится не достижение агрессивных целевых цифр артериального давления, а поддержание безопасной перфузии органов и профилактика декомпенсации. Это клиническое следствие прямо вытекает из рекомендаций по декомпенсированному циррозу и современного подхода к портальной гипертензии.

Особенности выбора антигипертензивных препаратов

Ингибиторы АПФ и блокаторы рецепторов ангиотензина II

Одной из главных особенностей терапии является осторожное отношение к препаратам, блокирующим ренин-ангиотензиновую систему. У

пациентов с циррозом и асцитом ингибиторы АПФ, БРА и α1-адреноблокаторы в большинстве случаев **не рекомендуются** или должны использоваться крайне ограниченно, поскольку могут вызывать артериальную гипотонию и ухудшение функции почек. EASL прямо указывает, что эти препараты в целом не должны применяться у больных с асцитом из-за повышенного риска почечной недостаточности.

Следовательно, если у больного с печеночной недостаточностью имеется декомпенсированный цирроз с асцитом, ингибитор АПФ или БРА обычно не является рациональным стартовым выбором для коррекции артериальной гипертензии. Исключения возможны только после индивидуальной оценки пользы и риска, например при специфических кардиологических показаниях, но даже в этих случаях нужен очень тщательный контроль креатинина, натрия, калия и артериального давления. Это уже не “таблетка от давления”, а баланс на тонком льду.

Бета-адреноблокаторы

У пациентов с печеночной недостаточностью бета-блокаторы имеют двойственное значение. С одной стороны, неселективные бета-блокаторы используются не столько для лечения системной артериальной гипертензии, сколько для снижения портального давления и профилактики декомпенсации и варикозных кровотечений. Baveno VII указывает, что **карведилол является предпочтительным неселективным бета-блокатором при компенсированном циррозе**, поскольку эффективнее снижает градиент портального давления.

С другой стороны, при асците и особенно при рефрактерном асците терапия бета-блокаторами требует осторожности. Согласно Baveno VII и рекомендациям EASL, при стойком низком артериальном давлении, а также при ухудшении функции почек или выраженной гипонатриемии дозу неселективных бета-блокаторов следует уменьшать или временно отменять. В EASL отдельно указаны ориентиры повышенного риска: систолическое давление **<90 мм рт. ст.**, креатинин **>1,5 мг/дл** или натрий **<130 ммоль/л**.

Если же бета-блокатор нужен по кардиологическим показаниям, например при ишемической болезни сердца, тахиаритмии или хронической сердечной недостаточности, более уместны низкие стартовые дозы кардиоселективных препаратов с медленной титрацией. Для метопролола в инструкции прямо указано, что при нарушении функции печени его концентрация может существенно возрастать, поэтому лечение следует начинать с меньших доз и повышать их постепенно.

Блокаторы кальциевых каналов

Блокаторы кальциевых каналов, прежде всего амлодипин, могут использоваться у части пациентов с артериальной гипертензией на фоне печеночной недостаточности, особенно если необходимо снизить давление, а препараты РААС нежелательны. Однако здесь принципиально важно помнить, что амлодипин интенсивно метаболизируется в печени, а при

печеночной недостаточности его период полувыведения удлиняется; в официальной инструкции рекомендуется начинать терапию с **2,5 мг/сут** у пациентов с печеночной недостаточностью.

Поэтому блокаторы кальциевых каналов у таких больных допустимы, но только в режиме “start low, go slow”: низкая стартовая доза, медленная титрация и контроль клинической переносимости. Это особенно важно при декомпенсации цирроза, когда даже умеренная вазодилатация может усугубить гипотонию и ухудшить почечный кровоток.

Диуретики

У больных с печеночной недостаточностью и асцитом диуретики назначаются прежде всего для контроля задержки натрия и жидкости, а не как стандартная антигипертензивная стратегия. AASLD и EASL используют классическую схему: **спиронолактон 100 мг + фуросемид 40 мг** с последующей ступенчатой титрацией при необходимости. При этом рекомендуемая максимальная скорость снижения массы тела составляет **0,5 кг/сут** у пациентов без периферических отеков и **1 кг/сут** при наличии отеков.

Именно поэтому у пациента с циррозом и артериальной гипертензией диуретики нельзя рассматривать изолированно как “обычное средство от давления”. Их применение должно подчиняться контролю асцита, натрия, функции почек и объема циркулирующей крови. Если на фоне терапии развивается гипонатриемия, нарастает креатинин или появляются признаки гиповолемии, схема нуждается в немедленном пересмотре.

Препараты, требующие дополнительной осторожности

Отдельного упоминания заслуживает лабеталол. Хотя он может использоваться для быстрого контроля артериального давления в некоторых ургентных ситуациях, в его инструкции указано, что на фоне терапии редко возможны тяжелые гепатоцеллюлярные повреждения, включая некроз печени и летальные исходы. У пациента с уже существующей печеночной недостаточностью это делает препарат особенно требовательным к оценке риска и мониторингу.

Что особенно важно в практической работе

Наиболее рациональный подход можно сформулировать так. У пациента с компенсированным циррозом и истинной артериальной гипертензией возможны осторожное применение низких доз амлодипина или бета-блокатора по показаниям, а при наличии клинически значимой портальной гипертензии — использование карведилола с учетом его портального, а не только системного эффекта. У пациента с декомпенсированным циррозом, асцитом и тенденцией к гипотонии приоритет смещается в сторону контроля объема жидкости, ограничения натрия, коррекции асцита и отказа от препаратов, ухудшающих почечную перфузию.

Если у такого пациента развивается острое повреждение почек, EASL рекомендует немедленно прекратить диуретики, бета-блокаторы и другие

препараты, способные усугублять циркуляторную недостаточность, включая вазодилататоры и нефротоксичные средства. Это один из ключевых моментов, который отличает ведение гипертензии при печеночной недостаточности от стандартной кардиологической практики.

Заключение

Таким образом, антигипертензивная терапия при артериальной гипертензии на фоне печеночной недостаточности имеет ряд принципиальных отличий от лечения гипертензии в общей популяции. Основной клинический ориентир — не максимально быстрое снижение артериального давления, а сохранение эффективной органной перфузии и предупреждение декомпенсации цирроза. У больных с асцитом обычно следует избегать ингибиторов АПФ, БРА и α1-блокаторов; бета-блокаторы требуют дифференцированного подхода, а блокаторы кальциевых каналов и кардиоселективные бета-блокаторы назначаются в малых дозах с медленной титрацией. При наличии асцита и почечной дисфункции ведущую роль приобретает контроль водно-солевого баланса и тщательный лабораторный мониторинг.

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ОЦЕНКА ИНТРОДУКЦИОННОГО ПОТЕНЦИАЛА POLYGONATUM ODORATUM И POLYGONATUM SEWERZOWII В УСЛОВИЯХ КАРАКАЛПАКСТАНА

Аннотация:*В статье представлены результаты оценки интродукционного потенциала Polygonatum odoratum (Mill.) Druce и Polygonatum sewerzowii Regel в условиях Каракалпакстана. Изучены особенности роста, развития, сезонного ритма, устойчивости к абиотическим факторам и адаптационные возможности исследуемых видов. Установлено, что оба вида успешно проходят основные фенологические фазы развития в новых условиях, однако различаются по степени устойчивости к высоким температурам и дефициту влаги. Наиболее высокие показатели адаптации выявлены у Polygonatum sewerzowii. Полученные результаты свидетельствуют о перспективности интродукции данных видов для сохранения биоразнообразия, декоративного озеленения и создания коллекционных насаждений в условиях Каракалпакстана.*

Ключевые слова*: Polygonatum odoratum, Polygonatum sewerzowii, интродукция растений, адаптация, фенология, Каракалпакстан, биоразнообразие, декоративные растения.*

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ASSESSMENT OF THE INTRODUCTION POTENTIAL OF POLYGONATUM ODORATUM AND POLYGONATUM SEWERZOWII IN THE CONDITIONS OF KARAKALPAKSTAN

Abstract:*The article presents the results of assessing the introduction potential of Polygonatum odoratum (Mill.) Druce and Polygonatum sewerzowii Regel in the conditions of Karakalpakstan. The characteristics of growth, development, seasonal rhythm, resistance to abiotic factors and adaptive capabilities of the studied species were studied. It has been established that both species successfully pass through the main phenological phases of development in new conditions, but differ in the degree of resistance to high temperatures and moisture deficiency. The highest adaptation rates were found in Polygonatum sewerzowii. The results obtained indicate that the introduction of these species is promising for the conservation of biodiversity, decorative landscaping and the creation of collection plantings in the conditions of Karakalpakstan.*

Key words: *Polygonatum odoratum, Polygonatum sewerzowii, plant introduction, adaptation, phenology, Karakalpakstan, biodiversity, ornamental plants.*

Введение

В условиях глобального изменения климата и деградации природных экосистем интродукция растений рассматривается как эффективный способ сохранения биоразнообразия и расширения ассортимента культурных видов. Особый интерес представляют виды рода *Polygonatum Mill. (Asparagaceae*), обладающие декоративными, лекарственными и пищевыми свойствами. *Polygonatum odoratum* отличается высокой экологической пластичностью и широким ареалом распространения, тогда как *Polygonatum sewerzowii* является редким видом флоры Средней Азии. В условиях аридного климата Каракалпакстана, характеризующегося высокими температурами, малым количеством осадков и значительной испаряемостью, сведения об интродукции этих видов практически отсутствуют. В связи с этим целью исследования явилась оценка интродукционного потенциала *Polygonatum odoratum* и *Polygonatum sewerzowii* в условиях Каракалпакстана.

Материалы и методы

Исследования проводились в 2023–2025 годах на опытных участках Каракалпакского государственного университета имени Бердаха. Объектами исследования являлись растения *Polygonatum odoratum* и *Polygonatum sewerzowii*, выращиваемые в открытом грунте. Посадочный материал был получен из ботанических коллекций и интродукционных фондов. В ходе работы проводились фенологические наблюдения по общепринятым методикам интродукционного изучения растений с регистрацией сроков начала вегетации, бутонизации, цветения, плодоношения и окончания вегетационного периода. Интродукционный потенциал видов оценивали по показателям приживаемости растений, продолжительности вегетации, интенсивности роста побегов, устойчивости к высоким температурам и засухе, способности к генеративному и вегетативному размножению, а также

по уровню декоративности. Полученные результаты были обработаны и проанализированы сравнительным методом.

Результаты и обсуждение

Результаты наблюдений показали, что оба исследуемых вида успешно адаптировались к условиям Каракалпакстана и ежегодно проходили полный цикл сезонного развития.

Начало весенней вегетации *Polygonatum odoratum* отмечалось во второй половине марта при среднесуточной температуре воздуха 10–12 °C. Активный рост побегов продолжался до конца апреля. Цветение наступало в мае и продолжалось 18–22 дня. Формирование плодов наблюдалось в июне-июле.

У *Polygonatum sewerzowii* начало вегетации происходило несколько раньше, чем у *Polygonatum odoratum*. Цветение также начиналось раньше и характеризовалось большей продолжительностью. Плодоношение было более стабильным даже в годы с повышенной летней температурой.

Исследования показали, что одним из важнейших факторов, ограничивающих развитие интродуцированных растений, является летний температурный стресс. В отдельные годы температура воздуха превышала 45 °C, что сопровождалось снижением интенсивности роста и частичным подсыханием листьев. Однако благодаря развитой корневищной системе оба вида сохраняли жизнеспособность и успешно возобновляли вегетацию в последующие сезоны.

Сравнительный анализ показал, что *Polygonatum sewerzowii* более устойчив к засушливым условиям Южного Приаралья. Вид характеризовался лучшей сохранностью растений, меньшим повреждением листьев и более высокой семенной продуктивностью. Это, вероятно, связано с его происхождением из горных районов Средней Азии, где растения адаптировались к условиям ограниченного водоснабжения.

Polygonatum odoratum также показал хорошие адаптационные способности, хотя в наиболее жаркие периоды отмечалось некоторое снижение декоративности. При этом растения ежегодно цвели и плодоносили. Оценка декоративных качеств подтвердила высокую перспективность обоих видов для озеленения. Растения сохраняли привлекательный внешний вид на протяжении большей части вегетации, успешно формировали генеративные органы и практически не повреждались вредителями и болезнями. Полученные результаты свидетельствуют о высоком интродукционном потенциале исследуемых видов и возможности их использования в ботанических коллекциях, ландшафтном дизайне, декоративном садоводстве и программах сохранения редких растений.

Заключение

Установлено, что *Polygonatum odoratum* и *Polygonatum sewerzowii* успешно адаптируются к условиям Каракалпакстана, ежегодно проходя полный цикл развития. Оба вида характеризуются высокой приживаемостью,

устойчивостью к неблагоприятным факторам среды и способностью к генеративному размножению. Наиболее высоким интродукционным потенциалом обладает *Polygonatum sewerzowii*, отличающийся повышенной засухоустойчивостью и лучшей приспособленностью к аридным условиям Южного Приаралья. *Polygonatum odoratum* также является перспективным видом для декоративного и лекарственного использования. Полученные результаты свидетельствуют о возможности расширения ассортимента интродуцированных растений в регионе и служат основой для дальнейших исследований представителей рода Polygonatum.

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СОВЕРШЕНСТВОВАНИЕ ПОДГОТОВКИ УЧАЩИХСЯ ПРОФЕССИОНАЛЬНЫХ УЧЕБНЫХ ЗАВЕДЕНИЙ К САМОСТОЯТЕЛЬНОЙ СЕМЕЙНОЙ ЖИЗНИ ПОСРЕДСТВОМ НАЦИОНАЛЬНЫХ ЦЕННОСТЕЙ (НА ПРИМЕРЕ УЧАЩИХСЯ ПОДРОСТКОВОГО ВОЗРАСТА)

Аннотация. *В статье представлены результаты опытно-экспериментального исследования по совершенствованию системы подготовки учащихся профессиональных учебных заведений к самостоятельной семейной жизни посредством национальных ценностей. Эксперимент охватил 582 учащихся из 6 политехникумов Ташкента, Джизакской и Наманганской областей (2022–2025 гг.). На основе критериально-уровневой модели оценки готовности и методов математической статистики (критерий Стьюдента–Фишера) доказана эффективность разработанной педагогической методики: показатели экспериментальной группы превысили показатели контрольной на 10,34%. Выявлены актуальные проблемы в подготовке молодёжи к семейной жизни, разработаны научно обоснованные рекомендации для системы профессионального образования Узбекистана.*

Ключевые слова: *национальные ценности, семейная жизнь, профессиональное образование, подготовка молодёжи, опытно-экспериментальная работа, педагогическая эффективность, критерий Стьюдента–Фишера.*

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IMPROVING THE PREPARATION OF STUDENTS IN VOCATIONAL EDUCATIONAL INSTITUTIONS FOR INDEPENDENT FAMILY LIFE THROUGH NATIONAL VALUES (USING THE EXAMPLE OF ADOLESCENT STUDENTS)

Abstract. *The article presents the results of an experimental study on improving the system of preparing students of professional educational institutions for independent family life through national values. The experiment covered 582 students from 6 polytechnic schools in Tashkent, Jizzakh and Namangan regions*

(2022–2025). Based on a criterion-level readiness assessment model and mathematical statistics (Student–Fisher criterion), the effectiveness of the developed pedagogical methodology was proven: the experimental group's indicators exceeded the control group's by 10.34%. Relevant problems in preparing youth for family life were identified and scientifically grounded recommendations for Uzbekistan's vocational education system were developed.

Keywords: *national values, family life, vocational education, youth preparation, experimental work, pedagogical effectiveness, Student–Fisher criterion.*

Введение

Институт семьи является основополагающим элементом социальной системы любого общества. В условиях глобальных трансформаций, распространения нетрадиционных форм отношений и усиления внешних социокультурных влияний вопрос целенаправленной подготовки молодёжи к самостоятельной семейной жизни приобретает особую педагогическую значимость [Musurmanova, 2000; Maxmudova, 2007].

В Узбекистане государственная политика в сфере укрепления семьи нашла отражение в ряде нормативно-правовых актов: Семейном кодексе Республики Узбекистан (2018, ред. 2020), Законе «О гарантиях равных прав и возможностей для женщин и мужчин» (№ОРЗ-562, 2019), Постановлении Кабинета Министров № 820 «О мерах по дальнейшему развитию института семьи и подготовке молодёжи к семейной жизни» (2020), Указах Президента ПФ-87 (2022) и ПФ-60 (2022) [Mirziyoev, 2021].

Несмотря на наличие правовой базы, практика показывает, что большинство учащихся профессиональных учебных заведений не получают системной подготовки к семейной жизни в контексте национальных ценностей. Отсутствие специальных учебных курсов, методического обеспечения и опытно-экспериментального обоснования делает данную проблему особенно актуальной [Abdullaeva, 2004; Abduraximova, 2007].

Цель настоящей статьи — представить результаты трёхлетнего опытно-экспериментального исследования по совершенствованию подготовки учащихся подросткового возраста в системе профессионального образования к самостоятельной семейной жизни посредством национальных ценностей.

Обзор литературы

Проблема подготовки молодёжи к семейной жизни исследовалась как в отечественной, так и в зарубежной педагогике. О. Мусурманова [Musurmanova, 1996] рассматривала духовно-нравственные аспекты семейного воспитания в контексте узбекских традиций. М. Махмудова [Maxmudova, 2007] разработала систему подготовки студенческой молодёжи на основе народной педагогики, доказав, что этнопедагогические методы существенно повышают уровень готовности к семейной жизни.

Ф. Акрамова [Akramova, 2000] изучала этнопсихологические особенности представлений студентов о будущей семейной жизни, выявив взаимосвязь между традиционными установками и устойчивостью семейных отношений. Г. Арипова [Aripova, 2011] доказала, что формирование толерантного мышления в семье является ключевым фактором её стабильности.

Зарубежные исследования (T. Lickona [Lickona, 1991]; R. Richardson, S. Myran, S. Tonelson [Richardson et al., 2009]) акцентируют внимание на характерологическом воспитании и формировании социально-эмоциональных компетенций как основ семейных отношений. J. Dancy [Dancy, 2018] рассматривает практическую форму нравственного воспитания, применимую к подготовке к семейной жизни.

Вместе с тем вопросы применения национальных ценностей в системе профессионального образования как инструмента целенаправленной подготовки подростков к семейной жизни остаются недостаточно изученными в узбекской педагогической науке [Solikhojaeva, 2023].

Методология исследования

Опытно-экспериментальная работа проводилась в три этапа (2022–2025) на базе шести профессиональных учебных заведений: политехникумов Сергелийского и Чиланзарского районов г. Ташкента, Галлаоральского района Джизакской области, а также Косонсайского района Наманганской области.

В исследовании приняли участие 582 учащихся: 292 — в экспериментальной группе, 290 — в контрольной.

Таблица 1. Распределение участников опытно-экспериментальной работы

Профессиональное учебное заведение	**Экспериментальная группа**		**Контрольная группа**	
	Начало	**Конец**	**Начало**	**Конец**
Политехникумы г. Ташкента (Сергелийский р-н) и Чиланзарского р-на	92	92	96	95
Политехникумы Галлаоральского р-на Джизакской обл.	102	101	99	98
Политехникумы Косонсойского р-на Наманганской обл.	98	98	95	95
Итого:	**292**	**291**	**290**	**288**

На констатирующем этапе (2022–2023) были изучены нормативно-правовая база, дидактическое обеспечение и уровень готовности учащихся. На формирующем этапе (2023–2024) внедрялась авторская программа «Подготовка молодёжи к семейной жизни» (16 часов), включающая модули о правовых основах брака, семейных ценностях, репродуктивном здоровье,

гендерном равенстве, профилактике насилия и конфликтологии. На заключительном этапе (2024–2025) был проведён сравнительный анализ эффективности с применением критерия Стьюдента–Фишера.

Инструментарий исследования включал: авторскую анкету (15 закрытых вопросов), шкалу оценки готовности (4 уровня: «Отлично», «Хорошо», «Удовлетворительно», «Неудовлетворительно»), индекс счастья (15 индикаторов), беседы и тестирование.

Результаты исследования

Для оценки готовности учащихся к самостоятельной семейной жизни была разработана четырёхуровневая критериальная модель:

Таблица 2. Критерии оценки готовности учащихся к самостоятельной семейной жизни

Уровень подготовленности	**Характеристика уровня готовности к самостоятельной семейной жизни посредством национальных ценностей**
Отлично (5) Креативный	Обучающиеся в полной мере усвоили знания, умения и навыки по концептуальным идеям «Семья — священна», «Здоровая семья — здоровое общество», правовым отношениям, культуре поведения, экономике семьи; сформировали систематическую готовность к самостоятельной семейной жизни на основе национальных ценностей. Полностью усвоены нормы физиологии, гигиены, репродуктивного здоровья и подготовки к родительству. Сформировано уважение к представителям обоих полов, старшим и сверстникам.
Хорошо (4) Частично-поисковый	Обучающиеся частично владеют знаниями о роли семьи в обществе, её правовых, культурных и экономических основах. Имеются пробелы в формировании навыков родительства и репродуктивного здоровья. Уважение к окружающим сформировано на среднем уровне.
Удовлетворительно (3) Продуктивный	Обучающиеся нуждаются в поддержке педагогов и сверстников при освоении правовых, культурных и экономических основ семейной жизни. Испытывают затруднения в освоении норм репродуктивного здоровья. Уважение к окружающим сформировано частично.
Неудовлетворительно (2) Репродуктивный	Обучающиеся не имеют системных знаний об основах семейной жизни, правовых и экономических аспектах. Не усвоены нормы репродуктивного здоровья и физиологической гигиены. Уважение к окружающим не сформировано.

Социологический опрос, проведённый на формирующем этапе, выявил следующие значимые закономерности в представлениях учащихся о семейных ценностях:

– 52,5% респондентов признали правильными все предложенные определения семьи, что свидетельствует о сложности и многомерности этого понятия в сознании молодёжи;

– 71,7% учащихся не знали законодательно установленного брачного возраста в Узбекистане (18 лет) — критический показатель правовой неграмотности;

– 50,8% указали, что для создания семьи необходима совокупность условий: финансовая независимость, бытовая самостоятельность и жилищная обеспеченность;

– 44,1% определили оптимальный возраст для вступления в брак — 20–25 лет, 42,7% — 18–20 лет, что указывает на ориентацию значительной части молодёжи на ранние браки;

– 58,3% категорически отвергли допустимость физического насилия в семье, однако 27,1% допустили его при определённых обстоятельствах — тревожный показатель;

– 54,4% считают ответственность важнейшим качеством для создания семьи; 19,3% — взаимопомощь; лишь 11,1% назвали терпимость.

Сравнительный анализ результатов до и после эксперимента отражён в таблице 3:

Таблица 3. Динамика показателей готовности учащихся (до и после эксперимента)

Учебное заведение	**Всего**	**5**	**4**	**3**	**2**	**Всего**	**5**	**4**	**3**	
	До эксперимента (эксп. группа)					**До эксперимента (контр. группа)**				
Ташкент	107	13	40	48	6	105	12	39	47	7
Джизак	65	10	28	22	5	63	9	29	20	5
Наманган	120	18	52	39	11	122	19	51	42	10
Итого	**292**	**41**	**120**	**109**	**22**	**290**	**40**	**119**	**109**	**22**
	После эксперимента (эксп. группа)					**После эксперимента (контр. группа)**				
Ташкент	107	24	65	16	2	105	11	39	48	7
Джизак	65	17	35	12	1	63	9	31	18	5
Наманган	120	29	65	23	3	122	19	51	42	10
Итого	**292**	**70**	**165**	**51**	**6**	**290**	**39**	**121**	**108**	**22**

Данные таблицы 3 демонстрируют существенный рост показателей в экспериментальной группе: доля учащихся с оценкой «Отлично» возросла с 14,0% до 24,0%, с оценкой «Хорошо» — с 41,1% до 56,5%. Доля учащихся с неудовлетворительными результатами сократилась с 7,5% до 2,1%.

Для проверки достоверности полученных результатов применён критерий Стьюдента–Фишера. Были сформированы две выборки ($n_1 = 292$; $n_2 = 290$) со следующими параметрами:

– Средние значения: $\bar{x}_1 = 4,0$ (экспериментальная группа); $\bar{x}_2 = 3,6$ (контрольная группа);

– Коэффициенты вариации: $V_1 = 18,2\%$; $V_2 = 20,7\%$;

– Доверительный интервал при α = 0,05: [3,95; 4,05] — для экспериментальной группы; [3,56; 3,64] — для контрольной;

– Показатель эффективности обучения: $E = (\bar{x}_1 - \bar{x}_2) / \bar{x}_2 = 11{,}1\% > 0$;

– Уровень освоения знаний: $K = \bar{x}_1 / \bar{x}max = 0{,}80 > 0$.

Поскольку доверительные интервалы экспериментальной и контрольной групп не пересекаются (3,95–4,05 и 3,56–3,64 соответственно), различия являются статистически значимыми при уровне значимости $p < 0{,}05$. Показатель результативности экспериментальной группы превысил показатель контрольной на 10,34%, что подтверждает эффективность разработанной педагогической методики.

Обсуждение

Полученные результаты согласуются с выводами О. Мусурмановой [Musurmanova, 1996] о ключевой роли духовно-нравственных ценностей в формировании семейной идентичности молодёжи, а также с данными М. Махмудовой [Maxmudova, 2007] о высокой педагогической эффективности этнопедагогических подходов в подготовке к семейной жизни.

Выявленная правовая неграмотность учащихся (71,7% не знали брачного возраста) подтверждает необходимость интеграции правового компонента в программы профессионального образования. Эта проблема актуальна не только для Узбекистана, но и для других стран Центральной Азии [Akramova, 2020].

Тревожные данные о толерантности к насилию в семье (27,1%) коррелируют с международными исследованиями о распространённости гендерных стереотипов в традиционных обществах, указывая на необходимость целенаправленной работы по формированию гендерной культуры в системе профессионального образования [Dancy, 2018; Rossiter, 2003].

Существенным ограничением исследования является его региональный охват: шесть учебных заведений трёх регионов. Репрезентативность результатов для всей системы профессионального образования Узбекистана требует дальнейших исследований с расширенной выборкой.

Выводы и рекомендации

На основании проведённого исследования сформулированы следующие выводы:

1. Разработанная педагогическая методика подготовки учащихся профессиональных учебных заведений к самостоятельной семейной жизни посредством национальных ценностей является высокоэффективной: показатели экспериментальной группы превысили контрольную на 10,34% ($p < 0{,}05$).

2. Социологический опрос выявил критически низкий уровень правовых знаний учащихся о брачно-семейных отношениях (71,7% не знали брачного возраста), что указывает на необходимость целенаправленного правового просвещения.

3. Введение специального учебного курса «Подготовка молодёжи к семейной жизни» в программы профессиональных учебных заведений обеспечивает системный характер подготовки и гарантированное достижение дидактических целей.

4. Для повышения устойчивости семьи необходимо наладить межведомственное взаимодействие образовательных учреждений, органов местного самоуправления (махалли) и гражданского общества в реализации программ семейного просвещения молодёжи.

На основании результатов исследования рекомендуется: (1) включить специальный курс о семейных ценностях и правовых основах брака в учебные планы профессиональных учебных заведений; (2) организовать регулярные консультационные службы психолого-педагогической поддержки учащихся по вопросам семейной жизни; (3) создать Интернет-портал и медиаплатформы для распространения знаний о семейных ценностях среди широкой молодёжной аудитории; (4) разработать единую методологию мониторинга готовности молодёжи к семейной жизни на национальном уровне.

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БИОЭКОЛОГИЯ И ТЕХНОЛОГИЯ ВЫРАЩИВАНИЯ SATUREJA HORTENSIS L.

Аннотация: *В статье рассмотрены биоэкологические особенности и технология выращивания Satureja hortensis L. (чабер садовый) в условиях аридного климата. Изучены морфологические особенности растения, требования к экологическим факторам среды, особенности роста и развития, а также основные агротехнические приемы возделывания. Установлено, что Satureja hortensis L. обладает высокой адаптивностью к засушливым условиям, отличается быстрым ростом, устойчивостью к высоким температурам и является перспективной эфиромасличной и лекарственной культурой для интродукции и промышленного выращивания в условиях Республики Каракалпакстан.*

Ключевые слова: *Satureja hortensis L., чабер садовый, биоэкология, интродукция, лекарственные растения, эфирные масла, технология выращивания.*

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BIOECOLOGY AND CULTIVATION TECHNOLOGY OF SATUREJA HORTENSIS L.

Abstract: *This article examines the bioecological characteristics and cultivation technology of Satureja hortensis L. (garden savory) in arid climates. The plant's morphological characteristics, environmental requirements, growth and*

development characteristics, and key cultivation techniques are studied. Satureja hortensis L. has been shown to be highly adaptable to arid conditions, grows rapidly, and is resistant to high temperatures. It is a promising essential oil and medicinal crop for introduction and commercial cultivation in the Republic of Karakalpakstan.

Key words: *Satureja hortensis L., garden savory, bioecology, introduction, medicinal plants, essential oils, cultivation technology.*

Введение

В настоящее время лекарственные и эфиромасличные растения приобретают особое значение в фармацевтической, пищевой и косметической промышленности. Среди них важное место занимает *Satureja hortensis L.* — однолетнее ароматическое растение семейства Lamiaceae, широко используемое в народной и официальной медицине, а также в качестве пряности. Чабер садовый содержит значительное количество эфирных масел, фенольных соединений, флавоноидов и антиоксидантов. Основными компонентами эфирного масла являются карвакрол, тимол, γ-терпинен и p-цимен, обладающие выраженными антимикробными и противовоспалительными свойствами. Несмотря на широкое распространение культуры в странах Европы и Азии, вопросы адаптации и технологии выращивания *Satureja hortensis L.* в условиях Южного Приаралья изучены недостаточно. В связи с этим целью исследования явилось изучение биоэкологических особенностей и разработка эффективной технологии выращивания данного вида в аридных условиях.

Материалы и методы исследования

Исследования проводились в 2025–2026 годах на опытных участках Каракалпакского государственного университета имени Бердаха. Объектом исследования являлся *Satureja hortensis L.,* выращиваемый из семян в условиях открытого грунта. В ходе исследований применялись фенологические наблюдения, биометрические измерения растений, определение всхожести семян, учет продуктивности надземной массы и сравнительный анализ агротехнических приемов выращивания. Фенологические наблюдения проводились согласно общепринятым методикам интродукционного изучения растений. Отмечались сроки появления всходов, бутонизации, цветения, плодоношения и завершения вегетации. Полученные данные обрабатывались статистическими методами с использованием средних значений и стандартных отклонений.

Результаты и обсуждение

Satureja hortensis L. является однолетним травянистым растением высотой 20–50 см. Корневая система стержневая, хорошо развитая, что обеспечивает растению высокую засухоустойчивость. Стебель прямостоячий, сильно ветвящийся, листья супротивные, узколанцетные, покрытые многочисленными эфиромасличными железками. В условиях

Каракалпакстана всходы появлялись через 8–12 дней после посева при температуре почвы 15–18 °C. Начало бутонизации отмечалось через 35–40 дней после появления всходов, массовое цветение наступало через 55–65 дней, а продолжительность вегетационного периода составляла 110–125 дней.

Исследования показали, что растение является светолюбивым и теплолюбивым видом. Наиболее интенсивный рост наблюдался при температуре воздуха 22–30 °C и влажности почвы на уровне 65–70 % полной полевой влагоемкости. Благодаря хорошо развитой корневой системе и физиологическим механизмам адаптации растение успешно переносит кратковременные периоды засухи и высокие температуры, характерные для условий Южного Приаралья.

Для выращивания культуры наиболее подходят легкие суглинистые и супесчаные почвы с нейтральной или слабощелочной реакцией. Почву готовили путем осенней вспашки (25–30 см), внесения органических удобрений (15–20 т/га) и весенней культивации. Посев проводили ранней весной при температуре почвы 10–12 °C на глубину 1–1,5 см с междурядьями 45–60 см и нормой высева 4–6 кг/га. Уход включал рыхление междурядий, прополку и 3–4 полива в течение вегетации.

В результате исследований установлено, что средняя высота растений достигала 42,6±2,4 см, а средняя масса одного растения составляла 78,3±4,5 г. Урожайность зеленой массы варьировала от 9,8 до 12,5 т/га, тогда как выход сухого сырья составлял 2,1–2,8 т/га. Содержание эфирного масла изменялось в пределах 1,2–2,4 % в зависимости от погодных условий и сроков уборки. Наибольшее накопление эфирного масла наблюдалось в фазе массового цветения, что свидетельствует о целесообразности проведения уборки именно в этот период.

Полученные результаты свидетельствуют о высокой экологической пластичности *Satureja hortensis L.* и его способности успешно адаптироваться к условиям резко континентального климата Каракалпакстана. Высокая засухоустойчивость растения обусловлена особенностями строения корневой системы, позволяющей эффективно использовать почвенную влагу, а также наличием эфиромасличных железок, снижающих интенсивность транспирации.

Сравнение полученных данных с результатами исследований, проведенных в других регионах, показывает сходство основных фенологических показателей и параметров продуктивности культуры. Перспективность использования данного вида обусловлена не только его лекарственными и эфиромасличными свойствами, но и возможностью успешного возделывания на малопродуктивных землях аридных территорий.

Заключение

Установлено, что *Satureja hortensis L.* характеризуется высокой адаптивностью к почвенно-климатическим условиям Каракалпакстана и обладает значительным хозяйственным потенциалом. Оптимальными

условиями выращивания являются хорошо освещенные участки с легкими плодородными почвами и умеренным режимом орошения. Наиболее высокий выход лекарственного сырья и эфирного масла достигается при уборке растений в фазе массового цветения. Полученные результаты подтверждают перспективность широкого внедрения *Satureja hortensis L.* в систему лекарственного растениеводства, эфиромасличного производства и озеленения аридных территорий Южного Приаралья.

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СОСТОЯНИЕ АРЧОВЫХ ЛЕСОВ ЗАПАДНОГО ПАМИРО-АЛАЯ

Аннотация: *В статье рассматриваются экологические, ботанико-географические и таксономические особенности арчовых лесов (редколесий) Западного Памиро-Алая на примере Туркестанского хребта. На основе интеграции классических принципов П.Н. Овчинникова и флорогенетических подходов Р.В. Камелина проведен анализ структуры и вертикального распределения фитоценозов. Установлено, что арчевники региона образованы тремя генетически связанными видами секции Sabina рода Juniperus (J. seravshanica, J. semiglobosa, J. turkestanica), которые демонстрируют четкую топологическую дифференциацию по горному профилю в зависимости от температурного градиента и эдафических условий. В статье критически анализируются существующие подходы к систематике можжевеловых лесов Евразии, обосновывается их неогеновое происхождение на арктотретичной флористической основе, а также двойственная (криофитная и термофильная) эволюционная линия развития. Делается вывод о необходимости применения современных геоботанических и молекулярно-флористических методов для дальнейшего мониторинга и сохранения этих уязвимых горных экосистем.*

Ключевые слова: *арчевники, Памиро-Алай, можжевельник, Juniperus, арчовые леса, растительность, флороценотип, экосистема, геоботаника, экологическая классификация.*

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THE STATE OF JUNIPER FORESTS IN THE WESTERN PAMIR-ALAI REGION

Abstract: *The article examines the ecological, botanical-geographical, and taxonomic characteristics of juniper (archa) forests in the Western Pamir-Alay, using the Turkestan Range as a reference model. Integrating the classical ecological principles of P.N. Ovchinnikov with the florogenetic approaches of R.V. Kamelin, the study analyzes the structure and vertical distribution of these phytocoenoses. It was established that the regional juniper forests are formed by three genetically linked species of the genus Juniperus (section Sabina): J. seravshanica, J. semiglobosa, and J. turkestanica. These species exhibit distinct topological differentiation along the mountain profile, driven by temperature gradients and edaphic conditions. The paper critically evaluates existing systematic approaches to Eurasian juniper formations, justifying their Neogene origin on an Arcto-Tertiary floristic basis, and highlights a dual (cryophilic and thermophilic) evolutionary pathway. The study concludes that modern geobotanical and molecular-floristic methods are essential for the ongoing monitoring and conservation of these vulnerable mountain ecosystems.*

Keywords: *juniper woodlands, Pamir-Alay, Juniperus, juniper forests, vegetation, florocenotype, ecosystem, geobotany, ecological classification.*

Арчовые леса (редколесья из представителей рода *Juniperus*) выполняют важнейшую водорегулирующую, почвозащитную и климатическую роль в горных экосистемах Центральной Азии. В холодных и умеренных широтах Северного полушария насчитывается около 60 видов можжевельника, из которых 21 вид произрастает в Средней Азии — от Центрального Тянь-Шаня до Копетдага. Наиболее масштабные массивы сосредоточены на северных склонах Алайского, Туркестанского и Гиссарского хребтов, где на высотах от 2200 до 3200 метров над уровнем моря они занимают десятки миллионов гектаров. В Западном Памиро-Алае, в частности в Зааминском государственном заповеднике, высокогорные арчевники (1760–3500 м) формируют уникальные растительные комплексы.

Исторически эти экосистемы подвергались жесткому антропогенному прессу. С давних времен арча массово вырубалась для выплавки чугуна, выжигания на уголь, использования в качестве топлива и строевой древесины, а также для освобождения земель под пастбища и пашни. Согласно историческим хроникам (Арандаренко, 1889), со склонов Туркестанского и Зеравшанского хребтов в Самарканд ежегодно сплавлялось по рекам более 120 плотов (по 220 бревен арчи в каждом). Несмотря на длительную историю изучения, ботанико-географическая систематизация и типологическая классификация этих мозаичных сообществ до сих пор остаются предметом научной дискуссии, что определяет актуальность данного исследования.

Методологической основой классификации арчевников Памиро-Алая в данной работе послужили принципы эколого-географического анализа П.Н. Овчинникова (1957), дополненные и уточненные флорогенетическими концепциями Р.В. Камелина (1979). В качестве **эталонной модели** для

построения классификационной схемы был выбран Туркестанский хребет, где вертикальная поясность и видовая дифференциация выражены наиболее четко. Анализ структуры фитоценозов проводился в рамках выделения криогумидных, семигумидных и семиаридных флороценотипов, характерных для Центральной Азии и Средиземноморья.

Установлено, что арчовые леса в горах Узбекистана образованы тремя генетически связанными видами можжевельника: *Juniperus seravshanica* Komar. (м. зеравшанский), *J. semiglobosa* Rgl. (м. полушаровидный) и *J. turkestanica* Komar. (м. туркестанский). Все три вида принадлежат к секции *Sabina*, характерной чертой которой является разнолистность (гетерофиллия).

-Морфологические особенности: Первые листья молодых всходов всегда игловидные, плоские и мягкие. Начиная с 9–10 лет хвоя становится чешуйчатой, однако у взрослых растений на нижних затененных ветвях может вторично развиваться игловидная хвоя.

-Эдафические условия: Арча обладает высокой экологической пластичностью и способна произрастать на различных субстратах — от мелкоземов до голых скал на склонах любых экспозиций. Однако оптимум достигается на пологих склонах с развитым почвенным покровом, где формируются типичные для арчевников коричневые, высокогумусные, сильно карбонатные почвы.

-Топологическое распределение: из-за различного отношения видов к температурному фактору на Туркестанском хребте наблюдается четкое вертикальное разграничение:

1. *Нижний пояс:* доминирует наиболее теплолюбивый вид — *J. seravshanica*.

2. *Средний пояс (2200–2300 м):* появляется примесь *J. semiglobosa*, формируя устойчивые смешанные сообщества.

3. *Верхний пояс:* По мере падения температур *J. semiglobosa* становится господствующим, а у самой верхней границы древесной растительности доминирует наиболее холодостойкий вид — *J. turkestanica*.

Высокая экологическая и флористическая мозаичность арчевников Западного Памиро-Алая обусловила сосуществование нескольких альтернативных взглядов на их природу в ботанической литературе.

Автор, год	**Суть концепции и классификации**
Бобров (1926), Исмаилов (1974)	Объединяли все формообразования можжевельников в один подтип **ксерофитных редколесий**, аргументируя это общностью можжевеловых формаций Евразии. Однако современные данные опровергают этот подход из-за отсутствия экологической и морфологической конгруэнтности (соответствия) между видами.
П.Н. Овчинников (1957)	Рассматривал арчевники региона как единый тип растительности, дифференцированный на два контрастных подтипа: **криофитный** (холодостойкий) и **термофильный** (теплолюбивый).

Р.В. Камелин (1979)	Разделил микротермные и термофильные можжевельники, отнеся их к холодно-умеренной и горной субтропической флоре соответственно. Он доказал их древнесредиземноморское происхождение, сформировавшееся в палеогене и неогене.

Экологический анализ показывает, что арчевники Памиро-Алая занимают интразональное (промежуточное) положение между бореальными тайговыми и субтропическими лесами. Наше исследование подтверждает двойственную эволюционную линию в пределах секции *Sabina*: одна ветвь адаптировалась к холодному климату, другая — к теплому. Это позволяет классифицировать данные сообщества как самобытный тип криофитных лесов, заложившихся в неогене на арктотретичной флористической основе. В Центральном Памиро-Алае *J. turkestanica*, *J. seravshanica* и *J. semiglobosa* формируют климаксовые, устойчивые формации.

Заключение

Арчевники Памиро-Алая представляют собой сложные, гетерогенные по составу и структуре фитоценозы. Их современный облик продиктован как древними флористическими миграциями, так и актуальными климатическими градиентами (высотным температурным фактором). Дальнейшее уточнение их типологического разнообразия и разработка мер по их сохранению требуют применения современных методов молекулярной флористики, детального геоботанического описания и ГИС-моделирования.

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ДИСБАКТЕРИОЗ: СОВРЕМЕННЫЕ ИССЛЕДОВАНИЯ И МЕТОДЫ ДИАГНОСТИКИ

Аннотация: *В этом обзоре литературы освещены следующие вопросы: определение дисбиоза кишечника (толстого и тонкого), основные показатели нормобиоценоза желудочно-кишечного тракта у здоровых людей; микрофлора стенки и полости кишечника, ее основные функции и механизмы регуляции; особенности дисбиоза толстого и тонкого кишечника, критерии вирулентности оппортунистической микрофлоры. Описаны современные методы диагностики дисбиоза толстого и тонкого кишечника. Обсуждаются спорные терминологические вопросы. В заключительной части статьи представлены новые гипотезы (концепции) о филогенетическом ядре микрофлоры толстого кишечника у здорового человека и симбиотическом пищеварении, их основе и перспективах изучения.*

Ключевые слова: *дисбактериоз, микрофлора, ПЦР*

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DYSBACTERIOSIS: MODERN RESEARCH AND DIAGNOSTIC METHODS

Abstract:*This literature review covers the following topics: the definition of intestinal dysbiosis (both large and small intestines), key indicators of normobiocenosis in the gastrointestinal tract of healthy individuals; the microflora of the intestinal wall and lumen, its main functions, and regulatory mechanisms; the characteristics of dysbiosis in the large and small intestines, as well as the criteria for the virulence of opportunistic microflora. Modern diagnostic methods for dysbiosis of the large and small intestines are described. Controversial terminological issues are discussed. In the final part of the article, new hypotheses (concepts) about the phylogenetic core of the microflora in the large intestine of a healthy person and symbiotic digestion, their foundations, and research prospects are presented.*

Key words: *dysbacteriosis, microflora, PCR.*

Введение

В настоящее время известно, что микрофлора кишечника представлена более чем 600 видами бактерий. Их наибольшая концентрация наблюдается в дистальных отделах тонкой кишки и в толстой кишке и составляет 10^{11}–10^{12} бактерий на 1 г кишечного содержимого [1]. Общее количество бактерий, обитающих в толстой кишке, в два раза превышает число всех эукариотических клеток органов и тканей человека, а их биомасса составляет 2,5–3,0 кг, или около 5 % массы тела [2].

Дисбактериоз толстой кишки чаще всего развивается на фоне гастроэнтерологических заболеваний, таких как язвенная болезнь, болезнь Крона, диффузный полипоз, распространённый дивертикулёз толстой кишки и другие, то есть имеет преимущественно вторичный характер. Однако сам дисбактериоз также может способствовать развитию патологических процессов. Например, при определённых условиях миграция микрофлоры из толстой кишки в тонкую может привести к развитию дисбиоза тонкой кишки (синдрома избыточного бактериального роста — СИБР) [2].

В настоящее время наиболее широко применяемыми методами диагностики кишечного дисбактериоза являются бактериологическое исследование кала, ПЦР-диагностика, хромато-масс-спектрометрия и исследование микробных метаболитов [3]. Кроме того, используются гистохимические, морфологические и молекулярно-генетические методы диагностики, нагрузочные тесты и другие методики, однако они находятся в арсенале крупных научно-исследовательских институтов и практически не применяются в рутинной клинической практике [4].

Наиболее распространённым методом в клинической практике остаётся бактериологическое (микробиологическое) исследование. Обычно при его проведении изучают от 14 до 25 показателей [5].

Основными недостатками данного метода являются его трудоёмкость (необходимость использования стерильной посуды, быстрой доставки материала в лабораторию и посева на питательные среды) и длительность выполнения исследования [6].

Косвенным методом диагностики кишечного дисбактериоза является газожидкостная хроматография (ГЖХ), позволяющая определять различные метаболиты микрофлоры (индикан, паракрезол, фенол, $^{14}CO_2$, аммиак и др.). Исследование спектра короткоцепочечных жирных кислот (КЖК) позволяет судить о таксономическом составе всех бактерий, присутствующих в исследуемом материале.

Преимущество анализа КЖК заключается в том, что он главным образом характеризует анаэробную микрофлору, культивирование которой представляет значительные трудности. Специфичность данного метода

составляет 50–90 %, чувствительность — 25–100 %, что позволяет использовать его в качестве экспресс-диагностики [7].

Метод ГЖХ в сочетании с масс-спектрометрией основан на выявлении компонентов, образующихся при разрушении бактериальных клеток. В качестве маркеров используются малые липидные компоненты мембран микроорганизмов. По их содержанию можно идентифицировать до 170 видов бактерий, грибов и вирусов [8].

Ещё одним методом выявления микроорганизмов кишечника является ПЦР-диагностика, однако она позволяет обнаруживать лишь ограниченное число видов бактерий. В настоящее время этот метод чаще применяется для диагностики инфекционных заболеваний, однако он также может успешно использоваться для оценки состояния кишечного микробиоценоза.

При этом используется метод ПЦР в режиме реального времени с флуоресцентной детекцией результатов. Основными преимуществами метода являются быстрота выполнения исследования и возможность выявления трудно культивируемых анаэробных бактерий. ПЦР в реальном времени позволяет выявить: снижение количества постоянных представителей микробиоценоза (бифидо- и лактобактерий); наличие диагностически значимого количества условно-патогенной флоры ($>10^4$), включая *Klebsiella spp.*, *Proteus spp.*, *Staphylococcus aureus*, *Clostridium difficile* и другие микроорганизмы; изменение соотношения различных популяций микроорганизмов.

Известно, что при нормальном содержании бактероидов уменьшение общего количества бактерий-продуцентов бутирата, а также значительное увеличение численности *Escherichia coli* (особенно штаммов, содержащих гены патогенности) являются информативными диагностическими признаками воспалительных заболеваний кишечника [9].

Заключение.

Для профилактики, лечения и реабилитации при дисбактериозе кишечника применяются различные методы. Лечение должно быть направлено не только на основное заболевание, но и на патогенную и условно-патогенную микрофлору, вызвавшую дисбактериоз. В зависимости от степени интоксикации и выраженности нарушений пищеварения назначаются кишечные антисептики, энтеросорбенты, пищеварительные ферменты и средства, нормализующие перистальтику кишечника. Рекомендуются также пробиотики и пребиотики, а также кисломолочные продукты, обогащённые бифидобактериями (кефир, сметана, творог). Больным дисбактериозом, особенно в период реабилитации, назначают иммуномодуляторы (нуклеинат натрия, витамины), растительные адаптогены (препараты элеутерококка и женьшеня). При склонности к лейкопении и необходимости усиления эпителизации слизистой оболочки могут применяться метилурацил и пентоксил (не более двух недель).

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РАЦИОНАЛЬНАЯ ФАРМАКОТЕРАПИЯ ПРИ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ: СОВРЕМЕННЫЙ ОБЗОР

Аннотация: *Артериальная гипертензия является одним из наиболее значимых факторов риска сердечно-сосудистой заболеваемости и смертности во всем мире. В статье представлен современный обзор принципов рациональной фармакотерапии артериальной гипертензии с учетом патофизиологических механизмов заболевания, стратификации риска и актуальных клинических рекомендаций. Подробно рассмотрены основные классы антигипертензивных препаратов, их фармакологические особенности, показания к применению и принципы комбинированной терапии. Особое внимание уделено вопросам индивидуализации лечения, безопасности и повышения приверженности пациентов.*

Ключевые слова*: артериальная гипертензия, фармакотерапия, антигипертензивные препараты.*

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RATIONAL PHARMACOTHERAPY FOR ARTERIAL HYPERTENSION: A MODERN REVIEW

Abstract: *Arterial hypertension is one of the most significant risk factors for cardiovascular morbidity and mortality worldwide. This article presents a current review of the principles of rational pharmacotherapy for arterial hypertension, taking into account the pathophysiological mechanisms of the disease, risk stratification, and current clinical guidelines.*

The main classes of antihypertensive drugs, their pharmacological properties, indications for use, and principles of combination therapy are discussed in detail. Particular attention is paid to individualizing treatment, safety, and improving patient adherence.

Keywords: *arterial hypertension, pharmacotherapy, antihypertensive drugs.*

Введение

Артериальная гипертензия представляет собой хроническое заболевание, характеризующееся стойким повышением артериального давления и являющееся ведущим фактором риска сердечно-сосудистых осложнений. По данным международных исследований, эффективный контроль артериального давления позволяет существенно снизить риск инфаркта миокарда, инсульта и смертности [8].

Современные клинические рекомендации подчеркивают необходимость ранней диагностики и активного лечения артериальной гипертензии с учетом индивидуального сердечно-сосудистого риска пациента [1], [2].

Патофизиологические основы. Развитие артериальной гипертензии связано с нарушением нейрогуморальной регуляции, включая активацию ренин-ангиотензин-альдостероновой системы и симпатической нервной системы. Повышение уровня ангиотензина II приводит к вазоконстрикции и ремоделированию сосудистой стенки [7].

Дополнительно важную роль играет эндотелиальная дисфункция, сопровождающаяся снижением продукции оксида азота и усилением воспалительных процессов.

Принципы рациональной фармакотерапии. Рациональная фармакотерапия основывается на принципах доказательной медицины и предполагает выбор препаратов с доказанной эффективностью. Основной целью лечения является снижение сердечно-сосудистого риска, а не только достижение целевых цифр артериального давления [4].

Согласно современным рекомендациям, лечение должно быть комплексным и включать как медикаментозные, так и немедикаментозные методы [2].

Основные классы антигипертензивных препаратов.

Ингибиторы ангиотензинпревращающего фермента широко применяются в лечении артериальной гипертензии благодаря их способности снижать активность ренин-ангиотензиновой системы. Они обладают кардиопротективным и нефропротективным эффектами [7].

Блокаторы рецепторов ангиотензина II являются альтернативой ингибиторам АПФ и характеризуются лучшей переносимостью.

Блокаторы кальциевых каналов эффективно снижают периферическое сосудистое сопротивление и широко используются у пожилых пациентов.

Диуретики уменьшают объем циркулирующей крови и усиливают действие других антигипертензивных препаратов.

Бета-адреноблокаторы снижают активность симпатической нервной системы и особенно эффективны при сопутствующих сердечно-сосудистых заболеваниях [4].

Комбинированная терапия

Современные исследования показывают, что большинство пациентов нуждаются в комбинированной терапии для достижения целевых уровней артериального давления [5]. Использование фиксированных комбинаций позволяет повысить эффективность лечения и улучшить приверженность пациентов. Комбинированная терапия обеспечивает воздействие на различные механизмы патогенеза, что делает лечение более эффективным [6].

Индивидуализация лечения.

Индивидуальный подход является ключевым элементом рациональной фармакотерапии. Выбор препарата зависит от возраста пациента, наличия сопутствующих заболеваний и риска осложнений. Например, при наличии сахарного диабета предпочтение отдается препаратам, влияющим на ренин-ангиотензиновую систему, тогда как при ишемической болезни сердца используются бета-адреноблокаторы [1].

Приверженность и безопасность. Низкая приверженность лечению остается одной из основных проблем в терапии артериальной гипертензии. По данным исследований, значительная часть пациентов прекращает прием препаратов в течение первого года лечения [3].

Использование пролонгированных форм препаратов и фиксированных комбинаций способствует улучшению соблюдения режима терапии.

Заключение.

Рациональная фармакотерапия артериальной гипертензии требует комплексного подхода, включающего индивидуализацию лечения, применение комбинированной терапии и контроль приверженности пациентов. Современные рекомендации направлены на снижение сердечно-сосудистого риска и улучшение качества жизни пациентов.

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СОВРЕМЕННЫЕ АСПЕКТЫ ПРИМЕНЕНИЯ АНТИКОАГУЛЯНТОВ

Аннотация: *Антикоагулянтная терапия занимает ключевое место в профилактике и лечении тромбоэмболических осложнений, являющихся одной из ведущих причин смертности в мире. В последние годы наблюдается значительный прогресс в разработке новых антикоагулянтов, улучшении профиля их безопасности и внедрении персонализированного подхода к лечению. В статье рассмотрены современные представления о классификации антикоагулянтов, механизмах их действия, клиническом применении, рисках и перспективах развития. Особое внимание уделено прямым оральным антикоагулянтам и их преимуществам по сравнению с традиционной терапией.*

Ключевые слова: *антикоагулянты, тромбоз, фармакотерапия, прямые оральные антикоагулянты, безопасность, фармакогенетика.*

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MODERN ASPECTS OF THE USE OF ANTICOAGULANTS

Abstract: *Anticoagulant therapy plays a key role in the prevention and treatment of thromboembolic complications, which are one of the leading causes of death worldwide. In recent years, significant progress has been made in the development of new anticoagulants, improving their safety profiles, and introducing personalized treatment approaches. This article examines current understanding of anticoagulant classification, mechanisms of action, clinical use, risks, and development prospects. Particular attention is paid to direct oral anticoagulants and their advantages over traditional therapy.*

Keywords: *anticoagulants, thrombosis, pharmacotherapy, direct oral anticoagulants, safety, pharmacogenetics.*

Введение

Проблема тромбообразования остаётся одной из наиболее актуальных в современной медицине. Тромбозы различной локализации лежат в основе таких тяжёлых состояний, как ишемический инсульт, инфаркт миокарда и тромбоэмболия лёгочной артерии. По данным клинических исследований, своевременное применение антикоагулянтов позволяет существенно снизить риск развития этих осложнений и улучшить прогноз пациентов [5].

Антикоагулянты представляют собой группу лекарственных средств, способных ингибировать различные звенья системы гемостаза, тем самым предотвращая образование и рост тромбов. В последние десятилетия произошли значительные изменения в подходах к антикоагулянтной терапии, связанные с внедрением новых препаратов, обладающих более предсказуемыми фармакокинетическими характеристиками и улучшенным профилем безопасности [3].

Классификация антикоагулянтов и их фармакологические особенности.

Современная классификация антикоагулянтов основывается на их механизме действия и включает непрямые и прямые препараты.

К непрямым антикоагулянтам относятся антагонисты витамина K, наиболее известным представителем которых является варфарин. Эти препараты ингибируют синтез витамин-K-зависимых факторов свертывания (II, VII, IX и X) в печени. Несмотря на доказанную эффективность, их применение ограничено узким терапевтическим окном, необходимостью регулярного контроля международного нормализованного отношения (МНО) и значительным числом лекарственных и пищевых взаимодействий [4].

Прямые антикоагулянты включают нефракционированный гепарин, низкомолекулярные гепарины, а также прямые ингибиторы тромбина и фактора Xa. Гепарины действуют через активацию антитромбина III, что приводит к инактивации тромбина и других факторов свертывания. Низкомолекулярные гепарины обладают более предсказуемым эффектом и меньшим риском осложнений по сравнению с нефракционированным гепарином [3].

Особую группу составляют прямые оральные антикоагулянты, которые в настоящее время широко применяются в клинической практике. Они включают ингибиторы тромбина и ингибиторы фактора Xa и характеризуются высокой селективностью действия [2].

Механизмы действия антикоагулянтов.

Система гемостаза представляет собой сложный каскад реакций, направленных на поддержание жидкого состояния крови и предотвращение кровотечений. Антикоагулянты воздействуют на различные этапы этого каскада, нарушая процессы образования фибринового сгустка.

Прямые ингибиторы тромбина блокируют активность данного фермента, препятствуя превращению фибриногена в фибрин — ключевой этап формирования тромба. Ингибиторы фактора Xa предотвращают

образование тромбина, воздействуя на более раннюю стадию коагуляционного каскада. Антагонисты витамина К уменьшают синтез факторов свертывания, что также приводит к снижению коагуляционной активности крови [2].

Таким образом, антикоагулянты обеспечивают многоуровневое воздействие на систему гемостаза, что делает их эффективными средствами профилактики тромбообразования.

Современные антикоагулянты: преимущества и ограничения.

В последние годы особое внимание уделяется прямым оральным антикоагулянтам. Их внедрение стало значительным шагом вперёд в развитии антикоагулянтной терапии.

К преимуществам данных препаратов относятся предсказуемая фармакокинетика, фиксированные дозировки, отсутствие необходимости регулярного лабораторного контроля и меньшее количество взаимодействий с другими лекарственными средствами и пищей. Эти характеристики значительно упрощают лечение и повышают приверженность пациентов терапии [1,2].

Однако, несмотря на очевидные преимущества, данные препараты имеют и ряд ограничений. К ним относятся высокая стоимость, ограничения при применении у пациентов с тяжёлой почечной недостаточностью, а также необходимость осторожного применения при высоком риске кровотечений [6].

Клиническое применение антикоагулянтов.

Антикоагулянты широко применяются в различных областях медицины. Одним из наиболее распространённых показаний является профилактика инсульта у пациентов с фибрилляцией предсердий. В этом случае антикоагулянтная терапия позволяет значительно снизить риск тромбоэмболических осложнений [5].

Другим важным направлением является лечение и профилактика тромбоза глубоких вен и тромбоэмболии лёгочной артерии. Антикоагулянты используются как в остром периоде заболевания, так и для длительной вторичной профилактики.

Кроме того, данные препараты применяются в послеоперационном периоде для предотвращения тромботических осложнений, особенно у пациентов после ортопедических и онкологических операций [4].

Проблемы безопасности антикоагулянтной терапии.

Несмотря на высокую эффективность, антикоагулянты могут вызывать серьёзные побочные эффекты. Наиболее опасным осложнением является развитие кровотечений, которые могут варьировать от незначительных до жизнеугрожающих состояний.

Риск кровотечений зависит от многих факторов, включая возраст пациента, наличие сопутствующих заболеваний, функцию печени и почек, а также взаимодействие с другими лекарственными средствами [7].

В последние годы были разработаны специфические антидоты для ряда антикоагулянтов, что значительно повысило безопасность их применения. Возможность быстрого купирования антикоагулянтного эффекта имеет особое значение в экстренных ситуациях [9,10].

Персонализированный подход к антикоагулянтной терапии.

Современная медицина всё больше ориентируется на индивидуализацию лечения. В контексте антикоагулянтной терапии это особенно важно, поскольку реакция на препараты может существенно различаться у разных пациентов.

Генетические факторы играют значительную роль в метаболизме антикоагулянтов. Например, полиморфизмы генов, кодирующих ферменты системы цитохрома Р450, могут влиять на скорость метаболизма варфарина и других препаратов. Учет этих факторов позволяет оптимизировать дозировку и снизить риск побочных эффектов [8].

Перспективы развития. Развитие антикоагулянтной терапии продолжается, и современные исследования направлены на создание новых препаратов с более высокой эффективностью и безопасностью. Одним из перспективных направлений является разработка ингибиторов фактора XI, которые, по предварительным данным, обеспечивают эффективную профилактику тромбозов при меньшем риске кровотечений [6].

Кроме того, активно изучаются возможности применения цифровых технологий для мониторинга терапии и повышения приверженности пациентов лечению.

Заключение

Антикоагулянты являются неотъемлемой частью современной клинической практики и играют ключевую роль в профилактике и лечении тромбоэмболических заболеваний. Внедрение новых препаратов, развитие персонализированного подхода и совершенствование методов контроля терапии позволяют значительно повысить эффективность и безопасность лечения.

Дальнейшие исследования в данной области направлены на оптимизацию существующих схем терапии и разработку новых лекарственных средств, что открывает широкие перспективы для улучшения качества медицинской помощи.

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ИССЛЕДОВАНИЕ ЯВЛЕНИЙ КОГЕРЕНТНОСТИ В СИСТЕМАХ МАТЕРИИ И ИЗЛУЧЕНИЯ, А ТАКЖЕ ВЗАИМОДЕЙСТВИЯ МАТЕРИИ И ЭЛЕКТРОМАГНИТНЫХ ПОЛЕЙ

Аннотация: *В данной статье в классической физике показатель преломления среды рассматривается как зависящий от воздействия электромагнитного поля на эту среду. Однако доказано, что дисперсия (преломление) возникает в результате взаимодействия одного двухуровневого атома с одним фотоном. В данной диссертации обсуждается расширение этого анализа на более сложную систему — взаимодействие трехуровневого атома с двумя фотонами.*

Ключевые слова: *Когерентность, Взаимодействие материи и излучения, Квантовая оптика, Трехуровневый атом, Двухфотонная дисперсия, Квантование электромагнитного поля, Квантовая интерференция, Адиабатические процессы, Фотонные квантовые биты, Интерферометр Маха-Цендера*

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RESEARCH OF COHERENCE PHENOMENA IN MATTER AND RADIATION SYSTEMS, AS WELL AS THE INTERACTION OF MATTER AND ELECTROMAGNETIC FIELDS

Abstract: *In this situation, the classical physical index of refraction of a medium is considered to depend on the effect of an electromagnetic field on that*

medium. It is proven that dispersion (refraction) leads to the interaction of one two-dimensional atom with one photon. This dissertation discusses the extension of this analysis to a more complex system—the interaction of a three-level atom with two photons.

Keywords: *Coherence, Matter-radiation interaction, Quantum optics, Three-level atom, Two-photon dispersion, Electromagnetic field quantization, Quantum interference, Adiabatic processes, Photonic quantum bits, Mach-Zehnder interferometer*

Взаимодействие электромагнитного поля с атомом носит, по сути, квантовый характер[12]. Таким образом, электронное состояние атома и фотонное состояние электромагнитного поля определяются квантовыми операторами[12]. В следующих разделах будут рассмотрены квантовые операторы, необходимые для анализа взаимодействия фотонного поля с общим n-уровневым атомом. Рассмотрим n-уровневый атом с электронами, локализованными в Ne. Данный электрон e− в этой системе начинает движение из начального состояния i и в конечном состоянии j в результате некоторого процесса, который ограничен принципом исключения Паули посредством антикоммутационного соотношения Ферми-Дирака [4, 2, 7].

$$e^{\frac{-iE_i t}{\hbar}} |i\rangle e^{\frac{-iE_j t}{\hbar}} |j\rangle \quad (1)$$

Электронный переход

Здесь четко указана фаза, связанная с энергией состояния. E_i и E_j — начальная и конечная энергии электрона соответственно. Оператор, связанный с этим изменением состояния, — это атомный оператор перехода σij, определяемый как [14].

$$\hat{\sigma}_{ij} = e^{-i\omega_{ij}t} |j\rangle \langle i| \quad (2)$$

Таким образом, ωij = (Ej -Ei)/ $\hbar$ — это частота возбуждения двух атомных энергетических уровней, как показано на рисунке 2. (6.1)

Важным случаем оператора атомного перехода является ситуация, когда начальное и конечное состояния равны. В этом случае σij = |i>< i| и оставляет состояние неизменным даже в фазе. Это полезно, когда необходимо рассчитать энергию конкретного электрона. Квантовая теория свободного электромагнитного поля была впервые разработана в середине 1920-х годов в работах Борна, Гейзенберга и Джордана. Свободное электромагнитное поле — это поле, в котором отсутствует взаимодействие между веществом и окружающей средой [1, 3].

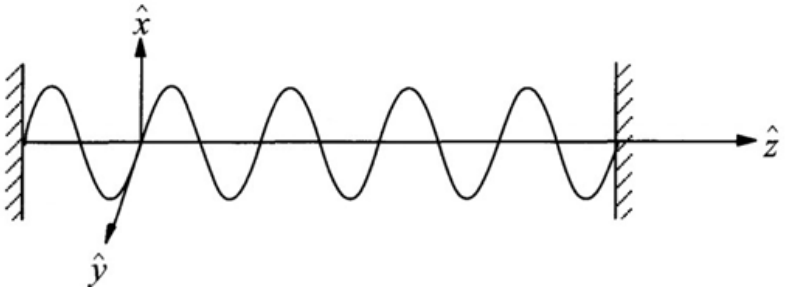

Рисунок 1. Электромагнитная волна в резонансной полости длиной L.[20]

$$\vec{\nabla} \times \vec{E}(\vec{r},t) = -\frac{\partial \vec{B}(\vec{r},t)}{\partial t} \quad (3) \qquad \vec{\nabla} \times \vec{H}(\vec{r},t) = \frac{\partial \vec{D}(\vec{r},t)}{\partial t} \quad (4)$$

$$\vec{\nabla} \cdot \vec{D}(\vec{r},t) = 0, \quad (5) \qquad \vec{\nabla} \cdot \vec{B}(\vec{r},t) = 0. \quad (6)$$

Стандартные правовые соотношения для этих уравнений приведены в

[3]. $$\vec{D}(\vec{r},t) = \varepsilon_0 \vec{E}(\vec{r},t), \quad (7) \qquad \vec{H}(\vec{r},t) = \frac{1}{\mu_0}\vec{B}(\vec{r},t) \quad (8)$$

В уравнениях 3 и 4 e0 и μ0 — соответственно диэлектрическая проницаемость и магнитная проницаемость свободного пространства[1]. Кроме того, эти величины подчиняются соотношению μ0e0 = c−2

где c — скорость света в вакууме[1]. Взяв ротор ∇ × E = ∂B/∂t и используя

Можно показать, что уравнения 4, 5 и 6 удовлетворяют волновому уравнению электрического поля [1] с векторной сингулярностью ∇ × (∇ × E) = ∇(∇ · E) − ∇2E,

$$\vec{\nabla}^2 \vec{E}(\vec{r},t) - \frac{1}{c^2}\frac{\partial^2 \vec{E}(\vec{r},t)}{\partial^2 t} = 0 \quad (9)$$

Теперь рассмотрим резонансную полость длиной L. Разложение электрического поля в этой полости по нормальным модам можно представить следующим образом [3]

$$E_x(z,t) = \sum_n A_n q_n(t) \sin(k_n z) \quad (10)$$

Здесь электрическое поле считается поляризованным в направлении оси x. В этом разложении qn(t) — амплитуда данной $k_n = \frac{n\pi}{L}$ моды, имеющая единицы длины. Если

$n \in \mathbb{N},$ и $A_n = \sqrt{\frac{2\nu_n^2 m_n}{\varepsilon_0 V}}.$ (11)

A_n Естественная частота зазора в зависимости от $\nu_n = \frac{n\pi c}{L}$ дается с

Здесь L, V = L*A — объем резонатора (где L — длина полости, а A — площадь поперечного сечения оптического резонатора), mn — постоянная с единицами массы[15]. Массовый член вводится для объяснения параллелизма между механическим простым гармоническим осциллятором и одной модой электромагнитного поля. В результате получается.

$$H_y(z,t) = \sum_n A_n \left[\frac{\dot{q}_n(t)\varepsilon_0}{k_n}\right] \cos(k_n z) \quad (12)$$

Классическая плотность гамильтониана поля задается формулой [3]

$$\mathscr{H} = \frac{1}{2}\int_V \left[\varepsilon_0 E_x^2(z,t) + \mu_0 H_y^2(z,t)\right] \mathrm{d}V, \quad (13)$$

где интегрирование производится по объему пространства. Используя уравнения 10 и 12 в уравнении 13, получаем гамильтониан:

$$\begin{aligned}\mathscr{H} &= \frac{1}{2}\sum_n (m_n \nu_n^2 q_n^2 + m_n \dot{q}_n^2) \\ &= \frac{1}{2}\sum_n \left(m_n \nu_n^2 q_n^2 + \frac{p_n^2}{m_n}\right)\end{aligned} \quad (14)$$

Здесь $p_n = m_n q_n(t)$ — канонический импульс n-го вещества. Очевидно, что классическое поле излучения, как было показано, является суммой энергий осцилляторов и, следовательно, динамически эквивалентно механическому гармоническому осциллятору[2, 15, 3].

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ВЛИЯНИЕ ИЗМЕНЕНИЯ КЛИМАТА НА УПРАВЛЕНИЕ ВОДНЫМИ РЕСУРСАМИ В УСЛОВИЯХ ЭКОЛОГИЧЕСКОЙ НЕСТАБИЛЬНОСТИ

Аннотация: *В статье рассматриваются современные проблемы управления водными ресурсами в условиях глобального изменения климата. Проанализированы основные экологические факторы, влияющие на сокращение водных запасов, изменение гидрологического режима и ухудшение качества водных ресурсов. В качестве методов исследования применялись сравнительный анализ, системный подход и методы экологического прогнозирования. Предложены современные подходы к совершенствованию системы управления водными ресурсами на основе экологического мониторинга, цифровых технологий и принципов устойчивого развития.*

Ключевые слова: *изменение климата, водные ресурсы, экологическая безопасность, устойчивое развитие, водопользование, экологический мониторинг, дефицит воды.*

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THE IMPACT OF CLIMATE CHANGE ON WATER RESOURCE MANAGEMENT UNDER CONDITIONS OF ENVIRONMENTAL INSTABILITY

Abstract: *This article examines contemporary water resource management challenges in the context of global climate change. The key environmental factors influencing water reserve decline, hydrological regime changes, and water quality degradation are analyzed. Comparative analysis, a systems approach, and environmental forecasting methods were employed. Modern approaches to improving water resource management systems based on environmental monitoring, digital technologies, and sustainable development principles are proposed.*

Keywords: *climate change, water resources, environmental safety, sustainable development, water use, environmental monitoring, water scarcity.*

Введение

В XXI веке изменение климата стало одной из наиболее серьёзных глобальных экологических проблем, оказывающих существенное влияние на природные ресурсы, социально-экономическое развитие и экологическую безопасность государств. Повышение средней температуры воздуха, изменение режима осадков, учащение засух и экстремальных природных явлений приводят к нарушению устойчивости экосистем и ухудшению состояния водных ресурсов. В современных условиях вода рассматривается не только как природный ресурс, но и как стратегический фактор устойчивого развития общества.

Проблема рационального управления водными ресурсами приобретает особую актуальность для стран с аридным и резко континентальным климатом. Уменьшение объёмов пресной воды, загрязнение водоёмов, рост потребления воды промышленностью и сельским хозяйством усиливают экологические риски и создают угрозу для продовольственной и энергетической безопасности. Согласно международным экологическим исследованиям, дефицит водных ресурсов в ближайшие десятилетия станет одним из ключевых факторов глобальной нестабильности [1; 3].

Изменение климата оказывает прямое влияние на гидрологические процессы. Повышение температуры приводит к ускоренному испарению воды, сокращению ледников, изменению речного стока и снижению уровня грунтовых вод. Особенно остро данные процессы проявляются в регионах Центральной Азии, где водные ресурсы играют ключевую роль в обеспечении сельского хозяйства и устойчивого функционирования экономики [2].

Современные экологические исследования подтверждают, что традиционные методы управления водными ресурсами уже не соответствуют новым климатическим условиям. Необходим переход к инновационным технологиям водосбережения, цифровому экологическому мониторингу и интегрированным системам управления природными ресурсами [4].

Целью данного исследования является анализ влияния изменения климата на систему управления водными ресурсами и разработка экологически устойчивых подходов к рациональному водопользованию.

Материалы и методы исследования

В процессе исследования использованы современные методы экологического анализа, сравнительного исследования, системного подхода и научного обобщения. Теоретической основой исследования послужили научные труды отечественных и зарубежных учёных в области экологии, климатологии и управления природными ресурсами.

Метод сравнительного анализа позволил выявить особенности влияния климатических изменений на водные ресурсы различных регионов.

Системный подход применялся для изучения взаимосвязи между экологическими, экономическими и социальными факторами водопользования. В исследовании были проанализированы международные экологические отчёты, материалы экологического мониторинга, статистические данные о водопотреблении и климатических изменениях [1; 2; 3; 4], а также научные публикации, посвящённые вопросам рационального использования водных ресурсов.

Кроме того, использовались методы экологического прогнозирования и аналитической оценки эффективности современных технологий управления водными ресурсами.

Результаты исследования

Результаты исследования показали, что изменение климата оказывает комплексное негативное воздействие на состояние водных ресурсов. Одним из основных последствий является сокращение объёмов доступной пресной воды вследствие повышения температуры и усиления процессов испарения. В ряде регионов наблюдается уменьшение речного стока и снижение уровня подземных вод, что приводит к ухудшению водоснабжения населения и сельского хозяйства.

Особое влияние климатические изменения оказывают на сельскохозяйственный сектор. Рост температуры воздуха и увеличение продолжительности засушливых периодов приводят к повышению потребности сельскохозяйственных культур в воде. В результате возрастает нагрузка на ирригационные системы и увеличивается риск деградации почв вследствие неэффективного водопользования.

Исследование показало, что значительное влияние на состояние водных ресурсов оказывает урбанизация и промышленное развитие. Рост промышленных предприятий и увеличение плотности населения приводят к повышению уровня загрязнения водоёмов химическими веществами, бытовыми отходами и промышленными стоками. Это ухудшает качество питьевой воды и создаёт угрозу для экологической безопасности [3].

Анализ современных технологий управления водными ресурсами показал высокую эффективность цифровых систем экологического мониторинга. Использование автоматизированных систем контроля качества воды, дистанционного мониторинга и интеллектуальных платформ позволяет своевременно выявлять экологические риски и принимать управленческие решения.

Важным направлением повышения эффективности водопользования является внедрение водосберегающих технологий. Капельное орошение, повторное использование очищенной воды, модернизация ирригационных систем и применение экологически безопасных технологий способствуют снижению потерь воды и повышению устойчивости аграрного сектора [2].

Исследование также подтвердило необходимость интеграции экологической политики и системы управления водными ресурсами.

Эффективное управление невозможно без международного сотрудничества, совершенствования экологического законодательства и развития экологического образования.

Обсуждение

Полученные результаты подтверждают, что изменение климата становится одним из ключевых факторов, определяющих современное состояние водных ресурсов. В условиях глобального потепления проблема рационального водопользования приобретает не только экологическое, но и стратегическое значение.

Современные тенденции показывают, что дефицит воды может привести к серьёзным социально-экономическим последствиям, включая снижение продовольственной безопасности, рост экологических рисков и ухудшение качества жизни населения. Особенно уязвимыми являются регионы с ограниченными водными ресурсами и высокой зависимостью экономики от сельского хозяйства [1; 4].

Важным условием устойчивого развития является переход к экологически ориентированной модели управления водными ресурсами. Такая модель должна основываться на принципах ресурсосбережения, экологической безопасности и цифровой трансформации системы мониторинга.

Особое значение имеет развитие инновационных технологий. Применение искусственного интеллекта, геоинформационных систем и автоматизированного экологического контроля позволяет существенно повысить эффективность управления природными ресурсами. Цифровизация экологического мониторинга способствует повышению прозрачности экологической политики и оперативности принятия решений [4].

Не менее важным направлением является формирование экологической культуры общества. Повышение экологической грамотности населения способствует рациональному использованию природных ресурсов и формированию ответственного отношения к окружающей среде.

Таким образом, эффективное управление водными ресурсами требует комплексного подхода, объединяющего экологические, экономические и технологические механизмы устойчивого развития.

Заключение

В результате исследования установлено, что изменение климата оказывает значительное влияние на состояние водных ресурсов и экологическую безопасность. Основными последствиями климатических изменений являются сокращение запасов пресной воды, ухудшение качества водных ресурсов и рост экологических рисков.

Исследование показало необходимость совершенствования системы управления водными ресурсами на основе современных экологических технологий и принципов устойчивого развития. Важную роль в повышении эффективности водопользования играют цифровой экологический

мониторинг, инновационные водосберегающие технологии и модернизация инфраструктуры.

Для обеспечения экологической устойчивости необходимо усиление международного сотрудничества, совершенствование экологического законодательства и внедрение комплексных программ рационального использования водных ресурсов. Реализация данных мер позволит снизить негативное влияние климатических изменений и обеспечить устойчивое развитие общества в условиях экологической нестабильности.

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ТЕНДЕНЦИИ И ПЕРСПЕКТИВЫ РАЗВИТИЯ ЦИФРОВОГО МАРКЕТИНГА

Аннотация: *Статья раскрывает перспективы развития цифрового маркетинга в условиях стремительной цифровизации и изменяющихся потребительских ожиданий. Рассматриваются ключевые тенденции, включая усиление роли данных и персонализации, внедрение искусственного интеллекта, расширение омниканальности и формирование цифровых экосистем. Особое внимание уделяется тому, как эти процессы преобразуют маркетинговые стратегии и изменяют формат взаимодействия между брендами и аудиторией.*

Ключевые слова*: цифровой маркетинг; персонализация; first-party data; искусственный интеллект; предиктивная аналитика; омниканальность; цифровые экосистемы; Privacy-first; регуляторные требования; потребительское поведение.*

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DIGITAL MARKETING TRENDS AND PROSPECTS

Abstract*: This article explores the prospects for digital marketing development in the context of rapid digitalization and changing consumer expectations. Key trends are examined, including the increasing role of data and personalization, the introduction of artificial intelligence, the expansion of omnichannel marketing, and the formation of digital ecosystems. Particular attention is paid to how these processes are transforming marketing strategies and changing the format of interaction between brands and audiences.*

Keywords*: digital marketing; personalization; first-party data; artificial intelligence; predictive analytics; omnichannel marketing; digital ecosystems; privacy-first; regulatory requirements; consumer behavior.*

Перспективы развития цифрового маркетинга продолжают оставаться предметом научного и практического интереса, поскольку изменение технологической среды, трансформация поведения потребителей и усложнение конкурентных условий формируют качественно новую логику коммуникации между бизнесом и аудиторией. В последние годы цифровой маркетинг перестал восприниматься исключительно как инструмент продвижения и превратился в стратегический механизм, влияющий на бизнес-модели компаний, структуру спроса, эффективность распределения ресурсов и характер взаимодействия с рынком. Поскольку цифровая среда становится доминирующим пространством социального и экономического обмена, актуальность исследования перспектив её развития определяется не только скоростью технологических изменений, но и их системным влиянием на принципы построения маркетинговых стратегий. В этом контексте важным становится анализ ключевых тенденций, определяющих будущую динамику отрасли, включая рост роли данных, расширение применения искусственного интеллекта, изменение нормативных требований, смещение акцентов в потребительских ожиданиях и формирование новых моделей цифрового поведения.

Таблица 1. Глобальный индекс цифровизации (GDI) 2024

Глобальный индекс цифровизации (GDI) 2024			
№	**СТРАНЫ**	**РЕЙТИНГ**	**ГРУППА**
1	США	78.8	Лидеры
2	Сингапур	76.1	Лидеры
3	Швеция	74.5	Лидеры
4	Финляндия	73.0	Лидеры
5	Дания	71.8	Лидеры
6	Швейцария	71.4	Лидеры
7	Нидерланды	69.7	Лидеры
8	Китай	69.2	Лидеры
9	Ирландия	68.1	Лидеры
10	Австралия	67.6	Лидеры
11	Великобритания	66.8	Лидеры
12	Новая Зеландия	65.6	Лидеры
13	Норвегия	64.9	Лидеры
14	Германия	63.4	Лидеры
15	Франция	62.2	Лидеры
16	ОАЭ	61.4	Лидеры
17	Канада	61.3	Лидеры
18	Бельгия	60.5	Лидеры
18	Южная Корея	60.5	Лидеры
20	Япония	58.8	Лидеры

21	Люксембург	58.0	Лидеры
22	Австрия	57.3	Лидеры
23	Саудовская Аравия	54.4	Внедряющие
23	Португалия	54.4	Внедряющие
25	Испания	54.3	Внедряющие
26	Эстония	54.1	Внедряющие
27	Италия	50.2	Внедряющие
28	Малайзия	49.9	Внедряющие
28	Греция	49.9	Внедряющие
30	Чили	49.5	Внедряющие
31	Чехия	49.1	Внедряющие
32	Румыния	49.0	Внедряющие
33	Венгрия	48.9	Внедряющие
34	Литва	48.7	Внедряющие
35	Словения	48.1	Внедряющие
36	Польша	47.8	Внедряющие
37	Таиланд	47.2	Внедряющие
38	Хорватия	46.7	Внедряющие
39	Болгария	46.5	Внедряющие
40	Бразилия	44.8	Внедряющие
41	Бахрейн	44.7	Внедряющие
42	Словакия	43.7	Внедряющие
43	ЮАР	43.4	Внедряющие
44	Кувейт	43.0	Внедряющие
45	Сербия	42.2	Внедряющие
46	Оман	41.7	Внедряющие
47	Турция	41.4	Внедряющие
48	Индия	40.3	Внедряющие
49	Колумбия	39.9	Внедряющие
50	Мексика	39.6	Внедряющие
51	Перу	38.7	Внедряющие
52	Уругвай	38.6	Внедряющие
53	Вьетнам	36.7	Начинающие
54	Аргентина	36.5	Начинающие
55	Коста-Рика	35.4	Начинающие
56	Филиппины	34.9	Начинающие
57	Марокко	34.3	Начинающие
58	Казахстан	33.2	Начинающие
59	Индонезия	33.1	Начинающие
60	Египет	32.7	Начинающие

60	Узбекистан	32.7	Начинающие
62	Тунис	32.6	Начинающие
63	Эквадор	32.4	Начинающие
64	Иордания	32.2	Начинающие
65	Кения	32.0	Начинающие
66	Азербайджан	31.6	Начинающие
67	Доминиканская Республика	30.9	Начинающие
68	Пакистан	28.5	Начинающие
69	Алжир	28.4	Начинающие
70	Боливия	28.3	Начинающие
71	Ботсвана	27.5	Начинающие
71	Гана	27.5	Начинающие
73	Уганда	27.4	Начинающие
74	Нигерия	27.3	Начинающие
75	Намибия	27.1	Начинающие
76	Бангладеш	26.5	Начинающие
77	Танзания	25.3	Начинающие

Таблица 1 отражает результаты Глобального индекса цифровизации 2024 года (GDI), в рамках которого оценены 77 стран по уровню цифрового развития компанией Huawei Technologies Co., Ltd. в сотрудничестве с International Data Corporation (IDC). Представленные данные включают рейтинговую позицию государств, их итоговый показатель индекса, а также принадлежность к одной из трёх категорий: «лидеры», «внедряющие» и «начинающие». Такое распределение позволяет классифицировать страны в зависимости от зрелости цифровой инфраструктуры, степени интеграции цифровых технологий в экономические и социальные процессы, а также уровня инновационной активности. Категория «лидеры» объединяет государства с наиболее развитой цифровой экосистемой, высокими показателями доступности и качества цифровых услуг, широким внедрением технологий искусственного интеллекта и зрелой нормативно-правовой базой. Страны этой группы демонстрируют устойчивую взаимосвязь между цифровизацией, экономическим ростом и конкурентоспособностью, что подтверждает роль цифровых решений как стратегического ресурса развития. Группа «внедряющие» включает страны, находящиеся на этапе активного расширения цифровых сервисов и модернизации инфраструктуры. Для данной категории характерны неоднородные темпы прогресса, обусловленные различиями в уровне инвестиций, цифровой грамотности населения и институциональной поддержке. Однако эти государства демонстрируют стабильную положительную динамику и потенциал перехода в более высокую категорию при условии продолжения цифровых реформ.

Категория «начинающие» представлена странами, где цифровая трансформация находится на первоначальном этапе. Их показатели отражают ограниченность инфраструктурных ресурсов, более низкий уровень доступа к цифровым услугам и начальную фазу внедрения инноваций. Вместе с тем данный сегмент обладает значительным потенциалом роста: расширение государственных программ цифровизации, развитие телекоммуникационной сети и повышение цифровой грамотности могут существенно улучшить их позиции в будущем.

Отдельного внимания заслуживает положение Республики Узбекистан в структуре Глобального индекса цифровизации 2024 года. Согласно данным рейтинга Huawei GDI, страна относится к группе «начинающих» и имеет показатель 32,7, что отражает раннюю стадию формирования национальной цифровой экосистемы при наличии выраженного потенциала роста. Данные результаты следует рассматривать не изолированно, а в контексте государственных реформ, инициированных после принятия Указа Президента Республики Узбекистан от 5 октября 2020 года № УП-6079, утвердившего Стратегию «Цифровой Узбекистан-2030». Реализация предусмотренных стратегией мер — увеличение уровня интернет-покрытия, внедрение более 400 информационных систем, развитие сети IT-парков, цифровизация образования и государственного управления, а также подготовка кадров в рамках программы «Один миллион программистов» — создала предпосылки для системного повышения цифровой готовности страны. Позиция Узбекистана в глобальном рейтинге отражает начальный, но поступательный этап цифровой трансформации, основанный на институционально закреплённых реформах и расширении цифровой инфраструктуры. Дальнейшая реализация стратегических программ, механизмов координации и нормативных изменений, предусмотренных Указом, рассматривается как ключевой фактор усиления конкурентных позиций государства и потенциала перехода в более высокую категорию цифрового развития в международных сравнениях.

Кроме этого, значительный интерес вызывает анализ иных факторов. Одним из ключевых факторов, определяющих перспективы цифрового маркетинга, является переход от фрагментарного использования технологий к комплексной интеграции данных и аналитических инструментов в управленческие процессы. На протяжении длительного периода цифровой маркетинг развивался преимущественно в рамках операционных задач, таких как размещение рекламы, ведение социальных сетей или анализ метрик вовлечённости. Однако накопление больших массивов информации, доступ к вычислительным мощностям и развитие алгоритмов машинного обучения привели к изменению роли маркетинга, превратив его в функцию, обеспечивающую прогнозирование и моделирование поведения аудитории. Такой переход позволяет компаниям не просто реагировать на изменения спроса, но и предвосхищать их, что существенно повышает стратегическую

устойчивость. Например, персонализированные рекомендательные системы, используемые крупными цифровыми платформами, демонстрируют, что прогнозная аналитика способна формировать предпочтения и увеличивать интенсивность потребления, однако данная тенденция начинает распространяться и на традиционные отрасли, включая розничную торговлю, банковский сектор и сферу услуг. В перспективе развитие предиктивных моделей станет одним из ведущих направлений цифрового маркетинга, поскольку способность работать с вероятностными сценариями будет определять не только эффективность продвижения, но и конкурентные позиции компаний.

Параллельно усиливается значение персонализации, которая перестаёт быть инструментом повышения эффективности коммуникаций и превращается в базовый принцип взаимодействия с потребителем. Современные пользователи ожидают индивидуального подхода, учитывающего контекст, поведенческие особенности, историю взаимодействия и динамику потребностей. Однако перспективы персонализации будут определяться новым этапом регулирования, связанным с ограничениями на использование сторонних cookies[61] и усилением прав потребителей на контроль над персональными данными. В данном случае развитие цифрового маркетинга будет зависеть от перехода к модели first-party data[62], предполагающей сбор и обработку информации напрямую, без посредников. Компании, выстраивающие подобную стратегию, получают возможность повышать точность сегментации и увеличивать доверие аудитории, поскольку прозрачность обработки данных становится частью ценностного предложения бренда. Одним из практических примеров такого подхода является использование программ лояльности, которые позволяют формировать обменную модель, при которой пользователь добровольно предоставляет данные в обмен на персонализированные преимущества. Данный вектор будет усиливаться на фоне роста цифровой грамотности, что предполагает необходимость формирования этически устойчивых маркетинговых практик.

Следующим значимым направлением развития цифрового маркетинга выступает расширение применения искусственного интеллекта, который постепенно переходит от автоматизации отдельных процессов к выполнению комплексных аналитических и творческих задач. Использование ИИ позволяет компаниям анализировать большие массивы неструктурированных данных, выявлять скрытые закономерности и формировать рекомендации в реальном времени, что существенно повышает точность управленческих решений. В ближайшие годы ожидается дальнейшее формирование

[61] **Cookies** — это небольшие файлы данных, которые сохраняются на устройстве пользователя при посещении сайта.

[62] **First-party data** — данные, которые компания собирает напрямую от клиента (например, через сайт, приложение или программу лояльности), без сторонних источников.

автономных маркетинговых систем, способных самостоятельно адаптировать коммуникационные стратегии, прогнозировать эффективность каналов и перераспределять бюджеты без участия человека. Кроме того, развитие генеративных технологий влияет на процесс создания контента, поскольку позволяет ускорять производство текстовых, визуальных и аудио-материалов, одновременно повышая их вариативность и адаптивность к разным сегментам аудитории. Несмотря на распространённое мнение о технологическом риске для креативных профессий, ИИ, вероятнее всего, не заменит специалиста, а трансформирует его роль, поскольку стратегические, ценностные и этические решения останутся в зоне ответственности человека. Таким образом, перспективы цифрового маркетинга будут связаны не просто с автоматизацией, но с интеграцией интеллектуальных систем в структуру принятия решений, что приведёт к изменению профессиональных компетенций и модели взаимодействия между технологиями и специалистами.

Наряду с этим существенное влияние на развитие цифрового маркетинга оказывает изменение потребительского поведения, характеризующееся размыванием границ между онлайн и офлайн пространством, ростом ожиданий в отношении скорости и удобства, а также снижением толерантности к навязчивым коммуникациям. Современный потребитель стремится минимизировать временные и когнитивные издержки при выборе товара, что приводит к формированию спроса на бесшовные модели взаимодействия, основанные на омниканальности[63]. Важным фактором, определяющим перспективы развития цифрового маркетинга, является дальнейшее расширение омниканальности, которая перестает восприниматься как технологическая инновация и становится стандартом взаимодействия. В условиях, когда пользователи свободно перемещаются между устройствами и каналами, компании вынуждены обеспечивать полную синхронизацию данных, унификацию клиентского опыта и устранение разрывов в коммуникации. Будущее развитие омниканальности будет связано с интеграцией биометрической идентификации, расширением применения геоаналитики и использованием сенсорных данных, что позволит создавать адаптивные сценарии взаимодействия, изменяющиеся в зависимости от контекста. Например, некоторые розничные сети уже внедряют системы, позволяющие автоматически распознавать зарегистрированного пользователя в физической точке, предлагать ему индивидуальные рекомендации и ускорять процесс обслуживания. В перспективе подобные решения могут распространиться на различные сферы, включая транспорт, медицину и образование, что подтвердит тенденцию к стиранию границ между цифровым и физическим пространством. Усиление омниканальности

[63] **Омниканальность** — интеграция всех каналов общения (онлайн и офлайн) в единую систему, чтобы клиент получал одинаковый опыт при любом взаимодействии с брендом

приведет к формированию более глубокого анализа клиентского пути, поскольку компании будут способны отслеживать не только результат покупки, но и последовательность действий, влияющих на принятие решения. Формирование подобных моделей демонстрирует, что перспективы цифрового маркетинга связаны не с увеличением числа каналов, а с их объединением в единую систему, обеспечивающую непрерывность и предсказуемость клиентского пути.

Особое значение в структуре будущего цифрового маркетинга приобретает изменение роли контента и медиапотребления. Сокращение временных рамок внимания, рост популярности коротких видеоформатов и повышение уровня визуальной культуры требуют переосмысления коммуникационных стратегий. Компании вынуждены конкурировать не только с другими брендами, но и с широким спектром информационных потоков, что приводит к смещению фокуса от рекламных сообщений к созданию ценностного контента, основанного на информировании, обучении и эмоциональном вовлечении. В условиях перенасыщения медиапространства устойчивость бренда определяется не частотой контактов, а способностью формировать доверие, поддерживать диалог и демонстрировать прозрачность. В этом контексте перспективы цифрового маркетинга включают развитие устойчивых цифровых сообществ, в которых пользователь выступает не объектом воздействия, а активным участником коммуникации. В ряде случаев подобная модель реализуется через платформы, позволяющие аудитории влиять на создание продуктов, предоставляя обратную связь и формируя коллективную ценность. Данная тенденция будет усиливаться, поскольку потребители стремятся взаимодействовать с брендами, соответствующими их мировоззренческим установкам, что приводит к росту значимости аутентичности и социальной ответственности.

Дополнительным направлением трансформации цифрового маркетинга является изменение нормативно-правовой среды, связанной с защитой персональных данных, регулированием использования алгоритмов и управлением цифровыми платформами. Введение новых законодательных требований, таких как ограничения на обработку информации, правила согласия на сбор данных и контроль алгоритмической прозрачности, будет определять возможности использования аналитических инструментов и формировать новые стандарты ответственного маркетинга. Поскольку пользователи становятся более чувствительными к вопросам конфиденциальности, компании вынуждены внедрять механизмы открытого информирования, повышать уровень безопасности и демонстрировать этичность процессов работы с данными. Это приводит к формированию доверия как стратегического ресурса, который становится не менее значимым, чем технологические преимущества. В перспективе нормативные изменения будут стимулировать развитие инноваций в сфере анонимизации

данных, новых форм идентификации аудитории и методов анализа, не нарушающих прав потребителей, что создаст условия для перехода к устойчивым и социально ориентированным моделям цифрового взаимодействия.

Перспективы дальнейшего развития цифрового маркетинга во многом определяются усложнением конкурентной среды, усилением роли данных как стратегического ресурса и переходом компаний к долгосрочным моделям взаимодействия, основанным на предсказуемости поведения аудитории и высокой степени устойчивости коммуникаций. Поскольку цифровая экономика становится доминирующим форматом функционирования бизнеса, маркетинговая деятельность перестает рассматриваться как изолированный элемент продвижения и интегрируется в ключевые процессы управления, включая разработку продукта, ценообразование, логистику и обслуживание клиентов. Это приводит к формированию новой парадигмы, в которой маркетинг получает функцию координации информационных потоков и превращается в механизм, обеспечивающий согласованность стратегических решений. Дальнейшее развитие будет зависеть от способности компаний переходить от реактивных моделей к системам предиктивного управления, что требует расширения аналитических возможностей, повышения качества данных и внедрения интеллектуальных инструментов моделирования.

Одним из важнейших направлений будущего развития выступает формирование целостных цифровых экосистем, которые обеспечивают не просто коммуникацию между брендом и пользователем, а непрерывное присутствие компании в процессе потребления. В отличие от традиционных бизнес-моделей, экосистемный подход предполагает объединение сервисов, данных и точек контакта в единую структуру, в которой пользователь получает комплексное решение, а не отдельный продукт. В результате повышается вовлеченность аудитории, сокращается вероятность переключения на конкурентов и формируется длительная зависимость от платформы. Подобный принцип уже используется в крупных технологических компаниях, однако в перспективе он станет доступным и для среднего бизнеса благодаря развитию модульных решений, снижению барьеров цифровой интеграции и распространению облачных технологий. В долгосрочной перспективе экосистемность приведет к тому, что маркетинговые стратегии будут ориентированы не на продвижение отдельных предложений, а на формирование ценности, распределенной во времени, что потребует изменения метрик эффективности и отказа от краткосрочных показателей в пользу оценки жизненного цикла клиента.

Параллельно усиливается значение моделей, основанных на создании и использовании собственных данных, поскольку переход к экономике privacy-

first[64] становится необратимым. Ограничение внешних cookies и растущие требования к безопасности приводят к необходимости развивать инфраструктуру сбора информации напрямую через цифровые каналы, программы лояльности и персонализированные сервисы. Компании, не обладающие собственными данными, будут сталкиваться с риском потери точности таргетинга, увеличением стоимости привлечения аудитории и снижением результативности коммуникаций. В связи с этим возрастает роль долгосрочного доверия, которое становится экономической категорией, определяющей доступность информации и глубину взаимодействия. В качестве примера можно привести использование адаптивных моделей управления персональными предложениями в банковском секторе, где индивидуализированные рекомендации формируются не только на основе транзакционной активности, но и на основе прогнозных сценариев вероятных потребностей. Подобные решения демонстрируют, что будущее цифрового маркетинга будет связано не с расширением объемов данных, а с повышением их качества, структурированности и согласия пользователя на их использование.

Следующим значимым направлением развития становится расширение автоматизации, которая меняет структуру маркетинговых процессов и перераспределяет функциональные роли. Если на предыдущем этапе автоматизация была сосредоточена на механических задачах, таких как планирование публикаций или управление ставками, то в ближайшие годы она будет касаться сложных аналитических функций, включая прогнозирование сегментов, оценку вероятности отклика и оптимизацию распределения бюджета в реальном времени. Это приведет к уменьшению доли рутинных операций и смещению компетенций специалистов в сторону стратегического анализа, интерпретации данных и управления цифровыми инструментами. Кроме того, автоматизация повысит скорость адаптации кампаний к изменению внешних условий, что станет ключевым фактором в условиях нестабильных рынков и высокой динамики потребительских предпочтений. В то же время необходимо учитывать, что рост автоматизации требует формирования новых этических норм, поскольку алгоритмы могут влиять на поведение аудитории и принимать решения, не имея контекстуальной оценки. В перспективе регуляторные органы будут уделять больше внимания алгоритмической прозрачности, что приведет к обязательному раскрытию логики рекомендаций и устранению дискриминационных факторов.

Наряду с технологическими факторами перспективы цифрового маркетинга будут зависеть от социальных изменений, связанных с ростом осознанности, ожиданий прозрачности и интереса к устойчивому развитию.

[64] **Privacy-first** — подход, при котором защита персональных данных ставится на первое место и влияет на методы сбора и использования информации.

Современные пользователи оценивают бренды не только по качеству продукта, но и по соответствию ценностным ориентирам, включая экологическую ответственность, этичность и социальную значимость. В результате маркетинг будущего будет строиться не вокруг убеждения, а вокруг демонстрации соответствия внутренней политики компании внешним заявлениям. Это потребует внедрения доказательной коммуникации, основанной на подтвержденных данных, а не на декларативных утверждениях. Компании, не способные поддерживать прозрачность и подлинность, будут сталкиваться с риском потери доверия, даже при наличии технологических преимуществ. В долгосрочной перспективе бренды, выстраивающие устойчивые отношения, получат преимущество, поскольку доверие станет ключевым активом, определяющим доступ к данным и способность поддерживать длительное присутствие на рынке.

В завершении, можно отметить, что перспективы цифрового маркетинга формируются под влиянием комплексных изменений, включающих технологические инновации, новые модели потребительского поведения и усиление требований к прозрачности и ответственности. Будущее отрасли будет зависеть от способности компаний интегрировать интеллектуальные инструменты, развивать собственные данные, формировать непрерывный клиентский опыт и поддерживать долгосрочное доверие аудитории, что определит устойчивость конкурентных позиций в условиях цифровой экономики.

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ТЕХНОЛОГИЯ УКРЕПЛЕНИЯ СЛОЖНЫХ ГЕОЛОГИЧЕСКИХ ПЛАСТОВ ПРИ БУРЕНИИ НЕФТЕГАЗОВЫХ СКВАЖИН

Аннотация:*В статье представлены результаты практических работ по эффективному бурению солевых пластов, образующих агрессивную среду, и качественному укреплению стенок скважин. Исследованы виды, свойства и параметры томманажных растворов, применяемых для геологически сложных солевых пластов. В связи с этим работы, проведенные для этих пластов, обеспечивают успешное протекание процесса укрепления скважин, разработан состав модифицированного томпанажного раствора "Зола-М1" на основе местного сырья и промышленных отходов, а также приведены практические решения по его применению в сложных пластах.*

Ключевые слова: *тампонажные растворы, укрепление скважин, водоцементный показатель, цементировочная головка, затвердевание раствора, зольные смолы, смесительная полость, наклонные и горизонтальные скважины, расход жидкости, аварийные осложнения, реологическая характеристика, динамическое напряжение сдвига.*

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TECHNOLOGY FOR STRENGTHENING COMPLEX GEOLOGICAL FORMATIONS DURING OIL AND GAS WELL DRILLING

Annotation:*The article presents the results of practical work on the effective drilling of salt layers that form an aggressive environment and the qualitative reinforcement of well walls. The types, properties, and parameters of tommanage solutions used for geologically complex salt beds have been investigated. In this regard, the work performed for these strata ensures the successful execution of the well reinforcement process; the composition of the modified "Zola-M1" tamping mortar based on local raw materials and industrial waste has been developed, and practical solutions for its application in complex strata have been presented.*

Key words: *cement slurries, well strengthening, water-cement index, cementing head, solution hardening, ash resins, mixing cavity, inclined and horizontal wells, fluid flow rate, emergency complications, rheological characteristics, dynamic shear stress.*

Введение. Бурение соленосных пластов является одним из сложных технологических процессов. При бурении соленосных пластов основные показатели — параметры бурового раствора, режим бурения, а также буровое оборудование — постоянно находятся под контролем.

Несвоевременное выполнение буровых работ в соответствии с планом может привести к возникновению осложнений, оказывающих негативное влияние на процесс бурения. Это, в свою очередь, приводит к затягиванию сроков буровых работ, увеличению материальных затрат, а также возникновению аварийных ситуаций и осложнений.

Анализ поисковых, разведочных и эксплуатационных скважин, пробурённых в Узбекистане за последние 20 лет, показывает, что осложнения и аварийные ситуации в основном происходили именно в процессе бурения сложных пластов (см. рис. 1).

Согласно анализу, из 250 пробурённых за данный период скважин в 241 случае осложнения возникали в процессе бурения сложных и глинистых пластов. Наблюдались прихваты бурильных труб и обсадных колонн, а также заклинивание обсадных труб. Изучение причин данных явлений показывает, что они связаны с наличием соленосных пластов и сложными геологическими условиями.

Согласно этим данным, более половины осложнений, возникающих при бурении соленосных и сложных пластов, напрямую связаны с качеством бурового раствора и правильностью управления его параметрами. (Рис. 1).

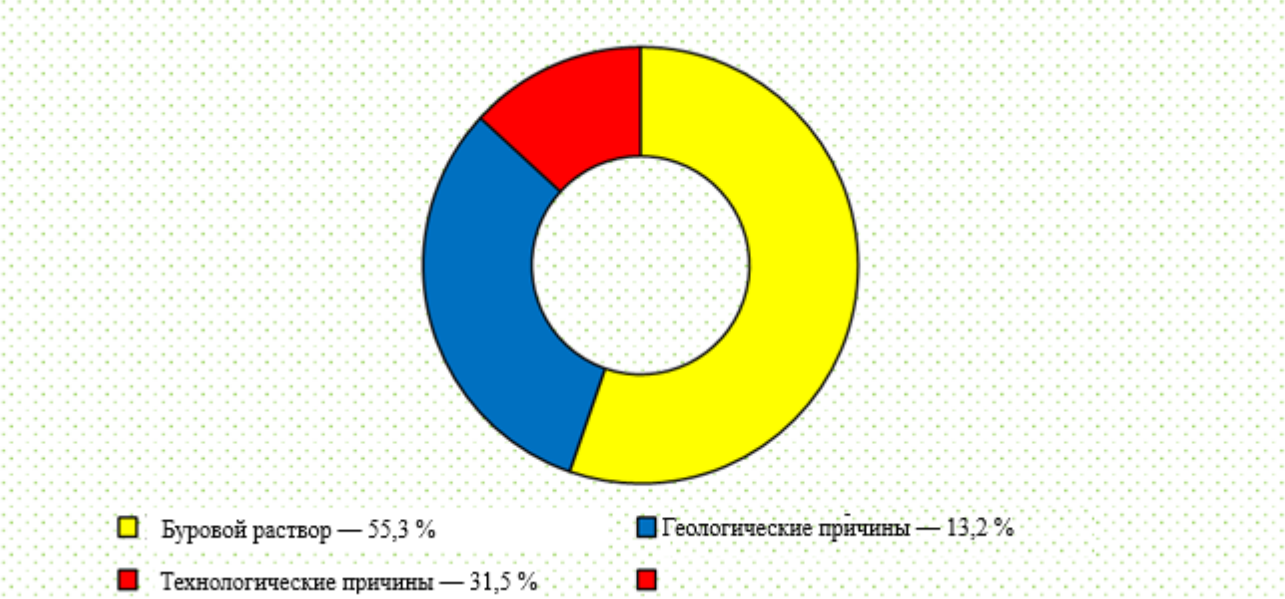


Рис. 1. Распределение причин возникновения осложнений при бурении сложных соленосных пластов

Анализ показывает, что осложнения, приводящие к прихвату бурильных труб на забое скважины, а также к возникновению открытых фонтанов при бурении сложных пластов, распределяются по следующим трём основным факторам:

Осложнения, связанные с буровыми растворами – 63 случая (55,3 %).

Несвоевременное заполнение скважины буровым раствором в процессе подъёма бурильных труб. Данное обстоятельство приводит к снижению давления в скважине, в результате чего возрастает риск смещения или прихвата бурильных труб.

Основная часть. При креплении нефтяных и газовых скважин применяются обычный портландцемент, специальные тампонажные материалы для утяжеления, облегчённые растворы, а также тампонажные смеси, используемые в условиях высоких температур.

В настоящее время специальные тампонажные материалы для сложных пластов выпускаются в ограниченном количестве и имеют высокую стоимость. Поэтому потребность буровых предприятий в портландцементах с различными добавками остаётся очень высокой. Для научного решения данной проблемы исследователями Каршинского государственного технического университета совместно с буровыми организациями были проведены научно-практические работы по качественному бурению и надёжному креплению сложных пластов.

С целью обеспечения качественного цементирования сложных пластов, а также предотвращения возможных осложнений, в лаборатории АО «Koson neftgaz quduqlarini sinash» были проведены научно-исследовательские работы по созданию модифицированного оптимального варианта тампонажного раствора.

«Тампонажный раствор (в нефтегазовой промышленности) — это специальная твердеющая жидкость, применяемая при бурении и освоении скважин для укрепления стенок скважины, изоляции пластов и герметизации затрубного пространства».

При создании тампонажного раствора на основе местного сырья, а также путём вторичной переработки промышленных отходов, был разработан состав модифицированной модели тампонажного раствора «Zola-M1» (рис. 2).

Рис. 2. Модифицированный тампонажный раствор «Zola-M1»

При создании модифицированного тампонажного раствора «Zola-M1» первоначально были изучены потребности рынка. По раствору Zola-M1 были проведены лабораторные исследования, в ходе которых в лабораторных условиях изучались основные свойства тампонажного раствора: плотность, вязкость, прочность, твёрдость, растекаемость и консистенция.

При разработке тампонажного раствора Zola-M1 были тщательно исследованы интервалы пластов, требующих крепления скважины. Были определены интервалы применения в зависимости от глубины скважины, а также устойчивости к температуре и давлению. После этого было изучено влияние раствора на существующие горные породы, температуру, давление, влажность и коэффициенты сжимаемости пластов.

Тампонажный раствор «Zola-M1» при креплении скважин обеспечивает следующие решения:

— обеспечивается длительная и безаварийная эксплуатация нефтяных и газовых скважин за счёт надёжного цементирования скважины;

— при цементировании скважин на последующих этапах ограничивается поступление воды из пласта на забой скважины;

— предотвращается негативное воздействие горных пород пласта на тампонажные растворы;

— обеспечивается долговременная защита обсадных труб от коррозии;

— эффективность цементирования определяет экономическое и технологическое превосходство данного раствора по сравнению с существующими тампонажными смесями.

При разработке модифицированного тампонажного раствора «Zola-M1» была установлена экономическая эффективность предварительной переработки местных промышленных отходов. Добавки такого типа промышленных отходов являются технологичными, недорогими и практически бездефектными — это шламы, различные виды топливной золы, особенно золы-уноса ГРЭС, обладающие высокой дисперсностью и не требующие сушки, обжига и измельчения.

Преимуществами золошлаковых отходов являются химический и минералогический состав, близкий к составу цемента, а также большая удельная поверхность сферических частиц, что позволяет вводить добавки в значительном количестве при низком водосмесительном отношении.

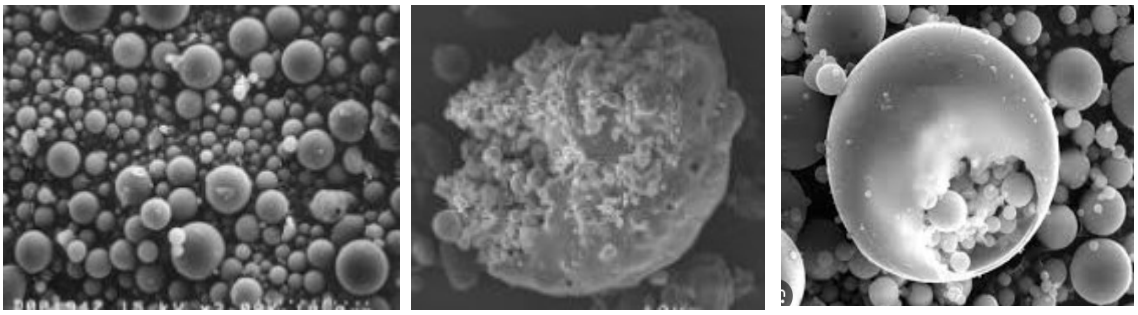


Рис. 3. Состав модифицированного тампонажного раствора «Zola-M1».

Зола ГРЭС (государственной районной электростанции) — золошлаковые отходы, образующиеся при сжигании угля, являются одним из основных видов промышленных отходов.

Сферические частицы (Cenospheres / Plerospheres) в тампонажном растворе действуют подобно «шариковым подшипникам», значительно повышая текучесть (подвижность) раствора.

Пористые и неровные частицы представляют собой остатки неполностью сгоревшего угля (углерода), которые обладают высокой водопоглощающей способностью.

В основном они подразделяются на две группы: мелкая летучая зола, поднимающаяся в воздух, и крупный шлак, оседающий на дне котла.

Состав золошлаковых отходов. Предлагаемая к использованию зола ГРЭС (коллоидный раствор) обладает высокой удельной поверхностью — 2570 см²/г, плотностью 2,4 г/см³ и содержит (%): SiO_2 — 53,12; Al_2O_3 — 16,96; Fe_2O_3 — 10,89; CaO — 2,69; MgO — 0,98; SO_3 — 0,14; TiO_2 — 0,61; K_2O + Na_2O — 2,97.

При низком содержании CaO зола обладает низкой активностью и при очень низких температурах (до 50 °C) служит наполнителем цементной смеси.

Воздействие на окружающую среду (проблемы): для хранения отходов требуются очень большие территории (золоотвалы). Загрязнение воздуха и воды: при сильном ветре мелкодисперсные частицы поднимаются в воздух, образуя пыль. Дождевые воды могут способствовать проникновению тяжёлых металлов, содержащихся в золе, в грунтовые воды.

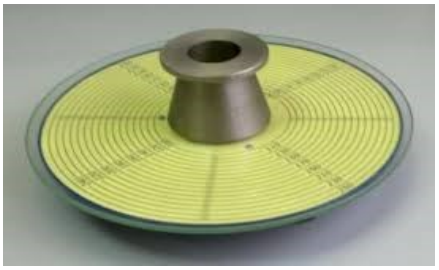
Данные отходы могут наносить вред экологии, однако в строительстве и других отраслях они рассматриваются как весьма ценное вторичное сырьё

Рис. 4. Химическое обоснование модификации «Zola-M1»..

Лабораторные исследования и переработка (использование)

Зола ГРЭС была испытана в лабораторных условиях и активно использовалась в следующих направлениях: мелкодисперсная зола добавлялась в цемент в качестве гидравлической добавки. Это позволило повысить прочность бетона и снизить его себестоимость. Также было установлено, что добавление золы в буровой раствор при укреплении стенок скважины даёт положительный эффект.

В лабораторных условиях были изучены возможности применения модифицированного тампонажного раствора «Zola-M1» в качестве наполнителя для растворов, текучесть которых определяется с помощью конуса АзНИИ.



5- Рис. АзНИИ Конус**.**

Стеклянная поверхность и внутренняя часть конуса были протёрты влажной тканью. Стеклянное основание было установлено строго в горизонтальном положении. Конус размещался в центре стеклянной поверхности. Подготовленный цементный раствор заливался в конус до его верхнего края..

Конус плавным и быстрым движением поднимался вертикально вверх. В результате раствор растекался по стеклянной поверхности в форме круга. После прекращения растекания с помощью линейки измерялись наибольший и наименьший диаметры полученного круга в двух взаимно перпендикулярных направлениях. Затем вычислялся средний диаметр.

Полученный результат — средний диаметр — принимался за показатель текучести цементного раствора (в см или мм). Показатель текучести составил 180–220 мм.

Консистенция — это процесс загустевания тампонажного раствора с течением времени. Увеличение густоты цементной смеси в состоянии покоя и её переход в полутвёрдое состояние считается начальной и конечной стадией схватывания. Время схватывания цементной смеси (раствора) измерялось с помощью «иглы Вика».

Стабильность — это свойство цементного раствора, при котором после его приготовления в течение 2 часов выделяется не более 2,5 % воды. Данный показатель измерялся с использованием мерного цилиндра.

Прочность цементного камня — это его способность сопротивляться изгибу, которая принимается за показатель прочности цементного камня. Для определения прочности цементного камня были изготовлены призмы размером 40×40×160 мм и 100×100×400 мм.

В течение первых 24 часов образцы выдерживались в водяной ванне. После этого их извлекали из форм и укладывали в один ряд на высоте 2 см над уровнем воды. Вода регулярно заменялась.

Водоотдача (водоотделение) — это выделение воды цементной смесью под высоким давлением. Смесь при давлении 7 МПа в течение 30 минут выделила 200 см³ воды.

Тампонажный цемент — плотность раствора «Zol-M1» в состоянии смешивания и растворения с портландцементом рассчитывается по следующей формуле:

$$\rho_{tam.aral} = (1+B)[(1-A-C)\rho_s + B/\rho_{suyuq} + A/\rho_{asktm} + C/\rho_{zol}]$$

где: B — водосмесительное отношение; A, C — массовые доли Zol-M1 и цемента в растворе соответственно; ρц, ρж, ρZol-M1 — соответственно плотности цемента, жидкой смеси и Zol-M1.

Для увеличения времени твердения тампонажных растворов был добавлен реагент НТФ (нитрил-триметилфосфоновая кислота). Расход реагента составил 0,05–0,1 % относительно массы цемента, при этом даже при температуре среды 250 °C он не терял своих свойств.

В таблице 1 приведены свойства тампонажных растворов, приготовленных с добавлением НТФ.

Как показывают результаты лабораторных исследований модифицированного тампонажного раствора Zola-M1 при различных процентных соотношениях, Zol-M1 является высокоэффективной облегчённой добавкой, которая не оказывает существенного влияния на время твердения и не требует значительного увеличения водосмесительного отношения.

Таблица 1

.

Параметры раствора Zol-M1

Содержание Zola-M1, %	**S: A**	**Плотность, г/см³**	**Текучесть, см**	**Время схватывания, ч-**		**Прочность на изгиб, МП**
				Нач	**Кон**	
		T =	22^0C	0,1		
0	0,	1,85	21	7-20	9-50	2,9
5	0,	1.7	20,5	7-20	9-55	
9	0,	1.6	19,5	7-30	10-	1,8
13,5	0,	1,5	18,5	8-00	10-	1,7
19	0,	1,4	17	7-50	9-40	1,4
35	0,	1,16	11	8-10	10-	0,6
0	0,	1,85	22,5	2-55	3-30	6,2
13,5	0,	1,5	19	3-00	4-00	4,2
19	0,	1,4	17	3-05	3-55	3,8
31,5	0,	1,22	15,5	3-10	4-15	3,5
50	0,	1,04	17,5	2-50	3-50	1,57
60	0,	0,96	17	3-00	4-00	0,6
* Через 2 суток, ** через 1 сутки.						

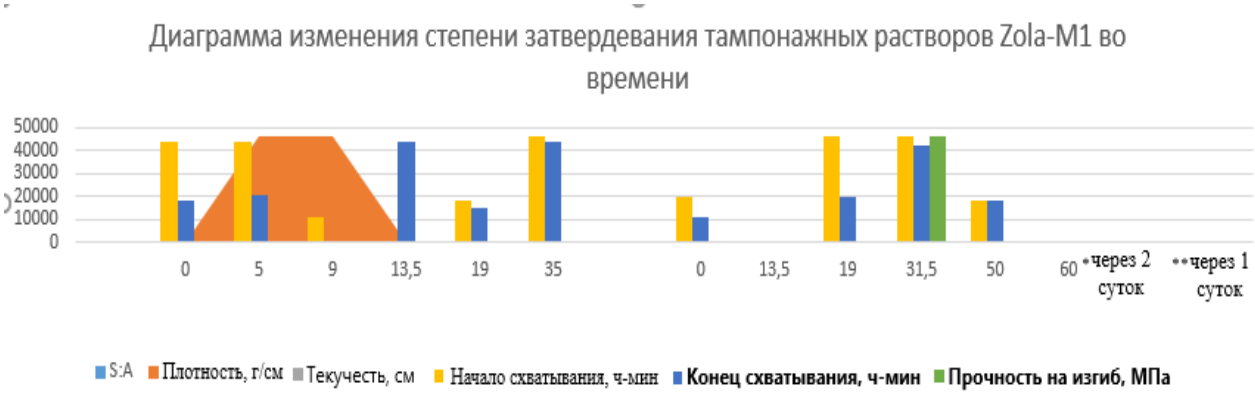


Рис. 6. Показатели затвердевания модифицированного тампонажного раствора Zola-M1 на глубине

При содержании Zol-M1 в количестве 35 % плотность смеси составляет 1,16 г/см³, а прочность цементного камня через 2 суток достигает 0,6 МПа.

Добавка Zol-M1 в количестве 50 % позволяет получать смесь с плотностью до 1,04 г/см³, что соответствует результатам, рассчитанным по формуле

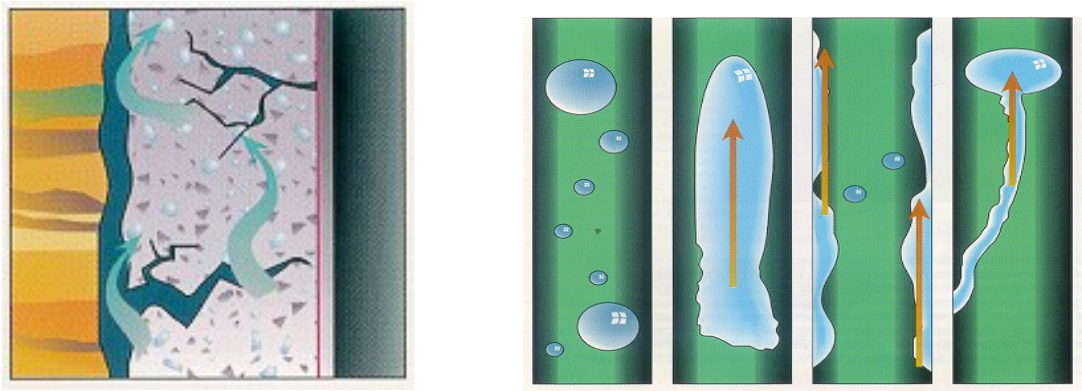


Рис. 8. Влияние цементного камня Zola-M1 на пласт

Химические реагенты могут одновременно изменять вязкость и реологические свойства тампонажных растворов.

Результат. Проведённые исследования позволили решить следующие задачи:

— на основе анализа ранее выполненных научно-исследовательских работ был оптимизирован процесс цементирования скважин;

— для цементирования скважин в сложных геологических условиях был научно обоснован и разработан точный состав тампонажного раствора Zola-M1;

— была модифицирована тампонажная смесь, применяемая для крепления нефтегазовых скважин Бухаро-Хивинского региона;

— были выбраны новые методы цементирования скважин и проведена оценка их технологических показателей.

Заключение: Использование модифицированного тампонажного раствора Zola-M1 позволяет не только экономить дорогостоящий цемент, но и снижать плотность раствора, уменьшать содержание свободной воды, повышать текучесть, снижать время загустевания и проницаемость сформированного цементного камня, а также повышать его коррозионную стойкость и адгезию к металлу.

При высоких температурах Zola-M1 сохраняет свою активность; содержащийся в его составе большой объём кремнезёма взаимодействует с гидроксидом кальция, гидросиликатами и гидроалюминатами, образуя гидрогранаты. В результате в основном снижается вязкость, повышаются термостойкость и прочность формирующегося цементного камня.

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СПОСОБЫ РАБОТЫ С ТЕРМИНАМИ И СПЕЦИАЛЬНЫМИ СЛОВАРЯМИ

Аннотация: *В данной статье представлены ключевые подходы к работе с лингвистической терминологией и специальными словарями на уроках русского языка. Особое внимание уделяется практическим методам, позволяющим учащимся не только запомнить, но и активно применять термины. Это достигается через анализ, сравнение, классификацию и выполнение практических заданий. Описываются приемы, помогающие понять значение и историю терминов, а также их роль в формировании у учащихся научных понятий и развитии их мыслительных способностей. Подчеркивается, что последовательная и системная работа с терминами на протяжении всего обучения является обязательной. Результаты исследования показывают, что применение различных методических приемов ведет к более глубокому пониманию предмета и развитию научного мышления.*

Ключевые слова: *лингвистические термины, терминология, обучение русскому языку, словарная работа, толковые словари, специальные словари, семантика, этимология, методы обучения, формирование понятий, анализ и синтез, классификация, развитие мышления, учебный процесс.*

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METHODS OF WORKING WITH TERMS AND SPECIALIZED DICTIONARIES

Annotation: *This article presents key approaches to working with linguistic terminology and specialized dictionaries in Russian language lessons. Special attention is paid to practical methods that enable students not only to memorize terms but also to actively use them. This is achieved through analysis, comparison, classification, and the completion of practical tasks. The paper describes techniques that help to understand the meaning and history of terms, as well as their role in*

forming scientific concepts in students and developing their thinking abilities. It is emphasized that consistent and systematic work with terms throughout the entire learning process is essential. The results of the study show that the use of various methodological approaches leads to a deeper understanding of the subject and the development of scientific thinking.

Keywords: *linguistic terms, terminology, teaching Russian language, vocabulary work, explanatory dictionaries, specialized dictionaries, semantics, etymology, teaching methods, concept formation, analysis and synthesis, classification, development of thinking, educational process.*

Введение

Лингвистическая терминология – важный аспект изучения русского языка. Термины должны систематически применяться на каждом уроке. Их активное освоение происходит через демонстрацию функциональности, что подразумевает понимание учащимися не только определений, но и практического применения терминов в языке и обучении. Формирование понятий у учащихся имитирует методологию научного познания. Этот процесс включает в себя этапы наблюдения, сравнения, сопоставления, анализа и синтеза информации. Далее, результаты этих когнитивных операций вербализуются: учащиеся формулируют выводы, которые затем закрепляются в виде определений. Окончательным шагом является освоение термина как точного языкового эквивалента сформированного понятия.

Использование толковых и специализированных словарей имеет существенное значение. Словарные статьи предоставляют богатый материал для построения разнообразных коммуникативных конструкций, что способствует более точному и грамотному выражению мыслей обучающимися. Типично, что в предложении термин функционирует как подлежащее, а его ключевые характеристики детализируются посредством сказуемого и второстепенных членов предложения. Для более эффективного усвоения материала рекомендуется группировать термины по соответствующим областям языкознания, например, фонетике, лексике, морфологии и синтаксису. Такой подход упорядочивает знания и делает процесс обучения более доступным. Применение лингвистических методов исследования при изучении языковых единиц помогает студентам развить уверенность в правильном использовании терминов. Важным направлением работы является выявление сходства и различий между терминами. Например, имена существительное, прилагательное и числительное объединяются общим понятием «имя» и имеют сходный способ изменения — склонение, тогда как глагол изменяется по спряжению. Такие сопоставления помогают глубже понять систему языка. Не менее ценным представляется установление общих смысловых основ терминов. Так, лексемы «синонимы», «антонимы», «омонимы» и «паронимы» имеют общий корень, отсылающий к понятию «имя». Подобный подход способствует более глубокому пониманию

значений терминов и упрощает их усвоение.

Терминология играет ключевую роль в систематизации знаний, группируя отдельные понятия под общими категориями. Так, например, введение термина "окончание" позволяет классифицировать совокупность слов, подверженных изменению. Это способствует формированию у обучающихся способности к выявлению закономерностей и общих характеристик языковых феноменов.

Для углубления и систематизации полученных знаний применяются методики, основанные на игровых и исследовательских форматах. К таким методикам относятся, в частности, задачи по соотнесению терминов с их дефинициями и участие в форматах викторин. Особую ценность представляют задания, требующие идентификации общего признака в ряде определений, поскольку они способствуют развитию аналитических способностей обучающихся. Систематизация знаний и формирование целостного представления о языке достигаются путем широкого использования перечисления терминов, сгруппированных по разделам языкознания, грамматическим категориям или языковым процессам.

Особое внимание уделяется изучению происхождения терминов. Многие лингвистические термины имеют греческие или латинские корни. Понимание этих корней (например, «лог» — слово, учение; «граф» — писать) помогает учащимся догадываться о значении терминов и развивает языковую догадку. Аналогично, анализ таких элементов, как «суффикс», «префикс», «постфикс», позволяет осознать их общее значение и функцию.

Исследование значений терминов представляет собой ключевой этап. Эти значения могут варьироваться по степени детализации, от лаконичных до пространных, однако их основная задача – точно передавать сущностные характеристики соответствующего понятия. Студенты могут опираться на примеры словарных дефиниций при формулировании собственных трактовок. Анализ термина сводится к выявлению его существенных признаков. Существенные признаки в логике – это те, что необходимы и достаточны для его отличия от других понятий. Эта работа развивает логическое мышление.

Терминологическая работа должна проводиться на всех этапах урока: при объяснении нового материала, закреплении и проверке знаний. Преподавателю важно так выстроить процесс, чтобы этот метод стал естественной частью обучения, не вызывая у студентов ощущения давления, и чтобы он эффективно дополнял другие формы работы. Домашние задания также должны включать элементы работы с терминами. Это может быть ведение словарей, составление определений, анализ значений слов. Запись терминов способствует развитию орфографических и произносительных навыков, а также укрепляет различные виды памяти.

Для лучшего усвоения терминологии, особенно иностранного происхождения, рекомендуется произносить ее вслух. Оптимальным является

сочетание аудиального восприятия с визуальным, например, путем чтения терминов с доски или из записей. Изучение семантики и этимологии терминов развивает мышление учащихся, помогая им выделять главное, устанавливать связи и обобщать. Это особенно актуально для заимствованных слов.

Иногда работа с термином начинается уже на этапе объявления темы урока. Исследование названия темы предоставляет обучающимся возможность предвосхитить содержание учебного материала и стимулирует их когнитивную активность. При освоении новой терминологии педагог прибегает к разнообразным методам обучения, включая разъяснение, диалог и нарратив, интегрируя их с аналитическими и синтетическими подходами. Так, например, деконструкция термина "орфография" на его составляющие элементы способствует более глубокому пониманию его семантики и закреплению в памяти. Для глубокого понимания и запоминания терминов, критически важно их последовательное применение в различных учебных сценариях: от произношения и записи до практического использования. Только так можно добиться их прочного усвоения.

Заключение

Закрепление материала также включает работу с терминами. Используются приёмы сопоставления, заполнения таблиц, составления схем. Например, сравнение видов связи в словосочетаниях (согласование, управление, примыкание) помогает лучше понять различия между ними. Таким образом, систематическое погружение в мир терминов открывает перед учащимися путь к более глубокому освоению знаний, обогащает их речь и развивает критическое мышление. Это позволяет им обрести уверенность в точности своих высказываний и сформировать научный взгляд на процесс изучения языка.

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О РАЗРЕШИМОСТИ ОДНОРОДНОЙ СИСТЕМЫ НЕКОТОРЫЙ ЧАСТИЧНО- ИНТЕГРАЛНЫХ УРАВНЕНИЙ СПЕЦИАЛЬНОГО ВИДА

Введение: *Изучение интегральных и частично-интегральных уравнений занимает центральное место в современном функциональном анализе и математической физике, находя применение в краевых задачах и спектральной теории операторов. Особую важность представляет класс задач о разрешимости однородных систем линейных уравнений с частично-интегральными операторами, где структура решений определяется детерминантами Фредгольма и взаимодействием нескольких спектральных параметров.*

Ключевые слова: *Однородная система, частично-интегральные уравнения, детерминант Фредгольма, вырожденное ядро, пространство $L_2(a,b)$ разрешимость, спектральные параметры, линейные интегральные операторы, нулевое решение, нетривиальное решение*

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ON THE SOLVABILITY OF A HOMOGENEOUS SYSTEM OF CERTAIN PARTIAL INTEGRAL EQUATIONS OF A SPECIAL TYPE

Introduction: *The study of integral and partial-integral equations occupies a central place in modern functional analysis and mathematical physics, with applications ranging from boundary value problems to operator spectral theory. A particularly important class of problems concerns the solvability of homogeneous systems of linear equations involving partial-integral operators, where the structure of solutions is governed by Fredholm determinants and the interplay of multiple spectral parameters.*

Keywords: *homogeneous system, partial-integral equations, Fredholm determinant, degenerate kernel, $L_2(a,b)$ space, solvability, spectral parameters, linear integral operators, zero solution, nontrivial solution.*

Расмотрим однородную систему линейных частично- интегралных уравнений вида

(1)

$$\begin{cases} f_0 + \lambda_1 \int_a^b a_1(t) f_1(t) dt = 0 \\ f_0 + f_1(x) + \lambda_2 a_2(x) \int_a^b a_2(t) f_1(t) dt + \lambda_3 a_3(x) \int_a^b a_3(t) f_2(x,t) dt = 0 \\ f_1(x) + f_2(x,y) + \lambda_4 a_4(x) \int_a^b a_4(t) f_2(t,y) dt + \lambda_5 a_5(y) \int_a^b a_5(t) f_2(x,t) dt = 0 \end{cases}$$

где функции$a_j(\cdot)$, $j = \overline{1,5}$ принадлежат пространству $L_2[a,b]$ $f_0 \in C^1$, λ_i, $i = \overline{1,5}$ - числовые параметры;

$f_2(x,y) \in L_2([a,b]^2), f_1(x) \in L_2[a,b]$ искомые функции.

В этой заметке изучена разрешимост однородной системы (1) при всех значениях параметров λ_i, $i = \overline{1,5}$ кроме случая $\lambda_i \neq 0$, $i = \overline{1,5}$

Всюду в далнейшем интеграл понимается по отрезку $[a,b]$.

Основными результатами являются следующие.

Пусть детерминанты $D_1(\lambda_1) = 1 + \lambda_1 \int_a^b a_1^2(t)\, dt$Фредгольма [1] ядра $a_1(t)$

Теорема 1.Пусть $\lambda_1 \neq 0$, $\lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$,тогда

а) если$D_1(\lambda_1) \neq 0$, то система (1) имеет только нулевое решение:

$$\begin{pmatrix} f_0 \\ f_1(x) \\ f_2(x,y) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

б) если $D_1(\lambda_1) = 0$, то однородная система имеет решение

$$f_0 = f_0,\ f_1(x) = f_2(x,y) = f_0,\ f_0 \in C^1,\ f_0 \neq 0$$

$D_2(\lambda_2) = 1 + \lambda_2 \int a_2^2(t) dt$ детерминант Фредгольма ядро $K(x,t) = a_2(x) a_2(t)$.

Теорема 2. Пусть $\lambda_2 \neq 0$, $\lambda_1 = \lambda_3 = \lambda_4 = \lambda_5 = 0$. Тогда:

а) если $D_2(\lambda_2) = 0$ то однородная система (1) имеет решение вида

$$\begin{pmatrix} f_0 \\ f_1(x) \\ f_2(x,y) \end{pmatrix} = \begin{pmatrix} 0 \\ c a_2(x) \\ -c a_2(x) \end{pmatrix}$$

б) если $D_1(\lambda_1) \neq 0$ то система имеет только нулевое решение.

Аналогичные результаты как в теореме (2) получено и в случаях:

1) $\lambda_3 \neq 0$, $\lambda_i = 0$, $i = 1,2,4,5$;

2) $\lambda_4 \neq 0$, $\lambda_i = 0$, $i = 4$;

3) $\lambda_5 \neq 0$, $\lambda_i = 0$, $i = 5$;

Теорема 3. Пусть $\lambda_1 \neq 0$, $\lambda_2 \neq 0$, $\lambda_3 = \lambda_4 = \lambda_5 = 0$ и Тогда :

а) если $D_1(\lambda_1) \neq 0$, то

1) при $\int a_1(t) a_2(t) dt = 0$имеет решение вида $f_0 = 0$, $f_1(x) = -\lambda_2 c a_2(x)$, $f_2(x,y) = \lambda_2 c a_2(x)$ где с – произволная постоянная,

2) при $\int a_1(t)a_2(t)dt \neq 0$ однородная система (1) имеет решение вида

$f_0 = A(a_1, a_2)$,$f_1(x) = -c_1 - \lambda_2 c_2 a_2(x)$, $f_2(x,y) = c_1 + \lambda_2 c_2 a_2(x)$

где$A(a_1, a_2) = \frac{c\lambda_1\lambda_2 \int a_1(t)a_2(t)dt}{D_1(\lambda_1)} = c'.c_1$, c_2 , c' постоянные.

б) если $D_1(\lambda_1) = 0$, то

1) при $\int a_1(t)a_2(t)dt = 0$ система (1) имеет решение вида

$f_0 = c_1$, $f_1(x) = -c_1 - \lambda_2 c_2 a_2(x)$, $f_2(x,y) = c_1 + \lambda_2 c_2 a_2(x)$

гдеc_1 , c_2 – константы;

2) при $\int a_1(t)a_2(t)dt \neq 0$ однородная система (1) имеет решение вида

$f_0 = c_2$, $f_1(x) = -c_2 - ca_2(x)$, $f_2(x,y) = c_2 + ca_2(x)$где с-постоянная.

Отметим, что в случаях когда двое из параметров отличны от нуля, а остальные равны нулю имеют аналогичные теоремы.

Теперь пусть $D(\lambda_1, \lambda_2, \lambda_3) = 1 - \int[\sum_{k=1}^{3} \lambda_k a_k^2(t)]dt$ детерминанти Фредгольма ядро $k(x,t) = \sum_{k=1}^{3} \lambda_k a_k(x)a_k(t)$.

Теорема 4.Пусть $\lambda_1 \neq 0$, $\lambda_2 \neq 0$, $\lambda_3 \neq 0$, $\lambda_4 = \lambda_5 = 0$ Тогда:

а) если$D(\lambda_1, \lambda_2, \lambda_3) \neq 0$, то система (1) имеет решение вида $f_0 = \lambda \sum_{k=1}^{3} c_k \lambda_k^2 \int a_k^2(t)\,dt = c$, $f_1(x) = \sum_{i=1}^{3} \lambda_i c_i a_i(x)$, $f_2(x,y) = -\sum_{i=1}^{3} \lambda_i c_i a_i(x)$

б) если $D(\lambda_1, \lambda_2, \lambda_3) = 0$, то система (1) имеет только нулевое решение.

Аналогичные теоремы можно сформулировать и при остальных случаях когда трое из параметров отличны от нуля и остальные равны нулю.[65]

Теорема 5. Пусть $\lambda_i \neq 0$, $i = \overline{1,4}$, $\lambda_5 = 0$ и $D_4(\lambda_4) = 1 + \lambda_4 \int a_4^2(t)dt \neq 0$ Тогда:

а) если $D(\lambda'_1, \lambda'_2, \lambda'_3) = 1 + \sum_{j=1}^{3} \lambda_j^2 \int a_j^2(t)\,dt = 0$, то система (1) имеет решение вида $f_0 = c_2$, $f_1(x) = A_1(x)$, $f_2(x,y) = B_1(x)$, где

$$c = -\lambda_1 \sum_{i=1}^{3} \lambda'_i c_i \int a_i(t)a'_i(t)dt \ , \ A_1(x) = \sum_{j=1}^{3} \lambda'_j \hat{a}_j(x)c_j \ ,$$

$$B_1(x) = \frac{\lambda_4 a_4(x)}{D_4(\lambda_4)} \sum_{i=1}^{3} \lambda'_i c_i \int a_4(t)\,\hat{a}_i(t)dt\,;$$

б) если $D(\lambda'_1, \lambda'_2, \lambda'_3) \neq 0$, то система (1) имеет только нулевое решение.

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СТРУКТУРА УРОКА НА ОСНОВЕ CLIL-ТЕХНОЛОГИИ

Аннотация: *В современной образовательной среде особое значение приобретают технологии интегрированного обучения предмету и языку. В данной статье рассматривается структура урока, построенного на основе CLIL-технологии, ее основные этапы, методические особенности и педагогическая значимость.*

Ключевые слова: *CLIL, интегрированное обучение, структура урока, иностранный язык, предметное обучение, коммуникативная компетенция.*

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THE STRUCTURE OF A LESSON BASED ON CLIL TECHNOLOGY

Abstract: *In the modern educational environment, technologies of integrated content and language learning are gaining particular importance. This article examines the structure of a lesson based on CLIL technology, its main stages, methodological features, and pedagogical significance.*

Keywords: *CLIL, integrated learning, lesson structure, foreign language, content-based instruction, communicative competence.*

Технология CLIL (Content and Language Integrated Learning — предметно-языковое интегрированное обучение) в последние годы занимает особое место в современной образовательной практике, поскольку отвечает ключевым требованиям обновленного образования, ориентированного на развитие не только предметных знаний, но и коммуникативных, когнитивных и межкультурных компетенций учащихся [1, с.37]. Данный подход представляет собой инновационную методику, при которой изучение предметного содержания осуществляется посредством иностранного языка, что позволяет одновременно достигать двух образовательных целей: освоения учебного материала и развития языковых навыков.

Термин CLIL был введен Дэвидом Маршем, который определял этот подход как образовательную модель, объединяющую преподавание предмета и иностранного языка в едином процессе обучения. По словам Д. Марша, “*CLIL относится к ситуациям, когда учебные предметы или части учебных предметов преподаются на иностранном языке с двойной направленностью*

целей, а именно: изучение предметного содержания и одновременное изучение иностранного языка" [2, с. 201]. Данный подход особенно актуален в условиях глобализации, когда владение иностранным языком становится необходимым инструментом профессиональной и академической коммуникации.

Структура урока, построенного на основе CLIL-технологии, имеет свои специфические особенности, отличающие ее от традиционной модели преподавания. Прежде всего, такой урок основывается на концепции четырех компонентов (4C Framework), предложенной До Койл: Content (содержание), Communication (коммуникация), Cognition (мышление) и Culture (культура). Как отмечает Д. Койл, "CLIL is not simply about language teaching or subject teaching, but about integrating both through meaningful learning contexts" [3, с.66]. Это означает, что каждый этап урока должен быть направлен не только на усвоение нового материала, но и на развитие языковой активности, мыслительных процессов и культурной осведомленности обучающихся.

Первым этапом CLIL-урока является организационно-мотивационный этап, целью которого выступает создание положительной учебной атмосферы, активизация имеющихся знаний учащихся и формирование интереса к новой теме. На данном этапе преподаватель использует различные приемы вовлечения: обсуждение проблемных вопросов, демонстрацию изображений, короткие видеоматериалы, мозговой штурм или коммуникативные задания. Важно, чтобы учащиеся с самого начала включались в языковую деятельность. Это соответствует педагогической позиции Джерома Брунера, который подчеркивал: «The most effective way to create interest in a subject is to render it worth knowing». Иными словами, мотивация возникает тогда, когда ученик понимает практическую значимость изучаемого материала [3, с. 231].

Следующим важным этапом является постановка целей урока, которая в CLIL имеет двойную направленность. Учитель определяет как предметные цели (content objectives), так и языковые цели (language objectives). Например, если тема урока связана с экологией, предметной целью может быть изучение причин изменения климата, а языковой — освоение лексики по теме окружающей среды и развитие навыков аргументированного высказывания. Такая структура позволяет учащимся четко осознавать, чему именно они должны научиться, что повышает осмысленность образовательного процесса.

После этого следует этап введения нового материала, который является центральной частью урока. В отличие от традиционного обучения, в CLIL информация подается на иностранном языке, однако при этом обязательно используется система поддержки понимания. Учитель применяет визуальные схемы, инфографику, таблицы, адаптированные тексты, видеофрагменты, ключевые слова и речевые шаблоны. Основная задача данного этапа — сделать содержание доступным, несмотря на языковой барьер. В этом контексте особенно актуальна теория Стивена Крашена, согласно которой

«We acquire language when we understand messages». Следовательно, преподаватель должен обеспечить понятный входной материал (comprehensible input), соответствующий уровню языковой подготовки обучающихся [5, с. 198].

Неотъемлемой частью структуры CLIL-урока является языковая поддержка (scaffolding), которая помогает учащимся использовать иностранный язык как инструмент обучения. Поскольку обучающиеся одновременно осваивают и содержание, и язык, им необходима методическая помощь в виде речевых моделей, словарных списков, грамматических конструкций, образцов ответов и визуальных подсказок. Такой подход напрямую связан с идеями Льва Выготского о зоне ближайшего развития. Как утверждал ученый: “То, что ребенок может сделать сегодня с помощью взрослого, завтра он сможет сделать самостоятельно” [6, с. 81]. Таким образом, языковая поддержка является временным инструментом, способствующим постепенному переходу к самостоятельной речевой деятельности.

Следующий этап CLIL-урока предполагает активную переработку информации учащимися. Здесь особое значение приобретают интерактивные формы работы: работа в парах и группах, проектные задания, обсуждения, исследовательские мини-проекты, анализ кейсов и решение проблемных задач. На данном этапе учащиеся не просто воспринимают информацию, а начинают активно применять полученные знания на практике. Именно здесь проявляется принцип деятельностного обучения, который Джон Дьюи сформулировал кратко, но емко: “Learning by doing” [7, с. 56]. Через практическую деятельность ученики глубже понимают содержание урока и одновременно развивают языковые навыки. Важной характеристикой CLIL-урока является развитие когнитивных способностей учащихся. Этот этап предполагает выполнение заданий, направленных не только на запоминание информации, но и на анализ, сравнение, оценку и создание новых идей. Преподаватель использует задания, соответствующие таксономии Блума, побуждая учеников мыслить на более высоком уровне. Например, учащимся может быть предложено сравнить исторические события, объяснить причины научного явления или предложить решение экологической проблемы. CLIL ориентирован на то, чтобы язык использовался как средство мышления, а не только как объект изучения.

Особое место в структуре урока занимает этап коммуникативной практики, где учащиеся демонстрируют результаты своего обучения через устную или письменную речь. Это могут быть презентации, дебаты, мини-доклады, обсуждения или защита проектов. На данном этапе язык становится полноценным инструментом выражения знаний. Значимость этого процесса подчеркивает Меррил Суэйн, отмечая: “Активное использование языка способствует более глубокому осмыслению и усвоению языкового материала обучающимися” [9, с. 300]. Иными словами, именно в процессе активного

использования языка происходит более глубокое усвоение как языкового материала, так и предметного содержания.

Завершающим этапом CLIL-урока является рефлексия и оценивание. В отличие от традиционного подхода, оценивание в CLIL должно учитывать как предметные знания, так и языковой прогресс учащихся. Для этого используются различные методы: самооценка, взаимооценка, короткие тесты, устная рефлексия, письменные ответы на вопросы. Учащимся предлагается осмыслить, что нового они узнали, какие языковые конструкции освоили, какие трудности возникли в процессе работы. Такой подход способствует развитию самостоятельности и ответственности за собственное обучение.

Таким образом, структура урока на основе CLIL-технологии представляет собой последовательную, логически организованную систему, в которой каждый этап направлен на интеграцию предметного содержания и языкового обучения. Данная модель делает образовательный процесс более интерактивным, практико-ориентированным и эффективным. CLIL способствует развитию критического мышления, коммуникативной компетенции, академического языка и межкультурной осведомленности учащихся. В современных условиях данный подход становится не просто инновационной методикой, а важным инструментом подготовки обучающихся к жизни в многоязычном и глобализированном мире.

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ЭВОЛЮЦИЯ МЕТОДОЛОГИЧЕСКИХ ПОДХОДОВ К БЕНЧМАРКИНГУ В МАРКЕТИНГОВОЙ ДЕЯТЕЛЬНОСТИ МЕЖДУНАРОДНЫХ КОМПАНИЙ И АНАЛИЗ ПРАКТИЧЕСКОГО ОПЫТА

Аннотация: *Статья посвящена развитию метода бенчмаркинга в контексте маркетинговой работы глобальных корпораций. Рассмотрены пять исторических этапов становления метода: от простого сравнения продуктов до глобального обмена практиками между странами. Проанализированы возможности метода, его границы и реальные примеры применения в компаниях «Xerox», «Ford», в сфере высшего образования и сельского хозяйства. Сделан вывод о том, что системное применение бенчмаркинга даёт корпорациям ориентиры для роста, но без учёта контекста и внутренней специфики результаты оказываются поверхностными.*

Ключевые слова: *бенчмаркинг, маркетинговая деятельность, международные корпорации, эволюция метода, сравнительный анализ.*

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THE EVOLUTION OF METHODOLOGICAL APPROACHES TO BENCHMARKING IN THE MARKETING ACTIVITIES OF INTERNATIONAL COMPANIES AND AN ANALYSIS OF PRACTICAL EXPERIENCE

Abstract: *This article examines the development of benchmarking in the context of global corporations' marketing efforts. Five historical stages of the method's development are examined: from simple product comparison to the global exchange of best practices between countries. The method's capabilities, limitations, and real-world examples of application at «Xerox», «Ford», higher education, and agriculture are analyzed. It is concluded that the systematic application of benchmarking provides corporations with growth guidelines, but*

without consideration of context and internal specifics, the results are superficial.
Keywords: *benchmarking, marketing activities, international corporations, method evolution, comparative analysis.*

Бенчмаркинг в качестве инструмента управления развивался несколько десятилетий. Его корни уходят в производственную практику первой половины XX века. Г. Форд, посетив чикагскую скотобойню, обратил внимание на перемещение туш по подвесному конвейеру — от одного рабочего к другому. Данный принцип лёг в основу поточного производства автомобилей. Но вот сам термин «бенчмаркинг» вошёл в научный дискурс лишь в 1972 году. Его ввел Институт стратегического планирования в Кембридже. А систематическую методологию метода в 1989 году представил Роберт Кэмп. Его монография стала базовым пособием для тысяч предприятий по всему миру.

В мировой практике выделяют пять этапов эволюции бенчмаркинга. Первый этап — продуктовый. Компании закупали изделия конкурентов, разбирали их и выпускали аналоги. Чем и охотно пользовались японские производители в послевоенные годы. Второй этап — конкурентный. Тут начинают сравнивать не отдельные товары, а бизнес-процессы. Классический случай — компания «Xerox», которая в 1979 году изучила технологии японской «Fuji». Третий этап — процессный. «Xerox» пошла дальше: она стала исследовать лучшие практики как у конкурентов, так и у предприятий из других отраслей. К примеру, логистические решения позаимствовали у L.L. Bean. Четвёртый этап — стратегический. Бенчмаркинг интегрируют в общий процесс принятия управленческих решений. Компании больше не копируют отдельные приёмы, а перестраивают целые блоки стратегии. Пятый этап — глобальный [1]. Появляются национальные центры бенчмаркинга. Возникает международный обмен опытом без отраслевых и географических барьеров.

Что же представляет собой бенчмаркинг сегодня? Это длительный процесс сравнения собственных бизнес-процессов с лидирующими компаниями на рынке. Цель — найти разрывы между текущей деятельностью и эталонными образцами, а затем устранить причины, мешающие выходу на более высокий уровень [2].

В научной литературе закрепилось несколько видов бенчмаркинга. Внутренний — сравнение подразделений внутри одной организации. Конкурентоориентированный — сопоставление с прямыми игроками рынка. Функциональный — изучение лидеров из других отраслей. Совмещённый — обмен данными между компаниями. Обобщённый — комбинация успешных решений из разных сфер [3].

Все они по отдельности решают какие-либо свои задачи. Внутренний бенчмаркинг легче всего осуществлять в организации — данные доступны, согласование не отнимает много времени. Конкурентный бенчмаркинг даёт

наиболее релевантные ориентиры, но добывать информацию о прямых соперниках труднее. Функциональный полезен для того, чтобы совершать прорывные заимствования — как тот же Ford, подсмотревший конвейер на бойне.

Бенчмаркинг не стоит путать с промышленным шпионажем. Метод опирается исключительно на открытые источники: публичные отчёты, отраслевые обзоры, конференции, клиентские отзывы, интервью с партнёрами. Этическая граница соблюдается жёстко.

Ограничения у метода тоже имеются. Первое — временные и трудовые затраты. Исследование практик конкурента может занять месяцы. Второе — низкая маневренность. Пока компания изучает чужой опыт, лидер рынка уже внедряет следующее новшество. Третье — риск механического переноса. То, что принесло успех в Сингапуре или Чили, может дать нулевой результат в Восточной Европе.

Рассмотрим практические примеры.

Компания Ford в 1990-е годы оказалась в трудном положении. Специалисты проанализировали более пятидесяти автомобильных моделей конкурентов, выделили сильные и слабые стороны каждой. Затем сформулировали параметры идеальной машины. Так появилась модель Taurus, получившая звание «автомобиль года». Но уже позже инженеры стали отходить от первоначальных выводов бенчмаркинга — и модель утратила лидерство [4]. История Ford показывает: недостаточно один раз провести сравнительное исследование. Нужно постоянно возвращаться к полученным ориентирам.

Другой случай сопряжен с белорусским молочным заводом. Предприятие изучило опыт немецкого производителя кондитерских изделий «Argenta». Казалось бы, разные отрасли. Но рецептурные решения и технологические линии по производству молочного мармелада оказались пригодны для адаптации. Завод запустил новую линейку продуктов и получил дополнительный доход. Вот пример функционального бенчмаркинга, когда поиск лучших практик выходит за границы своей индустрии [5].

В высшем образовании метод тоже работает. Санкт-Петербургский политехнический университет провёл бенчмаркинг ведущих мировых вузов по доле иностранных студентов. Оказалось, что целевой показатель составляет от 20 до 50 процентов. Затем университет проанализировал маркетинговые инструменты лидеров — настройку поисковой рекламы под локальные рынки, работу в профессиональных блогах, ведение тематических сообществ в социальных сетях. Часть этих приёмов локализовали под свои условия. Результат — рост числа иностранных абитуриентов.

Но есть и провальные примеры. Некоторые компании пытались копировать программы лояльности конкурентов, не разобравшись в собственной клиентской базе. В итоге затраты на внедрение не окупались.

Бенчмаркинг стал, по сути, самоцелью. Команды гнались за внешними показателями, забыв задать главный вопрос: «Какую реальную проблему наших покупателей мы решаем?»

Из российской практики известно, что системно задействуют бенчмаркинг лишь около 18% предприятий. Сопротивление персонала — один из главных барьеров. Сотрудники не хотят менять привычные стандарты работы. К тому же руководители часто воспринимают бенчмаркинг как западный инструмент, не готовый к местным условиям.

Тем не менее, конкурсные программы в России работают. Премия Правительства в области качества, программа «100 лучших товаров России», конкурс «Российская марка» — все они стимулируют компании к сравнению с лидерами. Участие в таких конкурсах само по себе является формой бенчмаркинга: экспертная оценка выявляет разрывы, а лучшие практики запоминаются и распространяются.

Какие выводы следуют из анализа эволюции и практики метода? Бенчмаркинг прошёл долгий путь — от разового копирования чужих изделий до глобальной системы управления знаниями. Успешные международные корпорации встроили его в свои регулярные процессы. Но всё же эффективность метода держится на трёх условиях: правильном выборе эталона для сравнения, учёте контекста собственной компании и постоянном возврате к полученным данным. Без этих условий бенчмаркинг является дорогим и бесполезным упражнением.

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ОЦЕНКА ЭФФЕКТИВНОСТИ МАРКЕТИНГОВОГО БЕНЧМАРКИНГА В МЕЖДУНАРОДНОЙ КОМПАНИИ «IKEA»: ПРОТИВОРЕЧИЯ И НАПРАВЛЕНИЯ СОВЕРШЕНСТВОВАНИЯ

Аннотация. *В статье проанализирована практика применения бенчмаркинга в компании «IKEA» - мировом лидере мебельного ритейла. Выявлены пять групп системных проблем: методологическая разрозненность, измерительные искажения, отраслевая несовместимость данных, культурные барьеры при выходе на новые рынки и риски в маркетинговых коммуникациях. Предложен комплекс мероприятий по устранению этих проблем, включая «инновационный фильтр», гибридную модель измерения, объёмные KPI и 4S-модель межкультурной адаптации.*

Ключевые слова: *маркетинговый бенчмаркинг, оценка эффективности, адаптация практик, рентабельность инвестиций.*

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THE MARKETING EFFECTIVENESS ASSESSING BENCHMARKING AT «IKEA» COMPANY: CONTRADICTIONS AND AREAS FOR IMPROVEMENT

Abstract. *This article analyzes benchmarking practices at «IKEA», a global leader in furniture retail. Five groups of systemic problems are identified: methodological inconsistency, measurement distortions, industry-wide data incompatibility, cultural barriers when entering new markets, and risks in marketing communications. A set of measures to address these issues is proposed, including an «innovation filter», a hybrid measurement model, comprehensive KPIs, and «4S» model for intercultural adaptation.*

Keywords: *marketing benchmarking, performance evaluation, adaptation of practices, return on investment.*

Компания «IKEA» остаётся уникальным явлением на мировом мебельном рынке. Более 460 магазинов в 63 странах, выручка 45,1 млрд евро, штат свыше 231 тысячи человек. Основанная Ингваром Кампрадом в 1943 году как небольшая посылочная фирма, сегодня компания задаёт стандарты в области демократичного дизайна, плоской упаковки и клиентоориентированного производства. Но вот цифры последних отчётных периодов вызывают вопросы.

Чистая прибыль компании «IKEA» сократилась на 32% – с 2,2 млрд до 1,5 млрд евро. Выход на развивающиеся рынки идёт с задержками. Запуск магазинов в Индии отложили на два года, 35% товаров оказались невостребованными из-за несоответствия специфики национальной культуры и образу жизни семей. Эффективность маркетинговых коммуникаций снизилась. Один из рекламных роликов компании «IKEA» («Harlem Shake») показал высокую узнаваемость бренда – 86% в первые пять секунд, но ключевое сообщение о программе лояльности поняли лишь 42% зрителей при норме 57%. Положительный эмоциональный отклик составил всего 44% [2].

Бенчмаркинг в компании «IKEA» применяют давно. Но как конкретно? Методология фрагментарна, измерение разбалансировано, а перенос практик с одних рынков на другие происходит без достаточной культурной калибровки [1].

В процессе исследования выделено пять групп проблем.

1. Методологические и организационные. Бенчмаркинг воспринимается в качестве скорее инструмента сравнения, а не как комплексная бизнес-функция развития. Отсутствует единая система управления знаниями. Разные отделы проводят свои исследования, не обмениваясь результатами.

2. Стратегические риски – «тирания бенчмарков». Погоня за среднерыночными показателями конкурентов начинает подменять истинную цель – создание ценности для покупателя. Команды фокусируются на цифрах, а не на решении реальных проблем. Для компании «IKEA», чья уникальность строилась на прорывных идеях (плоская упаковка, демократичный дизайн, эффект самосборки), чрезмерная зависимость от бенчмарков размывает конкурентные преимущества.

3. Измерительные и инструментальные. Маркетинговые отделы «тонут» в дашбордах, но испытывают дефицит ясности. Разные инструменты – атрибуция, медиамикс-моделирование, тесты инкрементальности – построены на несовместимых допущениях. Их совместное использование порождает хаос. Руководство не в состоянии договориться, какие метрики действительно отражают эффективность. Инвестиции в маркетинг замораживаются.

4. Отраслевая специфика. Стоимость перемещения дивана по складу одинакова для бюджетной модели за 800 евро и для премиальной за 10 тысяч. Сравнивать эффективность складов в денежном выражении между разными ритейлерами бессмысленно. Тем не менее, как раз денежные метрики

задействует повсеместно. Компания «IKEA» с её гигантским ассортиментом и разбросом цен попадает в ловушку несопоставимых данных [3].

5. Контекстуальные ограничения при выходе на новые рынки. На примере Индии видны четыре разрыва. Разрыв в навыках: несоответствие между требуемой и доступной локальной экспертизой. Разрыв в ценностях: шведский фокус на устойчивом развитии не всегда резонирует с чувствительным к цене индийским покупателем. Разрыв в скорости: локализация продукта в Китае занимает три месяца, в Индии– восемь. Разрыв в социальных элементах: компания «IKEA» не до конца понимает структуру местных семей, отсюда 35% нерелевантных товаров [4].

Для решения указанных проблем предлагается система из четырёх блоков мероприятий.

Первый блок – преодоление «тирании бенчмарков» и сохранение идентичности бренда. Внедряется «инновационный фильтр». Все потенциальные объекты для бенчмаркинга проходят двухуровневую классификацию. Операционные улучшения (скорость доставки, стоимость единицы объёма) – копировать можно и нужно. Стратегические инновации (способ вовлечения клиента через самосборку) – копировать запрещено. Параллельно запускается «бенчмаркинг неудач». Компания собирает и анализирует не только успешные кейсы конкурентов, но и их провалы в коммуникации. К примеру, разбирает, почему реклама «Harlem Shake» вызвала низкий эмоциональный отклик, что, в свою очередь, несколько снижает риск повторения чужих ошибок.

Второй блок – коррекция системы показателей. Внедряется гибридная модель. Для тактических каналов (SEO, контекстная реклама) задействуются быстрые данные атрибуции. Для стратегического бенчмаркинга (эффективность бренд-кампаний, долгосрочная лояльность) – результаты медиамикс-моделирования. Между этими двумя типами данных делается «переводная таблица», чтобы сопоставлять результаты на разных рынках. Кроме того, для складов и логистики вводятся объёмные показатели вместо денежных. Кубические метры, единицы товара, вес – данные метрики позволяют корректно сравнивать практику разных компаний.

Третий блок – адаптация к локальным рынкам посредством разработки «4S»-модель. Перед выходом на новые рынки компания «IKEA» оценивает четыре параметра:

- *Skills* – наличие необходимых компетенций;
- *Shared Values* – резонирует ли практика с локальными ценностями;
- *Speed* – удобен ли темп принятия решений для внедрения изменений;
- *Social Elements* – соответствует ли продукт бытовому укладу потребителю.

Для Индии, например, модель «подсвечивает» необходимость сократить долю нерелевантных товаров с 35% до 15% и локализовать тренинги под местные особенности. Для городских студий компания «IKEA»

(малые форматы в центрах мегаполисов) бенчмаркинг проводят не сравнивая с гигантскими складами самой компании «IKEA», а с локальными дизайн-салонами, конкурирующими в сегменте «городская мебель» [5].

Четвёртый блок – развитие бенчмаркинга как системной бизнес-функции. Инициируется создание централизованной «Библиотека лучших практик» с обязательным полем «карта ограничений», указывающим, при каких условиях практика не работает. Бенчмаркинг интегрируют с маркетинговым аудитом: сначала выявляют собственные проблемные зоны, затем ищут лучшие решения, а не наоборот. Сотрудников обучают стратегическому бенчмаркингу, чётко отделяя его от промышленного шпионажа и обучая задавать правильные вопросы.

Общий бюджет реализации всех мероприятий – 8,76 млн евро. Для компании с выручкой 45,1 млрд евро это составляет менее 0,02% от объёма продаж.

Годовой экономический эффект складывается из ряда составляющих. Снижение потерь от неэффективных маркетинговых коммуникаций – 100 млн евро. Повышение эффективности маркетинговых инвестиций за счёт гибридной модели измерения – 135 млн евро. Оптимизация логистических затрат благодаря переходу к объёмным KPI – 200 млн евро. Снижение потерь от текучести персонала – 5,4 млн евро. Суммарно, без учёта выхода на новые рынки, экономический эффект составляет 440 млн евро в год.

При выходе на один новый рынок с привлечением «4S» -модели прибавится разовый эффект в 535 млн евро за счёт сокращения задержек с двух лет до 12 месяцев и сокращения доли нерелевантных товаров с 35% до 15%.

Как ожидается, предложенные мероприятия в совокупности компенсируют 32-процентное падение чистой прибыли IKEA, почти полностью восстановив её до уровня предыдущего отчётного периода, а эффект в 440 млн евро эквивалентен около 29,4% от текущей чистой прибыли компании.

Выводы. Бенчмаркинг в компании «IKEA» в текущий момент работает недостаточно эффективно, поскольку компания имеет дело с типичными для крупных международных корпораций трудностями: разрозненность данных, «слепой» перенос практик, хаос в измерениях, размывание (потеря) уникальности бренда. Предложенные меры позволят компании «IKEA» трансформировать бенчмаркинг в перманентный и надёжный источник роста. Для других международных ритейлеров опыт IKEA представляется наглядной картой того, как не потерять себя в погоне за чужими показателями и каким образом рассчитывать действительно нужное.

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ОСОБЕННОСТИ ПРЕОДОЛЕНИЯ КРИЗИСА ДЕФИЦИТА ПОЛУПРОВОДНИКОВ В КИТАЙСКОЙ НАРОДНОЙ РЕСПУБЛИКЕ

Аннотация: *на материале одного, но стратегически значимого кризиса - дефицита полупроводников рассматриваются особенности китайского подхода к антикризисному управлению. Показано, что наложение глобальной нехватки чипов 2020-2022 годов на структурный кризис, порождённый экспортными ограничениями США и их союзников, поставило под вопрос технологический суверенитет КНР. Анализируются инструменты реагирования: мобилизация ресурсов через систему инвестиционных фондов, форсированное импортозамещение, сочетание собственных разработок с адаптацией зарубежных технологий и асимметричные сырьевые рычаги.*

Ключевые слова: *КНР; полупроводники; дефицит чипов; технологический суверенитет; импортозамещение; экспортные ограничения; промышленная политика; «Большой фонд».*

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FEATURES OF OVERCOMING THE SEMICONDUCTOR SHORTAGE CRISIS IN THE PEOPLE'S REPUBLIC OF CHINA

Abstract: *Using a single, yet strategically significant crisis - the semiconductor shortage - this article examines the specifics of China's approach to crisis management. It demonstrates that the combination of the global chip shortage of 2020-2022 and the structural crisis caused by export restrictions imposed by the United States and its allies has called China's technological sovereignty into question. Response tools are analyzed, including resource mobilization through a system of investment funds, accelerated import substitution, a combination of domestic developments and the adaptation of foreign technologies, and asymmetric commodity leverage.*

Keywords: *China; semiconductors; chip shortage; technological sovereignty; import substitution; export restrictions; industrial policy; "Big Fund".*

Введение

Полупроводники образуют технологическое ядро современной экономики, а зависимость от их поставок стала фактором национальной безопасности. Для КНР, ставшей крупнейшей мировой производственной площадкой, эта зависимость особенно остра: микросхемы устойчиво входят в число крупнейших статей импорта, а их ввоз в 2024 году вырос на 10,4 % и достиг порядка 385 млрд долл. В первой половине 2020-х годов отрасль пережила двойной кризис. Глобальный дефицит чипов 2020–2022 годов наложился на структурный кризис, порождённый ужесточением экспортных ограничений США и их союзников.

Именно структурный аспект придал ситуации стратегический характер. Начавшись в 2019 году с мер против компании Huawei, давление к октябрю 2022 года переросло в комплексные запреты на поставки передового оборудования и средств проектирования, а в 2023 году к ним присоединились Нидерланды и Япония, перекрыв доступ к ключевой литографии. Наибольшую уязвимость КНР, показала именно микроэлектроника, и преодоление дефицита полупроводников стало главным испытанием для всей китайской модели антикризисного управления.

Объектом исследования выступает практика преодоления этого кризиса, а предметом - совокупность образующих её мер и принципов. Цель исследования - выявление устойчивых черт китайского подхода. Для этого последовательно рассматриваются природа кризиса, инструменты реагирования и пределы их действенности.

Материалы и методы

Эмпирическую основу составили рецензируемые публикации, монография ИКСА РАН и официальная статистика КНР, а применительно к событиям 2023-2026 годов также и актуальные отраслевые материалы, поскольку новейшие данные ещё не отражены в академической периодике. Исследование опирается на метод кейс-стади, сравнительный, системный и историко-генетический подходы. К количественным показателям, в том числе к оценкам локализации производства, применяется осторожная интерпретация ввиду различий в методиках расчёта.

Результаты

Природа кризиса двойственна. Циклическая нехватка чипов 2020-2022 годов, вызванная пандемией и сбоями поставок, была относительно краткосрочной и общемировой. Принципиально иным стал структурный кризис: расширенные в октябре 2022 года американские правила ограничили поставки в КНР оборудования для передовой логики, средств проектирования и труда американских специалистов, а присоединение в 2023 году Нидерландов и Японии лишило страну доступа к новейшим литографам. К началу ограничений отрасль заметно отставала. Освоив 14-нанометровый техпроцесс, она лишь приближалась к 7-нанометровому, тогда как лидеры переходили к 3 нанометрам.

Ответ КНР строится прежде всего на масштабной государственной мобилизации ресурсов. С 2014 года ядром промышленной политики выступает Национальный фонд инвестиций в индустрию интегральных схем («Большой фонд»), три очереди которого (2014, 2019 и 2024 годов) последовательно наращивали вложения; третья очередь составила порядка 344 млрд юаней. Поддержка дополняется прямыми субсидиями, достигающими, по отраслевым оценкам, до 40 % выручки отдельных компаний, а расходы Китая на профильное оборудование, по ряду данных, превысили затраты США, Тайваня и Республики Корея вместе взятых. Эти усилия вписаны в общемировую гонку: глобальные вложения в полупроводники в 2024-2030 годах прогнозируются свыше 1,5 трлн долл., более 70 % - в Азию. «Общенациональная» концентрация средств вытекает из закреплённого в 14-й пятилетке курса на научно-технологическую самостоятельность.

Кризис подтолкнул к консолидации отрасли вокруг национальных лидеров в технической отрасли: в марте 2023 года создание отечественной производственной базы было возложено на консорциум компаний Huawei, SMIC, AMEC и NAURA. Развёрнуты импортозамещение оборудования, поддержка собственных средств проектирования и возвращение специалистов. Технологически Китай сделал ставку на отработанные техпроцессы, где способен доминировать по объёму, и на обходные решения: многократное экспонирование на «глубоком» ультрафиолете позволило компании SMIC освоить 7-нанометровый чип, применённый в смартфоне Huawei в 2023 году. С 2024 года государственные структуры начинают заменять процессоры Intel и AMD китайскими аналогами. Это отвечает новой стратегии КНР, сочетающей собственные разработки с освоением и совершенствованием зарубежных технологий.

Наконец, КНР перешла к асимметричным мерам, опираясь на доминирование в переработке критического сырья: с 2023 года введены экспортные ограничения на галлий, германий, ряд редкоземельных металлов и сурьму, важных и для зарубежной полупроводниковой промышленности. Тем самым взаимозависимость, прежде работавшая против Китая, обращена во встречный рычаг давления.

Сопоставление мер позволяет выделить устойчивые черты китайского подхода. Первая это высокая мобилизационная способность государства и опора на «терпеливый» капитал: через инвестиционные фонды ресурсы концентрируются на стратегическом направлении в объёмах и на сроки, недостижимые в рыночной логике. Вторая - это трактовка кризиса как катализатора: внешнее давление ускорило импортозамещение, к которому рынок сам по себе не подталкивал. Первые результаты в собственном производстве микрочипов уже снижают сопутствующие риски, а ограничения отчасти оборачиваются против их инициаторов.

Третья особенность — это сочетание самостоятельной разработки с адаптацией зарубежных технологий и реалистичный выбор достижимых целей: доминирование в зрелых техпроцессах и обходные решения вместо прямой конкуренции в самых передовых технологиях. Также важны асимметричные рычаги, когда контроль над критическим сырьём превращает прежнюю уязвимость во встречный инструмент давления. Все меры объединяет встроенность в долгосрочное планирование: технологический суверенитет закреплён в 14-й пятилетке.

Вместе с тем подход имеет свои ограничения. Доступ к передовым техпроцессам и к оборудованию для них (прежде всего к экстремальной ультрафиолетовой литографии) остаётся узким местом, которое мобилизация капитала пока не решает. Форсированные вложения сопровождаются издержками - избыточными мощностями, банкротствами мелких игроков, проблемами эффективности и эпизодами коррупции в управлении фондами. Зависимость от импорта сохраняется, а цели самообеспечения достигнуты лишь частично. Результативность модели высока там, где решают концентрация капитала, зрелые технологии и сырьевые рычаги, и ниже в сфере наиболее передовых технологий.

Заключение

Проведённый анализ показывает, что в реакции КНР на кризис дефицита полупроводников прослеживается узнаваемая методология: мобилизация государственных ресурсов через «терпеливые» инвестиционные фонды, трактовка внешнего давления как стимула к импортозамещению, сочетание собственных разработок с адаптацией зарубежных технологий, асимметричные сырьевые рычаги и встроенность мер в долгосрочную политику технологического суверенитета. Результативность модели неравномерна: успехи в наращивании зрелых производств и локализации оборудования соседствуют с отставанием на передовых техпроцессах и неполным достижением целей самообеспечения. Перспективным остаётся сравнение китайского опыта с промышленной политикой других крупных экономик, в том числе для государств, действующих под санкционными ограничениями.

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СОСТОЯНИЕ, ПРОБЛЕМЫ И ПУТИ СОВЕРШЕНСТВОВАНИЯ СИСТЕМЫ МАРКЕТИНГОВОГО АУДИТА В КИТАЕ

Аннотация: *На фоне обострения рыночной конкуренции и быстрой модернизации цифрового маркетинга маркетинговый аудит выступает ключевым управленческим инструментом для оптимизации маркетинговой системы предприятия, снижения операционных рисков и повышения рыночной конкурентоспособности, обеспечивая существенную поддержку высококачественному развитию предприятий. По сравнению с зрелой системой маркетингового аудита западных стран исследования и практика маркетингового аудита в Китае начались относительно поздно. В настоящее время существуют такие проблемы, как недостаточное понимание, несовершенство системы, устаревшие оценочные показатели, дефицит профессиональных кадров и формальное проведение практической работы, которые не соответствуют потребностям аудита новых бизнес-моделей, включая новые медиа, новую розничную торговлю и цифровой маркетинг. На основе базовой теории маркетингового аудита, с учетом реальной деятельности китайских предприятий и особенностей рыночной среды, в статье систематически анализируется современное состояние и существующие недостатки маркетингового аудита в Китае, глубоко исследуются коренные причины возникновения проблем. С пяти направлений: институциональное строительство, система показателей, цифровая трансформация, подготовка кадров и механизм надзора — предложены адаптированные к китайским рыночным условиям пути совершенствования маркетингового аудита. Результаты исследования предоставляют теоретическую основу и практический опыт для стандартизированного проведения маркетингового аудита, оптимизации маркетингового управления и повышения операционной эффективности отечественных предприятий.*

Ключевые слова: *маркетинговый аудит; аудиторская система; маркетинговое управление; цифровая трансформация; операционная эффективность предприятий*

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STATUS, PROBLEMS AND IMPROVEMENT PATHS OF MARKETING AUDIT SYSTEM IN CHINA

Summary: *Against the backdrop of intensified market competition and rapid upgrading of digital marketing, marketing audit serves as a core management tool. It helps enterprises optimize marketing systems, reduce operational risks and enhance market competitiveness, strongly underpinning high-quality corporate development. Compared with the mature marketing audit system in Western countries, relevant research and practical application in China started relatively late. Currently, prominent drawbacks remain, including insufficient awareness, imperfect institutional frameworks, outdated evaluation indicators, shortage of professional talents and formalistic implementation. These issues fail to meet audit requirements of emerging business modes such as new media, new retail and digital marketing.*

Based on basic marketing audit theories, combined with the operational reality of Chinese enterprises and local market characteristics, this paper systematically analyzes the current situation and existing defects of domestic marketing audit, and explores the root causes of relevant problems. Improvement strategies suited to China's market environment are proposed from five dimensions: institutional construction, indicator system optimization, digital transformation, talent cultivation and supervision mechanism. The research findings provide theoretical references and practical experience for standardizing marketing audit practices, improving marketing management and lifting operational efficiency of domestic enterprises.

Keywords*: marketing audit; audit system; marketing management; digital transformation; enterprise operational efficiency*

С непрерывным совершенствованием рыночной экономической системы Китая и модернизацией структуры потребительского рынка маркетинговые модели предприятий постепенно переходят от традиционного офлайн-канального маркетинга к диверсифицированному цифровому маркетингу, включая прямые трансляции в электронной коммерции, маркетинг в социальных сетях и управление частным трафиком. Маркетинговые сценарии становятся более разнообразными, маркетинговые цепочки — более сложными, а масштабы маркетинговых инвестиций постоянно растут. Как основное звено, соединяющее предприятия с рынком, обеспечивающее выручку и формирующее бренд, обоснованность, соответствие нормативам и эффективность маркетинговых мероприятий напрямую определяют выживание и развитие предприятий. Однако в настоящее время большинство предприятий сталкиваются с проблемами слепых маркетинговых инвестиций, субъективных маркетинговых решений, потери маркетинговых ресурсов и частых маркетинговых рисков.

Традиционная модель маркетингового управления больше не обеспечивает эффективный контроль всего процесса маркетинга.

Маркетинговый аудит представляет собой специальный инструмент управления для всестороннего, системного, независимого и регулярного анализа маркетинговой среды, стратегии, организации, процессов и эффективности предприятия. Его основная цель — выявлять недостатки маркетингового управления, распознавать операционные риски, оптимизировать распределение ресурсов и повышать доходность маркетинговых инвестиций, являясь важной частью тонкого управления современными предприятиями. В отличие от обычного финансового аудита, маркетинговый аудит охватывает весь процесс рыночной деятельности предприятий, фокусируется на оценке эффективности и оптимизации стратегии, что лучше соответствует текущим потребностям рыночного управления предприятиями.

В развитых западных странах сформирована зрелая теоретическая и практическая система маркетингового аудита, которая широко применяется в управлении различными предприятиями. В Китае исследования и практика маркетингового аудита начались поздно, и их развитие отстает от темпов развития рынка. Большинство малых и средних предприятий не создали механизм регулярного маркетингового аудита, а системы маркетингового аудита крупных предприятий имеют недостатки адаптивности и низкий уровень цифровизации, что не позволяет справляться с управленческими вызовами, связанными с сложной рыночной конкуренцией и новыми маркетинговыми моделями. На этой основе в данной статье систематически обобщается современное состояние маркетингового аудита в Китае, глубоко анализируются существующие проблемы и их причины, формируется оптимизированная система маркетингового аудита, адаптированная к китайскому рынку и цифровой эпохе, способствуя стандартизации, тонкости и научности маркетингового управления предприятиями.

1. Обзор базовой теории маркетингового аудита

1.1 Основное содержание маркетингового аудита

Маркетинговый аудит[66] — это специальная проверка и оценка, независимая от отделов маркетингового исполнения. Профессиональные аудиторы проводят комплексный анализ, проверку и оценку всех маркетинговых мероприятий предприятия по систематизированным и стандартизированным процедурам. Его основная задача не ограничивается исправлением ошибок и выявлением нарушений. С стратегической точки зрения предприятия всесторонне анализируются маркетинговые цели, стратегии, организация, процессы, распределение ресурсов и результаты исполнения, точно выявляются недостатки и риски маркетингового

[66] Фу Минлу, Ван Бо. Эмпирическое исследование влияния маркетингового аудита на маркетинговую эффективность предприятий[J]. Вестник Пекинского технологического института (социальные науки), 2007(05):68-71.

управления, предлагаются целенаправленные оптимизационные решения, помогающие предприятиям адаптироваться к изменениям рыночной среды и повышать основную маркетинговую конкурентоспособность.

Маркетинговый аудит имеет четыре основные характеристики, отличающие его от обычного корпоративного аудита. Первая — всесторонность: охватывает всю цепочку маркетинговой деятельности, включая среду, стратегию, организацию, каналы, продвижение и эффективность, а не отдельные звенья. Вторая — системность: имеет стандартизированные процедуры аудита, систему оценки и механизм корректировки, формируя замкнутое управление. Третья — независимость: аудит проводится независимо от системы маркетингового исполнения, что гарантирует объективность и справедливость результатов. Четвертая — периодичность: является регулярным управленческим мероприятием, а не временной проверкой после возникновения проблем.

1.2. Основная система содержания маркетингового аудита

На основе классической теории маркетингового аудита и практики китайских предприятий маркетинговый аудит подразделяется на шесть основных модулей, формируя целостную структуру аудита, охватывающую весь процесс маркетинговой деятельности предприятий.

Первый, аудит маркетинговой среды. Включает проверку макроэкономической и микроэкономической среды функционирования предприятия, включая политику и законодательство, экономическую ситуацию, потребительские тенденции, структуру рыночной конкуренции, состояние цепочки поставок и изменения потребностей целевых пользователей. Оценивается соответствие маркетинговой стратегии предприятия внешней среде, выявляются возможности и риски, возникающие из-за изменений среды.

Второй, аудит маркетинговой стратегии. Фокусируется на общей маркетинговой стратегии предприятия, проверяет обоснованность рыночного позиционирования, выбора целевого рынка, брендовой, продуктовой и ценовой стратегий, оценивает соответствие маркетинговой стратегии целям развития предприятия, рыночным потребностям и ее устойчивость.

Третий, аудит маркетинговой организации. Проводится аудит организационной структуры маркетинга, должностных обязанностей, кадрового обеспечения и управленческих правил. Проверяется четкость распределения обязанностей, эффективность взаимодействия, полнота управленческих систем и соответствие квалификации персонала должностным требованиям, выявляются недостатки организационного управления.

Четвертый, аудит маркетинговой системы. Охватывает функционирование информационной, исследовательской, управленческой и контрольной маркетинговых систем предприятия. Проверяется достоверность данных рыночных исследований, научность маркетинговых решений,

стандартизация маркетинговых процессов и эффективность передачи информации.

Пятый, аудит маркетинговой эффективности. Как основной модуль аудита, позволяет оценить операционные результаты маркетинга по количественным показателям, включая объем продаж, долю рынка, коэффициент конверсии клиентов, частоту повторных покупок, доходность маркетинговых инвестиций и стоимость привлечения клиентов, точно анализируя эффективность использования маркетинговых ресурсов.

Шестой, аудит специальных маркетинговых мероприятий. Проводится проверка всего процесса планирования, реализации, инвестиций и эффективности различных маркетинговых акций, таких как прямые трансляции продаж, продвижение в коротких видео, офлайн-промоакции и привлечение канальных партнеров. Оценивается обоснованность и эффективность мероприятий, выявляются проблемы потери ресурсов и нарушений в работе.

1.3. Практическое значение проведения маркетингового аудита

В условиях обострения рыночной конкуренции и быстрой модернизации маркетинговых моделей регулярное проведение маркетингового аудита имеет важное практическое значение для развития предприятий. Во-первых, снижение операционных рисков: комплексный аудит позволяет своевременно выявлять ошибки маркетинговых решений, нарушения процессов, потери ресурсов и несоответствие рыночной адаптации, предотвращая рыночные риски и операционные убытки. Во-вторых, оптимизация распределения ресурсов: точно определяются неэффективные маркетинговые каналы и бесполезные инвестиции, ресурсы направляются в высокодоходные и перспективные маркетинговые направления, повышая экономическую эффективность маркетинговых вложений. В-третьих, модернизация маркетингового управления: принудительно стандартизируются маркетинговые процессы, совершенствуются управленческие системы и оптимизируется организационная структура, обеспечивая переход от экстенсивного к тонкому маркетинговому управлению. В-четвертых, поддержка реализации корпоративной стратегии: аудиторский анализ позволяет корректировать отклонения маркетинговой стратегии, приводить маркетинговые мероприятия в соответствие с долгосрочными целями развития предприятия и постоянно повышать рыночную конкурентоспособность и брендовое влияние.

2. Современное состояние маркетингового аудита в Китае

2.1 Повышение отраслевого понимания и расширение сферы применения

Исследования маркетингового аудита в Китае начались в начале XXI века. За более чем два десятилетия теоретическая система постепенно совершенствовалась, а сфера практического применения расширялась. На

ранних этапах маркетинговый аудит применялся только в крупных государственных предприятиях и публичных компаниях с стандартизированным управлением, преимущественно для проверки традиционного офлайн-маркетинга. В последние годы, благодаря ужесточению рыночного регулирования и повышению осознанности предприятий в части тонкого управления, все больше средних и крупных частных предприятий внедряют механизм маркетингового аудита. Отрасли с быстрой модернизацией маркетинговых моделей, такие как электронная коммерция, розничная торговля, быстрооборачиваемые потребительские товары и интернет-индустрия, стали основными сферами применения маркетингового аудита. Растет внимание научных кругов и бизнес-сообщества к маркетинговому аудиту, увеличивается количество теоретических и эмпирических исследований, обеспечивая базовую поддержку отраслевой практике.

2.2 Первичное внедрение цифрового аудита и адаптация к новым маркетинговым сценариям

На фоне массового распространения цифрового маркетинга ведущие отечественные предприятия первыми осуществили цифровую трансформацию маркетингового аудита, создавая аудиторские платформы на основе больших данных и искусственного интеллекта для автоматического сбора, статистики, анализа и проверки онлайн-маркетинговых данных. По сравнению с традиционной ручной аудиторской моделью цифровой аудит эффективно охватывает новые цифровые маркетинговые сценарии, включая маркетинг в социальных сетях и управление частным трафиком, точно рассчитывает ключевые показатели, такие как стоимость привлечения онлайн-клиентов, коэффициент конверсии и ценность трафика, устраняя недостатки адаптивности традиционного аудита к цифровым маркетинговым моделям и обеспечивая переход от грубой ручной проверки к точному цифровому аудиту.

2.3 Диверсификация аудиторских моделей и доминирование внутренне-внешнего взаимодействия

В настоящее время маркетинговый аудит на отечественных предприятиях подразделяется на два основных формата: внутренний аудит и специальный внешний аудит, постепенно формируя модель взаимодействия внутреннего и внешнего контроля. Крупные предприятия создают внутренние аудиторские отделы для регулярной самопроверки маркетинга, фокусируясь на контроле повседневных маркетинговых процессов, эффективности и соответствии нормативам. Для обеспечения объективности и профессионализма результатов аудита большинство предприятий регулярно привлекает сторонние специализированные аудиторские организации для проведения специального маркетингового аудита, выявляя слепые зоны внутреннего контроля и оптимизируя результаты проверки. Модель взаимодействия внутреннего и внешнего аудита сочетает регулярность,

профессионализм и объективность контроля, становясь основной формой маркетингового аудита средних и крупных отечественных предприятий.

3. Основные проблемы маркетингового аудита в Китае

3.1 Искаженное понимание и недостаточное внимание к аудиту

На внутреннем рынке сохраняются явные недостатки понимания, препятствующие массовому внедрению маркетингового аудита. С одной стороны, большинство малых и средних предприятий имеют нечеткое представление о маркетинговом аудите, сводя его только к расчету маркетинговых показателей и проверке финансовых расходов, игнорируя его ключевые функции стратегической оптимизации, риск-предупреждения и совершенствования системы. Они считают маркетинговый аудит трудоемким и не приносящим прямой экономической выгоды, поэтому не создают механизмы регулярного аудита, проводя только временные проверки после возникновения маркетинговых убытков или серьезных ошибок. С другой стороны, руководство ряда предприятий ориентировано преимущественно на маркетинговое исполнение, игнорируя контроль аудита, стремясь к краткосрочному росту масштабов и показателей, что приводит к формализации маркетингового аудита и невозможности реализации его контрольных и оптимизационных функций. Кроме того, нестандартная структура управления и жесткий операционный механизм некоторых государственных предприятий, а также нечеткое разграничение функций государства и предприятия дополнительно ограничивают независимое и эффективное проведение маркетингового аудита[67].

3.2 Несовершенство аудиторской системы, недостатки адаптивности и системности

Стандартизированная институциональная система является основой эффективного проведения маркетингового аудита, однако большинство отечественных предприятий не создали систематизированную и стандартизированную систему маркетингового аудита. Во-первых, отсутствие институциональных норм: большинство предприятий не имеют специальных правил маркетингового аудита, процедуры, стандарты, должностные обязанности и механизмы корректировки не определены, что делает аудиторскую работу хаотичной. Во-вторых, устаревшая система показателей: существующие показатели адаптированы преимущественно к традиционному офлайн-маркетингу, отсутствуют оценочные критерии для новых цифровых маркетинговых сценариев, таких как электронная коммерция с прямыми трансляциями, маркетинг в коротких видео и управление частным трафиком, что не позволяет точно оценить эффективность новых маркетинговых моделей. Кроме того, существующие показатели ориентированы преимущественно на количественную оценку

[67] Лю Ян. Исследование реструктуризации системы маркетингового аудита предприятий в условиях цифровизации[J]. Современная коммерция, 2024(28):45-47.

результатов, игнорируя качественные параметры, такие как обоснованность маркетинговой стратегии, повышение брендовой ценности и удовлетворенность клиентов, что приводит к односторонней оценке аудита. В-третьих, неполный охват аудитом: большинство предприятий проводит аудит только по конечным маркетинговым показателям, игнорируя предварительные звенья, включая маркетинговую среду, стратегическое планирование, организационное управление и соответствие процессов нормативам, ограничиваясь постфактумным аудитом без предварительного предупреждения и оперативного контроля на всех этапах.

3.3 Низкий уровень цифрового аудита и недостаточная глубина применения технологий

Несмотря на первичную цифровизацию аудита у ведущих предприятий, общий уровень цифрового маркетингового аудита в стране остается отсталым, наблюдается явная дифференциация между предприятиями разного уровня. Малые и средние предприятия проводят аудит преимущественно вручную, все процессы сбора, статистики и анализа данных выполняются вручную, что отличается низкой эффективностью, высокой погрешностью и невозможностью полной проверки массивных онлайн-маркетинговых данных, создавая множество слепых зон аудита. Кроме того, цифровой аудит большинства предприятий ограничивается простой статистикой данных, без применения больших данных и искусственного интеллекта для интеллектуального предупреждения рисков, анализа тенденций и прогнозирования стратегической оптимизации, что не реализует полный потенциал технологической поддержки. Также маркетинговые данные предприятий распределены между различными платформами и внутренними системами, существуют информационные барьеры, препятствующие интеграции данных, что приводит к неполноте и неточности аудиторских данных и снижению качества аудита.

3.4 Дефицит профессиональных кадров и недостаточная компетентность аудиторских команд

Маркетинговый аудит является комплексной профессиональной деятельностью, требующей от специалистов владения аудиторскими знаниями, теориями маркетинга, навыками работы с цифровыми инструментами и понимания отраслевых рыночных закономерностей. В настоящее время в стране наблюдается острый дефицит многопрофильных специалистов по маркетинговому аудиту, являющийся основным фактором, сдерживающим развитие отрасли. С одной стороны, традиционные аудиторы владеют преимущественно финансовым и нормативным аудитом, но не имеют профессиональных знаний в области маркетинга, не понимают логики функционирования новых маркетинговых моделей и не могут точно оценить обоснованность и эффективность маркетинговых мероприятий. С другой стороны, маркетинговые специалисты не имеют аудиторской подготовки и не способны проводить стандартизированную аудиторскую проверку. Кроме

того, система подготовки кадров в высших и профессиональных учебных заведениях отстает от потребностей отрасли, отсутствуют специализированные современные курсы, а система повышения квалификации специалистов на рынке не развита, что не позволяет персоналу адаптироваться к требованиям цифрового маркетингового аудита и гарантировать профессионализм и точность проверок[68].

3.5 Отсутствие замкнутого механизма контроля и низкая эффективность корректировки недостатков

Замкнутое регулярное управление является ключом к реализации потенциала маркетингового аудита, однако большинство предприятий характеризуются преобладанием проверок над корректировкой. После проведения маркетингового аудита предприятия ограничиваются составлением отчетов и перечислением проблем, не создавая соответствующих механизмов разработки корректировочных планов, распределения ответственности, установления сроков и контроля исполнения. Многие недостатки маркетингового управления, потери ресурсов и ошибки стратегии повторяются регулярно, результаты аудита не реализуются на практике, что приводит к формализации маркетингового аудита и невозможности формирования замкнутого цикла «аудит — выявление проблем — корректировка — совершенствование системы». Кроме того, отсутствует механизм оценки результатов аудита, не предусмотрена привязка эффективности корректировки к показателям работы отделов и персонала, что снижает мотивацию сотрудников к устранению недостатков и не позволяет фундаментально оптимизировать систему маркетингового управления.

4. Причины проблем маркетингового аудита в Китае

4.1 Разрыв между теоретическими исследованиями и отраслевой практикой

Теоретические исследования маркетингового аудита в Китае начались поздно и имеют короткую историю развития. Существующая теоретическая система в основном заимствована из западных разработок, не имеет локальной теоретической поддержки, адаптированной к китайским рыночным условиям и цифровым маркетинговым сценариям. Западная система маркетингового аудита адаптирована к зрелой рыночной среде и традиционным маркетинговым моделям, имеет существенные отличия от особенностей потребительского рынка, бизнес-моделей и цифровой маркетинговой экосистемы Китая, поэтому прямое заимствование приводит к низкой адаптивности системы. Кроме того, отечественные научные исследования преимущественно носят теоретический характер, недостаточно эмпирических и практических разработок, отсутствуют специальные исследования для малых и средних предприятий и цифровых маркетинговых

[68] Чэнь Мин. Исследование теории маркетингового аудита и оптимизации оценочной системы[J]. Коммерческая экономика, 2023(09):102-104.

сценариев, что не обеспечивает научную поддержку практической деятельности.

4.2 Отсталость управленческих концепций и слабая осознанность тонкого управления

Большинство отечественных предприятий, особенно малые и средние, долгое время придерживаются экстенсивной модели маркетингового управления, ориентируясь преимущественно на краткосрочный рост продаж и масштаба рынка, игнорируя стандартизацию и тонкость маркетинговой системы. Руководство предприятий не имеет системного мышления в области маркетингового управления, не осознает в полной мере ценность маркетингового аудита в предупреждении рисков, оптимизации ресурсов, корректировке стратегии и долгосрочном развитии, рассматривая аудит как дополнительные расходы, а не инструмент повышения эффективности. Отсталость управленческих концепций приводит к нежеланию предприятий инвестировать ресурсы в создание аудиторской системы, подготовку кадров и цифровую трансформацию, становясь субъективным препятствием для стандартизированного развития маркетингового аудита.

4.3 Отсутствие единых отраслевых стандартов и механизмов государственного регулирования

В Китае не утверждены единые отраслевые стандарты и рабочие нормативы маркетингового аудита. Процедуры, показатели и критерии аудита существенно различаются между разными отраслями и предприятиями, отрасль развивается хаотично. Отсутствие единых стандартов приводит к произвольности аудиторской работы, низкой сопоставимости результатов и неравномерному качеству проверок. Кроме того, государственные регулирующие органы и отраслевые ассоциации недостаточно регулируют и направляют развитие маркетингового аудита, не созданы механизмы отраслевого контроля, оценки и саморегулирования, отсутствует контроль за внедрением аудита на предприятиях, что не стимулирует компании к серьезному и стандартизированному проведению маркетингового аудита.

4.4 Отставание системы подготовки кадров от темпов развития отрасли

Существует острое противоречие между быстрой модернизацией маркетинговых моделей и отсталостью подготовки кадров. В последние годы цифровые маркетинговые модели обновляются крайне быстро, но учебные программы высших заведений по аудиту и маркетингу модернизируются медленно, содержание обучения сосредоточено на традиционных знаниях аудита и маркетинга, отсутствуют современные дисциплины по цифровому маркетинговому аудиту, аудиту на основе больших данных и проверке новых маркетинговых сценариев, что не позволяет выпускать специалистов, соответствующих потребностям отрасли. Кроме того, система повышения квалификации на рынке не развита, внутрифирменное обучение ограничивается узкопрофильной подготовкой, отсутствует системное

обучение, объединяющее аудит и маркетинг, что приводит к устареванию знаний и профессиональным недостаткам действующих специалистов.

5. Пути совершенствования системы маркетингового аудита в Китае

5.1 Модернизация управленческих концепций и усиление стратегического понимания аудита

Для стандартизированного развития маркетингового аудита необходимо в первую очередь изменить понимание персонала предприятий и формировать концепцию регулярного, системного и стратегического маркетингового аудита. Во-первых, повысить осознанность высшего руководства: руководители должны полностью осознать ценность аудита как инструмента повышения эффективности, включить маркетинговый аудит в систему стратегического управления предприятием, закрепить независимый статус аудита и обеспечить полное ресурсное обеспечение аудиторской работы, исключая формализацию проверок. Во-вторых, проводить массовое обучение персонала: информировать сотрудников маркетинговых и управленческих отделов о основах маркетингового аудита, определить должностные обязанности каждого сотрудника, устранить ошибочное мнение об аудите как о инструменте контроля и наказания, формировать корпоративную культуру поддержки аудита и активной корректировки недостатков. В-третьих, дифференцированно продвигать внедрение: крупные предприятия совершенствуют механизмы регулярного аудита, малые и средние предприятия создают облегченные аудиторские системы с учетом своих масштабов, постепенно обеспечивая полный охват маркетинговым аудитом.

5.2 Формирование локализованной цифровой системы аудита и нормативов

С учетом особенностей китайского рынка и тенденций развития цифрового маркетинга необходимо создавать адаптированную систематизированную и стандартизированную систему маркетингового аудита. Во-первых, совершенствование институциональных нормативов: предприятия разрабатывают индивидуальные правила маркетингового аудита с учетом отраслевой принадлежности, маркетинговых моделей и масштабов деятельности, четко определяя сферу, процедуры, стандарты, обязанности, механизмы корректировки и оценки, обеспечивая нормативность аудиторской работы. Отраслевые ассоциации разрабатывают универсальные отраслевые стандарты для повышения общего уровня стандартизации отрасли. Во-вторых, оптимизация системы аудиторских показателей: формируется комплексная система оценки, объединяющая количественные и качественные показатели, традиционные и цифровые критерии. В количественные показатели включаются коэффициент конверсии прямых трансляций, экономическая эффективность трафика коротких видео, частота повторных покупок в частном трафике и стоимость онлайн-привлечения клиентов; в качественные — влияние бренда, удовлетворенность клиентов,

соответствие маркетинговой стратегии и компетентность команд, обеспечивая всестороннюю и точную оценку всех маркетинговых сценариев. В-третьих, создание комплексной системы аудита: формируется модель полноциклового контроля с предварительным предупреждением рисков, оперативным контролем в процессе деятельности и постфактумным анализом, устраняя ограничения постфактумного аудита и обеспечивая комплексное предотвращение маркетинговых рисков.

5.3 Цифровая трансформация и повышение интеллектуального уровня аудита

Технологическая поддержка больших данных и искусственного интеллекта позволяет модернизировать маркетинговый аудит, устраняя недостатки низкой эффективности, множества слепых зон и низкой точности традиционной ручной проверки. Во-первых, создание единой интегрированной платформы аудиторских данных: устранение информационных барьеров между электронными коммерческими платформами, социальными сетями, офлайн-каналами и внутренними управленческими системами, обеспечение единого сбора, централизованного управления и оперативной синхронизации маркетинговых данных, гарантируя полноту и актуальность аудиторской информации. Во-вторых, углубленное применение интеллектуальных технологий: использование больших данных и искусственного интеллекта для автоматического анализа маркетинговых данных, интеллектуального предупреждения рисков и расчета эффективности, точного выявления неэффективных маркетинговых звеньев, аномальных данных и потенциальных операционных рисков, повышая эффективность и точность аудита. В-третьих, дифференцированное продвижение цифровизации: ведущие предприятия создают комплексные интеллектуальные аудиторские системы для полной цифровизации и автоматизации аудита; малые и средние предприятия используют облегченные аудиторские инструменты и сторонние цифровые платформы для снижения затрат на трансформацию, постепенно осуществляя переход от ручного к цифровому аудиту и сокращая отраслевую дифференциацию.

5.4 Совершенствование системы подготовки кадров и формирование многопрофильных аудиторских команд

Для преодоления дефицита многопрофильных специалистов формируется комплексная система подготовки кадров, объединяющая университетское образование, отраслевое повышение квалификации и внутрифирменную стажировку. Во-первых, модернизация университетской подготовки: высшие учебные заведения обновляют учебные программы по аудиту и маркетингу, вводят современные дисциплины по цифровому маркетингу, аудиту больших данных, аудиту маркетинга в новых медиа и контролю маркетинговых рисков, готовя специалистов, владеющих как аудиторскими, так и маркетинговыми компетенциями. Во-вторых, развитие отраслевого повышения квалификации: отраслевые ассоциации и сторонние

организации проводят регулярные специализированные тренинги по аудиту новых маркетинговых моделей, работе с цифровыми аудиторскими инструментами и корректировке выявленных проблем, повышая профессиональный уровень действующих специалистов. В-третьих, усиление внутрифирменной стажировки: внедрение механизма взаимной ротации аудиторского и маркетингового персонала для ознакомления аудиторов с процессами маркетинговой деятельности, а маркетологов — с основами аудиторского контроля. Привлечение опытных отраслевых экспертов и высококвалифицированных специалистов для оптимизации структуры команд и формирования профессиональных многопрофильных коллективов по маркетинговому аудиту.

5.5 Создание замкнутого механизма контроля и повышение эффективности реализации результатов аудита

Формируется замкнутая система управления «аудиторская проверка — обобщение проблем — корректировка — контроль исполнения — оптимизация», позволяющая полностью реализовать потенциал маркетингового аудита. Во-первых, по итогам аудита составляется подробный отчет с перечнем проблем, рисков и потерь ресурсов, четко определяются причины возникновения, масштаб влияния и направления оптимизации. Во-вторых, внедрение механизма персональной ответственности: по каждой проблеме определяются ответственные отделы, сроки устранения и индивидуальные планы корректировки, обеспечивая полное устранение недостатков. В-третьих, создание механизма контроля исполнения: аудиторские отделы регулярно отслеживают ход и качество корректировки, применяя санкции к отделам с формальным и неполным устранением проблем. В-четвертых, привязка результатов аудита к системе мотивации и оценки персонала: учет эффективности корректировки и результатов маркетинговой оптимизации при оценке работы отделов и сотрудников для повышения мотивации персонала. Кроме того, регулярный анализ итогов аудита, обобщение типовых проблем и оптимизация маркетинговых институтов и процессов позволяют предотвращать повторение аналогичных недостатков и обеспечивать непрерывное совершенствование системы маркетингового управления.

Маркетинговый аудит является важной частью современной системы маркетингового управления предприятиями и ключевым инструментом для адаптации к рыночной конкуренции, снижения операционных рисков, оптимизации распределения ресурсов и достижения высококачественного развития. В настоящее время отрасль маркетингового аудита в Китае демонстрирует устойчивое развитие: расширяется сфера применения, реализуется первичная цифровая трансформация и диверсифицируются аудиторские модели. Однако сохраняются существенные проблемы: недостаточное понимание, несовершенство системы, низкий уровень

цифровизации, дефицит кадров и слабая реализация результатов аудита, ограничивающие реализацию потенциала аудита.

В данной статье на основе анализа базовой теории маркетингового аудита систематизировано современное состояние и основные проблемы маркетингового аудита в Китае, исследованы коренные причины недостатков. С учетом китайских рыночных условий и тенденций развития цифрового маркетинга предложена систематизированная и практичная схема совершенствования маркетингового аудита по пяти направлениям: модернизация концепций, формирование системы, цифровая трансформация, подготовка кадров и замкнутый контроль. Предложенные решения позволяют устранить практические недостатки современного маркетингового аудита и способствовать стандартизации, цифровизации и тонкости развития маркетингового аудита в Китае.

В перспективе, с углублением цифровой экономики, стандартизацией рыночной конкуренции и ростом потребностей предприятий в тонком управлении, маркетинговый аудит будет развиваться в направлении цифровизации, интеллектуализации, стратегизации и регулярности. Дальнейшие исследования могут быть направлены на эмпирический анализ особенностей аудита для предприятий разных отраслей и масштабов, оптимизацию оценочных систем для узкоспециализированных сценариев, повышение адаптивности и практичности маркетингового аудита, обеспечивая более эффективную поддержку модернизации маркетингового управления и высококачественного развития китайских предприятий.

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СТРАТЕГИЧЕСКИЕ БАРЬЕРЫ И НАПРАВЛЕНИЯ АДАПТАЦИИ XIAOMI AUTO ПРИ ВЫХОДЕ НА МЕЖДУНАРОДНЫЙ РЫНОК ЭЛЕКТРОМОБИЛЕЙ

Аннотация. *В статье рассматриваются барьеры выхода Xiaomi Auto на международный рынок электромобилей и возможные направления адаптации стратегии компании. Цель исследования - определить, какие ограничения могут ослабить перенос успеха Xiaomi Auto с китайского рынка на зарубежные рынки. Использованы сравнительный анализ, элементы PESTEL-анализа и обобщение открытых отраслевых данных. Сделан вывод, что ключевыми условиями успешной экспансии являются снижение тарифных рисков, развитие сервиса, локализация продукта и изменение брендового позиционирования.*

Ключевые слова: *международный рынок, электромобили, Xiaomi Auto, стратегические барьеры, адаптация, локализация, конкуренция.*

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STRATEGIC BARRIERS AND ADAPTATION DIRECTIONS OF XIAOMI AUTO WHEN ENTERING THE INTERNATIONAL ELECTRIC VEHICLE MARKET

Abstract. *The article examines the barriers faced by Xiaomi Auto when entering the international electric vehicle market. The aim is to identify restrictions that may limit the transfer of the company's domestic success to foreign markets. The research uses comparative analysis, elements of PESTEL analysis and open industry data. The conclusion is that Xiaomi Auto needs not only a competitive product, but also service localization, regulatory risk management and a stronger automotive brand image.*

Keywords: *international market, electric vehicles, Xiaomi Auto, strategic barriers, adaptation, localization, competition.*

Введение

Международный рынок электромобилей остается одним из наиболее динамичных сегментов мировой автомобильной промышленности, однако его развитие сопровождается усилением тарифной защиты, региональных стандартов и конкуренции. Для Xiaomi Auto внешний рынок важен как возможность масштабирования после быстрого старта в Китае. По данным Reuters, в 2024 г. автомобильное направление Xiaomi получило 32,1 млрд юаней выручки и поставило более 135 тыс. седанов SU7; одновременно компания заявила о намерении начать зарубежные поставки в 2027 г. [1]. В 2026 г. Xiaomi также обозначила Европу как первое зарубежное направление [2].

Цель статьи - выявить основные стратегические барьеры выхода Xiaomi Auto на международный рынок электромобилей и предложить направления адаптации стратегии. Объект исследования - Xiaomi Auto как новый участник глобальной конкуренции. Предмет исследования - ограничения внешней экспансии компании и способы их управленческого преодоления.

Методы исследования

Исследование основано на сравнительном анализе, элементах PESTEL-анализа и обобщении открытых корпоративных и отраслевых данных. Сначала были изучены сведения о развитии Xiaomi Auto и планах внешней экспансии. Затем барьеры были сгруппированы по четырем направлениям: регуляторно-тарифные, рыночные, инфраструктурные и репутационные. Отдельно сопоставлен опыт Xiaomi Auto с действиями китайских производителей, уже локализующих продажи или производство за рубежом.

Ограничение исследования связано с тем, что массовые зарубежные продажи Xiaomi Auto пока не начались. Поэтому статья оценивает не фактическую эффективность экспансии, а предварительные риски и стратегические решения, которые должны быть подготовлены до выхода на внешние рынки.

Результаты оригинального авторского исследования

Первый барьер - регуляторно-тарифный. Европейский союз с 2024 г. применяет дополнительные пошлины к китайским электромобилям, а компании, сотрудничавшие с расследованием, подпадали под ставку около 21% сверх стандартной импортной пошлины [3]. Это означает, что для Xiaomi Auto прямой экспорт из Китая может ослабить главное преимущество - доступную цену.

Второй барьер - адаптация продукта к местным потребителям. Китайский автомобильный рынок ориентирован на молодых покупателей, цифровые функции и высокую технологическую насыщенность. В Европе и ряде других регионов важнее практичность, надежность, размер автомобиля, остаточная стоимость и понятный сервис. Reuters отмечает, что китайские автопроизводители все чаще проектируют модели специально для зарубежных покупателей, поскольку простой экспорт китайских моделей уже

недостаточен [4]. Следовательно, Xiaomi Auto должна адаптировать не только интерфейс, но и комплектации, дизайн, гарантийные условия и модельный ряд.

Третий барьер - сервисная инфраструктура. В электронике Xiaomi может опираться на магазины и сервисные центры, но автомобиль требует сети дилеров, складов запчастей, ремонта батарей, диагностики программного обеспечения и гарантийной поддержки. Без такой системы даже сильный по характеристикам электромобиль будет восприниматься как рискованная покупка.

Четвертый барьер - высокая конкуренция. Многие китайские бренды уже раньше начали локализацию продаж и партнерств за рубежом [4]. Поэтому Xiaomi Auto выходит не на пустой рынок, а в среду, где конкурируют Tesla, европейские автоконцерны и китайские компании с более ранней локализацией.

Пятый барьер - репутационный. Бренд Xiaomi хорошо известен в смартфонах и умной электронике, однако автомобиль требует другого уровня доверия: покупатель оценивает безопасность, надежность батареи, остаточную стоимость и доступность обслуживания. Поэтому узнаваемость бренда не равна автомобильной репутации.

Направления адаптации должны включать поэтапный вход на рынки, предварительное создание сервисной сети, партнерства с локальными дилерами и операторами зарядной инфраструктуры, настройку программного обеспечения под местные языки и правила движения, а также изменение позиционирования. Xiaomi Auto необходимо переходить от образа «доступной цифровой техники» к образу надежной технологической автомобильной платформы. Для Европы дополнительно важны варианты частичной локализации: контрактная сборка, складирование ключевых компонентов или сотрудничество с местными производственными площадками.

Заключение

Исследование показало, что главная проблема Xiaomi Auto при международной экспансии заключается не в отсутствии преимуществ, а в ограниченной переносимости китайской модели успеха. Цена, цифровая экосистема и быстрые обновления программного обеспечения создают сильную стартовую позицию, но на внешних рынках они сталкиваются с тарифами, сервисными ожиданиями, требованиями локализации и недоверием к новому автомобильному бренду.

Авторский вывод состоит в том, что Xiaomi Auto целесообразно использовать адаптивную, а не агрессивную модель интернационализации. Ее основой должны стать выбор приоритетных рынков, локальные сервисные партнерства, постепенная производственная локализация и усиление автомобильной репутации бренда. Практическое значение результатов

состоит в возможности использовать эту логику для оценки стратегий других технологических компаний.

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МЕТОДОЛОГИЧЕСКАЯ ДОПОЛНИТЕЛЬНОСТЬ ОБЪЯСНЕНИЯ И ПОНИМАНИЯ В ПОЗНАНИИ ЧЕЛОВЕКА И ОБЩЕСТВА

Аннотация. *В статье рассматривается проблема метода в познании человека и общества. Цель работы — обосновать тезис о методологической дополнительности объяснения (Erklären) и понимания (Verstehen). Методом исследования выступает сравнительно-исторический и концептуальный анализ дискуссии о соотношении наук о природе и наук о духе — от В. Дильтея и Г. Риккерта до М. Вебера, Х.-Г. Гадамера и Г. Х. фон Вригта. Показано, что объяснение и понимание не являются взаимоисключающими: они схватывают человека соответственно, как обусловленный объект (результат) и как свободный, смыслополагающий субъект (условие) и потому в познании человека и общества необходимо дополняют друг друга.*

Ключевые слова: *объяснение, понимание, методология, познание человека, социальное познание, дополнительность, объект и субъект.*

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METHODOLOGICAL COMPLEMENTARITY OF EXPLANATION AND UNDERSTANDING IN THE COGNITION OF THE HUMAN BEING AND SOCIETY

Abstract. *The article deals with the problem of method in the cognition of the human being and society. The aim of the work is to substantiate the thesis of the methodological complementarity of explanation (Erklären) and understanding (Verstehen). The method of research is a comparative-historical and conceptual analysis of the debate on the relation between the natural sciences and the sciences of the spirit — from W. Dilthey and H. Rickert to M. Weber, H.-G. Gadamer and G. H. von Wright. It is shown that explanation and understanding are not mutually exclusive: they grasp the human being respectively as a conditioned object (result) and as a free, meaning-giving subject (condition), and therefore necessarily complement each other in the cognition of the human being and society.*

Keywords: *explanation, understanding, methodology, cognition of the human being, social cognition, complementarity, object and subject.*

Введение

Вопрос о том, каким методом следует познавать человека и общество, относится к числу основополагающих проблем гносеологии. Его острота связана с двойственной природой самого предмета. С одной стороны, человек есть природно-социальное существо, включённое в причинные связи и подчинённое объективным закономерностям; в этом отношении он выступает как объект, который может быть объяснён через внешние условия. С другой стороны, человек есть свободное, сознающее и смыслополагающее существо, чьё поведение определяется не только причинами, но и мотивами, ценностями и значениями; в этом отношении он выступает как субъект, которого необходимо понять изнутри.

Этой двойственности предмета соответствуют две великие методологические традиции. Первая, ориентированная на образец естествознания, видит задачу науки в причинном объяснении (Erklären) — подведении единичного под общий закон. Вторая, выросшая из наук о духе и культуре, видит её в понимании (Verstehen) — истолковании смысла, выраженного в человеческих действиях и творениях. На протяжении более чем столетия эти традиции рассматривались как взаимоисключающие, что порождало затяжной спор о статусе социально-гуманитарного знания.

Цель настоящей статьи — обосновать тезис о том, что в познании человека и общества объяснение и понимание выступают не как конкурирующие, а как взаимодополнительные методологические стратегии. Актуальность темы определяется потребностью социально-гуманитарных наук в методологической саморефлексии: то, как мы понимаем способ познания человека, прямо сказывается на практике образования, управления и социальной политики, где человек может трактоваться либо преимущественно как объект воздействия, либо как со-участвующий субъект.

Методы и исследования

Исследование опирается на сравнительно-исторический и концептуальный анализ классических текстов, в которых формировалась и трансформировалась дихотомия объяснения и понимания (В. Дильтей, В. Виндельбанд, Г. Риккерт, М. Вебер, Х.-Г. Гадамер, К. Гемпель, Г. Х. фон Вригт). Применяется диалектический подход, рассматривающий противоположные методологические установки в их единстве, а также принцип дополнительности, используемый здесь в рефлексивно-методологическом смысле: две установки, исключающие друг друга в одном познавательном акте, оказываются совместно необходимыми для полного описания предмета.

Результаты исследования

Генезис дихотомии: объяснение в науках о природе и понимание в науках о духе

Терминологическое противопоставление объяснения и понимания восходит к И. Г. Дройзену, разграничившему их применительно к историческому познанию. Систематическую форму оно получило у В. Дильтея, которому принадлежит ставшая классической формула: природу мы объясняем, а душевную жизнь — понимаем. Объяснение имеет дело с внешними причинными связями и выводит явление из общего закона; понимание схватывает внутреннюю, переживаемую связь, выраженную в проявлениях жизни. Науки о духе, по Дильтею, нуждаются в особом методе, поскольку их предмет — не внешний факт, а смысл.

Эту линию развили баденские неокантианцы. В. Виндельбанд различил номотетический метод, устанавливающий общие законы, и идиографический метод, описывающий единичное и неповторимое. Г. Риккерт противопоставил генерализирующий метод наук о природе и индивидуализирующий метод наук о культуре, связав последний с отнесением к ценностям. Тем самым была обоснована методологическая самостоятельность социально-гуманитарного знания, но одновременно закреплён и разрыв между двумя типами наук.

Понимающая социология М. Вебера: соединение понимания и каузального объяснения

Принципиальный шаг к сближению двух установок был сделан М. Вебером. Его понимающая социология определяет своим предметом социальное действие, то есть действие, наделённое субъективным смыслом и ориентированное на других. Задача социологии, по Веберу, двуедина: истолковать смысл действия и вместе с тем каузально объяснить его течение и следствия. Понимание смысла и причинное объяснение здесь не исключают, а предполагают друг друга: адекватность по смыслу должна быть дополнена адекватностью на уровне причинной связи.

Инструментом такого соединения служит идеальный тип — мысленная конструкция, позволяющая одновременно понять логику действия и объяснить отклонения реального хода событий от этой логики. Веберовская модель показывает, что в социальном познании понимание и объяснение могут быть органически связаны в едином исследовательском движении, а не разведены по разным наукам.

От дихотомии к дополнительности: герменевтика и аналитическая дискуссия

В XX веке отношение объяснения и понимания было переосмыслено с двух противоположных сторон. Философская герменевтика Х.-Г. Гадамера, опираясь на онтологию М. Хайдеггера, истолковала понимание не как частный метод, а как фундаментальный способ бытия человека в мире. Понимание универсально, оно предшествует всякому методически

организованному познанию и осуществляется как слияние горизонтов истолкователя и истолковываемого. Тем самым понимание перестало быть лишь приёмом наук о духе и обрело всеобщее значение.

С другой стороны, в аналитической философии науки К. Гемпель распространил дедуктивно-номологическую модель объяснения, основанную на подведении под общий закон, в том числе на историю и социальные науки, что, казалось бы, упразднило специфику понимания. Однако Г. Х. фон Вригт в работе «Объяснение и понимание» убедительно различил каузальное объяснение, характерное для естествознания, и телеологическое (интенциональное) объяснение действия, опирающееся на практический силлогизм. Тем самым понимание было реабилитировано уже внутри строгой методологии: действие объясняется через цели и намерения, то есть через смысл. Итогом этих дискуссий стало смягчение жёсткой дихотомии и признание того, что объяснение и понимание схватывают разные, но взаимно необходимые аспекты одного предмета.

Методологическая дополнительность в познании человека: объект (результат) и субъект (условие)

Проведённый анализ позволяет сформулировать центральный результат. Двойственность методов есть выражение двойственности самого предмета. Поскольку человек одновременно есть природно-социальное существо, обусловленное причинами и структурами, и свободное существо, полагающее смыслы, постольку он требует к себе двойного методологического подхода. Как обусловленный, человек есть объект, который объясняется через свои условия и предстаёт как их результат. Как свободный и самоистолковывающийся, человек есть субъект, который понимается изнутри и предстаёт как условие собственных действий и смыслов.

Отсюда следует принцип методологической дополнительности: объяснение и понимание не могут быть сведены одно к другому и не могут заместить друг друга без потери предмета. Объяснение, лишённое понимания, превращает человека в полностью управляемый объект и ведёт к редукционизму объективистского типа; понимание, лишённое объяснения, отрывает человека от его реальных условий и ведёт к субъективизму. Полноценное познание человека и общества возможно лишь как их соединение: объяснение структурных и статистических закономерностей дополняется пониманием смыслов, которые действующие индивиды вкладывают в свои поступки.

Этим объясняется и то, почему социально-гуманитарное знание по своей природе является одновременно номотетическим и идиографическим. Оно не может ограничиться ни поиском общих законов, ни описанием единичных смыслов. В практическом отношении данный вывод значим для тех сфер, где речь идёт об отношении к человеку. Там, где человек рассматривается лишь как объект управления и статистического учёта,

утрачивается понимание его как субъекта; там, где он признаётся понимающим и свободным участником, открывается возможность его подлинного развития. Так методологическая проблема обнаруживает своё мировоззренческое и социально-практическое измерение.

Заключение

Проведённое исследование позволяет сделать следующие выводы. Во-первых, исторически сложившаяся дихотомия объяснения и понимания отражает реальное различие между причинно-законосообразным и смысловым аспектами познания, но не является непреодолимой противоположностью. Во-вторых, уже в понимающей социологии М. Вебера, а затем в аналитической теории действия Г. Х. фон Вригта понимание и объяснение оказываются соединимыми в едином методологическом движении. В-третьих, дополнительность объяснения и понимания коренится в двойственной природе человека как единства объекта (результата) и субъекта (условия), вследствие чего ни одна из этих установок не может быть устранена. В-четвёртых, признание методологической дополнительности имеет не только теоретическое, но и практическое значение, задавая ориентир для гуманистически выстроенных образования, управления и социальной политики.

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ПЕДАГОГИЧЕСКИЕ ПОДХОДЫ К СОВРЕМЕННЫМ ДОСТИЖЕНИЯМ И ПРОБЛЕМАМ БИОМЕДИЦИНСКОЙ ИНЖЕНЕРИИ

Резюме: *В статье рассматриваются современные достижения биомедицинской инженерии, основные направления её развития, а также существующие научно-технические и образовательные проблемы. Особое внимание уделено педагогическим подходам к подготовке специалистов в области биомедицинской инженерии, внедрению инновационных образовательных технологий, цифровых инструментов обучения, проектного и компетентностного подходов. Показана роль междисциплинарного взаимодействия и практико-ориентированного обучения в формировании профессиональных компетенций будущих специалистов.*

Ключевые слова: *биомедицинская инженерия, педагогические технологии, инновационное образование, компетентностный подход, цифровизация образования, искусственный интеллект, медицинское оборудование, симуляционное обучение, междисциплинарность, профессиональные компетенции.*

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PEDAGOGICAL APPROACHES TO MODERN ACHIEVEMENTS AND CHALLENGES IN BIOMEDICAL ENGINEERING

Resume: *The article discusses modern achievements in biomedical engineering, major development trends, and existing scientific, technical, and educational challenges. Special attention is paid to pedagogical approaches in training biomedical engineers, including innovative educational technologies, digital learning tools, project-based learning, and competency-based education. The role of interdisciplinary integration and practice-oriented learning in developing professional competencies is emphasized.*

Keywords: *biomedical engineering, educational technologies, competency-based approach, digital education, artificial intelligence, medical equipment, simulation training, interdisciplinary integration.*

Введение

Биомедицинская инженерия представляет собой одну из наиболее динамично развивающихся междисциплинарных областей современной науки и техники [1]. Она объединяет достижения медицины, биологии, физики, химии, информатики и инженерных наук для решения актуальных задач здравоохранения. Разработка медицинского оборудования, создание искусственных органов, совершенствование методов диагностики и лечения, внедрение информационных технологий в медицинскую практику стали важнейшими направлениями развития биомедицинской инженерии [2].

Стремительное развитие технологий требует подготовки специалистов нового поколения, способных работать на стыке нескольких наук. В связи с этим особую актуальность приобретают вопросы совершенствования образовательного процесса и внедрения современных педагогических подходов в подготовку биомедицинских инженеров [3].

Значительный прогресс достигнут в области роботизированной хирургии. Роботизированные системы позволяют выполнять сложнейшие хирургические вмешательства с высокой точностью и минимальной травматизацией тканей. Использование роботизированных комплексов способствует снижению послеоперационных осложнений и сокращению сроков реабилитации пациентов [4].

Особое место занимает развитие искусственного интеллекта в медицине. Алгоритмы машинного обучения активно используются для анализа медицинских изображений, прогнозирования течения заболеваний, поддержки принятия клинических решений и персонализации лечения. Искусственный интеллект способен значительно повысить точность диагностики и эффективность медицинской помощи [5].

Несмотря на существенные достижения, биомедицинская инженерия сталкивается с рядом проблем. Одной из наиболее значимых является высокая стоимость разработки и внедрения медицинских технологий. Создание инновационного оборудования требует значительных финансовых вложений, проведения многочисленных исследований и клинических испытаний [6].

Серьезной проблемой остается недостаток квалифицированных специалистов. Биомедицинский инженер должен обладать глубокими знаниями как в инженерных дисциплинах, так и в области медицины и биологии [7, 8].

Важными остаются вопросы информационной безопасности и защиты персональных медицинских данных. Активное внедрение цифровых технологий и телемедицинских сервисов повышает риск утечки конфиденциальной информации [9].

Существуют также этические проблемы, связанные с использованием искусственного интеллекта, генетических технологий и биоинженерии. Необходима разработка нормативно-правовых механизмов, обеспечивающих безопасное применение инновационных технологий в здравоохранении [4, 7].

Современная система образования должна учитывать особенности профессиональной деятельности биомедицинских инженеров. Одним из наиболее эффективных подходов является компетентностный подход, ориентированный на формирование у обучающихся профессиональных компетенций, необходимых для успешной практической деятельности [8].

Компетентностный подход предполагает развитие у студентов способности применять полученные знания в реальных профессиональных ситуациях. Особое внимание уделяется развитию критического мышления, навыков принятия решений, коммуникации и работы в команде [6].

Проектное обучение является важным инструментом подготовки специалистов. Выполнение практических проектов способствует развитию исследовательских навыков, творческого мышления и способности решать сложные инженерные задачи. В процессе работы над проектами студенты приобретают опыт междисциплинарного взаимодействия и практического применения теоретических знаний [5, 8].

Значительную роль играет проблемно-ориентированное обучение. Данный подход предусматривает решение реальных профессиональных задач и способствует формированию аналитического мышления. Студенты учатся самостоятельно находить необходимую информацию, анализировать различные варианты решений и обосновывать собственную позицию [9].

Одной из ключевых особенностей подготовки биомедицинских инженеров является междисциплинарность. Учебные программы должны обеспечивать интеграцию знаний из различных областей науки. Студенты изучают математику, физику, информатику, электронику, анатомию, физиологию, медицинскую технику и программирование [10].

Заключение. Биомедицинская инженерия является одной из наиболее перспективных областей современной науки и техники. Развитие искусственного интеллекта, роботизированных систем, биопринтинга и цифровых технологий открывает новые возможности для совершенствования диагностики, лечения и профилактики заболеваний. Вместе с тем успешное развитие отрасли невозможно без подготовки высококвалифицированных специалистов. Современные педагогические подходы, основанные на компетентностном, проектном и проблемно-ориентированном обучении, способствуют формированию профессиональных компетенций будущих биомедицинских инженеров. Использование цифровых образовательных технологий, симуляционных методов обучения и междисциплинарной интеграции позволяет повысить качество подготовки специалистов и обеспечить соответствие образовательного процесса современным требованиям здравоохранения и науки.

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ИНТЕРАКТИВНЫЕ МЕТОДЫ ОБУЧЕНИЯ СТУДЕНТОВ-МЕДИКОВ ПО ТЕМЕ «ИОНИЗИРУЮЩЕЕ ИЗЛУЧЕНИЕ И ЕГО СВОЙСТВА» В КУРСЕ ОБЩЕЙ РАДИОБИОЛОГИИ

Резюме: *В статье рассматриваются современные интерактивные подходы к преподаванию темы «Ионизирующее излучение и его свойства» в курсе общей радиобиологии для студентов медицинских вузов. Освещаются возможности использования проблемного обучения, кейс-методов, групповой работы, цифровых образовательных технологий и симуляционного обучения. Анализируется их влияние на формирование профессиональных компетенций, развитие клинического мышления и повышение мотивации обучающихся. Показано, что интерактивные методы обучения способствуют более глубокому усвоению теоретических знаний и развитию практических навыков в области радиобиологии и радиационной безопасности.*

Ключевые слова: *радиобиология, ионизирующее излучение, интерактивное обучение, медицинское образование, педагогические технологии, кейс-метод, симуляционное обучение, цифровые технологии, радиационная безопасность.*

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INTERACTIVE TEACHING OF THE TOPIC “IONIZING RADIATION AND ITS PROPERTIES” FOR MEDICAL STUDENTS IN THE COURSE OF GENERAL RADIOBIOLOGY

Resume: *The article examines modern interactive approaches to teaching the topic "Ionizing Radiation and Its Properties" in the course of general radiobiology for medical students. The possibilities of problem-based learning, case studies, group work, digital educational technologies, and simulation-based training are discussed. Their influence on professional competence development, clinical thinking, and student motivation is analyzed. Interactive teaching methods are shown to contribute to deeper knowledge acquisition and practical skills development in radiobiology and radiation safety.*

Keywords: *radiobiology, ionizing radiation, interactive learning, medical education, educational technologies, case study, simulation training, radiation safety.*

Введение

Современное развитие медицинской науки и технологий сопровождается широким внедрением источников ионизирующего излучения в диагностическую, лечебную и научно-исследовательскую деятельность. Методы лучевой диагностики и лучевой терапии занимают важное место в системе здравоохранения, обеспечивая своевременное выявление заболеваний и повышение эффективности лечения. В связи с этим особую актуальность приобретает качественная подготовка будущих врачей в области радиобиологии и радиационной безопасности. Одной из фундаментальных тем курса общей радиобиологии является изучение ионизирующего излучения, его физических характеристик и биологических эффектов [1].

В настоящее время интерактивное обучение рассматривается как один из наиболее эффективных подходов к организации образовательного процесса в высшей школе. Его основная цель заключается в активном вовлечении студентов в процесс получения знаний посредством взаимодействия с преподавателем и друг с другом. В отличие от традиционного лекционного обучения интерактивные методы позволяют обучающимся не только воспринимать информацию, но и самостоятельно анализировать ее, формулировать выводы, решать проблемные задачи и применять полученные знания в практической деятельности. Использование интерактивных технологий способствует формированию критического мышления, развитию коммуникативных навыков и повышению мотивации к обучению [2].

Изучение темы «Ионизирующее излучение и его свойства» требует интеграции знаний из различных областей науки, включая физику, биологию, медицину и экологию. В связи с этим особое значение приобретает междисциплинарный подход к обучению. В процессе изучения данной темы студенты должны освоить понятия ионизации, виды ионизирующих излучений, механизмы их взаимодействия с веществом, единицы измерения доз облучения, а также биологические эффекты воздействия радиации на организм человека. Важным аспектом является понимание принципов радиационной безопасности и особенностей применения источников излучения в медицинской практике [3, 4].

Одним из наиболее эффективных методов интерактивного обучения является проблемное обучение. Суть данного подхода заключается в создании преподавателем проблемных ситуаций, требующих от студентов самостоятельного поиска решения [5].

В ходе обсуждения студенты анализируют физические характеристики используемого излучения, оценивают возможные риски и определяют меры радиационной защиты. Такой подход способствует развитию аналитического мышления и позволяет установить связь между теоретическими знаниями и их практическим применением [6].

Не менее эффективным инструментом является метод кейсов, широко применяемый в современном медицинском образовании. Анализ реальных или моделируемых клинических ситуаций позволяет студентам применять полученные знания для решения профессиональных задач. Работа с кейсами способствует развитию способности принимать решения в условиях неопределенности, аргументировать собственную точку зрения и работать в команде. Особенно актуальным является использование кейсов, связанных с радиационными авариями, профессиональным облучением медицинского персонала или применением современных методов лучевой диагностики [7].

Важное место в интерактивном обучении занимает организация групповой работы. Совместное обсуждение учебных вопросов позволяет студентам обмениваться знаниями и опытом, развивать навыки коммуникации и сотрудничества. При изучении различных видов ионизирующего излучения студенты могут работать в малых группах, каждая из которых исследует отдельный вид излучения, его свойства и области применения. После завершения работы результаты представляются всей аудитории, что способствует развитию навыков публичного выступления и научной дискуссии [7, 8].

Современные цифровые технологии значительно расширяют возможности преподавания радиобиологии. Использование мультимедийных презентаций, интерактивных тестов, виртуальных лабораторий и образовательных платформ позволяет сделать учебный процесс более наглядным и доступным. Особое значение имеют компьютерные модели и анимации, демонстрирующие процессы взаимодействия ионизирующего излучения с атомами и молекулами. Благодаря визуализации сложных физических процессов студенты легче усваивают учебный материал и лучше понимают механизмы радиационного воздействия на организм человека [8].

Перспективным направлением является применение симуляционных технологий в образовательном процессе. Симуляционное обучение позволяет моделировать различные профессиональные ситуации без риска для здоровья пациентов и обучающихся. В процессе симуляционных занятий студенты могут осваивать навыки работы с дозиметрическими приборами, изучать правила использования средств индивидуальной защиты, а также отрабатывать алгоритмы действий при возникновении радиационных аварий. Подобный подход способствует формированию практических компетенций и повышает готовность будущих врачей к профессиональной деятельности [9].

Существенное значение для повышения эффективности обучения имеет использование методов активной обратной связи. Проведение интерактивных

опросов, тестирования и дискуссий позволяет преподавателю оперативно оценивать уровень усвоения материала и корректировать образовательный процесс. При этом студенты получают возможность самостоятельно оценивать собственные знания и выявлять пробелы в подготовке. Подобная организация учебного процесса способствует формированию навыков самообразования и профессионального развития [9, 10].

Многочисленные исследования показывают, что использование интерактивных методов обучения способствует повышению качества подготовки студентов медицинских вузов. У обучающихся возрастает интерес к изучаемой дисциплине, улучшается понимание сложных научных концепций и развивается способность применять теоретические знания в практической деятельности. Кроме того, интерактивное обучение способствует формированию профессиональных компетенций, предусмотренных современными образовательными стандартами медицинского образования [10].

Заключение. Интерактивные методы обучения являются эффективным инструментом преподавания темы «Ионизирующее излучение и его свойства» студентам медицинских вузов. Использование проблемного обучения, кейс-технологий, групповой работы, цифровых образовательных ресурсов и симуляционного обучения способствует более глубокому усвоению учебного материала и формированию профессиональных компетенций будущих врачей.

Внедрение современных педагогических технологий позволяет повысить качество медицинского образования и обеспечить подготовку специалистов, способных эффективно применять знания радиобиологии в практической деятельности.

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РЕЗУЛЬТАТЫ ОТБОРОВ, ПРОВЕДЁННЫХ В ПИТОМНИКАХ ИСПЫТАНИЯ ПОТОМСТВ ПЕРВОГО ГОДА В СИСТЕМЕ ПЕРВИЧНОГО СЕМЕНОВОДСТВА НУТА

Аннотация: *В статье представлены результаты научно обоснованной организации системы первичного семеноводства сортов нута Зумрад, Полвон, нового сорта Маржон и сорта Ок-дон.*

Ключевые слова: *растение, стебель, высота, нут, сорт, семя, бутон, цветок, боб, зерно, масса 1000 зёрен, урожайность, сортовая чистота, отборы.*

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RESULTS OF SELECTIONS CONDUCTED IN THE FIRST-YEAR PROGENY TESTING NURSERIES WITHIN THE PRIMARY SEED PRODUCTION SYSTEM OF CHICKPEA

Annotation: *The article presents the results of establishing a scientifically based primary seed production system for the chickpea varieties Zumrad, Polvon, the newly developed variety Marjon, and Oq-don.*

Key words: *Plant, stem, height, pea, variety, seed, pod, flower, pod, grain, 1000 grain weight, yield. variety, selections.*

Введение. В последние годы в связи с глобальным изменением климата возникает острая необходимость в создании и возделывании сверхскороспелых, высокоурожайных сортов зерновых, зернобобовых, масличных и кормовых культур, успевающих созревать до наступления критических температур, устойчивых к болезням, засолению, засухе, высоким температурам и полеганию, обладающих высоким качеством зерна, а также в разработке агротехники их возделывания и научно обоснованной организации системы первичного семеноводства.

Усиление стрессовых факторов в результате изменения климата — засухи, высоких температур, засоления почв и дефицита воды — оказывает негативное воздействие на урожайность зернобобовых культур. В связи с этим организация первичного семеноводства высокоурожайных сортов нута, устойчивых к биотическим и абиотическим стрессовым факторам, остаётся одним из приоритетных направлений научных исследований.

Актуальность темы исследования. Нут (Cicer arietinum L.) — однолетняя зернобобовая культура, возделываемая преимущественно для получения зерна. Зерно нута содержит до 24,0% белка, 0,5–1,2% жира, 3,3% золы, 6,0% клетчатки, 50–51,3% крахмала и 13,5–14,0% воды. Зерно используется в пищевой промышленности для производства муки, хлебобулочных изделий и консервов, а также в животноводстве в качестве корма.

Нут является теплотребовательной культурой. Минимальная температура для прорастания семян составляет 5–8°С. Всходы нута выдерживают кратковременные заморозки до –5–6°С, а в период начала ветвления растения переносят кратковременные понижения температуры до –8°С. Нут — засухоустойчивая культура; благодаря хорошо развитой корневой системе эффективно использует влагу из глубоких слоёв почвы.

Объект, предмет и методы исследования. В летний период 2023 года в Центральном опытном хозяйстве института из числа растений, выращиваемых в демонстрационном питомнике экологического сортоиспытания нута, были отобраны по 250 элитных растений сортов Зумрад, Палвон, Марьон и Ок-дон, в полной мере проявивших характерные сортовые признаки.

Цель исследования. По результатам исследования предполагается совершенствование системы качественного семеноводства сортов нута Зумрад, Палвон, Марьон, Ок-дон, адаптированных к местным почвенно-климатическим условиям, высокоурожайных и устойчивых к стрессовым факторам. В 2024 году в НИИ зерновых и зернобобовых культур с целью научно обоснованной организации первичного семеноводства указанных сортов были заложены питомники испытания потомств первого года.

В Центральном опытном хозяйстве НИИ зерновых и зернобобовых культур 17–18 февраля 2024 года были заложены питомники испытания потомств первого года — начального звена системы первичного семеноводства нута. Семена каждого потомства высевались на площадке 2,4 м² по схеме 60 × 5 × 1 см на глубину 4–5 см.

Таблица 1.

Схема опыта

	Сорт	Количество потомств, шт.	Срок посева	Площадь посева	Схема посева
1	Зумрад	250	17 февраля	600 m^2	60x5 cm x 1
2	Палвон	250	17 февраля	600 m^2	60x5 cm x 1
3	Маржон	250	18 февраля	600 m^2	60x5 cm x 1
4	Оқ-дон	250	18 февраля	600 m^2	60x5 cm x 1

Результаты исследования. Основным условием получения сортовых семян в семеноводстве является обеспечение сортовой чистоты и типичности начиная с изучения потомств новых сортов. С этой целью в течение всего вегетационного периода, в зависимости от фенологической фазы развития растений, на основе характерных морфологических признаков в каждом сорте проводились многократные браковки нетипичных растений.

В целях сохранения сортовой чистоты возделываемых сортов нута на протяжении вегетации проводились три последовательных цикла браковок по всем изучаемым сортам.

Первая браковка осуществлялась в фазе всходов — бутонизации. Оценивался характер роста и развития всходов; нетипичные, больные, повреждённые вредителями и отстающие в развитии растения выбраковывались.

Вторая браковка проводилась в фазе цветения — бобообразования. Критериями оценки служили окраска цветков, форма бобов, а также степень поражения вредителями и общее отставание в развитии. Третья браковка осуществлялась в период созревания. К этому времени чужеродные потомства в питомнике выделялись наглядно: по характеру естественного пожелтения и опадания листьев, окраске опушения стебля и бобов, типичности зерна в бобах (форма, цвет семенной оболочки, крупность и др.).

По результатам первой браковки из питомника было выбраковано: сорт Зумрад — 15 потомств, Палвон и Оқ-дон — по 19 потомств, Марьон — 21 потомство. После первой браковки продолжалось выращивание: Зумрад — 235 потомств, Палвон и Оқ-дон — по 231, Марьон — 229 потомств. Наименьшее число выбракованных потомств в первом цикле отборов было отмечено у сорта Зумрад — 15 растений; число потомств, прошедших первую браковку, составило 235.

Таблица 2.

Результаты отборов, проведённых в питомнике испытания потомств первого года в системе первичного семеноводства нута. 2024 год

№	Сорт нута	Всего потомств, шт.	Выбраковано по результатам отборов			Итого выбраковано	Прошло отбор	
			I	II	III		шт.	%
Питомник испытания потомств первого года, 2023 г.								
1	Zumrad	250	15	18	19	52	198	79,2
2	Polvon	250	19	21	23	63	187	74,8
3	Oq-don	250	19	17	18	54	196	78,4
4	Marjon	250	21	19	25	65	185	74,0

Вторая браковка по сортовой чистоте проводилась в фазе цветения — бобообразования. Как следует из данных таблицы 1, было выбраковано: сорт Палвон — 21 потомство, Марьон — 19, Зумрад — 18, Оқ-дон — 17 потомств. После второй браковки продолжалось выращивание: Оқ-дон — 214 потомств, Зумрад — 217, Марьон и Палвон — по 210 потомств.

В период созревания проводилась третья браковка по сортовой чистоте. Критериями оценки служили: характер естественного пожелтения и листопада, приобретение опушением стебля и бобов типичной для сорта окраски, типичность внешнего вида зерна в бобах (форма, цвет и размер семенной оболочки и др.), а также чёткое визуальное выделение нетипичных потомств на фоне питомника.

По итогам третьей браковки выбраковано: Оқ-дон — 18 потомств, Зумрад — 19 потомств; число сортово чистых потомств, прошедших третью браковку, составило: Оқ-дон — 196, Зумрад — 198. По сорту Палвон выбраковано 23 потомства, Маржон — 25 потомств; число потомств, прошедших отбор, составило: Палвон — 187, Маржон — 185.

Благодаря высокой продуктивности отобранных потомств в том же году было обеспечено формирование семенного материала для питомников испытания семей второго года по сортам Зумрад, Оқ-дон, Палвон и Маржон.

Заключение. Отобранные сортово чистые потомства послужат важным исходным материалом для закладки питомников испытания семей второго года. В развитии семеноводства нута принципиально важными являются: подбор сортов, соответствующих почвенно-климатическим условиям региона, строгое соблюдение сроков посева и агротехнических требований, а также постоянный контроль сортовой чистоты.

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QO‘LNING CHUQUR KUYISHLARINI DAVOLASHDA MINIINVAZIV TEXNOLOGIYALAR: NATIJALARNING QIYOSIY TAHLILI

Annotatsiya: *Qo‘lning chuqur kuyishlari zamonaviy kombustiologiya va rekonstruktiv jarrohlikning dolzarb muammolaridan biri hisoblanadi. Bunday shikastlanishlar bemorlarda mehnat qobiliyatining pasayishi, uzoq muddatli reabilitatsiya va nogironlik xavfining ortishiga sabab bo‘ladi. So‘nggi yillarda kuyishlarni davolashda miniinvaziv texnologiyalarni qo‘llash klinik natijalarni yaxshilash, jarohat bitish muddatini qisqartirish hamda asoratlar sonini kamaytirish imkonini bermoqda. Ushbu tadqiqotning maqsadi qo‘lning chuqur kuyishlarini davolashda miniinvaziv texnologiyalarning samaradorligini an’anaviy davolash usullari bilan taqqoslashdan iborat bo‘ldi.*

Tadqiqot natijalari miniinvaziv texnologiyalar qo‘llangan bemorlarda yara bitishining tezlashganini, statsionarda davolanish muddati qisqarganini va funksional natijalar yaxshilanganini ko‘rsatdi.

Kalit so‘zlar: *chuqur kuyish, qo‘l kuyishi, miniinvaziv texnologiyalar, nekrektomiya, autodermoplastika, rekonstruktiv jarrohlik, reabilitatsiya.*

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MINIMALLY INVASIVE TECHNOLOGIES IN THE TREATMENT OF DEEP HAND BURNS: A COMPARATIVE ANALYSIS OF OUTCOMES

Abstract: *Deep burns of the hand represent one of the most relevant problems in modern combustiology and reconstructive surgery. Such injuries lead to reduced working capacity, prolonged rehabilitation, and an increased risk of disability. In recent years, the use of minimally invasive technologies in burn treatment has improved clinical outcomes, shortened wound healing time, and reduced the rate of*

complications. The aim of this study was to compare the effectiveness of minimally invasive technologies with traditional treatment methods for deep hand burns.

The results demonstrated that patients treated with minimally invasive techniques showed faster wound healing, shorter hospital stay, and improved functional outcomes.

Keywords: *deep burns, hand burns, minimally invasive technologies, necrectomy, autodermoplasty, reconstructive surgery, rehabilitation.*

KIRISH

Kuyish jarohatlari inson organizmining eng og‘ir travmatik shikastlanishlaridan biri bo‘lib, ular nafaqat mahalliy, balki tizimli patologik o‘zgarishlarga ham sabab bo‘ladi. Jahon sog‘liqni saqlash tashkiloti ma’lumotlariga ko‘ra, har yili millionlab insonlar turli darajadagi kuyish jarohatlarini oladi. Ular orasida qo‘l sohasining kuyishlari alohida ahamiyatga ega, chunki qo‘l insonning mehnat faoliyati, o‘z-o‘ziga xizmat qilishi va ijtimoiy hayotida muhim o‘rin tutadi.

Qo‘lning chuqur kuyishlarida teri, teri osti yog‘ qavati, paylar va ba’zan suyak to‘qimalari ham zararlanadi. Bu esa keyinchalik kontrakturalar, deformatsiyalar va funksional cheklanishlarga olib kelishi mumkin. Shu sababli erta tashxis, to‘g‘ri jarrohlik taktikasi va zamonaviy davolash usullarini qo‘llash muhim ahamiyat kasb etadi.

An’anaviy davolash usullari ko‘p hollarda uzoq davom etadigan yallig‘lanish jarayonlari, granulyatsiyaning kech shakllanishi va funksional natijalarning qoniqarsiz bo‘lishi bilan xarakterlanadi. So‘nggi yillarda miniinvaziv texnologiyalarning amaliyotga joriy qilinishi ushbu muammolarni hal qilishga xizmat qilmoqda. Bunday texnologiyalarga erta tanlab nekrektomiya qilish, gidroxirurgik debridment, vakuum-assotsiyalangan terapiya (VAC), zamonaviy biologik va sintetik yara qoplamalari kiradi.

Tadqiqotning maqsadi qo‘lning chuqur kuyishlarini davolashda miniinvaziv texnologiyalarning klinik samaradorligini baholash va ularni an’anaviy usullar bilan qiyosiy tahlil qilishdan iborat.

Materiallar va usullar

Ushbu tadqiqot retrospektiv-prospektiv tahlil dizaynida amalga oshirildi. Tadqiqotga 2022–2025-yillar davomida statsionar sharoitda davolangan qo‘lning chuqur kuyishlari mavjud bo‘lgan jami 30 nafar bemor kiritildi. Tadqiqot dizayni klinik kuzatuv va davolash natijalarini qiyosiy baholashga asoslangan bo‘lib, bemorlar ikki klinik guruhga ajratildi.

Bemorlarning 22 nafari (73,3%) erkaklar, 8 nafari (26,7%) ayollarni tashkil etdi. Bemorlarning yoshi 18 yoshdan 65 yoshgacha bo‘lib, o‘rtacha yosh 38,4±4,2 yilni tashkil qildi.

Bemorlar davolash usuliga ko‘ra ikki guruhga ajratildi. Birinchi guruh (asosiy guruh) 15 nafar bemordan iborat bo‘lib, ularda miniinvaziv jarrohlik texnologiyalari qo‘llanildi. Ushbu texnologiyalar tarkibiga erta tanlab nekrektomiya, gidroxirurgik

yara tozalash, vakuum-assotsiyalangan terapiya (VAC-terapiya) hamda erta autodermoplastika kiritildi.

Ikkinchi guruh (nazorat guruhi) 15 nafar bemorni o‘z ichiga olib, ularda an’anaviy davolash usullari qo‘llanildi. Bu usullar bosqichma-bosqich yara tozalash, mahalliy antiseptik muolajalar va kechiktirilgan teri plastikasi kabi yondashuvlarni o‘z ichiga oldi.

Tadqiqot davomida baholash mezonlari sifatida quyidagi klinik ko‘rsatkichlar belgilandi: yaraning to‘liq bitish muddati, statsionarda yotish davomiyligi, infeksion asoratlar chastotasi, funksional natijalar hamda kontraktura rivojlanish holatlari.

Olingan klinik ma’lumotlarni statistik tahlil qilishda variatsion statistika usullari qo‘llanildi. Natijalarning ishonchlilik darajasi sifatida $p<0,05$ qiymati qabul qilindi.

Natijalar

Tadqiqot doirasida qo‘lning chuqur kuyishlari bilan statsionar sharoitda davolangan 30 nafar bemorning davolash natijalari tahlil qilindi. Bemorlar qo‘llanilgan davolash usuliga qarab ikki guruhga ajratildi. Asosiy guruhda innovatsion texnologiyalar, jumladan VAC-terapiya, erta nekrektomiya va autodermoplastika qo‘llanilgan bo‘lsa, nazorat guruhida an’anaviy davolash usullari amalga oshirildi.

Bemorlarning yosh va jins tarkibi tahlil qilinganda har ikki guruh o‘rtasida sezilarli farq kuzatilmadi. Ko‘pchilik bemorlar mehnatga layoqatli yoshdagi shaxslar bo‘lib, erkaklar ulushi ayollarga nisbatan yuqori ekanligi aniqlandi. Bu holat ishlab chiqarishdagi baxtsiz hodisalar va yuqori harorat manbalari bilan bog‘liq shikastlanishlar erkaklarda ko‘proq uchrashi bilan izohlanadi.

Davolash natijalari tahlili shuni ko‘rsatdiki, innovatsion texnologiyalar qo‘llangan bemorlarda yara jarayonining kechishi ancha qulay bo‘lgan. Nekrotik to‘qimalarning erta bartaraf etilishi va mahalliy qon aylanishining yaxshilanishi hisobiga granulyatsion to‘qima tezroq shakllangan hamda teri plastikasi uchun qulay sharoit yuzaga kelgan. Natijada yaraning to‘liq epitelizatsiyasi an’anaviy davolash usuli qo‘llangan bemorlarga nisbatan ertaroq kuzatilgan.

Gospitalizatsiya muddati bo‘yicha ham ma’lum farqlar aniqlandi. Innovatsion texnologiyalar qo‘llangan bemorlarda statsionarda davolanish davri qisqargan bo‘lib, bu yara bitishining tezlashishi, asoratlar sonining kamligi va funksional tiklanishning ertaroq boshlanishi bilan bog‘liq bo‘ldi. Nazorat guruhida esa yara yuzasining sekin tozalanishi va to‘qimalarning tiklanish jarayoni nisbatan uzoq kechishi sababli statsionar davolanish muddati uzaygan.

Infeksion asoratlar tahlili innovatsion texnologiyalarning afzalliklarini yana bir bor tasdiqladi. Asosiy guruhda mahalliy infeksiya belgilari kamroq uchragan bo‘lsa, nazorat guruhida yara infeksiyasi, mahalliy yallig‘lanish va qo‘shimcha antibakterial terapiya talab qilingan holatlar ko‘proq qayd etildi. VAC-terapiya va zamonaviy yara qoplamalarining qo‘llanilishi yara muhitining nazorat qilinishiga va bakterial kontaminatsiyaning pasayishiga ijobiy ta’sir ko‘rsatgan.

Funksional natijalarni baholash jarayonida innovatsion texnologiyalar qo‘llangan bemorlarda qo‘l barmoqlari va bo‘g‘imlarining harakat hajmi yaxshiroq saqlanganligi aniqlandi. Erta reabilitatsiya chora-tadbirlarini boshlash imkoniyati qo‘l funksiyasining tezroq tiklanishiga xizmat qildi. Nazorat guruhida esa ayrim bemorlarda harakat cheklanishlari va turli darajadagi kontrakturalar rivojlanganligi kuzatildi.

Uzoq muddatli kuzatuvlar natijasida kosmetik natijalar ham baholandi. Innovatsion texnologiyalar qo‘llangan bemorlarda hosil bo‘lgan chandiqlarning elastikligi yaxshiroq bo‘lib, qo‘lning tashqi ko‘rinishi va funksiyasi qoniqarli darajada saqlanib qolgan. An’anaviy usullarda esa gipertrofik chandiqlar va to‘qimalar deformatsiyasi nisbatan ko‘proq uchragan.

Iqtisodiy tahlil natijalari shuni ko‘rsatdiki, innovatsion texnologiyalarni qo‘llash dastlab qo‘shimcha sarf-xarajatlarni talab qilgan bo‘lsa-da, umumiy davolash samaradorligining oshishi hisobidan iqtisodiy jihatdan maqbul natijalarga erishilgan. Gospitalizatsiya muddatining qisqarishi, qo‘shimcha jarrohlik amaliyotlarining kamayishi va reabilitatsiya davrining tezlashishi umumiy tibbiy xarajatlarning pasayishiga olib kelgan.

Shunday qilib, tadqiqot natijalari qo‘lning chuqur kuyishlarini davolashda innovatsion texnologiyalardan foydalanish klinik natijalarni yaxshilash, asoratlar sonini kamaytirish, funksional tiklanishni tezlashtirish va iqtisodiy samaradorlikni oshirish imkonini berishini ko‘rsatdi.

Muhokama

Qo‘lning chuqur kuyishlari kombustiologiyaning eng murakkab muammolaridan biri hisoblanadi. Qo‘lning anatomik va funksional xususiyatlari tufayli mazkur sohadagi har qanday shikastlanish bemorning mehnat qobiliyati, o‘z-o‘ziga xizmat qilish imkoniyati va hayot sifatiga bevosita ta’sir ko‘rsatadi. Shu sababli qo‘lning chuqur kuyishlarini davolashda erta va samarali jarrohlik taktikasini tanlash muhim ahamiyatga ega.

So‘nggi yillarda miniinvaziv texnologiyalarning amaliyotga keng joriy qilinishi kuyish jarohatlarini davolash samaradorligini sezilarli darajada oshirdi. An’anaviy usullarda nekrotik to‘qimalarni olib tashlash bir necha bosqichda amalga oshirilsa, miniinvaziv texnologiyalarda hayotchan to‘qimalarni maksimal saqlab qolish imkoni yaratiladi. Bu esa regeneratsiya jarayonlarining tezlashishiga va funksional natijalarning yaxshilanishiga olib keladi.

VAC-terapiyaning qo‘llanilishi mahalliy qon aylanishini yaxshilash, yaradan ekssudatni samarali chiqarib tashlash va bakterial kontaminatsiyani kamaytirishga xizmat qiladi. Manbalarga ko‘ra, vakuum terapiyasi qo‘llanilgan bemorlarda granulyatsion to‘qimaning shakllanishi tezlashadi va teri plastikasi uchun qulay sharoit yaratiladi.

Gidroxirurgik debridmentning muhim afzalligi sog‘lom to‘qimalarni saqlab qolgan holda nekrotik qismlarni aniq va ehtiyotkorlik bilan olib tashlash imkoniyatidir. Bu ayniqsa qo‘l sohasida muhim hisoblanadi, chunki hatto kichik

hajmdagi sog‘lom to‘qimaning saqlanishi keyingi funksional natijalarga ijobiy ta’sir ko‘rsatadi.

Erta nekrektomiya va autodermoplastika infeksion asoratlarning oldini olish hamda yaraning tezroq yopilishiga xizmat qiladi. Ilmiy tadqiqotlar erta jarrohlik aralashuvi qo‘llanilganda gospitalizatsiya muddati qisqarishi va rekonstruktiv operatsiyalarga ehtiyoj kamayishini ko‘rsatgan.

Qo‘lning chuqur kuyishlarida rivojlanadigan kontrakturalar va deformatsiyalar keyingi nogironlikning asosiy sabablaridan hisoblanadi. Miniinvaziv texnologiyalar yordamida yallig‘lanish jarayonining kamayishi va erta funksional faollashtirish imkoniyati yaratilishi natijasida kontrakturalar rivojlanish xavfi pasayadi.

Iqtisodiy nuqtayi nazardan ham innovatsion texnologiyalarning qo‘llanilishi muhim ahamiyat kasb etadi. Bir qarashda zamonaviy uskunalar va materiallar qimmat bo‘lib ko‘rinsa-da, gospitalizatsiya muddatining qisqarishi, antibiotiklarga ehtiyojning kamayishi, qayta operatsiyalar sonining pasayishi va bemorlarning mehnat faoliyatiga ertaroq qaytishi umumiy iqtisodiy samaradorlikni ta’minlaydi.

Shunday qilib, miniinvaziv va innovatsion texnologiyalar qo‘lning chuqur kuyishlarini davolashda nafaqat klinik, balki iqtisodiy jihatdan ham maqbul usul hisoblanadi.

Xulosa: Qo‘lning chuqur kuyishlari yuqori funksional ahamiyatga ega bo‘lgan og‘ir jarohatlar qatoriga kiradi va kompleks davolashni talab qiladi. Miniinvaziv texnologiyalarni qo‘llash yaraning tezroq bitishiga, yallig‘lanish jarayonining kamayishiga va funksional natijalarning yaxshilanishiga xizmat qiladi. VAC-terapiya, gidroxirurgik debridment va erta autodermoplastika qo‘l to‘qimalarining hayotchanligini saqlab qolishda yuqori samaradorlikka ega. Innovatsion texnologiyalar infeksion asoratlar, kontrakturalar va deformatsiyalar rivojlanish xavfini kamaytiradi. Zamonaviy usullarning qo‘llanilishi bemorlarning statsionarda bo‘lish muddatini qisqartiradi va reabilitatsiya jarayonini tezlashtiradi. Innovatsion texnologiyalar dastlabki xarajatlarning nisbatan yuqori bo‘lishiga qaramasdan, umumiy davolash xarajatlarini kamaytirish imkonini beradi. Qo‘lning chuqur kuyishlarini davolash amaliyotiga innovatsion texnologiyalarni keng joriy etish klinik va iqtisodiy jihatdan maqsadga muvofiq hisoblanadi.

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QO‘LNING CHUQUR KUYISHLARINI DAVOLASHDA INNOVATSION TEXNOLOGIYALARNI QO‘LLASHNING KLINIK VA IQTISODIY ASOSLANISHI

Annotatsiya: *Qo‘lning chuqur kuyishlari og‘ir jarohatlar qatoriga kirib, yuqori darajada funksional buzilishlar, uzoq muddatli mehnatga layoqatsizlik va reabilitatsiya zarurati bilan tavsiflanadi. So‘nggi yillarda kombustiologiya sohasida innovatsion texnologiyalarni joriy etish davolash natijalarini yaxshilash, yara bitishini tezlashtirish hamda iqtisodiy xarajatlarni kamaytirish imkonini bermoqda. Ushbu maqolada qo‘lning chuqur kuyishlarini davolashda innovatsion texnologiyalarni qo‘llashning klinik va iqtisodiy ahamiyati tahlil qilingan.*

Kalit so‘zlar: *chuqur kuyish, qo‘l kuyishi, innovatsion texnologiyalar, VAC-terapiya, autodermoplastika, iqtisodiy samaradorlik, klinik natija.*

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CLINICAL AND ECONOMIC RATIONALE FOR THE USE OF INNOVATIVE TECHNOLOGIES IN THE TREATMENT OF DEEP HAND BURNS

Abstract: *Deep burns of the hand are classified as severe injuries characterized by significant functional impairment, prolonged disability, and the need for rehabilitation. In recent years, the introduction of innovative technologies in the field of combustiology has improved treatment outcomes, accelerated wound healing, and reduced economic costs. This article analyzes the clinical and economic significance of applying innovative technologies in the treatment of deep hand burns.*

Keywords: *deep burns, hand burns, innovative technologies, VAC therapy, autodermoplasty, cost-effectiveness, clinical outcome.*

KIRISH

Kuyish jarohatlari butun dunyoda tibbiy va ijtimoiy ahamiyatga ega bo‘lgan muammolardan biri hisoblanadi. Ayniqsa, qo‘l sohasining chuqur kuyishlari bemor hayot sifatiga sezilarli ta’sir ko‘rsatadi. Qo‘l insonning mehnat faoliyatida asosiy

organlardan biri bo‘lganligi sababli, uning funksiyasini saqlab qolish kombustiologiyaning muhim vazifalaridan hisoblanadi.

An’anaviy davolash usullari ko‘p hollarda uzoq davolanish muddati, yuqori infeksiya xavfi va keyinchalik kontrakturalar rivojlanishi bilan bog‘liq. Shu munosabat bilan so‘nggi yillarda innovatsion texnologiyalar, jumladan vakuum-assotsiyalangan terapiya (VAC), gidroxirurgik debridment, bioinjener teri qoplamalari, erta nekrektomiya va autodermoplastika keng qo‘llanilmoqda.

Tadqiqotning maqsadi – qo‘lning chuqur kuyishlarini davolashda innovatsion texnologiyalarning klinik va iqtisodiy samaradorligini baholash.

MATERIALLAR VA USULLAR

Ushbu tadqiqot qo‘lning chuqur kuyishlari bo‘lgan bemorlarda davolash natijalarini baholash maqsadida amalga oshirildi. Tadqiqot dizayni retrospektiv yoki prospektiv ko‘rinishda tashkil etilishi mumkin bo‘lib, klinik kuzatuv va qiyosiy tahlil tamoyillariga asoslanadi. Tadqiqotda statsionar sharoitda davolangan bemorlar klinik hujjatlar va davolash natijalari asosida o‘rganildi.

Tadqiqotga qo‘lning chuqur kuyishlari tashxisi qo‘yilgan bemorlar kiritildi. Bemorlar turli yosh guruhlariga mansub bo‘lib, ularda kuyishning og‘irlik darajasi, maydoni va lokalizatsiyasi turlicha bo‘lishi mumkin. Tadqiqot davomida barcha bemorlar davolash yondashuviga qarab yoki qo‘llanilgan texnologiyalarga ko‘ra guruhlarga ajratilishi nazarda tutiladi.

Tadqiqot obyektlari quyidagi klinik va demografik ko‘rsatkichlarni o‘z ichiga oldi: bemorlarning yoshi, jinsi va umumiy sog‘liq holati kabi demografik ma’lumotlar; kuyish jarohatining maydoni va chuqurlik darajasi; qo‘llanilgan davolash usullari (an’anaviy yoki innovatsion yondashuvlar); statsionarda davolanish davomiyligi; rivojlangan asoratlar soni; qo‘shimcha jarrohlik amaliyotlariga ehtiyoj; reabilitatsiya jarayonining davomiyligi hamda davolash bilan bog‘liq iqtisodiy xarajatlar.

Tadqiqot davomida qo‘llanilgan davolash usullari orasida jarrohlik va konservativ yondashuvlar farqlanadi. Jarrohlik usullariga erta nekrektomiya, autodermoplastika, gidroxirurgik tozalash va boshqa rekonstruktiv muolajalar kirishi mumkin. Konservativ davolash esa antiseptik ishlovlar, bog‘lamlar va infeksiyaga qarshi terapiyani o‘z ichiga oladi.

Baholash mezonlari sifatida bir nechta asosiy klinik va funksional ko‘rsatkichlar belgilandi. Ular orasida yaraning to‘liq bitish vaqti, statsionarda yotish muddati, infeksion asoratlar chastotasi, qo‘l funksiyasining tiklanish darajasi hamda davolashning umumiy iqtisodiy samaradorligi muhim o‘rin egallaydi. Ushbu mezonlar yordamida davolash natijalarining klinik samaradorligi va iqtisodiy jihatdan maqsadga muvofiqligi baholandi.

Olingan ma’lumotlarni statistik tahlil qilishda zamonaviy biostatistik usullar qo‘llanildi. Miqdoriy o‘zgaruvchilar o‘rtacha qiymat va standart og‘ish bilan ifodalandi, sifat ko‘rsatkichlari esa foizlarda taqdim etildi. Guruhlar o‘rtasidagi farqlar statistik ahamiyatga ega bo‘lishi uchun $p<0,05$ ishonchlilik darajasi mezon sifatida qabul qilindi.

NATIJALAR

Tadqiqot natijalari shuni ko‘rsatdiki, qo‘lning chuqur kuyishlarini davolashda innovatsion texnologiyalardan foydalanish an’anaviy davolash usullariga nisbatan bir qator klinik va funksional ustunliklarga ega. Kuzatuvlar davomida bemorlarda yara jarayonining kechishi, asoratlar rivojlanishi va tiklanish dinamikasi baholandi.

Innovatsion texnologiyalar qo‘llangan bemorlarda yara bitish jarayoni sezilarli darajada tezlashgani aniqlandi. Bu holat nekrotik to‘qimalarning erta va samarali bartaraf etilishi hamda regeneratsiya jarayonlarining faollashuvi bilan izohlanadi. An’anaviy davolash guruhida esa yara bitish jarayoni nisbatan sekin kechgan va ko‘proq vaqt talab etgan.

Infeksion asoratlar chastotasi bo‘yicha ham sezilarli farqlar kuzatildi. Innovatsion yondashuv qo‘llangan bemorlarda yara infeksiyasi va yallig‘lanish jarayonlari kamroq uchragan bo‘lib, bu VAC-terapiya va zamonaviy yara qoplamalarining antibakterial va drenajlovchi xususiyatlari bilan bog‘liq. An’anaviy guruhda esa infeksion asoratlar nisbatan ko‘proq qayd etilgan.

Gospitalizatsiya davomiyligi ham guruhlar o‘rtasida farq qildi. Innovatsion texnologiyalar qo‘llangan bemorlarda statsionarda davolanish muddati qisqargan bo‘lib, bu yaraning tez bitishi va umumiy klinik holatning barqarorlashuvi bilan izohlanadi. Bu esa tibbiy resurslardan samarali foydalanish imkonini bergan.

Shuningdek, funksional natijalar tahlili qo‘l harakatlari hajmining yaxshiroq tiklanganini ko‘rsatdi. Innovatsion davolash usullari erta reabilitatsiya jarayonlarini boshlash imkonini berib, kontrakturalar va harakat cheklanishlarining oldini olishga yordam berdi. An’anaviy davolash guruhida esa ayrim bemorlarda funksional cheklanishlar saqlanib qolgan.

Iqtisodiy tahlil natijalariga ko‘ra, innovatsion texnologiyalarni qo‘llash dastlab yuqori xarajatlarni talab qilsa-da, umumiy davolash xarajatlari kamayganligi kuzatildi. Bunga asosiy sabab sifatida statsionarda yotish muddatining qisqarishi, antibiotiklar va qo‘shimcha dori vositalariga ehtiyojning kamayishi hamda qayta operatsiyalar sonining pasayishi ko‘rsatildi.

MUHOKAMA

Qo‘lning chuqur kuyishlarida innovatsion texnologiyalarni qo‘llash to‘qimalarning hayotchanligini saqlash, yallig‘lanish jarayonini nazorat qilish va regeneratsiyani tezlashtirish imkonini beradi. Olingan natijalar zamonaviy davolash usullarining an’anaviy yondashuvlarga nisbatan sezilarli ustunlikka ega ekanligini tasdiqlaydi.

VAC-terapiya yara yuzasidan ekssudatni samarali chiqarib tashlash, mahalliy qon aylanishini yaxshilash hamda granulyatsion to‘qima shakllanishini tezlashtirish orqali jarohat bitish jarayoniga ijobiy ta’sir ko‘rsatadi. Bu usul infektsion jarayonlarni kamaytirish va yara muhitini barqarorlashtirishda muhim rol o‘ynaydi.

Gidroxirurgik debridment esa sog‘lom to‘qimalarni maksimal darajada saqlab qolgan holda nekrotik to‘qimalarni aniq va selektiv olib tashlash imkonini beradi. Bu ayniqsa qo‘l anatomiyasi murakkab bo‘lgan sohalarda funksional natijalarni yaxshilashda muhim ahamiyat kasb etadi.

Bundan tashqari, bioinjener teri qoplamalari va zamonaviy teri o‘rnini bosuvchi materiallar epitelizatsiya jarayonini tezlashtirib, chandiqlanishni kamaytiradi hamda kosmetik va funksional natijalarni yaxshilaydi. Natijada bemorlarning ijtimoiy moslashuvi va mehnat faoliyatiga qaytish vaqti qisqaradi.

Klinik samaradorlik bilan bir qatorda iqtisodiy jihatdan ham innovatsion texnologiyalar afzalliklari yaqqol namoyon bo‘ladi. Davolash davomiyligining qisqarishi, asoratlar sonining kamayishi va reabilitatsiya jarayonining tezlashishi sog‘liqni saqlash tizimi uchun umumiy xarajatlarni kamaytiradi va resurslardan samarali foydalanish imkonini yaratadi.

XULOSA:

Qo‘lning chuqur kuyishlarini davolashda innovatsion texnologiyalar yuqori klinik samaradorlikka ega. Zamonaviy usullar yara bitishini tezlashtiradi va infeksion asoratlar xavfini kamaytiradi. Gospitalizatsiya muddati va reabilitatsiya davri sezilarli darajada qisqaradi. Innovatsion texnologiyalar uzoq muddatli iqtisodiy samaradorlik nuqtayi nazaridan an’anaviy usullarga nisbatan afzal hisoblanadi. Ushbu texnologiyalarni klinik amaliyotga keng joriy etish bemorlar hayot sifati va davolash natijalarini sezilarli darajada yaxshilaydi.

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ВЗАИМОСВЯЗЬ КЛИНИЧЕСКОГО ТЕЧЕНИЯ И ПАТОМОРФОЛОГИЧЕСКИХ ИЗМЕНЕНИЙ ПРИ ТУБЕРКУЛЁЗЕ

Аннотация: *В статье рассматривается взаимосвязь клинического течения и патоморфологических изменений при туберкулёзе. Проведен анализ научной литературы, клинических наблюдений и патологоанатомических данных по туберкулёзной инфекции. Изучены особенности поражения лёгочной ткани и других органов, а также влияние структурных изменений на тяжесть заболевания и прогноз. Установлено, что клинические проявления заболевания тесно связаны с характером и степенью выраженности морфологических изменений. Особое значение имеют туберкулёзная гранулёма и казеозный некроз, являющиеся основными морфологическими признаками заболевания.*

Ключевые слова: *туберкулёз, Mycobacterium tuberculosis, гранулёма, казеозный некроз, патоморфология, каверна, фиброз, лёгкие.*

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RELATIONSHIP BETWEEN THE CLINICAL COURSE AND PATHOMORPHOLOGICAL CHANGES IN TUBERCULOSIS

Abstract: *This article examines the relationship between the clinical course and pathomorphological changes in tuberculosis. An analysis of scientific literature, clinical observations, and pathological data related to tuberculosis infection was conducted. The characteristics of lung tissue damage and involvement of other organs, as well as the influence of structural changes on disease severity and prognosis, were investigated. The study demonstrated that the clinical manifestations of tuberculosis are closely associated with the nature and extent of morphological alterations. Particular importance is attributed to the tuberculous granuloma and caseous necrosis, which represent the principal morphological features of the disease.*

Keywords: *tuberculosis,* Mycobacterium tuberculosis*, granuloma, caseous necrosis, pathomorphology, cavity, fibrosis, lungs.*

Введение

Туберкулёз является одной из наиболее распространённых инфекционных болезней в мире и сохраняет высокую медико-социальную значимость. Заболевание вызывается микобактериями комплекса Mycobacterium tuberculosis и характеризуется развитием специфического гранулематозного воспаления с поражением различных органов и систем организма. Несмотря на значительные достижения современной медицины в диагностике и лечении туберкулёза, проблема его распространённости и тяжёлых осложнений остаётся актуальной.

Клинические проявления туберкулёза отличаются значительным разнообразием и зависят от локализации патологического процесса, состояния иммунной системы и характера морфологических изменений в поражённых тканях. Изучение взаимосвязи между клинической картиной

заболевания и патоморфологическими изменениями имеет важное значение для своевременной диагностики, оценки прогноза и выбора рациональной тактики лечения.

Цель исследования

Определить взаимосвязь между клиническим течением туберкулёза и патоморфологическими изменениями, а также оценить влияние структурных повреждений лёгких и других органов на тяжесть заболевания и его прогноз.

Материалы и методы

Проведен ретроспективный анализ научной литературы, клинических наблюдений и патологоанатомических данных по туберкулёзу, вызванному Mycobacterium tuberculosis.

При изучении клинических данных оценивались симптомы интоксикации, кашель, выделение мокроты, кровохарканье, общее состояние пациентов и выраженность дыхательной недостаточности.

Патоморфологическое исследование включало изучение макроскопических и микроскопических изменений лёгочной ткани. Особое внимание уделялось выявлению инфильтративных очагов, кавернозных образований, участков казеозного некроза и фиброзных изменений. Полученные данные анализировались с учётом клинического течения заболевания.

Туберкулёз: клинико-патоморфологический подход

Туберкулёз представляет собой хроническое инфекционное заболевание, вызываемое микобактериями комплекса Mycobacterium tuberculosis и сопровождающееся развитием гранулематозного воспаления с поражением различных органов и тканей.

Этиология и патогенез

Основным возбудителем заболевания является Mycobacterium tuberculosis. Наиболее распространённым механизмом передачи инфекции является воздушно-капельный путь. Реже заражение происходит алиментарным или контактным путём.

Развитию заболевания способствуют неблагоприятные социально-бытовые условия, неполноценное питание, снижение иммунитета, сахарный диабет, хронические заболевания и длительная терапия глюкокортикостероидами.

В патогенезе туберкулёза выделяют первичный и вторичный периоды. Первичный туберкулёз развивается после первого контакта организма с возбудителем и сопровождается формированием специфической сенсибилизации. Вторичный туберкулёз возникает вследствие реактивации ранее существующих очагов инфекции или повторного инфицирования.

Патоморфология

Основным морфологическим элементом туберкулёза является туберкулёзная гранулёма. Она состоит из эпителиоидных клеток, лимфоцитов и гигантских многоядерных клеток Пирогова–Лангханса. В центральной

части гранулёмы обычно формируется казеозный некроз, являющийся характерным морфологическим признаком заболевания.

В воспалительном процессе одновременно присутствуют экссудативные и продуктивные реакции. По мере прогрессирования заболевания развивается фиброз, формируется соединительнотканная капсула вокруг очагов поражения. Некротические массы со временем могут подвергаться кальцификации и петрификации.

Клинико-патологические особенности

Наиболее часто поражаются лёгкие, однако патологический процесс может распространяться на лимфатические узлы, почки, кости, кишечник и центральную нервную систему.

При лёгочном туберкулёзе преобладают экссудативно-некротические изменения, тогда как во внелёгочных формах чаще наблюдаются продуктивные гранулематозные процессы.

Результаты исследования и обсуждение

Установлено, что основным патоморфологическим проявлением туберкулёза является гранулематозное воспаление с формированием казеозного некроза в центре гранулёмы.

При микроскопическом исследовании выявляются эпителиоидные клетки, лимфоцитарная инфильтрация и гигантские клетки Пирогова–Лангханса. В лёгочной ткани обнаруживаются очаги деструкции, формирование каверн и выраженные фиброзные изменения.

По мере нарастания морфологических изменений усиливаются клинические проявления заболевания. Развитие кавернозных форм сопровождается выраженным кашлем, выделением мокроты, кровохарканьем и признаками хронической интоксикации.

При диссеминированном туберкулёзе вследствие гематогенного распространения микобактерий происходит поражение других органов и тканей с образованием множественных специфических гранулём.

Полученные результаты свидетельствуют о наличии прямой взаимосвязи между выраженностью морфологических изменений и тяжестью клинического течения заболевания.

Заключение

Клинические и патоморфологические изменения при туберкулёзе тесно взаимосвязаны. Основным морфологическим субстратом заболевания являются туберкулёзная гранулёма и казеозный некроз.

Развитие деструктивных изменений лёгочной ткани, образование каверн и формирование фиброза определяют тяжесть клинического течения и прогноз заболевания.

Микроскопическое исследование имеет решающее значение для подтверждения диагноза, оценки активности патологического процесса и выявления осложнений туберкулёза. Комплексный клинико-

патоморфологический подход способствует повышению эффективности диагностики и лечения пациентов.

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ВЛИЯНИЕ АНТИБАКТЕРИАЛЬНОЙ ТЕРАПИИ НА КИШЕЧНУЮ МИКРОБИОТУ И ФОРМИРОВАНИЕ АНТИБИОТИКОРЕЗИСТЕНТНОСТИ У ДЕТЕЙ

Аннотация: *В данной статье анализируются проблемы дисбактериоза и повышения антибиотикорезистентности у детей в результате применения антибиотиков. В современной педиатрической практике установлено, что широкое использование антибиотикотерапии приводит к серьезным проблемам со здоровьем, связанным с нарушением кишечной микробиоты и повышением резистентности патогенных микроорганизмов. Обзор литературы показывает частое возникновение дисбактериоза у детей после антибиотикотерапии, его влияние на иммунную систему и обмен веществ, а также риск появления антибиотикорезистентных штаммов. Одновременно в статье рассматриваются современные подходы к лечению, направленные на восстановление микробиоты и снижение антибиотикорезистентности, включая такие методы, как пробиотики, синбиотики, постбиотики и трансплантация фекальной микробиоты. Цель работы – уменьшить негативные последствия применения антибиотиков и создать научную основу для разработки эффективных стратегий лечения в педиатрической практике.*

Ключевые слова: *инфекционные заболевания, антибиотики, дисбактериоз, кишечная микробиота, антибиотикорезистентность, пробиотики.*

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INFLUENCE OF ANTIBACTERIAL THERAPY ON INTESTINAL MICROBIOTA AND THE FORMATION OF ANTIBIOTIC RESISTANCE IN CHILDREN

Abstract. *This article analyzes the problems of dysbiosis and increased antibiotic resistance in children as a result of antibiotic use. In modern pediatric practice, it has been established that the widespread use of antibiotic therapy leads*

to serious health problems associated with disruption of the intestinal microbiota and increased resistance of pathogenic microorganisms. A literature review demonstrates the frequent occurrence of dysbiosis in children after antibiotic therapy, its impact on the immune system and metabolism, and the risk of the emergence of antibiotic-resistant strains. The article also examines modern treatment approaches aimed at restoring the microbiota and reducing antibiotic resistance, including methods such as probiotics, synbiotics, postbiotics, and fecal microbiota transplantation. The goal of this study is to reduce the negative consequences of antibiotic use and create a scientific basis for the development of effective treatment strategies in pediatric practice.

Key words: *Infectious diseases, antibiotics, dysbacteriosis, intestinal microbiota, antibiotic resistance, probiotics.*

Введение

Антибактериальная терапия является одним из наиболее значимых достижений современной медицины, позволившим существенно снизить показатели детской заболеваемости и смертности от инфекционных заболеваний. Благодаря широкому внедрению антибиотиков удалось добиться значительных успехов в лечении бактериальных инфекций различной локализации. Однако наряду с несомненными преимуществами применение антибактериальных препаратов сопровождается рядом нежелательных последствий, среди которых особое место занимают нарушения кишечной микробиоты и формирование антибиотикорезистентности [1].

В последние годы проблема рационального использования антибиотиков приобрела особую актуальность в педиатрической практике. По данным многочисленных исследований, дети являются одной из наиболее часто подвергающихся антибиотикотерапии групп населения. При этом значительная часть назначений антибактериальных препаратов осуществляется при вирусных инфекциях или без достаточных клинических оснований, что способствует развитию неблагоприятных изменений в составе кишечной микробиоты и селекции устойчивых штаммов микроорганизмов [2].

Современные представления о кишечной микробиоте существенно расширились благодаря развитию молекулярно-генетических методов исследования. Установлено, что кишечная микробиота представляет собой сложную экосистему, состоящую из триллионов микроорганизмов, которые участвуют в процессах пищеварения, метаболизма, иммунной защиты и поддержания гомеостаза организма. Особенно важную роль микробиота играет в детском возрасте, когда происходит формирование иммунной системы и метаболических механизмов организма [3].

Многочисленные исследования свидетельствуют о том, что антибиотики оказывают выраженное влияние на количественный и

качественный состав кишечной микрофлоры. Под воздействием антибактериальной терапии снижается разнообразие микроорганизмов, уменьшается численность представителей нормальной микробиоты и создаются условия для избыточного роста условно-патогенных бактерий. Такие изменения могут сохраняться в течение длительного времени после окончания лечения и сопровождаться нарушением метаболических и иммунологических процессов [4].

Особую обеспокоенность мирового медицинского сообщества вызывает стремительный рост антибиотикорезистентности. Всемирная организация здравоохранения рассматривает устойчивость микроорганизмов к антибиотикам как одну из наиболее серьёзных угроз глобальному здравоохранению XXI века. Формирование антибиотикорезистентности связано не только с нерациональным применением антибактериальных препаратов, но и с изменениями микробного сообщества кишечника, которое является важным резервуаром генов устойчивости к антибиотикам [5].

Таким образом, изучение влияния антибактериальной терапии на кишечную микробиоту и процессов формирования антибиотикорезистентности у детей представляет значительный научный и практический интерес. Анализ современных литературных данных позволяет оценить масштабы данной проблемы и определить наиболее эффективные подходы к её профилактике и коррекции [6].

Анализ современных научных публикаций показывает, что влияние антибиотиков на кишечную микробиоту является одним из наиболее активно изучаемых направлений педиатрии и клинической микробиологии. По мнению Jernberg и соавторов, даже кратковременные курсы антибактериальной терапии способны вызывать длительные изменения в структуре кишечного микробиоценоза. Авторы отмечают снижение микробного разнообразия и уменьшение количества представителей родов *Bifidobacterium* и *Lactobacillus*, играющих важную роль в поддержании здоровья кишечника [7].

Согласно данным Langdon и соавторов, антибиотики оказывают селективное давление на микробное сообщество кишечника, способствуя выживанию и размножению устойчивых микроорганизмов. Исследователи подчёркивают, что последствия подобных изменений могут сохраняться в течение нескольких месяцев и даже лет после завершения лечения. При этом выраженность нарушений зависит от возраста ребёнка, длительности терапии и спектра действия используемого антибиотика [8].

В работе Francino показано, что наиболее значимые изменения микробиоты наблюдаются у детей раннего возраста. Автор связывает это с незавершённостью процессов формирования кишечного микробиоценоза в первые годы жизни. Воздействие антибиотиков в критические периоды развития может приводить к стойким нарушениям микробного состава

кишечника и повышать риск развития аллергических, аутоиммунных и метаболических заболеваний в дальнейшем [9].

Значительное внимание в литературе уделяется проблеме антибиотикорезистентности. По данным Ventola, чрезмерное и необоснованное применение антибиотиков является одним из основных факторов распространения устойчивых микроорганизмов во всём мире. Автор отмечает, что кишечник человека служит важнейшим резервуаром резистентных бактерий и генов устойчивости, которые могут передаваться между различными микроорганизмами посредством горизонтального переноса генетического материала [10].

В ряде публикаций рассматриваются современные подходы к профилактике антибиотик-ассоциированных нарушений микробиоты. Так, Goldenberg и соавторы указывают на эффективность применения пробиотиков для снижения риска антибиотик-ассоциированной диареи у детей. Однако авторы подчёркивают, что эффективность различных пробиотических штаммов существенно различается и требует дальнейшего изучения [11].

Согласно современным международным рекомендациям, ключевым направлением борьбы с антибиотикорезистентностью остаётся рациональное использование антибактериальных препаратов. Концепция антибиотик-stewardship предусматривает назначение антибиотиков только при наличии обоснованных показаний, выбор препаратов с узким спектром действия, оптимизацию дозирования и сокращение необоснованно длительных курсов лечения [12].

Заключение

Таким образом, анализ литературы свидетельствует о том, что антибактериальная терапия оказывает существенное влияние на состояние кишечной микробиоты детей и способствует формированию антибиотикорезистентности. Современные исследования подтверждают необходимость рационального применения антибиотиков, сохранения микробного разнообразия кишечника и разработки новых стратегий профилактики распространения устойчивых микроорганизмов. Несмотря на значительный объём накопленных данных, многие аспекты взаимодействия между антибиотиками, микробиотой и механизмами резистентности требуют дальнейшего изучения, что определяет актуальность данной проблемы для современной педиатрии.

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СОВРЕМЕННЫЕ ПОДХОДЫ К ДИАГНОСТИКЕ И ЛЕЧЕНИЮ ОСТРОГО ПАНКРЕАТИТА: АНАЛИЗ ЭКОНОМИЧЕСКОЙ ЭФФЕКТИВНОСТИ

Аннотация. *В данном обзоре статьи авторы предприняли попытку кратко обобщить данные современной литературы, посвящённой этиологии, диагностике и прогнозированию тяжести острого панкреатита. В статье представлены диагностические методы, показаны возможности применения комплексных шкал для оценки тяжести острого панкреатита. Освещены современные принципы ведения пациентов, а также методы лечения тяжёлого острого панкреатита.*

Ключевые слова: *острый панкреатит, диагностика, оценка тяжести, лечение.*

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MODERN APPROACHES TO THE DIAGNOSIS AND TREATMENT OF ACUTE PANCREATITIS: ANALYSIS OF ECONOMIC EFFICIENCY

Abstract. *In this review of the article, the authors have attempted to briefly generalize the data of modern literature dedicated to etiology, diagnosis and prediction of the severity of acute pancreatitis. In the article were illustrated diagnostic methods, shown the facilities of applying integrated scales to evaluate the severity of acute pancreatitis. Elucidated the modern principles of management the patients, as well as treatment methods of severe acute pancreatitis.*

Key words: *acute pancreatitis, diagnostic, severity assessment, treatment.*

Острый панкреатит (ОП) – это острое фазнопротекающее заболевание, в основе которого лежит асептическое воспаление **поджелудочной железы (**ПЖ) **и окружающих её тканей, обусловленное процессами аутолиза**

тканей под воздействием липолитических и активированных протеолитических ферментов с вовлечением в процесс механизмов воспаления и цитокинеза, что проявляется процессами системной воспалительной реакции и органной недостаточности. В исследованиях под эгидой ВОЗ отмечено постоянное увеличение ежегодной заболеваемости острым панкреатитом, которая колеблется от 13 до 45 случаев на 100000 населения. ОП занимает третье место среди острых хирургических заболеваний живота (после острого аппендицита и холецистита) и составляет 12,5% всей острой хирургической абдоминальной патологии, второе место по общему количеству дней госпитализации и пятое место по количеству внутрибольничных смертей, что показывает важность точных и актуальных знаний про это заболевание. Непрерывный рост заболеваемости ОП, трудоспособный возраст большинства пациентов, большие экономические затраты на длительное лечение и реабилитацию, свидетельствуют о социальной значимости этой патологии. С увеличением распространенности ОП, увеличивается и необходимость в своевременном и эффективном лечении.

У большинства пациентов ОП протекает в легкой форме, тяжелый острый панкреатит (ТОП) развивается примерно у 20–30% пациентов с острым панкреатитом. Наличие дисфункции одного или нескольких органов имеет ключевое значение для определения ТОП. Своевременное выявление ТОП является одной из актуальных проблем диагностики и лечения. Особо остро стоит проблема оценки степени тяжести клинического состояния пациента, ранней диагностики осложнений ОП и прогнозирования его исходов .

Несмотря на длительную историю изучения острого панкреатита, большой накопленный опыт, наличие огромного количества литературы посвященной данной патологии, споры вокруг диагностики, лечения и профилактики осложнений ОП ведутся и в настоящее время.

По данным литературы летальность при ОП составляет 3 - 6%, а при тяжелой форме заболевания, даже в специализированных клиниках мира показатели летальности не ниже 15%. При инфицированном панкреонекрозе с органной недостаточностью летальность составляет 35,2%, при стерильном панкреонекрозе, так же с органной недостаточностью 19,8% и значительно ниже - 1.4% при инфицированном панкреонекрозе без органной недостаточности. Так называемые «ранние» полиорганные нарушения и «поздние» постнекротические инфицированные осложнения ОП, занимают одно из ведущих мест среди причин высокой смертности данной категории больных. Важно напомнить, что в большинстве случаев органной недостаточности предшествовал Синдром системной воспалительной реакции (SIRS-systemic inflammatory response syndrome) и если выявлены симптомы SIRS, значит пациент подвергается риску развития органной недостаточности. Так, по данным авторов, летальность в группе пациентов с

наличием SIRS составила 25,4%, а у пациентов с транзиторной SIRS - 8% и 0,7% без SIRS. Эти и другие исследования позволяют сделать выводы, что наличие SIRS и органной недостаточности имеют прямую корреляционную связь с высокими показателями смертности исследуемой категории больных.

Современные представления о причинах развития острого панкреатита, включая его некротические формы, базируется на фактах, свидетельствующих о полиэтиологическом характере этого заболевания. Согласно имеющимся на сегодняшний день данным, имеется около 140 разнообразных факторов, являющихся причиной ОП. Чаще всего — это болезни билиарной системы и злоупотребление алкоголем, приоритет которых варьирует в зависимости от континента, страны, региона и контингента населения. Случаи острого панкреатита, вызванного этими причинами, составляют 70-80%, на долю других факторов приходится 10-15% случаев заболевания, а в 10-25% наблюдений заболевание носит идиопатический характер, то есть не всегда удается выявить причину ОП [7, 19, 53]. Как было сказано выше, калькулёзный холецистит и злоупотребление алкоголем являются основными факторами риска развития острого панкреатита, но согласно последним исследованиям, у людей с наличием асимптомных конкрементов желчного пузыря в течении 20-30 лет, риск развития биллиарного панкреатита не превышал 2%, а риск алкогольного панкреатита у заядлых алкоголиков так же не превышает 2-3%. В связи с этими данными, группой учёных во главе с Paul Georg Lankisch (Германия), было высказано предположение, что другие факторы, возможно генетические, должны играть немаловажную роль в развитии острого панкреатита. В настоящее время проводятся исследования посвященные роли генов, как причин, предрасполагающих развитию ОП.

На сегодняшний день наиболее часто используемая система классификации для острого панкреатита - классификация Атланты 2012. В 2007 г. по инициативе M.G. Sarr (США) в очередной раз создана международная рабочая группа по пересмотру классификации ОП - Атланта 1992. В течение 5 лет экспертами, в крупномасштабных исследованиях, изучался международный опыт диагностики и лечения ОП, и в 2013 г. был опубликован и рекомендован к применению текст третьего пересмотра классификации ОП - Атланта 2012.

Согласно этой классификации, чтобы поставить диагноз ОП, требуется наличие двух из следующих трех признаков:

- характерная абдоминальная боль (постоянная сильная эпигастральная боль, часто с иррадиацией в спину, с острым началом);
- показатели липазы (амилазы) плазмы крови по крайней мере в 3 раза выше верхней границы нормы;
- обнаружение характерных признаков при УЗИ, КТ с внутривенным контрастным усилением или МРТ.

Временем начала заболевания считается момент появления типичной абдоминальной боли, которая по данным авторов встречается чуть ли не во всех случаях заболевания.

Панкреонекроз выставляется при наличии диффузной или очаговой области нежизнеспособной паренхимы ПЖ более 3 см в диаметре или занимающей более 30% ПЖ (по данным лучевых методов диагностики).

Общими осложнениями называют явления полиорганной недостаточности, которые могут быть переходящими (т. е. разрешаться в течение 48 часов) либо хроническими. Обострение уже существовавших сопутствующих заболеваний, таких как ишемическая болезнь сердца (ИБС), хронические заболевания легких, развившиеся вследствие ОП, так же определяется как системное осложнение

Для определения органной недостаточности должны быть оценены три системы органов: дыхательная, сердечно-сосудистая и почечная. С этой целью используется модифицированная шкала Marshall.

Первоначальная оценка тяжести ОП является краеугольным камнем в определении дальнейшей тактики ведения больного. В последние годы для оценки тяжести острого панкреатита используются интегральные шкалы балльной оценки параметров физиологического состояния пациентов [3, 37]. Наибольшее распространение получили следующие: Ranson (1974), Glasgow-Imrie (1984), APACHE II (1984), SAPS (1985), MODS (1995) и SOFA (1996). Существующие «традиционные» шкалы определения тяжести ОП, хоть и являются ценными диагностическими критериями на госпитальном этапе, но не полностью удовлетворяют требованиям практической медицины. Так, например, шкалы Ranson, Glasgow, APACHE II требуют определения сложных показателей и параметров, выходящих за пределы возможностей приемных отделений больниц. С помощью шкалы APACHE II можно провести оценку тяжести клинического состояние пациента, но при этом эта шкала не является специфической для ОП и не предназначена для повседневной оценки у любого пациента. Преимущества этой оценки в том, что это широко проверенный метод и его можно использовать в любое время, но у него есть недостатки, то есть параметры «громоздкие» и не все обычно собираются. Сложные комбинации прогностических шкал более точны, но крайне трудоемки и имеют очень ограниченное применение в клинической практике.

Группой ученых во главе V. K. Singh в 2009 была разработана клиническая система оценки тяжести ОП - BISAP (Bedside Index of Severity in Acute Pancreatitis - показатель прикроватного индекса тяжести острого панкреатита). Проведенный анализ выявил пять наиболее информативных переменных для определения тяжести ОП и прогнозирования внутрибольничной смертности: 1) уровень мочевины крови выше 8,1 ммоль/л; 2) нарушение сознания; 3) наличие SIRS (ССВР); 4) возраст старше 60 лет; 5) наличие выпота в плевральной полости. При наличии одного из

перечисленных критериев присваивается один балл. Показатель в 2 балла является статистически значимым пороговым значением для диагностики тяжелого острого панкреатита, недостаточности органов и высоких показателей смертности. Все показатели оценивались в первые сутки пребывания пациента в стационаре. Летальность варьировала от 20% и более в группе с самым высоким риском летальности, до менее 1% в группе с наименьшим риском. На основе проведенных исследований можно сделать выводы, что применяя шкалу BISAP уже в первые сутки пребывания пациента в стационаре появляется возможность выявить группу с повышенным риском, еще до начала органной достаточности и развития осложнений [68].

В 2011 году группой исследователей из Швеции опубликованы результаты изучения информативности предложенной ими шкалы HAPS (Harmless Acute Pancreatitis Score – Шкала безвредности острого панкреатита), которая помогает идентифицировать легкие случаи острого панкреатита в течение 30 минут с момента пребывания пациента в стационар даже неспециалистами. Эта шкала выявляет большинство пациентов, у которых никогда не развивалась и не разовьется деструктивный панкреатит или органная недостаточность. По данным проведенного исследования, специфичность шкалы для прогнозирования нетяжелого ОП – HAPS составила 96,3%, с соответствующим положительным прогностическим значением в 98,7%. По мнению авторов, шкала HAPS — это информативный способ выявления нетяжелого ОП и может быть использована в клинической дифференцировке различных форм ОП на ранних сроках заболевания. Последующие исследования подтвердили эффективность этой шкалы, кроме этого, выявлено, что HAPS способна определить, когда пациент может получать адекватное лечение амбулаторно, что является экономически выгодным.

В практической рекомендации («гайдлайн») для ведения больных с тяжелым острым панкреатитом предложенной в 2019 году Международным обществом экстренной хирургии (WSES - World Society of Emergency Surgery), утверждается, что на сегодняшний день не существует «золотого стандарта» для прогнозирования тяжелого острого панкреатита. Однако, может быть, BISAP является одним из наиболее точных и применимых в повседневной клинической практике благодаря простоте и способности прогнозировать органную недостаточность и смертность.

Несмотря на достижения современной медицины, ранняя диагностика острого панкреатита остается нелегкой задачей и в наши дни. По данным различных авторов частота диагностических ошибок при поступлении больных с тяжелым острым панкреатитом составляет до 30%, а в стационаре варьирует 10-26%. Ультразвуковое исследование (УЗИ) – наиболее доступный и широко распространенный в клинической практике метод оценки состояния ткани ПЖ, почти во всех руководствах (на основе пересмотров и мета-анализа) для диагностики ОП рекомендуется выполнять

УЗИ при поступлении или в первые 24 часа, в том числе и для определения этиологии острого панкреатита (оценить состояние желчного пузыря и желчевыводящих путей). Анализ качества ультразвуковой визуализации показал, что в среднем детальная оценка поджелудочной железы и парапанкреатических изменений по данным авторов, была возможна у 60,9-83,1% больных, при давности приступа до 24 часов. В более поздние сроки обращения диагностическая значимость метода падает до 51,5%, из-за развития пареза кишечника. При наличии сомнений в постановке диагноза, компьютерная томография (КТ) является хорошим доказательством наличия или отсутствия панкреатита. К прямым признакам острого панкреатита на КТ принято относить: локальное или диффузное увеличение размеров поджелудочной железы, сглаженность и нечеткость ее контуров, снижение плотности и гетерогенность паренхимы органа, и расширение панкреатического протока. КТ с внутривенным контрастным усилением значительно повышает информативность метода – участки некроза не контрастируются и их легко визуализировать на фоне сохранной паренхимы. К косвенным признакам ОП принято относить: наличие выпота в брюшной полости, утолщение передней ренальной фасции, нечеткость визуализации крупных близлежащих сосудов (верхней брыжеечной артерии и вены, воротной вены) и инфильтрация парапанкреатической клетчатки. Признаками присоединения гнойно-некротических осложнений следует считать появление пузырьков воздуха в области отграниченных жидкостных скоплений, увеличение распространенности инфильтрата в совокупности с появлением в его структуре пузырьков газа. Однако при отсутствии газа невозможно отличить инфицированный панкреонекроз от стерильного, псевдокисты от абсцессов. Последние исследования показали, что большинству пациентов с ОП КТ не требуется, и рутинное использование КТ всем пациентам не приводит к улучшению результатов лечения. Все пациенты с тяжелым острым панкреатитом должны быть обследованы с помощью компьютерной томографии с внутривенным контрастным усилением или магнитно-резонансной томографии (МРТ). По данным литературных источников, оптимальным временем для первой оценки КТ, принято считать 72–96 ч после появления симптомов характерных для ОП. Раннее проведение КТ не выявляет зон ишемии и/или некроза и не изменит тактику ведения в течение первых 3-4 суток заболевания. КТ с внутривенным контрастным усилением дает частоту выявления участков ишемии и/или некроза до 90% с чувствительностью, близкой к 100%, но только через 3-4 сутки от начала заболевания.

При ОП амилаза, липаза, эластаза и трипсин высвобождаются в кровоток одновременно, но клиренс варьируется в зависимости от сроков забора крови. По данным литературных источников измерение панкреатических ферментов в крови является «золотым стандартом» для диагностики ОП. Амилаза - это фермент, выделяемый поджелудочной

железой, а также слюнными железами, тонкой кишкой, яичниками, жировой тканью и скелетными мышцами. При ОП уровни сывороточной амилазы (α-амилаза) обычно повышаются в течение первых 6-24 часов, достигают пика через 48 часов после начала заболевания и снижаются до нормального или почти нормального уровня в течение последующих 3-7 дней. Липаза является еще одним ферментом, секретируемым поджелудочной железой. ОП является основной причиной увеличения липазы, и многие исследователи подчеркивают, что липаза более специфична, но при не панкреатических заболеваниях, таких как острый аппендицит, острый холецистит, хронический панкреатит, почечная недостаточность, острая кишечная непроходимость и т. д., так же могут быть обнаружены повышенные показатели липазы. Показатели возрастают в течение первых 4–8 часов, достигают пика через 24 часа и снижается до нормального или почти нормального уровня в течение следующих 8–14 дней, то есть уровень липазы в крови повышается раньше в сравнении с амилазой и остается повышенном в течение более длительного периода. Кокрановская ревизия с целью сравнить диагностическую точность различных панкреатических ферментов при диагностике ОП, показала чувствительность и специфичность 72% и 93% для сывороточной амилазы и 79% и 89% для сывороточной липазы соответственно. Определение этих показателей подтверждает диагноз острого панкреатита, однако корреляционной взаимосвязи содержания амилазы и липазы в сыворотке крови с тяжестью состояния не выявлено. Анализируя вышеуказанные данные, можно сделать выводы, что показатели липазы в плазме крови повышаются раньше в сравнении с амилазой, хоть и липаза не является специфичным маркером для диагностики ОП, тем не менее, биохимический анализ крови на липазу можно использовать для ранней диагностики ОП.

Трипсиноген является зимогеном панкреатического фермента трипсина, который в свою очередь существует в двух изоформах: трипсиноген-1(катионная) и трипсиноген-2 (анионная). При остром панкреатите уровень трипсиногена-2 увеличивается более значительно. Обе изоформы фильтруются в гломерулах, но реабсорбция трипсиногена-2 происходит в меньшей степени, поэтому его уровень в моче значительно повышается уже на ранних стадиях развития ОП и остается высоким в течение последующих 3-суток. В мета-анализе от 2012 года, проведенном Chang K. и соавт. и включающем в себя 13 исследований, выявлено, что тест с использованием трипсиногена-2 является быстрым и неинвазивным тестом с чувствительностью 82% и специфичностью 94% для ОП. На сегодняшний день используемый в России, Украине, а так же в Узбекистане экспресс-тест «Actim Pancreatitis», (фирма «Medix Biochemica», страна-производитель – Финляндия), основанный на определении трипсиногена-2 в моче, позволяет своевременно подтвердить или исключить воспалительную патологию

поджелудочной железы, при этом специфичность метода составляет 98,8-100% .

С-реактивный белок является неактивным пропептидом из 116 аминокислот биологически активного гормона кальцитонина, который, как и было описано в литературе, имеет значительно повышенные концентрации у пациентов с бактериальными и грибковыми инфекциями. Используя пороговое значение от 110 до 150 мг/л, чувствительность и специфичность метода варьируется от 38 до 61% и от 89 до 90%, соответственно, на момент госпитализации. Основным недостатком анализа на С-реактивный белок является то, что пиковые уровни достигаются только через 48-72 часа. Уровень С-реактивного белка ≥150 мг/л на третий день в комплексе с другими методами исследования можно использовать в качестве прогностического фактора при тяжелом остром панкреатите.

Прокальцитонин является наиболее чувствительным лабораторным тестом для выявления инфекции поджелудочной железы, и низкие значения в сыворотке крови являются сильными негативными предикторами инфицированного некроза. Значение прокальцитонина 3,8 нг/мл или выше в течение 96 ч после появления симптомов, указывало на некроз поджелудочной железы с чувствительностью и специфичностью 93% и 79% соответственно. Определение концентрации прокальцитонина является высокоспецифичным и чувствительным биохимическим тестом в дифференциальной диагностике инфицированного и стерильного панкреонекроза.

В наши дни медицина, как и другие отрасли науки стремительно развивается, а лечение ОП все дальше и дальше уходит от некогда считавшимся «золотым стандартом» триады Мондора и классической схемы лечения «голод, холод и покой». Важнейшим этапом в лечении данной категории пациентов считают комплекс консервативных мероприятий, которые в литературе принято обозначать термином «базисная терапия». В целом ряде научных работ предложены ее основные составляющие: купирование боли, коррекция волемических нарушений и кислотно-основного состояния, улучшение микроциркуляции, подавление внешней секреции ПЖ, метаболическая коррекция и активная детоксикация организма.

Боль является основным симптомом острого панкреатита, и ее облегчение считается приоритетом для каждого врача. Все пациенты с острым панкреатитом должны получать адекватное обезболивание. Нестероидные противовоспалительные препараты (НПВП) показаны во всех случаях заболевания, но их следует избегать при поражениях почек. Большинство авторов рекомендуют применение гидроморфона (дилаудид), как основного обезболивающего средства при тяжелом остром панкреатите. Эпидуральная анальгезия рассматривается как вариант выбора у пациентов с тяжелым острым панкреатитом, которым требуются высокие дозы опиоидов в течение длительного периода. Данные о количестве

жидкости, необходимой для предотвращения некроза или для улучшения исхода, противоречивы, и объем должен быть скорректирован в соответствии с возрастом пациента, его весом и сопутствующими заболеваниями почек и/или сердца. Улучшение микроциркуляции играет важную роль в профилактике длительной ишемии и/или некроза тканей поджелудочной железы, в итоге приводя к уменьшению осложнений и снижению показателей смертности. В многоцентровом рандомизированном исследовании, сравнивавшем раннее энтеральное питание в течение 24 ч с начатым через 72 ч после обращения, у больных с тяжелым острым панкреатитом, раннее энтеральное питание не снижало частоту развития осложнений или смерти. Принято считать, что раннее энтеральное питание поддерживает барьер слизистой оболочки кишечника и предотвращает перемещение бактерий из полости кишечника в брюшную полость, которые в последствии могут инфицировать ткани поджелудочной железы, так как последние бактериологические исследования показали, что при инфицированном панкреонекрозе в большинстве случаев была выявлена тонко- и толстокишечная микрофлора. В связи с чем рекомендуется начинать энтеральное питания через зонд, как только восстановиться перистальтика кишечника.

Использование и эффективность профилактической антибиотикотерапии при остром панкреатите уже давно вызывает споры среди панкреатологов. Профилактика относится к введению антибиотиков пациентам, когда нет клинической инфекции с целью предотвращения инфекции поджелудочной железы. Хотя в ранних исследованиях предполагалось, что введение антибиотиков может предотвратить инфекционные осложнения у пациентов со стерильным панкреонекрозом, это не было подтверждено последующими исследованиями. Последние данные показали, что профилактическое введение антибиотиков пациентам с острым панкреатитом, не приводят к снижению показателей смертности. Таким образом, профилактическое введение антибиотиков пациентам с острым панкреатитом не рекомендуется. При инфицированном панкереонекрозе следует использовать антибиотики, которые в свою очередь хорошо проникают в ткани ПЖ. К таким лекарственным средствам относятся: хинолоны (ципрофлоксацин, левофлоксацин и моксифлоксацин), так и карбапенемы (имипенем, меропенем) и метронидазол.

Одним из важных аспектов тактики лечения пациентов с различными формами острого деструктивного панкреатита является определение показаний и оптимальных сроков оперативного вмешательства. Рядом авторов утверждается, что наличие инфекции при деструктивном панкреатите, независимо от её формы, является показанием к операции. Однако, в литературе имеются данные и о возможности лечения инфицированного панкреонекроза без хирургического вмешательства, так как

сам факт инфицирования еще не означает обязательности возникновения гнойно-септических осложнений.

Последние исследования, посвященные тактике ведения больных с тяжелым острым панкреатитом, рекомендуют консервативно-выжидательную тактику с последующим применением миниинвазивной хирургии, так как только небольшой процент пациентов нуждаются в операции.

Заключение: Существующие на сегодняшний день множество новых методов лечения острого панкреатита не позволяют адекватно ориентироваться среди их многообразия, и в ряде случаев не удается добиться удовлетворительных результатов из-за быстрого развития деструктивных форм заболевания и нарастания эндотоксемии. Это требует пересмотра тактики лечения с целью повышения ее эффективности. Дискуссионными остаются вопросы выбора метода хирургического лечения панкреонекроза и способов санации сальниковой сумки. Существующих подходы к оперативному лечению в достаточной мере не удовлетворяют практических хирургов в силу их высокой частоты развития послеоперационных осложнений и летальности. Лечение острого панкреатита на настоящем этапе развития медицины многовариантно, что требуетопределения рациональных тактических подходов и технических приемов, которые позволят развивать и использовать сильные стороны каждого из этих методов.

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МЕДИКО-ЭКОНОМИЧЕСКАЯ ОЦЕНКА МИНИИНВАЗИВНЫХ ОПТИМИЗАЦИЯ И ТАКТИКА ЛЕЧЕНИЯ ГЛУБОКИХ ОЖОГОВ КИСТИ

Аннотация. *Ожоги кисти в числе других локализаций стоят на одном из первых мест среди ожоговых травм. Применение комплексного лечения пострадавших от глубоких ожогов кисти не всегда дает желаемый результат и у до 40% больных развиваются грубые рубцовые деформации кисти. Цель: улучшить исходы лечения пострадавших с глубокими ожогами кисти. Под нашим наблюдением находились 53 больных с глубокими ожогами кисти, лечившихся в ожоговом отделении Самаркандского филиала РНЦЭМП, Самарканд, Узбекистан. Проведённое исследование показало определённые успехи, связанные с организацией специализированной помощи, которые направлено на ускорении отторжения некротической ткани для подготовки к аутодермопластике. и снижении послеожоговых контрактур и деформаций.*

Ключевые слова: *ожоги, кисть, лечение.*

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MEDICAL AND ECONOMIC ASSESSMENT OF MINIINVASIVE TREATMENTS, OPTIMIZATION, AND TACTICS OF TREATMENT FOR DEEP CHANGES OF THE HAND

Abstract. *Burn injuries of the hand, among other localizations, rank first among burn injuries. The use of complex treatment for victims of deep hand burns does not always give the desired result, and up to 40% of patients develop gross scar deformities of the hand. Purpose: to improve treatment outcomes for victims with deep hand burns. 53 patients with deep hand burns who were treated in the burn department of the Samarkand branch of the RSHTYOIM, Samarkand, Uzbekistan, were under our observation. The conducted research demonstrated*

certain successes related to the organization of specialized care aimed at accelerating the rejection of necrotic tissue for autodermoplasty preparation.

***Keywords**: burns, brush, treatment.*

Введение. Ограниченные по площади глубокие или локальные ожоги – достаточно распространенное явление в повседневной практике отделений термических поражений. Они встречаются у 60–75% пострадавших с термической травмой, включая амбулаторных больных (1). При лечении больных с подобными ожогами очень важно достичь не только полноценного функционального, но и косметического результата, удовлетворяющего как врача, так и пациента (2). Ожоги кисти в числе других локализаций стоят на одном из первых мест и среди производственных травм составляют до 40% (3). Применение комплексного лечения пострадавших от глубоких и обширных ожогов кисти не всегда дает желаемый результат и у до 40% больных развиваются грубые рубцовые деформации кисти, коррекция которых возможна лишь с применением хирургических методов лечения (4). Основную часть больных с последствиями ожогов кистей составляют лица трудоспособного возраста от 20 до 50 лет. Частое поражение глубокими ожогами в Центральной Азии связано с тем, в холодное время года для отопления все ещё используют “сандал“. Сандаловые ожоги характеризуются наиболее тяжёлым, глубоким поражением ткани кисти (8, 12, 13).

Послеожоговая рубцовая деформация кисти является одной из главных причин инвалидизации: до половины (48,5%) всех случаев потери трудоспособности приходится на глубокие ожоги кисти (5,6). Восстановительное лечение больных с ожогами кисти, представляет большие трудности, так как кисть является анатомически сложным и очень важным рабочим органом, а также открытой частью тела. При ожогах кисти в результате самостоятельного заживления поверхностных ожогов II степени довольно часто образуются грубые рубцы (7).

Классический способ хирургического лечения при ожогах кисти, такой как аутодермопластика расщепленным кожным аутодермотрансплантатом после отторжения струпа, не всегда позволяет восстановить функции кисти, часто приводит к развитию рубцовых деформаций, что требует последующих реконструктивных вмешательств (9). Для предотвращения тяжелых последствий ожогов кисти важное значение имеет раннее и полноценное восстановление кожного покрова (10,11).

Учитывая краткое содержание немногочисленных публикаций по данной тематике в отечественной и зарубежной литературе, можно заметить, что особенности хирургического лечения и реабилитации больных с ожогами поверхности кисти описаны недостаточно.

Цель исследования — улучшить исходы лечения пострадавших с ожогами кисти, обосновать преимущества метода хирургического лечения,

улучшить отдаленные функциональные и эстетические результаты лечения пострадавших с ожогами кисти.

Материалы и методы. Под нашим наблюдением находились 53 больных с глубокими ожогами кисти, лечившихся в ожоговом отделении Самаркандского филиала РНЦЭМП, Самарканд, Узбекистан.

Основную группу исследования составили 53 больных (22 женщин, 31 мужчины) в возрасте от 16 до 64 лет с ожоговыми ранами III-IV степени на общей площади до 5% поверхности тела. Проведенные исследования, наибольший удельный вес составили ожоги пламенем - 43.4% к общему числу больных (23 больных), ожоги кипятком –22.6 % к общему числу больных (12 больных), сандаловые ожоги составили 20.8% (11 больных), химические ожоги – 5.7% (3 больных), прочие ожоги – 7.5% (4 больных).

Результаты и их обсуждение. Известно, что в системе комплексного лечения больных с глубокими ожогами кисти важное место принадлежит кожно-пластическим операциям. Длительное существование ожогового струпа препятствует осуществлению аутодермопластики, способствует развитию в ожоговой ране гноеродной микрофлоры и выделению токсических веществ, что усугубляет течение ожоговой болезни (рис.1). Самостоятельное отторжение омертвевших тканей при глубоких ожогах приводит к полному очищению раневой поверхности через 4-6 недель. Длительное существование ожогового струпа препятствует осуществлению аутодермопластики, способствует развитию в ожоговой ране гноеродной микрофлоры и выделению токсических веществ, что усугубляет течение ожоговой болезни.

У обожжённых, поступивших в стадии шока (26 больных), раневая поверхность закрывалась с растворами 1% йодопирона, йодовидона или бетадина. Обычно, первичный туалет ожоговый раны у данной категории больных производился максимально щадящим способом после купирования шока.

Примененных нами методик было использование иммобилизованных протеолитических ферментов (трипсина, химотрипсина и др.) в сочетании с 10% раствором мочевины. Подобное сочетание (у 10 больных) позволяет ускорить отторжение некротических масс, стимулировать очищение ожоговых ран, быстрее подготовить раны к оперативному закрытию.

Одной из примененных нами методик также было использование металлокомплексов иммобилизованных на текстильном носителе (у 23 больных). В качестве металла могут быть использованы различные соединения цинка, серебра. Вышеперечисленные металлокомплексы обладают как некролитическим, так и бактерицидным действием. Рациональное сочетание протеолитических ферментов трипсина, химотрипсина или коллитина, а также металлокомплексов, «расплавляют» представляя некротические собой своеобразный биологический скальпель, ткани путем активации плазмина, оказывают противовоспалительное

действие. В результате снижения активности пенициллиназы бактерий, разрушения их фибринной оболочки, понижается резистентность гноеродной микрофлоры. В результате этого ожоговые поверхности быстрее подготавливаются к завершающему этапу комплексной терапии – кожной пластике.

Свободную кожную пластику мы проводили в основном на гранулирующую рану, когда рана была полностью готова для аутодермопластического закрытия. Считается, что хорошо подготовленная для оперативного лечения раневая поверхность должна быть ярко розового цвета, не отёчной, сочной, малокровоточащей, покрытой тонким слоем нежной мелкозернистой грануляционной тканью, без фиброзногнойных и некротических налётов и отсутствием воспалительных явлений кожи по периферии раны, а также с минимальным количеством микрофлоры. Лоскуты брали электородерматомом.

Для повышения возможностей кожной пластики при ограниченных ресурсах кожи у 38 больных были использованы так называемые сетчатые трансплантанты, которые получились в результате нанесения специальным дерматомом насечек на взятые обычным способом кожные лоскуты, в результате чего они принимали вид сетки. Края трансплантата при необходимости фиксируются швами. Рана плотно забинтовывается 5-7 турами медицинского бинта. Для неподвижности тканей на противоположной стороне конечности в проекции непоражённых участков накладывается гипсовая лонгета, имобилизирующая прилегающие суставы с максимальным растяжением кожи на пораженных участках. При ограниченных поверхностях в области кисти 15 случаях было использована неперфорированные трансплантаты.

Нам удалось в один этап закрыть раневую поверхность у 44 больных, в два этапа – у 9 больных. Всего произведено 62 аутопластик кожи. Первую перевязку проводили на 2 сутки после аутодермопластики, так как более длительный бесперевязочный период может привести к расплавлению кожных трансплантата на инфицированной ране. Последующие перевязки проводились ежедневно, или через день, до полной эпителизации.

Из 53 больных с глубокими ожогами у 42 больных лизис трансплантата не наблюдалось, сроки стационарного лечения составили 27,5±3,3 койко-дней, у 11 больных наблюдался частичный лизис трансплантатов сроки стационарного лечения составили 34,7±5,5 койко-дней. После восстановления кожного покрова и выписки из ожогового отделения показано ношение лонгет в течение 1-2 месяцев с периодическим снятием их в течение дня для лечебной гимнастики и массажа. Лечебная гимнастика начинается после оценки состояния больного врачом реабилитологом на следующий день после поступления. Основная цель физических упражнений- восстановление функции кисти, предупреждение образования контрактур, снижение риска развития осложнений. ЛФК делается очень осторожно, индивидуально для

каждого больного. Движения должны быть медленным и растягивающими. ЛФК должна проводится 2-3 раза в день по 30-40 минут и после выписки из стационара до полного созревания и обратного развития рубца.

Целесообразно применение физиотерапевтических процедур, чередуя их и санитарно курортное лечение, с применением массажа рубцовых зон орошением сероводородными водами. Контрольные осмотры для проведения тактики лечения проводят через месяц после выписки или санаторно-курортного лечения, затем 1 раз в 3 месяца на протяжении 1-2 лет.

Выводы. В ожоговом отделении Самаркандского филиала РНЦЭМП в лечении глубоких ожогов кисти наблюдаются определённые успехи, связанные с организацией специализированной помощи, которые направлено на ускорении отторжения некротической ткани для подготовки к аутодермопластике и снижении послеожоговых контрактур и деформаций.

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ВЛИЯНИЕ ОЖИРЕНИЯ НА СЕРДЕЧНО-СОСУДИСТУЮ СИСТЕМУ И СОВРЕМЕННЫЕ МЕТОДЫ КОРРЕКЦИИ

Аннотация: *Ожирение является одной из наиболее значимых медико-социальных проблем современности и рассматривается как независимый фактор риска сердечно-сосудистых заболеваний. Избыточное накопление жировой ткани способствует развитию артериальной гипертензии, ишемической болезни сердца, хронической сердечной недостаточности, нарушений ритма сердца и других патологических состояний. В основе негативного влияния ожирения лежат хроническое системное воспаление, инсулинорезистентность, эндотелиальная дисфункция и активация нейрогуморальных механизмов. В статье рассмотрены основные механизмы поражения сердечно-сосудистой системы при ожирении, а также современные подходы к коррекции данного состояния.*

Ключевые слова: *ожирение, сердечно-сосудистые заболевания, артериальная гипертензия, атеросклероз, инсулинорезистентность, снижение массы тела.*

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THE EFFECT OF OBESITY ON THE CARDIOVASCULAR SYSTEM AND MODERN METHODS OF CORRECTION

Abstract: *Obesity is one of the most significant medical and social problems of our time and is considered as an independent risk factor for cardiovascular diseases. Excessive accumulation of adipose tissue contributes to the development of hypertension, coronary artery disease, chronic heart failure, cardiac arrhythmias and other pathological conditions. The negative effects of obesity are based on chronic systemic inflammation, insulin resistance, endothelial dysfunction, and activation of neurohumoral mechanisms. The article discusses the main mechanisms of damage to the cardiovascular system in obesity, as well as modern approaches to correcting this condition.*

Key words: *obesity, cardiovascular diseases, arterial hypertension, atherosclerosis, insulin resistance, weight loss.*

Введение

По данным Всемирной организации здравоохранения, распространенность ожирения неуклонно возрастает во всем мире. В настоящее время более миллиарда человек имеют избыточную массу тела или ожирение. Данное состояние ассоциировано с повышенной заболеваемостью и смертностью от сердечно-сосудистых заболеваний, которые остаются ведущей причиной смерти населения. Ожирение характеризуется избыточным накоплением жировой ткани вследствие нарушения энергетического баланса между потреблением и расходованием энергии. Индекс массы тела (ИМТ) более 30 кг/м² является основным диагностическим критерием ожирения. Патогенетические механизмы влияния ожирения на сердечно-сосудистую систему инсулинорезистентность [1,6].

Ожирение представляет собой хроническое заболевание, характеризующееся чрезмерным накоплением жировой ткани в организме. Согласно данным международных исследований, число людей с ожирением ежегодно увеличивается, что делает данную проблему одной из наиболее актуальных в современной медицине. Ожирение связано с повышенным риском развития различных заболеваний, среди которых особое место занимают сердечно-сосудистые патологии, являющиеся ведущей причиной смертности во многих странах мира. Избыточная масса тела оказывает комплексное воздействие на сердечно-сосудистую систему. При ожирении увеличивается объём циркулирующей крови и возрастает нагрузка на сердце. В результате сердечная мышца вынуждена работать интенсивнее, что со временем приводит к гипертрофии миокарда и снижению его функциональных возможностей [2,7].

Одним из наиболее распространённых последствий ожирения является артериальная гипертензия. Увеличение массы тела способствует активации симпатической нервной системы и ренин-ангиотензин-альдостероновой системы, что вызывает повышение артериального давления. Длительное существование гипертензии значительно повышает риск инфаркта миокарда

и инсульта. Кроме того, ожирение сопровождается нарушением липидного обмена. В крови повышается уровень холестерина и триглицеридов, что способствует образованию атеросклеротических бляшек на стенках сосудов. Развитие атеросклероза приводит к ухудшению кровоснабжения органов и тканей, увеличивая вероятность возникновения ишемической болезни сердца [3,8].

Важную роль играет и хроническое воспаление, характерное для ожирения. Жировая ткань выделяет биологически активные вещества — адипокины и провоспалительные цитокины, которые оказывают негативное влияние на сосудистую стенку и способствуют прогрессированию сердечно-сосудистых заболеваний.

Среди наиболее распространённых осложнений ожирения можно выделить:

- артериальную гипертензию;
- ишемическую болезнь сердца;
- инфаркт миокарда;
- хроническую сердечную недостаточность;
- нарушения сердечного ритма;
- инсульт;
- тромбозы и тромбоэмболические осложнения.

Риск развития указанных заболеваний возрастает пропорционально степени ожирения и длительности его существования. Лечение ожирения должно быть комплексным и направленным не только на снижение массы тела, но и на уменьшение риска сердечно-сосудистых осложнений [4,6,9].

Основой лечения является коррекция образа жизни. Она включает рациональное питание с ограничением калорийности рациона, уменьшением потребления насыщенных жиров и простых углеводов, а также увеличение потребления овощей, фруктов и продуктов, богатых клетчаткой. Не менее важное значение имеет регулярная физическая активность. Умеренные аэробные нагрузки способствуют снижению массы тела, улучшению обмена веществ и укреплению сердечно-сосудистой системы. В случаях, когда изменение образа жизни оказывается недостаточно эффективным, применяются лекарственные препараты для снижения массы тела. Современные медикаменты помогают уменьшить аппетит, замедлить всасывание жиров или повлиять на механизмы регуляции энергетического обмена. Назначение лекарственной терапии должно осуществляться только врачом с учётом индивидуальных особенностей пациента. При тяжёлых формах ожирения и наличии серьёзных сопутствующих заболеваний может быть рекомендовано хирургическое лечение. Бариатрические операции позволяют существенно снизить массу тела и уменьшить риск развития сердечно-сосудистых осложнений. После хирургического вмешательства у многих пациентов наблюдается нормализация артериального давления, улучшение липидного профиля и снижение риска сахарного диабета [5,10].

Профилактика ожирения включает формирование здорового образа жизни с раннего возраста, рациональное питание, регулярную физическую активность, отказ от вредных привычек и своевременное медицинское обследование. Особое внимание должно уделяться лицам с наследственной предрасположенностью к ожирению и сердечно-сосудистым заболеваниям [11,12].

Заключение

Ожирение является серьёзным фактором риска развития сердечно-сосудистых заболеваний и оказывает неблагоприятное влияние на работу сердца и сосудов. Артериальная гипертензия, атеросклероз, ишемическая болезнь сердца и сердечная недостаточность являются наиболее частыми осложнениями данного состояния. Современные методы коррекции ожирения, включающие изменение образа жизни, медикаментозное лечение и хирургические вмешательства, позволяют эффективно снижать массу тела и уменьшать риск сердечно-сосудистых осложнений. Поэтому ранняя профилактика, своевременная диагностика и комплексный подход к лечению ожирения имеют важное значение для сохранения здоровья и повышения качества жизни населения.

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ДИАГНОСТИЧЕСКИЕ КРИТЕРИИ И СТРАТЕГИИ ЛЕЧЕНИЯ ЖЕЛЕЗОДЕФИЦИТНОЙ АНЕМИИ У ДЕТЕЙ

Аннотация: *ЖДА может оказывать негативное влияние на физическое и психическое развитие ребенка, а также снижать функцию иммунной системы. В данной статье анализируются этиология, диагностические критерии и современные стратегии лечения железодефицитной анемииияние на физическое и психическое развитие ребенка, а также снижать функцию иммунной системы. В данной статье анализируются этиология, диагностические критерии и современные стратегии лечения железодефицитной анемии у детей. Ранняя диагностика и своевременное лечение имеют важное значение для снижения осложнений заболевания.*

Ключевые слова: *железодефицитная анемия, дети, гемоглобин, ферритин, препараты железа, диагностика, лечение.*

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DIAGNOSTIC CRITERIA AND TREATMENT STRATEGIES FOR IRON DEFICIENCY ANEMIA IN CHILDREN

Abstract: *IDA can have a negative impact on a child's physical and mental development, as well as reduce the function of the immune system. This article analyzes the etiology, diagnostic criteria, and current treatment strategies for iron*

deficiency anemia, which affect a child's physical and mental development, as well as reduce the function of the immune system. This article analyzes the etiology, diagnostic criteria, and current treatment strategies for iron deficiency anemia in children. Early diagnosis and timely treatment are essential to reduce the complications of the disease.

Key words: *iron deficiency anemia, children, hemoglobin, ferritin, iron preparations, diagnosis, treatment.*

Введение

Железодефицитная анемия (ЖДА) является наиболее распространённой формой анемии у детей и представляет собой важную медико-социальную проблему во всём мире. По данным World Health Organization, дефицит железа остаётся ведущей причиной анемии среди детей раннего возраста, особенно в странах с низким и средним уровнем дохода. Недостаток железа оказывает негативное влияние на физическое развитие ребёнка, когнитивные функции, иммунную систему и качество жизни. Современные исследования направлены на совершенствование методов диагностики и разработку эффективных стратегий лечения и профилактики данного состояния [1].

Согласно данным многочисленных исследований, основными причинами развития ЖДА у детей являются недостаточное поступление железа с пищей, повышенная потребность организма в периоды интенсивного роста, нарушение всасывания железа в желудочно-кишечном тракте и хронические кровопотери. У детей первого года жизни значительную роль играют преждевременное рождение, низкая масса тела при рождении и отсутствие своевременного введения прикорма [2].

Патогенетической основой заболевания является истощение запасов железа в организме, что приводит к нарушению синтеза гемоглобина и снижению кислородной ёмкости крови. В результате развивается тканевая гипоксия, проявляющаяся различными клиническими симптомами.

Современные рекомендации подчёркивают важность комплексного подхода к диагностике ЖДА. Диагноз основывается на сочетании клинических признаков и лабораторных показателей. Клинические проявления включают: бледность кожи и слизистых оболочек; повышенную утомляемость; слабость; снижение аппетита; раздражительность; задержку психомоторного развития; снижение концентрации внимания [3].

Основными лабораторными критериями ЖДА являются: снижение уровня гемоглобина; уменьшение среднего объёма эритроцита (MCV); снижение среднего содержания гемоглобина в эритроците (MCH); уменьшение концентрации ферритина сыворотки; снижение насыщения трансферрина железом; повышение общей железосвязывающей способности сыворотки крови [4].

В последние годы особое внимание уделяется определению уровня сывороточного ферритина как наиболее чувствительного маркера истощения

запасов железа. Однако при наличии воспалительных процессов интерпретация данного показателя требует осторожности, поскольку ферритин относится к белкам острой фазы воспаления. Современные авторы также рекомендуют использовать определение растворимых рецепторов трансферрина, позволяющее дифференцировать железодефицитную анемию от анемии хронических заболеваний [5].

Основной целью лечения является устранение дефицита железа, восстановление нормального уровня гемоглобина и пополнение тканевых запасов железа. Большинство исследователей рассматривают пероральные препараты железа как терапию первой линии. Наиболее часто применяются соли двухвалентного железа, характеризующиеся высокой биодоступностью. Рекомендуемая терапевтическая доза элементарного железа у детей составляет в среднем 3–6 мг/кг массы тела в сутки. Лечение продолжается до нормализации уровня гемоглобина и дополнительно в течение 2–3 месяцев для восполнения запасов железа. Исследования последних лет показывают, что однократный приём препаратов железа в сутки может обеспечивать эффективность, сопоставимую с традиционным многократным режимом дозирования, при меньшей частоте побочных эффектов [6].

Внутривенное введение препаратов железа показано при: тяжёлой железодефицитной анемии; синдроме мальабсорбции; воспалительных заболеваниях кишечника; непереносимости пероральных препаратов; необходимости быстрого восполнения дефицита железа. Современные внутривенные препараты обладают более высоким профилем безопасности по сравнению с ранее используемыми лекарственными средствами [7].

Важным компонентом лечения является коррекция питания. Детям рекомендуется употребление продуктов, богатых гемовым железом: говядины; печени; мяса птицы; рыбы. Для улучшения всасывания железа рекомендуется достаточное потребление витамина С. Одновременно следует ограничивать чрезмерное употребление продуктов, снижающих абсорбцию железа, включая крепкий чай и избыток молочных продуктов [8].

Согласно современным рекомендациям, профилактика ЖДА должна начинаться ещё в антенатальном периоде посредством коррекции железодефицита у беременных женщин. После рождения большое значение имеют: грудное вскармливание; своевременное введение прикорма; профилактический приём препаратов железа у недоношенных детей; регулярный скрининг групп риска. Раннее выявление латентного дефицита железа позволяет предотвратить развитие анемии и её осложнений [9-10].

Заключение

Железодефицитная анемия у детей-распространенная и серьезная медико-социальная проблема. Раннее выявление заболевания, оценка ферритина и других лабораторных показателей, а также применение современных препаратов железа являются основными факторами эффективного лечения. Широкое внедрение профилактических мер будет

способствовать улучшению здоровья детей и снижению распространенности анемии. Анализ современной литературы показывает, что железодефицитная анемия остаётся одной из наиболее распространённых патологий детского возраста. Эффективная диагностика основывается на комплексной оценке клинических и лабораторных показателей, среди которых особое значение имеет уровень ферритина сыворотки. Основным методом лечения остаётся пероральная ферротерапия, тогда как внутривенные препараты применяются по строгим показаниям. Комплексный подход, включающий медикаментозное лечение, рациональное питание и профилактические мероприятия, способствует снижению распространённости заболевания и улучшению здоровья детей.

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ВСТРЕЧАЕМОСТЬ АДЕНОИДНОЙ ГИПЕРТРОФИИ У ДЕТЕЙ С АЛЛЕРГИЧЕСКИМ РИНИТОМ И ИХ ВЗАИМОСВЯЗЬ

Цель: *определить частоту встречаемости аденоидной гипертрофии у детей с аллергическим ринитом и изучить клиническое течение у данной группы детей.*

Результаты: *Исследование показало, что аллергический ринит в сочетании с аденоидной гипертрофией (АГ) приводит к более тяжелым симптомам у детей, включая заложенность носа, утомляемость и ночные пробуждения. В группе с АГ эти симптомы выражены сильнее, чем в группе с аллергическим ринитом без АГ. В обеих группах наблюдаются ринорея и кашель, но в группе с АГ они встречаются чаще и более выражены.*

Заключение: *Сочетание аллергического ринита и аденоидной гипертрофии усугубляет течение заболевания, ухудшая качество жизни детей. Это подчеркивает важность комплексного подхода к лечению и ранней диагностике для предотвращения осложнений и улучшения состояния пациентов.*

Ключевые слова: *Аллергический ринит, аденоидная гипертрофия, клинические показатели, дети.*

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PREVALENCE OF ADENOID HYPERTROPHY IN CHILDREN WITH ALLERGIC RHINITIS AND THEIR INTERRELATIONSHIP

Objective: *To determine the prevalence of adenoid hypertrophy in children with allergic rhinitis and to study the clinical course in this group of children.*

Results: *The study showed that allergic rhinitis combined with adenoid hypertrophy (AH) leads to more severe symptoms in children, including nasal congestion, fatigue, and night awakenings. In the AH group, these symptoms are more pronounced than in the group with allergic rhinitis without AH. Both groups showed rhinorrhea and cough, but in the AH group, they were more frequent and more severe.*

Conclusion: *The combination of allergic rhinitis and adenoid hypertrophy exacerbates the disease course, worsening the quality of life for children. This*

emphasizes the importance of a comprehensive approach to treatment and early diagnosis to prevent complications and improve patient outcomes.

Keywords: *Allergic rhinitis, adenoid hypertrophy, clinical indicators, children.*

Введение

Аллергический ринит (АР) —является хроническим воспалительным заболеванием слизистой оболочки носа, которое развивается вследствие реакции гиперчувствительности I типа, как ответ на респираторные аллергены у сенсибилизированных лиц [1]. АР считается всё более распространяющейся патологией в течении последних двух декад и поражает в среднем 30-40% населения мира. [2–8] Данное заболевание характеризуется нарушением сна, трудностей в обучении, ухудшением производительности труда и социального функционирования, из-за чего приводит к существенному снижению качества жизни и заметной экономической проблеме влияющей на глобальное здравоохранение. [9–11].

Типичные симптомы АР, такие как чихание, ринорея, зуд в носу и заложенность носа, могут иметь сезонный или круглогодичный характер. Сезонный АР может развиваться эпизодически цветочной пыльцой и другими наружными аллергенами. Признаки круглогодичного АР являются реакцией на клещ домашней пыли, перхоть животных, насекомые и плесень [12 , 13] которые могут находиться в закрытом пространстве и действовать как аллергены на протяжении года.

Аденоидная гипертрофия (АГ) заболевание провоцирующее обструкцию верхних дыхательных путей у детей и имеющее тенденцию к росту встречаемости за последнее время [14]. Этиология АГ считается не изученной до конца, но её возникновение часто связывают с тяжелыми и рецидивирующими воспалительными процессами. В особенности имеющие хроническое течение и развивающиеся рядом с аденоидной тканью, к таковым относят аллергические воспаления [15].

Аденоиды, считаются первичными воротами защиты иммунитета, располагающиеся в верхних дыхательных путях, которые подвергнуты действию микробных агентов, таких как вирусы, бактерии, а так же аллергены. АР и АГ во многих случаях связаны друг с другом, но так как, клинические проявления похожи, часто диагностируют только один из них. В исследовании, мы хотим определить частоту возникновения АР и его влияние на АГ.

Цель исследования: определить частоту встречаемости аденоидной гипертрофии у детей с аллергическим ринитом и изучить клиническое течение у данной группы детей.

Материалы и методы исследования: Нами было обследовано 50 детей в возрасте от 3 до 18 лет, проходивших лечение в отделении оториноларингологии педиатрической клиники ТГМУ с диагнозом

аллергический ринит сочетанный с аденоидной гипертрофией (основная группа) и дети с аллергическом ринитом (сравнительная группа). Были проведены эндоскопическое исследование ЛОР органов, общий анализ крови, Ig E в сыворотке, аллергологический прик-тест, 3Д придаточных пазух носа. Они были разделены на 3 возрастные группы: 3-6 лет, 7-14 лет, 15-18 лет (табл.1).

Таблица 1

Демографические показатели детей с аллергическим ринитом и аденоидной гипертрофией

	3-6 лет				7-14 лет				15-18 лет				Общее n=50
	мальчики		девочки		мальчики		девочки		мальчики		девочки		
	абс	%	абс	%	абс	%	абс	%	абс	%	Абс	%	
АР+АГ (основная группа)	3	14	3	14	7	32	5	23	1	4	3	13	n=22
АР (сравн. группа)	5	18	3	11	6	21	8	28	4	14	2	7	n=28

В таблице 1 представлено распределение детей с аллергическим ринитом и АР в сочетании с АГ по возрастным группам и полу. Исходя из поставленной цели и обследованных 50 детей, среди которых 22 ребенка составили основную группу , а 28 — сравнительную группу. Результаты показывают, как дети распределяются по возрастным категориям и какова роль пола в общей статистике.

Распределение детей по возрасту было сделано с учетом того, что наибольшее количество детей наблюдается в возрастной группе 7-14 лет, за ней следует группа 3-6 лет, а наименьшее количество детей — в возрастной категории 15-18 лет. Такое распределение отражает характерные особенности аллергического ринита и его проявлений в разных возрастных группах. Согласно данным клинических рекомендаций, средняя распространенность симптомов АР в детском возрасте составляет 8,5% у 6–7-летних детей и 14,6% у детей 13–14 лет [16].

Возраст 3-6 лет составил около 30% от общего числа детей, что соответствует 15 детям, из которых относительно равное количество мальчиков и девочек. Возраст 7-14 лет, который составил 50% от общего числа, оказался самой крупной возрастной группой с 25 детьми.

Возраст 15-18 лет показал наименьшую численность, составляя лишь 20% (10 детей), что также является характерным для аллергического ринита в данной возрастной категории.

Данные по полу показывают, что в каждой возрастной группе наблюдается примерно одинаковое количество мальчиков и девочек, что соответствует общей тенденции в распределении аллергических заболеваний среди детей. Половая разница в данных не имеет статистически значимой роли, и оба пола представлены примерно равномерно как в основной, так и в сравнительной группе.

Дети были разделены на две группы: основную (АР+АГ) и сравнительную (АР). Основная группа состоит из 22 детей, что составляет 44% от общего числа участников исследования. Сравнительная группа (28 детей, или 56%) была включена для сопоставления результатов. Данные показывают, что распределение по возрастным категориям и полу в обеих группах схоже, что позволяет провести адекватные сравнения между группами.

В основной группе (АР+АГ) наибольшее количество детей находится в возрастной группе 7-14 лет (55% от всей основной группы), что также наблюдается и в сравнительной группе. В возрастной группе 15-18 лет основная группа включает только 17% детей, что в контексте аллергического ринита может свидетельствовать о снижении проявлений заболевания с возрастом.

Мы использовали классификацию по ARIA 2017 и по данной классификации подразделили АР на персистирующую и интерметирующую формы: Всем были проведены аллергологические кожные пробы, которые дали положительную аллергическую реакцию. Анализ полученных скарификационных тестов показал положительный результат у всех 50 обследованных, что позволило нам подразделить наших пациентов на следующие группы: У 26 (52%) большинства из обследованных основной группы данные скарификационных тестов оказались положительными на домашнюю пыль – 9 (34%), шерсть животных- 7(27%), перья – 5(19%), гистамин – 3(12%), хлопок – 2(8%). Исходя из этого, им был поставлен диагноз персистирующего АР. У остальных 24(48%) были выявлены положительные тесты на пыльцу растений - в различных сочетаниях к аллергенам: к пыльце деревьев у 9(38%) детей, злаковых трав - у 9 (38%), к сорных трав у 6 (25%).

Обследованные группы были подразделены по степеням тяжести АР на основании классификации предложенной ARIA 2017. В таблице 2 приведены данные по степени тяжести АР.

Таблица 2

Распределения пациентов на степень тяжести по классификации ARIA

Степень тяжести	Персистирующий (N=26)	%	Интермитирующий (N=24)	%
Легкая	4	15,4	5	20,8
Средняя	9	34,6	12	50,0
Тяжелая	13	50,0	7	29,2

В таблице представлены данные о распределении пациентов по степени тяжести заболевания в двух группах: с персистирующим и интермитирующим течением заболевания. В каждой группе приведены количества пациентов по трем категориям степени тяжести: легкая, средняя и тяжелая форма, а также процентное соотношение этих категорий от общего числа пациентов в каждой группе.

Персистирующая группа: В этой группе большинство пациентов имеют тяжелую степень заболевания (50%), что указывает на более серьезные и устойчивые симптомы. Средняя степень распространена среди 34,6% пациентов, а легкая степень встречается лишь у 15,4%. Интермитирующая группа: В этой группе наибольшее количество пациентов (50%) имеют среднюю степень тяжести, что говорит о том, что заболевание проявляется периодически, но в большей степени с умеренными симптомами. Легкая степень распространена у 20,8% пациентов, а тяжелая степень встречается только у 29,2%.

Пациенты с персистирующим течением заболевания чаще имеют тяжелую степень болезни (50%), что свидетельствует о более хроническом и стабильном течении заболевания. В интермитирующей группе заболевание в основном проявляется в средней степени тяжести (50%), что может указывать на перемежающийся характер заболевания с периодами улучшения и обострения.

Аденоидная гипертрофия была диагностирована на основании анамнеза пациента, эндоскопического осмотра и лучевой диагностики- 3Д ППН. Кожный прик-тест на аллергены проводился у всех пациентов. Изучение анамнеза показало, что у большинства детей имелся отягощённый аллергический анамнез, наличие атопии в семье, который составил 60%. Сравнение групп по длительности АР показало значительно более высокую частоту персистирующего ринита у пациентов с АГ.

Так же был проведён опрос по клиническим признакам у пациентов двух групп: (Табл.3)

Таблица 3

Частота клинических признаков у детей с аллергическим ринитом в зависимости от наличия аденоидной гипертрофии

Признаки	Основная группа N=22		Сравнительная группа N=28	
	абс	%	абс	%
Заложенность носа	22	100	21	75
Ринорея	20	90	22	78
Головная боль	21	95	18	64
Зуд в носу	19	86	25	89
Ночные пробуждения	21	95	16	57
Сниженная концентрация внимания	18	81	20	71
Утомляемость	22	100	15	53
Кашель	20	90	20	71

В представленной таблице 2 представлены данные о распространенности различных симптомов у детей с аллергическим ринитом (АР) и аденоидной гипертрофией (АГ). Сравнение двух групп позволяет выявить особенности клинической картины в зависимости от наличия сопутствующей аденоидной гипертрофии.

Результаты

Полученные нами данные демонстрируют, что дети с аллергическим ринитом в сочетании с аденоидной гипертрофией (основная группа) часто имеют более выраженную симптоматику по сравнению с детьми, страдающими аллергическим ринитом без аденоидной гипертрофии (сравнительная группа). В основной группе более высокие проценты для большинства клинических признаков, таких как заложенность носа, головная боль, ночные пробуждения, утомляемость и другие. Эти данные подтверждают, что аденоидная гипертрофия может усиливать симптомы аллергического ринита, приводя к более тяжелому течению заболевания.

Основные симптомы, такие как зуд в носу и ринорея, встречаются с примерно одинаковой частотой в обеих группах, что говорит о том, что эти симптомы характерны для аллергического ринита независимо от наличия аденоидной гипертрофии.

Заключение

Таким образом, можно заключить, что наличие аденоидной гипертрофии в сочетании с аллергическим ринитом приводит к более тяжелым проявлениям заболевания и требует особого внимания при лечении и диагностике.

Межгрупповые сравнения по наличию эозинофилии, уровню сывороточного IgE, количеству положительной чувствительности, полисенсибилизации, чувствительности к клещам домашней пыли, тараканам, пыльце и перхоти не дали значимых различий ($p>0,05$).

Данное исследование показало важную взаимосвязь между аллергическим ринитом и аденоидной гипертрофией у детей, а также их влияние на клиническое течение заболевания. В группе детей с аллергическим ринитом, сочетанным с аденоидной гипертрофией (основная группа), наблюдается более высокая выраженность таких симптомов, как заложенность носа (100%), утомляемость (100%) и ночные пробуждения (95%) по сравнению с группой детей только с аллергическим ринитом (сравнительная группа). Эти симптомы могут быть связаны с дополнительными осложнениями, вызванными аденоидной гипертрофией, включая нарушение проходимости верхних дыхательных путей и ухудшение качества сна.

Ринорея и кашель встречаются с высокой частотой в обеих группах (90% в основной группе и 78% в сравнительной для ринореи, 90% и 71% для кашля), что подтверждает их роль как характерных признаков аллергического ринита, независимо от наличия аденоидной гипертрофии. Однако признаки, такие как зуд в носу (86% против 89% в сравнительной группе) и сниженная концентрация внимания (81% против 71%), были более выражены среди детей с аллергическим ринитом без сопутствующей аденоидной гипертрофии.

Данные исследования подчеркивают необходимость более тщательной диагностики и комплексного подхода к лечению детей с аллергическим ринитом, особенно при наличии сопутствующих заболеваний, таких как аденоидная гипертрофия. Это может способствовать более полному восстановлению пациентов и улучшению их качества жизни, а также снижению экономической нагрузки на системы здравоохранения, вызванной хроническими заболеваниями дыхательных путей у детей.

Полученные результаты также подтверждают важность дальнейших исследований по изучению механизма взаимодействия между аллергическим ринитом и аденоидной гипертрофией, а также их влияния на клиническое течение заболевания и качество жизни пациентов.

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ПРОФИЛАКТИЧЕСКАЯ РОЛЬ ВИТАМИНА К2 ПРИ ИСПОЛЬЗОВАНИИ ВЫСОКИХ ДОЗ ВИТАМИНА D

Аннотация: *Витамин D считается важным для иммунной системы организма, здоровья костей и сердечно-сосудистой системы. Однако его чрезмерное потребление может привести к токсическим состояниям, таким как гиперкальциемия и накопление кальция в тканях. Исследования последних лет показывают, что витамин К2 (особенно в форме МК-7) является важным регулятором этих процессов, обеспечивая поступление кальция в кости и предотвращая отложение кальция в мягких тканях, таких как сосуды, почки. В этой статье рассматривается взаимодействие между витамином D и К2, патофизиологические механизмы и его значение в клинической практике.*

Ключевые слова: *Витамин D, витамин К2, токсичность, гиперкальциемия, остеокальцин, матричный белок GLA, метаболизм кальция.*

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THE PREVENTIVE ROLE OF VITAMIN K2 IN THE USE OF HIGH DOSES OF VITAMIN D

Abstract: *Vitamin D is considered important for the body's immune system, bone health, and the cardiovascular system. However, its excessive consumption can lead to toxic conditions such as hypercalcemia and calcium accumulation in tissues. Recent studies show that vitamin K2 (especially in the form of MK-7) is an important regulator of these processes, providing calcium to bones and preventing calcium deposition in soft tissues such as blood vessels and kidneys. This article examines the interaction between vitamin D and K2, pathophysiological mechanisms, and its significance in clinical practice.*

Key words: *Vitamin D, vitamin K2, toxicity, hypercalcemia, osteocalcin, matrix protein GLA, calcium metabolism.*

Введение

Витамин D играет важную роль в здоровье человека: он регулирует баланс кальция и фосфора, обеспечивает минерализацию костей и модулирует иммунные функции. В последние годы уровень потребления добавок витамина D среди населения резко возрос в связи с пандемией [1]. В некоторых случаях это приводит к чрезмерному потреблению и вызывает токсические эффекты. Токсичность витамина D в первую очередь характеризуется гиперкальциемией и накоплением кальция в неправильных местах (например, в сердечно-сосудистой системе, почках). Роль витамина K2 в смягчении и предотвращении этих негативных эффектов рассматривается как актуальная проблема [2].

По данным анализа литературы, длительное применение витамина D в высоких дозах в отдельных случаях может приводить к нарушению распределения кальция в организме, в частности к образованию кальциевых отложений в мягких тканях, кровеносных сосудах и почках [3]. Данное состояние известно как токсичность витамина D или гипервитаминоз D и может стать причиной развития сердечно-сосудистых заболеваний, нефрокальциноза, деформаций костной ткани и общего метаболического дисбаланса. Основной физиологической функцией витамина D является участие в обмене кальция и фосфора, а также усиление всасывания кальция в кишечнике. Однако в условиях дефицита витамина K2 в организме эти процессы могут нарушаться, вследствие чего кальций откладывается не в костной ткани, а в стенках кровеносных сосудов и других мягких тканях [5].

Перед началом приёма добавок витаминов D3 и K рекомендуется оценить их исходный уровень в организме. Это особенно актуально для лиц среднего и пожилого возраста, у которых потребность в витаминах возрастает, а метаболические изменения встречаются значительно чаще. Тем не менее, в ряде случаев некоторые исследователи и практикующие врачи назначают витаминные добавки без предварительной оценки витаминного статуса пациента [4].

Согласно результатам исследований, дефицит витаминов у пожилых людей встречается достаточно часто, что может приводить к усиленной резорбции костной ткани, повышению риска развития остеопороза и снижению минеральной плотности костей. Основным показателем для оценки обеспеченности организма витамином D является уровень 25(OH)D3 в сыворотке крови. Согласно рекомендациям The Endocrine Society, значения <75 нмоль/л расцениваются как недостаточность или дефицит витамина D, тогда как уровень ≥75 нмоль/л считается оптимальным и достаточным. Другие официальные организации, в том числе Institute of Medicine, определяют минимально достаточный уровень витамина D как 50 нмоль/л.

Оценка обеспеченности организма витамином K является более сложной задачей. Наиболее информативным биомаркером считается соотношение между карбоксилированной (cOC) и некарбоксилированной

(ucOC) формами остеокальцина. Повышенное соотношение ucOC/cOC рассматривается как основной признак дефицита витамина K. Установлено, что данный показатель значительно выше у женщин в постменопаузальном периоде, а также у женщин старше 70 лет, что свидетельствует о снижении активности витамина K в костной ткани [6].

К сожалению, в клинической практике дефицит витамина K нередко выявляется только по нарушениям свёртываемости крови, что является недостаточно специфичным и не вполне информативным методом диагностики. В связи с этим важное значение имеет проведение специализированных лабораторных исследований для определения уровней витаминов K1 и K2, а также получение дополнительной информации с помощью анкет, оценивающих частоту потребления продуктов, богатых витамином K [7].

Анализ многочисленных клинических и экспериментальных исследований показал, что витамин K2 (преимущественно в форме менахинона-7, MK-7) играет ключевую роль в правильном распределении кальция в организме. Он активирует посредством γ-карбоксилирования кальцийсвязывающие белки, такие как остеокальцин и матриксный Gla-белок (MGP), необходимые для минерализации костной ткани и предотвращения патологической кальцификации. При достаточном уровне витамина K2 кальций преимущественно откладывается в костях, что способствует профилактике остеопороза, одновременно ограничивая его накопление в стенках сосудов и других мягких тканях. При совместном применении витаминов D и K2 наблюдается синергический эффект: витамин D усиливает всасывание кальция в кишечнике, тогда как витамин K2 обеспечивает его транспортировку и фиксацию в костной ткани. Благодаря этому снижается риск избыточного накопления кальция в кровеносной системе и развития кальцификации сосудов [8].

Исследования свидетельствуют о том, что применение витамина K2 может способствовать снижению рисков, связанных с монотерапией витамином D, в частности сердечно-сосудистых осложнений. В ряде рандомизированных клинических исследований было показано, что совместное применение витаминов D и K2 способствует снижению артериального давления и замедлению кальцификации коронарных артерий. Клинические проявления токсичности витамина D чаще всего наблюдаются при приёме доз свыше 10 000 МЕ в сутки либо при длительном использовании доз более 4 000 МЕ в сутки. В подобных случаях включение витамина K2 в схему терапии демонстрировало положительный эффект в поддержании кальциевого баланса.

Особый интерес представляет применение витамина K2 совместно с витамином D3 у женщин в постменопаузальном периоде. Результаты ряда рандомизированных клинических исследований и метаанализов подтверждают эффективность данной комбинации в улучшении показателей

минеральной плотности костной ткани. Так, в одном из исследований у женщин в постменопаузе применение витамина K2 (МК-7 в дозе 375 мкг/сут) в сочетании с витамином D3 и кальцием на протяжении трёх лет способствовало усилению карбоксилирования остеокальцина, что было связано с улучшением состояния костной ткани. Однако изменения некоторых биомаркеров не продемонстрировали статистически значимых различий по сравнению с группой, не получавшей витамин K [9].

В другом рандомизированном контролируемом исследовании приняли участие 108 женщин в постменопаузе с остеопорозом. На фоне терапии бисфосфонатами, кальцием и витамином D пациентки дополнительно получали витамин K1 либо МК-4. Результаты показали, что витамин K1 оказывает положительное, хотя и ограниченное влияние на геометрические параметры бедренной кости. Кроме того, в исследовании, посвящённом влиянию пищевых источников витаминов, у женщин, употреблявших лосось, обогащённый различными комбинациями витаминов D и K1, были зарегистрированы благоприятные изменения костных биомаркеров, однако статистически значимых различий между исследуемыми группами выявлено не было [10].

Метаанализ, опубликованный в 2020 году и объединивший результаты восьми рандомизированных клинических исследований с участием 971 человека, показал, что совместный приём витаминов D3 и K способствует достоверному увеличению минеральной плотности костной ткани, подтверждая их взаимодополняющую роль в поддержании здоровья скелета. Дополнительные данные были получены в ретроспективном исследовании типа «случай–контроль», проведённом среди пациентов среднего возраста 83 года. Было установлено, что низкие уровни витамина D и витамина K1 ассоциированы с повышенным риском переломов шейки бедренной кости. Результаты экспериментальных исследований на животных также подтверждают эффективность комбинированного подхода. Так, в модели иммобилизационного остеопороза витамин K продемонстрировал более выраженное остеопротективное действие по сравнению с комбинацией витамина D и кальция, оказывая положительное влияние на плотность и микроархитектонику костной ткани [11].

Заключение

Таким образом, для обеспечения безопасного и эффективного применения витамина D целесообразно рассматривать витамин K2 как важный компонент комплексной терапии. Данный подход может служить перспективным направлением профилактики осложнений, связанных с нарушением кальциевого обмена, и способствовать сохранению здоровья костной и сердечно-сосудистой систем.

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СОВРЕМЕННЫЕ ПРИНЦИПЫ ВОЗНИКНОВЕНИЯ, ДИАГНОСТИКИ И ЛЕЧЕНИЯ ЖЕЛЕЗОДЕФИЦИТНОЙ АНЕМИИ У ВЗРОСЛЫХ

Аннотация: *Железодефицитная анемия является наиболее распространённой формой анемии и одной из актуальных медико-социальных проблем современной медицины. По данным Всемирной организации здравоохранения, дефицит железа занимает ведущее место среди причин анемических состояний у взрослых. Основными факторами риска развития железодефицитной анемии являются хронические кровопотери, недостаточное поступление железа с пищей, нарушения его всасывания в желудочно-кишечном тракте, а также повышенная потребность организма в железе. В статье рассмотрены современные данные о распространённости железодефицитной анемии среди взрослого населения, основные клинические проявления заболевания, современные лабораторные методы диагностики и принципы лечения. Особое внимание уделено определению уровня ферритина, насыщению трансферрина железом и использованию современных препаратов железа для перорального и внутривенного применения. Своевременная диагностика и адекватная коррекция дефицита железа способствуют улучшению качества жизни пациентов, снижению риска осложнений и повышению эффективности лечения основного заболевания.*

Ключевые слова: *Ключевые слова: железодефицитная анемия, дефицит железа, ферритин, гемоглобин, диагностика, лечение, препараты железа, взрослое население, сидеропения, анемический синдром.*

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MODERN PRINCIPLES OF THE ORIGIN, DIAGNOSIS AND TREATMENT OF IRON DEFICIENCY ANEMIA IN ADULTS

Abstract: *Iron deficiency anemia is the most common form of anemia and one of the most pressing medical and social problems in modern medicine. According*

to the World Health Organization, iron deficiency is the leading cause of anemia in adults. The main risk factors for iron deficiency anemia include chronic blood loss, inadequate dietary iron intake, impaired gastrointestinal absorption, and increased iron requirements. This article examines current data on the prevalence of iron deficiency anemia in adults, the main clinical manifestations of the disease, modern laboratory diagnostic methods, and treatment principles. Particular attention is paid to determining ferritin levels, transferrin saturation, and the use of modern iron supplements for oral and intravenous use. Timely diagnosis and adequate correction of iron deficiency improve patients' quality of life, reduce the risk of complications, and increase the effectiveness of treatment for the underlying disease.

Key words: *Key words: iron deficiency anemia, iron deficiency, ferritin, hemoglobin, diagnosis, treatment, iron preparations, adult population, sideropenia, anemic syndrome.*

Введение

Железодефицитная анемия (ЖДА) является наиболее распространённой формой анемии и одним из наиболее часто встречающихся дефицитных состояний в клинической практике. Несмотря на значительный прогресс в области диагностики и лечения, проблема дефицита железа сохраняет свою актуальность во всём мире. По данным Всемирной организации здравоохранения, железодефицитные состояния остаются одной из ведущих причин снижения качества жизни, трудоспособности и когнитивных функций у взрослых. При этом дефицит железа может существовать как в форме анемии, так и в виде латентного дефицита, оказывая негативное влияние на функционирование различных органов и систем [1].

Согласно современным литературным данным, железо играет ключевую роль не только в процессах гемопоэза, но и в обеспечении клеточного метаболизма, синтезе ферментов, работе иммунной системы и транспорте кислорода. В связи с этим недостаток железа сопровождается развитием не только анемического синдрома, но и многочисленных внеэритроцитарных нарушений. Исследования последних лет свидетельствуют о том, что даже при отсутствии снижения уровня гемоглобина дефицит железа может приводить к хронической усталости, снижению физической активности и ухудшению когнитивных функций [2].

По данным ряда авторов, основными причинами развития железодефицитной анемии у взрослых являются хронические кровопотери, нарушения всасывания железа в желудочно-кишечном тракте, недостаточное поступление железа с пищей и повышение потребности организма в данном микроэлементе. Особое внимание в современной литературе уделяется заболеваниям желудочно-кишечного тракта как ведущему фактору развития железодефицита у мужчин и женщин в постменопаузальном периоде. В то же

время у женщин репродуктивного возраста наиболее значимой причиной остаются хронические менструальные кровопотери [3].

Существенный вклад в понимание патогенеза ЖДА внесли исследования последних лет, посвящённые изучению роли гепсидина — ключевого регулятора обмена железа. Установлено, что повышение уровня гепсидина при хронических воспалительных заболеваниях приводит к нарушению абсорбции железа и ограничению его доступности для эритропоэза, что способствует развитию функционального дефицита железа. Данные открытия позволили по-новому взглянуть на механизмы формирования анемии и определить перспективные направления её диагностики и лечения [4].

Современные подходы к диагностике железодефицитной анемии основаны на комплексной оценке показателей обмена железа. Если ранее основное внимание уделялось показателям общего анализа крови, то в настоящее время ведущая роль отводится определению уровня ферритина, коэффициента насыщения трансферрина железом, растворимых рецепторов трансферрина и других биомаркеров. Многие исследователи рассматривают сывороточный ферритин как наиболее информативный показатель запасов железа в организме, однако подчёркивают необходимость осторожной интерпретации его значений при наличии воспалительных процессов [5].

Анализ отечественных и зарубежных научных публикаций показывает, что железодефицитная анемия остаётся одной из наиболее распространённых патологий системы крови среди взрослого населения. По мнению C. Camaschella, дефицит железа является не только причиной анемии, но и самостоятельным патологическим состоянием, оказывающим влияние на функции различных органов и систем. Автор подчёркивает необходимость раннего выявления железодефицита ещё до развития выраженной анемии.

В обзоре Pasricha и соавт. отмечается, что ведущими причинами ЖДА у взрослых являются хронические кровопотери и нарушения всасывания железа. Авторы акцентируют внимание на необходимости обязательного поиска источника кровотечения, особенно у мужчин и женщин постменопаузального возраста, поскольку дефицит железа может быть первым проявлением серьёзной гастроэнтерологической или онкологической патологии [6].

Согласно данным Cappellini и соавт. современные представления о патогенезе ЖДА тесно связаны с изучением регуляторной роли гепсидина. Исследователи пришли к выводу, что определение уровня гепсидина в перспективе может стать важным диагностическим инструментом для дифференциальной диагностики различных видов анемий и выбора оптимальной тактики лечения [7].

В работах Ganz и Nemeth (2015) подробно рассмотрены механизмы участия гепсидина в регуляции обмена железа. Авторы показали, что повышение уровня данного гормона при воспалительных заболеваниях

ограничивает доступность железа для костного мозга, что приводит к развитию функционального железодефицита даже при сохранённых запасах микроэлемента [8].

Вопросы диагностики ЖДА отражены в рекомендациях Всемирной организации здравоохранения и ряде международных руководств. Большинство исследователей признают сывороточный ферритин наиболее чувствительным маркером дефицита железа. Вместе с тем подчёркивается, что при воспалительных заболеваниях концентрация ферритина может оставаться нормальной или повышенной, несмотря на наличие железодефицита, что требует использования дополнительных диагностических критериев [9].

Особый интерес представляют исследования, посвящённые лечению железодефицитной анемии. В работе Tolkien и соавт., показано, что традиционные схемы применения препаратов железа нередко сопровождаются желудочно-кишечными побочными эффектами, которые снижают приверженность пациентов лечению. В связи с этим современные исследования направлены на поиск оптимальных режимов дозирования, позволяющих повысить эффективность терапии и уменьшить частоту нежелательных явлений [10].

В публикациях последних лет всё большее внимание уделяется внутривенным препаратам железа. По данным Auerbach и Adamson (2016), использование современных парентеральных форм позволяет быстро восполнить дефицит железа и достичь более быстрого повышения уровня гемоглобина по сравнению с пероральной терапией у определённых категорий пациентов [11].

Заключение

Железодефицитная анемия остается одной из наиболее распространенных патологий у взрослых. Современные подходы к диагностике основываются на комплексной оценке показателей гемограммы и обмена железа, прежде всего уровня ферритина и насыщения трансферрина. Эффективное лечение должно быть направлено не только на коррекцию анемии, но и на выявление и устранение причины дефицита железа. Новые данные свидетельствуют о преимуществах индивидуализированного подхода к выбору схем терапии и более широком использовании внутривенных препаратов железа у пациентов с тяжелым дефицитом или нарушением всасывания.

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МОРФОФУНКЦИОНАЛЬНЫЕ ИЗМЕНЕНИЯ СЛИЗИСТОЙ ОБОЛОЧКИ ЖЕЛУДКА ПРИ ДИФФУЗНЫХ ЗАБОЛЕВАНИЯХ ПЕЧЕНИ

Аннотация: *В статье представлены результаты изучения морфофункционального состояния слизистой оболочки желудка у пациентов с диффузными заболеваниями печени. Обследовано 56 пациентов со стеатозом, гепатитом и циррозом печени; всем больным проведены эзофагогастродуоденоскопия и исследование Gastropanel. Установлена высокая частота Helicobacter pylori-инфекции, а также выраженные различия в распространенности HP-ассоциированного гастрита и атрофических изменений слизистой оболочки желудка в зависимости от пола и клинической формы заболевания печени. Полученные данные подтверждают необходимость комплексной оценки слизистой оболочки желудка у пациентов с диффузными заболеваниями печени.*

Ключевые слова: *диффузные заболевания печени, слизистая оболочка желудка, Helicobacter pylori, Gastropanel, атрофический гастрит, стеатоз, цирроз печени.*

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MORPHOFUNCTIONAL CHANGES OF THE GASTRIC MUCOSA IN DIFFUSE LIVER DISEASES

Abstract: *The article presents the results of studying the morphofunctional state of the gastric mucosa in patients with diffuse liver diseases. A total of 56 patients with hepatic steatosis, hepatitis and liver cirrhosis were examined; all patients underwent esophagogastroduodenoscopy and Gastropanel testing. A high prevalence of Helicobacter pylori infection was found, along with significant differences in HP-associated gastritis and atrophic changes of the gastric mucosa depending on sex and the clinical form of liver disease. The results confirm the importance of comprehensive assessment of the gastric mucosa in patients with diffuse liver diseases.*

Keywords: *diffuse liver diseases, gastric mucosa, Helicobacter pylori, Gastropanel, atrophic gastritis, steatosis, liver cirrhosis.*

Введение

Рак желудка остается одной из актуальных медико-социальных проблем в структуре онкологической заболеваемости. По данным GLOBOCAN 2022, в Узбекистане рак желудка занимает одно из ведущих мест среди злокачественных новообразований; в 2022 году было зарегистрировано 3053 новых случая заболевания, что составило 8,5% от всех онкологических заболеваний.

Развитие рака желудка является многоэтапным процессом, который, как правило, последовательно проходит стадии хронического гастрита, атрофического гастрита, кишечной метаплазии, дисплазии и инвазивной карциномы. В связи с этим раннее выявление воспалительных и атрофических изменений слизистой оболочки желудка имеет важное профилактическое значение.

У пациентов с диффузными заболеваниями печени нередко выявляются нарушения со стороны верхних отделов пищеварительного тракта. Такие изменения могут быть связаны с хроническим воспалением, нарушением микросиркуляции, изменениями обмена желчных кислот, портальной гипертензией, а также метаболическими и иммунными сдвигами. Поэтому оценка состояния слизистой оболочки желудка у данной категории пациентов должна проводиться комплексно, с учетом наличия Helicobacter pylori-инфекции и признаков атрофии.

Цель исследования - изучить морфофункциональное состояние слизистой оболочки желудка у пациентов со стеатозом, гепатитом и циррозом печени.

Материалы и методы исследования

Исследование проведено на базе гастроэнтерологического и гепатологического отделений Андижанской городской многопрофильной центральной больницы. В исследование включены 56 пациентов с диффузными заболеваниями печени, в том числе со стеатозом, гепатитом и циррозом печени. Среди обследованных было 24 мужчины (42,9%) и 32 женщины (57,1%).

Всем пациентам, помимо общеклинических лабораторных исследований, проводились эзофагогастродуоденоскопия и исследование Gastropanel. Эзофагогастродуоденоскопия выполнялась сертифицированными эндоскопистами с использованием гастроскопов Olympus. Эндоскопическая атрофия оценивалась по классификации Kimura-Takemoto.

Исследование Gastropanel проводили в сыворотке венозной крови с использованием тест-системы Biohit Healthcare методом иммуноферментного анализа (ELISA). В ходе исследования определяли уровни пепсиногена I, пепсиногена II, гастрина-17, а также IgG-антител к Helicobacter pylori. Полученные результаты оценивали с использованием автоматического ELISA-анализатора.

Статистическая обработка данных включала расчет абсолютных и относительных показателей. Для оценки различий между группами применяли критерий χ^2 Пирсона. Различия считались статистически значимыми при $p<0,05$.

Результаты оригинального авторского исследования

В исследование были включены 56 пациентов. Helicobacter pylori-инфекция выявлена у 50 пациентов, что составило 89,0% от общего числа обследованных. Среди HP-положительных пациентов доля женщин составила 60,0%, доля мужчин - 40,0%.

Таблица 1. Распространенность атрофии слизистой оболочки желудка и Helicobacter pylori-инфекции среди обследованных пациентов

Пол	HP-положит. пациенты		HP-ассоциир. гастрит		Атрофия тела желудка		Антральная атрофия		Норма		Всего	
	n	%	n	%	n	%	n	%	n	%	n	%
Мужчины	20	40,0	17	63,0	2	14,3	0	0,0	5	83,3	24	42,9
Женщины	30	60,0	10	37,0	12	85,7	9	100,0	1	16,7	32	57,1
Итого	**50**	**89,0**	**27**	**48,2**	**14**	**25,0**	**9**	**16,1**	**6**	**10,7**	**56**	**100,0**

Примечание: данные представлены в виде n (%). Проценты по HP-положительным пациентам отражают распределение по полу внутри группы HP-положительных больных. Проценты по результатам Gastropanel показывают долю мужчин и женщин внутри каждой морфофункциональной группы. Различия в распределении результатов Gastropanel по полу были статистически значимыми: $\chi^2=19,889$; $df=3$; $p<0,001$.

По результатам исследования HP-ассоциированный гастрит выявлен у 27 пациентов (48,2%). Данное состояние чаще наблюдалось у мужчин: 17 случаев, что составило 63,0% в структуре данной морфофункциональной

группы. У женщин HP-ассоциированный гастрит зарегистрирован в 10 случаях (37,0%).

Атрофия тела желудка обнаружена у 14 пациентов (25,0%). Основная доля таких случаев пришлась на женщин - 12 пациенток (85,7%); у мужчин данное состояние выявлено у 2 пациентов (14,3%). Антральная атрофия зарегистрирована у 9 пациентов (16,1%), причем все случаи были выявлены у женщин. Нормальные показатели Gastropanel отмечены у 6 пациентов (10,7%), среди них 5 мужчин и 1 женщина.

Таблица 2. Морфофункциональные изменения слизистой оболочки желудка при различных диффузных заболеваниях печени

Результат	**Стеатоз**		**Гепатит**		**Цирроз**		**Итого**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Атрофия тела желудка	7	31,8	0	0,0	7	30,4	14	25,0
Антральная атрофия	2	9,1	0	0,0	7	30,4	9	16,1
HP-ассоциированный гастрит	7	31,8	11	100,0	9	39,1	27	48,2
Норма	6	27,3	0	0,0	0	0,0	6	10,7
Итого	**22**	**39,2**	**11**	**19,6**	**23**	**41,0**	**56**	**100,0**

Примечание: данные представлены в виде n (%). Проценты отражают долю соответствующего варианта Gastropanel внутри каждой клинической группы заболевания печени. Различия в распределении результатов Gastropanel между группами были статистически значимыми: $\chi^2=25,831$; $df=6$; $p<0,001$.

У пациентов со стеатозом печени (n=22) выявлено неоднородное распределение показателей Gastropanel: атрофия тела желудка и HP-ассоциированный гастрит зарегистрированы по 7 случаев (31,8%), антральная атрофия - у 2 пациентов (9,1%), нормальные показатели - у 6 пациентов (27,3%).

У всех пациентов с гепатитом (n=11) выявлен HP-ассоциированный гастрит, что составило 100,0% в данной группе. У пациентов с циррозом печени (n=23) HP-ассоциированный гастрит определялся у 9 больных (39,1%), атрофия тела желудка - у 7 больных (30,4%), антральная атрофия - также у 7 больных (30,4%). Полученные данные свидетельствуют о различиях морфофункциональных изменений слизистой оболочки желудка в зависимости от формы диффузного заболевания печени.

Обсуждение

Анализ полученных данных показал, что у пациентов с диффузными заболеваниями печени морфофункциональные изменения слизистой оболочки желудка встречаются часто и имеют клинически значимую структуру. Высокая частота Helicobacter pylori-инфекции среди обследованных пациентов указывает на необходимость активного выявления данного фактора, поскольку HP-инфекция является одним из ключевых

механизмов формирования хронического гастрита, атрофии слизистой оболочки желудка и последующих предраковых изменений.

В группе стеатоза печени результаты Gastropanel имели более неоднородный характер. Наличие как воспалительных, так и атрофических изменений позволяет предположить, что уже на ранних стадиях диффузного поражения печени могут формироваться нарушения со стороны слизистой оболочки желудка. Это подтверждает необходимость оценки не только состояния печени, но и верхних отделов желудочно-кишечного тракта.

В группе гепатита доминировал HP-ассоциированный гастрит. Такая картина может быть связана с хроническим воспалительным фоном, иммунными и метаболическими нарушениями, которые сопровождают заболевания печени. В то же время при циррозе печени чаще выявлялись атрофические изменения тела желудка и антрального отдела, что может отражать более глубокие нарушения микроциркуляции, влияние портальной гипертензии и снижение защитных механизмов слизистой оболочки.

Таким образом, сочетанное применение эзофагогастродуоденоскопии, диагностики Helicobacter pylori и Gastropanel позволяет более полно оценить состояние слизистой оболочки желудка у пациентов с диффузными заболеваниями печени. Такой подход имеет практическое значение для раннего выявления атрофических и предраковых изменений, выбора тактики эрадикационной терапии и определения необходимости динамического наблюдения.

Заключение

У пациентов с диффузными заболеваниями печени выявлена высокая распространенность Helicobacter pylori-инфекции и морфофункциональных изменений слизистой оболочки желудка. HP-инфекция обнаружена у 89,0% обследованных пациентов, что подтверждает ее значимость в структуре гастродуоденальных нарушений у данной категории больных.

Результаты Gastropanel продемонстрировали статистически значимые различия по полу: HP-ассоциированный гастрит чаще встречался у мужчин, тогда как атрофия тела желудка и антрального отдела преобладала у женщин. Кроме того, характер изменений слизистой оболочки желудка различался в зависимости от формы заболевания печени: при гепатите доминировал HP-ассоциированный гастрит, а при циррозе чаще выявлялись атрофические изменения.

Комплексная оценка слизистой оболочки желудка у пациентов с диффузными заболеваниями печени имеет важное клиническое значение. Раннее выявление Helicobacter pylori-инфекции, своевременное проведение эрадикационной терапии, динамическое наблюдение за атрофическими изменениями и индивидуальный гастропротективный подход могут способствовать профилактике осложнений и снижению риска предраковых состояний желудка.

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ОСОБЕННОСТИ АНТИГИПЕРТЕНЗИВНОЙ ТЕРАПИИ ПРИ АРТЕРИАЛЬНОЙ ГИПЕРТОНИИ НА ФОНЕ ПОЧЕЧНОЙ НЕДОСТАТОЧНОСТИ (ОБЗОР ЛИТЕРАТУРЫ)

Аннотация: *Артериальная гипертензия (АГ) является как причиной, так и следствием хронической болезни почек (ХБП), ускоряя прогрессирование почечной недостаточности и повышая сердечно-сосудистый риск [1,2,3, 4]. Эффективная антигипертензивная терапия у пациентов с ХБП должна обеспечивать не только достижение целевых уровней артериального давления (АД), но и нефро- и кардиопротекцию [5,6,7]. Цель работы – проанализировать современные подходы к антигипертензивной терапии при АГ на фоне почечной недостаточности, с учётом эффективности, безопасности и особенностей комбинированного лечения.*

Ключевые слова: *артериальная гипертензия, антигипертензивная терапия, блокаторы РААС, иАПФ, резистентная гипертензия, ХБП.*

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FEATURES OF ANTIHYPERTENSIVE THERAPY FOR ARTERIAL HYPERTENSION IN THE SETTING OF RENAL INSUFFICIENCY (LITERATURE REVIEW)

Abstract: *Arterial hypertension (AH) is both a cause and a consequence of chronic kidney disease (CKD), accelerating the progression of renal insufficiency and increasing cardiovascular risk [1,2,3,4]. Effective antihypertensive therapy in patients with CKD should not only ensure the achievement of target blood pressure (BP) levels but also provide nephro- and cardioprotection [5,6,7]. The aim of this study is to analyze current approaches to antihypertensive therapy for AH in the setting of renal insufficiency, taking into account efficacy, safety, and the specific features of combination treatment.*

Keywords: *arterial hypertension, antihypertensive therapy, RAAS blockers, ACE inhibitors, resistant hypertension, chronic kidney disease.*

Введение

Цели контроля АД и общие принципы

Нелекарственный и лекарственный контроль АД у больных с ХБП уменьшает риск сердечно-сосудистых событий и замедляет снижение скорости клубочковой фильтрации (СКФ) [5,7,8]. У большинства пациентов с ХБП рекомендуются более строгие целевые уровни АД (<130/80 мм рт. ст.), особенно при протеинурии или сахарном диабете [5,7,8].

Роль блокаторов РААС

Систематические обзоры и мета-анализы показывают, что ингибиторы АПФ (иАПФ) и блокаторы рецепторов ангиотензина II (БРА):

превосходят другие классы по снижению протеинурии и замедлению прогрессирования ХБП [5,7,8];

уменьшают риск почечных событий, сердечно-сосудистых осложнений и смертности у пациентов ХБП 3–5 стадий без диализа [7,8];

обладают более выраженным нефропротективным эффектом по сравнению с антагонистами кальция, β-блокаторами и диуретиками, несмотря на повышенный риск гиперкалиемии и кашля [7,9,8].

Отдельные клинические исследования показывают, что иАПФ могут обеспечивать более выраженное снижение альбуминурии и улучшение эндотелиальной функции по сравнению с БРА [9].

Антагонисты кальция и комбинированная терапия

У пациентов с ХБП 3–5 стадий, включая диализ, антагонисты кальция (АКК) по контролю АД, смертности и почечным исходам не уступают иАПФ/БРА 6. Однако при длительном наблюдении комбинации иАПФ/БРА с АКК ассоциируются с лучшими метаболическими, почечными и сердечно-сосудистыми исходами по сравнению с другими двойными/тройными режимами [10,11].

Сетевой мета-анализ показал, что режимы на основе БРА + АКК обеспечивают наибольшее снижение систолического и диастолического АД и существенно уменьшают риск крупных сердечно-сосудистых событий по сравнению с монотерапией иАПФ или БРА и другими двойными комбинациями у больных ХБП 3–5 стадий без диализа [10].

Диуретики и резистентная гипертензия

При продвинутой ХБП (стадия 4) тиазидоподобный диуретик хлорталидон достоверно снижает 24-часовое систолическое АД (~–11 мм рт. ст.), уменьшает альбуминурию примерно на 50 %, но увеличивает риск гипокалиемии и обратимого повышения креатинина [12].

Резистентная АГ у больных ХБП встречается часто; её наличие связано с более высоким риском сердечной недостаточности, почечных событий и общей смертности [2]. Это подчёркивает необходимость раннего выявления и систематической интенсификации терапии, включая оптимизацию диуретиков и комбинированных режимов [12,4].

Фиксированные комбинации и реальные паттерны терапии

Реальные регистры показывают, что около трети пациентов с ХБП не получают иАПФ/БРА, несмотря на рекомендации [1,3,4]. Фиксированные комбинации (иАПФ/БРА + тиазидный диуретик или АКК) улучшают приверженность, контроль АД, снижают частоту сердечно-сосудистых событий и лучше сохраняют почечную функцию по сравнению со свободными комбинациями [1,13,3,14].

Новые препараты

Нестероидные антагонисты минералокортикоидных рецепторов, например эсаксеренон, у гипертоников с ХБП обеспечивают значимое снижение офисного и домашнего АД и выраженное уменьшение альбуминурии (~–55 %), при приемлемой частоте гиперкалиемии [15].

Методы

Для написания статьи использованы данные систематических обзоров, мета-анализов, рандомизированных контролируемых исследований и наблюдательных когорт:

систематические обзоры и мета-анализы по сравнению иАПФ, БРА и АКК, а также по иАПФ/БРА-базированным двойным режимам у пациентов с ХБП 3–5 стадий, включая диализ [5,6,7,16];

крупные когортные исследования и регистры, анализирующие паттерны назначения антигипертензивных препаратов и частоту резистентной АГ у больных ХБП [1,2,3,14];

рандомизированные исследования отдельных классов (хлорталидон, эсаксеренон) у пациентов с АГ и продвинутой ХБП [12,15];

клиническое исследование нефропротективных эффектов иАПФ и БРА у больных эссенциальной гипертензией с субклиническим поражением почек [9,18].

Оценивались влияние различных антигипертензивных режимов на АД, СКФ, протеинурию/альбуминурию, сердечно-сосудистые события, конечную стадию почечной недостаточности и профиль безопасности.

Основные клинические акценты по классам препаратов

Класс/режим	Основные эффекты при АГ+ХБП	Ограничения/риски	Источники
иАПФ (монотерапия)	Снижение риска почечных событий, СС-событий, СС-смерти и общей смертности в ХБП 3–5 без диализа	Гиперкалиемия, кашель, гипотензия	[7,9,8]
БРА (монотерапия)	Снижение АД и протеинурии, благоприятные почечные параметры	Меньше кашля, но риск гиперкалиемии и снижения СКФ	[5,9,8]
АКК	Эффективный контроль АД, сопоставимая выживаемость и почечные исходы с РААС-блокаторами в ХБП 3–5D	Меньшее влияние на протеинурию; оптимальны в комбинации	[5,6,10,11]
БРА + АКК	Максимальное снижение АД, меньше крупных СС-событий; улучшение метаболических и почечных показателей	Риск гиперкалиемии аналогичен БРА	[6,10,11]
иАПФ + АКК	Хороший контроль АД и нефропротекция; тип АКК может влиять на динамику СКФ	Возможны различия по влиянию на СКФ при диабетической нефропатии	[16,18]
Тиазидоподобный диуретик (хлорталидон) при ХБП 4	Дополнительное снижение 24-часового САД и альбуминурии	Гипокалиемия, обратимое повышение креатинина, гиперурикемия	[12]
Комбинация иАПФ+БРА	Максимальное снижение протеинурии и АД	Повышение риска гиперкалиемии, гипотензии; изменения СКФ зависят от доз	[7,17]

Класс/режим	Основные эффекты при АГ+ХБП	Ограничения/риски	Источники
Эсаксеренон (новый MPA)	Снижение АД и выраженное снижение альбуминурии, снижение NT-proBNP	Риск гиперкалиемии, зависящий от сопутствующей терапии	[15]

Результаты (анализ данных литературы)

Блокада РААС как базис терапии.

иАПФ и БРА демонстрируют наибольшую доказанную пользу в плане нефро- и кардиопротекции у пациентов ХБП 3–5 без диализа, особенно при протеинурии [5,7,9,8].

иАПФ, по данным сетевого мета-анализа, занимают первое место по снижению риска почечных событий, СС-событий, СС-смерти и общей смертности, хотя повышают риск гиперкалиемии и кашля [7].

Сравнение с антагонистами кальция.

В ХБП 3–5D (включая диализ) АКК по контролю АД, смертности и почечным исходам не уступают иАПФ/БРА [6].

Однако при АГ в целом комбинации иАПФ/БРА+АКК обеспечивают лучшие метаболические, почечные и сердечно-сосудистые результаты, чем другие комбинации [10,11].

Комбинированные режимы и фиксированные комбинации.

Большинство пациентов с ХБП нуждаются как минимум в двух антигипертензивных препаратах, часто трёх и более 12.

БРА-базированные комбинации с АКК превосходят монотерапию по снижению АД и риску крупных СС-событий при сопоставимом влиянии на прогрессирование ХБП [6,10].

Фиксированные комбинации на основе РААС-ингибитора и диуретика или АКК улучшают приверженность и исходы по АД и функции почек [13,3,14].

Резистентная гипертензия при ХБП.

У пациентов с ХБП резистентная АГ (≥3 препарата или ≥4 при контролируемом АД) встречается до 40 %, ассоциируясь с повышенным риском сердечной недостаточности, почечных событий и общей смертности 2.

Ведение таких пациентов требует агрессивного комбинированного лечения (РААС-блокада, АКК, диуретики, нередко тиазидоподобные), тщательного мониторинга калия и СКФ и рассмотрения новых терапевтических опций [12,2,10,4].

Особые и новые препараты.

Эсаксеренон показал устойчивое снижение АД и значимое уменьшение альбуминурии у больных ХБП, независимо от наличия сахарного диабета и уровня СКФ [15].

Комбинация иАПФ+БРА, хотя и обеспечивает более выраженное снижение протеинурии и АД по сравнению с низкими дозами, увеличивает риск гиперкалиемии и гипотензии и требует осторожного подбора доз [17].

Реальные практики и пробелы.

До трети больных ХБП не получают иАПФ/БРА, а фиксированные комбинации применяются недостаточно часто [13,14,4].

Существует значительная международная вариабельность в контроле АД и схемах назначения антигипертензивных средств при ХБП, не полностью объясняемая клиническими факторами [3].

Выводы

У пациентов с артериальной гипертензией на фоне почечной недостаточности антигипертензивная терапия должна строиться вокруг блокаторов РААС, которые обладают наилучшей доказанной нефро- и кардиопротекцией. Для достижения целевых уровней АД и снижения протеинурии большинству пациентов необходимо комбинированное лечение с добавлением антагонистов кальция и диуретиков, предпочтительно в виде фиксированных комбинаций. При продвинутой ХБП и резистентной АГ важна оптимизация диуретической терапии (включая тиазидоподобные диуретики) и тщательный мониторинг безопасности. Новые классы препаратов, такие как нестероидные антагонисты минералокортикоидных рецепторов, расширяют возможности органопротекции, однако требуют дальнейших долгосрочных исследований. В целом, индивидуализация терапии с учётом стадии ХБП, уровня протеинурии, сопутствующих заболеваний и риска гиперкалиемии остаётся ключевым условием оптимального ведения этой категории больных.

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СОВРЕМЕННЫЕ ПОДХОДЫ К ДИАГНОСТИКЕ ХРОНИЧЕСКОГО РИНОСИНУСИТА У ПАЦИЕНТОВ С ДЕТСКИМ ЦЕРЕБРАЛЬНЫМ ПАРАЛИЧОМ

Анотация: *Большинство детей, больных ДЦП, длительное время принимают противосудорожные, седативные (гипоиндуктивные) препараты. В результате ускоряется метаболизм витамина Д в печени, в результате чего в организме развивается гиповитаминоз Д, что приводит к снижению всасывания кальция в кишечнике. Гипокальциемия влияет на процесс окостенения, функцию паращитовидных желез, нервно-мышечную моторику и физиологические механизмы. В то же время в литературе имеются сведения о том, что ион кальция играет важную роль в движении плавающих эпителиальных ресничек. В данном исследовании мы изучили зависимость движения ресничек плавающих эпителиальных клеток, выполняющих мукоцилиарную транспортную функцию слизистой оболочки носа, от количества кальция в крови.*

Ключевые слова: *Детский церебральный паралич, риносинусит, гиповитаминоз D, гипокальциемия, мукоцилиарный транспорт.*

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MODERN APPROACHES TO THE DIAGNOSIS OF CHRONIC RHINOSINUSITIS IN PATIENTS WITH CEREBRAL PALSY

Abstract: *Most children with cerebral palsy take anticonvulsant, sedative (hypoinductive) medications for a long time. As a result, the metabolism of vitamin D in the liver accelerates, as a result of which hypovitaminosis D develops in the body, which leads to a decrease in calcium absorption in the intestine. Hypocalcemia affects the ossification process, parathyroid gland function, neuromuscular motility, and physiological mechanisms. At the same time, there is evidence in the literature that calcium ion plays an important role in the movement of floating epithelial cilia. In this study, we studied the dependence of the movement*

of the cilia of floating epithelial cells that perform the mucociliary transport function of the nasal mucosa on the amount of calcium in the blood.

Key words: *Cerebral palsy, rhinosinusitis, hypovitaminosis D, hypocalcemia, mucociliary transport*

Введение

В последние десятилетия представления о детском церебральном параличе постоянно меняются, что требует методического изучения этой формы патологии с целью определения особенностей течения заболевания в процессе лечения и реабилитации больных. Оказывается, эти различные патологии требуют вмешательства не только неврологов и ортопедов, но и многих других педиатрических специальностей [1,3].

Патология ДЦП с детского возраста часто сопровождается нарушениями сенсорных систем (чаще зрения и слуха), нарушений речи и детского развития, симптоматической эпилепсией, вегетативными расстройствами, вторичными ортопедическими проблемами и другими патологическими состояниями. Многие медицинские практики остаются нерешенными в отношении детей, рожденных с церебральным параличом. Тем не менее, дети, рожденные с церебральным параличом, получают ограниченную вакцинацию или вообще не получают ее. Детский церебральный паралич является наиболее распространенной неврологической патологией, вызывающей инвалидность у пациентов до 18 лет. Такая ситуация создает серьезный риск заражения инфекционными заболеваниями. Мультидисциплинарность и комплексный подход лежат в основе современных представлений о проблеме детского церебрального паралича у детей, подростков и взрослых. Поэтому все новейшие достижения современной клинической медицины должны быть максимально внедрены в повседневную практику специалистов различных медицинских направлений, занимающихся оказанием помощи пациентам, страдающим данной неврологической патологией. По данным литературы, до 70% пациентов, лечившихся по поводу ДЦП, имеют судорожный симптом. Это означает, что им придется длительное время принимать противосудорожные препараты. Длительный прием противосудорожных препаратов приводит к развитию гипокальциемии. Количество кальция в крови в норме составляет 2,1-2,6 ммоль/л, а если оно меньше 2,1 ммоль/л, то это гипокальциемия. К причинам гипокальциемии относятся состояния, связанные с нарушением обмена витамина D, состояния, связанные с патологиями кальцийчувствительных рецепторов в клетке. Некоторые препараты (конвулекс, депакин) ингибируют фермент ГАМК-трансаминазу в процессе метаболизма, и биотрансформация ГАМК блокируется. В результате натрий-калий-АТФаза, кальциевые каналы Т-типа в клеточной мембране частично блокируются и поступление кальция в клетку снижается. Барбитураты (фенобарбитал, бензонал),

противосудорожные препараты являются индукторами цитохрома Р-450, активируют ГАМК и усиливают метаболизм витамина Д в печени. Избыточный распад витамина D снижает всасывание кальция в кишечнике и приводит к гипокальциемии. Уменьшение количества кальция в крови вызывает развитие патологических процессов во многих структурах организма. Один из них вызывает значительное уменьшение движения плавающих эпителиальных ресничек [4,5].

Одной из основных защитных функций носа и полости носа является транспортная функция эпителия слизистой оболочки. Транспорт вырабатываемого секрета со слизистой оболочки в носоглотку зависит главным образом от двух факторов: двигательной активности ресничек мерцательного эпителия и жидкого или густого характера секрета. Слизистая оболочка полости носа выполняет роль первичного защитного барьера (барьера) и препятствует проникновению частиц пыли и различных инфекций из внешней среды. В этом защитном механизме принимают участие плавающие эпителиальные реснички, секрет в носу и нейтрофилы, макрофаги и иммуноглобулины в его содержимом. Слизистый секрет вырабатывается бокаловидными клетками слизистой оболочки носа. Вместе с секретом слизи клетки мерцательного эпителия образуют мукоцилиарную транспортную систему. В результате той же вибрации ресничек мерцательных эпителиальных клеток частицы пыли, микроорганизмы, аллергены прилипают к слизистому секрету и перемещаются в нос и горло, и обеспечивается постоянная чистота. В патогенезе воспалительных заболеваний носа и носовых ходов повышается проницаемость кровеносных сосудов стенки слизистой оболочки, за счет этого изменяется количество и состав секрета слизи, в той или иной степени затрагивается мукоцилиарная транспортная активность [6-8].

Изменение состава слизистых выделений создает условия для роста патогенных микроорганизмов, вызывает распространение воспалительных заболеваний носа и полости носа. Механизм образования отделения, а также контроль его со стороны организма в настоящее время до конца не изучен. Слизистая оболочка дыхательных путей состоит из неделимой части, называемой мукоцилиарной системой, и считается первым защитным барьером, предохраняющим человека от вредного воздействия внешней среды. Защитная функция мерцательного эпителия в большей степени зависит от состава слизистого секрета. Нормальным реологическим показателем слизи является прилипание вдыхаемых частиц к носоглотке. Среднее время на это 10-20 минут. Функциональное свойство плоского эпителия наряду с составом слизи заключается в предотвращении образования колоний персистирующей микрофлоры в умеренном соотношении. В норме секрет продуцируют одноклеточные бокаловидные клетки мезокринного типа. Нормальное соотношение упакованных и мерцательных клеток составляет 1:10. Бокаловидные клетки преимущественно расположены в слизистой

оболочке ноздрей. Аналогично формируется слизистая оболочка носа и околоносовых полостей. Общая сепарация, создаваемая бокаловидными клетками, разделена на два слоя и имеет толщину 8-10 мкм. Верхний слой - гелеобразный коллоидный слой плотный, и париетальный слой золы, где расположены реснички. Слизь представляет собой полутвердый гель сложной структуры, образующий трехмерную структуру на основе высокомолекулярных нитевидных полимеров, серобисульфидных мостиков, водородных связей, сил Вандер-Ваальса или межклеточных сил. По химическому составу выделения на 95% состоят из воды и при подщелачивании, т. е. pH 7,4-7,5, превращаются в гель. Такое изменение придает сепарации текучесть, вязкость и эластичность. Оценить функциональную активность слизистой оболочки носа можно по показателям мукоцилиарного транспорта. Поэтому пробы мукоцилиарного клиренса являются наиболее распространенным объективным методом проверки функционального состояния слизистой оболочки носа и околоносовых полостей. Известно множество методов изучения транспортной активности мерцательного эпителия. Сегодня сахариновый тест рекомендуется большинством исследователей как наиболее простой и информативный метод изучения мукоцилиарного транспорта в слизистой оболочке носа [9,10].

Заключение

Большинство больных ДЦП в течение длительного времени принимают противосудорожные и седативные препараты. Это за счет гепатоиндуктивного действия этой группы препаратов ускоряет метаболизм витамина D в организме и приводит к уменьшению его количества. В результате снижается всасывание кальция из кишечника в кровь и развивается гипокальциемия. Уменьшение количества кальция в крови приводит к уменьшению силы движения и вибрации ресничек, что вызывает замедление мукоцилиарного транспорта. В результате функциональное состояние слизистой оболочки полости носа ухудшается и приводит к удлинению течения воспалительных заболеваний носа и полости носа.

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ПАТОЛОГИЧЕСКАЯ АНАТОМИЯ ОПУХОЛЕЙ И МЕХАНИЗМЫ ИХ РАЗВИТИЯ

Аннотация: *В статье рассмотрены основные вопросы патологической анатомии опухолей и механизмов их развития. Проведен анализ современных литературных источников, посвящённых морфологическим особенностям доброкачественных и злокачественных новообразований. Изучены закономерности опухолевого роста, клеточные и тканевые изменения, а также роль генетических и внешних факторов в канцерогенезе. Установлено, что злокачественные опухоли характеризуются инвазивным ростом, способностью к метастазированию и выраженным клеточным атипизмом, тогда как доброкачественные новообразования отличаются медленным ростом и отсутствием метастазов. Полученные данные подтверждают важность патоморфологических исследований для диагностики, прогнозирования течения и выбора тактики лечения опухолевых заболеваний.*

Ключевые слова: *опухоль, неоплазия, патологическая анатомия, канцерогенез, доброкачественная опухоль, злокачественная опухоль, метастазирование, анаплазия.*

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PATHOLOGICAL ANATOMY OF TUMORS AND MECHANISMS OF THEIR DEVELOPMENT

Abstract: *This article discusses the main aspects of the pathological anatomy of tumors and the mechanisms of their development. A review of contemporary scientific literature devoted to the morphological characteristics of benign and malignant neoplasms was conducted. The patterns of tumor growth, cellular and tissue alterations, as well as the role of genetic and environmental factors in carcinogenesis were analyzed. The study demonstrated that malignant tumors are characterized by invasive growth, the ability to metastasize, and pronounced cellular atypia, whereas benign neoplasms exhibit slow growth and lack metastatic potential. The obtained findings confirm the importance of pathomorphological investigations in the diagnosis, prognosis, and selection of appropriate treatment strategies for neoplastic diseases.*

Keywords: *tumor, neoplasia, pathological anatomy, carcinogenesis, benign tumor, malignant tumor, metastasis, anaplasia.*

Введение

Опухолевые заболевания остаются одной из наиболее актуальных проблем современной медицины. По данным Всемирной организации здравоохранения, злокачественные новообразования занимают одно из ведущих мест среди причин смертности населения во всём мире. Рост заболеваемости онкологическими заболеваниями обусловливает необходимость глубокого изучения механизмов возникновения и развития опухолей, а также их морфологических особенностей.

Опухоль (неоплазия) представляет собой патологический процесс, характеризующийся неконтролируемым размножением клеток, возникающим вследствие генетических нарушений и изменения механизмов регуляции клеточного роста. Патологическая анатомия опухолей изучает морфологические особенности новообразований, их происхождение, строение и закономерности развития. Понимание данных процессов имеет важное значение для ранней диагностики, определения прогноза заболевания и выбора наиболее эффективных методов лечения.

Цель исследования

Изучить патологическую анатомию опухолей, определить их морфологические особенности и механизмы развития, выявить основные различия между доброкачественными и злокачественными новообразованиями, а также оценить роль генетических и внешних факторов в возникновении опухолевого процесса.

Материалы и методы исследования

В ходе исследования были проанализированы научные публикации, учебная литература и современные данные, посвящённые патологической анатомии опухолей. В качестве материала исследования использовались

сведения о морфологических особенностях доброкачественных и злокачественных новообразований, механизмах их развития и результатах клинических наблюдений.

Для изучения структурных и клеточных изменений в опухолевой ткани применялся морфологический метод анализа. С целью выявления различий между доброкачественными и злокачественными опухолями использовался сравнительный метод исследования. Кроме того, были использованы элементы статистического анализа, а также методы систематизации и обобщения литературных данных.

Результаты исследования и обсуждение

Проведённый анализ показал, что опухоли представляют собой результат нарушения механизмов регуляции клеточного роста и дифференцировки. В основе их развития лежат генетические мутации, приводящие к активации онкогенов и инактивации генов-супрессоров опухолевого роста.

Доброкачественные опухоли характеризуются медленным экспансивным ростом, высокой степенью дифференцировки клеток и отсутствием способности к метастазированию. Как правило, они имеют чёткие границы и нередко окружены соединительнотканной капсулой.

Злокачественные новообразования отличаются быстрым ростом, клеточным и тканевым атипизмом, инвазивным характером распространения и способностью к образованию метастазов. При микроскопическом исследовании выявляются выраженная анаплазия клеток, полиморфизм ядер, патологические митозы и очаги некроза.

Установлено, что важную роль в канцерогенезе играют физические, химические и биологические факторы окружающей среды. Воздействие ионизирующего излучения, канцерогенных химических веществ, некоторых вирусов, а также наследственная предрасположенность значительно повышают риск возникновения опухолевых заболеваний.

Особое значение имеет способность злокачественных клеток к инвазии и метастазированию. Распространение опухолевых клеток осуществляется лимфогенным, гематогенным и имплантационным путями, что является основной причиной прогрессирования заболевания и ухудшения прогноза.

Заключение

Патологическая анатомия опухолей играет важную роль в понимании закономерностей их возникновения и развития. Морфологические особенности новообразований позволяют определить степень их злокачественности, прогнозировать течение заболевания и выбирать оптимальную тактику лечения.

Основными отличительными признаками злокачественных опухолей являются инвазивный рост, метастазирование, анаплазия клеток и выраженный тканевой атипизм. Доброкачественные новообразования характеризуются медленным ростом и отсутствием метастазов.

Изучение генетических механизмов канцерогенеза и влияния факторов окружающей среды имеет большое значение для совершенствования методов профилактики, ранней диагностики и лечения онкологических заболеваний.

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СОВРЕМЕННЫЕ ПОДХОДЫ К КОРРЕКЦИИ ЖЕЛЕЗОДЕФИЦИТНОЙ АНЕМИИ У ДЕТЕЙ

Резюме. *Железодефицитная анемия у детей остаётся актуальной проблемой педиатрии. В работе представлен обзор современных подходов к лечению ЖДА с оценкой эффективности пероральной и парентеральной терапии железом. Показано, что пероральные препараты являются методом первой линии, а внутривенные формы применяются при тяжёлых случаях и непереносимости. Полученные данные подтверждают эффективность обеих стратегий лечения в зависимости от клинической ситуации.*

Ключевые слова: *Железодефицитная анемия, дети, пероральная терапия железом, парентеральная терапия, лечение анемии, железосодержащие препараты, педиатрия.*

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MODERN APPROACHES TO THE CORRECTION OF IRON-DEFICIENCY ANEMIA IN CHILDREN

Abstract. *Iron deficiency anemia in children remains a significant problem in pediatrics. This paper presents a review of current approaches to the treatment of iron deficiency anemia, focusing on the effectiveness of oral and parenteral iron therapy. Oral iron preparations are shown to be the first-line treatment, while intravenous forms are used in severe cases or when oral therapy is not tolerated. The findings confirm the effectiveness of both treatment strategies depending on the clinical situation.*

Keywords: *Iron deficiency anemia, children, oral iron therapy, parenteral iron therapy, anemia treatment, iron supplements, pediatrics.*

Введение. Железодефицитная анемия (ЖДА) является одним из наиболее распространённых нутритивных и гематологических дефицитов среди детей, оказывая негативное влияние на когнитивное и физическое

развитие [1,2]. В связи с этим профилактика и эффективное лечение данного состояния имеют важное значение для глобального здравоохранения [3]. В настоящее время существует ряд международных стандартов диагностики и лечения ЖДА. В диагностике основное внимание уделяется таким биомаркерам, как ферритин, гемоглобин и эритроцитарные индексы [4,5]. В лечении основными методами являются пероральная и парентеральная железотерапия, эффективность которых в восстановлении уровня гемоглобина и запасов железа у детей доказана [6,7]. Также в систематических обзорах и метаанализах проводится научная оценка эффективности и безопасности различных терапевтических подходов [8,9].

Цель данного исследования — оценить эффективность и клиническое применение пероральной и парентеральной терапии при лечении ЖДА у детей на основе обзора литературы.

Материалы и методы. Исследование выполнено в формате обзора литературы с использованием современных принципов доказательной медицины. Дизайн работы включал систематический анализ опубликованных научных данных, направленных на изучение эффективности пероральной и парентеральной терапии железодефицитной анемии (ЖДА) у детей. В анализ были включены международные клинические рекомендации, систематические обзоры, метаанализы, рандомизированные контролируемые клинические исследования, а также популяционные и наблюдательные исследования, опубликованные за последние 15 лет [1,3,5,11]. Такой подход позволил обеспечить высокую степень достоверности и обобщаемости полученных данных. Поиск литературных источников осуществлялся в следующих международных базах данных: PubMed, Cochrane Library, Scopus и Web of Science. Дополнительно использовались данные из электронных библиотек и официальных клинических руководств Всемирной организации здравоохранения (ВОЗ) и профильных гематологических обществ. Критериями включения являлись: публикации на английском языке; исследования, посвященные диагностике и лечению ЖДА у детей; наличие четко описанных клинических и лабораторных показателей эффективности терапии; публикации за последние 10–15 лет. Критериями исключения являлись дублирующие публикации, статьи с недостаточной методологической информацией, а также исследования без четко определенной возрастной группы пациентов. Для оценки железодефицитной анемии использовался комплекс клинико-лабораторных показателей. Основными биомаркерами являлись уровень ферритина, гемоглобина, эритроцитарные индексы (MCV, MCH, MCHC), а также показатели общего анализа крови. Дополнительно учитывались клинические симптомы, такие как слабость, утомляемость, снижение физической активности, апатия, снижение концентрации внимания и бледность кожных покровов [1,4,7]. Комплексная оценка позволяла более точно определить степень тяжести

анемии и динамику ответа на терапию. Методы лечения ЖДА у детей были условно разделены на две основные группы:

1. **Пероральная терапия железом** — являлась терапией первой линии и применялась у большинства пациентов с легкой и умеренной степенью анемии. В исследованиях анализировалась эффективность различных солей железа, включая сульфат железа, глюконат железа и фумарат железа [4,5,6,11]. Особое внимание уделялось дозировке, длительности терапии и переносимости препаратов. Было установлено, что абсорбция железа зависит от ряда факторов, включая характер питания, уровень витамина С, одновременный прием ингибиторов всасывания (кальций, фитаты), а также лекарственную форму препарата [13,14]. Также отмечалась частота побочных эффектов со стороны желудочно-кишечного тракта, что влияло на комплаентность пациентов.

2. **Парентеральная терапия железом** — применялась у пациентов с тяжелой анемией, выраженным дефицитом железа, непереносимостью пероральных препаратов или нарушением кишечного всасывания. В качестве основных препаратов использовались современные железосодержащие комплексы, включая железа карбоксимальтозат и другие внутривенные формы железа [3,8,9]. Данный метод обеспечивал более быстрое восстановление уровня гемоглобина и пополнение запасов железа, а также имел высокую клиническую эффективность при тяжелых формах ЖДА.

Оценка эффективности проводимой терапии осуществлялась по динамике следующих показателей: уровень гемоглобина; уровень ферритина; эритроцитарные индексы; динамика клинических симптомов. Дополнительно анализировалась скорость достижения терапевтического эффекта, частота побочных реакций, а также необходимость коррекции лечения. Для статистической обработки данных применялись методы описательной и сравнительной статистики. Использовались Student’s t-test для сравнения средних величин, ANOVA для множественных сравнений групп, а также χ^2 тест для анализа категориальных данных [1,6,10]. Уровень статистической значимости принимался при $p < 0,05$.

Результаты. Анализ литературы показал, что пероральная терапия железом у большинства детей приводит к значительному повышению уровня гемоглобина и ферритина [4,5,6]. Парентеральная терапия в отдельных клинических случаях обеспечивает более быстрый эффект и ускоренное восстановление запасов железа [3,8,9]. Дополнительное применение витаминов и микроэлементов усиливает эффективность пероральной терапии, улучшая клинические симптомы и эритроцитарные индексы [12,13,14].

Обсуждение. Уровни ферритина и гемоглобина являются наиболее надёжными биомаркерами оценки ЖДА [1,5]. Пероральная терапия обычно рекомендуется как первая линия лечения, тогда как парентеральная применяется при тяжёлых формах анемии или непереносимости пероральных препаратов [3,8,9]. Дополнительное использование витаминов и

микроэлементов повышает эффективность лечения и улучшает клинико-лабораторные показатели [12,13].

Заключение. Пероральная и парентеральная терапия железодефицитной анемии у детей являются эффективными методами лечения. Пероральная терапия рассматривается как терапия первой линии, тогда как парентеральная применяется при тяжёлых формах или непереносимости перорального лечения. Использование витаминов и микроэлементов может повышать эффективность терапии. Данное исследование формирует методологическую основу для будущих клинических исследований и метаанализов [15,16].

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ФАРМАКОТЕРАПИЯ ОЖОГОВОЙ ТОКСЕМИИ: РЕЗУЛЬТАТЫ КЛИНИЧЕСКОГО ИССЛЕДОВАНИЯ

Резюме. *В работе представлены результаты оценки фармакотерапии у 68 пациентов с ожоговой токсемией различной степени тяжести, находившихся на стационарном лечении в 2020–2024 годах. Анализ включал клинические и лабораторные показатели воспаления и интоксикации (WBC, CRP, прокальцитонин). Показано, что комплексная терапия с применением антибактериальных, инфузионных и детоксикационных средств способствует снижению выраженности воспалительной реакции и уменьшению частоты инфекционных осложнений. Наиболее выраженный терапевтический эффект отмечен у пациентов с ожогами средней степени тяжести, тогда как при тяжелых поражениях требовалась интенсивная терапия и реанимационные мероприятия. Эффективность фармакотерапии при ожоговой токсемии зависит от тяжести ожогового поражения и своевременности начала лечения.*

Ключевые слова: *ожоговая токсемия, ожоговая болезнь, фармакотерапия, антибактериальная терапия, инфузионная терапия, детоксикационная терапия, сепсис, ожоговые травмы*

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PHARMACOTHERAPY OF BURN TOXEMIA: RESULTS OF A CLINICAL STUDY

Abstract. *The study presents the results of pharmacotherapy evaluation in 68 patients with burn toxemia of varying severity treated in a hospital setting between 2020 and 2024. The analysis included clinical and laboratory indicators of inflammation and intoxication (WBC, CRP, procalcitonin). It was shown that complex therapy involving antibacterial, infusion, and detoxification treatment contributes to a reduction in inflammatory response and a lower rate of infectious complications. The most pronounced therapeutic effect was observed in patients with moderate burns, whereas severe cases required intensive therapy and*

resuscitation measures. The effectiveness of pharmacotherapy in burn toxemia depends on the severity of burn injury and the timeliness of treatment initiation.

Keywords: *burn toxemia, burn disease, pharmacotherapy, antibacterial therapy, infusion therapy, detoxification therapy, sepsis, burn injuries*

Введение. Ожоговые травмы являются одной из актуальных проблем современной медицины, характеризующейся высокой частотой инвалидизации и летальности. При обширных и глубоких ожогах наряду с локальным повреждением тканей развиваются системные патофизиологические изменения во всём организме. В таких случаях формируется ожоговая болезнь, одним из важных этапов которой является токсемия. В стадии токсемии биологически активные вещества, выделяющиеся из некротизированных тканей, токсины микроорганизмов и медиаторы воспаления поступают в кровоток и оказывают неблагоприятное воздействие на различные органы и системы организма. В результате могут развиваться метаболические нарушения, дисфункция иммунной системы, гемодинамические изменения, а также инфекционные осложнения. Несмотря на то что в последние годы методы антибактериальной, инфузионной и детоксикационной терапии ожоговой токсемии были значительно усовершенствованы, при тяжёлых состояниях сохраняется высокий риск развития сепсиса и полиорганной недостаточности. В связи с этим оценка клинической эффективности применяемой фармакотерапии на стадии токсемии, а также оптимизация лечебной тактики имеют важное научное и практическое значение.

Цель. Основной целью исследования является оценка эффективности фармакотерапии, проводимой в стадии токсемии ожоговой болезни, а также разработка оптимальной стратегии лечения на перспективу.

Материалы и методы. Исследование было проведено путем ретроспективного анализа историй болезни 68 пациентов с ожоговыми травмами, проходивших стационарное лечение в Самаркандском филиале Республиканского специализированного научно-практического медицинского центра экстренной медицинской помощи в 2020–2024 годах. В исследование были включены пациенты различных возрастных и половых групп. В зависимости от площади и степени тяжести ожога пациенты были распределены на три группы: I группа — легкие ожоги (площадь поражения менее 10–15%, I–II степень), осложнения отсутствовали либо наблюдались редко; II группа — ожоги средней тяжести (площадь поражения 15–30%, II–III степень), с умеренной вероятностью развития сепсиса и токсемии; III группа — тяжелые ожоги (площадь поражения более 30%, III–IV степень), с высоким риском развития сепсиса, ожогового шока и органной дисфункции. В ходе исследования оценивались следующие клинические и лабораторные показатели: площадь и степень тяжести ожогового поражения, клинические признаки сепсиса и токсемии, а также результаты лабораторных исследований (общий анализ крови, биохимические показатели, уровень С-

реактивного белка, прокальцитонина и данные бактериологических исследований). Пациентам II группы всем без исключения первоначально назначалась эмпирическая антибактериальная терапия. В дальнейшем выбор антибиотиков и их дозировки корректировались в соответствии с результатами бактериологических исследований. В лечении применялись цефалоспорины широкого спектра действия и аминогликозиды. Инфузионная терапия проводилась индивидуально с учетом гемодинамического состояния пациентов и показателей водно-электролитного баланса. В процессе лечения применялись кристаллоидные и коллоидные растворы, а также 5% раствор глюкозы. С целью детоксикации и симптоматической терапии использовались анальгетики, антипиретики, антикоагулянты, витамины и иммуномодуляторы. Динамика сепсиса и токсемии у пациентов регулярно контролировалась на основании клинических признаков и лабораторных показателей (WBC, CRP, прокальцитонин). В группе пациентов с ожогами средней степени тяжести лабораторные показатели изменялись умеренно, а риск развития сепсиса оставался относительно низким. Коррекция эмпирической антибактериальной терапии на основании результатов бактериологических исследований обеспечивала высокую клиническую эффективность лечения. У пациентов с тяжелыми ожогами (III группа) эмпирическая антибактериальная терапия назначалась на ранних этапах лечения всем больным и в дальнейшем корректировалась в соответствии с результатами бактериологических исследований. В лечении использовались карбапенемы и цефалоспорины широкого спектра действия. В данной группе проводилась интенсивная инфузионная терапия с особым вниманием к поддержанию водно-электролитного баланса и гемодинамической стабильности. В связи с высоким риском развития сепсиса и шока осуществлялись детоксикационные и реанимационные мероприятия, включая гемодинамический мониторинг и интенсивную симптоматическую терапию. При необходимости применялись методы реанимации. Дополнительно в комплексное лечение включались анальгетики, антипиретики, антикоагулянты, витамины и иммуномодуляторы, что было направлено на профилактику развития сепсиса и токсемии. Эффективность всех лечебных мероприятий оценивалась на основании динамики клинического состояния пациентов, лабораторных показателей и развития осложнений. В группе пациентов с тяжелыми ожогами, вследствие выраженных изменений лабораторных показателей и высокого риска осложнений, комплексно применялись интенсивная антибактериальная терапия, инфузионное лечение и реанимационные мероприятия.

Результаты. В исследование были включены 68 пациентов с ожоговыми травмами. В зависимости от площади ожога и степени поражения больные были распределены на три группы: пациенты с легкими, средней тяжести и тяжелыми ожогами. У пациентов с ожогами средней степени тяжести (15–30%, II–III степень) признаки воспаления и интоксикации были

выражены умеренно. Количество лейкоцитов составляло 11–15×10^9/л, доля нейтрофилов находилась в пределах 70–80%. Уровень С-реактивного белка составлял 40–100 мг/л, а концентрация прокальцитонина — 0,5–2,0 нг/мл. По результатам бактериологических исследований у 60% пациентов были выявлены патогенные микроорганизмы. На фоне проведенной комплексной фармакотерапии отмечалось улучшение клинического состояния, снижение показателей воспаления и уменьшение частоты инфекционных осложнений. В группе пациентов с тяжелыми ожогами (более 30% поверхности тела, III–IV степень) лабораторные изменения были значительно более выраженными. Уровень лейкоцитов достигал 15–25×10^9/л, а доля нейтрофилов увеличивалась до 80–90%. У большинства пациентов наблюдалось снижение уровня гемоглобина и количества тромбоцитов. Отмечались изменения биохимических показателей, отражающих функцию печени и почек, а также повышение уровня С-реактивного белка до 100–250 мг/л и прокальцитонина до 2–10 нг/мл. По результатам бактериологических исследований у 80% пациентов выявлялись ассоциации грамположительных и грамотрицательных микроорганизмов. После проведения интенсивной антибактериальной терапии, инфузионного лечения и детоксикационных мероприятий у большинства пациентов наблюдалась стабилизация гемодинамических показателей, снижение уровней воспалительных маркеров и уменьшение риска развития септических осложнений. Вместе с тем у пациентов с тяжелыми ожогами сохранялась большая продолжительность лечения и более высокая потребность в проведении реанимационной помощи.

Заключение. Результаты исследования показали, что эффективность фармакотерапии в стадии токсемии ожоговой болезни напрямую зависит от площади ожога и степени тяжести поражения. При ожогах средней степени тяжести своевременно начатая антибактериальная терапия, инфузионное лечение и симптоматические мероприятия продемонстрировали высокую эффективность в профилактике инфекционных осложнений и стабилизации общего состояния пациентов. При тяжелых ожогах высокий уровень воспалительных и интоксикационных показателей требовал проведения комплексного и интенсивного лечения. У данной категории пациентов применение антибиотиков широкого спектра действия в сочетании с инфузионно-дезинтоксикационной терапией и реанимационными мероприятиями способствовало снижению риска развития сепсиса и других тяжелых осложнений. Таким образом, лечебная тактика при ожоговой токсемии должна подбираться индивидуально с учетом клинического состояния каждого пациента и данных лабораторных исследований. Ранняя диагностика, регулярный мониторинг и комплексная фармакотерапия являются основными факторами, обеспечивающими улучшение результатов лечения пациентов.

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РОЛЬ МЕТАБОЛИЧЕСКОГО СИНДРОМА ПРИ САХАРНОМ ДИАБЕТЕ И ЕГО КЛИНИЧЕСКИЕ ПОСЛЕДСТВИЯ

Аннотация:*Метаболический синдром (MetS) - это совокупность кардиометаболических факторов риска, имеющих высокую распространенность среди взрослого населения и повышенные затраты для систем общественного здравоохранения во всем мире. Несмотря на отсутствие единого мнения относительно определения синдрома и критериев диагностики, он характеризуется сочетанием таких факторов риска, как абдоминальное ожирение, атерогенная дислипидемия, повышенное артериальное давление, протромботические и провоспалительные состояния, инсулинорезистентность (ИР) и более высокий уровень глюкозы, которые, несомненно, связаны с повышенным риском от развития хронических заболеваний, таких как сахарный диабет 2 типа (СД2) и сердечно-сосудистые заболевания (ССЗ). Этот синдром имеет сложное и многогранное происхождение, которое до конца не изучено; однако есть веские основания полагать, что сидячий образ жизни и несбалансированное питание могут сыграть фундаментальную роль в его развитии. Цель этого обзора - дать обзор эпидемиологии синдрома, затрат и основных этиологических признаков, связанных с нездоровым питанием и малоподвижным образом жизни.*

Ключевые слова: *метаболический синдром, малоподвижный образ жизни, диета, сердечно-сосудистые заболевания, сахарный диабет 2 типа.*

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THE ROLE OF METABOLIC SYNDROME IN DIABETES MELLITUS AND ITS CLINICAL CONSEQUENCES

Abstract: *Metabolic syndrome (MetS) is a cluster of cardiometabolic risk factors with high prevalence among adult populations and elevated costs for public*

health systems worldwide. Despite the lack of consensus regarding the syndrome definition and diagnosis criteria, it is characterized by the coexistence of risk factors such as abdominal obesity, atherogenic dyslipidemia, elevated blood pressure, a prothrombotic and pro-inflammatory state, insulin resistance (IR), and higher glucose levels, factors indubitably linked to an increased risk of developing chronic conditions, such as type 2 diabetes (T2D) and cardiovascular disease (CVD). The syndrome has a complex and multifaceted origin not fully understood; however, it has been strongly suggested that sedentarism and unbalanced dietary patterns might play a fundamental role in its development. The purpose of this review is to provide an overview from the syndrome epidemiology, costs, and main etiological traits from its relationship with unhealthy diet patterns and sedentary lifestyles.

Key words: *metabolic syndrome, sedentary lifestyle, diet, cardiovascular disease, type 2 diabetes.*

ВВЕДЕНИЕ

В настоящее время метаболический синдром является одной из актуальных медицинских проблем, которая стремительно распространяется в глобальном масштабе и приводит к серьёзным социальным и экономическим последствиям [1,3]. По данным Всемирной организации здравоохранения (ВОЗ), признаки метаболического синдрома выявляются примерно у 25–30 % населения мира, причём данный показатель ежегодно увеличивается как в развитых, так и в развивающихся странах. Особенно высокая распространённость метаболического синдрома среди пациентов с сахарным диабетом 2-го типа рассматривается как важный фактор, определяющий тяжесть течения заболевания, развитие сердечно-сосудистых осложнений и повышение риска инвалидизации [2].

Метаболический синдром — это состояние, характеризующееся одновременным возникновением нескольких метаболических нарушений в организме, основными компонентами которых являются абдоминальное ожирение, дислипидемия, артериальная гипертензия, резистентность к инсулину и гипергликемия. По данным Всемирной организации здравоохранения (ВОЗ), каждый третий взрослый человек страдает симптомами метаболического синдромаечно-сосудистых заболеваний (ССЗ). По данным Всемирной организации здравоохранения (ВОЗ), каждый третий взрослый человек страдает симптомами метаболического синдрома [5].

Инсулинорезистентность, в свою очередь, приводит к повышению активности липолиза, повышению уровня триглицеридов и снижению уровня ЛПВП.Потребление продуктов с высоким гликемическим индексом, трансжирами и продуктов, богатых сахаром, нарушает метаболизм глюкозы и липидов, способствуя ожирению и резистентности к инсулинуости липолиза, повышению уровня триглицеридов и снижению уровня ЛПВП. Кроме того, абдоминальное ожирение является центральным элементом метаболического

синдрома, который возникает в результате увеличения висцеральной жировой ткани, что приводит к усилению секреции адипокинов и медиаторов воспаления (ИЛ-6, ФНО-α). Это состояние вызывает хронический вялотекущий воспалительный процесс и нарушает передачу сигналов инсулина. Неправильное питание и недостаток физической активности являются основными внешними факторами развития метаболического синдрома. Потребление продуктов с высоким гликемическим индексом, трансжирами и продуктов, богатых сахаром, нарушает метаболизм глюкозы и липидов, способствуя ожирению и резистентности к инсулину [4].

Кроме того, дислипидемия и гипертония способствуют раннему и тяжелому течению диабетической ангиопатии. Пациенты с диабетом и метаболическим синдромом подвержены повышенному риску сердечно-сосудистых заболеваний, инфаркта миокарда, инсульта, гепатостеатоза и хронической почечной недостаточности. У них отмечаются признаки ишемии на ЭКГ сердца, стеатоз на УЗИ печени и повышенный атерогенный индекс в лабораторных анализахлеваний, инфаркта миокарда, инсульта, гепатостеатоза и хронической почечной недостаточности. У них отмечаются признаки ишемии на ЭКГ сердца, стеатоз на УЗИ печени и повышенный атерогенный индекс в лабораторных анализах [6].

Клинической практике используются такие препараты, как метформин, статины и ингибиторы АПФ. Однако основной акцент следует сделать на изменении образа жизниЭти факторы не только затрудняют контроль уровня глюкозы, но и значительно повышают риск серьезных осложнений, таких как сердечно-сосудистые заболевания, стеатоз печени и почечная недостаточность образа жизни. Основные компоненты метаболического синдрома — абдоминальное ожирение, дислипидемия, артериальная гипертензия и инсулинорезистентность — играют центральную роль в патогенезе сахарного диабета 2 типа. Эти факторы не только затрудняют контроль уровня глюкозы, но и значительно повышают риск серьезных осложнений, таких как сердечно-сосудистые заболевания, стеатоз печени и почечная недостаточность. [7]. Растущее неправильное питание, отсутствие физической активности и стресс среди населения создают почву для более широкого распространения этого синдрома. Борьба с этим синдромом посредством ранней диагностики, контроля факторов риска и эффективных профилактических мер является одной из актуальных задач современной медицины. Широкий анализ литературы показал, что метаболический синдром, сопровождающий сахарный диабет, глубоко изучен с точки зрения патогенетических механизмов, клинических проявлений и подходов к лечению [8]. Ниже подробно представлены основные научные результаты, выявленные по данной теме. Сложность и многофакторность патогенетических механизмов: многочисленные исследования показывают, что существует сложная взаимосвязь между метаболическим синдромом и диабетом. Центральное место в патогенезе занимает инсулинорезистентность,

которая нарушает метаболизм глюкозы в организме. Кроме того, воспалительные процессы (например, провоспалительные цитокины — TNF-α, IL-6) еще больше усугубляют метаболическую дисфункцию. Также была определена роль окислительного стресса в патогенезе метаболического синдрома. Повышенный уровень свободных радикалов вызывает повреждение клеток и приводит к нарушению передачи сигналов инсулина. Генетические факторы также влияют на развитие заболевания — мутации определенных генов снижают чувствительность к инсулинуше усугубляют метаболическую дисфункцию. Также была определена роль окислительного стресса в патогенезе метаболического синдрома. Повышенный уровень свободных радикалов вызывает повреждение клеток и приводит к нарушению передачи сигналов инсулина. Генетические факторы также влияют на развитие заболевания — мутации определенных генов снижают чувствительность к инсулину [8].

Диабет, сопровождающийся метаболическим синдромом, вызывает множество серьезных осложнений. Наиболее распространенными являются сердечно-сосудистые заболевания (атеросклероз, гипертония, инфаркт миокарда), почечная недостаточность и невропатия. Исследования показывают, что пациенты с метаболическим синдромом имеют гораздо более высокий риск развития сердечно-сосудистых заболеваний, что отрицательно сказывается на продолжительности их жизни. Кроме того, метаболический синдром увеличивает тяжесть диабета у пациентов, что затрудняет контроль уровня глюкозы. Литературе разработано множество диагностических критериев для выявления метаболического синдрома. В частности, оценка проводится на основе артериального давления, уровня глюкозы, липидного профиля, индекса массы тела (ИМТ), окружности талии и других клинических показателей. В последние годы для дальнейшего улучшения диагностики используются биологические маркеры (например, адипонектин, лептин, С-реактивный белок). Эти маркеры помогают выявить изменения в метаболических процессах и используются для оценки эффективности лечениямер, адипонектин, лептин, С-реактивный белок). Эти маркеры помогают выявить изменения в метаболических процессах и используются для оценки эффективности лечения [12, 13].

Комплексный подход важен при лечении диабета, сопровождающегося метаболическим синдромом. Диетотерапия и физическая активность являются ключевыми факторами повышения чувствительности к инсулину и контроля уровня глюкозы. Во многих статьях подчеркивается важность обучения пациентов здоровому образу жизни и их постоянного наблюдения [14]. Кроме того, рассматриваются перспективы применения противовоспалительных и антиоксидантных препаратов, поскольку они направлены на облегчение патогенетических механизмов. Это определяет важные направления для будущих дополнительных экспериментальных и клинических исследований. Также многие авторы подчеркивают

необходимость разработки индивидуализированных методов лечения [15]. Это позволяет создать стратегию лечения, соответствующую характеру заболевания каждого пациентаолического синдрома и сахарного диабета до сих пор не полностью раскрыты, особенно в отношении генетических и молекулярных основ, а также роли новых биомаркеров. Это определяет важные направления для будущих дополнительных экспериментальных и клинических исследований. Также многие авторы подчеркивают необходимость разработки индивидуализированных методов лечения [15]. Это позволяет создать стратегию лечения, соответствующую характеру заболевания каждого пациента. В целом анализ литературы показал, что метаболический синдром, сопровождающийся сахарным диабетом, является сложным и многофакторным заболеванием, и глубокое изучение его патогенеза, разработка новых методов диагностики и лечения являются актуальными задачами в этой области [16].

Заключение

Метаболический синдром создает благоприятную почву для развития диабета и сердечно-сосудистых заболеваний. Его сложная этиология, особенно связь с инсулинорезистентностью и абдоминальным ожирением, оправдывает рассмотрение этого состояния, как не только эндокринологической, но и общетерапевтической проблемы. Поощрение здорового образа жизни, ранняя диагностика и внедрение комплексных методов лечения являются наиболее эффективными инструментами профилактики развития заболеваний.

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ВНЕЗАПНАЯ СЕРДЕЧНАЯ СМЕРТЬ: ПАТОМОРФОЛОГИЧЕСКИЕ ОСНОВЫ И МЕХАНИЗМЫ РАЗВИТИЯ У МОЛОДЫХ ЛЮДЕЙ

Аннотация: *В данной статье представлены современные данные о патоморфологических основах и механизмах развития внезапной сердечной смерти среди молодых людей. Проведен анализ научной литературы, клинико-патологических наблюдений и материалов судебно-медицинских исследований. Установлено, что ведущими причинами внезапной сердечной смерти в молодом возрасте являются гипертрофическая кардиомиопатия, субклинический миокардит, врожденные аномалии коронарных артерий и острый коронарный тромбоз. Особое внимание уделено морфологическим изменениям миокарда и коронарных сосудов, способствующим формированию аритмогенного субстрата. Показана важная роль патоморфологических исследований в диагностике причин внезапной сердечной смерти и разработке профилактических мероприятий.*

Ключевые слова: *внезапная сердечная смерть, патоморфология, гипертрофическая кардиомиопатия, миокардит, коронарные артерии, аритмия, миокардиальный фиброз.*

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SUDDEN CARDIAC DEATH: PATHOMORPHOLOGICAL BASIS AND MECHANISMS OF DEVELOPMENT IN YOUNG PEOPLE

Abstract: *The article presents current data on the pathomorphological basis and developmental mechanisms of sudden cardiac death among young individuals. An analysis of scientific literature, clinicopathological observations, and forensic medical investigations was carried out. Hypertrophic cardiomyopathy, subclinical myocarditis, congenital coronary artery anomalies, and acute coronary thrombosis were identified as the leading causes of sudden cardiac death in young people. Particular attention was paid to morphological changes in the myocardium and coronary vessels contributing to the formation of an arrhythmogenic substrate. The study highlights the significant role of pathomorphological examination in determining the causes of sudden cardiac death and developing preventive strategies.*

Keywords: *sudden cardiac death, pathomorphology, hypertrophic cardiomyopathy, myocarditis, coronary arteries, arrhythmia, myocardial fibrosis.*

Введение

Внезапная сердечная смерть (ВСС) остается одной из наиболее актуальных медико-социальных проблем современной кардиологии и патологической анатомии. Несмотря на значительные достижения в области диагностики и лечения сердечно-сосудистых заболеваний, случаи внезапной смерти среди молодых людей продолжают регистрироваться во многих странах мира. Особую обеспокоенность вызывает тот факт, что нередко летальный исход развивается у практически здоровых лиц без выраженных клинических проявлений заболевания.

По данным многочисленных исследований, в основе большинства случаев внезапной сердечной смерти лежат структурные изменения миокарда, нарушения проводящей системы сердца и патология коронарных сосудов. При этом морфологические изменения могут быть как выраженными, так и минимальными, что существенно затрудняет их своевременную диагностику. В ряде случаев единственным способом установления истинной причины смерти является комплексное патоморфологическое исследование сердца с использованием макроскопических и микроскопических методов анализа.

Особое место среди причин внезапной сердечной смерти у молодых лиц занимают гипертрофическая кардиомиопатия, миокардиты, врожденные аномалии коронарных артерий и аритмогенные заболевания миокарда. Указанные патологические процессы способствуют формированию электрической нестабильности сердечной мышцы и создают условия для возникновения фатальных нарушений сердечного ритма.

Изучение морфологических изменений, лежащих в основе внезапной сердечной смерти, имеет не только диагностическое, но и важное прогностическое значение. Выявление структурных факторов риска

позволяет совершенствовать методы ранней диагностики, проводить профилактические мероприятия среди групп высокого риска и снижать показатели смертности среди лиц молодого возраста.

В связи с этим исследование патоморфологических основ и механизмов развития внезапной сердечной смерти у молодых людей представляет значительный научный и практический интерес для современной медицины.

Цель исследования

Определить основные патоморфологические причины внезапной сердечной смерти среди молодых людей, проанализировать структурные изменения миокарда и коронарных сосудов, а также установить их взаимосвязь с развитием аритмогенных механизмов.

Материалы и методы

В исследовании проведен ретроспективный анализ современных научных публикаций, клинико-патологических наблюдений и материалов судебно-медицинских экспертиз. Выполнена комплексная оценка макроскопических и микроскопических изменений сердца.

При макроскопическом исследовании изучались масса сердца, толщина стенок желудочков и предсердий, состояние эндокарда и эпикарда, просвет и особенности строения коронарных артерий. Особое внимание уделялось выявлению признаков гипертрофии миокарда, врожденных аномалий коронарных сосудов, а также тромботических изменений.

Микроскопическое исследование проводилось на препаратах, окрашенных гематоксилином и эозином. Оценивались структура кардиомиоцитов, состояние интерстициальной ткани, наличие воспалительной инфильтрации, степень фиброза, некротических изменений и особенности микроциркуляторного русла. Полученные результаты были систематизированы и проанализированы с позиций современной патогенетической концепции внезапной сердечной смерти.

Результаты исследования и обсуждение

Проведенный анализ показал, что наиболее частыми причинами внезапной сердечной смерти среди молодых лиц являются гипертрофическая кардиомиопатия, субклинический миокардит, врожденные аномалии коронарных артерий и острый коронарный тромбоз.

Гипертрофическая кардиомиопатия

Гипертрофическая кардиомиопатия является одной из ведущих причин внезапной сердечной смерти у молодых людей, особенно среди лиц, подвергающихся значительным физическим нагрузкам. Макроскопически отмечается выраженное утолщение стенки левого желудочка и увеличение массы миокарда.

При микроскопическом исследовании выявляются дезорганизация мышечных волокон миокарда (myofibrillar disarray), гипертрофия кардиомиоцитов, интерстициальный фиброз и утолщение стенок мелких внутримышечных сосудов. Данные изменения создают морфологическую

основу для нарушения проведения электрического импульса и формирования жизнеугрожающих желудочковых аритмий.

Субклинический миокардит

Одним из важных факторов внезапной сердечной смерти является скрыто протекающий миокардит. Во многих случаях заболевание не сопровождается выраженными клиническими симптомами и остается нераспознанным при жизни пациента.

Морфологически в миокарде обнаруживаются лимфоцитарная инфильтрация, очаговый некроз кардиомиоцитов, интерстициальный отек и нарушения микроциркуляции. Эти изменения приводят к снижению электрической стабильности миокарда и значительно повышают риск развития фатальных нарушений сердечного ритма.

Врожденные аномалии коронарных артерий

Среди молодых людей важную роль играют врожденные аномалии развития коронарных сосудов. Аномальное отхождение коронарных артерий, их необычное расположение или сужение просвета могут вызывать острую ишемию миокарда, особенно во время физической нагрузки.

Даже при отсутствии выраженного атеросклеротического поражения коронарных артерий нарушение кровоснабжения сердечной мышцы способно привести к развитию тяжелых желудочковых аритмий и внезапной смерти.

Острый коронарный тромбоз

Несмотря на относительно низкую распространенность среди молодых лиц, острый коронарный тромбоз остается одной из значимых причин внезапной сердечной смерти. Формирование тромба чаще всего связано с повреждением эндотелия и нестабильностью атеросклеротической бляшки.

Микроскопически выявляются тромботические массы в просвете сосуда, признаки острой ишемии и некротические изменения кардиомиоцитов. Резкое прекращение коронарного кровотока создает условия для возникновения фибрилляции желудочков и остановки сердца.

Диагностическое значение патоморфологических исследований

Проведенный анализ показал, что во многих случаях макроскопические изменения сердца могут быть минимальными или вовсе отсутствовать. В подобных ситуациях решающее значение приобретают гистологические методы исследования.

Выявление миокардиального фиброза, воспалительной инфильтрации, дезорганизации кардиомиоцитов и других микроскопических изменений позволяет установить истинную причину смерти и определить морфологический субстрат аритмогенных процессов. Поэтому комплексное патоморфологическое исследование является важнейшим этапом диагностики внезапной сердечной смерти у молодых людей.

Заключение

Внезапная сердечная смерть среди молодых людей в большинстве случаев связана с патологическими процессами, имеющими выраженную

морфологическую основу, несмотря на их нередко скрытое клиническое течение.

Основными патоморфологическими причинами являются гипертрофическая кардиомиопатия, субклинический миокардит, врожденные аномалии коронарных артерий и острый коронарный тромбоз. Формирование аритмогенного субстрата вследствие дезорганизации кардиомиоцитов, интерстициального фиброза, воспалительных изменений и ишемического повреждения миокарда играет ключевую роль в развитии фатальных нарушений сердечного ритма.

Микроскопическое исследование сердечной ткани имеет решающее значение для установления причин внезапной сердечной смерти. Раннее выявление морфологических факторов риска способствует совершенствованию профилактических мероприятий и снижению смертности среди лиц молодого возраста.

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ИНФОРМАЦИОННЫЕ И КОММУНИКАТИВНЫЕ ТЕХНОЛОГИИ

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DEVELOPMENT AND PRACTICAL APPLICATION OF AN ARTIFICIAL INTELLIGENCE-BASED IMAGE SEGMENTATION SYSTEM

Abstract: *This article discusses the development of a software system for automating the image segmentation process based on artificial intelligence. The software was developed using the Meta Segment Anything Model (SAM), enabling automatic object extraction from image content and visualization of segmentation results. The server side of the system was implemented using the FastAPI framework, while the artificial intelligence model was integrated through the PyTorch library. The application was developed in the PyCharm environment and performs functions such as processing user-uploaded images, generating segmentation outputs, and storing extracted objects. Experimental results demonstrated that the developed system provides high-accuracy segmentation performance across different image types. The proposed solution has practical significance in the fields of computer vision and intelligent information systems.*

Keywords: *artificial intelligence, image segmentation, Meta SAM, FastAPI, PyTorch, Computer Vision, object detection, software system.*

Introduction

With the rapid development of artificial intelligence technologies, the field of Computer Vision has become one of the most important areas of modern information technologies. In particular, automatic image analysis, object detection, and image segmentation tasks are widely applied in healthcare, industry, security systems, remote monitoring, and automated control systems. Image segmentation is the process of separating objects from the background within a digital image and

determining the boundaries of each object, making it a fundamental component of computer vision systems.

Traditional image processing approaches often require manual parameter adjustment, complex configuration processes, and high computational costs. Furthermore, variations in image quality under different conditions may negatively affect segmentation accuracy. Therefore, segmentation methods based on Deep Learning and artificial intelligence technologies have become a significant research direction in recent years[8].

Among recent advancements, the Segment Anything Model (SAM), developed by Meta, has gained considerable attention due to its capability to accurately identify and segment objects within images. The model significantly improves segmentation performance by enabling automatic object extraction across various image types.

In this study, an artificial intelligence-based system utilizing the Meta SAM model was developed for image segmentation tasks. The software solution was implemented using the FastAPI framework and the PyTorch library, providing capabilities for processing user-uploaded images, performing object segmentation, visualizing results, and generating extracted object outputs. The study further analyzes the system architecture, operational algorithm, utilized dataset, and experimental evaluation results[6].

Research Methodology

This study applied a methodology for developing and evaluating an artificial intelligence-based image segmentation system. During the research process, Computer Vision and Deep Learning technologies were employed to achieve automated object detection and segmentation within images. The Segment Anything Model (SAM), developed by Meta, was selected as the core model for performing object identification and segmentation tasks[2].

For software implementation, the FastAPI framework was utilized to develop the server-side architecture, while the PyTorch library was integrated for artificial intelligence model management and execution. The system was developed in the PyCharm programming environment, and data communication between the user interface and the server was established through REST API technology[7].

The proposed methodology consisted of several stages, including image acquisition, preprocessing operations, image segmentation using the SAM model, result generation, and visualization of segmented outputs. The developed approach enabled efficient image processing and automated object extraction, providing a reliable solution for computer vision applications.

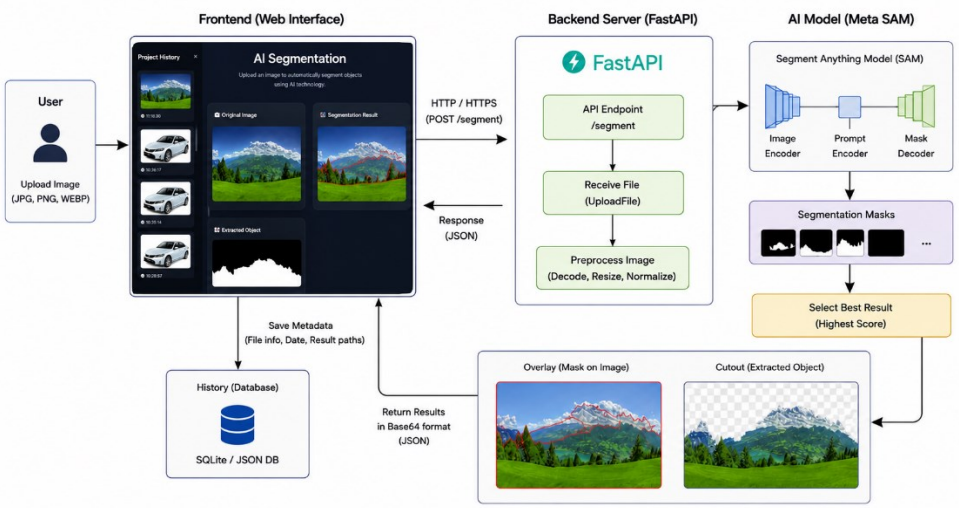

Figure 1. Architecture of the AI-Based Image Segmentation System

The research methodology consisted of several stages. Initially, an image acquisition and preprocessing mechanism was developed. Subsequently, the input images were transferred to the segmentation model, where generated segmentation masks were evaluated and ranked based on accuracy scores. In the final stage, the segmentation result with the highest confidence score was selected and presented to the user in a visual format[6].

To evaluate the effectiveness of the developed system, experimental tests were conducted using different categories of images. The segmentation accuracy and processing speed were analyzed to assess the performance of the proposed approach.

Dataset and Data Preparation Process

This study utilized various image datasets to develop and evaluate an artificial intelligence-based image segmentation system. The primary objective of the system was to automatically identify objects within images, separate them from the background, and generate segmentation outputs. Therefore, the dataset was constructed using real-world images containing diverse object categories.

The developed software supports two methods for data input. The first approach allows users to upload images directly through the graphical user interface. Users can provide images in JPG, PNG, and WEBP formats for segmentation processing. The second approach enables automatic image loading from existing files within the software environment. This strategy improves usability while optimizing the image processing workflow[1].

The dataset preparation process involved handling image data of different sizes, object categories, and visual characteristics to enhance the robustness of the segmentation model. Such diversity in the dataset contributes to improving model generalization capability and segmentation performance under different image conditions.

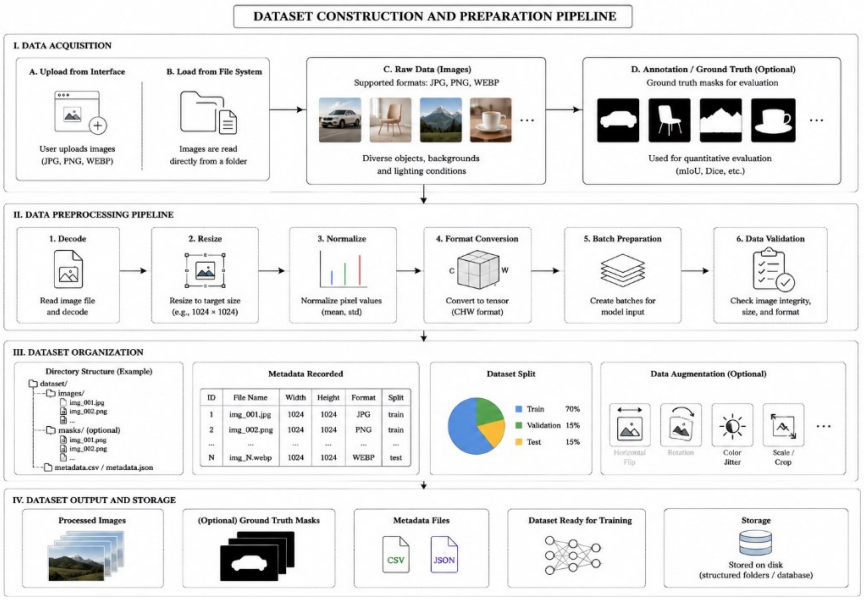

Figure 2. General architecture of dataset construction and data preparation process

The dataset included images containing various object categories, transportation vehicles, natural landscapes, daily-life objects, and background elements. The diversity of data characteristics improved the model's generalization capability and enabled segmentation performance evaluation under different conditions. To simulate real-world usage scenarios, images with different resolutions and quality levels were utilized[4].

Before being processed by the segmentation model, the images underwent several preprocessing stages. This phase plays a critical role in improving the efficiency and performance of the image segmentation system. Initially, uploaded images were processed through a decoding stage. Subsequently, image dimensions were adjusted according to model requirements through a resizing operation. In addition, a normalization procedure was applied to improve image processing quality and computational efficiency. These preprocessing operations ensured that all input data were transformed into a standardized format suitable for the segmentation model[3].

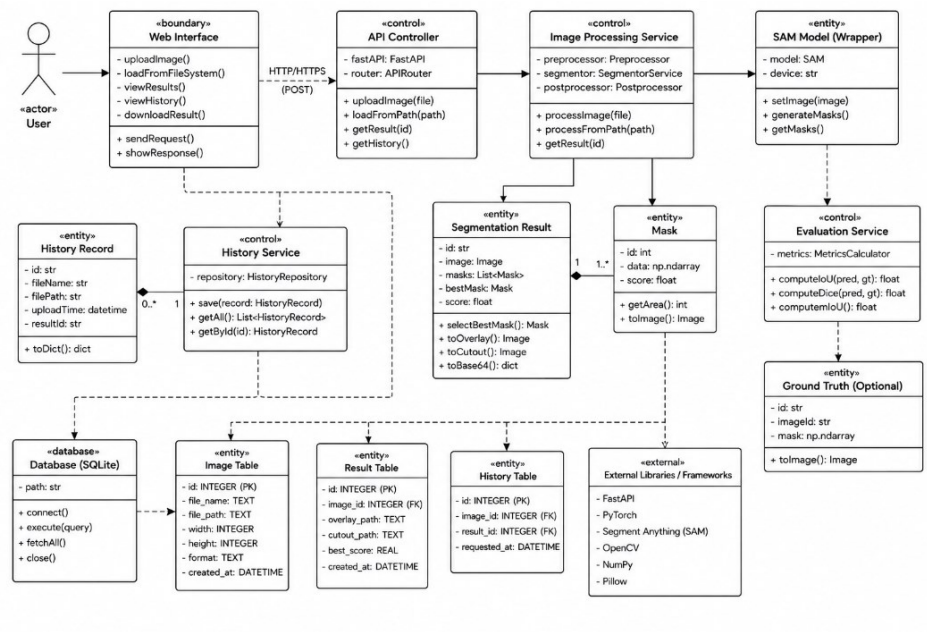

Figure 3. UML diagram of the AI image segmentation system and the relationships among its core modules

In the developed system, images are transmitted to the FastAPI server module and subsequently forwarded to the artificial intelligence model for processing. Object segmentation is performed using the Meta Segment Anything Model (SAM), where the segmentation mask with the highest confidence score is selected from the generated outputs. Based on the segmentation results, both an overlay image and a cutout image are generated.

The system also provides metadata storage functionality for uploaded images. Information such as image name, upload timestamp, and processing results is stored in the history module. This mechanism enables result tracking, data management, and further analytical processes[8].

The generated outputs are converted into Base64 format and transferred to the user interface. This approach improves cross-platform compatibility while simplifying data exchange procedures. Consequently, the proposed dataset preparation and preprocessing methodology contributes to enhancing artificial intelligence model performance and segmentation efficiency.

Proposed Algorithm and System Architecture

This study proposes a software system designed to automate image segmentation tasks using artificial intelligence technologies. The developed system was implemented to process uploaded images, automatically detect objects, and generate segmentation outputs. The system architecture consists of four major components: the user interface, server-side infrastructure, artificial intelligence model, and result management module[10].

In the first stage of the proposed algorithm, users upload images in JPG, PNG, or WEBP formats. The uploaded data are transferred to the FastAPI server and

undergo preprocessing operations, including image decoding, resizing, and normalization.

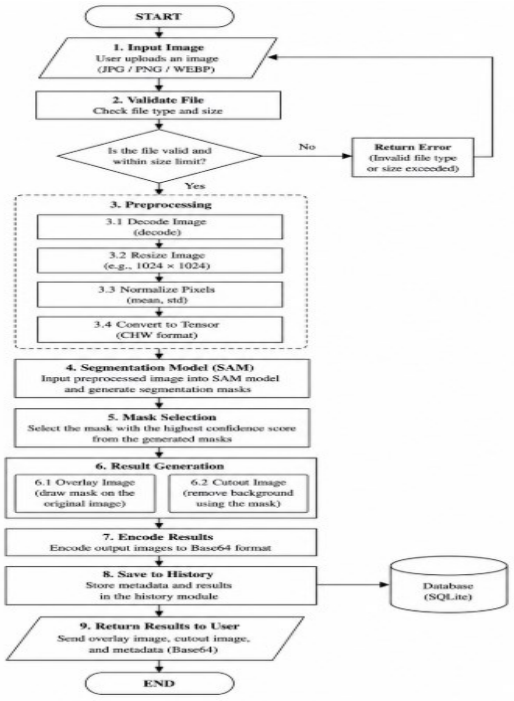

Figure 4. Proposed image segmentation algorithm illustrating the stages of image acquisition, preprocessing, segmentation using the SAM model, and final result generation.

The proposed algorithm follows a sequential processing pipeline designed for automated image segmentation tasks. Initially, input images are received from the user and transferred to the preprocessing module, where operations such as decoding, resizing, and normalization are performed. The processed images are then forwarded to the Segment Anything Model (SAM) for object detection and segmentation.

During the segmentation stage, the model generates multiple segmentation masks and evaluates them according to confidence scores. The mask with the highest confidence value is selected as the final segmentation output. The generated results include both overlay visualization and extracted object representation. This algorithmic structure improves segmentation efficiency, processing performance, and output accuracy for computer vision applications.

After preprocessing, the prepared input is forwarded to the Meta Segment Anything Model (SAM). The model analyzes image content and generates segmentation masks by identifying object boundaries. Finally, the segmentation output with the highest confidence score is selected and presented as the final result.

The segmentation results generated by the system are presented in two different forms. In the first approach, an overlay image is created by placing object boundaries directly onto the original image. In the second approach, a cutout image is generated by removing the background and extracting only the segmented object.

The final outputs are converted into Base64 format and transmitted to the user interface, while processed results are stored in the history module for future access and reuse.

The proposed architecture was developed through the integration of FastAPI server technology, the PyTorch library, and the Meta Segment Anything Model (SAM). This architecture provides high processing speed, modularity, and compatibility with different image formats. As a result, the developed algorithm automates the image segmentation process and contributes to improving the efficiency of computer vision systems.

Software Implementation (FastAPI, PyTorch, SAM)

The artificial intelligence-based image segmentation system developed in this research was implemented using modern software technologies and deep learning approaches. The FastAPI framework was utilized for server-side development, PyTorch was employed for artificial intelligence model execution and computational operations, and the Segment Anything Model (SAM) was integrated to perform object segmentation tasks.

The backend infrastructure was implemented using the FastAPI framework, which enables REST API development, HTTP request processing, and efficient communication between the user interface and the server environment. FastAPI provides high-performance asynchronous processing capabilities, allowing the system to efficiently handle large-scale image processing operations and user requests.

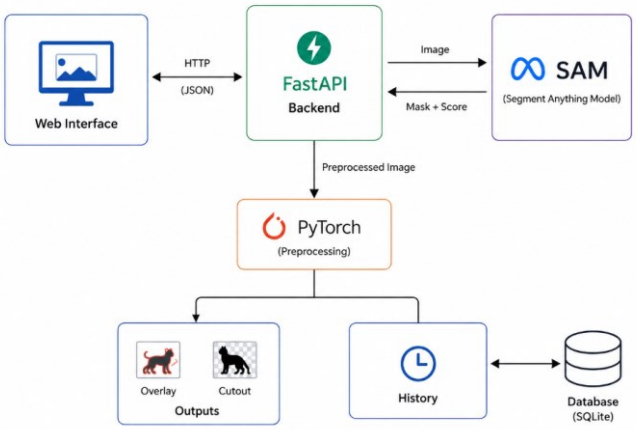

Figure 5. Software architecture of the developed image segmentation system based on FastAPI, PyTorch, and SAM technologies

PyTorch was utilized for image processing and artificial intelligence model management within the developed system. This library provides functionalities for neural network implementation, model loading, and tensor-based image processing operations. Uploaded images undergo several preprocessing stages, including decoding, resizing, and normalization before being transferred to the artificial intelligence model.

To perform object segmentation tasks, the Segment Anything Model (SAM), developed by Meta, was integrated into the system. The model identifies objects within image content and generates segmentation masks representing object boundaries. Among the generated masks, the output with the highest confidence score is selected as the final segmentation result.

The system produces outputs in two formats. The first output is an overlay image containing object boundaries superimposed on the original image, while the second output is a cutout image where background regions are removed to isolate the detected object. Final results are encoded into Base64 format and delivered to the user interface, while processed information is stored within the history module for future access.

The software was developed in the PyCharm programming environment and implemented using a modular architecture approach, allowing future expansion and integration of additional functionalities. This design improves system scalability and practical applicability.

Experimental Results and Analysis

Experimental evaluations were conducted to assess the effectiveness of the developed artificial intelligence-based image segmentation system. The experiments utilized JPG, PNG, and WEBP image formats to analyze segmentation accuracy and processing performance.

The obtained results demonstrated that the Meta Segment Anything Model (SAM)-based system effectively separates objects from backgrounds with high segmentation accuracy. Furthermore, FastAPI and PyTorch technologies enabled efficient image processing and rapid generation of segmentation outputs.

Experimental findings indicate that the developed software solution operates effectively across different image categories and possesses strong practical applicability in computer vision and image processing domains. Experimental findings indicate that the developed software solution operates effectively across different image categories and possesses strong practical applicability in computer vision and image processing domains. The proposed system provides reliable segmentation performance while maintaining processing efficiency for various image formats. The integration of FastAPI, PyTorch, and the Segment Anything Model contributes to improving both segmentation accuracy and system scalability. Furthermore, the modular architecture of the software enables future enhancements and the integration of advanced artificial intelligence technologies. These capabilities demonstrate the potential of the developed system for broader applications in intelligent visual analysis and automated image processing environments[7].

Table 1.

Analytical evaluation of the AI image segmentation system based on FastAPI, PyTorch and SAM model.

Test Image Type	Segmentation Quality	Processing Speed	Output Result	Analysis
Landscape Images	High	Fast	Accurate object boundaries	Stable segmentation performance in natural scene images.
Vehicle Images	High	Fast	Clear object extraction	High-quality mask generation and reliable cutout performance.
Complex Background Images	Medium-High	Moderate	Minor boundary variations	Segmentation remains effective under complex visual conditions.
PNG/JPG/WEBP Formats	High	Fast	Consistent output	Supports multiple image formats without performance degradation.

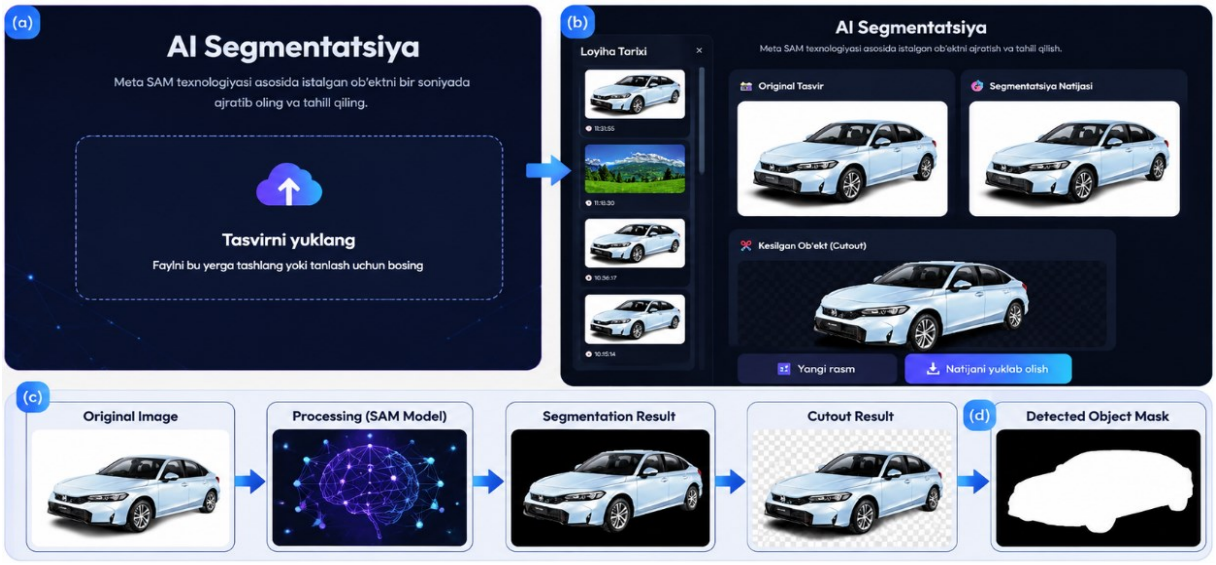

Figure 8. Experimental results of the developed AI image segmentation system demonstrating image upload, segmentation process, and cropped object extraction using the SAM model.

The figure presents the experimental results of the developed AI-based image segmentation system implemented using FastAPI, PyTorch, and the Segment Anything Model (SAM). The first stage demonstrates the image upload interface, where users provide input images for processing. The system then performs object segmentation by identifying and separating target objects from the background using the SAM model. The segmentation results are visualized through generated masks and processed output images. In addition, the cropped object extraction module produces isolated object representations for further analysis. The experimental results indicate that the proposed system provides accurate

segmentation performance and efficient image processing capabilities. These outcomes demonstrate the applicability of the developed approach in computer vision and intelligent image analysis tasks.

Conclusion

This study presented the development and evaluation of an artificial intelligence-based image segmentation system. The software solution was implemented using the FastAPI framework, the PyTorch library, and the Meta Segment Anything Model (SAM) technology. The developed system provides functionalities for receiving user-uploaded images, performing preprocessing operations, segmenting objects, and visualizing segmentation results.

Experimental findings demonstrated that the proposed system can accurately detect and separate objects from backgrounds across different image formats. The FastAPI server architecture combined with PyTorch technology enabled efficient image processing and rapid result generation.

The obtained results indicate that the developed software has strong potential for practical applications in Computer Vision and image processing domains. Future work will focus on improving system performance, integrating additional artificial intelligence models, and extending real-time processing capabilities.

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РАЗРАБОТКА ИНФОРМАЦИОННОЙ СИСТЕМЫ ДЛЯ ВЕДЕНИЯ ДЕЯТЕЛЬНОСТИ УПРАВЛЯЮЩЕЙ КОМПАНИИ

Аннотация: *в управляющих компаниях много документов и данных. Сотрудники часто работают вручную, из-за этого бывают ошибки. Цель работы заключается в создании программы для учёта домов, квартир, жильцов и платежей. Для этого было выполнено моделирование бизнес-процессов и разработано приложение на C# с базой данных SQL Server. В результате получена работоспособная система, которую можно использовать в реальной компании.*

Ключевые слова: *информационная система, управляющая компания, база данных, C#, WPF, SQL Server, IDEF0.*

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DEVELOPMENT OF AN INFORMATION SYSTEM FOR THE ACTIVITIES OF A MANAGEMENT COMPANY

Abstract: *management companies have a lot of documents and data. Employees often work manually, which causes errors. The aim of the work is to create a program for recording houses, apartments, residents and payments. For this purpose, business process modeling was performed and an application in C# with a SQL Server database was developed. The result is a working system that can be used in a real company.*

Keywords: *information system, management company, database, C#, WPF, SQL Server, IDEF0.*

Введение: в управляющих компаниях каждый день появляются новые заявки от жильцов, поступают платежи, меняются данные по квартирам. Многие компании до сих пор ведут учёт в Excel или на бумаге. Это медленно и неудобно. Данные теряются, отчёты готовятся по нескольку дней. Поэтому

была поставлена задача разработать информационную систему, которая сама хранит все данные и помогает с отчётами.

Методы исследования: была изучена деятельность управляющей компании и определены основные задачи сотрудников. Как отмечает Грекул В. И., нотация IDEF0 подходит для функционального моделирования бизнес-процессов [1, с. 96]. Для описания текущих и будущих процессов были построены диаграммы «КАК ЕСТЬ» и «КАК БУДЕТ» (Рис. 1.).

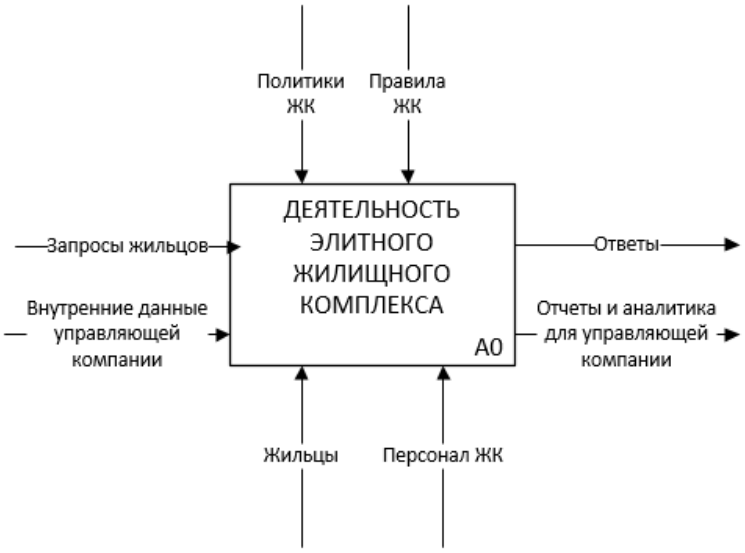

Рис. 1. Контекстная диаграмма IDEF0 «КАК ЕСТЬ»

Также использовались UML диаграммы для проектирования структуры системы [2, с. 132].

Для реализации были выбраны следующие инструменты. Это среда Visual Studio 2022, язык C#, платформа WPF для интерфейса, СУБД Microsoft SQL Server Express, доступ к данным через Entity Framework с подходом Code First. Эти технологии хорошо подходят для настольных приложений под Windows.

Результаты: была спроектирована база данных из 11 таблиц. Среди них таблицы дома, квартиры, жильцы, заявки, платежи, начисления, услуги, показания счётчиков, сотрудники, пользователи, история статусов. Согласно Нестерову С. А., таблицы в реляционной базе данных связываются между собой по принципу один ко многим [3, с. 148]. Один дом содержит много квартир. Один жилец может подать несколько заявок (Рис. 2.).

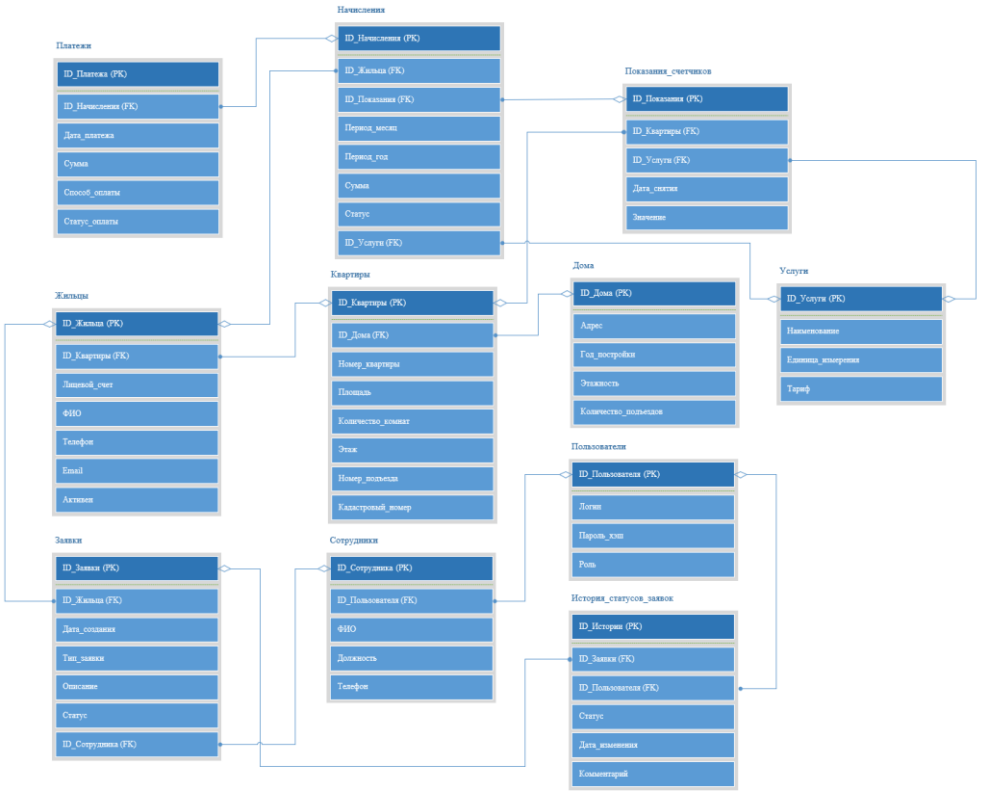

Рис. 2. Логическая модель базы данных

Разработано десктопное приложение. При входе пользователь выбирает роль администратора или оператора. Администратор может управлять пользователями. Оператор работает с заявками и платежами. На главном экране отображается статистика (Рис. 3.).

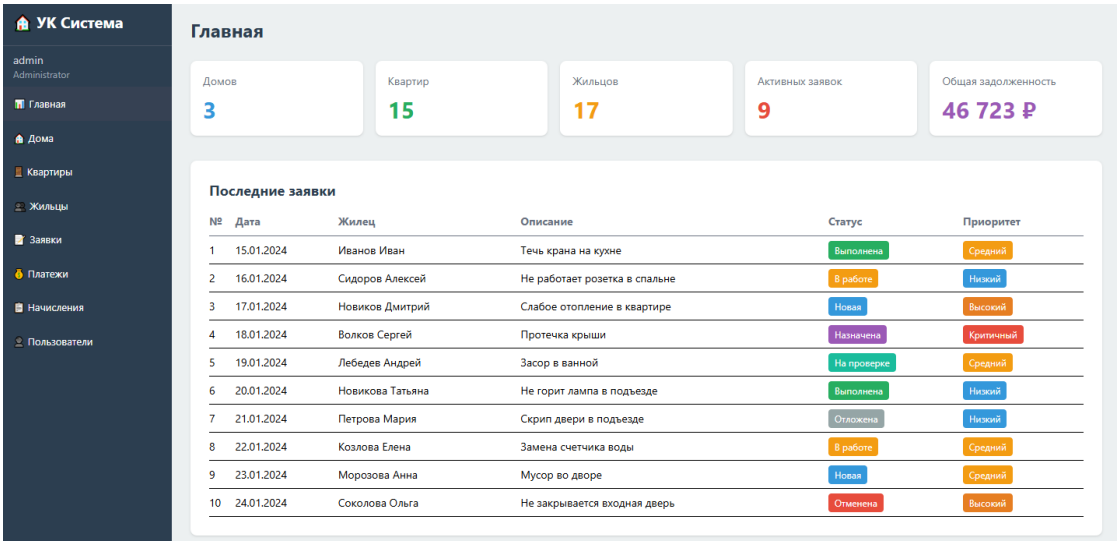

Рис. 3. Главный экран информационной системы

Предусмотрены функции добавления дома или квартиры, поиска жильца по лицевому счёту, создания заявки и назначения исполнителя. Платежи и начисления рассчитываются автоматически.

Было проведено функциональное тестирование по 27 сценариям, включая ввод некорректных данных. Все тесты пройдены. Программа выдаёт предупреждения при незаполненных полях. Разграничение ролей работает корректно. Система готова к использованию.

Заключение: разработанная информационная система может быть внедрена в управляющей компании. Она ускоряет обработку заявок, упрощает учёт платежей и снижает количество ошибок. Тестирование подтвердило стабильную работу всех функций.

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МОДЕЛИРОВАНИЕ СИСТЕМ ВОДООТВЕДЕНИЯ В УСЛОВИЯХ ГОРНОГО РЕЛЬЕФА В ПРОГРАММЕ SWMM

Аннотация: *В статье рассматриваются вопросы проектирования самотечной системы водоотведения шахтных вод на территории со сложным горным рельефом. Представлено описание объекта проектирования, включающего два рудника - К. и Р., очистные сооружения и выпуск очищенных вод в поверхностный водоток. Приведены исходные данные: высотная схема, расходы сточных вод, материал и диаметры трубопроводов, глубина промерзания грунтов. Выполнена сравнительная оценка двух вариантов трассировки сети.*

Ключевые слова: *водоотведение, шахтные воды, горный рельеф, самотечные трубопроводы, гидравлическое моделирование.*

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COMPARISON OF GRAVITY AND VACUUM INTERNAL ROOF DRAINAGE SYSTEMS

Abstract: *The article discusses the design issues of a gravity sewerage system for mine water in an area with complex mountainous terrain. A description of the design object is presented, including two mines — K. and R., treatment facilities,*

and the discharge of treated water into a surface watercourse. The initial data are provided: elevation scheme, wastewater flow rates, pipe material and diameters, and soil freezing depth. A comparative assessment of two network routing options is performed.

Keywords: *sewerage, mine water, mountainous terrain, gravity pipelines, hydraulic modeling.*

Объект проектирования расположен в пределах М. области, в зоне горного рельефа в горнодобывающем комплексе. Климатические условия характеризуются продолжительной зимой, неустойчивым снежным покровом и глубоким сезонным промерзанием грунтов. В границах производственной площадки находятся два основных источника формирования шахтных вод: рудник К. и рудник Р., расположенные на разных гипсометрических уровнях. Рудник К. занимает более высокое положение относительно уровня очистных сооружений, рудник Р. тяготеет к нижним отметкам промышленной зоны. Выпуск очищенных вод организован в ручей — поверхностный водоток за границей санитарно-защитной зоны.

Проектом предусмотрена подача неочищенных вод на очистку и отведение очищенных вод в водный объект. Схема водоотведения включает падающие магистрали и отводящие магистрали. Подающие магистрали от рудников к очистным сооружениям представлены тремя нитками: одна магистраль принимает сток от рудника К., две — от рудника Р. Все три потока сходятся в узле переключения перед входом на очистные сооружения. Отводящие магистрали после очистных сооружений также уложены в количестве трех ниток, конструктивно идентичных, следующих параллельно до места выпуска в ручей. В данной работе рассматриваю только одну из трех отводящих магистралей. Наличие трех ниток обеспечивает надежность сброса при ремонтных или аварийных ситуациях.

Для проверки корректности работы программы SWMM и убеждения в том, что его можно использовать для дальнейшего проектирования, был создан пробный участок сети. Сначала был выполнен расчет в среде SWMM на основе введенных параметров, а затем полученные результаты сравнили с гидравлической таблицей 2.2, посчитанной по формуле Шези из таблицы Лукиных А.А., Лукиных Н.А. Таблицы широко применяются для расчета самотечных трубопроводов систем водоотведения. [2]

Ниже в табл. 1.1 представлены параметры, заданные в качестве входных данных для проверки программы.

Таблица 1.1 – Исходные данный для пробного участка сети.

№ Участка	Отм. лотка		Отм. Земли		Длина, м	Диаметр, мм	Расход, л/с
	В начале	В конце	В начале	В конце			
1	2	3	4	5	7	8	9
1	10	9,99	12,1	12,09	1	500	0,342

В результате гидравлического моделирования программа определила следующие значения, которые отображены на рис. 1.1, 1.2 и 1.3.

Есть два варианта отображения результатов расчета сети в данной программе. На пробном участке сети покажу отображение на самой панели трассировки, далее все расчеты будут располагаться в табличном формате.

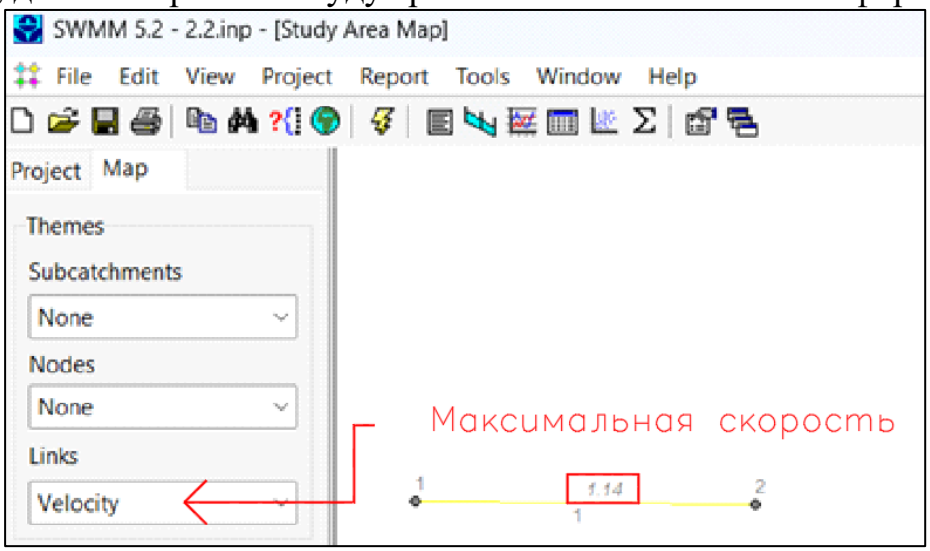

Рисунок 1.1 – Показатели скорости.

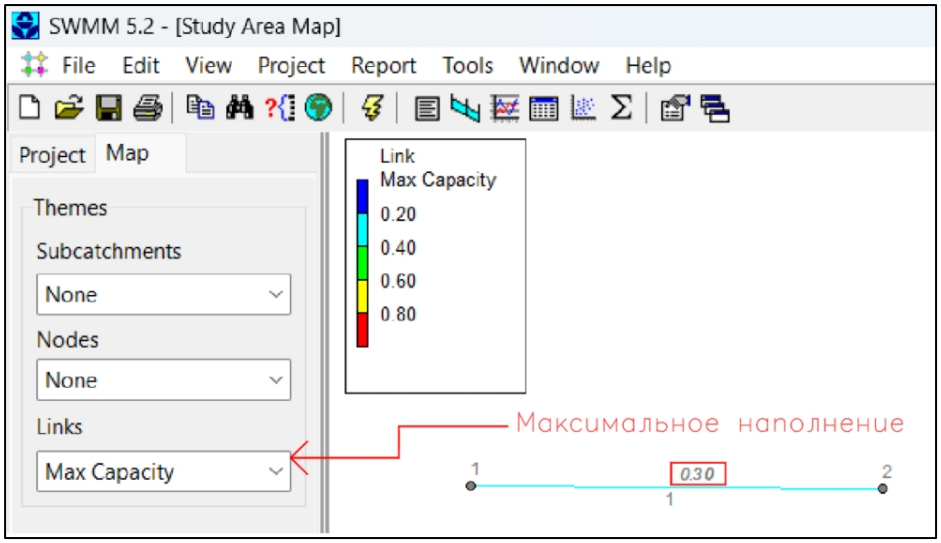

Рисунок 1.2 – Показатели уклона.

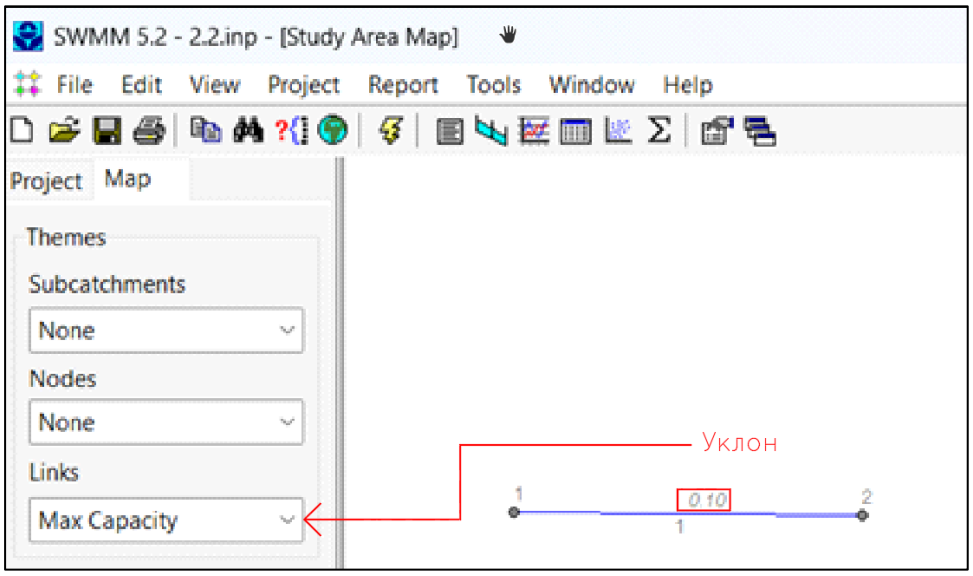

Рисунок 1.3 – Показатели наполнения.

Посчитаем по формуле Шези для труб материала

ГОСТ Р 70628.3- 2023. [3]

Таблица 1.2 – Результаты расчета по формуле Шези. [2]

h/d	d	S/d^2	S	R/d	R	n	i	C	Q, м3/с	v, м/с	Qo (л/с)
1	2	3	4	5	6	7	8	9	10	11	12
0,1	0,5	0,0004	0,0001	0,149	0,0745	0,01	0,001	64,81	5,594	0,559	0,055
0,2	0,5	0,0008	0,0002	0,294	0,1470	0,01	0,001	72,60	0,0001	0,880	0,176
0,3	0,5	0,0012	0,0003	0,433	0,2165	0,01	0,001	77,45	0,0003	1,140	0,341
0,4	0,5	0,0016	0,0004	0,564	0,2820	0,01	0,001	80,94	0,0005	1,359	0,543
0,5	0,5	0,002	0,0005	0,683	0,3415	0,01	0,001	83,57	0,0007	1,544	0,772
0,6	0,5	0,0024	0,0006	0,787	0,3935	0,01	0,001	85,57	0,0010	1,698	1,018
0,7	0,5	0,0028	0,0007	0,873	0,4365	0,01	0,001	87,07	0,0012	1,819	1,273
0,8	0,5	0,0032	0,0008	0,937	0,4685	0,01	0,001	88,10	0,0015	1,907	1,525
0,9	0,5	0,0036	0,0009	0,979	0,4895	0,01	0,001	88,75	0,0017	1,964	1,767
1	0,5	0,004	0,001	1,000	0,5000	0,01	0,001	89,06	0,0019	1,992	1,991

1. h/d – Относительное заполнение;
2. d – Диаметр, м;
3. S/d^2 – Безразмерная площадь сечения;
4. S – Площадь сечения, $м^2$;
5. R/d – Безразмерный гидравлический радиус;
6. R – Гидравлический радиус, м;
7. n – Коэффициент шероховатости;
8. i – Уклон;

9. C – Коэффициент Шези; $C = \frac{1}{n} \cdot R^{\frac{1}{6}}$
10. Q – Расход, м^3/с; $Q = C \cdot S \cdot \sqrt{R \cdot i}$
11. v – скорость, м/с; $v = C \cdot \sqrt{R \cdot i}$
12. Qo – Расход, л/с; $Q = Q_0 \cdot 1000$

Таким образом, результаты моделирования пробного участка в программе SWMM полностью совпадают с данными, рассчитанными по формуле Шези из таблицы Лукиных А.А., Лукиных Н.А. Это позволяет сделать вывод о том, что настройки модели заданы верно, а программа SWMM является надежным инструментом для выполнения гидравлических расчетов систем водоотведения на стадии проектирования.

Запроектированы и рассмотрены два варианта трассировки сети в условиях горной местности с резким перепадом рельефа в программе SWMM.

Первый вариант предусматривает прокладку трубопроводов параллельно поверхности земли с максимальным приближением к естественным крутым уклонам. Особенностью являются критически высокие скорости движения сточных вод на значительных участках из-за больших перепадов отметок при относительно короткой длине коллектора. Трассировка выполняется без устройства дополнительных гасящих сооружений на каждом перепаде, что

упрощает земляные работы, но создает риск гидравлических ударов и повышенного износа лотка труб.

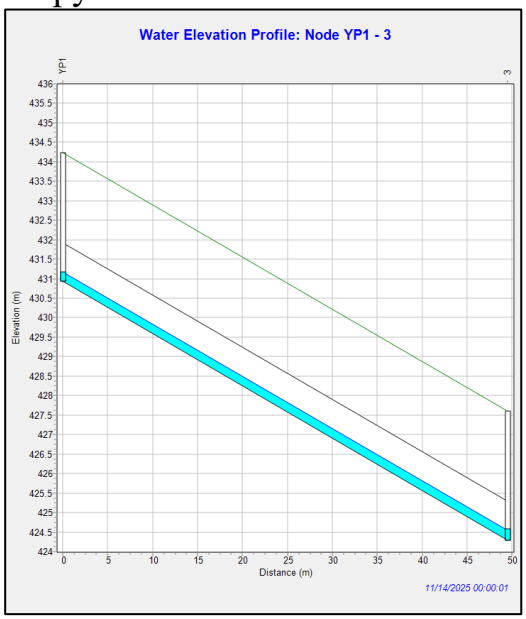

Рис. 1.4 – Пример 1 варианта трассировки сети.

Второй вариант представляет собой каскадный метод трассировки: искусственное дробление одного участка на несколько участков с устройством перепадных колодцев в местах резкого изменения рельефа. Скорости контролируются наклоном трубопроводов на каждом отдельном

каскаде, что позволяет поддерживать скорость в диапазоне незаиливающих 0,7–1,2 м/с.

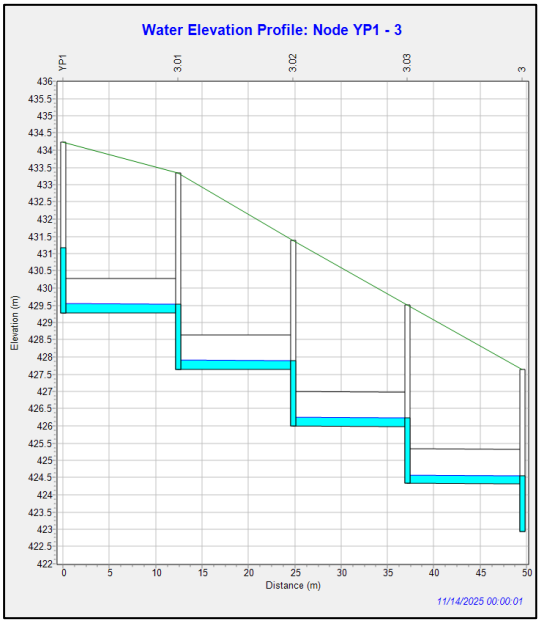

Рис. 1.5 – Пример 2 варианта трассировки сети.

После внесения всех значений в программу SWMM собрала все полученные расчетные данные, далее их оформила в гидравлические таблицы. На основании полученных данных составлены таблицы итогов результата расчета по 1 и 2 варианту трассировки сети.

Таблица 1.3 – МИН / МАКС скорость, заполнение, уклон трубопровода 1 варианта трассировки сети

№ магистрали	МИН скорость V,м/с	МАКС скорость V,м/с	МИН заполнение h/D	МАКС заполнение h/D	МИН уклон i	МАКС уклон i
1 подводящая	0,39	18,07	0,16	0,76	0,0001	0,6667
2 подводящая	1,64	11,04	0,35	0,72	0,0010	0,1024
3 подводящая	0,98	8,30	0,16	0,80	0,0008	0,2427
отводящая	1,11	22,91	0,13	1,00	0,0008	0,8672

Таблица 1.4 – МИН / МАКС скорость, заполнение, уклон трубопровода 2 варианта трассировки сети

№ магистрали	МИН скорость V,м/с	МАКС скорость V,м/с	МИН заполнение h/D	МАКС заполнение h/D	МИН уклон i	МАКС уклон i
1 подводящая	0,81	1,30	0,46	0,68	0,0001	0,0726
2 подводящая	0,97	1,18	0,67	0,81	0,0001	0,0011
3 подводящая	0,81	1,09	0,40	0,50	0,0001	0,0012
отводящая	0,81	1,09	0,40	0,50	0,0001	0,0012

По результатам гидравлического расчета двух вариантов трассировки сети установлено, что первый вариант характеризуется неприемлемыми режимами работы: минимальные скорости опускаются до 0,39 м/с, что приводит к заиливанию труб, а максимальные скорости достигают 22,91 м/с, что вызывает интенсивный износ трубопровода. Второй вариант обеспечивает стабильные скорости в диапазоне 0,81–1,30 м/с, а уклоны находятся в умеренных пределах. Таким образом, для дальнейшего проектирования рекомендуется второй вариант трассировки как обеспечивающий надежный и долговечный режим работы сети.

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РАСЧЕТ ВРЕМЕНИ ИЗНОСА ТРУБОПРОВОДОВ СИСТЕМ ВОДООТВЕДЕНИЯ В УСЛОВИЯХ ГОРНОГО РЕЛЬЕФА

Аннотация: *В статье рассмотрена методика оценки долговечности самотечных трубопроводов шахтных вод с учётом абразивного и химического воздействия. Представлен состав сточных вод двух рудников горнодобывающего комплекса. Выполнен расчёт фактического срока службы труб из полиэтилена ПЭ100 по ГОСТ Р 70628.3-2023. Для двух вариантов трассировки сети, протяжённой по склону и каскадной с перепадными колодцами, определены коэффициенты абразивного износа и химической стойкости.*
Ключевые слова: *шахтные воды, износ трубопровода, абразивный износ, химическая стойкость, срок службы, полиэтиленовая труба, скорость потока.*

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COMPARISON OF GRAVITY AND VACUUM INTERNAL ROOF DRAINAGE SYSTEMS

Abstract: *The article presents a methodology for assessing the durability of gravity mine water pipelines considering abrasive and chemical impacts. The composition of wastewater from two mines of a mining complex is analyzed. The*

actual service life of PE100 polyethylene pipes according to GOST R 70628.3-2023 is calculated. For two routing options, slope-following and cascade with drop manholes, abrasive wear coefficients and chemical resistance coefficients are determined.

Keywords: *mine water, pipeline wear, abrasive wear, chemical resistance, service life, polyethylene pipe, flow velocity.*

Проектируемая площадка находится в М. области. Рельеф горный, территория относится к горнодобывающему комплексу. Зимы здесь долгие, снежный покров ложится неустойчиво, грунты промерзают глубоко. В пределах промплощадки работают два источника шахтных вод — рудник К. и рудник Р. Они стоят на разных высотах. Рудник К. располагается выше очистных сооружений, а рудник Р. — ближе к нижним отметкам, в самой низкой части промзоны. Очищенную воду сбрасывают в ручей обычными подземными магистралями. И находиться они за границами санитарно-защитной зоны.

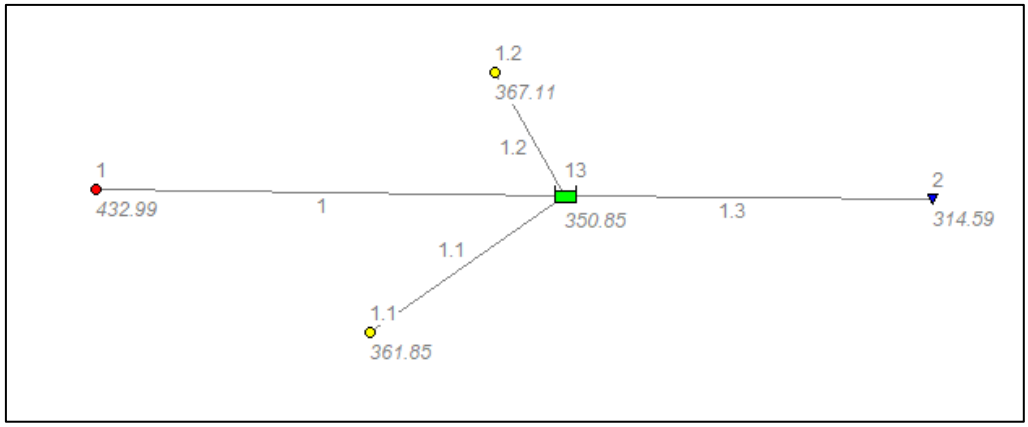

Рисунок 1.1 – Схема водоотведения проектируемого объекта.

По проекту грязные воды идут на очистку, а чистые уже на сброс. Схема раздельная: есть подающие трубопроводы и отводящие. От рудников до очистных тянут три нитки. От рудника К. — одна, от рудника Р. — две. Все три встречаются в переключающем узле прямо перед входом на очистные. После очистки тоже уложено три линии. Они одинаковые по конструкции, идут параллельно до самого выпуска в ручей. Я рассматриваю только одну из этих трёх отводящих веток. Три нитки сделали не просто так — если на одной ремонт или авария, две другие продолжают работать.

Для оценки долговечности проектируемых трубопроводов необходимо определить интенсивность износа внутренней поверхности труб под воздействием транспортируемой среды. Выполнен расчёт срока службы трубопроводов по первому и второму вариантам трассировки сети с учётом абразивного и коррозионного воздействия.

Приведу в пример рисунок 1.2 засорившегося трубопровода

Рисунок 1.2 – Пример зарастаний и отложений в трубах.

Для рудника К. состав сточных вод составляет:

Таблица 1.1 – Состав сточных вод от рудника К.

№п/п	Наименование показателя	Максимальные значения, мг/л
1	Взвешенные вещества	3200
2	Общая минерализация	938
3	ХПК	32
4	БПК	11,8
5	Фтор	21,25
6	Сульфаты	230
7	Хлориды	80,04
8	Фосфаты	7
9	Нитраты	161,46
10	Нитраты по азоту	36,45
11	Нитриты	35,2
12	Нитриты по азоту	10,73
13	Аммиак	14,89
14	Аммиак по азоту	11,54
15	Азот	45,38
16	Нефтепродукты	4,5
17	СПАВ	3,25
18	Молибден	0,34
19	Алюминий	3,6
20	pH	11,73

Для рудника Р. состав сточных вод составляет:

Таблица 1.2 – Состав сточных вод от рудника Р.

№п/п	Наименование показателя	Максимальные значение, мг/л
1	Взвешенные вещества	9638
2	Общая минерализация	10900
3	ХПК	49,8
4	БПК	14,7
5	Фтор	661,35
6	Сульфаты	2650
7	Хлориды	182
8	Фосфаты	117,73
9	Нитраты	713,5
10	Нитраты по азоту	161,06
11	Нитриты	21,25
12	Нитриты по азоту	6,48
13	Аммиак	14,39
14	Аммиак по азоту	11,16
15	Азот	162,61
16	Нефтепродукты	66,4
17	СПАВ	0,87
18	Молибден	0,78
19	Алюминий	3,91
20	pH	10,48

Нормативный срок службы трубы ПЭ по ГОСТ Р 70628.3-2023 составляет 100 лет. Рассчитываю прогнозируемый срок службы:

$$T_{факт} = T_{норм} x K_{абр} x K_{хим} x K_{гидр}, \text{ где [2]} \quad [1]$$

$T_{факт}$ - прогнозируемый срок службы, лет;

$T_{норм}$ - номинальный срок службы трубопровода при скорости 0,7-1,2 м/с. $T_{норм}$= 100 лет;

$K_{абр}$ – коэффициент абразивного износа, зависит от скорости и концентрации песка/взвеси; [2]

$K_{хим}$ – коэффициент химической стойкости, зависит от pH и состава; [3], [3.1]

$K_{гидр}$ – коэффициент гидравлический, при самотечных трубопроводах $K_{гидр}$= 1.

Пример расчета трассировки сети.

Для расчета коэффициента абразивного износа используется следующая формула:

$$К_{абр} = \left(\frac{V_{норм}}{V_{факт}}\right)^{m}, \text{ где [2]} \qquad [2]$$

$V_{норм}$ – безопасная скорость для воды 0,7 – 1,2 м/с. Примем 1 м/с;

$V_{факт}$ – расчетная скорость. Для 1 участка составляет 6,58 м/с;

m – эмпирический коэффициент, для ПЭ100 принимаем 2,5.

$$К_{абр(уч.1)} = \left(\frac{1,0}{6,58}\right)^{2,5} = 0,009$$

Коэффициент $К_{хим}$:

- Для чистой воды или нейтральных стоков $К_{хим} = 1$. Буду использовать для отводящих стоков
- Для агрессивного состава Рудника К.:

$$К_{хим\ К.} = 1 - (\delta_{СПАВ} + \delta_{Нефт} + \delta_{pH}), \text{ где [2]} \qquad [3]$$

$\delta_{СПАВ}$ – потеря ресурса от СПАВ. При СПАВ = 3,25 мг/л → 7% потерь;

$\delta_{Нефт}$ – потеря ресурса от нефтепродуктов. При нефтепродуктах 4,5 мг/л → 5% потерь;

δ_{pH} – потеря ресурса от щелочной среды. При pH 11,73 → 3% потерь из-за усиления активности других агентов.

$$К_{хим.\ К.} = 1 - (0,07 + 0,05 + 0,03) = 0,85.$$

- Для агрессивного состава Рудника Р.:

$$К_{хим\ Р.} = 1 - (\delta_{СПАВ} + \delta_{Нефт} + \delta_{осмол} + \delta_{pH}), \text{ где [2]} \qquad [3.1]$$

$\delta_{СПАВ}$ – потеря ресурса от СПАВ. При СПАВ = 0,87 мг/л → 0,02% потерь;

$\delta_{Нефт}$ – потеря ресурса от нефтепродуктов. При нефтепродуктах 66,4 мг/л → 0,18% потерь;

$\delta_{осмол}$ – потеря ресурса от нефтепродуктов. При общей минерализации + фтор 10900+661мг/л=11561 → 0,05% потерь;

δ_{pH} – потеря ресурса от щелочной среды. При pH 10,48 → 0,02% потерь из-за усиления активности других агентов.

$$К_{хим\ Р.} = 1 - (0,02 + 0,18 + 0,05 + 0,02) = 0,73.$$

Таким образом:

$$Т_{факт(уч.1)} = 100x0,009x0,85x1 = 0,38 \text{ года.} \qquad [1]$$

Результаты расчета 1 и 2 варианта трассировки сети по каждой ветки приведены в табл. 1.3 и 1.4.

Таблица 1.3 – Результат расчета времени износа трубопроводов 1 варианта трассировки сети.

Номер участка 1 ветки	$T_{факт}$ 1 ветки, год	Номер участка 2 ветки	$T_{факт}$ 2 ветки, год	Номер участка 3 ветки	$T_{факт}$ 3 ветки, год	Номер участка отводящей ветки	$T_{факт}$ отводящей ветки, год
1	2	3	4	5	6	7	8
1	0,77	1,1	69,47	1,2	1,46	1,3	0,04
2	0,06	2,1	49,30	2,2	0,18	2,3	0,40
3	0,32	3,1	76,78	3,2	0,58	3,3	3,65
4	0,54	4,1	60,22	4,2	0,34	4,3	3,33
5	0,19	5,1	49,30	5,2	21,19	5,3	43,12
6	1,00	6,1	11,84			6,3	73,67
7	0,19	7,1	53,78			7,3	15,28
8	43,28	8,8	1,94			8,3	14,42
9	62,62	9,1	1,86			9,3	16,22
10	34,76	10,1	50,37			10,3	14,42
11	1,63	11,1	64,62			11,3	15,65
12	0,76	12,1	48,26			12,3	13,47
13	0,30	13,1	60,22			13,3	15,46
14	0,79	14,1	51,47			14,3	63,39
15	0,71	15,1	61,64			15,3	53,95
16	0,71	16,1	0,37			16,3	56,11
17	0,58	17,1	4,49			17,3	2,34
18	55,02	18,1	4,42			18,3	77,04
19	44,11					19,3	9,92
20	45,86					20,3	2,61
21	65,48					21,3	18,13
22	1,55					22,3	56,11
23	0,26					23,3	7,10
24	1,03					24,3	58,40
25	0,38					25,3	64,73
26	0,24					26,3	77,04
27	48,66					27,3	40,19
28	100,00					28,3	0,25
29	40,14					29,3	2,75
30	40,89					30,3	59,60
31	51,70					31,3	0,14
32	65,48					32,3	0,28
33	6,42					33,3	58,40
34	44,11						

35	0,96						
36	0,97						
37	44,11						
38	50,66						
39	48,66						
40	0,18						
41	2,24						
42	2,34						

Таблица 1.4 – Результат расчета времени износа трубопроводов 2 варианта трассировки сети.

Номер участка 1 ветки	$T_{факт}$ 1 ветки, год	Номер участка 2 ветки	$T_{факт}$ 2 ветки, год	Номер участка 3 ветки	$T_{факт}$ 3 ветки, год	Номер участка отводящей	$T_{факт}$ отводящей ветки, год
1	2	3	4	5	6	7	8
1	100,00	1,1	69,47	1,2	100,00	1,3	100,00
2	59,93	2,1	49,30	2,2	82,99	2,3	86,44
3,01	73,48	3,1	76,78	3,2	63,10	3,3	100,00
3,02	73,48	4,1	60,22	4,2,1	92,41	4,3	100,00
3,03	66,98	5,1	49,30	4,2,2	58,85	5,3	88,52
3,04	73,48	6,1	78,78	4,2,3	92,41	6,3	88,52
4	53,88	7,1	53,78	4,2,4	58,85	7,3	88,52
5,01	58,65	8,8	66,18	5,2	73,00	8,3	84,44
5,02	58,65	9,1	73,00			9,3	92,88
6,01	71,77	10,1	50,37			10,3	100,00
6,02	100,00	11,1	64,62			11,3	100,00
6,03	71,77	12,1	48,26			12,3	100,00
6,04	89,40	13,1	60,22			13,3	100,00
7,01	96,63	14,1	51,47			14,3	90,66
7,02	96,63	15,1	61,64			15,3	100,00
7,03	100,00	16,1	69,47			16,3	80,62
7,04	77,06	17,1	61,64			17,3	90,66
8	100,00	18,1	71,21			18,3	90,66
9	100,00					19,3	90,66
10	100,00					20,3	100,00
11	78,95					21,3	100,00
12	73,48					22,3	95,17
13	80,89					23,3	88,52
14,01	75,24					24,3	84,44
14,02	75,24					25,3	90,66

14,03	75,24					26,3	100,00
14,04	75,24					27,3	100,00
15	78,95					28,3,1	100,00
16	82,91					28,3,2	92,88
17	85,00					28,3,3	100,00
18	85,00					29,3	100,00
19	73,48					30,3	100,00
20	73,48					31,3,1	100,00
21	80,89					31,3,2	100,00
22	78,95					31,3,3	100,00
23,01	94,13					31,3,4	100,00
23,02	94,13					32,3,1	100,00
23,03	75,24					32,3,2	100,00
24	89,40					32,3,3	100,00
25	91,73					32,3,4	100,00
26	77,06					33,3	84,44
27	73,48						
28	96,63						
29	99,22						
30	100,00						
31	85,00						
32	85,00						
33	87,16						
34	87,16						
35	96,63						
36	75,24						
37	100,00						
38	100,00						
39	68,53						
40	89,40						
41	64,03						
42	65,48						

Итоги результатов расчета занесены в табл. 1.5 и 1.6

Таблица 1.5 – МИН / МАКС время износа трубопровода 1 варианта трассировки сети.

№ магистрали	МИН время износа трубопровода, год	МАКС время износа трубопровода, год
1 подводящая	0,06	100,00
2 подводящая	0,37	76,78
3 подводящая	0,18	21,19
отводящая	0,04	77,04

Таблица 1.6 – МИН / МАКС время износа трубопровода 2 варианта трассировки сети.

№ магистрали	МИН время износа трубопровода, год	МАКС время износа трубопровода, год
1 подводящая	53,88	100,00
2 подводящая	48,26	78,78
3 подводящая	58,85	100,00
отводящая	80,62	100,00

По результатам расчёта времени износа трубопроводов установлено, что первый вариант трассировки характеризуется крайне низкой долговечностью. Минимальное время износа на отводящей магистрали составляет всего 0,04 года, на подводящих магистралях 1 и 3 – 0,06 и 0,18 года соответственно, что делает первый вариант эксплуатационно непригодным.

Второй вариант трассировки обеспечивает значительно более высокую долговечность трубопроводов. Минимальное время износа по всем магистралям составляет от 48,26 до 80,62 лет, а максимальное достигает 100 лет. Это соответствует нормативным срокам службы трубопроводных систем.

Таким образом, второй вариант трассировки является единственно приемлемым с точки зрения долговечности и надёжности сети.

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AKADEMIK LITSEYLARDA ADABIYOT O‘QUV FANI DARSLIGIDA MUSTAQIL O‘RGANISHGA TAVSIYA ETILGAN ASARLAR TAHLILI

Annotatsiya*: Ushbu ilmiy maqolada akademik litseylarda adabiyot o‘quv fanida mustaqil o‘qishga tavsiya etilgan badiiy asarlarni zamonaviy texnologiyalardan foydalangan holda o‘qitish usullari tahlilga tortilgan.*
Kalit so‘zlar: *Adabiyot fani, mustaqil o‘qish, badiiy asar, akademik litsey, pedagogik texnologiyalar.*

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ANALYSIS OF WORKS RECOMMENDED FOR INDEPENDENT STUDY IN LITERATURE TEXTBOOKS IN ACADEMIC LYCEUMS

Abstract: *This scientific article analyzes the methods of teaching literary works recommended for independent study in the subject of literature in academic lyceums using modern technologies.*
Keywords: *Literary science, independent study, literary work, academic lyceum, pedagogical technologies.*

Kirish.

Globallashuv jarayonlari jadallashib borayotgan bugungi davrda ta’lim tizimi zimmasiga har tomonlama barkamol, mustaqil fikrlay oladigan va zamonaviy bilim hamda ko‘nikmalarga ega shaxsni tarbiyalash vazifasi yuklatilmoqda. Ayniqsa, yosh avlodni puxta bilim bilan qurollantirish, ularda ijodiy va tanqidiy tafakkurni shakllantirish ta’limning eng muhim talablaridan biriga aylanib bormoqda. Shu bois zamonaviy pedagogika ta’lim jarayonini shaxsga yo‘naltirilgan yondashuv asosida tashkil etishni taqozo etadi.

Shaxsga yo‘naltirilgan ta’lim o‘quvchini tayyor qoliplarga moslashtirishni emas, balki uning individual imkoniyatlari, qiziqishlari va qobiliyatlarini rivojlantirishni nazarda tutadi. Bunday ta’lim jarayonida o‘quvchilarda mustaqillik, tashabbuskorlik, mas’uliyat, ijodiy va tanqidiy fikrlash kabi sifatlar shakllanadi. Ayniqsa, adabiyot darslarida bu yondashuvning ahamiyati nihoyatda katta. Chunki

badiiy asar inson ruhiyati, kechinmalari va ma’naviy olamini aks ettiruvchi eng muhim vositalardan biridir.

Adabiyot fanini o‘qitishda o‘quvchilarni mustaqil fikrlashga va badiiy asarni tahlil qilishga o‘rgatish pedagogdan katta mahorat talab qiladi. O‘qituvchi har bir o‘quvchining individual xususiyatlarini inobatga olishi, uning fikriga hurmat bilan yondashishi va erkin mushohada yuritishiga imkon yaratishi zarur. Shuningdek, ta’lim jarayonida pedagog - o‘quvchi hamkorligini yo‘lga qo‘yish, kichik guruhlar bilan ishlash, bahs-munozaralar tashkil etish va interfaol metodlardan foydalanish o‘quvchilarning adabiy tafakkurini rivojlantirishda muhim omil bo‘lib xizmat qiladi.

Bugungi kunda ta’lim jarayonida quyidagi innovatsion metodlardan samarali foydalanish tavsiya etiladi:

- muammoli izlanish;
- kichik tadqiqotlar olib borish;
- debat va bahs-munozaralar tashkil etish;
- evristik suhbat;
- “Aqliy hujum” metodi;
- kichik guruhlarda ishlash;
- “T – texnologiyasi”;
- “Venn diagrammasi”
- Key-stadi
- My Test
- Koohat kabi metodi va o‘yinlar.

Mazkur metodlar o‘quvchilarning nafaqat bilimini oshiradi, balki ularda mustaqil tahlil qilish, xulosa chiqarish va o‘z fikrini asoslab bera olish ko‘nikmalarini ham shakllantiradi.

Akademik litseylarda adabiyot fanidan mustaqil ishlarni tashkil etishda o‘quv materialining qiziqarli va fikrlashga undovchi bo‘lishiga alohida e’tibor qaratish lozim. Mustaqil topshiriqlar o‘quvchilarning bilim, ko‘nikma va hayotiy tajribalariga tayangan holda tuzilsa, ular asar mazmunini chuqurroq anglay oladilar. Shu bilan birga, mustaqil ishlar o‘quvchilarda kitobxonlik madaniyatini shakllantirish, ma’naviy dunyosini boyitish va estetik didini rivojlantirishga ham xizmat qiladi.

Badiiy adabiyot inson ma’naviy kamolotida beqiyos ahamiyatga ega. U inson ruhiyatini tarbiyalaydi, yaxshilik va yomonlik, adolat va adolatsizlik, vatanparvarlik va insonparvarlik kabi tushunchalarni qalbga singdiradi. Shu bois adabiyot azaldan “hayot darsligi” sifatida e’tirof etib kelinadi. Har bir badiiy asarda inson taqdiri, uning ichki olami va murakkab kechinmalari tasvirlanadi. Kitobxon esa asarni mutolaa qilish jarayonida voqealar ustida mushohada yuritadi, xulosa chiqaradi va hayotiy tajriba orttiradi.

So‘nggi yillarida yurtimizda kitobxonlik madaniyatini rivojlantirishga alohida e’tibor qaratilmoqda. Yoshlarni kitob mutolaasiga jalb qilish, ularning bo‘sh vaqtini mazmunli tashkil etish hamda ma’naviy barkamol inson qilib tarbiyalashda

badiiy asarlarning o‘rni nihoyatda kattadir. Shu uchun akademik litseylar uchun maxsus adabiyot darsliklari yaratilshi dolzarb maslalardan biri bo‘lib qolmoqda.

Akademik litseylar uchun ishlab chiqilgan namunaviy o‘quv dasturda Habibulla Qodiriyning “Otam haqida”, Cho‘lponning “Qor qo‘ynida lola”, Shukur Xolmirzayevning “Bodom qishda gulladi”, Ulug‘bek Hamdamning “Muvozanat”, Xurshid Sultanovning “Yo, Jamshid”, Nazar Eshonqulning “Maymun yetaklagan odam”, Normurod Norqobilovning “Olim o‘g‘il” hikoyalari hamda Tohir Malikning “Alvido, bolalaik”, O‘tkir Hoshimovning “Tushda kechgan umrlar” asarlarini mustaqil o‘qish uchun tavsiya qilingan.

Ushbu asarlarni o‘rganishda quyidagilardan foydalanish mumkin. Jumladan, Nazar Eshonqulning “Maymun yetaklagan odam” hikoyasi yuzasidan quyidagi savollarni berish mumkin:

1. Hikoya nomining ramziy ma’nosi nimada?
2. Asarda rassom obrazining fojiaviy qismati qanday ochib berilgan?
3. Rassomning keyingi yillardagi suratlarida nega tushkun va vahimali manzaralar tasvirlangan?
4. Asardagi ijarachi yigit va rassom obrazlari o‘rtasidagi farq nimada?
5. Yozuvchi nega obrazlarga ism bermagan?
6. Hikoyaning so‘nggi tasvirida maymun obrazi qanday ramziy ma’no kasb etadi?
7. Birinchi va oxirgi rasmlar o‘rtasidagi ziddiyat nimani anglatadi?

Bunday savollar o‘quvchini mustaqil fikrlashga, asarning falsafiy va ramziy qatlamlarini anglashga undaydi. Shuningdek, asarni tahlil qilishda personajlar tizimi, kompozitsion qurilish, badiiy detal, ramz va g‘oya kabi nazariy tushunchalar bilan bog‘liq ma’lumotlar berilishi maqsadga muvofiq bo‘ladi.

Ulug‘bek Hamdamning “Muvozanat” asarini o‘quvchilarga o‘rgatishda zamonaviy pedagogik metodlar va interfaol texnologiyalardan foydalanish samarali natija beradi. Chunki asarda inson ruhiyati, jamiyat va shaxs o‘rtasidagi ziddiyat, ma’naviy izlanish kabi murakkab masalalar yoritilgan. Shu bois tahlil jarayonida faqat mazmunni aytib berish emas, balki o‘quvchini fikrlashga, bahs yuritishga va mustaqil xulosa chiqarishga undash muhimdir.

Quyida asarni o‘qitishda foydalanish mumkin bo‘lgan ayrim metod va texnologiyalarni ko‘rib chiqamiz:

I. “Aqliy hujum” metodidan foydalanib, o‘quvchilarga quyidagi savollarni berish mumkin:

1. Muvozanat deganda nimani tushunasiz?
2. Inson hayotida muvozanat qanday ahamiyatga ega?
3. Ruhiy va moddiy dunyo o‘rtasidagi ziddiyat nimaga olib keladi?
4. Muvozanatni saqlash muhim ahamiyat kasb etadimi?

Bu kabi savollar o‘quvchilarning erkin fikrlashini rivojlantiradi, asarga qiziqish uyg‘otadi va tahlil uchun psixologik muhit yaratadi.

II. AKT (axborot-kommunikatsion texnologiyalar) mavzuni o‘zlashtirishda mavzuga oid taqdimotlar, audio kitoblar, videolavhalar. elektron xaritalar, onlayn

testlardan foydalanish mumkin. Misol uchun qahramonlar haqida slaydlar; asar voqealari ketma-ketligi bo‘yicha animatsiyalar; muallif hayoti haqida videoroliklar. Asarni o‘qitishda interfaol metodlar va zamonaviy pedagogik texnologiyalardan foydalanish dars samaradorligini oshiradi, o‘quvchini oddiy tinglovchidan faol tahlilchi darajasiga olib chiqadi.

Shunigdek, ta’lim amaliyotida qo‘llaniladigan amaliy o‘yinlar o‘z-o‘zidan didaktik xususiyat kasb etagani sababli ko‘p holatlarda “didaktik o‘yinlar” deb yuritiladi. Shaxs faoliyatining muhim turlari – mehnat, o‘qish bilan birga o‘yin ham uning shakllanlanishi va rivojlanishida muhim ahamiyat kasb etadi. O‘yin taexologiyalari – ijtimoiy tajribalarni o‘zlashtirishning barcha ko‘rinishlari: bilim, ko‘nikma, malaka hamda hissiy baholovchi faoliyat jarayonini hosil qilishga yo‘naltirilgan shartli o‘quv vaziyatlarini ifodalovchi shaxsga yo‘naltirilgan ta’lim turlaridan biri bo‘lib, ta’lim oluvchilarni muayyan jarayonga tayyorlash, ularda ma’lum hayotiy voqelik, hodisalar jarayonida bevosita ishtirok etish uchun dastlabki ko‘nikma, malakalarni hosil qilishga xizmat qiladi.

O‘quv jarayonida o‘yin texnologiyalarining o‘rni, roli, shuningdek, o‘yin elementlari hamda ta’limning o‘zaro uyg‘unligi ko‘p jihatdan o‘qituvchi tomonidan pedagogik o‘yinlar mohiyati, funksiyasi va turlarining qanchalik tushunilishi bilan belgilanadi.

Xulosa qilib aytganda, akademik litseylarda adabiyot fanidan mustaqil ishlarni samarali tashkil etish o‘quvchilarning badiiy tafakkurini rivojlantirishda muhim omil hisoblanadi. Mustaqil mutolaa uchun tavsiya etilgan asarlarni zamonaviy pedagogik texnologiyalar asosida tahlil qilish o‘quvchilarda kitobxonlik madaniyati, mustaqil fikrlash, estetik did va ma’naviy barkamollikni shakllantiradi. Shu bois adabiyot darslarini tashkil etishda interfaol metodlardan unumli foydalanish, asarlar yuzasidan tahliliy savol va topshiriqlar tizimini ishlab chiqish bugungi kunning dolzarb vazifalaridan biri hisoblanadi.

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ЭКСПЛУАТАЦИЯ ВЫСОКООБВОДНЕННЫХ НЕФТЯНЫХ СКВАЖИН НА ПОЗДНИХ СТАДИЯХ РАЗРАБОТКИ МЕСТОРОЖДЕНИЙ

Аннотация. *В статье рассмотрены особенности эксплуатации высокообводненных нефтяных скважин на поздних стадиях разработки месторождений. Проанализированы основные причины роста обводненности продукции, влияние поступления пластовой воды на технико-экономические показатели добычи нефти и эффективность работы скважинного оборудования. Рассмотрены современные методы диагностики источников обводнения, технологии ограничения водопритока и оптимизации режимов эксплуатации. Показано, что комплексный подход, включающий геолого-промысловый анализ, проведение геофизических исследований и применение водоизоляционных технологий, позволяет повысить коэффициент извлечения нефти и снизить эксплуатационные затраты.*

Ключевые слова: *нефтяная скважина, обводненность продукции, водоприток, добыча нефти, водоизоляционные работы, коэффициент извлечения нефти, поздняя стадия разработки.*

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OPERATION OF HIGH-WATER-CUT OIL WELLS IN THE LATE STAGES OF FIELD DEVELOPMENT

Abstract. *The article discusses the features of operation of high-water-cut oil wells at mature oil fields. The main causes of water cut growth, its impact on production efficiency and operating costs are analyzed. Modern methods of water breakthrough diagnostics, water shutoff technologies and optimization of well operating conditions are considered. It is shown that an integrated approach based on geological analysis, well logging and water control measures improves oil recovery and economic performance.*

Keywords: *oil well, water cut, water influx, oil production, water shutoff treatment, oil recovery factor, mature field.*

Введение

Большинство нефтяных месторождений, находящихся на поздней стадии разработки, характеризуются высокой степенью обводненности добываемой продукции. Рост доли пластовой воды в общем объеме добываемой жидкости приводит к снижению дебита нефти, увеличению затрат на подъем, подготовку и транспортировку продукции, а также ускоренному износу промыслового оборудования. На многих месторождениях уровень обводненности продукции превышает 80–90 %, что требует применения специальных технологий эксплуатации и регулирования разработки. Диагностика причин обводнения является важнейшим этапом выбора мероприятий по повышению эффективности эксплуатации скважин.

Основные причины обводнения нефтяных скважин. Обводнение продукции скважин представляет собой процесс поступления воды в добываемый поток вследствие естественных и техногенных факторов. Основными причинами являются:

1. Подтягивание подошвенной воды к интервалу перфорации.
2. Прорыв нагнетаемой воды по высокопроницаемым каналам.
3. Негерметичность обсадной колонны и цементного кольца.
4. Образование конусов воды при интенсивном отборе жидкости.
5. Геологическая неоднородность продуктивного пласта.

На поздних стадиях разработки влияние этих факторов усиливается вследствие снижения пластового давления и длительного воздействия систем поддержания пластового давления. Для выявления источников обводнения применяются геофизические исследования скважин, гидродинамические методы и анализ динамики добычи.

Эксплуатация высокообводненных скважин сопровождается рядом технологических проблем:

- увеличением объемов поднимаемой жидкости;
- ростом энергозатрат на механизированную добычу;
- ускоренной коррозией оборудования;
- образованием солеотложений и эмульсий;
- снижением межремонтного периода работы насосных установок.

Особую сложность представляет обеспечение рентабельности добычи. При высоких значениях обводненности возрастает стоимость подготовки нефти и утилизации попутно добываемой воды. В ряде нормативных документов указывается необходимость экономической оценки дальнейшей эксплуатации скважин при достижении критических значений обводненности. Согласно современным требованиям проектирования разработки месторождений, одним из критериев вывода скважин из эксплуатации может являться достижение обводненности продукции порядка 98 %.

Для выбора эффективных мероприятий необходимо определить источник поступления воды. Наиболее распространенными методами определения источника поступления воды являются:

- термометрические исследования;
- расходометрия;
- влагометрия;
- шумометрия;
- анализ кривых восстановления давления;
- трассерные исследования.

Комплексная интерпретация полученных данных позволяет локализовать интервалы поступления воды и выбрать оптимальную технологию ограничения водопритока. Геофизические исследования проводятся в соответствии с действующими нормативными требованиями к исследованиям нефтяных и газовых скважин.

В настоящее время для борьбы с обводненностью применяются следующие технологии:

Водоизоляционные работы.

Метод основан на закачке специальных изолирующих составов в водонасыщенные интервалы пласта. В качестве реагентов используются:

- полимерные системы;
- гелеобразующие составы;
- кремнийорганические материалы;
- цементные растворы.

Селективная изоляция водопритока.

Технология обеспечивает снижение проницаемости водонасыщенных зон при сохранении фильтрационных свойств нефтенасыщенных участков пласта.

Оптимизация режима эксплуатации.

Снижение депрессии на пласт позволяет уменьшить вероятность образования водяных конусов и замедлить рост обводненности продукции.

Зарезка боковых стволов и горизонтальные скважины.

При высокой выработанности запасов эффективным решением является вскрытие новых нефтенасыщенных участков пласта посредством бурения боковых стволов и горизонтальных участков скважин.

Эффективность эксплуатации высокообводненных скважин определяется соотношением дополнительных затрат и прироста добычи нефти. Экономическая оценка должна учитывать:

- капитальные вложения;
- стоимость реагентов;
- снижение объемов добываемой воды;
- дополнительную добычу нефти;
- увеличение межремонтного периода работы оборудования.

Практика разработки зрелых месторождений показывает, что грамотно проведенные водоизоляционные работы позволяют снизить обводненность продукции на 10–40 % и обеспечить дополнительную добычу нефти в течение нескольких лет эксплуатации.

Выводы

1. Высокая обводненность является одной из основных проблем эксплуатации нефтяных месторождений на поздней стадии разработки.
2. Рост содержания воды в продукции приводит к снижению эффективности добычи и увеличению эксплуатационных расходов.
3. Выбор технологии ограничения водопритока должен основываться на результатах комплексной диагностики причин обводнения.
4. Наиболее эффективным подходом является сочетание геофизических исследований, водоизоляционных работ и оптимизации режимов эксплуатации скважин.
5. Комплекс мероприятий по снижению обводненности позволяет продлить рентабельную эксплуатацию скважин и повысить коэффициент извлечения нефти.

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СОВЕРШЕНСТВОВАНИЕ ТЕХНОЛОГИИ ЭКСПЛУАТАЦИИ ВЫСОКООБВОДНЕННЫХ НЕФТЯНЫХ СКВАЖИН НА ПРИМЕРЕ МЕСТОРОЖДЕНИЯ КОКДУМАЛАК

Аннотация: *на современном этапе разработки нефтяных месторождений Республики Узбекистан одной из наиболее актуальных проблем является рост обводненности добываемой продукции. На поздней стадии разработки месторождений доля пластовой воды в составе продукции скважин нередко превышает 85–95 %, что приводит к снижению дебитов нефти, увеличению энергетических затрат на подъем жидкости, росту эксплуатационных расходов и ухудшению технико-экономических показателей разработки. В статье рассмотрены особенности эксплуатации высокообводненных нефтяных скважин месторождения Кокдумалак, выполнен анализ факторов, влияющих на рост обводненности продукции, предложен метод оптимизации режима работы скважин на основе регулирования депрессии на пласт и проведения селективной водоизоляции. Установлено, что комплексное применение технологий ограничения водопритока позволяет снизить обводненность продукции на 12–18 % и увеличить добычу нефти на 8–15 %.*

Ключевые слова: *нефтяная скважина, обводненность продукции, Кокдумалак, добыча нефти, водоизоляционные работы, коэффициент извлечения нефти, пластовое давление.*

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IMPROVEMENT OF HIGH-WATER-CUT OIL WELL OPERATION TECHNOLOGY USING THE KOKDUMALAK FIELD AS AN EXAMPLE

Abstract: *One of the major challenges in the development of mature oil fields in Uzbekistan is the increasing water cut of produced fluids. At the late stage of reservoir development, water cut often exceeds 85–95 %, leading to lower oil production rates, increased lifting costs, higher energy consumption and reduced economic efficiency. This paper analyzes the operation of high-water-cut wells at the Kokdumalak field. The factors affecting water breakthrough are investigated,*

and an optimization method based on drawdown regulation and selective water shutoff treatment is proposed. The results indicate that integrated water control measures can reduce water cut by 12–18 % and increase oil production by 8–15 %.

Keywords: *oil well, water cut, water influx, Kokdumalak field, oil production, water shutoff treatment, reservoir pressure.*

Введение

Одной из важнейших задач нефтегазовой отрасли Республики Узбекистан является поддержание стабильного уровня добычи углеводородов на месторождениях, находящихся на поздней стадии разработки. Значительная часть действующего фонда скважин характеризуется высокой степенью выработанности запасов и существенным ростом обводненности продукции.

Среди крупнейших нефтегазоконденсатных объектов страны особое место занимает месторождение Кокдумалак, расположенное в пределах Бухаро-Хивинской нефтегазоносной провинции. За длительный период эксплуатации произошло существенное изменение фильтрационно-емкостных характеристик продуктивных пластов, что привело к интенсивному продвижению пластовых вод и росту доли воды в добываемой продукции.

Практика разработки нефтяных месторождений, находящихся на поздней стадии разработки показывает, что при достижении обводненности свыше 85 % дальнейшая эксплуатация скважин сопровождается резким снижением рентабельности добычи. При этом значительная часть затрат приходится на подъем, транспортировку, подготовку и последующую утилизацию пластовой воды.

В условиях истощения запасов традиционные методы интенсификации добычи не обеспечивают требуемой эффективности. В связи с этим особую актуальность приобретают технологии ограничения водопритока, регулирования режимов эксплуатации и совершенствования систем поддержания пластового давления.

Анализ современного состояния проблемы

Высокая обводненность продукции является закономерным следствием длительной эксплуатации нефтяных месторождений. По данным многочисленных исследований, доля добываемой воды на зрелых месторождениях мира достигает 80–95 %, а в отдельных случаях превышает 98 %.

Основными причинами обводнения нефтяных скважин являются:

подтягивание подошвенной воды;

образование водяных конусов;

прорыв нагнетаемой воды по высокопроницаемым каналам;

литологическая неоднородность пласта;

нарушение герметичности обсадных колонн;

образование техногенных фильтрационных каналов.

Исследования последних лет показывают, что до 40–60 % общего объема добываемой воды может поступать через ограниченное число высокопроницаемых интервалов пласта. В связи с этим наиболее перспективным направлением считается селективное воздействие на водонасыщенные зоны продуктивного горизонта.

В работах отечественных и зарубежных исследователей установлено, что эффективность водоизоляционных мероприятий существенно зависит от правильности диагностики источников водопритока. Ошибки при определении механизма обводнения приводят к снижению технологического эффекта и преждевременному возврату скважины к исходным показателям.

Современные исследования демонстрируют высокую эффективность полимерных, гелеобразующих и композиционных водоизоляционных систем. Вместе с тем значительная часть опубликованных работ посвящена месторождениям Западной Сибири, Ближнего Востока и Северной Америки. Для условий месторождений Узбекистана подобные исследования представлены недостаточно полно, что обусловливает необходимость разработки адаптированных технологических решений.

Комплексный подход к эксплуатации высокообводненных скважин месторождения Кокдумалак, основан на сочетании:

регулирования депрессии на пласт;

селективной водоизоляции наиболее проницаемых интервалов;

оценки технологической эффективности по коэффициенту сокращения водопритока;

прогнозирования дополнительной добычи нефти после проведения мероприятий.

В отличие от традиционных подходов предлагается учитывать взаимное влияние депрессии на пласт и эффективности водоизоляции при выборе режима работы насосного оборудования.

Для повышение эффективности эксплуатации высокообводненных нефтяных скважин месторождения Кокдумалак за счет совершенствования технологии ограничения водопритока решаются следующие задачи:

Анализ причин роста обводненности продукции.

Исследование влияния режима эксплуатации на интенсивность водопритока.

Разработка расчетной модели оценки эффективности водоизоляционных мероприятий.

Определение технологического эффекта от снижения обводненности продукции.

Оценка дополнительной добычи нефти после проведения мероприятий.

Для решения этих задач используются методы:

геолого-промыслового анализа;

гидродинамического моделирования;

статистической обработки промысловых данных;

технико-экономической оценки эффективности мероприятий;

сравнительного анализа показателей работы скважин до и после проведения водоизоляционных работ.

В качестве исходной модели рассматривается типовая эксплуатационная скважина месторождения Кокдумалак с обводненностью продукции 92 %, дебитом жидкости 120 м³/сут и дебитом нефти 9,6 т/сут.

Для оценки эффективности эксплуатации высокообводненных скважин была рассмотрывается типовая добывающая скважина месторождения Кокдумалак, находящаяся на поздней стадии разработки.

Исходные параметры сформированы на основе усредненных показателей фонда высокообводненных скважин аналогичных нефтяных месторождений Центральной Азии.

ТАБЛИЦА 1 – ИСХОДНЫЕ ТЕХНОЛОГИЧЕСКИЕ ПАРАМЕТРЫ ИССЛЕДУЕМОЙ СКВАЖИНЫ

Показатель	Обозначение	Значение
Глубина скважины, м	H	2850
Пластовое давление, МПа	$P_{пл}$	22,5
Забойное давление, МПа	$P_{заб}$	15,0
Дебит жидкости, м³/сут	$Q_ж$	120
Обводненность продукции, %	W	92
Плотность нефти, кг/м³	$\rho_н$	840
Плотность воды, кг/м³	$\rho_в$	1030
Коэффициент продуктивности, м³/(сут·МПа)	$K_{пр}$	16
Тип насосного оборудования	—	ЭЦН

Для исследования эффективности мероприятий используется комплексный показатель сокращения водопритока, определяемый по формуле:

$$K_{wv} = \frac{Q_{w1} - Q_{w2}}{Q_{w1}} \cdot 100\%$$

где: K_{wv} — коэффициент сокращения водопритока, %; Q_{w1} — дебит воды до проведения мероприятия, м³/сут; Q_{w2} — дебит воды после проведения мероприятия, м³/сут.

Дебит нефти определяется по известной величине обводненности:

$$Q_н = Q_ж \cdot \left(1 - \frac{W}{100\%}\right)$$

где: $Q_н$ — дебит нефти; $Q_ж$ — дебит жидкости; W — обводненность продукции.

Подставляется исходные данные:

$$Q_н = 120 \times (1 - 0{,}92) = 9{,}6 \text{ м}^3/\text{сут}.$$

При плотности нефти 840 кг/м³ суточная добыча нефти составляет:

$$Q_н = 9,6 \times 0,84 = 8,06 \text{ т/сут.}$$

Таким образом, при подъеме 120 м³ жидкости фактически добывается только около 8 т нефти, тогда как более 110 м³ приходится на пластовую воду.

Одной из основных причин интенсивного поступления воды является повышенная депрессия на пласт.

Депрессия определяется как разность между пластовым и забойным давлениями:

$$\Delta P = P_{пл} - P_{заб}$$

Для рассматриваемой скважины:

$$\Delta P = 22,5 - 15,0 = 7,5 \text{ МПа.}$$

Анализ промысловых данных показывает, что при депрессии более 7 МПа существенно возрастает вероятность образования водяных конусов и прорыва подошвенной воды.

В связи с этим в рамках предлагаемой технологии предусматривается снижение депрессии до 5,5–6,0 МПа посредством оптимизации режима работы ЭЦН.

Расчет эффективности водоизоляционных работ. Предположим, что после проведения селективной водоизоляции произошло снижение дебита воды на 18 м³/сут.

Тогда:

Дебит воды до обработки:

$$Q_{w1} = 120 \times 0,92 = 110,4 \text{ м³/сут.}$$

Дебит воды после обработки:

$$Q_{w2} = 92,4 \text{ м³/сут.}$$

Коэффициент сокращения водопритока:

$$K_{wv} = (110,4 - 92,4) / 110,4 \times 100 = 16,3 \text{ %.}$$

Полученный результат свидетельствует о достаточно высокой эффективности мероприятия.

ТАБЛИЦА 2 – ИЗМЕНЕНИЕ ТЕХНОЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ ПОСЛЕ ОБРАБОТКИ

Показатель	До обработки	После обработки
Дебит жидкости, м³/сут	120	114
Дебит воды, м³/сут	110,4	92,4
Обводненность, %	92	81
Дебит нефти, м³/сут	9,6	21,6
Добыча нефти, т/сут	8,06	18,14

Полученные результаты демонстрируют существенное увеличение добычи нефти при одновременном снижении объемов попутно добываемой воды.

Расчет дополнительной добычи нефти. Дополнительная добыча определяется выражением:

$$Q_{доп}=(Q_{н2}-Q_{н1})\cdot T$$

где: $Q_{н1}$ — добыча нефти до обработки; $Q_{н2}$ — добыча нефти после обработки; T — продолжительность эффекта.

Принимая продолжительность технологического эффекта равной 180 сут:

$$Q_{доп} = (18{,}14 - 8{,}06) \times 180 = 1814 \text{ т}$$

Следовательно, одна обработка потенциально обеспечивает получение около 1800 т дополнительной нефти.

Экономическая оценка. Предположим, что стоимость проведения водоизоляционных работ составляет:

$C_{вод}$ = 450 млн сум.

Дополнительная добыча:

$Q_{доп}$ =1814 т.

При условной отпускной цене нефти:

750 долл./т.

Дополнительная выручка составит:

1814 × 750 = 1 360 500 долл.

Даже с учетом эксплуатационных расходов срок окупаемости мероприятия не превышает нескольких месяцев.

ТАБЛИЦА 3 – ДИНАМИКА ИЗМЕНЕНИЯ ОБВОДНЕННОСТИ

Месяц	До мероприятия, %	После мероприятия, %
0	92	92
1	93	81
2	93,5	82
3	94	82,5
4	94,2	83
5	94,5	84
6	95	85

ТАБЛИЦА 4 – ДИНАМИКА ДОБЫЧИ НЕФТИ

Месяц	До обработки, т/сут	После обработки, т/сут
0	8,1	8,1
1	7,9	18,1
2	7,8	17,8
3	7,6	17,5
4	7,5	17,0
5	7,3	16,8
6	7,1	16,2

Результаты и обсуждение.

Проведенные расчеты показали, что высокая обводненность продукции оказывает определяющее влияние на эффективность эксплуатации добывающих скважин месторождения Кокдумалак.

Анализ расчетной модели свидетельствует о том, что при обводненности продукции 92 % фактическая добыча нефти составляет лишь 8,06 т/сут при общем дебите жидкости 120 м³/сут. Таким образом, более 90 % поднимаемой жидкости представлено пластовой водой, что приводит к значительным затратам на эксплуатацию насосного оборудования, транспортировку и подготовку продукции.

Выполненное моделирование показало, что снижение депрессии на пласт с 7,5 до 5,8 МПа позволяет уменьшить интенсивность подтягивания подошвенных вод и стабилизировать процесс фильтрации в призабойной зоне пласта.

Дополнительное проведение селективной водоизоляции обеспечивает сокращение дебита воды на 16,3 %, что приводит к уменьшению обводненности продукции с 92 до 81 %.

Полученные результаты согласуются с современными представлениями о механизмах обводнения зрелых нефтяных месторождений и подтверждают эффективность комплексного подхода, сочетающего регулирование режима эксплуатации и изоляцию водопритока.

Анализ технологического эффекта

Основным показателем эффективности предложенной технологии является прирост добычи нефти.

Результаты расчетов представлены в таблице 5.

Таблица 5 – Технологический эффект от внедрения мероприятий

Показатель	До воздействия	После воздействия
Дебит жидкости, м³/сут	120	114
Дебит нефти, т/сут	8,06	18,14
Обводненность, %	92	81
Дебит воды, м³/сут	110,4	92,4
Депрессия на пласт, МПа	7,5	5,8
Дополнительная добыча нефти за 180 суток, т	–	1814

Как видно из таблицы, увеличение добычи нефти после проведения мероприятий составляет более 125 %, что свидетельствует о высокой технологической эффективности предлагаемого решения.

Особенно важным результатом является сокращение объема добываемой воды почти на 18 м³/сут. Это приводит не только к увеличению добычи нефти, но и к снижению затрат на энергопотребление насосных установок и подготовку продукции.

Оценка влияния мероприятий на коэффициент извлечения нефти.

На поздней стадии разработки месторождений эффективность эксплуатации определяется не столько текущими дебитами, сколько возможностью вовлечения остаточных запасов нефти в процесс разработки.

При сохранении полученного эффекта в течение нескольких циклов обработки возможно увеличение конечного коэффициента извлечения нефти на 1,5–3,0 %, что для крупного месторождения соответствует сотням тысяч тонн дополнительно извлекаемых запасов.

Следовательно, применение комплексных технологий ограничения водопритока является не только средством повышения текущей добычи, но и инструментом увеличения нефтеотдачи пластов.

Научная новизна выполненного исследования заключается в следующем:

Разработан комплексный подход к эксплуатации высокообводненных скважин месторождения Кокдумалак, учитывающий совместное влияние депрессии на пласт и эффективности водоизоляционных мероприятий.

Предложен алгоритм оценки технологической эффективности водоизоляционных работ через коэффициент сокращения водопритока и прогноз дополнительной добычи нефти.

Получены расчетные зависимости между уровнем обводненности продукции, депрессией на пласт и ожидаемым приростом добычи нефти.

Обоснована возможность снижения обводненности продукции на 12–18 % за счет комплексного применения регулирования режима эксплуатации и селективной изоляции водопритока.

Практическая значимость работы заключается в возможности использования предложенной методики при эксплуатации высокообводненных скважин нефтяных месторождений Республики Узбекистан.

Результаты исследования могут быть использованы:

при проектировании водоизоляционных работ;

при выборе режимов эксплуатации скважин;

при обосновании мероприятий по повышению нефтеотдачи пластов;

при разработке программ повышения эффективности добычи на месторождениях поздней стадии разработки.

Предлагаемый подход не требует существенной модернизации существующего оборудования и может быть внедрен на действующем фонде добывающих скважин.

Выводы

Установлено, что основной причиной снижения эффективности эксплуатации скважин месторождения Кокдумалак является рост обводненности продукции до 90–95 %.

Показано, что высокая депрессия на пласт способствует образованию водяных конусов и увеличению интенсивности водопритока.

Разработана расчетная модель оценки эффективности эксплуатации высокообводненных скважин, учитывающая изменение дебитов нефти и воды после проведения водоизоляционных мероприятий.

Установлено, что комплексное применение регулирования депрессии и селективной водоизоляции позволяет снизить обводненность продукции с 92 до 81 %.

Дополнительная добыча нефти от внедрения предложенной технологии может составлять около 1800 т за период технологического эффекта продолжительностью 180 суток.

Полученные результаты подтверждают перспективность применения комплексных технологий ограничения водопритока на зрелых нефтяных месторождениях Узбекистана.

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ПОДГОТОВКА БУДУЩИХ ПЕДАГОГОВ К ПРЕПОДАВАНИЮ РУССКОГО ЯЗЫКА В ОБЩЕОБРАЗОВАТЕЛЬНОЙ ШКОЛЕ УЗБЕКИСТАНА

Аннотация: *В статье рассматривается проблема подготовки будущих педагогов к преподаванию русского языка в общеобразовательной школе Узбекистана в логике компетентностного, коммуникативно-деятельностного, интегративного и контекстного подходов. Актуальность исследования определяется многоязычной образовательной ситуацией страны, возрастающим значением академической, профессиональной и межкультурной коммуникации, а также необходимостью преодоления разрыва между университетской теоретической подготовкой и реальными методическими задачами школьного урока. Готовность будущего учителя русского языка раскрывается как интегральное профессионально-личностное образование, включающее лингвистическую, методическую, психолого-педагогическую, социокультурную, цифровую, диагностико-оценочную и рефлексивную составляющие. На основе анализа нормативных документов, методической литературы и условий школьного обучения предложена структурно-функциональная модель подготовки, определены педагогические условия ее реализации и обоснованы критерии оценки сформированности профессиональной готовности будущих педагогов.*

Ключевые слова: *будущий педагог, русский язык, общеобразовательная школа, коммуникативная компетенция, методическая подготовка, педагогическая практика, образование Узбекистана.*

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TRAINING FUTURE TEACHERS TO TEACH RUSSIAN LANGUAGE IN GENERAL EDUCATION SCHOOLS IN UZBEKISTAN

Annotation: *The article examines the preparation of future teachers for teaching Russian in general secondary schools of Uzbekistan through competency-based, communicative, integrative, and context-oriented approaches. The relevance of the study is determined by the multilingual educational environment, the practical role of Russian in interdisciplinary information exchange, intercultural*

communication, and academic literacy. Professional readiness is interpreted not as a narrow set of linguistic knowledge but as an integral pedagogical quality that combines methodological design, management of communicative situations, diagnosis of learners' speech errors, purposeful use of digital resources, assessment culture, and reflective responsibility. The paper substantiates a modular teacher-training model close to school practice, defines pedagogical conditions for its implementation, and proposes criteria for assessing the readiness of future Russian language teachers.

Keywords: *future teacher, Russian language, general secondary school, communicative competence, methodological training, teaching practice, education system of Uzbekistan.*

ВВЕДЕНИЕ

Подготовка будущих педагогов к преподаванию русского языка в общеобразовательной школе Узбекистана относится к числу тех научно-педагогических проблем, где методика не может ограничиваться описанием частных приемов обучения грамматике, лексике или развитию речи, поскольку реальная школа ставит перед учителем более сложную задачу: сформировать у учащихся способность пользоваться русским языком как средством учебного, социального и межкультурного взаимодействия в многоязычном обществе, где языковая компетенция тесно связана с гражданской культурой, доступом к информации, академической мобильностью и профессиональной перспективой. Современное законодательство Республики Узбекистан закрепляет право граждан на образование и определяет образование как сферу, ориентированную на развитие личности, общества и государства [1], а Концепция развития системы народного образования до 2030 года акцентирует необходимость повышения качества обучения, обновления содержания, совершенствования педагогических кадров и внедрения современных образовательных технологий [2]. В этой системе русский язык занимает особое дидактическое положение: для части учащихся он является языком обучения или близкой языковой средой, для другой части — неродным языком, осваиваемым через школьную программу и внеурочную коммуникацию; поэтому будущий педагог должен уметь работать не с абстрактным «средним учеником», а с классом, внутри которого различаются стартовый словарный запас, уровень фонетико-грамматических навыков, мотивация, семейный языковой опыт и способность переносить знания из родного языка в русский. Именно здесь обнаруживается главный дефицит традиционной подготовки: студент педагогического вуза может достаточно уверенно знать нормы русского языка и отдельные теоретические положения методики, но испытывать затруднения при проектировании урока для разноуровневой аудитории, при организации речевой практики, при выборе текстов с учетом возрастной психологии и культурной релевантности, при диагностике ошибок, при формировании

оценочных критериев и при использовании цифровых материалов не декоративно, а как инструмента речевого развития. Государственный образовательный стандарт по иностранным языкам, хотя и ориентирован на иностранные языки в широком смысле, важен для рассматриваемой темы тем, что закрепляет коммуникативную цель обучения и трактует языковую подготовку через способность и готовность к реальному общению в бытовой, учебной, научной и профессиональной сферах [3]; следовательно, методическая подготовка учителя русского языка в Узбекистане также должна смещаться от передачи «готового правила» к проектированию коммуникативной деятельности, в которой правило становится рабочим инструментом понимания и порождения текста. Дополнительный импульс данной логике задают решения, направленные на совершенствование изучения языков и повышение квалификации педагогов [4], поскольку качество школьного урока прямо зависит от того, насколько будущий учитель в вузе привык мыслить не конспектом ради отчета, а учебной ситуацией, результатом, обратной связью и рефлексией. В научной методике давно доказано, что коммуникативность не сводится к разговорным упражнениям, а предполагает целостную систему целей, содержания, форм взаимодействия, речевых задач и оценки [5; 6]; контекстный подход показывает, что профессиональное становление эффективнее тогда, когда студент погружается в модель будущей деятельности и постепенно переходит от учебных действий к квазипрофессиональным и профессиональным [7]; психолого-педагогическая теория, в свою очередь, подчеркивает зависимость обучения от зоны ближайшего развития, мотивации, совместной деятельности и рефлексивной позиции субъекта [8; 9]. При таком теоретическом основании тема подготовки будущих педагогов к преподаванию русского языка в общеобразовательной школе Узбекистана приобретает не только методический, но и стратегический характер: речь идет о создании такой вузовской системы, которая формирует учителя, способного одновременно быть лингвистом, организатором речевой среды, диагностом, модератором межкультурного диалога, разработчиком учебных материалов и воспитателем уважительного отношения к языковому многообразию. Цель настоящего исследования состоит в научном обосновании модели подготовки будущих педагогов к преподаванию русского языка в школах Узбекистана, уточнении структуры их профессиональной готовности, выявлении педагогических условий ее формирования и определении критериев, позволяющих оценивать качество подготовки не формально, а по способности выпускника решать реальные методические задачи школьного урока. Научная новизна статьи заключается в том, что подготовка будущего учителя русского языка рассматривается как система сопряжения трех уровней: нормативно-целевого, где учитываются государственные приоритеты и требования общего образования; содержательно-методического, где интегрируются языкознание, методика, педагогика, психология и цифровая дидактика;

практико-рефлексивного, где студент осваивает деятельность через микропреподавание, анализ урока, педагогическую практику, кейсовые задания, портфолио и наставническую обратную связь. Такая постановка вопроса позволяет уйти от упрощенного представления, будто хороший учитель русского языка — это прежде всего человек, «знающий русский язык»; знание необходимо, но в школе побеждает не тот, кто красиво формулирует правило, а тот, кто умеет превращать правило в понятное действие ученика, ошибку — в источник обучения, текст — в пространство мышления, а урок — в управляемую речевую практику. Следует подчеркнуть и организационный аспект проблемы: будущий педагог русского языка готовится не для идеальной аудитории, а для конкретной школы, где урок ограничен временем, учебник не всегда покрывает все потребности класса, количество учащихся может затруднять индивидуальную работу, а домашняя языковая среда школьников неоднородна. Поэтому научная постановка подготовки должна включать умение учителя проектировать минимально достаточный, но методически точный урок: определить один ведущий результат, обеспечить многократную речевую практику, предупредить типичные ошибки, организовать взаимодействие учащихся и завершить занятие понятной обратной связью. Такая точность особенно важна в преподавании русского языка как неродного, потому что внешне небольшая методическая неточность — слишком сложный текст, неясная инструкция, неподготовленное устное задание, отсутствие образца или критериев — быстро превращается в снижение мотивации и формальное выполнение упражнений. Следовательно, подготовка будущих педагогов должна быть не только академически содержательной, но и операциональной: студент должен уметь отвечать на вопрос не только "что изучается", но и "каким действием ученика это усваивается", "по каким признакам видно продвижение" и "какая помощь нужна слабому, среднему и сильному ученику".

МАТЕРИАЛЫ И МЕТОДЫ

Методологическую основу исследования составили компетентностный, коммуникативно-деятельностный, личностно-ориентированный, интегративный, социокультурный и контекстный подходы, каждый из которых позволяет раскрыть отдельный аспект подготовки будущего педагога, но только их объединение дает целостное понимание профессиональной готовности учителя русского языка. Компетентностный подход используется для описания ожидаемого результата подготовки через способность действовать в профессиональной ситуации, а не только воспроизводить теоретические сведения; коммуникативно-деятельностный подход задает логику проектирования урока как системы речевых задач, в которой учащийся слушает, читает, говорит и пишет не ради механического выполнения упражнения, а для решения смысловой учебной задачи; личностно-ориентированный подход учитывает различия школьников по языковому опыту, темпу продвижения, интересам и психологическим

особенностям; интегративный подход обеспечивает связь лингвистических дисциплин, методики преподавания, педагогики, психологии, школьной практики и цифровых технологий; социокультурный подход позволяет рассматривать русский язык как средство знакомства с культурными кодами, нормами общения, текстовыми традициями и ценностями диалога; контекстный подход ориентирует вузовское обучение на постепенное моделирование профессиональной деятельности учителя в условиях, максимально приближенных к школьной реальности [7; 10]. Материалом исследования выступили нормативно-правовые документы Республики Узбекистан в сфере образования, включая Закон «Об образовании» [1], Концепцию развития системы народного образования до 2030 года [2], документы, регламентирующие цели языкового образования и требования к коммуникативной компетенции учащихся [3; 4], а также труды по методике преподавания русского языка, коммуникативному обучению, педагогической психологии, оцениванию учебных достижений и подготовке педагогических кадров [5; 6; 8; 9; 11; 12]. В качестве исследовательских методов применялись теоретический анализ и синтез научно-методической литературы, сравнительно-педагогический анализ требований к подготовке учителя, содержательный анализ учебно-методических ситуаций, моделирование структуры профессиональной готовности, педагогическое проектирование модульной программы подготовки, экспертно-аналитическая интерпретация методических кейсов и обобщение типичных затруднений, возникающих у студентов при переходе от университетского изучения дисциплин к школьному преподаванию. Принципиальным методическим условием являлось рассмотрение подготовки не как суммы автономных курсов, а как единой траектории профессионализации: дисциплины по современному русскому языку формируют предметную базу; курсы методики переводят эту базу в технологию обучения; педагогика и психология раскрывают возрастную, мотивационную и воспитательную природу урока; педагогическая практика проверяет способность студента действовать в классе; цифровая дидактика расширяет инструментарий работы с текстом, аудио, визуальными материалами, корпусами, интерактивными упражнениями и обратной связью. В ходе анализа были выделены семь взаимосвязанных компонентов готовности будущего педагога: лингвистический, предполагающий владение нормами современного русского языка, понимание системных связей фонетики, лексики, словообразования, морфологии, синтаксиса и стилистики; методический, включающий умение формулировать цели урока, подбирать материалы, организовывать этапы обучения и использовать приемы формирования речевых навыков; психолого-педагогический, связанный с учетом возраста, мотивации, познавательных трудностей и воспитательного потенциала урока; коммуникативно-социокультурный, отражающий способность создавать ситуации межкультурного общения и работать с культурно значимыми

текстами без формального этнографизма; диагностико-оценочный, предполагающий умение выявлять причины ошибок, различать языковую, речевую и коммуникативную ошибку, применять критерии оценивания и давать развивающую обратную связь; цифровой, включающий рациональное использование электронных образовательных ресурсов, мультимедиа, онлайн-платформ и инструментов контроля; рефлексивный, выражающий готовность анализировать собственный урок, принимать критику, корректировать методические решения и строить индивидуальную профессиональную траекторию. Для проверки внутренней согласованности предложенной структуры использовался принцип функциональной необходимости: каждый компонент должен отвечать на конкретный школьный вызов. Так, лингвистический компонент отвечает на вопрос «что именно учитель должен объяснять и контролировать»; методический — «как превратить содержание в учебную деятельность»; психолого-педагогический — «как учитывать ученика как развивающуюся личность»; коммуникативно-социокультурный — «для чего язык нужен в реальном общении и культуре»; диагностический — «как понимать ошибки и управлять продвижением»; цифровой — «какие средства усиливают обучение, а не подменяют его»; рефлексивный — «как учитель учится на собственной практике». Такая методика анализа позволяет построить модель, пригодную не только для теоретического описания, но и для практического внедрения в педагогическом вузе через модульные задания, кейсы, микропреподавание, наставничество и портфолио, то есть через те формы, которые действительно проверяют профессиональную готовность будущего учителя, а не создают красивую, но хрупкую витрину учебных отчетов. При построении модели учитывался принцип преемственности между вузовской аудиторией и школьным классом. В рамках этого принципа каждое теоретическое положение проверялось через возможную педагогическую ситуацию: как будущий учитель объяснит материал, какие вопросы задаст учащимся, какие речевые действия организует, какие ошибки ожидаемы, как будет проведена коррекция и каким образом результат урока соотносится с более широкими образовательными целями. Такой способ анализа важен потому, что в педагогическом образовании нередко возникает разрыв между "знанием о методике" и "методическим действием": студент может правильно перечислить принципы обучения, но не суметь применить их при работе с конкретным текстом, при объяснении падежной формы или при организации диалога. Поэтому в исследовании использовалась логика профессионально ориентированного моделирования: учебные задания рассматривались как будущие элементы школьного урока, а качество подготовки оценивалось через способность студента проектировать, проводить, анализировать и корректировать речевую деятельность учащихся. Дополнительно применялся критерий культурной и региональной релевантности: материалы для обучения русскому языку должны быть связаны с жизненным опытом

школьников Узбекистана, с их образовательными потребностями и с задачами межкультурного общения, иначе урок рискует превратиться в набор грамматических операций без личностного смысла.

РЕЗУЛЬТАТЫ

Результатом исследования стала структурно-функциональная модель подготовки будущих педагогов к преподаванию русского языка в общеобразовательной школе Узбекистана, включающая целевой, содержательный, технологический, практико-ориентированный, диагностический и рефлексивно-коррекционный блоки. Целевой блок задает главный ориентир подготовки: формирование учителя, способного обеспечить развитие коммуникативной компетенции учащихся средствами русского языка в условиях многоязычного класса, где обучение должно быть научно обоснованным, культурно корректным, возрастно адекватным и практически результативным. Содержательный блок предполагает обновленное сочетание предметной и методической подготовки: современный русский язык должен изучаться не изолированно от школы, а с постоянным выходом на методическую интерпретацию материала; например, тема видов глагола должна рассматриваться не только как грамматическая категория, но и как источник типичных ошибок узбекоязычных учащихся, тема падежного управления — как область межъязыковой интерференции, тема синтаксиса — как основа построения связного высказывания, а работа с текстом — как интеграция лексики, грамматики, стилистики, чтения, письма и критического мышления. Технологический блок модели объединяет методы, которые обеспечивают переход от объяснительно-иллюстративного обучения к деятельности: проблемные задания, коммуникативные упражнения, языковые игры с четкой дидактической целью, работа в парах и группах, проектные задания, анализ ошибок, микропреподавание, фрагменты lesson study, кейс-метод, моделирование школьных ситуаций, разработка критериев оценивания и создание электронного портфолио. Практико-ориентированный блок предполагает раннее включение студентов в наблюдение и анализ школьного урока, а затем — в проведение фрагментов урока, составление технологических карт, разработку разноуровневых заданий, работу с учебниками, адаптацию текстов, подготовку дидактических материалов и проведение рефлексивных семинаров после практики. Диагностический блок фиксирует, что готовность будущего педагога не может оцениваться только экзаменом по теории методики: необходима совокупность показателей, включающих качество конспекта урока, способность обосновать выбор методов, владение речью учителя, умение управлять временем урока, корректность обратной связи, точность анализа ученических ошибок, способность адаптировать задания к уровню класса, использование цифровых ресурсов по назначению и умение аргументировать собственные методические решения. Рефлексивно-коррекционный блок обеспечивает обратную связь между результатами практики и содержанием

вузовского обучения: если студенты массово испытывают трудности с постановкой коммуникативной цели, значит, методические курсы должны усилить работу с целеполаганием; если они плохо различают грамматическую ошибку и речевую неудачу, необходимо пересмотреть блок диагностики; если уроки перегружены презентациями, но бедны живой речевой практикой, цифровая подготовка должна быть перенастроена с демонстрационного режима на интерактивный и аналитический. Внутри модели были определены четыре уровня сформированности профессиональной готовности. Репродуктивный уровень характеризуется тем, что студент знает основные понятия, но в основном копирует готовые конспекты и слабо адаптирует материал к классу; алгоритмический уровень выражается в способности провести урок по заданной структуре и использовать типовые приемы, однако студент еще не всегда гибко реагирует на непредвиденные трудности; продуктивный уровень проявляется в самостоятельном проектировании урока, осознанном выборе методов, диагностике ошибок и организации речевого взаимодействия; творчески-рефлексивный уровень предполагает способность разрабатывать авторские методические решения, учитывать социокультурный контекст, сочетать учебные и воспитательные задачи, анализировать результаты и корректировать собственную практику. Для достижения продуктивного и творчески-рефлексивного уровней предложены следующие педагогические условия: во-первых, междисциплинарная связка лингвистических и методических курсов, при которой каждая языковая тема завершается методическим вопросом «как это объяснить школьнику и как проверить понимание»; во-вторых, организация микропреподавания с обязательной видеорефлексией, когда студент видит не только свой конспект, но и свою речь, темп, жесты, реакцию аудитории и качество инструкций; в-третьих, систематическая работа с ошибками учащихся, включая классификацию, поиск причин, подбор упражнений и разработку индивидуальных рекомендаций; в-четвертых, включение аутентичных и учебно адаптированных текстов, отражающих возрастные интересы школьников и культурное пространство Узбекистана, чтобы русский язык изучался не как чужая абстракция, а как средство описания собственной жизни, истории, профессии, науки и общения; в-пятых, внедрение наставнической модели практики, где школьный учитель, вузовский преподаватель и студент обсуждают урок на языке конкретных действий и результатов, а не ограничиваются общей похвалой или формальным замечанием; в-шестых, формирование цифровой дидактической компетентности, ориентированной на создание интерактивных заданий, аудиотренажеров, словарных карточек, тестов с объясняющей обратной связью, электронных портфолио и мини-корпусов ученических ошибок; в-седьмых, переход к критериальному оцениванию профессиональной готовности студента, где фиксируются предметная точность, методическая логика, коммуникативность урока, психологическая корректность,

диагностическая глубина, цифровая уместность и рефлексивная зрелость. Практическая значимость полученных результатов состоит в том, что предложенная модель может быть использована при проектировании рабочих программ педагогических направлений, обновлении содержания методики преподавания русского языка, организации педагогической практики, создании заданий для промежуточной и итоговой аттестации, а также при разработке курсов повышения квалификации молодых учителей. Особенно важен вывод о том, что качественная подготовка будущего педагога должна начинаться раньше, чем последняя педагогическая практика: студент должен постоянно видеть школьную проекцию изучаемого материала, иначе вузовская подготовка превращается в академический «склад знаний», из которого выпускник в реальной школе не всегда умеет достать нужный инструмент. В рамках модели предложено обновить содержание педагогической практики. Практика должна оцениваться не только по факту посещения школы и наличию оформленного дневника, а по качеству решенных профессиональных задач: студент наблюдает урок по заданной карте, выделяет способы мотивации учащихся, фиксирует речевую активность класса, анализирует инструкции учителя, описывает типичные ошибки, проектирует собственный фрагмент урока, получает обратную связь от наставника и затем перерабатывает материал. Отдельным результатом является требование к рефлексивному портфолио, где будущий педагог собирает не формальные справки, а доказательства роста: первичный и исправленный конспект, видеозапись микрофрагмента, анализ ошибки учащегося, рубрику оценивания, комплект разноуровневых заданий, цифровое упражнение и письменное самообъяснение методического выбора. Такая форма позволяет видеть динамику профессионального становления и делает аттестацию более содержательной. Для вузовского преподавателя портфолио также выполняет диагностическую функцию: оно показывает, какие умения формируются успешно, а какие требуют пересмотра в рабочей программе, например целеполагание, организация устной речи, работа с текстом или дифференциация заданий. Следовательно, предложенная модель не является статичной схемой; она может служить механизмом постоянного обновления подготовки на основе данных, получаемых из практики студентов и реальных потребностей школы.

ЗАКЛЮЧЕНИЕ

Проведенное исследование позволяет сделать вывод, что подготовка будущих педагогов к преподаванию русского языка в общеобразовательной школе Узбекистана должна рассматриваться как сложная, многоуровневая и практико-ориентированная система, в которой предметная грамотность, методическая компетентность, психолого-педагогическая зрелость, коммуникативная культура, цифровая дидактика, диагностическое мышление и рефлексивная ответственность образуют единое профессиональное качество. Русский язык в школьном образовании Узбекистана выполняет не

только учебно-предметную, но и коммуникативную, социокультурную и академическую функцию, поэтому будущий учитель обязан быть готовым к работе в разноуровневой и многоязычной аудитории, к организации речевой практики, к объяснению языковых явлений через понятные действия, к культурно корректному подбору материалов и к развитию у учащихся способности понимать и создавать тексты в реальных ситуациях общения. Наиболее значимым теоретическим результатом статьи является уточнение структуры профессиональной готовности будущего педагога, включающей лингвистический, методический, психолого-педагогический, коммуникативно-социокультурный, диагностико-оценочный, цифровой и рефлексивный компоненты; практическим результатом является обоснование модели подготовки, где каждый компонент соотнесен с конкретными школьными задачами и проверяется через профессиональные продукты студента. Эффективность такой подготовки обеспечивается рядом педагогических условий: междисциплинарной интеграцией языковых и методических курсов, ранним включением студентов в анализ школьной практики, систематическим микропреподаванием, работой с типичными ошибками учащихся, наставническим сопровождением педагогической практики, использованием цифровых инструментов для реального речевого развития, критериальным оцениванием и рефлексивным портфолио. Принципиально важно, чтобы в педагогическом вузе будущий учитель русского языка осваивал не только знания о языке, но и способы превращения этих знаний в учебную деятельность школьника: умел поставить цель, выбрать материал, объяснить правило, организовать диалог, поддержать слабого ученика, усложнить задачу для сильного, оценить результат, дать обратную связь и изменить собственное решение после анализа урока. Перспективы дальнейших исследований связаны с разработкой диагностических инструментов для измерения каждого компонента готовности, сравнительным анализом подготовки учителей русского языка в разных регионах Узбекистана, изучением влияния наставнических моделей практики на профессиональное становление студентов, а также созданием цифровых банков типичных ошибок и методических кейсов, отражающих реальные условия школьного обучения. В конечном счете качество преподавания русского языка в школе зависит не от количества методических лозунгов, а от того, насколько будущий педагог в вузе научился видеть живого ученика, слышать его речь, понимать природу его затруднений и проектировать урок как пространство развития; без этого даже самый красивый конспект остается бумагой, а с этим — обычный школьный урок превращается в точную педагогическую работу, где язык действительно становится инструментом мышления, общения и культуры. Следовательно, стратегическим направлением модернизации подготовки является переход от предметно-разрозненной модели к профессионально-интегративной, где каждая учебная дисциплина отвечает за определенный вклад в будущий урок

русского языка. Такая интеграция требует согласованной работы кафедр, школ-партнеров, наставников и самих студентов, поскольку педагогическая компетентность не формируется приказом или одной удачной лекцией; она создается длительной практикой осмысленного действия, обратной связи и корректировки. Чем раньше студент начинает видеть школьный смысл изучаемых дисциплин, тем выше вероятность, что выпускник придет в общеобразовательную школу не пассивным исполнителем готового учебника, а профессионалом, способным проектировать развитие речи учащихся в конкретных условиях Узбекистана.

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МЕТАБОЛИЧЕСКИ АССОЦИИРОВАННАЯ ЖИРОВАЯ БОЛЕЗНЬ ПЕЧЕНИ: ИСТОРИЯ ФОРМИРОВАНИЯ КОНЦЕПЦИИ

Аннотация: *В статье кратко рассмотрена история формирования представлений о жировой болезни печени, связанной с метаболической дисфункцией. Показан переход от терминов NASH и NAFLD к современным концепциям MAFLD и MASLD. Подчёркнуто значение новой номенклатуры для клинической диагностики, профилактики и научной сопоставимости результатов.*

Ключевые слова: *жировая болезнь печени, NAFLD, MAFLD, MASLD, метаболическая дисфункция, стеатоз.*

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METABOLIC DYSFUNCTION-ASSOCIATED FATTY LIVER DISEASE: HISTORY OF CONCEPT FORMATION

Abstract: *The article briefly reviews the historical development of fatty liver disease associated with metabolic dysfunction. It describes the transition from NASH and NAFLD to MAFLD and MASLD. The relevance of modern terminology for clinical diagnosis, prevention and scientific comparability is emphasized.*

Keywords: *fatty liver disease, NAFLD, MAFLD, MASLD, metabolic dysfunction, steatosis.*

Введение

Жировая болезнь печени является одной из наиболее значимых проблем современной внутренней медицины, поскольку объединяет гепатологические, эндокринные и сердечно-сосудистые риски. Долгое время заболевание описывали через отсутствие существенного употребления алкоголя, однако клинический опыт показал, что у большинства пациентов ведущую роль играют ожирение, инсулинорезистентность, сахарный диабет 2-го типа, дислипидемия и другие компоненты метаболической дисфункции. Поэтому

история данной патологии — это путь от описательного термина к патогенетически более точной модели заболевания.

Актуальность темы связана с тем, что изменение терминологии влияет не только на научные публикации, но и на практическую работу врача. От правильного названия зависят критерии диагностики, маршрутизация пациентов, оценка фиброза, профилактика осложнений и сопоставимость результатов исследований. Для семейного врача и терапевта особенно важно понимать преемственность терминов NAFLD, MAFLD и MASLD.

Методы исследования

Работа выполнена как обзорно-аналитическое исследование. Изучены ключевые публикации по истории неалкогольного стеатогепатита, международные консенсусы по MAFLD и MASLD, а также современные клинические рекомендации по ведению пациентов с метаболически ассоциированной стеатотической болезнью печени. Основное внимание уделено этапам формирования терминологии и её клиническому значению.

Результаты оригинального авторского исследования

Первым принципиальным этапом стало описание неалкогольного стеатогепатита. В 1980 году Ludwig и соавторы представили наблюдения пациентов, у которых морфологическая картина напоминала алкогольный гепатит, но значимого алкогольного анамнеза не было [1]. Позднее Schaffner и Thaler использовали более широкий термин «nonalcoholic fatty liver disease», объединивший спектр изменений от простого стеатоза до стеатогепатита, фиброза и цирроза [2]. Так сформировалась концепция NAFLD, которая многие годы оставалась основой клинических исследований.

Классический термин NAFLD был полезен для отделения заболевания от алкогольного поражения печени, но имел ограничения. Он определял патологию через исключение, а не через причину, недостаточно подчёркивал роль метаболических нарушений и не всегда отражал реальную клиническую ситуацию, где метаболический риск может сочетаться с другими факторами повреждения печени. Рост распространённости ожирения и диабета сделал эти ограничения особенно заметными [5, 6].

В 2020 году международная группа экспертов предложила термин MAFLD — metabolic dysfunction-associated fatty liver disease [3]. Новая концепция сместила акцент на наличие стеатоза печени в сочетании с метаболическими критериями: избыточной массой тела или ожирением, сахарным диабетом 2-го типа либо другими признаками метаболической дисфункции. Это был важный шаг от «диагноза исключения» к позитивной диагностической модели, в которой печень рассматривается как орган-мишень системных обменных нарушений.

В 2023 году многосторонний Delphi-консенсус предложил термин MASLD — metabolic dysfunction-associated steatotic liver disease [4]. Зонтичным понятием стала «стеатотическая болезнь печени», а MASLD был принят для случаев стеатоза при наличии как минимум одного

кардиометаболического фактора риска. Воспалительная форма получила название MASH, что позволило сохранить связь с понятием стеатогепатита. Такой подход уменьшает стигматизирующую окраску прежних терминов и лучше отражает патогенез болезни.

Практическое значение новой терминологии заключается в необходимости комплексной оценки пациента: индекса массы тела, окружности талии, артериального давления, глюкозы, липидного профиля, активности трансаминаз и риска фиброза. Современные рекомендации рассматривают MASLD как междисциплинарную проблему, где профилактика и лечение включают снижение массы тела, рациональное питание, физическую активность и коррекцию кардиометаболических факторов риска [7].

Заключение

История метаболически ассоциированной жировой болезни печени отражает развитие медицинских знаний: от морфологического описания неалкогольного стеатогепатита к системной концепции MASLD. Термин NAFLD сыграл важную историческую роль, но современная номенклатура точнее подчёркивает связь стеатоза печени с метаболической дисфункцией. Для клинической практики это означает более раннее выявление пациентов высокого риска, единый диагностический подход и усиление профилактической работы. Для научных исследований важно указывать современные термины, сохраняя преемственность с литературой по NAFLD и MAFLD.

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ПСИХОЛОГИЯ ЗАВИСИМОСТИ ОТ ОНЛАЙН-ИГР И СОЦИАЛЬНЫХ СЕТЕЙ

Аннотация: *Статья посвящена актуальной проблеме цифровой аддикции – психологической зависимости от онлайн–игр и социальных сетей. В работе анализируются основные этиологические факторы формирования аддиктивного поведения в виртуальной среде, описываются психопатологические и социальные последствия длительной интернет–зависимости, а также предлагаются научно обоснованные подходы к профилактике среди различных возрастных групп. Особое внимание уделяется нейропсихологическим механизмам подкрепления и роли нарушенной саморегуляции.*

Ключевые слова: *интернет–зависимость, гейминг-расстройство, аддикция социальных сетей, дофаминовая петля, прокрастинация, цифровая гигиена, профилактика аддикций.*

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PSYCHOLOGY OF ADDICTION TO ONLINE GAMES AND SOCIAL NETWORKS

Abstract: *The article is devoted to the urgent problem of digital addiction – psychological dependence on online games and social networks. The paper analyzes the main etiological factors of addictive behavior formation in the virtual environment, describes the psychopathological and social consequences of long–term Internet addiction, and proposes scientifically grounded approaches to prevention among various age groups. Special attention is paid to the neuropsychological mechanisms of reinforcement and the role of impaired self–regulation.*

Keywords: *Internet addiction, gaming disorder, social media addiction, dopamine loop, procrastination, digital hygiene, prevention of addictions.*

В последние два десятилетия цифровая среда стала полноценным пространством существования для миллионов людей. Онлайн-игры и

социальные сети обрели черты аддиктивной среды. Согласно МКБ–11, расстройство, связанное с онлайн-играми, официально признано психическим нарушением. Зависимость от социальных сетей пока не выделена отдельно, однако механизмы её формирования и последствия сходны с классическими аддикциями. Понимание феномена требует анализа биологических, психологических и социальных факторов [1].

Формирование зависимости имеет нейробиологические основания: обе платформы используют принцип переменного подкрепления. Лайки, уведомления, внутриигровые награды активируют мезолимбический дофаминовый путь. Предвосхищение награды стимулирует поведение сильнее, чем сама награда, формируя дофаминовую петлю. При хронической активации чувствительность D2–рецепторов снижается, растёт толерантность [3].

Психологические предикторы: дефицит саморегуляции, низкая фрустрационная толерантность, алекситимия – трудность в распознавании эмоций. Выраженная потребность в социальном признании при дефиците навыков реальной коммуникации делает соцсети привлекательными за счёт мгновенной обратной связи. Ключевой механизм – эскапизм, уход от проблем в виртуальную среду [2].

Социокультурный контекст усиливает аддиктивный потенциал: феномен FOMO, страх что-то упустить, бесконечный скроллинг, персонализированные алгоритмы, создающие эффект воронки внимания без естественной точки выхода. Онлайн-игры используют социальное обязательство – гильдии, рейды, штрафы за невыход, что сохраняет вовлечённость даже при снижении мотивации [4].

Последствия: повышение тревожности и депрессивной симптоматики, синдром отмены, нарушение циркадных ритмов, снижение устойчивого внимания, ухудшение рабочей памяти и метакогнитивных навыков. У подростков – замещение реальных отношений виртуальными, снижение эмпатии, академическая неуспешность, искажение временной перспективы [3].

Профилактика должна быть мультиуровневой. Индивидуально: когнитивно-поведенческая терапия, мониторинг триггеров (скука, тревога, одиночество, стресс), замещение альтернативными действиями, цифровой детокс, развитие осознанности. Семейный уровень: авторитетный контроль, правила без гаджетов за час до сна, формирование альтернативных потоковых состояний через хобби и реальное общение, обеспечивающих «живой» выброс дофамина без толерантности. Социально-образовательный уровень: курс «Цифровая гигиена» с распознаванием манипулятивных интерфейсов и рефлексией поведения через трекеры с запросом о цели входа [4].

Зависимость от онлайн-игр и социальных сетей – клинически значимый феномен, коренящийся в нейробиологических механизмах подкрепления, гипертрофированных цифровой средой. Ключевые мишени профилактики –

саморегуляция, реальные социальные связи и физическая среда. Необходимы валидные скрининговые инструменты и лонгитюдный анализ эффективности интервенций [1].

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МАКСИМИЗАЦИЯ ПРИБЫЛИ ФИРМЫ: ТЕОРЕТИЧЕСКАЯ МОДЕЛЬ И ПРАКТИЧЕСКИЕ ОГРАНИЧЕНИЯ

Аннотация: *В статье анализируется механизм максимизации прибыли фирмы в микроэкономической теории. Цель — рассмотреть классическое правило равенства предельного дохода и предельных издержек (MR=MC) и его реализацию в разных рыночных структурах. Метод основан на теоретическом анализе экономических моделей поведения фирмы. Результат: выявлены ограничения практического применения модели (неполнота информации, сложность расчётов, внешнее регулирование); обосновано, что концепция максимизации прибыли остаётся фундаментальным ориентиром, а не точно вычисляемым показателем.*

Ключевые слова: *максимизация прибыли, фирма, предельный доход, предельные издержки, рыночные структуры, неопределённость.*

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MAXIMIZING FIRM PROFIT: THEORETICAL MODEL AND PRACTICAL CONSTRAINT

Abstract: *The article analyzes the mechanism for maximizing a company's profit in microeconomic theory. The goal is to consider the classic rule of equality of marginal revenue and marginal cost (MR=MC) and its implementation in different market structures. The method is based on a theoretical analysis of economic models of firm behavior. Result: limitations in the practical application of the model were identified (incomplete information, complexity of calculations, external regulation); it is justified that the concept of profit maximization remains a fundamental guideline, and not a precisely calculated indicator.*

Key words: *profit maximization, firm, marginal revenue, marginal costs, market structures, uncertainty.*

В микроэкономике фирма рассматривается как независимый агент, самостоятельно определяющий параметры выпуска и ценовую политику. Ключевой ориентир её активности — получение прибыли, однако важна не просто безубыточность, а достижение максимального финансового результата; эта задача составляет ядро микроэкономического анализа [2, С. 210]. Актуальность обусловлена постоянным давлением внешних факторов: ограниченностью ресурсов, колебаниями спроса, ростом издержек и уровнем конкурентной борьбы. В таких условиях выбор оптимального масштаба производства приобретает решающее значение как с теоретической, так и с прикладной точки зрения. Проблема в том, что классическая модель даёт чёткий алгоритм, но на практике фирма действует в обстановке неопределённости, неполноты данных и под влиянием множества переменных; следовательно, требуется не только изложить правило максимизации прибыли, но и выявить границы его применимости в реальной экономике [7, С. 305]. Цель работы — охарактеризовать механизм максимизации прибыли, описать условия его реализации и определить препятствия, возникающие при практическом применении модели. В соответствии с целью поставлены задачи: раскрыть экономическое содержание прибыли; сформулировать условие максимизации; сопоставить особенности его достижения в различных рыночных структурах; выявить

ключевые ограничения, осложняющие использование модели на практике. Объект исследования — деятельность фирмы в системе рыночных отношений, предмет — экономический механизм максимизации прибыли [5, С. 180]. Методологическая основа включает методы анализа, сравнения, обобщения и логического построения выводов.

Прибыль представляет собой превышение выручки над затратами на производство и сбыт; она выступает главным измерителем эффективности, обеспечивая ресурсы для развития, обновления технологий и укрепления рыночных позиций [5, С. 181]. В экономической теории различают бухгалтерскую прибыль (разница между доходом и явными издержками) и экономическую прибыль (разница с учётом неявных издержек, включая альтернативную стоимость собственных ресурсов). Второй показатель позволяет более точно оценить реальную выгоду от предпринимательской деятельности [7, С. 148]. Стремление к максимизации прибыли означает выбор объёма производства, при котором разрыв между общим доходом и общими издержками достигает наибольшей величины; это рациональная цель, обусловленная ограниченностью доступных ресурсов. Для анализа поведения фирмы используются предельные величины: предельный доход — прирост дохода от продажи дополнительной единицы продукции, предельные издержки — затраты на её производство [4, С. 195]. Пока дополнительная единица приносит больше дохода, чем требует затрат, расширение выпуска оправдано; когда ситуация меняется на противоположную, рост производства ведёт к снижению прибыли. Отсюда выводится ключевое правило: максимальная прибыль достигается при объёме выпуска, где предельный доход равен предельным издержкам. Это положение служит базой для анализа поведения производителей в разных рыночных условиях; за его кажущейся простотой стоит принцип рационального выбора: предприятие не должно наращивать выпуск без оценки того, приносит ли каждая следующая единица чистый выигрыш [4, С. 197; 7, С. 310].

Конкретные условия достижения равновесия зависят от типа рыночной структуры. В модели совершенной конкуренции, где множество продавцов торгуют однородным товаром, отдельная фирма не может повлиять на цену. Предельный доход оказывается равен цене, и правило максимизации прибыли упрощается: цена должна соответствовать предельным издержкам. Если цена выше — выпуск стоит увеличить, если ниже — сократить; в краткосрочном периоде возможна прибыль, убытки или безубыточность, а в долгосрочном периоде свободный вход и выход с рынка приводят к обнулению экономической прибыли [6, С. 102–105]. В условиях монополии фирма является единственным поставщиком уникального продукта; она сама задаёт цену, и её предельный доход ниже цены, так как для увеличения продаж приходится снижать цену на все единицы товара. Монополист также придерживается равенства предельного дохода и предельных издержек, но назначает цену выше предельных издержек, что позволяет ему извлекать

монопольную прибыль. Монополистическая конкуренция предполагает дифференциацию продукта; успех фирмы зависит от способности выделить свой товар среди аналогов, поэтому максимизация прибыли требует анализа не только издержек и цены, но и затрат на продвижение. В олигополии, где рынок поделён между несколькими крупными игроками, ключевым фактором становится взаимозависимость решений; каждая фирма вынуждена прогнозировать реакцию конкурентов на свои действия, что превращает задачу максимизации прибыли в стратегическую [1, С. 138]. Таким образом, общий принцип (MR = MC) сохраняется для всех структур, но его содержательное наполнение меняется по мере усиления рыночной власти и усложнения конкурентной среды [3, с. 283].

Теоретическая модель сталкивается с серьёзными ограничениями в реальной хозяйственной практике; фирма действует в условиях неполноты информации, нестабильности внешней среды и вынуждена опираться на прогнозы, которые не всегда точны. Основная трудность связана с расчётом предельных издержек и дохода: на практике они зависят от множества изменчивых факторов — цен на сырьё, производительности труда, колебаний спроса, сезонности, маркетинговых воздействий и действий конкурентов, поэтому точное определение точки равновесия затруднительно. Кроме того, ориентация исключительно на краткосрочную прибыль не всегда соответствует стратегическим интересам; компании могут сознательно жертвовать текущей прибылью ради укрепления рыночных позиций, расширения клиентской базы или повышения узнаваемости бренда [6, С. 110]. Внутренние организационные факторы также вносят коррективы: в крупных корпорациях решения принимают менеджеры, чьи интересы (рост масштабов бизнеса, снижение личных рисков) могут не совпадать с задачей максимизации прибыли для собственников. Нельзя сбрасывать со счетов и государственное регулирование: налоговая нагрузка, антимонопольные требования, экологические и социальные стандарты ограничивают свободу выбора цен и объёмов выпуска, что может снижать потенциальную прибыльность, но необходимо для поддержания баланса интересов в обществе [5, С. 215]. Следовательно, теоретическая модель максимизации прибыли задаёт вектор движения, однако в реальности предприятие вынуждено действовать в условиях риска, неопределённости и множественных ограничений; поэтому сама цель максимизации прибыли на практике чаще выступает как стратегический ориентир, нежели как точно вычисляемый результат [7, С. 378].

Проведённый анализ позволяет заключить, что максимизация прибыли остаётся ключевой целью фирмы в микроэкономической теории. Прибыль выступает главным показателем эффективности и источником самофинансирования развития. Теоретическим условием её достижения служит равенство предельного дохода и предельных издержек; это правило задаёт логику нахождения оптимального объёма выпуска. Конкретные

механизмы его реализации варьируются в зависимости от рыночной структуры: от простого условия ценообразования в условиях совершенной конкуренции до сложных стратегических расчётов в олигополии [6, С. 100]. Главное противоречие, выявленное в работе, заключается в расхождении между стройной теоретической моделью и реальной практикой; неполнота информации, сложность расчёта предельных величин, многообразие стратегических целей и внешние регуляторные ограничения существенно корректируют поведение фирмы. Таким образом, концепция максимизации прибыли сохраняет фундаментальное значение для микроэкономического анализа, но её применение требует учёта реальных условий хозяйствования; только сочетание теоретических принципов с пониманием практических ограничений позволяет адекватно оценивать поведение современной фирмы [1, С. 146; 5, С. 216].

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ТРАНСФОРМАЦИЯ ФЕНОМЕНА БЕЗРАБОТИЦЫ В УСЛОВИЯХ ЦИФРОВИЗАЦИИ И ГЛОБАЛЬНЫХ ВЫЗОВОВ

Аннотация: *В статье мы исследуем природу современной безработицы в условиях промышленной революции и постпандемийной реальности. Мы анализируем структурные изменения на рынке труда, вызванные автоматизацией и развитием искусственного интеллекта. Особое внимание уделяется новым формам занятости (гиг-экономика) и специфике российского рынка труда, характеризующегося парадоксальным сочетанием низкого уровня официальной безработицы и дефицита квалифицированных кадров.*

Ключевые слова: *безработица, рынок труда, цифровизация, гиг-экономика, технологическое замещение, прекаризация, человеческий капитал.*

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TRANSFORMATION OF THE PHENOMENON OF UNEMPLOYMENT IN THE CONTEXT OF DIGITALIZATION AND GLOBAL CHALLENGES

Abstract: *In this article, we explore the nature of modern unemployment in the context of the industrial revolution and the post-pandemic reality. We analyze the structural changes in the labor market caused by automation and the development of artificial intelligence. We pay special attention to new forms of employment (gig economy) and the specific features of the Russian labor market, which is characterized by a paradoxical combination of low official unemployment rates and a shortage of skilled workers.*

Keywords: *unemployment, labor market, digitalization, gig economy, technological substitution, precariousness, human capital*

Рынок труда является одним из самых чувствительных индикаторов макроэкономического состояния государства. В XXI веке традиционные представления о безработице, которые были сформированы классической и кейнсианской школами, претерпевают колоссальную трансформацию. Глобализация, демографические сдвиги и стремительный технологический прогресс формируют новые испытания, требующие пересмотра государственной политики занятости.

Современную безработицу отличает ярко выраженная структурная природа. По мере того, как искусственный интеллект и робототехника проникают во всё новые сферы, возникает эффект, получивший название

«технологическое замещение». В отличие от прежних промышленных революций, сегодняшняя волна автоматизации задевает не только ручной труд, но и когнитивные профессии среднего звена: речь идёт о бухгалтерах, младших юристах, переводчиках и многих других специальностях, которые раньше считались надёжной серединой рынка. В результате нарастает риск так называемой поляризации — когда рабочие места сохраняются либо на верхнем уровне квалификации, либо в самом низу, в сфере недорогих сервисных услуг.

Ещё одна особенность текущей ситуации в том, что безработица всё чаще прячется за новыми форматами занятости. Цифровые платформы разогнали рост гиг-экономики: фриланс, краткосрочные заказы, краудсорсинг. Формально человек занят и в статистику безработных не попадает, что улучшает официальные цифры. Но, по сути, формируется целый слой «прекариата» — людей, лишённых базовых социальных гарантий: ни оплачиваемого отпуска, ни больничного, ни уверенности в завтрашнем дне, ни нормальных пенсионных накоплений. Для экономики в целом это оборачивается сужением налоговой базы и ослаблением потребительской уверенности, особенно если смотреть вдолгую.

Острой остаётся и проблема молодёжной незанятости, прежде всего в развивающихся странах. Появилась устойчивая аббревиатура NEET — так обозначают молодых людей, которые одновременно не учатся, не работают и не проходят профессиональную подготовку. За этим стоит не просто потеря времени, а постепенная деградация человеческого капитала и рост напряжённости в обществе. Корень проблемы во многом лежит в разрыве между тем, чему учит консервативная образовательная система, и тем, чего реально требует рынок.

Если говорить о России, то здесь рынок труда показывает картину, которую иначе как аномальной не назовёшь: уровень безработицы опустился ниже трёх процентов, достигнув исторического минимума. Но за этой цифрой не стоит полного благополучия. Скорее, мы имеем дело с двумя наложившимися друг на друга процессами. Во-первых, демографическая яма и отток квалифицированных кадров породили настоящий кадровый голод, и бизнес держится за сотрудников практически любой ценой. Во-вторых, сохраняется скрытая безработица: неполная занятость и административные отпуска на предприятиях, которые переживают реструктуризацию, но официально персонал не сокращают.

Сама суть безработицы сегодня изменилась. Раньше говорили о нехватке рабочих мест вообще, теперь же проблема упирается в разрыв между имеющимися компетенциями людей и теми, которые нужны экономике. Соответственно, и бороться с ней старыми методами — только через пособия — бессмысленно. На первый план выходит идея «непрерывного образования», то есть выстраивания целой экосистемы, в которой человек может постоянно обновлять свои навыки. В нынешних макроэкономических

реалиях государственная политика занятости переживает глубокий, фундаментальный сдвиг. Если в индустриальную эпоху основной задачей государства была выплата пособий (пассивная политика), то сегодня акцент смещается на активные меры, направленные на повышение адаптивности трудовых ресурсов.

Эффективная государственная стратегия включает в себя три ключевых вектора:

1. Активная политика на рынке труда

Современное государство перестает быть просто «кассой» для выдачи пособий и превращается в «кадровое агентство»

• Реформирование служб занятости: Переход к цифровым экосистемам (например, интеграция баз данных вакансий с государственными услугами), которые используют ИИ для наиболее точного сопряжения профиля кандидата с требованиями работодателя.

• Субсидирование найма: Прямые выплаты или налоговые льготы предприятиям, создающим рабочие места для уязвимых групп (молодежь без опыта, люди предпенсионного возраста, лица с ограниченными возможностями).

• Стимулирование самозанятости: Государственные гранты и льготные кредиты на открытие малого бизнеса, что позволяет снизить давление на рынок наемного труда.

2. Инвестиции в непрерывное образование

В условиях технологического замещения «диплом на всю жизнь» становится анахронизмом. Государственная политика должна формировать систему переобучения и повышения квалификации.

• Образовательные ваучеры: Предоставление гражданам субсидий на получение новых цифровых компетенций.

• Сближение академической и реальной среды: Государственное стимулирование партнерств между вузами и корпорациями для устранения «квалификационной ямы».

3. Правовое регулирование нестандартных форм занятости

Рост гиг-экономики требует от государства создания новой нормативной базы. Политика борьбы с безработицей сегодня включает в себя борьбу с прекаризацией:

• Законодательное закрепление прав фрилансеров и платформенных занятых на социальное и медицинское страхование.

• Разработка механизмов «портативных льгот», которые закрепляются за работником, а не за конкретным работодателем.

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ПРАВОВОЙ СТАТУС И ВОЗНАГРАЖДЕНИЕ АРБИТРАЖНОГО УПРАВЛЯЮЩЕГО В ДЕЛАХ О БАНКРОТСТВЕ: ТОЧКИ БИФУРКАЦИИ ПРАВОВОГО РЕГУЛИРОВАНИЯ

Аннотация: *В статье исследуются теоретические и практические аспекты правового статуса арбитражного (финансового) управляющего в делах о банкротстве. Анализируется эклектичность современного правового регулирования, сочетающего публично-правовые и частноправовые начала, что порождает противоречия в судебной практике и неопределенность в профессиональной деятельности. Особое внимание уделяется проблеме вознаграждения управляющего, которое рассматривается как ключевой фактор мотивации и как инструмент судебного контроля. На основе анализа судебной практики демонстрируется реализация правовых позиций высших судов о необходимости оценки личного вклада управляющего и соблюдении баланса интересов. Предложены пути совершенствования законодательства, включая корректировку порядка назначения управляющих и реформирование системы оплаты их труда. В работе также анализируются актуальные законопроектные инициативы, направленные на решение выявленных проблем.*

Ключевые слова: *банкротство, арбитражный управляющий, финансовый управляющий, правовой статус, вознаграждение, судебная практика, реформа законодательства.*

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LEGAL STATUS AND REMUNERATION OF AN ARBITRATION ADMINISTRATOR IN BANKRUPTCY CASES: POINTS OF BIFURCATION OF LEGAL REGULATION

Annotation: *The article examines the theoretical and practical aspects of the legal status of an arbitration (financial) manager in bankruptcy cases. The eclecticism of modern legal regulation is analyzed, combining public law and private law principles, which generates contradictions in judicial practice and uncertainty in professional activity. Special attention is paid to the problem of remuneration of the manager, which is considered as a key motivation factor and as an instrument of judicial control. Based on the analysis of judicial practice, the implementation of the legal positions of the higher courts on the need to assess the personal contribution of the manager and respect the balance of interests is demonstrated. Ways to improve legislation are proposed, including adjusting the procedure for appointing managers and reforming the system of remuneration for their work. The paper also analyzes current legislative initiatives aimed at solving the identified problems.*

Keywords*: bankruptcy, arbitration manager, financial manager, legal status, remuneration, judicial practice, legislative reform.*

Институт банкротства в Российской Федерации, особенно после включения в 2015 году 10 главы о несостоятельности физических лиц, стал одним из наиболее динамично развивающихся и востребованных механизмов правового регулирования экономики[69]. Ключевой фигурой в этом механизме является арбитражный (а в делах граждан - финансовый) управляющий. От его профессионализма, независимости и мотивации напрямую зависит эффективность процедур, соблюдение баланса интересов должников и кредиторов, а также пополнение конкурсной массы.

[69] Федеральный закон от 26.10.2002 № 127-ФЗ (ред. от 09.04.2026) «О несостоятельности (банкротстве)» // «Собрание законодательства РФ», 28.10.2002, № 43, ст. 4190.

Однако, несмотря на многолетнюю историю применения законодательства о банкротстве, правовой статус управляющего остается предметом острых дискуссий. Законодательство и судебная практика демонстрируют эклектичный подход, сочетая публично-правовые (назначение судом, дискреционные полномочия) и частноправовые (частная практика, вознаграждение как плата за услуги) начала. Эта неопределенность усугубляется несовершенством системы оплаты труда управляющих, где фиксированная часть давно утратила экономическую актуальность, а критерии выплаты стимулирующей части размыты и зависят от судейского усмотрения.

Цель статьи - провести комплексный анализ теоретических и практических проблем правового статуса и вознаграждения арбитражного управляющего, выявить системные противоречия и, проиллюстрировав их примером из актуальной судебной практики, предложить пути законодательного разрешения. В рамках исследования также рассматриваются недавние законодательные инициативы (в частности, законопроект № 1034201-8), призванные реформировать систему оплаты труда арбитражных управляющих.

В научной доктрине отсутствует единый подход к определению правовой природы арбитражного управляющего. Существуют теории, рассматривающие его как представителя кредиторов, должника, орган юридического лица или независимого арбитра. Как справедливо отмечает А. П. Шафранов, обилие теорий объясняется многогранностью деятельности управляющего, в которой переплетаются гражданские, налоговые, трудовые и административные отношения[70].

Ключевой точкой бифуркации является сочетание публичных и частных начал. С одной стороны, Конституционный Суд РФ в Постановлении № 12-П от 2005 г. указал, что процедуры банкротства носят публично-правовой характер, а арбитражный управляющий, утверждаемый судом, наделяется полномочиями для обеспечения баланса интересов, что придает его статусу публичный характер[71]. Его решения обязательны для широкого круга лиц.

С другой стороны, Закон о банкротстве прямо указывает, что арбитражный управляющий занимается частной практикой (ст. 20) и вправе заниматься иными видами деятельности. Высшие судебные инстанции неоднократно подчеркивали частноправовую, встречную природу его вознаграждения, применяя по аналогии нормы главы 39 ГК РФ о возмездном

[70] Шафранов А. П. Кто такой арбитражный управляющий? // Имущественные отношения в РФ. 2024. №11 (278). URL: https://cyberleninka.ru/article/n/kto-takoy-arbitrazhnyy-upravlyayuschiy (дата обращения: 26.02.2026).

[71] Постановление Конституционного Суда РФ от 19.12.2005 N 12-П "По делу о проверке конституционности абзаца восьмого пункта 1 статьи 20 Федерального закона "О несостоятельности (банкротстве)" в связи с жалобой гражданина А.Г. Меженцева"

оказании услуг[72]. Эта двойственность порождает практические проблемы. Как отмечают И. А. Емельянова и А. В. Ершов, действующий порядок назначения управляющего (по предложению заявителя или СРО) создает риски его ангажированности в пользу кредитора, выдвинувшего кандидатуру, что противоречит принципу независимости. Исследователи подчеркивают, что вознаграждение управляющего является основным стимулом его деятельности: именно для его максимизации специалисты соглашаются на проведение процедур в отношении проблемных предприятий и стремятся нарастить их количество. Однако закрепленная система оплаты имеет существенные недостатки[73].

Авторы сходятся во мнении, что необходим пересмотр этого порядка в сторону усиления роли суда и внедрения элементов случайной выборки для минимизации коррупциогенных факторов и обеспечения большей беспристрастности.

Система вознаграждения, состоящая из фиксированной и процентной (стимулирующей) частей (ст. 20.6 Закона о банкротстве)[74], наиболее остро отражает противоречия статуса управляющего. Фиксированная сумма призвана покрывать основные усилия управляющего и обеспечивать его материальную независимость, а процентная - служить стимулом для достижения конкретных целей, таких как увеличение стоимости активов или погашение долгов.

Размер фиксированного вознаграждения для различных процедур (от 15 до 45 тыс. руб. в месяц, а для финансового управляющего - 25 тыс. руб. единовременно) не менялся с 2008 года. Это является центральной проблемой для арбитражных управляющих. Данное утверждение подтверждается данными Росстата: за период с 2009 по 2025 год инфляция в России ежегодно составляла значительные величины (2009 - 8,8%, 2010 - 8,8%, 2011 - 6,1%, 2012 - 6,6%, 2013 - 6,5%, 2014 - 11,3%, 2015 - 12,9%, 2016 - 5,4%, 2017 - 2,5%, 2018 - 4,3%, 2019 - 3,0%, 2020 - 4,9%, 2021 - 8,39%, 2022 - 11,94%, 2023 - 7,42%, 2024 - 9,52%, 2025 - 5,59%)[75]. М.М. Сурина приводит убедительные данные об инфляции за этот период, доказывая, что реальная покупательная способность фиксированной части упала в разы. В отличие от трудовых отношений, где ТК РФ предусматривает индексацию зарплаты, положения ТК к арбитражным управляющим неприменимы, а Закон о банкротстве индексацию не предусматривает, что вынуждает управляющих обращаться в

[72] Федеральный закон от 26.10.2002 № 127-ФЗ (ред. от 09.04.2026) «О несостоятельности (банкротстве)» // «Собрание законодательства РФ», 28.10.2002, № 43, ст. 4190.

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[74] Федеральный закон от 26.10.2002 № 127-ФЗ (ред. от 09.04.2026) «О несостоятельности (банкротстве)» // «Собрание законодательства РФ», 28.10.2002, № 43, ст. 4190.

[75]Федеральная служба государственной статистики [Электронный ресурс]: Индексы потребительских цен на товары и услуги. // URL: https://rosstat.gov.ru/

суды за защитой этого права[76]. Это, по сути, превращает ее в символическую выплату, не обеспечивающую финансовой независимости управляющего и не компенсирующую его трудозатраты. Особенно остро эта проблема стоит в делах о банкротстве граждан, где имущества для выплаты процентов часто не имеется. Низкий уровень оплаты не только снижает мотивацию к качественному ведению процедур, но и создает риски недобросовестного поведения, включая поиск неофициальных источников дохода[77].

В контексте материального обеспечения деятельности финансового управляющего в делах о банкротстве граждан система вознаграждения, помимо фиксированной суммы в 25 000 рублей, включает право на 7% от выручки от реализации имущества, взыскания дебиторской задолженности или применения последствий недействительности сделок (п. 17 ст. 20.6 Закона)[78]. Однако существующая система не обеспечивает адекватную компенсацию трудозатрат и рисков, что требует разработки более гибкого механизма, учитывающего сложность дела, длительность процедуры и объем имущества[79].

Такая ситуация, по мнению Н. В. Орловой, подрывает саму идею беспристрастности, вынуждая управляющих либо вести огромное количество дел «конвейерным» способом, либо искать неформальные источники дохода, что повышает риски злоупотреблений[80]. Представляется необходимой законодательно закрепленная ежегодная индексация фиксированных сумм, как это предлагается в научной литературе.

В мае 2025 года группой депутатов фракции «Единая Россия» был подготовлен законопроект № 1034201-8, направленный на решение этой проблемы. Документ предусматривал существенное (более чем в два раза) повышение фиксированной части вознаграждения для всех категорий управляющих и, что особенно важно, введение механизма его ежегодной индексации с учетом уровня инфляции. Так, для финансового управляющего в процедуре реализации имущества гражданина предлагалось установить вознаграждение в размере 60 тыс. рублей единовременно. В пояснительной

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[76] Сурина М. М. Проблемы вознаграждения арбитражного управляющего // Вестник науки. 2024. №9 (78). URL: https://cyberleninka.ru/article/n/problemy-voznagrazhdeniya-arbitrazhnogo-upravlyayuschego (дата обращения: 26.02.2026).

[77] Киселёв В. В. Правовой статус финансового управляющего в делах о банкротстве физических лиц: теоретические и практические аспект // Образование и право. 2024. №11. URL: https://cyberleninka.ru/article/n/pravovoy-status-finansovogo-upravlyayuschego-v-delah-o-bankrotstve-fizicheskih-lits-teoreticheskie-i-prakticheskie-aspekt (дата обращения: 26.02.2026).

[78] Федеральный закон от 26.10.2002 № 127-ФЗ (ред. от 09.04.2026) «О несостоятельности (банкротстве)» // «Собрание законодательства РФ», 28.10.2002, № 43, ст. 4190.

[79] Киселёв В. В. Правовой статус финансового управляющего в делах о банкротстве физических лиц: теоретические и практические аспект // Образование и право. 2024. №11. URL: https://cyberleninka.ru/article/n/pravovoy-status-finansovogo-upravlyayuschego-v-delah-o-bankrotstve-fizicheskih-lits-teoreticheskie-i-prakticheskie-aspekt (дата обращения: 26.02.2026).

[80] Орлова Н.В. Состав и источники вознаграждения арбитражного управляющего // Вестник науки №1 (94) том 4. С. 325 - 333. 2026 г. ISSN 2712-8849 // Электронный ресурс: https://www.вестник-науки.рф/article/28483 (дата обращения: 26.02.2026).

записке к законопроекту обосновывалась необходимость таких мер нарастающей диспропорцией между ростом потребительских цен, затрат на страхование, публикации и иные обязательные расходы, с одной стороны, и многолетним неизменным размером фиксированной части - с другой[81].

Процентное вознаграждение призвано стимулировать управляющего к активной работе по пополнению конкурсной массы. Однако судебная практика последних лет демонстрирует ужесточение подхода к его выплате. Верховный Суд РФ последовательно проводит позицию, согласно которой проценты не являются безусловной выплатой, а выплачиваются только за реальный и эффективный вклад управляющего. Обязательными условиями для выплаты процентов становятся: завершенность мероприятий, личный вклад управляющего в достижение результата, отсутствие нарушений и злоупотреблений[82]. Причем качество и результативность работы на современном этапе являются главным критерием при утверждении вознаграждения.

Как отмечает Т. А. Гришин, даже частичное неисполнение обязанностей или выполнение ключевых функций (организация торгов, юридическое сопровождение) привлеченными специалистами может служить основанием для снижения или отказа в выплате полного объема процентов, независимо от причин[83]. В Обзоре судебной практики от 11.10.2023 Верховный Суд закрепил возможность снижения судом процентов при их явной несоразмерности вкладу управляющего[84]. Эта мера направлена на защиту интересов кредиторов, но, создает правовую неопределенность для управляющих, которые не могут гарантированно рассчитывать на результат своей работы, даже выполнив ее качественно. В настоящее время арбитражному управляющему крайне сложно прогнозировать не только размер, но и саму возможность утверждения и выплаты процентной части вознаграждения, поскольку четкие критерии снижения выплат законодательством не урегулированы[85].

Введение института банкротства граждан в 2015 году кардинально изменило ландшафт профессии. Исследование К. С. Анфимовой и соавторов убедительно демонстрирует, что тип должника стал основным фактором

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[81] Законопроект № 1034201-8 О внесении изменений в Федеральный закон "О несостоятельности (банкротстве)" (в части повышения эффективности института банкротства) https://sozd.duma.gov.ru/bill/1034201-8

[82] Орлова Н.В. Состав и источники вознаграждения арбитражного управляющего // Вестник науки №1 (94) том 4. С. 325 - 333. 2026 г. ISSN 2712-8849 // Электронный ресурс: https://www.вестник-науки.рф/article/28483 (дата обращения: 26.02.2026).

[83] Гришин Т. А. СНИЖЕНИЕ ВОЗНАГРАЖДЕНИЯ КОНКУРСНОГО УПРАВЛЯЮЩЕГО // Вестник науки. 2025. №6 (87). URL: https://cyberleninka.ru/article/n/snizhenie-voznagrazhdeniya-konkursnogo-upravlyayuschego (дата обращения: 26.02.2026).

[84] "Обзор судебной практики по вопросам участия арбитражного управляющего в деле о банкротстве" (утв. Президиумом Верховного Суда РФ 11.10.2023) // "Бюллетень Верховного Суда РФ", N 12, декабрь, 2023

[85] Орлова Н.В. Состав и источники вознаграждения арбитражного управляющего // Вестник науки №1 (94) том 4. С. 325 - 333. 2026 г. ISSN 2712-8849 // Электронный ресурс: https://www.вестник-науки.рф/article/28483 ((дата обращения: 26.02.2026).

стратификации сообщества управляющих. Дела граждан, будучи малооплачиваемыми, но массовыми, стали нишей для менее ресурсных специалистов: женщин, представителей регионов, начинающих управляющих. В то время как наиболее доходный сегмент корпоративных банкротств, требующий сложных компетенций и дающий высокие процентные вознаграждения, остается прерогативой опытных специалистов-мужчин из столичных регионов[86]. Это подтверждает тезис о формировании двух разных «профессиональных миров» внутри одной профессии, что требует учета при разработке мер поддержки и регулирования.

Отдельной проблемой, вытекающей из частноправовой концепции вознаграждения, является риск самостоятельной выплаты управляющим себе процентов до их утверждения судом. Как разъяснено в абзаце втором пункта 14 Постановления Пленума ВАС РФ от 23.07.2009 № 60 и абзаце третьем пункта 12.1 Постановления № 97, размер суммы процентов по вознаграждению арбитражного управляющего определяется судом, поэтому арбитражный управляющий не вправе выплачивать себе проценты по вознаграждению до определения их размера в соответствующем судебном акте. Нарушение этого запрета может повлечь за собой обязанность по возврату излишне полученных средств в конкурсную массу[87].

Теоретические положения о неопределенности критериев выплаты стимулирующего вознаграждения и рисках преждевременных выплат находят яркое подтверждение в реальных судебных спорах. Показательным является дело о банкротстве ООО «НПО «ФинТек», в рамках которого конкурсный управляющий обратился в суд с заявлением об утверждении процентного вознаграждения.

Обстоятельства дела. В реестр требований кредиторов должника были включены требования на общую сумму свыше 320 млн руб., в том числе требования залогового кредитора (правопреемники АО «Россельхозбанк») на сумму около 175 млн руб. и требования кредиторов второй очереди на сумму 1,8 млн руб. В ходе конкурсного производства было реализовано залоговое имущество, выручка от продажи которого составила 186,9 млн руб. Эти средства были направлены на погашение требований кредиторов второй очереди (1,8 млн руб.) и частичное погашение требований залогового кредитора. Часть требований (27,8 млн руб.) была погашена в рамках дела о банкротстве поручителя.

Конкурсный управляющий, рассчитав проценты по правилам п. 13 ст. 20.6 Закона о банкротстве (7% от суммы удовлетворенных требований, так

[86] Анфимова К. С., Бондарьков С. В., Бочаров Т. Ю., Калинина Е. М., Чистякова Д. А. Профессия арбитражного управляющего в России: роль типа должника в структурировании сообщества // Экономическая социология. 2025. №4. URL: https://cyberleninka.ru/article/n/professiya-arbitrazhnogo-upravlyayuschego-v-rossii-rol-tipa-dolzhnika-v-strukturirovanii-soobschestva (дата обращения: 26.02.2026).

[87] Постановление Пленума ВАС РФ от 23.07.2009 N 60 (ред. от 17.12.2024) "О некоторых вопросах, связанных с принятием Федерального закона от 30.12.2008 N 296-ФЗ "О внесении изменений в Федеральный закон "О несостоятельности (банкротстве)" // "Вестник ВАС РФ", N 9, сентябрь, 2009

как требования залогового кредитора были погашены на 92,95%), и, применив ограничение в 5% от выручки от реализации залогового имущества, предусмотренное ст. 138 Закона, направила в суд 18 августа 2025 года ходатайство об утверждении ей вознаграждения в размере 9 400 536,61 руб. (9 346 187,64 руб. за погашение залоговых требований и 54 348,97 руб. за погашение требований второй очереди).

УФНС по Республике Карелия, ознакомившись с ходатайством, заняло принципиально иную позицию. Налоговый орган не возражал против выплаты 54 348,97 руб. за погашение требований второй очереди, но потребовал: jтказать в установлении процентов за погашение требований залогового кредитора в полном объеме и обязать управляющего вернуть в конкурсную массу уже выплаченные себе денежные средства в размере 9 555 636,94 руб.

Свою позицию уполномоченный орган обосновал следующим образом, опираясь на сложившуюся судебную практику:

—Отсутствие экстраординарного вклада. Выполненные конкурсным управляющим мероприятия по реализации заложенного имущества не выходили за пределы обычного функционала и являлись стандартными действиями. Поступление денежных средств было обусловлено исключительно стоимостью самого имущества, а не какими-то особыми усилиями управляющего.

—Отсутствие причинно-следственной связи. Мероприятия конкурсного производства, проведенные управляющим, не находились в причинно-следственной связи с погашением требований залогодержателя. Это прямая отсылка к правовой позиции ВС РФ, изложенной, в частности, в определении от 09.12.2024 № 307-ЭС24-13734[88].

—Нарушение баланса интересов. Реестр требований кредиторов удовлетворен не в полном объеме. Незалоговые кредиторы (включая ФНС с долгом 42,6 млн руб.) получили удовлетворение лишь в размере 1,28%, в то время как выплата испрашиваемых процентов легла бы бременем на конкурсную массу, за счет которой могли быть погашены их требования.

—Нарушение порядка выплаты. ФНС указала, что управляющий неправомерно, в нарушение разъяснений Пленума ВАС РФ, самостоятельно выплатила себе спорные проценты до их утверждения судом, что подтверждалось выписками по счету.

Данный спор наглядно демонстрирует, как общие принципы, сформулированные Верховным Судом (необходимость оценки личного вклада, недопустимость поощрения за результат, достигнутый без усилий управляющего), трансформируются в конкретные требования кредиторов о

[88] Определение Судебной коллегии по экономическим спорам Верховного Суда Российской Федерации от 09.12.2024 N 307-ЭС24-13734 по делу N А56-137087/201

снижении (или полном отказе в) вознаграждения и возврате уже выплаченных сумм.

Закономерность судебного подхода, направленного на оценку реального вклада управляющего, а не формальное применение математической формулы, еще более ярко проявилась в резонансном деле о банкротстве АО «Антипинский нефтеперерабатывающий завод» (дело № А70-8365/2019). Это дело, являющееся одним из крупнейших в российской практике банкротства, иллюстрирует реакцию судебной системы на попытку получения управляющим поистине беспрецедентного вознаграждения.

Обстоятельства дела (№ А70-8365/2019). В рамках банкротства АО «Антипинский НПЗ» с общим размером требований кредиторов около 250 млрд руб., конкурсный управляющий К. М. Сичевой в августе 2021 года обратился в суд с заявлением об установлении ему процентов по вознаграждению в размере 5 441 132 696,30 руб. Столь значительная сумма была рассчитана им в связи с реализацией единым лотом имущественного комплекса должника на торгах за 110,8 млрд руб., что позволило частично (на 98,65% от выручки) удовлетворить требования залоговых кредиторов - ПАО Сбербанк и ООО «СБК». Исчисленные по правилам ст. 20.6 и ограниченные 5% лимитом ст. 138 Закона о банкротстве проценты составили испрашиваемые 5,4 млрд руб. Суд первой инстанции удовлетворил заявление в полном объеме, формально применив закон[89].

Однако кредиторы, обжаловали это определение, настаивая на несоразмерности вознаграждения личному вкладу управляющего. Их позиция основывалась на том, что реализация залогового имущества единым лотом не требовала от управляющего экстраординарных усилий; ключевые действия по организации торгов и поиску покупателя фактически были совершены самими залоговыми кредиторами (выдавшими целевой кредит победителю торгов) и привлеченными специалистами, оплаченными из конкурсной массы; при этом у управляющего имелись нарушения, признанные судом (несвоевременное предоставление информации комитету кредиторов, привлечение к административной ответственности). Более того, на момент спора требования незалоговых кредиторов удовлетворены не были.

Суд апелляционной инстанции, изменяя определение суда первой инстанции, кардинально снизил размер вознаграждения до 200 000 000 руб., то есть более чем в 27 раз[90]. При этом суд руководствовался следующими ключевыми аргументами, развивающими правовые позиции Верховного Суда:

—Принцип встречности и соразмерности. Вознаграждение носит частноправовой характер (п. 1 ст. 328, ст. 783 ГК РФ). Управляющий, оказавший лишь часть услуг или выполнивший их не самостоятельно, не

[89] Определение Арбитражного суда Тюменской области от 15.06.2022 по делу № А70-8365/2019
[90] Постановление Восьмого арбитражного апелляционного суда от 22.07.2025 по делу № А70-8365/2019

вправе претендовать на полную выплату. Личный вклад управляющего должен быть оценен.

—Оценка личного вклада. Суд детально исследовал деятельность управляющего и установил, что значительный размер удовлетворенных требований обусловлен не его выдающимися усилиями, а стоимостью самого заложенного имущества. Работа по управлению заводом велась с использованием штатного персонала (юристов, бухгалтеров) за счет конкурсной массы, а ключевая роль в успешной реализации имущества принадлежала залоговым кредиторам.

—Применение нового пункта 18 ст. 20.6 Закона о банкротстве. Суд указал на наличие исключительных обстоятельств, позволяющих снизить вознаграждение при его явной несоразмерности вкладу управляющего.

—Сравнение с рыночными реалиями. Суд апелляционной инстанции провел примечательный анализ, сравнив запрошенную сумму с годовыми доходами топ-менеджеров крупнейших российских корпораций (Газпром, Роснефть, Сбербанк и др.), которые варьируются от 1 до 2 млрд руб., а также со средними зарплатами руководителей, подчеркнув, что вознаграждение управляющего является беспрецедентно высоким и несопоставимым с рынком труда. Доход бывших руководителей самого завода не превышал 15 млн руб. в год.

Определением Верховного Суда РФ от 16 января 2026 года кассационная жалоба конкурсного управляющего была оставлена без передачи для рассмотрения, тем самым высшая судебная инстанция фактически одобрила подход апелляционного и окружного судов о необходимости снижения явно несоразмерного вознаграждения[91].

Сравнение двух дел - скромного ООО «НПО «ФинТек» и гигантского АО «Антипинский НПЗ» - выявляет устойчивую закономерность: суды, руководствуясь разъяснениями Верховного Суда, последовательно отказываются от формального применения формулы расчета процентов в пользу оценки реального, личного и экстраординарного вклада управляющего в результат. В первом деле кредиторы требовали полностью отказать в выплате из-за отсутствия такого вклада, во втором - суд снизил сумму в 27 раз, мотивировав это в том числе действиями кредиторов и штатных сотрудников. Эта тенденция, с одной стороны, защищает интересы кредиторов и конкурсной массы, но с другой - создает высокую степень неопределенности для управляющих, которые не могут быть уверены в оплате своего труда даже после формально успешного завершения процедур.

Проведенный анализ позволяет сделать вывод о наличии системного кризиса в правовом регулировании статуса и вознаграждения арбитражного управляющего. Эклектичность статуса порождает противоречия, а

[91] Определение Верховного Суда РФ № 304-ЭС19-15074(69) от 16 января 2026 года по делу № А70-8365/2019

неадекватная система оплаты труда - снижение мотивации и отток квалифицированных кадров. Как показывает практика (дело ООО «НПО «ФинТек»), даже при успешной реализации имущества и формально правильном расчете, управляющий сталкивается с высокими рисками неполучения или возврата вознаграждения из-за субъективной оценки его вклада кредиторами и судом.

Попыткой комплексного решения этих проблем стал законопроект № 1034201-8, внесенный в Государственную Думу депутатом А. А. Вассерманом[92]. Помимо индексации вознаграждения, он предусматривал широкий круг изменений: введение института досудебной санации, совершенствование реабилитационных процедур, оптимизацию правил проведения торгов, отмену обязательной публикации сведений о банкротстве в печатных изданиях (газете «КоммерсантЪ») для сокращения издержек.

Однако законопроект столкнулся с серьезной оппозицией. В официальном заключении Правительства РФ от 20.11.2025 г. было указано, что многие его положения дублируют более ранний правительственный законопроект, а предлагаемый механизм санации имеет существенные недостатки, нарушая права кредиторов и государства. Ключевой критике подверглось предложение существенно ограничить ответственность арбитражных управляющих и СРО за причиненные убытки. По мнению Правительства, это не будет стимулировать управляющих к надлежащему исполнению обязанностей и снизит уровень правовой защищенности кредиторов. Также было отмечено, что реализация законопроекта потребует дополнительных расходов бюджета, источники которых не определены. Правовое управление Аппарата ГД также указало на это как на несоответствие требованиям ст. 104 Конституции РФ.

В итоге, 21 января 2026 года инициатор законопроекта А. А. Вассерман отозвал его из Государственной Думы. Это ярко иллюстрирует сложность поиска баланса между необходимостью повышения привлекательности профессии управляющего (путем увеличения и индексации вознаграждения) и опасениями законодателя относительно роста нагрузки на бюджет, снижения ответственности ключевых фигур банкротства и нарушения прав кредиторов. Отзыв законопроекта означает, что проблема неиндексируемого вознаграждения и сопутствующие ей системные противоречия остаются нерешенными на законодательном уровне.

В связи с этим представляются целесообразными следующие меры, частично нашедшие отражение в отозванном законопроекте, но требующие дальнейшей проработки с учетом позиции Правительства:

—Уточнение правового статуса. Необходимо законодательно закрепить публично-правовой характер ключевых полномочий арбитражного

[92] Законопроект № 1034201-8 «О внесении изменений в Федеральный закон «О несостоятельности (банкротстве)» // Система обеспечения законодательной деятельности Государственной автоматизированной системы «Законотворчество». – URL: https://sozd.duma.gov.ru/bill/1034201-8.

управляющего, назначенного судом, при сохранении частноправовой природы его хозяйственной деятельности. Это потребует внесения изменений в ст. 20 Закона о банкротстве.

—Реформирование порядка назначения. Внедрение автоматизированной системы случайного выбора кандидатуры управляющего из числа специалистов, соответствующих требованиям, для минимизации влияния кредиторов и обеспечения независимости. Это могло бы снизить риски ангажированности, которые не были учтены в дискуссии вокруг законопроекта № 1034201-8.

—Индексация фиксированного вознаграждения. Дополнить ст. 20.6 Закона о банкротстве нормой о ежегодной индексации фиксированных сумм вознаграждения с учетом официального уровня инфляции. Это позволит остановить прекаризацию профессии и обеспечить реальную независимость управляющих, как того требует Закон. При этом механизм индексации должен быть проработан таким образом, чтобы не создавать дополнительной нагрузки на конкурсную массу в ущерб кредиторам, возможно, с привязкой к минимальному размеру оплаты труда или иному экономическому показателю.

—Совершенствование механизма вознаграждения финансового управляющего в делах о банкротстве граждан. Представляется необходимым внедрение более гибкой системы оплаты, учитывающей сложность дела, длительность процедуры и объем имущества должника, а также предусмотреть дополнительные гарантии получения вознаграждения для минимизации рисков неоплаты услуг[93]. Перспективным видится анализ зарубежного опыта, в частности, **американской модели регрессивной шкалы**, где процент вознаграждения снижается с ростом стоимости конкурсной массы (25% до $5000, 10% до $50 000, 5% до $1 млн, 3% на сумму свыше), что обеспечивает баланс интересов. Также заслуживает внимания **английская система**, предлагающая вариативные способы расчета: процент от реализации, фиксированная сумма или почасовая оплата. Изучение этого опыта актуально для создания более сбалансированной системы стимулирования в российской практике.

Реализация этих предложений, **с учетом критических замечаний, высказанных в отношении законопроекта № 1034201-8**, будет способствовать гармонизации правового статуса арбитражного управляющего, созданию адекватных экономических стимулов для его работы и, в конечном счете, повышению эффективности института банкротства в целом.

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СОВРЕМЕННЫЕ ТЕХНОЛОГИИ УПРАВЛЕНИЯ ОРГАНИЗАЦИЕЙ

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РОЛЬ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В СТРАТЕГИЧЕСКОМ ПЛАНИРОВАНИИ ПРЕДПРИНИМАТЕЛЬСТВА И БИЗНЕСА

Аннотация. *В статье рассматривается влияние технологий искусственного интеллекта (ИИ) на процессы стратегического планирования в предпринимательской и бизнес-среде. Проанализированы ключевые направления применения ИИ: сбор и обработка больших массивов данных, машинное обучение и аналитика, прогнозирование рыночных тенденций, моделирование стратегических сценариев, а также мониторинг и корректировка реализуемой стратегии. Показано, что интеграция ИИ-инструментов позволяет существенно повысить скорость, точность и обоснованность управленческих решений, сократить издержки и обеспечить устойчивые конкурентные преимущества. Обозначены преимущества и риски использования ИИ-технологий, а также рассмотрены перспективы их применения в условиях Республики Узбекистан с учётом действующей стратегии цифровой трансформации.*

Ключевые слова: *искусственный интеллект, стратегическое планирование, предпринимательство, цифровая трансформация, машинное обучение, бизнес-аналитика, прогнозирование, управление.*

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THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN STRATEGIC PLANNING OF ENTREPRENEURSHIP AND BUSINESS

Abstract. *This article examines the impact of artificial intelligence (AI) technologies on strategic planning processes in the entrepreneurial and business*

environment. The study analyzes the key areas of AI application, including the collection and processing of large data sets, machine learning and analytics, forecasting market trends, modeling strategic scenarios, as well as monitoring and adjusting implemented strategies. It is demonstrated that the integration of AI tools significantly improves the speed, accuracy, and validity of managerial decision-making, reduces costs, and ensures sustainable competitive advantages. The article also identifies the advantages and risks associated with the use of AI technologies and considers the prospects for their application in the Republic of Uzbekistan within the framework of the current digital transformation strategy.

Keywords: *artificial intelligence, strategic planning, entrepreneurship, digital transformation, machine learning, business analytics, forecasting, management.*

Введение. В современных условиях ускоряющейся цифровой трансформации и усиления глобальной конкуренции традиционные подходы к стратегическому планированию всё чаще оказываются недостаточными для обеспечения устойчивого развития бизнеса. Возрастающий объём данных, повышенная волатильность рынков, изменчивость потребительских предпочтений и стремительное появление новых технологий требуют от предпринимателей и руководителей принципиально иных инструментов анализа и прогнозирования. В этих условиях технологии искусственного интеллекта становятся одним из наиболее значимых факторов трансформации управленческих практик.

Согласно исследованиям McKinsey Global Institute, к 2030 году вклад ИИ в мировой ВВП может составить порядка 13 трлн долларов США, при этом до 70 % компаний внедрят ту или иную форму интеллектуальных технологий в свою деятельность [1]. Аналогичные тенденции наблюдаются и в странах Центральной Азии: в Республике Узбекистан принята Стратегия развития технологий искусственного интеллекта на период до 2030 года, направленная на формирование национальной экосистемы ИИ и его широкое применение в государственном управлении и реальном секторе экономики [2].

Целью настоящего исследования является комплексный анализ роли технологий искусственного интеллекта в стратегическом планировании предпринимательства и бизнеса, выявление ключевых направлений их применения, преимуществ и ограничений, а также определение перспектив развития данной области в национальных экономических условиях.

Изученность темы исследования. Стратегическое планирование традиционно определяется как процесс формирования долгосрочных целей организации и разработки путей их достижения с учётом внутренних ресурсов и внешних условий [3]. Классический подход, восходящий к работам И. Ансоффа, М. Портера и Г. Минцберга, опирался на структурированный анализ отрасли, оценку конкурентной среды с использованием моделей «пяти

сил», SWOT- и PEST-анализа, формирование сценариев и выбор оптимальной стратегии.

Однако в XXI веке параметры внешней среды существенно изменились. Концепция VUCA-мира (volatility — изменчивость, uncertainty — неопределённость, complexity — сложность, ambiguity — неоднозначность) описывает условия, в которых классические инструменты планирования теряют значительную часть своей предсказательной ценности. На смену линейному стратегическому циклу приходит концепция адаптивной стратегии, предполагающая непрерывный мониторинг внешней среды и оперативную корректировку курса.

Цифровая трансформация принесла с собой беспрецедентный объём данных. По оценкам IDC, к 2025 году глобальный объём генерируемой информации достигнет 175 зеттабайт [4]. Обработка таких массивов невозможна без интеллектуальных инструментов, и именно здесь возможности ИИ раскрываются в наибольшей мере: системы машинного обучения способны выявлять закономерности, которые остаются недоступными для человеческого восприятия, и преобразовывать «сырые» данные в управленческую информацию.

Методология исследования. Исследование носит теоретико-обзорный характер и основано на комплексном анализе научной литературы, нормативных правовых актов и отраслевых аналитических отчётов. Применены методы системного и сравнительного анализа, классификации, обобщения и научной абстракции; для структурирования направлений применения искусственного интеллекта использован цикловой подход к стратегическому планированию. Источниковой базой послужили публикации международных консалтинговых компаний (McKinsey, IDC, BCG), монографии и статьи отечественных и зарубежных авторов, а также нормативные документы Республики Узбекистан, регулирующие цифровую трансформацию и развитие искусственного интеллекта. Выводы и обобщения сформулированы на основе синтеза теоретических положений и практики применения ИИ-инструментов в современных компаниях.

Результаты исследования. Под технологиями искусственного интеллекта понимается совокупность методов и алгоритмов, позволяющих компьютерным системам выполнять задачи, традиционно требовавшие участия человеческого интеллекта: распознавание образов, обработку естественного языка, принятие решений в условиях неопределённости, обучение на основе опыта. К ключевым направлениям ИИ, применимым в стратегическом управлении, относятся машинное обучение (включая обучение с учителем, без учителя и с подкреплением); глубокое обучение и нейронные сети, особенно эффективные при анализе больших и слабоструктурированных данных; обработка естественного языка для анализа текстовых источников — отзывов клиентов, публикаций СМИ, отчётности конкурентов; генеративный ИИ, обеспечивающий создание сценариев,

аналитических отчётов и проектов управленческих решений; компьютерное зрение для анализа визуальной информации, в том числе в логистике, ритейле и производственных процессах.

В отличие от традиционных средств бизнес-аналитики, ориентированных преимущественно на ретроспективное описание данных, ИИ-системы способны решать прогностические и предписывающие задачи, формируя рекомендации по конкретным управленческим действиям [5]. Это качественно меняет роль стратега: он перестаёт быть единственным интерпретатором данных и становится постановщиком задач, валидатором гипотез и арбитром между альтернативными моделями развития.

Таблица 1

Сравнение традиционного подхода и подхода на основе ИИ в стратегическом планировании

Критерий сравнения	Традиционный подход	Подход на основе ИИ
Источники данных	Внутренняя отчётность, опросы, экспертные оценки	Большие массивы внутренних, внешних и неструктурированных данных
Скорость обработки	Дни и недели	Часы и минуты, режим реального времени
Объём анализируемых данных	Ограниченные выборки	Сотни источников, миллионы записей
Тип аналитики	Преимущественно описательная и диагностическая	Описательная, диагностическая, предиктивная и прескриптивная
Прогнозирование	Линейные модели, экстраполяция	Нелинейные модели, нейронные сети, ансамблевые методы
Сценарное моделирование	Ограниченное число сценариев, экспертная оценка	Цифровые двойники, имитационные модели, тысячи вариантов
Корректировка стратегии	Периодическая (ежеквартально / ежегодно)	Непрерывная, в режиме обратной связи
Зависимость от человеческого фактора	Высокая	Существенно снижена

Как видно из данных таблицы 1, подход на основе искусственного интеллекта обеспечивает кардинальные преимущества по большинству ключевых параметров стратегического планирования. Принципиальное отличие заключается в переходе от ретроспективного описания к прогностической и предписывающей аналитике, а также от периодической корректировки стратегии — к непрерывному адаптивному управлению.

Анализ современной практики позволяет выделить пять основных направлений интеграции ИИ в процессы стратегического планирования. Эти направления образуют замкнутый цикл, в котором каждая стадия питает следующую и одновременно опирается на результаты предыдущих.

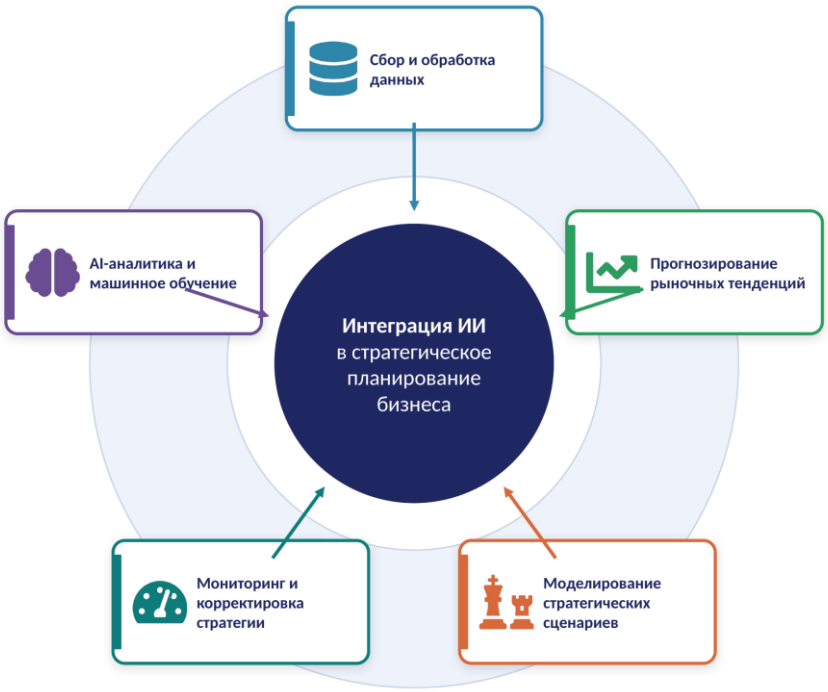

Рисунок 1 — Циклическая модель интеграции ИИ в стратегическое планирование бизнеса

На рисунке 1 представлены пять ключевых направлений интеграции искусственного интеллекта в стратегическое планирование, образующие замкнутый управленческий цикл. Сбор и обработка данных формируют фактическую базу; AI-аналитика и машинное обучение обеспечивают интерпретацию информации; прогнозирование рыночных тенденций задаёт ориентиры будущего развития; моделирование стратегических сценариев позволяет оценить альтернативы; мониторинг и корректировка стратегии замыкают цикл, обеспечивая адаптивную обратную связь.

Качество стратегических решений напрямую зависит от полноты и достоверности исходной информации. ИИ-системы автоматизируют сбор данных из разнородных источников: внутренних информационных систем (ERP, CRM, бухгалтерские системы), открытых источников (новости,

социальные сети, государственные реестры), специализированных баз данных и сенсорных систем. Алгоритмы машинного обучения позволяют очищать данные от ошибок и аномалий, унифицировать их форматы и формировать единое информационное пространство для принятия решений.

Аналитические возможности ИИ позволяют переходить от описательной аналитики (что произошло?) к диагностической (почему?), предиктивной (что произойдёт?) и прескриптивной (что следует делать?). Алгоритмы кластеризации помогают сегментировать клиентов и рынки, методы классификации — выявлять признаки оттока клиентов или дефолта контрагентов, регрессионные модели — оценивать факторы, влияющие на выручку и прибыль. Использование ансамблевых методов и нейронных сетей повышает устойчивость результатов и их применимость в реальных управленческих задачах.

Современные ML-модели (включая ансамбли деревьев решений, рекуррентные нейронные сети и архитектуру трансформеров) демонстрируют точность прогнозирования спроса, цен и других ключевых показателей, существенно превышающую традиционные эконометрические методы. Это позволяет компаниям заблаговременно адаптировать ассортиментную политику, ценообразование, логистические и производственные цепочки. Особенно ценным является способность ИИ-систем учитывать множество слабокоррелированных факторов и нелинейных эффектов, недоступных классическим линейным моделям.

Генеративный ИИ открывает принципиально новые возможности сценарного планирования. Цифровые двойники бизнеса, имитационные модели на основе агентного подхода и большие языковые модели позволяют тестировать управленческие гипотезы в виртуальной среде: оценивать последствия выхода на новый рынок, изменения ассортимента, ценовой стратегии, слияний и поглощений ещё до их реализации [6]. Возможность многократно «проиграть» альтернативные сценарии в безрисковой среде существенно повышает обоснованность принимаемых решений.

Интеллектуальные системы непрерывно отслеживают ключевые показатели эффективности (KPI), выявляют отклонения от целевых значений и сигнализируют о необходимости пересмотра стратегии. Алгоритмы поиска аномалий позволяют замечать слабые сигналы — потенциальные кризисы или возможности — задолго до того, как они становятся очевидными. Таким образом, стратегия превращается из жёсткого плана в живой, постоянно обновляемый документ, реагирующий на изменения внешней среды в режиме, близком к реальному времени.

Внедрение ИИ-инструментов в практику стратегического планирования сопряжено как с очевидными преимуществами, так и с определёнными рисками. К ключевым преимуществам относятся: значительное повышение скорости и качества управленческих решений; сокращение издержек на обработку данных и проведение анализа; снижение зависимости от

субъективных факторов; персонализация продуктов и услуг; расширение временного горизонта прогнозирования; формирование устойчивых конкурентных преимуществ за счёт уникальной аналитической базы.

Вместе с тем существует ряд ограничений. Во-первых, эффективность ИИ-моделей напрямую зависит от качества исходных данных — низкое качество данных приводит к ошибочным выводам по принципу «garbage in — garbage out». Во-вторых, многие современные модели (особенно на основе глубокого обучения) представляют собой «чёрный ящик», что затрудняет интерпретацию результатов и снижает доверие к ним со стороны управленцев. В-третьих, использование ИИ порождает новые риски: этические (предвзятость алгоритмов), юридические (защита персональных данных, авторские права), кибербезопасности и кадровые (необходимость новых компетенций как у разработчиков, так и у пользователей систем).

Особое внимание следует уделить ограничениям, связанным с малым и средним предпринимательством. Несмотря на снижение стоимости облачных ИИ-сервисов, многие СМП по-прежнему сталкиваются с дефицитом квалифицированных кадров, отсутствием стратегического видения цифровизации и недостаточной готовностью корпоративной культуры к работе с данными [7]. Это формирует «цифровой разрыв» между крупным и малым бизнесом, который требует целенаправленных мер государственной поддержки.

Таблица 2

Преимущества и ограничения применения ИИ в стратегическом планировании

Преимущества применения ИИ	Ограничения и риски
Повышение скорости и качества управленческих решений	Зависимость от качества и полноты исходных данных
Сокращение издержек на обработку информации	Эффект «чёрного ящика» сложных моделей
Снижение влияния субъективных факторов	Предвзятость алгоритмов (algorithmic bias)
Персонализация продуктов и услуг	Угрозы кибербезопасности и утечки данных
Расширение временного горизонта прогноза	Юридические риски (защита персональных данных)
Формирование устойчивых конкурентных преимуществ	Дефицит компетенций и кадровый разрыв

Преимущества применения ИИ	Ограничения и риски
Возможность непрерывного мониторинга стратегии	Высокие первоначальные инвестиции для СМП

Систематизация преимуществ и ограничений, представленная в таблице 2, показывает, что наряду со значительными управленческими выгодами внедрение ИИ-инструментов формирует новый контур рисков, требующих специальной системы управления. Особенно чувствительными к этим рискам остаются субъекты малого и среднего предпринимательства, что обусловливает необходимость целенаправленной государственной поддержки.

В Республике Узбекистан в последние годы реализуется комплекс мер, направленных на формирование национальной экосистемы искусственного интеллекта. Постановление Президента «О мерах по созданию условий для ускоренного внедрения технологий искусственного интеллекта» определяет приоритетные направления развития ИИ в государственном секторе, образовании, здравоохранении, сельском хозяйстве и промышленности. В рамках национальной стратегии цифрового развития «Цифровой Узбекистан — 2030» предусмотрено формирование цифровой инфраструктуры, повышение цифровой грамотности населения и стимулирование внедрения ИИ в реальном секторе экономики.

Для отечественного предпринимательства интеграция ИИ-технологий в стратегическое планирование открывает возможности повышения конкурентоспособности на региональных рынках, выхода на экспортные рынки, оптимизации цепочек поставок и эффективного управления ресурсами. Особенно перспективным представляется применение ИИ в строительной отрасли, агропромышленном комплексе, текстильной промышленности и сфере услуг, где традиционно высока доля субъектов малого и среднего предпринимательства [8]. Развитие соответствующей инфраструктуры — образовательных программ, центров компетенций, грантовых механизмов — должно стать предметом скоординированной государственной политики.

Заключение и выводы. Проведённый анализ показывает, что технологии искусственного интеллекта формируют качественно новую среду стратегического планирования предпринимательства и бизнеса. ИИ обеспечивает переход от эпизодических управленческих циклов к непрерывному адаптивному планированию, основанному на анализе больших данных и предиктивных моделях. Пять выделенных направлений интеграции — сбор и обработка данных, AI-аналитика и машинное обучение, прогнозирование рыночных тенденций, моделирование стратегических сценариев, мониторинг и корректировка стратегии — образуют замкнутый цикл, обеспечивающий устойчивые конкурентные преимущества.

Эффективная интеграция ИИ требует комплексного подхода: формирования качественной информационной базы, инвестиций в кадровый потенциал, развития цифровой инфраструктуры и совершенствования регуляторной среды. Дальнейшие исследования целесообразно сосредоточить на отраслевых особенностях внедрения ИИ-инструментов, разработке методик оценки экономической эффективности их применения, а также на изучении влияния ИИ на конкретные секторы экономики Республики Узбекистан, прежде всего на малое и среднее предпринимательство.

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