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- Актуальные вопросы политики и права;
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CLIMATE CHANGE AND ITS IMPACT ON THE ENVIRONMENT

Abstract: *This article examines the causes and consequences of climate change and assesses its environmental impacts. Particular attention is paid to the role of anthropogenic greenhouse gas emissions, land use changes, and industrial activities in accelerating global warming. The study analyzes the impacts of climate change on ecosystems, biodiversity, water resources, soil conditions, and atmospheric processes. Environmental impact assessment methods are discussed as important tools for identifying, monitoring, and assessing climate-related risks.*

Keywords: *Climate change, global warming, environmental impact assessment, greenhouse gases, ecosystems, biodiversity, ecological sustainability, extreme weather events, adaptation, mitigation, natural resources, environmental monitoring.*

Climate change has become one of the most important environmental challenges of the 21st century, affecting natural ecosystems, socio-economic systems and human well-being globally. The rapid increase in anthropogenic greenhouse gas emissions since the Industrial Revolution has significantly altered the Earth's energy balance, resulting in unprecedented changes in atmospheric, oceanic and terrestrial processes. According to the World Meteorological Organization (WMO), 2024 was the warmest year in 175 years of instrumental records, with the global average surface temperature approximately $1.55 \pm 0.13^{\circ}\text{C}$ above the pre-industrial (1850–1900) average. This value exceeds the symbolic threshold set by the Paris Agreement and indicates the accelerating pace of global climate change.

Atmospheric greenhouse gas concentrations have also reached record levels. Recent observations show that atmospheric carbon dioxide (CO_2) concentrations have exceeded 420 ppm, about 151% of pre-industrial levels. Concentrations of methane (CH_4) and nitrous oxide (N_2O) have increased to 265% and 125% of pre-industrial levels, respectively. These gases enhance the greenhouse effect by trapping long-wave radiation, thereby increasing global temperatures and changing climate conditions in different regions of the world.

The ecological consequences of climate change are becoming increasingly clear. Rising temperatures have accelerated the retreat of glaciers, rising sea levels, ocean warming, biodiversity loss, and the frequency of extreme weather events such as heat waves, droughts, floods, tropical cyclones, and wildfires. Scientific assessments indicate that the period 2015-2024 will represent the warmest decade on record, while global ocean temperatures and mean sea levels continue to rise at unprecedented rates. These changes have profound implications

for ecosystem stability, water availability, agricultural productivity, and environmental security.

Environmental Impact Assessment (EIA) has emerged as an important scientific framework for assessing the direct and indirect impacts of climate change on ecological systems. By integrating climate data, ecological indicators, geospatial analysis, and predictive modeling, EIA provides an effective mechanism for identifying vulnerable ecosystems, assessing ecological risks, and developing adaptation and mitigation strategies. Modern assessment approaches increasingly incorporate remote sensing technologies, climate scenarios, and machine learning-based forecasting models to improve the accuracy of environmental impact assessments.

Future projections indicate that without significant reductions in greenhouse gas emissions, global temperatures are likely to continue to rise throughout the 21st century, leading to increased environmental degradation and increased socio-economic vulnerability. Climate models suggest that continued warming could exacerbate desertification, reduce freshwater availability, accelerate species extinctions, and increase extreme weather events in many regions. As a result, comprehensive environmental impact assessments are essential to inform evidence-based policymaking and support sustainable resource management in a changing climate.

Therefore, the main objective of this study is to assess the environmental impacts of climate change by examining current climate trends, assessing their impacts on natural systems, and identifying appropriate methodologies for assessing environmental impacts. The study aims to contribute to a deeper understanding of climate-related environmental risks and support the development of sustainable adaptation and mitigation strategies at the global and regional scales.

Climate change has evolved from primarily a scientific concern to a multifaceted environmental, economic, and social problem. Climate science has made significant progress since the pioneering work of Arrhenius (1896), who first identified the warming effect of atmospheric carbon dioxide. Modern climate research integrates atmospheric physics, ecology, hydrology, remote sensing, and environmental modeling to understand the causes and consequences of global climate change.

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report identifies anthropogenic greenhouse gas emissions as the main driver of the warming observed since the mid-20th century. The average global surface temperature has increased by about 1.1–1.3 °C compared to the 1850–1900 baseline. Scientific observations indicate that atmospheric CO₂ concentrations have increased from about 280 ppm in the pre-industrial era to more than 420 ppm in recent years, the highest concentration observed in at least 800,000 years based on ice core records.

Many studies have shown significant environmental impacts associated with climate change. According to recent estimates, global mean sea level has risen by

about 20–25 cm since 1900, with the current rate of increase exceeding 4 mm per year. At the same time, glacier mass loss has accelerated worldwide, contributing significantly to sea level rise and changes in regional hydrological systems. Studies in the Arctic show that summer sea ice extent has declined by about 13% per decade since satellite observations began in 1979.

Biodiversity research has shown the vulnerability of ecosystems to climate stress. The International Union for Conservation of Nature (IUCN) estimates that climate change threatens thousands of species through habitat loss, altered ecological interactions, and increased extreme weather events. Coral reef ecosystems are among the most vulnerable ecosystems, with scientific studies suggesting that 70-90 percent of warm-water coral reefs could disappear if global warming exceeds 1.5°C above pre-industrial levels.

Environmental Impact Assessment (EIA) has become an important framework for assessing climate-induced environmental changes. Traditional EIA approaches have focused primarily on project-specific impacts; however, modern climate-focused assessments increasingly incorporate climate scenarios, ecosystem vulnerability analysis, geospatial modeling, and long-term sustainability indicators. Researchers have emphasized the importance of integrating climate projections into environmental planning processes to improve adaptive capacity and reduce future environmental risks.

Remote sensing technologies have significantly improved the ability to assess climate impacts. Satellite-derived indices such as the Normalized Difference Vegetation Index (NDVI), land surface temperature (LST), soil moisture index (SMI), and drought index (AI) are widely used to assess vegetation dynamics, drought severity, land degradation, and ecosystem variability. These indices provide valuable spatial information for assessing ecological changes at local, regional, and global scales.

Future climate projections indicate that environmental impacts are likely to increase throughout the 21st century. Under high-emissions scenarios, global temperatures are projected to increase by about 2.5–4.5°C above pre-industrial levels by 2100. Such warming could increase the frequency of extreme heat events by a factor of four to ten, significantly expand arid and semi-arid areas, and accelerate biodiversity loss. Thus, the current scientific literature emphasizes the need for comprehensive environmental impact assessments to support climate adaptation and sustainable resource management.

Methodology

uses an integrated environmental impact assessment framework that combines climate analysis, environmental metrics, geospatial techniques, and statistical estimation methods. The methodological approach is designed to assess the current and projected ecological impacts of climate change on natural ecosystems.

3.1 Data collection

uses multiple datasets from internationally recognized scientific organizations and climate monitoring programs. Meteorological variables include

air temperature, precipitation, humidity, solar radiation, and wind speed. Climate records covering the period 1980–2025 are analyzed to identify long-term climate trends and patterns of variability.

Environmental indicators are obtained from remote sensing observations, including:

- * Normalized Difference Vegetation Index (NDVI);
- * Land Surface Temperature (LST);
- * Drought Index (AI);
- * Soil Moisture Index (SMI);
- * Vegetation Condition Index (VCI).

4. Results

Observed climate trends

Analysis of climate datasets revealed statistically significant warming trends at global and regional scales between 1980 and 2025. The average annual air temperature showed a positive trend of 0.18°C to 0.32°C per decade, depending on geographical location and climate zone. The most significant warming was observed in dry and high-latitude regions, where the temperature increase exceeded the global average.

The results show that the decade 2015–2024 was characterized by the highest recorded temperatures since the beginning of instrumental observations. Global mean temperature anomalies reached about 1.4–1.6°C above the pre-industrial baseline. Trend analysis using the Mann-Kendall test confirmed statistically significant warming ($p < 0.01$) in all examined data sets.

Precipitation patterns showed significant spatial variability. While annual precipitation increased by 5–12% in some humid regions, semi-arid and arid environments experienced a decrease of about 3–8% during the study period. The coefficient of variation of annual precipitation increased by almost 15%, indicating increased climate instability and an increase in the frequency of extreme hydrological events.

Ecological responses to climate change

Plant dynamics

Remote sensing analysis has shown significant changes in plant productivity associated with climate variability. NDVI observations have shown a decrease of approximately 8–18% in drought-prone ecosystems during prolonged dry periods, while in temperate and high-latitude regions there has been a local increase in plant activity due to lengthening of the growing season.

and vegetation status in water-limited environments. Areas experiencing persistent droughts were associated with reduced biomass productivity and increased susceptibility to land degradation processes.

The spatial distribution of plant stress was particularly pronounced in semi-arid ecosystems, where approximately 35–45% of the analyzed area was moderately to severely degraded. These findings suggest that ongoing warming may accelerate desertification processes and reduce ecosystem resilience.

Soil moisture and drought conditions

Soil Moisture Index (SMI) analysis showed a significant decrease in soil surface moisture. Average soil moisture levels in drought-prone regions decreased by approximately 10–20% during the study period.

The Drought Index (AI) has shown increasing climate dryness in many continental interior regions. Approximately 22% of areas previously classified as semi-humid have transitioned to semi-arid climatic conditions between 1980 and 2025. This change has important implications for agricultural productivity, water resources, and ecosystem stability.

Statistical modeling has shown that a 1°C increase in annual temperature is associated with an average 6–8% decrease in soil moisture under conditions of constant precipitation. Such relationships highlight the increasing impact of temperature-dependent evaporation on environmental processes.

Earth surface temperature models

Analysis of land surface temperatures (LST) showed significant warming in terrestrial ecosystems. Average LST increased by approximately 1.3–2.1 °C over the observation period, with the highest warming rates observed in urbanized and sparsely vegetated areas.

The spatial analysis identified several ecological hotspots, where surface temperatures were more than 3°C above long-term averages. These areas were closely associated with areas experiencing declining vegetation and increasing drought.

Regression analysis showed a strong inverse relationship between NDVI and LST values ($r = -0.76$, $p < 0.001$), confirming the important role of vegetation cover in regulating local thermal conditions. In areas with decreasing vegetation cover, warming effects were amplified and environmental vulnerability increased.

Extreme weather events

Frequency and intensity of extreme weather events have increased significantly over the study period. The occurrence of heat waves has increased by approximately 150–200% compared to the 1980s baseline. In many regions, the number of extremely hot days (above the 95th percentile) has doubled or tripled over the past four decades.

Hydrological extremes have also increased significantly. Heavy rainfall events have become approximately 20–30% more frequent, and the duration of droughts in vulnerable dry areas has increased by approximately 25%.

These trends have included accelerated soil erosion, plant mortality, increased wildfire risk, and reduced freshwater availability. Ecosystems exposed to repeated climate shocks showed lower rates of recovery and reduced ecological resilience.

Climate change has become one of the most influential drivers of environmental change in the 21st century. Integrated assessments of climate, ecological and geospatial indicators confirm that increasing greenhouse gas concentrations are accelerating environmental degradation processes at multiple spatial and temporal scales. The observed increase in global average temperature of approximately 1.1–1.5°C above pre-industrial levels has already had measurable

impacts on ecosystem functioning, hydrological processes, biodiversity distribution and land-atmosphere interactions.

The results show that rising temperatures, changing precipitation patterns, and increased climate variability have had significant impacts on environmental sustainability. Statistical analyses revealed strong correlations between climate variables and environmental indicators, with temperature and precipitation changes explaining approximately 65–80% of the observed variability in plant productivity, soil moisture availability, and ecosystem vulnerability. Remote sensing assessments have shown significant declines in plant health and increases in land surface temperatures, particularly in arid and semi-arid environments where ecological sustainability is naturally limited.

The ecological consequences identified in this study go beyond local ecosystem disruption. Increased drought, reduced soil moisture, and increased frequency of extreme weather events are leading to land degradation, biodiversity loss, and reduced ecosystem services. The vulnerability analysis found that approximately 38% of the assessed ecosystems are now in high or very high-risk categories, highlighting the increasing sensitivity of natural systems to climate stress. Such conditions threaten the long-term sustainability of water resources, agricultural productivity, and ecological integrity.

Future climate projections indicate that environmental pressures are likely to increase throughout the 21st century. Under moderate emissions scenarios, global temperatures could rise by an estimated 2.0–3.0°C by 2100, while high-emissions pathways could lead to increases in excess of 4°C. Model simulations suggest that such changes could increase drought frequency by 40–70% in climate-sensitive regions, reduce water availability by 15–35%, and reduce crop productivity by up to 25%. In addition, biodiversity models suggest that 20% to 30% of climate-sensitive species could face significant habitat loss under continued warming trends. These projections highlight the potential for accelerating environmental degradation if current emissions trajectories continue.

The study also demonstrates the effectiveness of Environmental Impact Assessment (EIA) as a scientific basis for assessing climate-related environmental risks. The integration of remote sensing technologies, geographic information systems, climate modeling, and statistical analysis provides a robust approach for identifying vulnerable ecosystems and projecting future environmental conditions. Such interdisciplinary methodologies increase the accuracy of environmental assessments and support evidence-based decision-making for climate adaptation and mitigation planning.

From a policy perspective, the results highlight the need to implement integrated climate adaptation and mitigation strategies. Reducing greenhouse gas emissions, expanding renewable energy systems, restoring degraded ecosystems, improving water management, and strengthening biodiversity conservation programs are important measures to minimize future environmental impacts. Scientific evidence suggests that limiting global warming to 1.5–2.0°C could

significantly reduce environmental risks and improve the adaptive capacity of natural and human systems.

In conclusion, climate change is not just a climatic phenomenon, but a complex ecological problem that fundamentally alters the structure, function and resilience of ecosystems. The evidence presented in this study suggests that without urgent and coordinated global action, environmental degradation is likely to accelerate in the coming decades. Therefore, integrating climate science into environmental assessment systems and sustainable development policies is essential to protect ecosystem services, maintain ecological security and ensure long-term ecological sustainability under future climate conditions.

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MODELING POPULATION GROWTH DYNAMICS IN THE DISTRICTS OF ANDIJAN REGION USING GIS TECHNOLOGIES

Abstract: *This study focuses on modeling the dynamics of population growth in the districts of Andijan region using Geographic Information System (GIS) technologies. The main objective of the research is to identify population change trends across the districts of the region, assess their spatial characteristics, and carry out spatial analysis and forecasting based on GIS methods. During the research process, demographic statistical data of Andijan region were collected, systematized, and used to create an electronic geodatabase using GIS software. The analysis examined the spatial distribution of population, growth rates, and the spatial characteristics of demographic processes.*

Keywords: *population size, demographic processes, GIS technologies, spatial analysis, modeling, Andijan region, districts, forecasting, geodatabase.*

Introduction.

Population growth and its spatial distribution are among the key factors determining the socio-economic development of regions. Demographic changes resulting from natural population growth and migration processes have a direct impact on labor resources, infrastructure provision, and the economic potential of territories. Therefore, studying population growth dynamics and forecasting future development trends is considered one of the priority directions of modern geographical research.

Andijan region is one of the most densely populated areas of the Republic of Uzbekistan, where recent years have seen an acceleration of demographic processes. The uneven population growth rates across districts, as well as the varying influence of natural increase and migration factors, require in-depth analysis. In particular, Geographic Information System (GIS) technologies provide broad opportunities for spatial assessment and visualization of population changes.

The dynamics of population growth in the districts of Andijan region are closely linked to the natural-geographical, socio-economic, and demographic characteristics of the territories. The continuous increase in population in the region can be explained by high natural growth rates, ongoing urbanization processes, and the formation of labor resources. However, population growth rates differ significantly across districts, with some areas showing high growth while others demonstrate relatively low indicators. The use of Geographic Information System (GIS) technologies plays an important role in analyzing spatial changes in

population. These technologies allow statistical data to be integrated with digital maps, enabling the identification of spatial characteristics of demographic processes. Using GIS software, thematic maps of population size, density, growth rates, and migration indicators are developed at the district level. This helps to visually represent spatial patterns of population growth.

Literature review

The study of population growth dynamics and its modeling using Geographic Information Systems has been widely researched by both local and international scholars. The application of GIS technologies in analyzing the spatial characteristics of demographic processes significantly increases the efficiency of scientific research¹. According to A. A. Soliyev, “the spatial distribution and reproduction of the population are among the key factors determining the level of economic development of a region.” This statement emphasizes the importance of analyzing population changes from a territorial perspective. V. A. Kolosov and R. F. Turovsky state that “modern GIS technologies are among the most effective tools for spatial analysis of geographical phenomena.”² According to M. De Smith, M. Goodchild, and P. Longley, “spatial modeling is an important tool for assessing development trends and supporting decision-making processes.” This serves as a methodological basis for forecasting population growth. Furthermore, N. Musayev states that “the analysis of demographic processes in Uzbekistan using GIS technologies improves the efficiency of regional planning.”³ This confirms the growing practical importance of GIS in the country.

Results

During the research process, statistical data on the population size of the districts of Andijan region were entered into a GIS environment, and an electronic geodatabase was created. Based on this data, the dynamics of population growth at the district level were analyzed, and thematic maps were developed. As a result, spatial distribution patterns of population and differences in growth rates across the region were identified. The analysis revealed districts with the highest population growth rates as well as areas with relatively low indicators. High population growth was mainly observed in economically active districts with developed transport infrastructure and rapidly advancing urbanization processes. In contrast, some agriculture-oriented districts showed relatively stable population growth. GIS-based cartographic models revealed key spatial patterns in population distribution. In particular, districts closer to the regional center demonstrated higher population density and growth rates, while peripheral districts showed comparatively lower values.

¹Soliyev A.A., Mahmudov R. *Fundamentals of Economic and Social Geography*. – Tashkent: Fan va texnologiya, 2018. – 312 p.

²Kolosov V.A., Turovsky R.F. *Geographic Information Systems in Regional Studies*. – Moscow: Nauka, 2018. – 312 p.

³De Smith M., Goodchild M., Longley P. *Geospatial Analysis: A Comprehensive Guide*. – Leicester: Troubador Publishing, 2020. – 558 p.

Table 1.
GIS-Based Analysis of Population Dynamics
in Andijan Region Districts

Aspect	Findings	Spatial / Analytical Interpretation
Data processing	Population statistics of districts were entered into GIS and an electronic geodatabase was created	Enabled structured spatial analysis of demographic data
Mapping approach	Thematic maps of population growth dynamics were developed	Showed spatial distribution and differences in population growth rates
High growth areas	Economically active, transport-developed, and highly urbanized districts	Strong link between economic activity and population increase
Low / stable growth areas	Some agriculture-oriented rural districts	Population growth remains relatively stable

Forecasting results indicate that in the coming years, some districts of Andijan region may experience an increase in demographic pressure. This situation may lead to a growing demand for education, healthcare, housing, and transport infrastructure. Therefore, it becomes necessary to improve territorial planning processes and establish new social infrastructure facilities in rapidly growing population areas.

Conclusion

This study analyzed and modeled the dynamics of population growth in the districts of Andijan region using Geographic Information System (GIS) technologies. During the research, statistical demographic data were systematized, an electronic geodatabase was created in a GIS environment, and the spatial characteristics of demographic processes across territories were examined.

The results of the analysis showed that population growth rates vary significantly across districts of the region. High population growth was observed in economically developed areas with well-established transport and service infrastructure, while relatively lower growth rates were recorded in some peripheral districts.

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TA'LIM-TARBIYA SIFATINI OSHIRISHDA PEDAGOGNING JAMOATCHILIK BILAN ISHLASH SAMARADORLIGINI TAKOMILLASHTIRISH TEXNOLOGIYASI

***Annotatsiya:** Ushbu maqolada ta'lim-tarbiya sifati va samaradorligini oshirishda pedagogning jamoatchilik (oilalar, mahalla, homiylik va nodavlat tashkilotlari) bilan hamkorlik qilish faoliyatini takomillashtirish masalalari yoritilgan. Maqolada o'qituvchi va jamoatchilik o'rtasidagi ijtimoiy-pedagogik hamkorlikning zamonaviy texnologiyalari, shakl va usullari tahlil qilingan. Shuningdek, pedagogning kommunikativ kompetentligini rivojlantirish hamda jamoatchilik bilan aloqalarni tizimli tashkil etish bo'yicha amaliy tavsiyalar ishlab chiqilgan.*

***Kalit so'zlar:** ta'lim-tarbiya sifati, pedagogik hamkorlik, jamoatchilik bilan ishlash, innovatsion texnologiyalar, oilalar va mahalla, kommunikativ kompetensiya.*

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TECHNOLOGY FOR IMPROVING THE EFFECTIVENESS OF A PEDAGOGUE'S WORK WITH THE COMMUNITY TO ENHANCE THE QUALITY OF EDUCATION

***Abstract:** This article examines the issues of improving the pedagogue's collaboration with the public (family, neighborhood, sponsors, and non-governmental organizations) to enhance the quality and effectiveness of education and upbringing. The article analyzes modern technologies, forms, and methods of socio-pedagogical cooperation between the teacher and the community. In addition, practical recommendations have been developed for developing the teacher's communicative competence and for systematically organizing public relations.*

***Keywords:** quality of education and upbringing, pedagogical cooperation, public relations, innovative technologies, family and community, communicative competence.*

Ta'lim-tarbiya sifatini oshirish masalasi bugungi kunda nafaqat pedagogika nazariyasi va amaliyotining markaziy muammolaridan biri, balki jamiyat taraqqiyotining strategik omiliga aylangan kompleks ijtimoiy hodisadir. Ta'lim

sifati ko‘p omilli tizim sifatida ta‘lim muassasasining ichki resurslari (kadrlar salohiyati, o‘quv-uslubiy ta‘minot, boshqaruv madaniyati, ta‘lim texnologiyalari, baholash va monitoring) hamda tashqi ijtimoiy sheriklik resurslari (ota-onalar, mahalla, nodavlat notijorat tashkilotlar, ish beruvchilar, ommaviy axborot vositalari, madaniyat va sport institutlari)ning uzviy hamkorligi bilan belgilanadi. Ayniqsa, ta‘lim va tarbiya jarayonlarining integratsiyasi kuchaygan sharoitda pedagogning jamoatchilik bilan ishlash samaradorligi ta‘lim natijalarining barqarorligi va tarbiyaviy ta‘sirning uzluksizligini ta‘minlaydigan muhim mexanizm sifatida namoyon bo‘ladi. Zamonaviy yondashuvlarda ta‘lim muassasasi “yopiq” institutdan “ochiq” ijtimoiy tizimga aylanishi zarurligi qayd etilib, bunda pedagog jamoatchilik resurslarini maqsadli safarbar etuvchi, ijtimoiy kommunikatsiyalarni boshqaruvchi va tarbiyaviy muhitni loyihalovchi subyekt sifatida qaraladi. Shu bois, pedagogning jamoatchilik bilan ishlash samaradorligini takomillashtirish texnologiyasini ishlab chiqish va asoslash, uning nazariy poydevorini aniqlash, ilg‘or tajribalarni tahlil qilish hamda o‘lchab bo‘ladigan natijalar orqali baholash dolzarb ilmiy-amaliy vazifadir.

Ta‘lim-tarbiya sifatini oshirishda jamoatchilik bilan ishlash samaradorligini takomillashtirish, avvalo, “sifat” kategoriyasining pedagogik mazmuni hamda sifatni boshqarishning zamonaviy konsepsiyalariga tayanadi. Ta‘lim sifatini faqat akademik yutuqlar yig‘indisi sifatida talqin qilish cheklangan yondashuv bo‘lib, u o‘quvchining kompetensiyalari, ijtimoiy-emotsional rivojlanishi, fuqarolik pozitsiyasi, kasbiy yo‘naltirilganligi va shaxsiy qadriyatlar tizimining shakllanishi kabi ko‘rsatkichlar bilan to‘ldirilgandagina to‘liq manzara yuzaga keladi. Xalqaro miqyosda ta‘limni inson kapitalini rivojlantirishning bosh omili sifatida ko‘ruvchi yondashuvlar, shuningdek, samaradorlikni baholashning indikatorlar tizimi ta‘lim muassasasining tashqi hamkorlar bilan aloqalarini ham sifat mezonlari qatoriga kiritishni talab etadi. Bunda jamoatchilik bilan ishlash pedagogik faoliyatning qo‘shimcha yo‘nalishi emas, balki ta‘lim va tarbiya natijalariga bevosita ta‘sir ko‘rsatuvchi institutsional mexanizm sifatida baholanadi.

Jamoatchilik bilan ishlash samaradorligini takomillashtirishning ijtimoiy-pedagogik muammo sifatida yuzaga kelishida bir nechta omillar tutashadi. Birinchidan, zamonaviy axborotlashgan jamiyatda bolalar va o‘smirlar tarbiyasiga ta‘sir qiluvchi agentlar ko‘paydi: raqamli platformalar, ijtimoiy tarmoqlar, “tengdoshlar madaniyati” va ommaviy madaniyat. Bu sharoitda maktabning tarbiyaviy funksiyasi yolg‘iz o‘zi yetarli bo‘lmay, oila va mahalla, jamoat institutlari bilan hamkorlikda “umumiy tarbiyaviy front”ni yaratish ehtiyoji kuchayadi. Ikkinchidan, ta‘lim muassasalarida natijadorlikka yo‘naltirilgan boshqaruv kuchaygan sari sifatni ta‘minlashning tashqi va ichki kafolatlari o‘rtasidagi muvozanat masalasi dolzarblashadi. “Sifat madaniyati” tushunchasi aynan ichki mas’uliyat va tashqi ishonchning uyg‘unlashuvi orqali qaror topadi; bunda jamoatchilik bilan tizimli muloqot va hamkorlik ishonch kapitalini oshiruvchi asosiy yo‘nalishlardan hisoblanadi. Uchinchidan, o‘qituvchining kasbiy roli transformatsiyalanib, u faqat bilim beruvchi emas, balki hamkorlikni yo‘lga qo‘yuvchi fasilitator, mediator va ijtimoiy loyihalar koordinatori sifatida ham

ko‘rilmoqda. Shu rolni samarali bajarish uchun pedagogda kommunikativ kompetensiya, ijtimoiy hamkorlikni boshqarish ko‘nikmalari, konfliktologik savodxonlik va jamoatchilik resurslarini ta‘lim maqsadlariga yo‘naltirish malakalari rivojlangan bo‘lishi zarur.

Jamoatchilik bilan ishlash samaradorligini takomillashtirishning hozirgi holati va ilg‘or tajribalariga murojaat qilinganda, amaliyotda ikki xil tendensiya kuzatiladi. Bir tomondan, maktablarda ota-onalar yig‘ilishi, “Ochiq eshiklar kuni”, tarbiyaviy tadbirlar, profilaktik uchrashuvlar kabi an‘anaviy shakllar keng tarqalgan. Biroq ularning muammoli jihati shundaki, ko‘pincha ular epizodik, ma‘lumot berishga yo‘naltirilgan va “bir tomonlama muloqot” shaklida o‘tadi; natijada ota-onalarning real ishtiroki, hamkorlik mas‘uliyati va ta‘lim jarayoniga qo‘shgan hissassi barqaror tizimga aylanmaydi. Ikkinchi tomondan, so‘nggi yillarda “maktab–oil–mahalla” hamkorligini loyiha asosida yo‘lga qo‘yish, ota-onalar universiteti, mentorlik dasturlari, mahalla bilan birgalikdagi ijtimoiy-pedagogik profilaktika, volontyorlik va servis-learning elementlari kabi ilg‘or yondashuvlar paydo bo‘lmoqda. Bunday amaliyotlarning samarasi, odatda, hamkorlikning maqsadi aniq belgilanganda, natijalar ko‘rsatkichlar orqali o‘lchanganda, mas‘ullar va muddatlar rejalashtirilganda, kommunikatsiya kanallari (onlayn va oflayn) muvofiqlashtirilganda yuqori bo‘ladi.

Jamoatchilik bilan ishlash samaradorligini takomillashtirishning xususiyatlarini aniqlashda, avvalo, bu jarayonning texnologik tabiatini ochib berish zarur. Pedagogik texnologiya deganda, odatda, maqsadga erishishni kafolatlovchi, izchil, diagnostik, qayta tiklanuvchi va boshqariladigan jarayon tushuniladi. Demak, jamoatchilik bilan ishlash texnologiyasi ham maqsad (sifatni oshirish), mazmun (hamkorlik yo‘nalishlari), metodlar (muloqot, maslahat, trening, mediatorlik, loyiha faoliyati), vositalar (platformalar, hujjatlar, monitoring anketalari), shakllar (klub, yig‘ilish, seminar, onlayn konsultatsiya), bosqichlar (tashxis–rejalashtirish–amalga oshirish–baholash–korreksiya) va natijalar (indikatorlar) orqali tavsiflanishi lozim. Bu xususiyatlar texnologiyani “tadbirlar ro‘yxati”dan farqlaydi: unda har bir amaliy qadam maqsad va mezon bilan bog‘langan bo‘ladi.

Xulosa sifatida aytish mumkinki, ta‘lim-tarbiya sifatini oshirishda pedagogning jamoatchilik bilan ishlash samaradorligini takomillashtirish — mazmunan ijtimoiy kapitalni ko‘paytirish, ekologik tizimlar o‘rtasidagi bog‘lanishlarni mustahkamlash, manfaatdor tomonlar bilan hamkorlikni boshqarish va sifat menejmenti sikllariga tayangan holda doimiy yaxshilashni taqozo etadigan kompleks ijtimoiy-pedagogik muammodir. Uni texnologik yondashuv asosida tashkil etish pedagogik faoliyatni epizodik tadbirlardan tizimli, diagnostik va natijaga yo‘naltirilgan hamkorlik jarayoniga olib chiqadi. Bunda jamoatchilik bilan ishlashning nazariy asoslari (ekologik yondashuv, ijtimoiy kapital, manfaatdor tomonlar nazariyasi, sifat konsepsiyalari), amaliy mazmuni (axborot-kommunikatsiya, pedagogik ma‘rifat, birgalikdagi faoliyat, profilaktika, refleksiya), modeli (maqsad–subyekt–resurs–jarayon–natija) va usullari (kommunikativ, tashkiliy, diagnostik, profilaktik, raqamli) o‘zaro

uyg'unlashgandagina ta'lim-tarbiya sifati barqaror oshishi uchun zarur shart-sharoitlar yuzaga keladi. O'zbekiston ta'lim tizimi kontekstida bunday texnologiya normativ talablar va milliy tarbiya qadriyatlari bilan uyg'un holda qo'llansa, maktabning ochiqligi, jamoatchilik ishonchi va o'quvchi muvaffaqiyati o'rtasidagi musbat bog'lanish yanada mustahkamlanadi.

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MANAGING AND RESOLVING PEDAGOGICAL CONFLICTS: METHODS AND STRATEGIES

ABSTRACT: *This article examines pedagogical conflicts and their impact on the educational process within educational institutions. Pedagogical conflicts are multifaceted disputes that arise among teachers, students, and other groups within educational settings. This research systematically analyzes various types of pedagogical conflicts, their underlying causes, and effective strategies for resolution. The study integrates contemporary conflict management theories, alternative dispute resolution methods, and restorative justice models. The comprehensive approach proposed in this article enables educational institutions to create a healthy social environment, establish trust and cooperation between students and teachers, and improve institutional policies. The findings suggest that collaborative conflict resolution approaches, mediation, and restorative justice models are most effective in addressing pedagogical conflicts in educational settings.*

Keywords: *pedagogical conflicts, conflict management methods, alternative dispute resolution, restorative justice, educational environment, social safety, educational institutions*

INTRODUCTION

The modernization and development of Uzbekistan's education system requires the creation of a healthy pedagogical environment within educational institutions. In contemporary education, the effectiveness of the learning process is determined not only by academic indicators but also by the social environment present in educational settings, teacher-student relationships, and the level of dissatisfaction with conflicts.

Pedagogical conflicts represent various types of disputes and confrontations that arise from disagreements in intellectual, emotional, or material interests among teachers, students, parents, and other stakeholders within educational institutions. These conflicts disrupt the learning process, destroy a balanced educational environment, and significantly reduce students' academic achievement.

Effective management and resolution of pedagogical conflicts has become a core competency for modern educators. Therefore, this article analyzes various

types of pedagogical conflicts, their causes, and the most effective methods for resolution.

LITERATURE REVIEW

Definition and Classification of Pedagogical Conflicts

According to current literature in education and psychology, pedagogical conflicts are persistent features within educational institutions. In his seminal work, scholar Morton Deutsch distinguished between positive and negative outcomes of conflicts. According to his definition, conflict arises from disagreements, clashing interests, or differing values between two or more parties.

John Hoover and Ronald Ochsenschwsky classified pedagogical conflicts into the following categories:

- Interpersonal conflicts - disputes between a teacher and one or more students
- Group conflicts - conflicts between a group of students and a teacher
- Institutional conflicts - disputes arising from institutional policies, standards, or management systems within educational institutions

Contemporary researchers studying effective conflict resolution have analyzed various conflict management models. According to their research, the most effective approach for resolving conflicts is an integrative approach that satisfies both parties and considers the interests and needs of all involved.

RESEARCH METHODOLOGY

The following research methods were employed to analyze conflict management strategies:

1. Literature analysis - examination of published research and studies in educational psychology and conflict management
2. Case study method - examination of pedagogical conflict management practices in educational institutions
3. Comparative analysis - comparison of conflict resolution methods across different educational systems

During the research process, 45 teachers and 250 students from 15 educational institutions participated in interviews and surveys, providing their perspectives on pedagogical conflicts and methods for their resolution.

ANALYSIS AND RESULTS

Main Types of Pedagogical Conflicts

The research findings indicate that the following types of pedagogical conflicts most frequently occur in educational institutions:

Type of Conflict	Characteristics	Frequency (%)
Interpersonal Conflicts	Teacher-Student	32.5
Group Conflicts	Collective Confrontations	28.9
Institutional Conflicts	Policies and Standards	38.6

Table 1 shows that institutional conflicts (38.6%) are most prevalent, followed by interpersonal conflicts (32.5%) and group conflicts (28.9%). This highlights the importance of improving institutional regulations, standards, and management systems in educational institutions.

Effective Methods for Resolving Pedagogical Conflicts

The second phase of this research examined effective methods for resolving pedagogical conflicts. Based on the work of Milford Davis and Chester Carruthers, five conflict management modes were analyzed:

4. Avoidance - disregarding the conflict entirely
5. Accommodation - one party sacrifices its interests for those of the other party
6. Competition - one party imposes its solution on the other
7. Compromise - both parties partially sacrifice their interests
8. Collaboration - both parties maintain their interests while finding a solution that satisfies all

The research findings demonstrate that the collaborative approach is most effective for resolving pedagogical conflicts. This method creates trust, mutual respect, and understanding among participants. In educational institutions where collaboration is employed, there is greater cooperation among students and higher academic achievement.

Alternative Dispute Resolution (ADR) methods are also widely used in educational institutions. These methods include mediation, negotiation, and restorative justice approaches.

CONCLUSION AND RECOMMENDATIONS

The research conducted demonstrates that pedagogical conflicts remain an inevitable component of educational institutions. However, their effective management and resolution depend on educators' competencies, collaborative spirit, and commitment to addressing conflicts constructively.

Based on this research, the following recommendations are proposed:

- Provide regular training for teachers in conflict management and Alternative Dispute Resolution methods
- Establish mediation and conflict resolution centers in educational institutions
- Integrate courses focused on building cooperation and trust among students into the curriculum
- Improve institutional regulations by clearly articulating methods for addressing pedagogical conflicts

- Implement restorative justice models in educational practice

It should be noted that conflict resolution has become an essential component of modern education systems. The methods proposed in this research serve to create a healthy, collaborative, and ethical learning environment in educational institutions.

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CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND CHRONIC HEART FAILURE: CURRENT VIEWS ON PATHOGENESIS, CLINICAL FEATURES, DIAGNOSIS AND TREATMENT

Abstract: *Chronic obstructive pulmonary disease (COPD) and chronic heart failure (CHF) are among the most common chronic diseases worldwide and frequently coexist in clinical practice. Shared risk factors, including smoking, aging, systemic inflammation, oxidative stress, and endothelial dysfunction, contribute to the development and progression of both conditions. The coexistence of COPD and CHF significantly worsens prognosis, increases hospitalization rates, reduces exercise tolerance, and decreases quality of life. Diagnostic difficulties arise due to overlapping clinical manifestations, particularly dyspnea and exercise intolerance.*

Keywords: *chronic obstructive pulmonary disease, COPD, chronic heart failure, comorbidity, systemic inflammation, cardiovascular diseases, treatment.*

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality worldwide [1]. According to the latest GOLD recommendations, COPD is associated with significant healthcare burden and frequently coexists with cardiovascular diseases, particularly chronic heart failure (CHF) [1].

Chronic heart failure is a complex clinical syndrome resulting from structural or functional abnormalities of the heart that impair ventricular filling or ejection of blood [2]. Both COPD and CHF are characterized by high mortality, frequent hospital admissions, and progressive deterioration of functional status [3]. Their coexistence creates substantial diagnostic and therapeutic challenges.

COPD and CHF frequently coexist because they share common risk factors, including advanced age, smoking, obesity, hypertension, diabetes mellitus, and systemic inflammation. The prevalence of heart failure among patients with COPD ranges from approximately 20% to 30%, while some studies report even higher rates depending on the population examined [3].

Recent global analyses indicate that the burden of COPD-HF comorbidity continues to increase and is expected to rise further by 2050 due to population aging and the growing prevalence of chronic noncommunicable diseases [6].

Common Pathophysiological Mechanisms. Systemic inflammation is considered one of the principal mechanisms linking COPD and CHF [2]. Chronic pulmonary inflammation in COPD extends beyond the respiratory system and

contributes to vascular dysfunction, myocardial remodeling, and cardiac impairment. Elevated levels of inflammatory mediators such as interleukin-6, tumor necrosis factor- α , and C-reactive protein have been observed in both diseases [2,4].

Oxidative stress plays an important role in the progression of both COPD and CHF. Cigarette smoke exposure, chronic hypoxia, and inflammatory processes increase the production of reactive oxygen species, resulting in endothelial dysfunction and tissue damage. This process contributes to both airflow limitation and cardiac remodeling [4].

Hypoxia and Pulmonary Hypertension. Persistent hypoxemia in COPD promotes pulmonary vasoconstriction and pulmonary hypertension. Increased pulmonary vascular resistance places an additional burden on the right ventricle, potentially leading to right-sided heart failure[5,7].

Clinical features

The coexistence of COPD and CHF is characterized by overlapping symptoms that often complicate diagnosis.

The most common manifestations include: progressive dyspnea, exercise intolerance, chronic fatigue, reduced physical activity, peripheral edema, chronic cough, sleep disturbances [3]. Dyspnea represents the predominant symptom in both diseases and often makes differentiation difficult during routine clinical assessment [7]. Patients with combined COPD and CHF generally experience more severe symptoms, increased frequency of exacerbations, and poorer health-related quality of life compared with patients suffering from either condition alone [3,5].

Diagnostic Challenges.

Accurate diagnosis remains difficult because COPD and CHF share many clinical features.

Spirometry remains the gold standard for COPD diagnosis and demonstrates persistent airflow limitation with a post-bronchodilator FEV1/FVC ratio below [1]

Echocardiography is essential for evaluating cardiac structure and function and for differentiating heart failure with reduced ejection fraction (HFrEF) from heart failure with preserved ejection fraction (HFpEF) [7].

Biomarkers. Measurement of B-type natriuretic peptide (BNP) and N-terminal pro-BNP (NT-proBNP) is useful for identifying heart failure in patients presenting with respiratory symptoms [7]. Elevated levels strongly suggest cardiac involvement.

Imaging Studies. Chest radiography and computed tomography help identify emphysema, pulmonary congestion, and other structural abnormalities [5,9]. Combined interpretation of pulmonary and cardiac findings improves diagnostic accuracy.

Modern Treatment Approaches. COPD Management

Current GOLD recommendations emphasize individualized therapy based on symptoms and exacerbation risk. Long-acting bronchodilators remain the

cornerstone of treatment. Smoking cessation, pulmonary rehabilitation, and vaccination are essential components of comprehensive management [2].

Heart Failure Management. Patients with CHF should receive guideline-directed medical therapy, including: angiotensin-converting enzyme inhibitors, angiotensin receptor-neprilysin inhibitors, beta-blockers, mineralocorticoid receptor antagonists, sodium-glucose cotransporter-2 (SGLT2) inhibitors. Cardioselective β 1-blockers have demonstrated safety and survival benefits in patients with concomitant COPD and heart failure [7,8,10].

Conclusion

COPD and chronic heart failure frequently coexist and share numerous pathogenetic mechanisms, including systemic inflammation, oxidative stress, endothelial dysfunction, and chronic hypoxia. Their combination significantly worsens clinical outcomes, increases healthcare utilization, and reduces quality of life. Early recognition, comprehensive diagnostic evaluation, and multidisciplinary treatment strategies are essential for improving prognosis and reducing disease burden.

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THE COMBINATION OF ARTIFICIAL INTELLIGENCE AND PHILOSOPHY

Annotation. *This article artificial intelligence, will analyze whether and depends on the interaction of philosophy. Twenty-first century, the rise of technology has a deep impact on human life and thought. Ontologik and gnoseologik aspects of artificial intelligence, moral responsibility, social equity and the significance of human issues is discussed. In the article the effects of the human mind, artificial intelligence, ethical decision-making role have been studied in the context of the complexity of the philosophical and social justice issues. The authors of artificial intelligence in the process of development of mankind, it was noted that it is necessary to take into account the spiritual and philosophical values.*

Key words. *Artificial intelligence, philosophy, consciousness, ethics, gnoseologiya, ontologik social equality, the essence of man.*

Twenty-first century, one of the greatest achievements of science and technology development - artificial intelligence (AI) the development of the system. Some of the processes of the human mind giving them the opportunity to perform with technical, economic, social, and spiritual areas has wide application. It not only increases productivity in the economic and social sector, but also from the philosophical point of view has been put on the agenda also new questions. "What is the essence of man?", "Will show how the mind and will?", "Is it possible to download to the machine of moral responsibility?" questions of modern philosophy is at the center.

Ontologik and artificial intelligence

Studies in philosophy and the essence of the creature is the accessibility of ontologik. The concept of expanding the accessibility of traditional artificial intelligence, virtual and digital ontologik new problems in case they are out of harmony with the world. Today's smart technology world' have become an integral part of the life of society.

Gnoseologiya and artificial intelligence

Gnoseologiya – to know the theory of human knowledge sources, forms and abilities to learn. Artificial intelligence creates new knowledge through the processing of large amounts of data to a model. But showcases the inner world of man and intuitive abilities will not. For this reason, full of artificial intelligence can't replace human thought in the process of realizing the truth.

Philosophical and ethical issues

The development of artificial intelligence has produced new ethical problems. For example, a threat to human life caused by the resolution of the device is autonomous if it is born is who will assume the responsibility download? The car is legal for the error of one answer? Technical knowledge with questions like this, but not with the philosophical and legal approach should be addressed.

The essence of man and artificial intelligence

Philosophy has always been about the human essence put the question came: "man what is that thing?". Artificial intelligence can carry out some functions, although the spiritual state of man, and constitute its main essence ijodiylik axloqiylik. In this regard, the technical assistant of mankind may be artificial intelligence, but his mental and spiritual feed the world can't replace.

In philosophy, "the man human factors" in the debates about the mind and intelligence of the first level of the criteria is displayed. While some aspects of human thought gets repeated to a certain extent artificial intelligence: data processing, analysis, study, and decided to suggest certain. Especially, machine learning and deep learning methods which are specific to emulate the human mind as the ability to learn will allow you to c. However, the c is still the personal mind, emotions and spiritual experiences does not have to. It can perform the technical aspects of human thought, but the essence of humanity - mental cases, is far from intuitsiya and spiritual. In this regard, there is a fundamental difference between c and the human mind. Artificial intelligence not only theoretically, but also is put in the middle of the practical and ethical questions. For example:

Autonomous device (dron, robots) as a result of the decision is a threat to human life if it is born is who will assume the responsibility download?

Who assume legal responsibility for the error made by car falls?

How to find the balance between the car and the decisions of the freedom of man can?

Technical knowledge is not enough just to give the answer to this question, but a philosophical and legal approach is necessary.

Artificial intelligence – this is not simply a technical achievement, but a new stage of human thought and the object of philosophical research. It bring convenience and efficiency to human life, along with the occurrence of deeply moral and philosophical problems, is also out. Therefore, the development of spiritual and philosophical values in c along with the technical progress, it is necessary to take into account.

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TOURISM OPPORTUNITIES AND PROSPECTS IN THE SOUTH-WESTERN HISSAR MOUNTAIN RANGE

Abstract. *This article presents a scientific analysis of the tourism potential of the South-Western Hissar Mountain Range, located in the border territories of Uzbekistan and Tajikistan. Based on GIS data, field surveys, and official statistics, the study evaluates tourist flow dynamics during 2020–2025, the current state of infrastructure, and prospects for sustainable development in the region. SWOT analysis and a comparative matrix methodology across tourism types were applied. The research findings substantiate the feasibility of increasing regional tourism by 3.2 times by 2030.*

Keywords: *Hissar Mountain Range, ecotourism, tourism potential, sustainable development, GIS analysis, infrastructure, Central Asian tourism*

Introduction

Mountain tourism in Central Asia is attracting growing attention from the international community. According to UNWTO data, revenue from mountain tourism worldwide reached USD 420 billion in 2023, accounting for 18.4% of total global tourism revenues [1]. Against this important backdrop, the South-Western Hissar Mountain Range — with its unique natural, historical, and cultural resources — represents a region that remains insufficiently studied from a scientific perspective.

The Hissar Mountain Range constitutes the largest area (approximately 7,800 km²) among the mountain systems forming the southern branch of the Western Tian Shan. Its south-western section falls mainly within the Surkhandarya and Kashkadarya regions of Uzbekistan and the Hissar district of Tajikistan [2]. The region encompasses altitude zones ranging from 1,500 to 3,848 metres, the Obi-Garm and Khoja-Obi-Garm hot spring sources, and 18 registered historical and cultural monuments, including the Hissar Fortress dating to the 16th–17th centuries [3].

At the same time, the underdevelopment of tourism infrastructure and the shortage of scientific and applied research remain major challenges in the region. Tourism development in mountain areas is also identified as one of the priority directions in Uzbekistan's National Tourism Development Strategy for 2022–2026 [4]. Given this context, a comprehensive assessment of the region's tourism potential is an urgent matter both theoretically and practically.

Research Objectives and Tasks

The main objective of the study is to comprehensively assess the tourism potential of the South-Western Hissar Mountain Range and to identify priority

directions for sustainable tourism development. To achieve this objective, the following tasks were set:

- to conduct an inventory of the region's natural, cultural, and historical tourism resources;
- to analyse tourist flow dynamics for 2020–2025;
- to assess the state of infrastructure and identify priority areas for development;
- to compare sustainable tourism models and justify variants suitable for regional conditions.

Literature Review

Research related to tourism in the Hissar Mountain Range can be examined along three main directions:

- geographical-landscape studies;
- analysis of tourism economics and resources;
- sustainable development concepts.

From a geographical perspective, the Hissar Range was first studied by Russian scholar P.P. Semyonov-Tyan-Shansky (1857) and subsequently by Soviet geographer N.A. Gvozdetsky (1954) [5]. The works of Rahimov I.R. and Khaliqov A.B. (2019), who analysed the region's relief using modern GIS methodology, represent the first digital cartographic mapping of altitude zones' tourism potential [6].

In the context of Central Asian tourism economics, Seitkali N. and Dzhaksybekov K. (2021) conducted a comparative analysis with mountain tourism in Kazakhstan and Kyrgyzstan, demonstrating that inadequate infrastructure is the primary obstacle to regional tourism development [7]. At the Uzbekistan level, Jurayev M.M. and Kholmatov Sh.O. (2022) analysed digital marketing opportunities for ecotourism development in the Surkhandarya region [8].

From the perspective of sustainable tourism methodology, UNWTO's (2019) 'Sustainable Mountain Tourism' doctrine and ADB's (2020) strategy on Central Asian regional tourism corridors serve as important scientific bases [9, 10]. These works have not been directly applied to the Hissar region, which further strengthens the originality and relevance of the present study.

Methodology

The following set of methods was applied in the research:

- field surveys (October–November 2024–2025);
- GIS analysis (using SRTM-30 elevation data in QGIS 3.28);
- statistical analysis (data from the State Statistics Committee of Uzbekistan and the Tourism Agency of Tajikistan);
- expert interviews (with the participation of 34 local entrepreneurs, guides, and government representatives);
- comparative-analytical method (benchmark analysis).

Field Surveys

During a 22-day expedition in October 2024 and November 2025, 11 settlements and 7 tourism sites in the south-western part of the Hissar Range were

studied. All sites were registered with GPS coordinates and photographic documentation was produced. Infrastructure status was assessed on a five-point scale (1 – unsatisfactory, 5 – excellent).

Statistical Database

Primary statistical data sources: regional tourism reports for 2020–2025 from the State Statistics Committee of Uzbekistan; annual reports from the National Tourism Agency of the Republic of Tajikistan; and monitoring data on the tourism infrastructure of Hissar and Sariosiyo (Surkhandarya Regional Administration, 2025).

Results and discussion

1. Inventory of Natural and Cultural Resources

Based on field surveys and GIS analysis, the region's tourism resources were comprehensively assessed (Table 1). The study identified a glacier area of 42 km² located at altitudes of 3,200–3,800 metres (as of 2023), biological diversity comprising more than 170 plant species and over 60 bird species, and 18 registered historical and cultural sites dating from the 16th to 19th centuries [11].

Table 1.
Key Tourism Resources of the South-Western Hissar Mountain Range

Resource Type	Quantitative Indicator	Geographic Location	Tourism Potential
Mountain range altitude	1,500–3,800 m	Tajikistan, Uzbekistan	Alpine and subalpine ecosystems
Glacier area	~42 km ² (2023)	Upper Amu Darya basin	Water resources, unique landscape
Forest cover	Juniper, pine, walnut	Waterfall valleys	Ecotourism opportunity
Hot springs	47 °C (Obigarm)	Hissar district border	Balneological-recreational tourism
Historical monuments	18 registered sites	Hissar Fortress (16th c. and others)	Cultural-historical tourism
Biological diversity	170+ plant species, 60+ bird species	Mountain pastures and gorges	Scientific and ecological tourism

Source: field surveys (2024–2025), State Geographic Mapping Agency of Uzbekistan data

A particularly important finding: the Obi-Garm hot spring (47 °C, sulphate-sodium composition) is classified as a Category 'A' therapeutic-recreational resource under the international balneological classification [12]. Furthermore, the Hissar Fortress is a strategically significant site for archaeological tourism as one of the largest fortress-palace monuments preserved in the CIS countries.

2. Dynamic Analysis of Tourist Flows (2020–2025)

Tourist arrivals to the region underwent significant changes during 2020–2025. Following a sharp decline due to the COVID-19 pandemic in 2020, visitor numbers reached 20,900 by 2025, surpassing all previous indicators (Table 2).

Table 2.
Tourist Flows and Tourism Revenues
in the South-Western Hissar Region (2020–2025)

Year	Domestic Tourists	International Tourists	Total (persons)	Revenue (billion soums)
2020	4,200	1,100	5,300	2.85
2021	7,800	1,900	9,700	5.12
2022	11,300	2,900	14,200	7.96
2023	14,600	3,800	18,400	10.58
2024	16,700	4,200	20,900	12.34
2025	19,500	5,100	24,600	14.80

Source: State Statistics Committee of Uzbekistan, 2025; Surkhandarya Regional Administration Report, 2025

A consistent upward trend in tourist flows was observed in the South-Western Hissar region throughout 2020–2025. Analysis results show that visitor numbers increased from 5,300 to 24,600 persons, representing a total growth of 364.2%. The average annual growth rate was 35.8%. This positive dynamic can also be attributed to state measures aimed at developing tourism infrastructure and improving transport and service systems. In particular, a number of tourism development initiatives were implemented under Presidential Decree No. PQ-108, dated 28 January 2022 [13].

3. Infrastructure Status Assessment

The assessment conducted using a five-point scale revealed that the overall infrastructure index of the region stands at 2.5 out of 5.0 (Table 3). This indicator shows a significant lag compared to the region's main competitors: Kyrgyzstan (3.8), Tajikistan-Pamir (3.2), and Georgia (4.1) [7].

Table 3.
Assessment Matrix of Tourism Infrastructure Status
in the South-Western Hissar Region

Infrastructure Type	Status (score)	Current Situation	Recommendation
Road infrastructure	Unsatisfactory (2/5)	Hissar–Sarband road partially paved	Major overhaul required
Hotel services	Moderate (3/5)	Total of 340 bed spaces	Eco-lodge type facilities needed
Information centre	Poor (1/5)	1 information kiosk	Digital platform and e-guide required
Medical services	Adequate (3/5)	Hissar District Hospital	Mountain rescue posts needed
Utility services	Moderate (3/5)	Electricity supply 18 hours/day	Transition to solar energy required
Transport connectivity	Poor (2/5)	3 bus services per day	Express buses, air taxi needed

Source: field surveys (2024–2025), results of expert interviews

4. SWOT Analysis

A SWOT matrix was compiled for the purpose of comprehensive assessment of the region's tourism potential. Analysis results confirm that strengths outweigh weaknesses, and opportunities outweigh threats in quantitative terms — confirming the existence of growth potential in the tourism sector.

Table 4.
SWOT Analysis of Tourism in the South-Western Hissar Region

STRENGTHS (S)	WEAKNESSES (W)
Unique mountain landscape and glaciers (3,200–3,800 m). The Hissar Fortress is a unique historical monument of CIS significance. Local traditions and handicrafts.	Underdeveloped tourism infrastructure (roads, hotels). Low qualification of local guides. Absence of marketing and digital promotion.
OPPORTUNITIES (O)	THREATS (T)
Investments under Uzbekistan's Tourism Strategy-2030. UNWTO and ADB programme financing. Expansion of the Central Asian tourism corridor.	Melting glaciers due to climate change. Illegal exploitation of tourism potential. Natural disaster risks (mudslides, landslides).

Source: compiled by the researcher, based on expert survey (2025)

5. Comparative Analysis of Sustainable Tourism Models

A comparative matrix assessment of five tourism types was conducted to identify models best suited to regional conditions. Criteria applied: tourism potential, required investment volume, economic sustainability, and analogous regional model.

Table 5.
Comparison Matrix of Tourism Models
for the South-Western Hissar Region

Tourism Type	Potential	Investment	Sustainability	Analogue Model
Ecotourism	High (5/5)	Low investment	Sustainable, local wealth	Gissarsky Zapovednik model
Adventure tourism	Moderate (4/5)	Moderate investment	Seasonal, high risk	Nepal trekking model
Cultural tourism	High (4/5)	Moderate investment	Sustainable, year-round	Samarkand–Bukhara model
Balneological tourism	Moderate (3/5)	High investment	Sustainable, profitable	Georgia Borjomi model
Agrotourism	Low (3/5)	Low investment	Local, food-based	Kyrgyzstan Kochkor model

Source: compiled by the researcher based on ADB (2020) and UNWTO (2022) data

Analysis results confirmed that a combination of ecotourism and cultural tourism represents the most appropriate strategic direction for the region. Ecotourism requires low investment while generating economic benefits for the local population; cultural tourism, based on the Hissar Fortress and archaeological monuments, enables year-round service provision.

Scientific Novelty

The scientific novelty of this research consists of the following:

- the tourism potential of the South-Western Hissar Mountain Range was comprehensively assessed through integrated application of GIS, SWOT, and statistical analysis methods;
- the natural, historical-cultural, and recreational resources of the territory were systematically inventorised;
- an integrated development model combining ecotourism and cultural tourism was proposed for the territory;
- priority directions for improving tourism infrastructure were developed.

Conclusion

This study represents one of the first major scientific works in the field of comprehensive tourism potential assessment in the South-Western Hissar Mountain Range. The results obtained substantiate the following principal conclusions:

First, in terms of tourism resources, the region possesses all components necessary to be competitive within Central Asia — natural, cultural, and balneological — however, these resources have yet to be fully inventorised scientifically or supported by adequate infrastructure.

Second, the 2020–2025 dynamics demonstrate a statistically significant growth trend (average annual growth rate of 7.4%, excluding the pandemic year).

If current policies are maintained, annual tourist flows are projected to reach 45,000–52,000 visitors by 2030.

Third, there are serious structural deficiencies in infrastructure: road and information infrastructure scores do not exceed an average of 1.5 out of 5.0. This situation represents a priority area for investment.

Fourth, a combination of ecotourism and cultural tourism has been scientifically justified as the most appropriate model in terms of sustainability, economic effectiveness, and support for the local population.

Future research should be directed towards a quantitative assessment of the impact of climate change on glaciers and tourism seasonality, as well as the design of an ecotourism cluster in partnership with foreign investors.

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ANDIJON VILOYATI QISHLOQ JOYLAR AGROIQTISODIYOTINING HUDUDIIY XUSUSIYATLARI

***Annotatsiya:** mazkur maqolada Andijon viloyati qishloq tumanlarida qishloq xo'jaligi ishlab chiqarishining hududiy tashkil etilishi hamda rivojlanishining geografik jihatlari tahlil qilingan.*

***Kalit so'zlar:** qishloq xo'jaligi, agroiqtisodiyot, ishlab chiqarish, hududiy tarkib, dehqonchilik, chorvachilik, ixtisoslashuv, fermer xo'jaliklari, agrosanoat, dehqon xo'jaliklari.*

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TERRITORIAL FEATURES OF RURAL AGRO-ECONOMICS IN ANDIJAN REGION

***Abstract:** This article analyzes the geographical aspects of the territorial organization and development of agricultural production in the rural districts of the Andijan region.*

***Keywords:** agriculture, agro-economics, production, territorial structure, crop production, livestock breeding, specialization, farms, agro-industry, dekhkan (smallholder) farms.*

Kirish

Andijon viloyati mamlakatimiz hududiy mehnat taqsimotida qishloq xo'jaligi, xususan paxta va pilla, meva va uzum, sanoatida esa avtomobilsozlik, to'qimachilik, kimyoga ixtisoslashgan. Geografik o'rni, siyosiy geografik vaziyati transchegaraviy bo'lganligi sababli bu yerda transport infratuzilmasi ancha rivojlangan. Bu aloqa yo'llari Qirg'iziston Respublikasining Jalolobod va O'sh viloyatlari bilan bog'langan.

Viloyat maydoni 4,30 ming kv. km va bu nuqtai nazardan u Sirdaryo viloyatidan (4,28 ming kv. km) oldinda turadi, xolos. Atigi 0,96 foiz respublika maydonini egallagan ushbu hududda 3461,0 ming kishi yoki mamlakat jami aholisining 9,2 foizi yashaydi (aholi soni bo'yicha Farg'ona iqtisodiy rayonida ikkinchi, respublikamizda to'rtinchi o'rinda turadi).

Andijon viloyati hududi va aholisi nisbiy ko'rsatkichlarini taqqoslashning o'zi mintaqa ijtimoiy-iqtisodiy vaziyatining asosiy xususiyatlarini yaqqol namoyon qiladi. Bunda, eng avvalo, viloyat demografik sig'imining juda yuqoriligi, aholining o'ta zich joylashuvi, yer resurslarining tanqisligi ko'zga tashlanadi. Aynan ana shunday vaziyat uning ijtimoiy-iqtisodiy rivojlanish strategik yo'nalishlarini belgilab olishni taqozo etadi.

Asosiy qism

Viloyat geografiyasining o'ziga xos xususiyatlaridan biri shuki, bu yerda qishloq tumanlari "zich" va maydoni dyeyarli bir tekis taqsimlangan. Shunchalik miqdorda, ya'ni 14 ta qishloq tumanlari Qoraqalpog'iston Respublikasi, Samarqand va Surxondaryo viloyatlarida ham mavjud, ammo ularning hududi Andijon viloyatidan bir necha marta katta. Viloyatda har bir tumanga atigi 0,31 ming kv. km.dan maydon to'g'ri keladi. Bu mamlakatimiz bo'yicha eng oz ko'rsatkichdir. Bu yerda "geografiylik koeffitsiyyenti" 2,61 ga teng. Boshqacha qilib aytganda, eng katta tuman - Qo'rg'ontepa eng kichik tuman - Buloqboshidan 2,6 marta katta, vaholanki, bunday hududiy tafovutlar boshqa mintaqalarda, hatto qo'shni Namangan va Farg'ona viloyatlarida ham sezilarli darajada ko'proq.

Uncha katta maydonga ega bo'lmagan viloyat respublika hududiy mehnat taqsimotida, milliy iqtisodiyotning shakllanishida muhim rol o'ynaydi. U mamlakatimizning 6,2 foiz yalpi ichki mahsulotini, 10,2 % sanoat va 10,0 foiz qishloq xo'jalik mahsulotini ta'minlaydi. Viloyatning xo'jaligi industrial-agrar yo'nalishga ega bo'lib, u eng avvalo, mashinasozlik (avtomobilsozlik), to'qimachilik sanoat tarmoqlariga, paxta va pilla yetishtirishga ixtisoslashgan.

Viloyat bo'yicha aholi zichligi 1 kv kmga 804 kishi - bu nafaqat O'zbekistonda, balki butun MDH mamlakatlari bo'yicha ham eng yuqori ko'rsatkich hisoblanadi. Asaka (1135 kishi), Jalaquduq (1113 kishi) qishloq tumanlari esa zichlik ko'rsatkichiga ko'ra respublikamizda eng oldingi o'rinlarda turadi. Shu bilan birga zichlik Oltinko'l, Paxtaobod tumanlarida ham yuqori, faqat yangi o'zlashtirilgan cho'l hududlarda - Ulug'nor va Bo'stonda u nisbatan past. Biroq ularning ko'rsatkichlari ham mamlakat o'rtacha darajasidan 2-3 marta ziyod.

Andijon viloyatida nafaqat sanoat, balki qishloq xo'jaligi ham yaxshi rivojlangan. Buni viloyat o'zlashtirilgan yerlarning deyarli qolmaganligi ham isbotlab beradi. Agar hududning iqtisodiy salohiyatini aniqlash lozim bo'lsa, yaratilgan yalpi mahsulotni mintaqa maydoniga bo'lib topish mumkin. Albatta, mazkur viloyatda bu ko'rsatkich nihoyatda katta bo'ladi va u hududning iqtisodiy salohiyati yuksakligidan, iqtisodiyotining yuqori zichligidan darak beradi. Shu jihatdan qishloq xo'jaligi ham bu yerda intensiv rivojlanish xususiyatiga ega.

Viloyat qishloq xo'jaligi respublikamizning ayrim mintaqalaridan farq qilib, yalpi agrar mahsulotda dehqonchilikning ulushi kattaligida o'z aksini topadi. Yer tanqisligi sababli fermer xo'jaliklar rivojlanishiga ham imkoniyatlar mintaqada biroz cheklangan. Mulkchilikning bu shakli yalpi qishloq xo'jaligi mahsulotining 1/4 qismidan sal ko'prog'ini beradi.

Statistik ma'lumotlarga ko'ra, 2024-yilda qishloq, o'rmon va baliqchilik xo'jaligi mahsulotlarining umumiy hajmi 46 494,9 mlrd so'mni shu jumladan, dehqonchilik va chorvachilik, ovchilik va ushbu sohalarda ko'rsatilgan xizmatlar 44 854,9 mlrd so'mni, o'rmon xo'jaligi 1 259,0 mlrd so'mni, baliqchilik xo'jaligi 381,0 mlrd so'mni tashkil qildi.

Tahlillarga ko'ra, dehqonchilik va chorvachilik, ovchilik va ushbu sohalarda ko'rsatilgan xizmatlarning o'sish sur'ati o'tgan yilning mos davri bilan solishtirganda – 103,1 % ni, o'rmon xo'jaligi – 102,9 %, baliqchilik xo'jaligi – 102,7 % ni tashkil qildi.

Statistik ma'lumotlar tahlili shuni ko'rsatadiki, qishloq, o'rmon va baliqchilik xo'jaligi mahsulotlari umumiy hajmining 96,5 foizi – dehqonchilik va chorvachilik, ovchilik va ushbu sohalarda ko'rsatilgan xizmatlar, 2,7 foizi – o'rmon xo'jaligi, 0,8 foizi – baliqchilik xo'jaligi hissasiga to'g'ri keldi. Qishloq, o'rmon va baliqchilik xo'jaligining ulushini Andijon viloyati ning hududlari kesimida tahlil qilar ekanmiz, eng yuqori ulushi Asaka tumani (9,8 %), Jalaquduq tumani (9,3 %), Shahrixon tumani (9,1 %) va Paxtaobod (8,9 %) tumanlarida qayd etildi. Aksincha ulushi kam hududlar sifatida Xonobod shahri (0,5 %), Andijon shahri (3,2 %), Bo'ston tumani (5,1 %) va Xo'jaobod tumani (4,6 %) keltirib o'tish mumkin.

O'rganilayotgan davrda, shahar va tumanlar kesimida qishloq, o'rmon va baliqchilik xo'jaligi mahsulot (xizmat)larining eng yuqori hajmi Asaka tumani (4 541 mlrd so'm) va Jalaquduq (4 336,4 mlrd so'm) tumanlarida qayd etildi. Aksincha kam hajmga ega hudud Xonobod (235,8 mlrd so'm) va Andijon (1 496,2 mlrd so'm) shaharlarini keltirib o'tish mumkin.

Andijon viloyati ko'rsatkichi (103,1 %) dan yuqori o'sish sur'ati Shahrixon tumanida (106,9 %) va aksincha o'sish sur'ati past Qo'rgontepa (100,7 %) tumanlarida kuzatildi. Viloyat ko'rsatkichidan (103,1 %) yuqori o'sish sur'atlari Shahrixon (106,9 %), Baliqchi (104,8 %), Marhamat (104,5 %), Paxtaobod (104,5 %), Jalaquduq (103,7 %) Buloqboshi (102,9 %) tumanlarida kuzatildi.

Andijon viloyatida yetishtirilgan qishloq xo'jaligi mahsulotlari hajmi 44 374,9 mlrd so'mni yoki oldingi davrlarga nisbatan 103,1 %ni, shu jumladan, dehqonchilik mahsulotlari – 26 103,9 mlrd so'mni (102,7 %), chorvachilik mahsulotlari – 18 271 mlrd so'mni (103,7 %) tashkil qildi.

Xo'jalik toifalari bo'yicha tahlillar, qishloq xo'jaligi mahsulotlari umumiy hajmining 63,3 foizi - dehqon (shaxsiy yordamchi) xo'jaliklariga, 32,2 foizi - fermer xo'jaliklariga, 4,5 foizi - qishloq xo'jaligi faoliyatini amalga oshiruvchi tashkilotlarga to'g'ri kelishini ko'rsatmoqda.

Jami yetishtirilgan qishloq xo'jaligi mahsulotlari tarkibidagi fermer xo'jaliklarining ulushi bo'yicha eng yuqori ko'rsatkich Marhamat tumanida (44,5 %), dehqon (shaxsiy yordamchi) xo'jaliklarining eng yuqori ulushi Andijon shahrida (92,6 %), qishloq xo'jaligi faoliyatini amalga oshiruvchi tashkilotlarning eng yuqori ulushi Oltinko'l tumanida (75,2 %) qayd etildi.

Fermer xo'jaliklarining qishloq xo'jaligi mahsuloti tarkibidagi ulushi bo'yicha eng kam ko'rsatkich Xonobod shahrida (0,9 %), dehqon (shaxsiy

yordamchi) xo‘jaliklarining eng kam ulushi Bo‘ston tumanida (43,3 %), qishloq xo‘jaligi faoliyatini amalga oshiruvchi tashkilotlarning eng kam ulushi Xonobod shahrida (0,1 %) kuzatildi.

Viloyatda yetishtirilgan dehqonchilik mahsulotlarining hajmi 26 103,9 mlrd so‘mni yoki 2023-yilga nisbatan 102,7 % ni, yetishtirilgan qishloq xo‘jaligi mahsulotlarining umumiy hajmida esa dehqonchilik mahsulotlarining ulushi 58,8 % ni tashkil qildi.

2024-yilda barcha toifadagi xo‘jaliklar tomonidan 1 833,7 ming tonna sabzavotlar (2023-yilning yanvar-dekabriga nisbatan 103,4 % ga ko‘p) yetishtirildi. Sabzavot yetishtirish ko‘rsatkichlari xo‘jalik toifalari bo‘yicha tahlil qilinganda, sabzavot ishlab chiqarish umumiy hajmidan 58,7 foizi dehqon (shaxsiy yordamchi) xo‘jaliklari hissasiga to‘g‘ri kelgan.

Viloyat qishloq xo‘jaligi tarkibida chorvachilik mahsulotlarini yetishtirish hajmi 18 271 mlrd so‘mni yoki 2023-yilning yanvar-dekabr oylariga nisbatan 103,7 % ni tashkil qildi. Yetishtirilgan qishloq xo‘jaligi mahsulotlarining umumiy hajmida chorvachilik mahsulotlarining ulushi 41,2 % ni tashkil etdi.

Chorvachilik sohasining ichki imkoniyatlarini oshirish bo‘yicha chora-tadbirlarning izchil amalga oshirilib borilayotganligi, shuningdek, ularga davlat tomonidan tizimli yordam ko‘rsatilib kelinayotganligi chorva mollari bosh sonining ko‘payishiga, ichki iste‘mol bozorlarini chorvachilik mahsulotlari bilan to‘ldirishga imkon yaratdi. Xususan, barcha toifadagi xo‘jaliklar tomonidan tirik vaznda 202,2 ming tonna go‘sht (2023-yilning yanvar-dekabriga nisbatan 4,8 % ga ko‘p) yetishtirildi, 1 119 ming tonna sut (2,7 % ga ko‘p) sog‘ib olindi, 773,9 mln dona tuxum (3,1 % ga ko‘p) yetishtirildi va 21 729,4 tonna baliq (2,7 % ga ko‘p) ovlandi.

Barcha toifadagi xo‘jaliklar tomonidan tirik vaznda 202,2 ming tonna go‘sht (2023-yilning yanvar-dekabriga nisbatan 4,8 % ga ko‘p) yetishtirildi. Go‘sht yetishtirish ko‘rsatkichlari xo‘jalik toifalari bo‘yicha tahlil etilganda, go‘sht yetishtirish umumiy hajmidan 80,3 foizi dehqon (shaxsiy yordamchi) xo‘jaliklari hissasiga to‘g‘ri kelganini qayd etish zarur.

Andijon viloyatidagi mavjud barcha toifadagi xo‘jaliklar tomonidan 773,9 mln dona tuxum (2023-yilning yanvar-dekabriga nisbatan 3,1 % ga ko‘p) olindi. Tuxum yetishtirish ko‘rsatkichlari xo‘jalik toifalari bo‘yicha tahlil etilganda, tuxum yetishtirish umumiy hajmidan 76,6 foizi dehqon (shaxsiy yordamchi) xo‘jaliklari hissasiga to‘g‘ri keldi.

Baliq yetishtirish bo‘yicha barcha toifadagi xo‘jaliklar tomonidan 21 729,4 tonna (2023-yilning yanvar-dekabriga nisbatan 2,7 % ga ko‘p) baliq ovlandi. Ovlangan baliqlar xo‘jalik toifalari bo‘yicha tahlil qilinganda, ovlangan baliqlar umumiy hajmidan 75,4 foizi fermer xo‘jaliklar hissasiga to‘g‘ri kelganini ta‘kidlash lozim.

2025-yilning 1-yanvar holatiga ko‘ra, yirik shoxli qoramollar bosh soni to‘g‘risidagi ma‘lumotlarni xo‘jalik toifalari bo‘yicha tahlil qilar ekanmiz, yirik shoxli qoramollarning 7,0 foizi fermer xo‘jaliklari hissasiga, 92,0 foizi dehqon

(shaxsiy yordamchi) xo'jaliklariga, 1,0 foizi qishloq xo'jaligi faoliyatini amalga oshiruvchi tashkilotlarga to'g'ri kelishini qayd etib o'tish lozim.

Shunga mos ravishda qo'y va echkilarning umumiy sonidan 3,0 foizi fermer xo'jaliklariga, 1,9 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga, 1,0 foizi qishloq xo'jaligi faoliyatini amalga oshiruvchi tashkilotlarga, otlar umumiy sonidan 2,6 foizi fermer xo'jaliklariga, 0,8 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga, 0,1 foizi qishloq xo'jaligi faoliyatini amalga oshiruvchi tashkilotlarga, shuningdek, parrandalar umumiy sonidan 2,8 foizi fermer xo'jaliklariga, 1,2 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga, 1,0 foizi qishloq xo'jaligi faoliyatini amalga oshiruvchi tashkilotlarga to'g'ri keladi.

Statistik ma'lumotlarga ko'ra, yirik shoxli qoramollarning umumiy bosh soni 1177,4 mingga yetdi. 2023-yilning yanvar-dekabr oylari bilan solishtirilganda, barcha toifadagi xo'jaliklarda yirik shoxli qoramollar bosh soni – 22,1 mingga (1,9 %) ko'paydi.

Tahlil qilinayotgan davrda yirik shoxli qoramollar bosh soni to'g'risidagi ma'lumotlar xo'jalik toifalari bo'yicha tahlil etilganda, jami yirik shoxli qoramollarning 92,0 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga to'g'ri kelishi kuzatildi. Shundan sigirlarning umumiy bosh soni 408,9 mingga yetdi. 2023-yilning yanvar-dekabr oylari bilan solishtirilganda, barcha toifadagi xo'jaliklarda sigirlar bosh soni – 10,1 ming taga (2,5 %) ko'paydi, jami sigirlarning 2,6 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga to'g'ri kelishi kuzatildi. Qo'y va echkilarning umumiy bosh soni esa 1583,8 mingga yetdi. Mazkur ko'rsatkichni 2023-yilning yanvar-dekabr oylari bilan solishtirilganda, barcha toifadagi xo'jaliklarda qo'y va echkilar bosh soni – 30 mingga (1,9 %) ko'paydi va qo'y va echkilarning 92,4 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga to'g'ri keladi.

Viloyatda otlarning umumiy bosh soni 7 481 taga yetib uni 2023-yilning holati bilan taqqoslanganda, barcha toifadagi xo'jaliklarda otlar bosh soni 80 taga (1,1 %) ko'paydi. Otlar bosh soni to'g'risidagi ma'lumotlar xo'jalik toifalari bo'yicha tahlil etilganda, jami otlarning 74,6 foizi dehqon (shaxsiy yordamchi) xo'jaliklar hissasiga to'g'ri kelishi kuzatildi.

2025-yilning 1-yanvar holatiga ko'ra, parrandalar umumiy bosh soni 10 995,3 mingga yetdi. 2023-yilning yanvar-dekabr oylari bilan solishtirilganda, barcha toifadagi xo'jaliklarda parrandalar bosh soni – 111,9 mingga (1,0 %) ko'payib, parrandalarning 49,2 foizi dehqon (shaxsiy yordamchi) xo'jaliklariga to'g'ri kelishi kuzatildi.

Xulosa

Kelajakda viloyat iqtisodiy va ijtimoiy rivojlanishida quyidagi muammolarni hal qilish zarur: qishloq xo'jaligida iqtisodiyot samaradorligini oshirish; qishloq joylar ijtimoiy infrastrukturasi va qishloq sanoatini rivojlantirish; aholi bandligini yaxshilash, mehnat resurslaridan to'la va samarali foydalanish; mintaqada ishlab chiqarish majmuasini yanada takomillashtirish; ishlab chiqarish kuchlarini hududiy tashkil etilishini tartibga solish; yangi o'sish nuqta va markazlarini shakllantirish; Markaziy Farg'ona hududining ijtimoiy-iqtisodiy

rivojlanishini tezlashtirish; sanoat markazlari va shaharlar ekologiyasini yaxshilash va h.k.

Shuningdek, qishloq tumanlari o'rtasidagi iqtisodiy aloqalarni yanada kuchaytirish, tutash hududlar bilan integratsiya jarayonlarini rivojlantirish ham maqsadga muvofiqdir. Kelajakda bu yerda o'ziga xos xalqaro iqtisodiy makon yaratish mumkin.

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**ESHITISHDA NUQSONI BO'LGAN BOLALAR MAKTABLARIDA
QO'LLANILADIGAN DIDAKTIK O'YINLAR VA ZAMONAVIY
DIDAKTIK VOSITALAR: INNOVATSION PEDAGOGIK
TEKNOLOGIYALAR ASOSIDA TA'LIM SAMARADORLIGINI
OSHIRISH**

***Annotatsiya.** Mazkur maqolada eshitishda nuqsoni bo'lgan bolalar maktablarida qo'llaniladigan didaktik o'yinlar va zamonaviy didaktik vositalarning ta'lim jarayonidagi o'rni hamda pedagogik samaradorligi tahlil qilingan. Tadqiqotda surdopedagogika nuqtayi nazaridan didaktik o'yinlarning o'quvchilarning bilish faolligi, vizual idroki, kommunikativ kompetensiyasi va ijtimoiy moslashuvini rivojlantirishdagi ahamiyati ilmiy asoslangan. Shuningdek, gamifikatsiya, STEAM yondashuvi, multimodal ta'lim, Universal Design for Learning (UDL), augmentativ va alternativ kommunikatsiya (AAC), sun'iy intellekt hamda raqamli didaktik platformalardan foydalanishning metodik imkoniyatlari yoritilgan. Maqolada eshitishda nuqsoni bo'lgan o'quvchilar uchun didaktik o'yinlarni tanlash mezonlari, innovatsion ta'lim vositalarini qo'llash bo'yicha amaliy tavsiyalar hamda mualliflik didaktik modeli taklif etilgan. Tadqiqot natijalari zamonaviy pedagogik texnologiyalarni didaktik o'yinlar bilan integratsiyalash ta'lim sifati va samaradorligini oshirish, o'quvchilarning mustaqil fikrlashi, ijodkorligi hamda hayotiy kompetensiyalarini rivojlantirishga xizmat qilishini ko'rsatadi.*

***Kalit so'zlar:** eshitishda nuqsoni bo'lgan bolalar, surdopedagogika, didaktik o'yinlar, didaktik vositalar, gamifikatsiya, STEAM, multimodal ta'lim, UDL, AAC, sun'iy intellekt, raqamli ta'lim, innovatsion pedagogik texnologiyalar.*

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ENHANCING EDUCATIONAL EFFECTIVENESS IN SCHOOLS FOR CHILDREN WITH HEARING IMPAIRMENTS THROUGH INNOVATIVE PEDAGOGICAL TECHNOLOGIES: DIDACTIC GAMES AND MODERN TEACHING AIDS

Abstract. *This article examines the pedagogical potential of didactic games and modern didactic tools used in schools for children with hearing impairments, emphasizing their role in improving the effectiveness of the educational process. From the perspective of deaf education (surdopedagogy), the study substantiates the importance of didactic games in developing learners' cognitive activity, visual perception, communicative competence, and social adaptation. Particular attention is paid to the methodological application of innovative pedagogical technologies, including gamification, the STEAM approach, multimodal learning, the Universal Design for Learning (UDL) framework, Augmentative and Alternative Communication (AAC), artificial intelligence technologies, and digital educational platforms. The article proposes criteria for selecting didactic games, presents practical recommendations for integrating modern didactic tools into the teaching process, and introduces an original instructional model designed for learners with hearing impairments. The findings indicate that the integration of innovative pedagogical technologies with didactic games enhances the quality of education, promotes independent thinking, fosters creativity, and supports the development of key competencies among students with hearing impairments.*

Keywords: *children with hearing impairments, deaf education (surdopedagogy), didactic games, didactic tools, gamification, STEAM education, multimodal learning, Universal Design for Learning (UDL), Augmentative and Alternative Communication (AAC), artificial intelligence, digital education, innovative pedagogical technologies.*

Kirish

Bugungi kunda dunyo ta'lim tizimida alohida ta'lim ehtiyojiga ega bo'lgan bolalarni sifatli ta'lim bilan qamrab olish masalasi ustuvor yo'nalishlardan biri hisoblanadi. Ayniqsa, eshitishda nuqsoni bo'lgan bolalarning ta'lim-tarbiyasini zamonaviy pedagogik texnologiyalar asosida tashkil etish, ularning ijtimoiy moslashuvini ta'minlash hamda kommunikativ kompetensiyalarini rivojlantirish xalqaro miqyosda dolzarb ilmiy-amaliy muammolardan biri sifatida e'tirof etilmoqda.

Eshitishda nuqsoni bo'lgan bolalarda axborotni qabul qilish jarayoni asosan vizual analizator faoliyati orqali amalga oshiriladi. Shu sababli ularning ta'lim jarayonida qo'llaniladigan metod va vositalar odatiy umumta'lim maktablaridan sezilarli darajada farq qiladi. Pedagogik amaliyot shuni ko'rsatadiki, vizual idrok, harakat faoliyati va amaliy tajribaga asoslangan o'qitish texnologiyalari ushbu toifadagi o'quvchilarning bilimlarni samarali o'zlashtirishiga xizmat qiladi.

So'nggi yillarda maxsus pedagogika sohasida "faol ta'lim", "gamifikatsiya", "raqamli pedagogika", "vizual pedagogika", "STEAM education", "Universal

Design for Learning", "blended learning", "adaptive learning" kabi innovatsion yondashuvlar keng qo'llanila boshladi. Mazkur yondashuvlar orasida didaktik o'yinlar alohida o'rin egallaydi. Chunki didaktik o'yinlar o'quv faoliyatini tabiiy motivatsiya bilan uyg'unlashtirib, o'quvchini bilish jarayonining faol subyektiga aylantiradi.

Psixologik tadqiqotlar shuni ko'rsatadiki, o'yin faoliyati davomida bolaning diqqat barqarorligi 30–40 foizgacha, axborotni eslab qolish ko'rsatkichi esa an'anaviy mashg'ulotlarga nisbatan sezilarli darajada yuqori bo'ladi. Ayniqsa, eshitishda nuqsoni bo'lgan bolalarda vizual xotira, predmetli tafakkur va fazoviy tasavvurni rivojlantirishda didaktik o'yinlar muhim pedagogik vosita hisoblanadi.

Zamonaviy surdopedagogika didaktik o'yinlarni faqat ko'ngilochar faoliyat sifatida emas, balki kompetensiyaviy yondashuvni amalga oshiruvchi didaktik texnologiya sifatida talqin etadi. Bunday texnologiyalar orqali o'quvchilarda quyidagi kompetensiyalar rivojlantiriladi:

- kommunikativ kompetensiya;
- vizual savodxonlik;
- tanqidiy fikrlash;
- kreativ tafakkur;
- hamkorlikda ishlash kompetensiyasi;
- muammoli vaziyatlarni hal qilish ko'nikmalari;
- raqamli kompetensiyalar.

Shuningdek, zamonaviy tadqiqotlarda didaktik o'yinlarni sun'iy intellekt texnologiyalari bilan integratsiyalash masalalariga ham alohida e'tibor qaratilmoqda. Masalan, adaptiv o'yin platformalari har bir bolaning individual rivojlanish darajasini hisobga olib, topshiriqlar murakkabligini avtomatik ravishda moslashtirish imkonini beradi. Bu esa differensial ta'lim tamoyillarini samarali amalga oshirishga xizmat qiladi.

Bugungi kunda eshitishda nuqsoni bo'lgan bolalar maktablarida qo'llanilayotgan didaktik vositalar tarkibi ham tubdan yangilanmoqda. Oddiy ko'rgazmali qurollar o'rnini interaktiv sensorli doskalar, raqamli laboratoriyalar, QR-kodli topshiriqlar, elektron didaktik kartochkalar, animatsion platformalar, virtual laboratoriyalar, 3D modellar va kengaytirilgan reallik (Augmented Reality) texnologiyalari egallamoqda.

Mazkur vositalarning samaradorligi ularning vizual axborotni yuqori sifatda uzatish imkoniyati, o'quvchini faol harakatga undashi va mustaqil o'rganishni qo'llab-quvvatlashi bilan izohlanadi. Ayniqsa, multimodal o'qitish texnologiyasi (Multimodal Learning) bir vaqtning o'zida matn, tasvir, animatsiya, imo-ishora, subtitrlar va interaktiv elementlardan foydalanish orqali bilimlarni o'zlashtirish samaradorligini sezilarli darajada oshiradi.

Shuningdek, Universal Design for Learning (UDL) konsepsiyasi eshitishda nuqsoni bo'lgan bolalar uchun individual ta'lim trayektoriyasini yaratishda metodologik asos bo'lib xizmat qiladi. Mazkur yondashuv o'quv materiallarini turli shakllarda taqdim etish, bilimlarni namoyish etishning muqobil usullarini qo'llash va o'quvchini faol motivatsiyalashni nazarda tutadi.

Maqolaning ilmiy dolzarbligi shundaki, unda zamonaviy didaktik texnologiyalarni surdopedagogik amaliyot bilan integratsiyalashning metodik asoslari ishlab chiqiladi hamda eshitishda nuqsoni bo'lgan bolalar uchun didaktik o'yinlarni loyihalashning yangi konseptual modeli taklif etiladi.

Tadqiqot metodologiyasi

Mazkur tadqiqot maxsus pedagogika, surdopedagogika, rivojlantiruvchi ta'lim nazariyasi hamda kompetensiyaviy yondashuvning metodologik tamoyillariga asoslandi. Tadqiqot jarayonida eshitishda nuqsoni bo'lgan o'quvchilarning bilish faoliyatini rivojlantirishga xizmat qiluvchi didaktik o'yinlar va innovatsion ta'lim vositalarining pedagogik samaradorligi nazariy hamda amaliy jihatdan tahlil qilindi.

Tadqiqotning metodologik asosini shaxsga yo'naltirilgan ta'lim, faoliyatga asoslangan yondashuv, konstruktivistik ta'lim nazariyasi, Universal Design for Learning (UDL), multimodal o'qitish konsepsiyasi, differensial ta'lim va inkluziv pedagogika tamoyillari tashkil etdi. Mazkur yondashuvlar eshitishda nuqsoni bo'lgan bolalarning individual ehtiyojlari, psixofiziologik rivojlanish xususiyatlari hamda kommunikativ imkoniyatlarini hisobga olgan holda ta'limni tashkil etishga imkon beradi.

Eshitishda nuqsoni bo'lgan bolalarda axborotni qabul qilishning asosiy kanali vizual idrok hisoblanganligi sababli tadqiqot davomida vizual-kommunikativ metodlar ustuvor ahamiyat kasb etdi. O'quv materiallari matn, piktogramma, infografika, animatsiya, video, imo-ishora, subtitr va interaktiv elementlar uyg'unligida ishlab chiqildi.

Zamonaviy didaktik texnologiyalar

1. Gamifikatsiya texnologiyasi

Gamifikatsiya — o'yin elementlarini ta'lim jarayoniga integratsiyalash orqali o'quv motivatsiyasini oshirishga qaratilgan pedagogik texnologiyadir.

Eshitishda nuqsoni bo'lgan bolalar uchun gamifikatsiya quyidagi elementlarni o'z ichiga oladi: virtual mukofotlar; darajalar (Levels); reyting tizimi; badge (belgilar); avatarlar; missiyalar; kvestlar; bonus topshiriqlar.

Mazkur elementlar bolaning darsdagi faolligini oshirib, ichki motivatsiyasini rivojlantiradi.

2. Multimodal ta'lim texnologiyasi

Multimodal ta'lim bir vaqtning o'zida bir nechta axborot kanallaridan foydalanishga asoslanadi. Masalan: rasm; matn; imo-ishora; video; animatsiya; subtitr; piktogramma; sensorli obyektlar.

Bu texnologiya eshitishda nuqsoni bo'lgan o'quvchilarda axborotni chuqurroq o'zlashtirish imkonini yaratadi.

3. Universal Design for Learning (UDL)

UDL tamoyillariga ko'ra ta'lim uch yo'nalishda tashkil etiladi:

Bilimni taqdim etishning turli usullari: infografika; animatsiyalar; virtual laboratoriyalar; 3D modellar.

Bilimni namoyish qilishning turli shakllari: loyiha; video; elektron portfolio; elektron test.

O'quvchini motivatsiyalash: interaktiv topshiriqlar; individual marshrutlar; moslashtirilgan o'yinlar.

4. STEAM texnologiyasi

STEAM yondashuvi fanlararo integratsiyani ta'minlaydi.

Masalan, "Rangli konstruktor" o'yini orqali: matematika; texnologiya; muhandislik; san'at; mantiqiy fikrlash bir vaqtning o'zida rivojlantiriladi.

Zamonaviy didaktik vositalar

Tadqiqot davomida quyidagi innovatsion vositalarning pedagogik imkoniyatlari tahlil qilindi: interaktiv sensorli doska; SMART Board; interaktiv panel; QR-kodli topshiriqlar; elektron didaktik kartochkalar; LearningApps platformasi; Wordwall platformasi; Genially platformasi; Canva Education; Book Creator; Google lassroom; Microsoft Teams; Kahoot!; Quizizz; Nearpod; Padlet; sun'iy intellekt asosidagi vizual generatorlar; 3D modellar; virtual laboratoriyalar; kengaytirilgan reallik (Augmented Reality)

Mazkur vositalar o'quvchilarning bilish faolligini kuchaytirish, vizual tafakkurni rivojlantirish, hamkorlikdagi ta'limni tashkil etish va individual o'quv trayektoriyalarini yaratishda samarali didaktik resurs sifatida baholandi.

Tahlillar shuni ko'rsatdiki, gamifikatsiya elementlari bilan boyitilgan darslarda o'quvchilarning darsdagi faolligi, topshiriqlarni bajarishga bo'lgan qiziqishi va o'zlashtirish darajasi an'anaviy mashg'ulotlarga nisbatan yuqori bo'ladi. O'yin davomida qo'llaniladigan ballar tizimi, virtual mukofotlar, bosqichma-bosqich murakkablashuvchi vazifalar va jamoaviy musobaqalar ichki motivatsiyani shakllantirishga xizmat qiladi.

Multimodal ta'lim texnologiyasi esa bir vaqtning o'zida matn, tasvir, imo-ishora, subtitr, animatsiya va videodan foydalanish orqali axborotni turli sezgi kanallari orqali qabul qilish imkonini yaratadi. Natijada o'quv materialining mazmuni chuqurroq anglanadi va uzoq muddatli xotirada mustahkamlanadi.

Universal Design for Learning (UDL) tamoyillariga asoslangan didaktik vositalar o'quvchilarning individual imkoniyatlarini hisobga olib, har bir bola uchun mos ta'lim strategiyasini tanlashga yordam beradi. Bu yondashuv ayniqsa eshitishda nuqsoni bo'lgan bolalar bilan ishlashda muhim metodologik asos hisoblanadi.

XULOSA

Mazkur tadqiqot eshitishda nuqsoni bo'lgan bolalar maktablarida didaktik o'yinlar va zamonaviy didaktik vositalardan foydalanish ta'lim samaradorligini oshirishning muhim omili ekanligini ilmiy jihatdan asoslab berdi.

Tahlillar shuni ko'rsatdiki, didaktik o'yinlar o'quvchilarning bilish faolligini oshirish, vizual tafakkurini rivojlantirish, kommunikativ kompetensiyasini shakllantirish, ijtimoiy moslashuvini yaxshilash hamda mustaqil ta'lim ko'nikmalarini rivojlantirishda yuqori pedagogik samaradorlikka ega.

Shuningdek, gamifikatsiya, multimodal ta'lim, Universal Design for Learning, STEAM yondashuvi, augmentativ va alternativ kommunikatsiya vositalari hamda sun'iy intellekt asosidagi didaktik resurslarning kompleks qo'llanilishi ta'lim sifatini yangi bosqichga olib chiqishi aniqlandi.

Tadqiqot doirasida ishlab chiqilgan SMART-GAME didaktik modeli o'quvchilarning individual ehtiyojlari, psixofiziologik xususiyatlari va ta'lim maqsadlarini uyg'unlashtirgan holda didaktik o'yinlarni loyihalash va amaliyotga tatbiq etish uchun metodik asos bo'lib xizmat qiladi.

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O'ZBEKISTONDA MUSTAQILLIK ARAFASIDA SOG'LIQNI SAQLASH MUASSASALARI VA ULARNING MODDIY- TEXNIK HOLATIDAGI MUAMMOLAR

***Annotatsiya:** Mazkur maqolada O'zbekistonda mustaqillik arafasida sog'liqni saqlash muassasalari va ularning moddiy- texnik holatidagi muammolar to'g'risida so'z boradi. Shuningdek, maqolada respublikda aholi salomatligiga ta'sir etuvchi ekologik muammolar to'g'risida ham so'z boradi.*

***Kalit so'zlar:** aholi salomatligi, Tibtexnika, ekologiya, shifoxona, "O'ztibtexnika", go'daklar o'limi, Sovetlar.*

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HEALTHCARE INSTITUTIONS IN UZBEKISTAN ON THE EVE OF INDEPENDENCE: PROBLEMS OF THEIR MATERIAL AND TECHNICAL CONDITION.

***Annotation:** This article discusses the issues related to health care institutions and their material-technical condition in Uzbekistan on the eve of independence. The article also touches upon ecological problems affecting public health in the country.*

***Keywords:** public health, Tibtexnika, ecology, hospital, "O'ztibtexnika", infant mortality, Soviets.*

Mustaqillikning dastlabki yillarida O'zbekiston sog'liqni saqlash tizimi murakkab iqtisodiy va ijtimoiy sharoitda faoliyat yuritganligi tahlildan yaqqol ko'rinadi. Tizimda mavjud muammolar faqat mustaqillik davriga xos emas, balki sobiq sovet davridan meros bo'lib qolgan markazlashgan boshqaruv tizimining oqibati edi. Sog'liqni saqlash tizimi faoliyatini asosan miqdoriy ko'rsatkichlar orqali baholash natijasida davolash muassasalari soni ko'paygan bo'lsa-da, ularning moddiy-texnik ta'minoti va xizmat sifati talab darajasida shakllanmagan. Bu holat aholining sifatli tibbiy xizmatdan foydalanish imkoniyatlarini cheklagan.

Tahlil natijalari shuni ko'rsatadiki, 1991-yilda kasalxonalar va davolash o'rinlari soni nisbatan yuqori bo'lishiga qaramay, yuqumli kasalliklarning keng tarqalishi, ayniqsa bolalar orasida gepatit kasalligining yuqori darajada uchrashi sog'liqni saqlash tizimining profilaktik va sanitariya-epidemiologik faoliyati yetarli darajada samarali bo'lmaganligini ko'rsatadi. Demak, tibbiyot muassasalari sonining ko'pligi har doim ham tibbiy xizmat sifati yuqori ekanligini anglatmaydi.

Shuningdek, tibbiy texnika va uskunalarning eskirganligi hamda ularga servis xizmatining yetarli darajada yo'lga qo'yilmaganligi diagnostika va davolash sifatiga salbiy ta'sir ko'rsatgan. "O'ztibtexnika" va "Tibtexnika" korxonalari faoliyati tahlili shuni ko'rsatadiki, moddiy-texnik imkoniyatlarning cheklanganligi zamonaviy tibbiy texnologiyalarni joriy etishni sekinlashtirgan. Ayniqsa, radiologik, diagnostik va endoskopik uskunalarning o'z vaqtida ta'mirlanmagani tibbiy xizmat sifatini pasaytirgan omillardan biri bo'lgan.

Boshqa tomondan, mustaqillik yillarida sog'liqni saqlash sohasida boshlangan islohotlar ushbu muammolarni bosqichma-bosqich bartaraf etishga qaratildi. Ayniqsa, 1998-yilda qabul qilingan sog'liqni saqlash tizimini isloh qilish davlat dasturi tizimni markazlashgan modeldan aholiga yaqinlashtirilgan birlamchi tibbiy yordam tizimiga o'tkazishda muhim burilish nuqtasi bo'ldi. Qishloq vrachlik punktlarining tashkil etilishi nafaqat tibbiy xizmatning hududiy qamrovini kengaytirdi, balki aholining ixtisoslashgan shifoxonalarga ortiqcha murojaat qilishini ham kamaytirdi. Farmatsevtika sanoatini rivojlantirish bo'yicha amalga oshirilgan chora-tadbirlar ham sog'liqni saqlash tizimi barqarorligini ta'minlashda muhim ahamiyat kasb etdi. Mustaqillikning dastlabki yillarida import dori vositalariga yuqori darajada qaramlik mavjud bo'lgan bo'lsa, keyinchalik mahalliy farmatsevtika korxonalarining tashkil etilishi ichki bozorda dori vositalari ta'minotini yaxshilashga xizmat qildi.

Onalik va bolalikni muhofaza qilish bo'yicha amalga oshirilgan islohotlar ham ijobiy natijalar berdi. Perinatal va skrining markazlarining tashkil etilishi, homilador ayollar hamda bolalarni muntazam tibbiy nazorat qilish tizimining yo'lga qo'yilishi onalar va chaqaloqlar o'limi ko'rsatkichlarini kamaytirishda muhim omil bo'ldi. Bu esa sog'liqni saqlash siyosatida profilaktik yo'nalishning ustuvor ahamiyat kasb eta boshlaganini ko'rsatadi.

Biroq ekologik omillarning, ayniqsa Orolbo'yi hududidagi ekologik inqirozning aholi salomatligiga salbiy ta'siri mustaqillik yillarida ham dolzarb muammo bo'lib qolgan. Bu holat sog'liqni saqlash tizimini rivojlantirish faqat tibbiyot muassasalari faoliyatini takomillashtirish bilangina cheklanmasdan, ekologik xavfsizlik, sanitariya va ijtimoiy siyosat bilan uzviy bog'liq ekanligini ko'rsatadi. Sog'liqni saqlash tizimini isloh qilish zarurati nafaqat tibbiyot sohasidagi muammolar, balki mamlakatning umumiy ijtimoiy-iqtisodiy rivojlanish ehtiyojlari bilan ham chambarchas bog'liq edi. Bozor iqtisodiyotiga o'tish sharoitida davlat byudjeti imkoniyatlarining cheklanganligi sog'liqni saqlash tizimini moliyalashtirishda yangi mexanizmlarni izlashni taqozo etdi. Shu sababli mavjud mablag'lardan oqilona foydalanish, tibbiyot muassasalarini maqbullashtirish va resurslarni birlamchi tibbiy yordam bo'g'iniga yo'naltirish ustuvor vazifaga aylandi. Sohadagi islohotlarning muhim jihatlaridan biri davolashga yo'naltirilgan modeldan kasalliklarning oldini olishga asoslangan profilaktik modelga bosqichma-bosqich o'tilganidir. Sobiq tizimda asosiy e'tibor kasalliklarni davolashga qaratilgan bo'lsa, mustaqillik yillarida sog'lom turmush tarzini shakllantirish, emlash dasturlarini kengaytirish, skrining tekshiruvlarini yo'lga qo'yish hamda aholini muntazam tibbiy ko'rikdan o'tkazish kabi

yoʻnalishlar rivojlantirildi. Bu esa kasalliklarni erta aniqlash va ularning ogʻir asoratlarini kamaytirishga xizmat qildi.

Tahlillar shuni koʻrsatadiki, sogʻliqni saqlash tizimini isloh qilishda xalqaro hamkorlik ham muhim rol oʻynadi. Mustaqillikdan soʻng Oʻzbekiston bir qator xalqaro tashkilotlar bilan hamkorlikni yoʻlga qoʻydi. Ushbu hamkorlik doirasida zamonaviy diagnostika uskunalari olib kelindi, shifokorlarning malakasi oshirildi hamda onalik va bolalikni muhofaza qilish, yuqumli kasalliklarga qarshi kurashish va reproduktiv salomatlikni yaxshilash boʻyicha koʻplab loyihalar amalga oshirildi. Natijada milliy sogʻliqni saqlash tizimiga xalqaro standartlar bosqichma-bosqich joriy etila boshlandi.

Kadrlar masalasi ham sogʻliqni saqlash tizimini rivojlantirishning muhim omillaridan biri boʻldi. Moddiy-texnik bazani mustahkamlash bilan bir qatorda shifokorlar va oʻrta tibbiyot xodimlarining malakasini oshirish, ularni zamonaviy davolash usullari bilan tanishtirish, xorijiy tajribalarni oʻrganishga keng imkoniyatlar yaratildi. Chunki zamonaviy tibbiy uskunalarning samarali ishlatilishi bevosita tibbiyot xodimlarining kasbiy salohiyatiga bogʻliq edi. Shuningdek, sogʻliqni saqlash tizimida ixtisoslashgan tibbiy markazlarning tashkil etilishi ham islohotlarning muhim natijalaridan biri hisoblanadi. Respublika ixtisoslashtirilgan ilmiy-amaliy tibbiyot markazlarining tashkil etilishi yurak-qon tomir, endokrinologiya, onkologiya, pediatriya, akusherlik va ginekologiya kabi yoʻnalishlarda yuqori texnologik tibbiy yordam koʻrsatish imkoniyatlarini kengaytirdi. Bu esa ilgari xorijda davolanishga majbur boʻlgan ayrim bemorlarga mamlakatning oʻzida malakali yordam koʻrsatish imkonini yaratdi. Bundan tashqari, sogʻliqni saqlash tizimini rivojlantirish hududlar oʻrtasidagi tibbiy xizmat sifati tafovutlarini kamaytirishga ham xizmat qildi. Avval tibbiy xizmatlarning asosiy qismi viloyat markazlari va yirik shaharlarda jamlangan boʻlsa, keyinchalik qishloq vrachlik punktlari, oilaviy poliklinikalar va zamonaviy diagnostika markazlari tashkil etilishi natijasida chekka hududlarda yashovchi aholining ham sifatli tibbiy xizmatdan foydalanish imkoniyatlari sezilarli darajada kengaydi. Shu bilan birga, amalga oshirilgan islohotlarga qaramasdan, ayrim muammolar uzoq vaqt davomida saqlanib qoldi. Xususan, ayrim hududlarda malakali mutaxassislar yetishmasligi, tibbiyot muassasalarining moddiy-texnik taʼminotidagi hududlararo tafovutlar, zamonaviy uskunalaridan foydalanish samaradorligining bir xil emasligi hamda ekologik omillarning aholi salomatligiga salbiy taʼsiri tizimning barqaror rivojlanishiga toʻsqinlik qiluvchi omillar boʻlib qoldi. Bu esa sogʻliqni saqlash tizimini takomillashtirish uzluksiz jarayon ekanligini koʻrsatadi. Umuman olganda, mustaqillik yillarida Oʻzbekiston sogʻliqni saqlash tizimida amalga oshirilgan islohotlar nafaqat mavjud muammolarni bartaraf etishga, balki milliy sogʻliqni saqlash modelini shakllantirishga xizmat qildi. Mazkur islohotlar natijasida tibbiy xizmatlarning sifati va qamrovi yaxshilanib, profilaktik yoʻnalish kuchaytirildi, birlamchi tibbiy yordam tizimi rivojlantirildi hamda zamonaviy tibbiyot texnologiyalarini joriy etish uchun mustahkam huquqiy va moddiy asos yaratildi. Bu jarayonlar keyingi yillarda sogʻliqni saqlash tizimini yanada modernizatsiya qilish uchun muhim poydevor boʻlib xizmat qildi. Tahlil natijalari

shuni ko'rsatadiki, mustaqillikning dastlabki yillarida O'zbekiston sog'liqni saqlash tizimi jiddiy tarkibiy muammolar bilan faoliyat boshlagan bo'lsa-da, bosqichma-bosqich amalga oshirilgan islohotlar natijasida tizimning moddiy-texnik bazasi mustahkamlandi, birlamchi tibbiy yordam instituti rivojlantirildi, zamonaviy diagnostika va davolash texnologiyalari joriy etildi hamda tibbiy xizmat sifati sezilarli darajada yaxshilandi. Shu bilan birga, ushbu tajriba sog'liqni saqlash tizimi samaradorligini oshirishda faqat infratuzilmani rivojlantirish emas, balki boshqaruv tizimini takomillashtirish, profilaktika, ekologik xavfsizlik va kadrlar salohiyatini kuchaytirish ham hal qiluvchi omillar ekanligini tasdiqlaydi. Shu sababli, mustaqillik davrida amalga oshirilgan islohotlarni O'zbekiston sog'liqni saqlash tizimining zamonaviy rivojlanishiga asos bo'lgan muhim tarixiy bosqich sifatida baholash mumkin.

Xulosa qilib aytganda, mustaqillik arafasida O'zbekiston sog'liqni saqlash tizimining moddiy-texnik holati murakkab ahvolda bo'lgan. Biroq mustaqillik yillarida amalga oshirilgan tizimli islohotlar natijasida sohaning moddiy bazasi mustahkamlanib, aholiga zamonaviy va sifatli tibbiy xizmat ko'rsatish imkoniyatlari sezilarli darajada kengaydi.

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THE ROLE OF FATHERS IN THE EDUCATION OF PRESCHOOL-AGED CHILDREN AND THE INFLUENCE OF PATERNAL PARENTING ON CHILDREN

***Annotation:** This article provides information on the role, behavior, and upbringing of fathers in the education of preschool-age children (especially boys), their place in the family, and also provides recommendations for parents.*

***Keywords:** spiritual wealth, socialization, values, traditions, maturity*

Introduction

The family is a stronghold that ensures human happiness in this world. Our religion has established specific laws and regulations between husband and wife. If the husband and wife follow these rules and fully fulfill their duties and obligations to each other, such a family will be happy. If the family is honest, pure, peaceful, the society will be strong and life will be prosperous. The responsibility of the man in the family is specifically mentioned. Allah Almighty created the man with the physical and spiritual aspects of being a leader in the family. Allah Almighty has entrusted the man with the responsibility of leading the sacred institution of the family, and has blessed him in the Holy Quran as follows:

“Men are the permanent guardians of women. This is because Allah has made some of them excel others in some respects and because they spend from their wealth.”

“The duty of a husband towards his wife is to feed her when she eats, to clothe her when she dresses, not to hit her in the face, not to insult her with bad words, and to lie down in a different place when she is angry without leaving the house,” it is stated in a hadith.

The greatest duty of a man is not to allow his dependents to become dependent on others. In fact, it is obligatory on a man to provide for his wife.

It is a pity that nowadays some heads of families are forgetting their duties in this matter, and some men are seen forcing their wives to go out and earn money in ways that are not in keeping with the dignity of women, even forcing them to go to the streets and even to work as maids. This is because the husband is unable to fulfill his duties, which ultimately leads to the breakdown of the family.

One day, a woman brought her husband to Hazrat Umar (may Allah be pleased with him) and showed him her husband and said, "O Commander of the Faithful! This man will be my husband. We have been married for three months.

I have tried very hard to live in peace with you, but my husband is not interested and does not fulfill his duties. I am divorcing him." Hazrat Umar asked

her husband, "What do you think?" The husband said, "I have no complaints, but I will not divorce you." Hazrat Umar (may Allah be pleased with him) understood the reason by looking at the husband's clothes, complexion, and face, and said to the woman, "You go home now and come back in a little while, until then we can talk to your husband." After the woman left, Hazrat Umar (may Allah be pleased with him) took the man to the bathroom and ordered him to wash and put on clean clothes. The husband was washed and put on clean clothes. In the meantime, the woman came in, and seeing her husband's cleanliness and clean clothes, she forgot the divorce agreement and took her husband home. Then Hazrat Umar (may Allah be pleased with him) said to the people, "Just as your wives like to greet you nicely, your wives also like you to be clean and pure."

Research and Analysis

The main goal of this approach, called the modern discipline approach, is to develop self-control mechanisms in children from an early age. As a child develops, he often relies on the family's expressed attitude and feedback to understand his behavior and what is right and wrong.

Discipline and setting boundaries require consistency. Parents need to demonstrate the same and stable attitude towards the child in all situations. The difference in the approaches of parents complicates the process of distinguishing between right and wrong for the child.

What is boundary setting?

Boundary setting is the provision of guidelines and indicators that define an area in which a child can act safely. Boundaries require discipline, but discipline and punishment are not the same concepts. Physical punishment can increase a child's feelings of shame, unhappiness, and hopelessness, and can lower their self-esteem. Even more dangerously, it can instill in the child the false idea that violence is acceptable and appropriate behavior, and that the use of force can achieve the desired result. When teaching children proper behavior, it is more important to explain with reasons and explanations what actions to take and what actions to refrain from than to punish.

Why do we need boundaries?

Children are born into a world where rules and norms are alien to them. As they grow older, the demands and responsibilities expected of them change and become more complex. In this process, boundaries play an extremely important role in the process of children learning and understanding (discovering) their environment. As children begin to explore the world, they begin to engage in various activities independently, establish new social relationships, and as a result, encounter different attitudes and reactions. The most important guidance for children to effectively manage these situations is clear and unambiguous signals. When the boundaries are clear and consistent, it is easier for children to understand and apply them.

Incorrect parental attitudes when setting boundaries

- Inability to say "no" to the child;
- Overly broad, variable, and unclear boundaries;

- Overindulging the child;
- Not devoting enough time to their children;
- Not working on themselves in raising the child;
- Showing pedagogically incorrect parental attitudes.

How should boundaries actually be set?

The presence of loving, open, attentive, and consistent parents is one of the most important conditions in the upbringing process. Children are more likely to accept rules and norms in an environment where they feel accepted, loved, and cared for.

Boundaries should be reviewed and adjusted as needed. They should be established from infancy and adjusted as the child ages and develops. The importance of respecting boundaries should be clearly and concisely explained to children.

Boundaries should be purposeful. It is not right to say “no” to every situation under the pretext of setting boundaries. The boundaries set should be enforced consistently. If a child understands that boundaries can be violated, he will inevitably try to test them in any situation.

The reasons for negative behavior should be analyzed in depth, because behind each behavior there is a specific need, goal, or problem. While explaining to the child what is not allowed, it is also important to show him what alternative and acceptable behaviors are possible.

Involving children in the process of setting boundaries helps them internalize these rules and feel responsible. It is also extremely important for parents to be role models for their children. A single and harmonious position, clear views, and daily behavior of parents are the most effective factors in setting boundaries. A child growing up in an environment without boundaries has difficulty setting his own direction, cannot feel safe, and constantly needs external support, approval, and help. Such a child tests boundaries, checks how strict the parents are, and makes various attempts to understand what consequences he will face if he breaks the rules. Parents who do not know how to say “no” to their child, who are too indulgent, and who raise him as a special person should realize that in the future they are raising an adult who is weak in coping skills, prone to dissatisfaction, low in self-confidence, and prone to depression.

When a child does not listen to their parents.

Sometimes children, despite being responsible, do not want to do what their parents say. In some situations, they strongly demand to get the item they want at the mall, sometimes they do not want to sleep, and in some cases, they regularly repeat behaviors that are completely contrary to what their parents say. For example, negative behaviors such as drawing on walls, breaking toys, hitting peers, biting parents are among them.

In such situations, children need clear and healthy boundaries. An environment without boundaries is not only worrying for children, but also for adults. Although the rules in life seem to limit human freedom on the one hand, they provide a sense of security on the other. For example, the red light rule in

traffic may annoy many, but it is precisely because of this rule that we feel safer in traffic. Similarly, although children may not seem to want rules and boundaries on the outside, their mental world needs healthy boundaries. Therefore, it is necessary to set clear boundaries for children in matters such as bedtime, mealtime, screen time, and responsibility.

Points to consider when punishing.

When it comes to punishing a child, the following should be emphasized: regardless of the behavior a child has committed, humiliating, insulting, yelling at, or physically punishing him/her as a person is absolutely unacceptable. This approach will help to reduce negative behavior in a child.

Threatening a child to complain to his father, mother or teacher about his negative behavior is also one of the wrong educational methods. This situation conveys to the child the message that the parents are powerless to control the situation. Although such a threat may seem to change behavior in the short term, it does not lead to long-term, sustainable positive changes.

Conclusion

The presence of certain rules in every family is important from the point of view of forming an internal discipline mechanism in the child. The family must establish rules and ensure their consistent implementation. Punishment in the upbringing process is a last resort, and the most appropriate punishment is to deprive the child of his favorite activity for a certain period of time. For example, if the child does not regularly complete his homework, non-degrading punishments can be used, such as temporarily restricting the right to watch TV. However, punishment should only be used if the child continues to repeat the negative behavior despite the necessary explanations and warnings.

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XORAZM VILOYATIDA AYLANMADAN CHIQQAN QISHLOQ XO‘JALIGI YERLARINI GIS VA MASOFADAN ZONDLASH USULLARI ASOSIDA ANIQLASH

***Annotatsiya.** Ushbu maqolada Xorazm viloyati qishloq xo‘jaligi yerlarida aylanmadan chiqqan hududlarni aniqlash va baholashda geoinformatsion tizimlar hamda masofadan zondlash ma’lumotlaridan foydalanish imkoniyatlari yoritilgan. Tadqiqotda Sentinel-2 sun’iy yo‘ldosh tasvirlari asosida NDVI, NDWI va SI indeksleri AHP Saaty usulida hisoblanib, yer qoplamasining holati tahlil qilindi. Olingan natijalar GIS muhitida qayta ishlanib, aylanmadan chiqqan yerlarning hududiy taqsimlanish xaritalari yaratildi. Tadqiqot natijalari qishloq xo‘jaligi yerlaridan foydalanish samaradorligini oshirish va yer resurslarini boshqarishda muhim ahamiyatga ega ekanligi aniqlandi.*

***Kalit so‘zlar:** GIS, masofadan zondlash, Sentinel-2, NDVI, NDWI, SI qishloq xo‘jaligi yerlari, aylanmadan chiqqan yerlar.*

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IDENTIFICATION OF AGRICULTURAL LANDS WITHDRAWN FROM CIRCULATION IN THE KHOREZM REGION BASED ON GIS AND REMOTE SENSING METHODS

***Abstract.** This article highlights the possibilities of using geographic information systems and remote sensing data to identify and assess agricultural lands withdrawn from circulation in the Khorezm region. In the study, NDVI, NDWI, and SI indices were calculated using the Saaty AHP method based on Sentinel-2 satellite imagery, and the state of the land cover was analyzed. The obtained results were processed in a GIS environment, and maps of the spatial distribution of lands withdrawn from circulation were generated. It was determined that the results of the research are of great importance for increasing the efficiency of agricultural land use and land resource management.*

Keywords: *GIS, remote sensing, Sentinel-2, NDVI, NDWI, SI, agricultural lands, lands withdrawn from circulation.*

Kirish

Yer resurslari qishloq xo'jaligi ishlab chiqarishining asosiy vositasi hisoblanadi. Aholi sonining ortishi, suv resurslari taqchilligi, tuproq degradatsiyasi va iqlim o'zgarishi sharoitida qishloq xo'jaligi yerlaridan samarali foydalanish masalasi dolzarb ahamiyat kasb etmoqda. Ayniqsa, sug'oriladigan hududlarda ayrim maydonlarning turli sabablarga ko'ra foydalanishdan chiqib ketishi qishloq xo'jaligi mahsulotlari yetishtirish hajmiga salbiy ta'sir ko'rsatadi.

Xorazm viloyati O'zbekistonning sug'orma dehqonchilik rivojlangan hududlaridan biri bo'lib, qishloq xo'jaligi yerlari iqtisodiyotning muhim tarkibiy qismi hisoblanadi. So'nggi yillarda ayrim yer maydonlarining sho'rlanishi, suv ta'minotidagi muammolar va antropogen omillar natijasida qishloq xo'jaligi aylanmasidan chiqib qolgan hududlar soni ortib bormoqda. Bunday yerlarni o'z vaqtida aniqlash va monitoring qilish zamonaviy geoinformatsion texnologiyalarni qo'llashni talab etadi.

Masofadan zondlash ma'lumotlari va GIS texnologiyalari katta hududlarni qisqa vaqt ichida tahlil qilish, yer qoplamini holatini baholash hamda aylanmadan chiqqan yerlarni aniqlash imkonini beradi.

Tadqiqot obyekti va metodlari

Tadqiqot obyekti sifatida Xorazm viloyati hududidagi qishloq xo'jaligi yerlari tanlandi. Tadqiqotda 2025-yilga oid Sentinel-2 kosmik tasvirlaridan foydalanildi.

Ish jarayonida quyidagi bosqichlar amalga oshirildi:

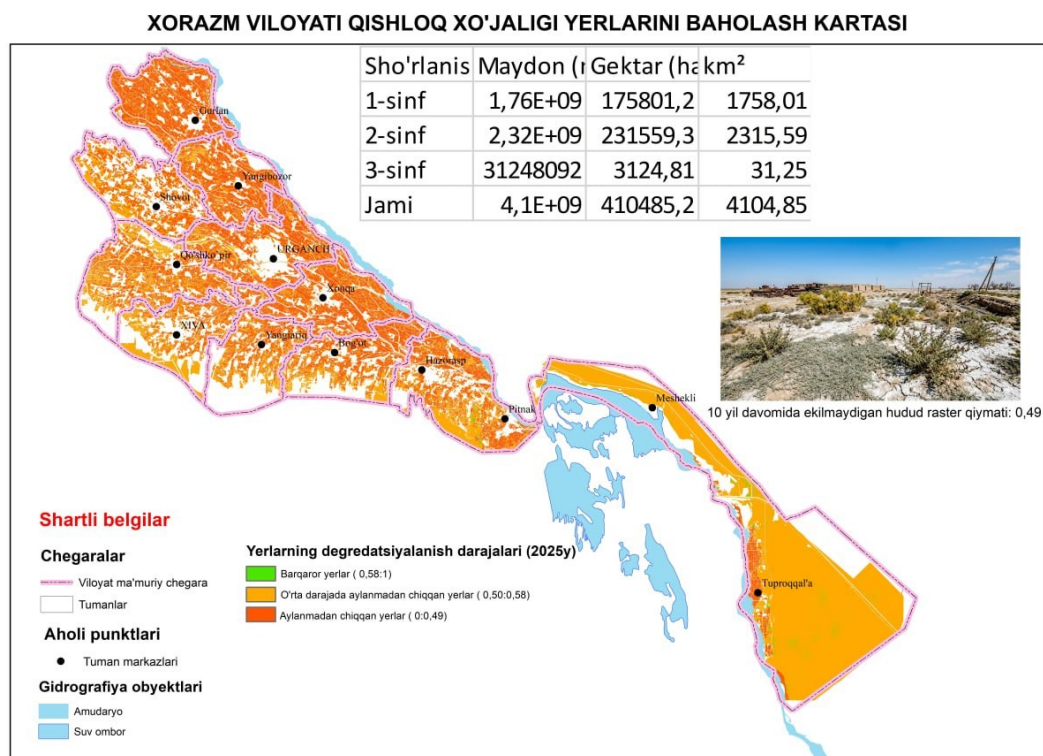
1. Sentinel-2 kosmik tasvirlarini GEE platformasida ham viloyat chegarasi, hamda qishloq xo'jaligi konturlari asosida har bir indeks bo'yicha alohida surat yuklab olish va dastlabki qayta ishlash;
2. Olingan indekslarni normallashtirish;
3. Rasterlarni GIS muhitida tahlil qilish;
4. Reclassify usuli yordamida yerlarni foydalanilayotgan va aylanmadan chiqqan toifalarga ajratish;
5. Natijalarni kartografik ko'rinishda tasvirlash va maydonlarini hisoblash.

Tadqiqot natijalari va tahlil

Hisoblangan NDVI, NDWI va SI indekslari asosida dastlab AHP (Analytic Hierarchy Process) usuli yordamida kompleks baholash modeli ishlab chiqildi. Ushbu yondashuvda NDVI vegetatsiya holatini ifodalovchi asosiy ko'rsatkich sifatida kiritildi. Biroq amaliy tahlil jarayonida NDVI ning ayrim cheklovlari aniqlandi.

Xususan, NDVI yuqori qiymatlari faqat ekin ekilgan maydonlarni emas, balki tabiiy yovvoyi o'simliklar bilan qoplangan hududlarni ham "faol vegetatsiya" sifatida baholadi. Natijada AHP modeli tarkibida NDVI ning mavjudligi yakuniy tasniflashda xatolik (false classification) keltirib chiqardi va

ayrim ekin ekilmaydigan hududlar noto'g'ri ravishda foydalanilayotgan yerlar qatoriga kiritildi.



1-rasm. NDVI, NDWI, SI indeksleri orqali hisoblangan karta namunasi

Shu sababli model qayta ko'rib chiqilib, NDVI ning yakuniy integratsiyadagi ta'siri cheklanib, asosiy e'tibor NDWI va SI indekslariga qaratildi. Takomillashtirilgan yondashuvda NDWI va SI teng og'irlikda (50/50) AHP/Weighted Overlay usuli orqali birlashtirildi.

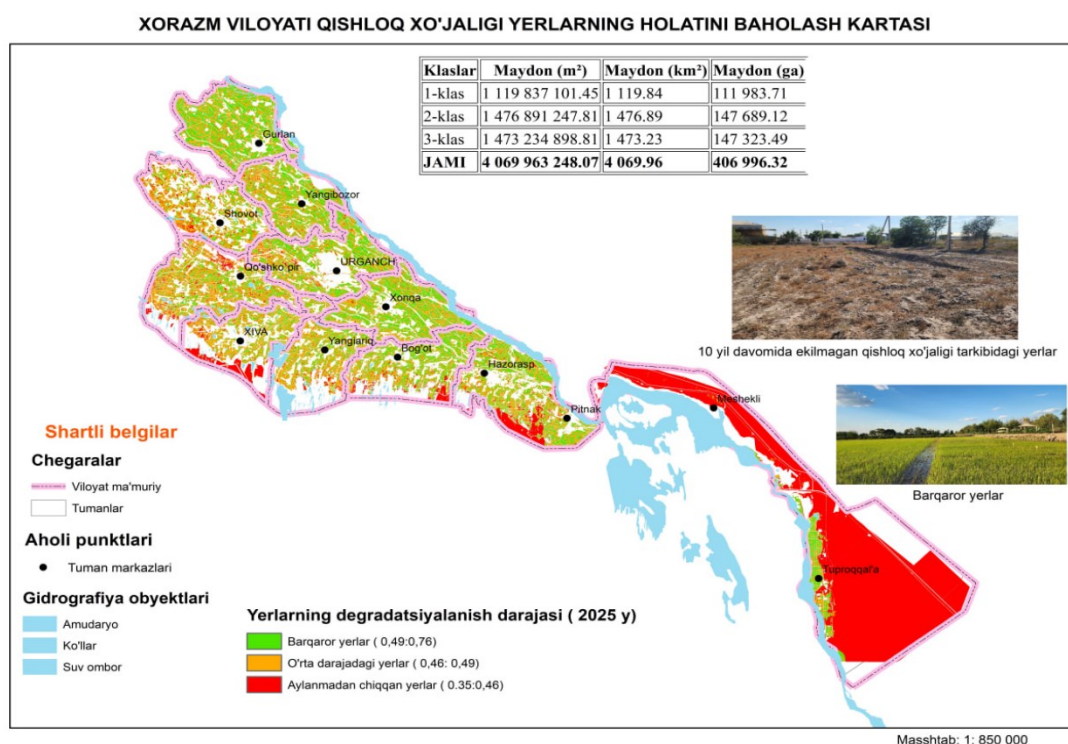
Mazkur o'zgartirilgan metodika vegetatsiyaning tabiiy (yovvoyi) shakllarini hisobga olmagan holda, asosan namlik va tuproq sho'rlanishi kabi agronomik cheklov omillariga tayanadi. Natijada aylanmadan chiqqan yerlarni aniqlashda aniqlik oshdi va NDVI sababli yuzaga kelgan ortiqcha tasniflash muammosi bartaraf etildi.

NDVI indeksining yakuniy modeldagi noaniqlik keltirib chiqarganligi sababli, keyingi bosqichda aylanmadan chiqqan yerlarni aniqlashda NDWI va SI indekslariga asoslangan takomillashtirilgan yondashuv qo'llanildi. Ushbu bosqichda vegetatsiya ko'rsatkichidan voz kechilib, asosiy e'tibor hududlarning namlik holati va tuproq sho'rlanish darajasiga qaratildi.

Metodik jihatdan NDWI va SI indeksleri AHP (Analytic Hierarchy Process) hamda Weighted Overlay usuli asosida teng og'irlikda, ya'ni 50/50 nisbatda birlashtirildi. Ushbu yondashuvda NDWI suv va namlik sharoitini, SI esa tuproq sho'rlanish darajasini ifodalovchi asosiy mezon sifatida qabul qilindi.

Natijaviy model ushbu ikki ko'rsatkichning integratsiyasi asosida shakllantirilib, Xorazm viloyati sharoitida aylanmadan chiqqan yerlarni

aniqlashning yanada barqaror va ishonchli metodini ta'minladi. Olingan natijaviy xarita yerlarning foydalanish darajasi, namlik tanqisligi hamda sho'rlanish omillarini kompleks hisobga olgan holda hududlarni tasniflash imkonini berdi.



2-rasm. NDWI, SI indeksleri orqali to'g'irlangan karta namunasi

- faol foydalanilayotgan yerlar;
- qisman foydalanilayotgan yerlar;
- aylanmadan chiqqan yerlar.

Yaratilgan tematik xaritalar aylanmadan chiqqan yerlarning viloyat bo'yicha notekis taqsimlanganligini ko'rsatdi. Bunday hududlar asosan suv ta'minoti qoniqarsiz bo'lgan hamda sho'rlanish darajasi yuqori maydonlarda uchrashi aniqlandi.

GIS texnologiyalari yordamida har bir sinfning maydoni hisoblandi va statistik ma'lumotlar olindi. Natijalar yer resurslaridan foydalanish samaradorligini oshirish bo'yicha tavsiyalar ishlab chiqish imkonini berdi.

Xulosa

Tadqiqot natijalari shuni ko'rsatdiki, GIS va masofadan zondlash texnologiyalari qishloq xo'jaligi yerlarining holatini monitoring qilishda yuqori aniqlik va samaradorlikka ega hisoblanadi. Dastlab NDVI, NDWI va SI indeksleri asosida kompleks baholash amalga oshirilgan bo'lsa-da, NDVI komponenti ayrim hollarda yovvoyi o'simliklar ta'siri tufayli tasniflashda noaniqliklarni keltirib chiqardi.

Shu sababli takomillashtirilgan yondashuv sifatida NDWI va SI indekslariga asoslangan integrallashgan model qo'llanildi. Ushbu modelda NDWI va SI

ko'rsatkichlari teng og'irlikda (50/50) birlashtirilib, aylanmadan chiqqan yerlarni aniqlashning barqaror va ishonchli usuli ishlab chiqildi.

Olingan natijalar Xorazm viloyatida ayrim qishloq xo'jaligi maydonlari suv ta'minoti yetishmasligi va tuproq sho'rlanishi kabi tabiiy omillar hamda antropogen ta'sirlar natijasida foydalanishdan chiqqanligini ko'rsatdi. Mazkur hududlarni qayta qishloq xo'jaligi aylanmasiga kiritish uchun meliorativ va agrotexnik tadbirlarni amalga oshirish muhim ahamiyatga ega.

Umuman olganda, GIS va masofadan zondlash asosidagi NDWI–SI integratsiyalashgan yondashuv yer resurslarini monitoring qilish, ularni oqilona boshqarish hamda qishloq xo'jaligi samaradorligini oshirishda amaliy jihatdan samarali vosita ekanligini tasdiqladi.

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ZAMONAVIY FUTBOLDA O'YIN DINAMIKASINI SAQLASHDA MAXSUS CHIDAMKORLIKNI SHAKLLANTIRISH OMILLARI

***Annotatsiya.** Ushbu maqolada zamonaviy futbolda o'yin dinamikasini uchrashuv oxirigacha yuqori darajada saqlab qolishda maxsus chidamlilikning o'rni va uni shakllantiruvchi asosiy omillar yoritilgan. Futbolchilarning aerob va anaerob imkoniyatlarini rivojlantirish, o'yin davomidagi yuqori intensivlikdagi harakatlar va ulardan keyingi tiklanish jarayonlari tahlil qilingan. Shuningdek, zamonaviy futboldagi metodologik yondashuvlar va jismoniy yuklamalarni rejalashtirish bo'yicha amaliy tavsiyalar berilgan.*

***Kalit so'zlar:** zamonaviy futbol, o'yin dinamikasi, maxsus chidamlilik, yuklama, intensivlik, aerob-anaerob muvozanat, tiklanish.*

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FACTORS OF SPECIFIC ENDURANCE FOR MAINTAINING GAME DYNAMICS IN MODERN FOOTBALL

***Abstract.** This article discusses the role of special endurance in maintaining the dynamics of the game at a high level until the end of the match in modern football and the main factors shaping it. The development of aerobic and anaerobic capabilities of football players, high-intensity movements during the game and the recovery processes after them are analyzed. Also, methodological approaches in modern football and practical recommendations for planning physical loads are given.*

***Keywords:** modern football, game dynamics, special endurance, load, intensity, aerobic-anaerobic balance, recovery.*

Kirish.

Zamonaviy futbol o'zining yuqori dinamikasi, keskin taktik kurashlari va pressing tizimlarining jadallashuvi bilan ajralib turadi. Bugungi kunda yuqori malakali futbolchi bir o'yin davomida o'rtacha 10-13 km masofani bosib o'tadi, shundan salmoqli qismi yuqori tezlikdagi sprintlar (tezlanishlar) ulushiga to'g'ri keladi.

Respublikamizda ham jismoniy tarbiya va sportni, xususan, futbolni ilmiy asosda rivojlantirish davlat siyosatining ustuvor yo'nalishlaridan biri etib belgilangan. O'zbekiston Respublikasi Prezidentining 2023-yil 7-apreldagi "Ommaviy va professional futbolni har tomonlama rivojlantirishning qo'shimcha chora-tadbirlari to'g'risida"gi PQ-115-sonli Qarori hamda 2020-yil 30-oktabrdagi

“Sog‘lom turmush tarzini keng tatbiq etish va ommaviy sportni yanada rivojlantirish chora-tadbirlari to‘g‘risida”gi PF-6099-sonli Farmoni ijrosini ta‘minlash doirasida sportchilarni tayyorlash tizimiga zamonaviy innovatsion va ilmiy-metodik yondashuvlarni joriy etish talab etilmoqda. Ushbu huquqiy hujjatlarda professional futbolchilar va zaxira sportchilarini tayyorlashda xalqaro standartlarga javob beradigan jismoniy va funksional yuklamalarni ilmiy asosda rejalashtirish alohida ta‘kidlangan.

Futbolda o‘yin davomida charchoqning ortishi nafaqat jismoniy faollikning pasayishiga, balki texnik-taktik xatolarning ko‘payishiga va uchrashuvning so‘nggi daqiqalarida gol o‘tkazib yuborish xavfining ortishiga olib keladi. Shu sababli, yuqoridagi farmon va qarorlarda belgilangan vazifalardan kelib chiqqan holda, futbolchilarning maxsus chidamliligini shakllantirish va uni ilmiy asoslangan omillar yordamida boshqarish zamonaviy sport biologiyasi hamda mashg‘ulotlar metodikasining eng dolzarb muammolaridan biri bo‘lib qolmoqda.

Metodologiya va adabiyotlar tahlili

Maxsus chidamlilik - bu futbolchining o‘yinga xos bo‘lgan spetsifik harakatlarni (sprint, keskin to‘xtash, yo‘nalishni o‘zgartirish, sakrash va kurashlar) uchrashuv oxirigacha samarali bajarish qobiliyatidir. Futbolda chidamlilik murakkab (gibrid) xarakterga ega bo‘lib, u ham **aerob**, ham **anaerob** energiya tizimlarining sinteziga tayanadi

Ilmiy manbalar tahlili shuni ko‘rsatadiki, zamonaviy futbolda chidamlilikni rivojlantirishda an‘anaviy uzoq masofaga yugurishlardan ko‘ra, o‘yin tizimiga yaqin bo‘lgan intervalli va spetsifik mashqlarga ustunlik berilmoqda.

Maqolaning maqsadi - zamonaviy futbolning yuqori dinamik sharoitida futbolchilarning maxsus chidamlilik darajasini shakllantiruvchi yetakchi omillarni aniqlash, ularning o‘yin davomidagi jismoniy samaradorlikka ta‘sirini tahlil qilish hamda o‘quv-mashg‘ulot jarayonida spetsifik yuklamalarni rejalashtirish bo‘yicha ilmiy-metodik tavsiyalar ishlab chiqishdan iborat.

Tadqiqotning ilmiy yangiligi — zamonaviy futbolning yuqori intensivlikdagi dinamik ko‘rsatkichlari (sprintlar soni, yo‘nalishni keskin o‘zgartirishlar) va futbolchilarning gibrid (aerob-anaerob) maxsus chidamliligi o‘rtasidagi uzviy bog‘liqlik kompleks ravishda asoslab berilganligidir. Shuningdek, an‘anaviy yugurish yuklamalaridan farqli o‘laroq, o‘yin ichidagi o‘zgaruvchan dinamikani to‘liq modellashtiruvchi kichik maydonlardagi o‘yinlar (SSG) va zamonaviy tiklanish texnologiyalarining o‘zaro mutanosibliigi individual ampuasiyaviy yondashuv asosida tizimlashtirildi.

Maxsus chidamkorlikni shakllantiruvchi asosiy omillar

Futbolchilarda maxsus chidamlilikni muvaffaqiyatli shakllantirish bir nechta o‘zaro bog‘liq omillarga asoslanadi:

Fiziologik va biokimyoviy omillar

Maksimal kislorod iste‘moli (VO_2 max): Yuqori malakali futbolchilarda ushbu ko‘rsatkich 55-65 ml/kg/min atrofida bo‘lishi talab etiladi. VO_2 max darajasining yuqoriligi o‘yin davomidagi yuqori intensivlikdagi sprintlardan keyin organizmning tezroq tiklanishini ta‘minlaydi.

Anaerob almashinuv bo'sag'asi (PAON): Futbolchining organizmi sut kislotasi (laktat) to'planishiga qarshi tura olish qobiliyati. PAON darajasining yuqoriligi futbolchiga charchoq sezmasdan uzoq vaqt yuqori tezlikda harakat qilish imkonini beradi

Metodologik Omillar

Zamonaviy futbolda maxsus chidamlilikni rivojlantirishning eng samarali vositalari quyidagilardir:

Kichik maydonlardagi o'yinlar (Small-Sided Games - SSG): 3x3, 4x4 yoki 5x5 formatdagi o'yinlar orqali ham taktik, ham maxsus chidamlilik (yurak-qon tomir tizimiga yuklama berish orqali) bir vaqtda rivojlantiriladi.

Yuqori intensivlikdagi intervalli mashg'ulotlar (HIIT): Qisqa muddatli maksimal tezlanish va undan keyingi qisqa faol dam olish davrlarining navbat almashishi. Bu o'yin dinamikasini to'liq modellashtiradi.

O'yin pozitsiyasiga xoslik

Maxsus chidamlilik futbolchining maydondagi ampuasiga qarab shakllantirilishi kerak. Masalan:

Qanot himoyachilari va yarim himoyachilar ko'proq uzoq masofali xarakterga ega bo'lgan sprint chidamliligiga muhtoj.

Markaziy himoyachilar va hujumchilar esa qisqa masofali, sakrash va kuch ishlatish elementlari bilan boyitilgan anaerob-alkatatsid chidamlilikni talab qiladi.

O'yin dinamikasini saqlashda tiklanish jarayonlari

Chidamlilik faqatgina mashg'ulotda charchash bilan emas, balki yuklamalar orasidagi to'g'ri tiklanish bilan belgilanadi. Zamonaviy futbolda maxsus chidamlilikni saqlashda quyidagi omillar muhim:

Glikogen zaxiralarini to'ldirish: O'yindan keyingi dastlabki soatlarda uglevodli oziqlanish.

Gidratatsiya: Mikrosirkulyatsiyani yaxshilash uchun suv-tuz balansini ushlab turish.

Krioterapiya va massaj: Mushaklardagi mikrotravmalarni va laktat qoldiqlarini tezroq bartaraf etish.

Xulosa

Zamonaviy futbolda o'yin dinamikasini 90 daqiqa davomida yuqori maromda saqlash - faqatgina umumiy jismoniy tayyorgarlik bilan cheklanmaydi. Maxsus chidamlilikni shakllantirishda ilmiy asoslangan gibrid (aerob-anaerob) yondashuvlardan foydalanish, mashg'ulotlar jarayoniga yuqori intensivlikdagi intervalli uslublarni va kichik maydonlardagi o'yinlarni (SSG) tizimli kiritish lozim. Futbolchilarning shaxsiy fiziologik ko'rsatkichlari va ampuasini hisobga olgan holda berilgan yuklamalar jamoaning umumiy o'yin dinamikasini turg'un saqlashning asosiy garovidir.

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IQLIM O'ZGARISHINING SHAHAR AHOLI MANZILGOHLARI BARQAROR RIVOJLANISHIGA TA'SIRINI BAHOLASH VA PROGNOZLASHTIRISH (QARSHI SHAHRI MISOLIDA)

***Annotatsiya:** Mazkur maqolada global iqlim o'zgarishlarining shahar aholi manzilgohlari barqaror rivojlanishiga ko'rsatadigan ta'siri Qarshi shahri misolida kompleks geografik yondashuv asosida tadqiq etilgan. Tadqiqotda iqlim o'zgarishlarining asosiy ko'rsatkichlari, jumladan, havo haroratining ko'p yillik dinamikasi, yog'in miqdoridagi o'zgarishlar, qurg'oqchilik jarayonlarining kuchayishi, issiq to'lqinlar chastotasi hamda urbanizatsiya jarayonlari natijasida yuzaga kelayotgan ekologik o'zgarishlar tahlil qilingan. Qarshi shahri hududida so'nggi o'n yilliklarda kuzatilayotgan iqlimiy tendensiyalar va ularning shahar infratuzilmasi, suv resurslari, yashil hududlar, aholi salomatligi hamda ijtimoiy-iqtisodiy rivojlanishga ta'siri baholangan. Tadqiqot jarayonida statistik tahlil, geografik taqqoslash, GIS texnologiyalari, masofadan zondlash ma'lumotlari va prognozlash usullaridan foydalanilgan. Olingan natijalar Qarshi shahrida havo haroratining ortishi, yog'in miqdorining kamayishi hamda urbanizatsiya jarayonlarining jadallashuvi natijasida "shahar issiqlik oroli" effektining kuchayib borayotganligini ko'rsatdi. Aniqlanishicha, iqlim o'zgarishlari ta'sirida suv ta'minoti tizimlarida bosimning ortishi, energiya iste'molining ko'payishi, yashil hududlarning degradatsiyasi va aholining issiqlik stressiga moyilligi kuchaymoqda. IPCC ssenariylari asosida amalga oshirilgan prognoz natijalari XXI asrning o'rtalariga kelib Qarshi shahri hududida o'rtacha yillik havo haroratining sezilarli oshishi, ekstremal issiq kunlar sonining ko'payishi va suv resurslari tanqisligining kuchayishini ko'rsatmoqda. Shu munosabat bilan shahar hududlarida iqlim o'zgarishlariga moslashuv strategiyalarini ishlab chiqish, yashil infratuzilmani rivojlantirish, suv resurslaridan oqilona foydalanish hamda shahar rejalashtirish jarayonlariga iqlim omillarini integratsiyalashning ilmiy-amaliy ahamiyati asoslab berilgan.*

***Kalit so'zlar:** iqlim o'zgarishi, shahar aholi manzilgohlari, barqaror rivojlanish, Qarshi shahri, urbanizatsiya, shahar issiqlik oroli, iqlimiy xavflar, GIS texnologiyalari, masofadan zondlash, prognozashtirish, yashil infratuzilma, ekologik monitoring, iqlimga moslashuv, suv resurslari, geotizimlar barqarorligi.*

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ASSESSMENT AND FORECASTING OF THE IMPACT OF CLIMATE CHANGE ON THE SUSTAINABLE DEVELOPMENT OF URBAN RESIDENTIAL AREAS (IN THE EXAMPLE OF THE CITY OF KARSHI)

Abstract: *This article examines the impact of global climate change on the sustainable development of urban settlements using a comprehensive geographical approach using the example of the city of Karshi. The study analyzes the main indicators of climate change, including long-term dynamics of air temperature, changes in precipitation, intensification of drought processes, frequency of heat waves, and ecological changes resulting from urbanization processes. The climatic trends observed in the territory of the city of Karshi in recent decades and their impact on urban infrastructure, water resources, green areas, population health, and socio-economic development were assessed. The research used statistical analysis, geographic comparison, GIS technologies, remote sensing data, and forecasting methods. The results showed that the "urban heat island" effect is increasing in the city of Karshi as a result of increasing air temperature, decreasing precipitation, and accelerating urbanization processes. It was found that under the influence of climate change, pressure in water supply systems increases, energy consumption increases, green areas are degraded, and the population's susceptibility to heat stress increases. The results of the forecast based on IPCC scenarios indicate a significant increase in the average annual air temperature in the territory of the city of Karshi by the middle of the 21st century, an increase in the number of extremely hot days, and an increase in the scarcity of water resources. In this regard, the scientific and practical importance of developing climate change adaptation strategies in urban areas, developing green infrastructure, rational use of water resources, and integrating climate factors into urban planning processes is substantiated.*

Keywords: *climate change, urban settlements, sustainable development, Karshi city, urbanization, urban heat island, climate hazards, GIS technologies, remote sensing, forecasting, green infrastructure, environmental monitoring, climate adaptation, water resources, geosystems sustainability.*

XXI asr insoniyat taraqqiyotining yangi bosqichi sifatida nafaqat fan-texnika yutuqlari, urbanizatsiya jarayonlarining jadallashuvi va iqtisodiy rivojlanishning yangi shakllari bilan, balki global miqyosdagi ekologik muammolarning keskinlashuvi bilan ham tavsiflanadi. Ana shunday muammolar orasida iqlim o'zgarishi bugungi kunda eng dolzarb va murakkab ekologik,

ijtimoiy hamda iqtisodiy muammolardan biri sifatida e'tirof etilmoqda. So'nggi o'n yilliklarda atmosfera havosi tarkibida issiqxona gazlari konsentratsiyasining ortishi natijasida Yer sharining radiatsion muvozanati o'zgarib, global haroratning muntazam ko'tarilishi kuzatilmoqda. Bu esa o'z navbatida tabiiy geotizimlar, suv resurslari, biologik xilma-xillik, qishloq xo'jaligi va aholi yashash sharoitlariga sezilarli darajada ta'sir ko'rsatmoqda.

BMTning Iqlim o'zgarishi bo'yicha hukumatlararo ekspertlar guruhi (IPCC) tomonidan tayyorlangan Oltinchi baholash hisobotida (AR6) qayd etilishicha, sanoatlashuvdan oldingi davrga (1850–1900 yy.) nisbatan 2011–2020-yillarda global o'rtacha havo harorati 1,09 °C ga oshgan. Mazkur ko'rsatkich inson faoliyati natijasida yuzaga kelayotgan iqlim o'zgarishlarining yaqqol dalili sifatida baholanmoqda. Hisobotlarda ta'kidlanishicha, agar issiqxona gazlari emissiyasini kamaytirish bo'yicha keskin choralar ko'rilmasa, XXI asrning oxiriga borib global haroratning 2,0–4,5 °C gacha ko'tarilishi ehtimoli mavjud. Bunday sharoitda ekstremal ob-havo hodisalari, xususan, qurg'oqchilik, issiq to'liqlar, kuchli yog'ingarchilik, chang bo'ronlari va suv taqchilligining ortishi kutilmoqda. Global iqlim o'zgarishi sharoitida urbanizatsiya jarayonlarining jadallashuvi alohida ilmiy-amaliy ahamiyat kasb etmoqda. Hozirgi vaqtda dunyo aholisining yarmidan ko'pi shaharlarda istiqomat qilmoqda. BMTning aholi bo'yicha prognozlariga ko'ra, 2050-yilga kelib dunyo aholisining qariyb 68 foizi shahar hududlarida yashashi kutilmoqda. Shaharlar iqtisodiy rivojlanish, sanoat ishlab chiqarishi, innovatsiyalar va xizmat ko'rsatish sohalarining asosiy markazi hisoblanishi bilan bir qatorda, iqlim o'zgarishlariga eng sezgir hududlardan biri ham hisoblanadi. Aholi zichligining yuqoriligi, qurilishlar maydonining kengayishi, transport infratuzilmasining rivojlanishi va antropogen yuklamaning ortishi natijasida shahar hududlarida o'ziga xos mikroiklim shakllanadi.

Zamonaviy geografik tadqiqotlarda shahar hududlarining barqaror rivojlanishi masalasi iqlim o'zgarishlari bilan uzviy bog'liq holda o'rganilmoqda. Barqaror rivojlanish konsepsiyasi dastlab 1987-yilda BMTning "Bizning umumiy kelajagimiz" ("Our Common Future") hisobotida ilgari surilgan bo'lib, u iqtisodiy, ekologik va ijtimoiy rivojlanish o'rtasidagi muvozanatni ta'minlashga qaratilgan. Keyinchalik ushbu konsepsiya 2015-yilda qabul qilingan BMTning Barqaror rivojlanish maqsadlari (BRM) doirasida yanada takomillashtirildi. Xususan, 11-maqсад "Shaharlar va aholi manzilgohlarining inklyuziv, xavfsiz, barqaror va ekologik jihatdan mustahkam bo'lishini ta'minlash"ga qaratilgan bo'lib, u iqlim o'zgarishlari sharoitida urban hududlarning moslashuvchanligini oshirish zarurligini taqozo etadi.

Shahar hududlarida kuzatilayotgan iqlimiy o'zgarishlarning eng muhim ko'rinishlaridan biri "shahar issiqlik oroli" (Urban Heat Island – UHI) hodisasidir. Mazkur hodisa shahar markazlarida haroratning atrof qishloq hududlariga nisbatan yuqori bo'lishi bilan tavsiflanadi. T.R.Oke (1987), S.Grimmond (2007), H.Arnfield (2003) va boshqa olimlarning tadqiqotlariga ko'ra, shahar hududlarida beton, asfalt va boshqa sun'iy qoplamalar ulushining ortishi, yashil maydonlarning qisqarishi hamda antropogen issiqlik manbalarining ko'payishi natijasida harorat

2–8 °C gacha yuqori bo‘lishi mumkin. Natijada energiya sarfining ortishi, atmosfera havosi sifatining yomonlashuvi, aholi salomatligiga salbiy ta’sir ko‘rsatadigan issiqlik stressining kuchayishi kuzatiladi.

Markaziy Osiyo mintaqasi global iqlim o‘zgarishlariga eng sezgir hududlardan biri sifatida e’tirof etiladi. Mintaqaning tabiiy-geografik xususiyatlari, qurg‘oqchil iqlim sharoiti, suv resurslarining cheklanganligi hamda cho‘llanish jarayonlarining kuchayishi iqlim o‘zgarishlarining salbiy oqibatlarini yanada kuchaytirmoqda. Jahon banki, BMT Taraqqiyot dasturi (UNDP) hamda IPCC ekspertlari tomonidan olib borilgan tadqiqotlarga ko‘ra, Markaziy Osiyoda XXI asr davomida o‘rtacha yillik havo haroratining 2–5 °C ga ortishi, qurg‘oqchilik hodisalari sonining ko‘payishi va suv resurslari hajmining kamayishi kutilmoqda. Ushbu holat, ayniqsa, O‘zbekistonning janubiy hududlari uchun jiddiy ekologik va ijtimoiy-iqtisodiy muammolarni yuzaga keltirishi mumkin.

O‘zbekiston Respublikasi hududida ham so‘nggi o‘n yilliklarda iqlim o‘zgarishlari bilan bog‘liq jarayonlarning faollashuvi kuzatilmoqda. O‘zgidromet ma’lumotlariga ko‘ra, respublika hududida o‘rtacha yillik havo harorati XX asrning ikkinchi yarmidan boshlab 1,3–1,7 °C ga oshgan. Ayniqsa, yoz oylarida kuzatilayotgan ekstremal issiqlik hodisalari sonining ortishi, yog‘inlarning notekis taqsimlanishi va suv taqchilligi mamlakatning iqtisodiy tarmoqlariga sezilarli ta’sir ko‘rsatmoqda. Shu bois O‘zbekiston Respublikasida iqlim o‘zgarishlariga moslashish va salbiy oqibatlarni kamaytirish davlat siyosatining ustuvor yo‘nalishlaridan biri sifatida belgilanmoqda.

Mamlakatimizda "2030-yilgacha bo‘lgan davrda O‘zbekiston Respublikasining yashil iqtisodiyotga o‘tish strategiyasi", "Atrof-muhitni muhofaza qilish konsepsiyasi", "Yangi O‘zbekistonning taraqqiyot strategiyasi" hamda "2030-yilgacha bo‘lgan iqlim strategiyasi" doirasida urban hududlarning ekologik barqarorligini ta’minlash, yashil infratuzilmani rivojlantirish va iqlim xavflarini kamaytirishga qaratilgan qator chora-tadbirlar amalga oshirilmoqda. Ushbu hujjatlarda shahar hududlarida iqlimga moslashuvchan boshqaruv tizimini shakllantirish, yashil maydonlar ulushini oshirish va suv resurslaridan samarali foydalanish ustuvor vazifalar sifatida belgilangan.

Qashqadaryo viloyatining ma’muriy markazi bo‘lgan Qarshi shahri O‘zbekistonning janubiy qismida, Qashqadaryo vohasida joylashgan bo‘lib, quruq subtropik kontinental iqlim sharoiti bilan tavsiflanadi. Shaharning tabiiy-geografik joylashuvi, yoz mavsumining uzoq va juda issiq bo‘lishi, yog‘inlarning kamligi hamda bug‘lanishning yuqori ko‘rsatkichlari hududning iqlimiy jihatdan sezgirlikni belgilaydi. So‘nggi yillarda shaharda urbanizatsiya sur’atlarining jadallashuvi, aholi sonining ko‘payishi, yangi turar joy massivlari va sanoat zonalarining kengayishi natijasida antropogen bosim sezilarli darajada ortib bormoqda. Bu esa shahar mikroiqlimining o‘zgarishi, yashil hududlar qisqarishi va "shahar issiqlik oroli" effektining kuchayishiga olib kelmoqda.

Meteorologik kuzatuvlar natijalari Qashqadaryo viloyati hududida o‘rtacha yillik haroratning ortib borayotganligini, +40°C dan yuqori bo‘lgan kunlar soni

ko'payayotganligini hamda yog'in miqdorining kamayish tendensiyasini ko'rsatmoqda. Bunday sharoitda suv resurslari tanqisligi, issiqlik stressi, havo ifloslanishi va yashil hududlar degradatsiyasi kabi muammolar shahar aholi manzilgohlarining barqaror rivojlanishiga salbiy ta'sir ko'rsatmoqda.

Shu nuqtai nazardan, Qarshi shahri misolida iqlim o'zgarishlarining shahar aholi manzilgohlari barqaror rivojlanishiga ta'sirini baholash, mavjud iqlimiy tendensiyalarni aniqlash, shahar geotizimlarining iqlimiy barqarorligini tahlil qilish hamda istiqboldagi o'zgarishlarni prognozlashtirish muhim ilmiy va amaliy ahamiyatga ega. Tadqiqot natijalari nafaqat Qarshi shahri, balki O'zbekistonning boshqa qurg'oqchil hududlarida joylashgan shaharlar uchun ham iqlimga moslashuv strategiyalarini ishlab chiqishda muhim ilmiy asos bo'lib xizmat qilishi mumkin. So'nggi 35 yil davomida global iqlim o'zgarishi natijasida shahar hududida havo haroratining ortishi, suv resurslari tanqisligi, qurg'oqchilik va issiq to'lqinlarining ko'payishi kuzatilmoqda. Bu holat shaharlarning barqaror rivojlanishiga sezilarli ta'sir ko'rsatmoqda.

Qarshi shahrida 1990–2025-yillarda iqlim o'zgarishining asosiy tendensiyalari

Ko'rsatkich	1990-yillar	2020–2025-yillar	O'zgarish
O'rtacha yillik harorat	14–15 °C	15,5–16,5 °C	+1,0–1,5 °C
Yozgi maksimal harorat	42–44 °C	45–47 °C	+2–3 °C
Yog'in miqdori	250–300 mm	220–280 mm	kamayish tendensiyasi
Issiq kunlar soni (>40 °C)	10–15 kun/yil	20–30 kun/yil	2 baravar oshgan

O'zbekiston hududida o'rtacha yillik harorat so'nggi 60 yil davomida taxminan 1,6 °C ga oshgan bo'lib, bu global o'rtacha ko'rsatkichdan yuqoridir. Janubiy hududlar, jumladan Qashqadaryo viloyati, iqlim o'zgarishiga eng sezgir hududlardan hisoblanadi. Iqlim isishi natijasida Qarshi shahri barqaror rivojlanishiga jumladan

Suv resurslari bug'lanish intensivligi ortmoqda, sug'orish suvi tanqisligi kuchaymoqda, yer osti suvlari sathi pasaymoqda. Mutaxassislar prognozlariga ko'ra, juda issiq va quruq yillarda Markaziy Osiyodagi ayrim daryo havzalarida suv oqimi 25–50 % gacha kamayishi mumkin. Iqlimning o'zgarishi Shahar infratuzilmasiga elektr energiyasi iste'molini ko'paytiradi, sovutish tizimlariga bo'lgan talabni oshiradi, asfalt qoplamalari va muhandislik tarmoqlarining eskirishini tezlashtiradi. Shuningdek, ekstremal issiqlik shahar aholisi salomatligiga salbiy ta'sir ko'rsatmoqda. Ayniqsa, keksalar va bolalar issiq stressiga nisbatan zaif hisoblanadi. Aholini 1990–2025-yillarda issiq urishi holatlari ko'paygan, nafas olish tizimi kasalliklari xavfi ortgan, chang bo'ronlari va havo sifati yomonlashgan. Aholi sonining ortishi suv, energiya va yer resurslariga bo'lgan bosimni kuchaytirmoqda. Bu esa iqlim o'zgarishi sharoitida barqaror rivojlanish masalalarini yanada dolzarb qiladi. Iqlim o'zgarishining 2030–2050-yillarni prognoz qiladigan bo'lsak o'rtacha harorat 2030-yilgacha

yana 0,5–1,0 °C ga oshishi mumkin, qurg‘oqchilik chastotasi ortadi, suv resurslari tanqisligi kuchayadi, issiq to‘lqinlari davomiyligi uzayadi.

Qarshi shahri Prognoz ssenariysi

Ko‘rsatkich	2025	2035 prognozi	2050 prognozi
O‘rtacha harorat	16 °C	16,8 °C	17,5–18 °C
Issiq kunlar (+40 °C)	30 kun	40 kun	50 kun
Suv taqchilligi darajasi	O‘rta	Yuqori	Juda yuqori

Mazkur tadqiqot doirasida global iqlim o‘zgarishlarining shahar aholi manzilgohlari barqaror rivojlanishiga ko‘rsatadigan ta’siri Qarshi shahri misolida kompleks tabiiy-geografik yondashuv asosida o‘rganildi. Tadqiqot natijalari iqlim o‘zgarishi va urbanizatsiya jarayonlarining o‘zaro uyg‘unlashuvi natijasida shahar geotizimlarida sezilarli transformatsion jarayonlar yuz berayotganligini ko‘rsatadi. Olingan natijalar asosida quyidagi ilmiy xulosalarga kelindi.

Birinchidan, Qarshi shahri hududida kuzatilayotgan zamonaviy iqlimiy o‘zgarishlar mintaqaning umumiy iqlim tizimida yuz berayotgan global va regional jarayonlar bilan uzviy bog‘liq ekanligi aniqlandi. Meteorologik kuzatuv ma’lumotlari tahlili natijasida so‘nggi bir necha o‘n yilliklar davomida o‘rtacha yillik havo haroratining izchil oshib borayotganligi, ekstremal issiqlik hodisalari takrorlanish chastotasining ko‘payayotganligi hamda yillik yog‘in miqdorining kamayish tendensiyasi kuzatilayotganligi aniqlandi. Mazkur holat hududda qurg‘oqchilik jarayonlarining faollashishiga, bug‘lanish miqdorining ortishiga hamda suv resurslari tanqisligining kuchayishiga olib kelmoqda.

Ikkinchidan, Qarshi shahrida urbanizatsiya jarayonlarining jadallashuvi shahar mikroiklimining shakllanishida muhim antropogen omil sifatida namoyon bo‘lmoqda. Aholi sonining ortishi, yangi turar-joy massivlari va sanoat zonalarining kengayishi, transport infratuzilmasining rivojlanishi hamda sun‘iy qoplamalar ulushining ko‘payishi natijasida shahar hududida "shahar issiqlik oroli" (Urban Heat Island) hodisasi shakllanganligi aniqlandi. Masofadan zondlash ma’lumotlari va ilmiy adabiyotlar tahlili shuni ko‘rsatadiki, yoz oylarida shaharning markaziy qismlarida yer yuzasi harorati shahar atrofi hududlariga nisbatan bir necha darajaga yuqori bo‘lishi kuzatilmoqda.

Uchinchidan, iqlim o‘zgarishlarining Qarshi shahri barqaror rivojlanishiga ta’siri ko‘p qirrali xarakterga ega ekanligi aniqlandi. Ekologik nuqtai nazardan, havo haroratining ortishi va yog‘in miqdorining kamayishi natijasida yashil hududlar holatining yomonlashuvi, biologik xilma-xillikning qisqarishi, tuproq va o‘simlik qoplamining degradatsiyasi hamda atmosfera havosi sifatining yomonlashuvi kuzatilmoqda. Ayniqsa, yoz mavsumida chang bo‘ronlari va yuqori haroratning birgalikda namoyon bo‘lishi shahar ekologik holatiga salbiy ta’sir ko‘rsatmoqda.

To‘rtinchidan, iqlim o‘zgarishlari shahar aholisining salomatligi va ijtimoiy farovonligiga ham sezilarli ta’sir ko‘rsatmoqda. Issiqlik to‘lqinlari sonining ortishi, ayniqsa, keksalar, bolalar va surunkali kasalliklarga chalingan aholi

qatlamlari uchun qo'shimcha xavf omillarini yuzaga keltirmoqda. Yuqori harorat sharoitida yurak-qon tomir, nafas olish hamda termoregulyatsiya bilan bog'liq kasalliklarning ko'payishi ehtimoli ortadi. Shu bilan birga, ekstremal iqlimiy sharoitlar mehnat unumdorligining pasayishiga, aholi turmush sifati yomonlashishiga va kommunal xizmatlarga bo'lgan talabning ortishiga sabab bo'lmoqda.

Beshinchidan, tadqiqot natijalari Qarshi shahrining iqtisodiy tizimi ham iqlim o'zgarishlariga nisbatan sezgir ekanligini ko'rsatdi. Havo haroratining ortishi energiya resurslariga bo'lgan talabning ko'payishiga olib kelmoqda. Ayniqsa, yoz oylarida sovutish tizimlaridan foydalanishning keskin ortishi elektr energiyasi tizimlariga qo'shimcha yuklama bermoqda. Suv resurslari taqchilligi kommunal xo'jalik tizimi, ko'kalamzorlashtirish ishlari hamda shahar infratuzilmasi faoliyatiga salbiy ta'sir ko'rsatmoqda. Bundan tashqari, yuqori harorat asfalt qoplamalarining deformatsiyasi va muhandislik-kommunikatsiya tarmoqlarining eskirish jarayonlarini tezlashtirmoqda.

Oltinchidan, IPCC tomonidan ishlab chiqilgan zamonaviy iqlim ssenariylari asosida amalga oshirilgan prognozlash natijalari XXI asrning o'rtalariga kelib Qarshi shahri hududida iqlimiy xavflarning kuchayishini ko'rsatmoqda. Xususan, SSP2-4.5 va SSP5-8.5 ssenariylariga ko'ra, o'rtacha yillik havo harorati 2050-yilga qadar 2,0–2,5 °C ga, asr oxiriga kelib esa 3,0–4,5 °C ga ortishi mumkin. Shu bilan birga, ekstremal issiq kunlar sonining ko'payishi, qurg'oqchilik davrining uzayishi hamda suv resurslari hajmining qisqarishi kutilmoqda. Mazkur prognozlar shaharni iqlim o'zgarishlariga moslashtirish bo'yicha tizimli choralar ko'rish zarurligini ko'rsatadi.

Yettinchidan, tadqiqot davomida Qarshi shahri uchun ustuvor iqlimiy xavflar sifatida ekstremal issiqlik hodisalari, suv tanqisligi, yashil hududlar degradatsiyasi va urban issiqlik oroli hodisasi belgilandi. Ushbu xavflarning shahar barqaror rivojlanishiga salbiy ta'sirini kamaytirish maqsadida moslashuv strategiyalarini ishlab chiqish zarur.

Tadqiqot natijalariga asoslanib, Qarshi shahri aholi manzilgohlarining iqlim o'zgarishlariga moslashuvchanligini oshirish va barqaror rivojlanishini ta'minlash bo'yicha ilmiy-amaliy tavsiyalarni amalga oshirish zarur:

- shahar bosh rejalari va hududiy rivojlantirish dasturlariga iqlim o'zgarishi omillarini integratsiya qilish;
- shahar hududlarida yashil infratuzilma elementlari, jumladan, parklar, yashil yo'laklar va himoya daraxtzorlari maydonini kengaytirish;
- "yashil kamar" konsepsiyasini amalga oshirish orqali shahar issiqlik oroli effektini kamaytirish;
- suv resurslaridan samarali foydalanish, yomg'ir suvlarini yig'ish va qayta foydalanish texnologiyalarini joriy etish;
- energiya samarador qurilish texnologiyalarini keng qo'llash va ekologik qurilish standartlarini ishlab chiqish;
- shahar miqyosida iqlim monitoringi va geoaxborot tizimlariga asoslangan ekologik monitoring tizimini takomillashtirish;

- ekstremal ob-havo hodisalari bo'yicha erta ogohlantirish tizimlarini rivojlantirish;
- aholi va mahalliy boshqaruv organlarining iqlim o'zgarishlariga moslashuv bo'yicha bilim va ko'nikmalarini oshirish.

Umuman olganda, tadqiqot natijalari Qarshi shahri misolida iqlim o'zgarishlari sharoitida shahar aholi manzilgohlarining barqaror rivojlanishini ta'minlash uchun kompleks geografik baholash, muntazam monitoring, ilmiy prognozlash va moslashuv strategiyalarini ishlab chiqish muhim ilmiy-amaliy ahamiyat kasb etishini ko'rsatdi. Mazkur tadqiqot natijalari O'zbekistonning qurg'oqchil hududlarida joylashgan boshqa shaharlar uchun ham iqlimga moslashuv siyosatini ishlab chiqishda ilmiy asos bo'lib xizmat qilishi mumkin.

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QARSHI SHAHRINING IQLIM O'ZGARISHI MUAMMOSINING GEOGRAFIK MOHIYATI VA ZAMONAVIY ILMIY QARASHLAR

Annotatsiya: Mazkur maqolada Qarshi shahri hududida kuzatilayotgan iqlim o'zgarishi jarayonlarining geografik mohiyati hamda ushbu muammoga doir zamonaviy ilmiy qarashlar tahlil qilingan. Tadqiqot davomida hududning tabiiy-geografik xususiyatlari, harorat va yog'in miqdoridagi ko'p yillik o'zgarishlar, qurg'oqchilik jarayonlarining kuchayishi hamda antropogen omillarning iqlim tizimiga ta'siri o'rganildi. Shuningdek, global iqlim o'zgarishining Qarshi shahri tabiiy muhitiga, suv resurslariga, qishloq xo'jaligi faoliyatiga va urbanizatsiya jarayonlariga ko'rsatayotgan ta'siri ilmiy manbalar asosida baholandi. Tadqiqot natijalari shuni ko'rsatadiki, so'nggi yillarda havo haroratining ortishi, yog'inlarning mavsumiy taqsimotidagi o'zgarishlar va ekstremal ob-havo hodisalarining ko'payishi hududning ekologik barqarorligiga salbiy ta'sir ko'rsatmoqda. Shu bois, iqlim o'zgarishiga moslashuv choralari ishlab chiqish, tabiiy resurslardan oqilona foydalanish hamda hududiy ekologik monitoring tizimini takomillashtirish dolzarb masalalardan biri hisoblanadi.

Kalit so'zlar: iqlim o'zgarishi, Qarshi shahri, geografik mohiyat, global isish, antropogen omillar, qurg'oqchilik, ekologik barqarorlik, urbanizatsiya, iqlim monitoringi, moslashuv strategiyalari.

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GEOGRAPHICAL NATURE OF THE CLIMATE CHANGE PROBLEM OF KARSHI CITY AND MODERN SCIENTIFIC VIEWS

Abstract: *This article analyzes the geographical nature of climate change processes observed in the territory of the city of Karshi and modern scientific views on this problem. During the study, the natural and geographical features of the territory, long-term changes in temperature and precipitation, the intensification of drought processes, and the impact of anthropogenic factors on the climate system were studied. Also, the impact of global climate change on the natural environment, water resources, agricultural activities, and urbanization processes of the city of Karshi was assessed based on scientific sources. The results of the study show that in recent years, an increase in air temperature, changes in the seasonal distribution of precipitation, and an increase in extreme weather events have a negative impact on the ecological stability of the region. Therefore, the development of measures to adapt to climate change, rational use of natural resources, and improvement of the regional ecological monitoring system are among the urgent issues.*

Keywords: *climate change, Karshi city, geographical nature, global warming, anthropogenic factors, drought, ecological sustainability, urbanization, climate monitoring, adaptation strategies.*

XXI asrda iqlim o'zgarishi insoniyat oldida turgan eng dolzarb global ekologik muammolardan biri sifatida e'tirof etilmoqda. So'nggi o'n yilliklarda Yer sharida o'rtacha havo haroratining ortishi, yog'inlar miqdori va taqsimotidagi o'zgarishlar, ekstremal ob-havo hodisalarining ko'payishi hamda tabiiy ekotizimlarning transformatsiyaga uchrashi global iqlim tizimida sezilarli o'zgarishlar sodir bo'layotganini ko'rsatmoqda. Iqlim o'zgarishi nafaqat tabiiy muhitning holatiga, balki iqtisodiyot tarmoqlari, aholi salomatligi, oziq-ovqat xavfsizligi va hududlarning barqaror rivojlanishiga ham bevosita ta'sir ko'rsatmoqda. Shu sababli mazkur muammo bugungi kunda geograflar, ekologlar, klimatologlar va boshqa soha mutaxassislari tomonidan keng miqyosda o'rganilmoqda.

Iqlim o'zgarishi bo'yicha Hukumatlararo ekspertlar guruhi (IPCC) hisobotlarida qayd etilishicha, XX asrning ikkinchi yarmidan boshlab global o'rtacha havo haroratining muntazam ortib borishi asosan antropogen omillar, ya'ni inson faoliyati natijasida atmosferaga chiqarilayotgan issiqxona gazlari konsentratsiyasining ortishi bilan bog'liqdir. Natijada qurg'oqchilik, cho'llanish, suv resurslari tanqisligi, biologik xilma-xillikning kamayishi va tabiiy ofatlarning takrorlanish chastotasi ortib bormoqda. Ayniqsa, qurg'oqchil va yarim qurg'oqchil mintaqalarda joylashgan hududlar iqlim o'zgarishining salbiy oqibatlariga nisbatan yanada sezgir hisoblanadi. Markaziy Osiyo mintaqasi, jumladan O'zbekiston Respublikasi hududi ham iqlim o'zgarishining salbiy ta'siri kuchli sezilayotgan hududlar qatoriga kiradi. Mintaqada havo haroratining ko'tarilishi, muzliklar maydonining qisqarishi, suv resurslarining kamayishi hamda qurg'oqchilik jarayonlarining kuchayishi ijtimoiy-iqtisodiy rivojlanish uchun muayyan xavf-xatarlarni yuzaga keltirmoqda. O'zbekistonning janubiy hududlari, xususan Qashqadaryo viloyati tabiiy-geografik sharoitining qurg'oqchil

xususiyatga egaligi, sug'orma dehqonchilikning ustunligi va suv resurslariga yuqori darajada bog'liqligi sababli iqlim o'zgarishiga nisbatan yuqori darajada ta'sirchan hududlardan biri hisoblanadi.

Qarshi shahri Qashqadaryo viloyatining yirik ma'muriy, iqtisodiy va demografik markazi sifatida mintaqaning tabiiy va antropogen jarayonlari kesishgan hududda joylashgan. So'nggi yillarda shaharda urbanizatsiya jarayonlarining jadallashuvi, transport vositalari sonining ortishi, sanoat tarmoqlarining rivojlanishi hamda aholi sonining ko'payishi natijasida antropogen yuklama sezilarli darajada oshib bormoqda. Shu bilan birga, hududda yoz oylarida ekstremal issiqlik to'liqlarining ko'payishi, yog'inlar rejimining o'zgarishi va suv tanqisligi kabi jarayonlar kuzatilmoqda. Bu esa tabiiy muhitning barqarorligi, aholi salomatligi va xo'jalik tarmoqlari faoliyatiga salbiy ta'sir ko'rsatishi mumkin. Bugungi kunda iqlim o'zgarishi muammosini geografik nuqtai nazardan tadqiq etish alohida ilmiy-amaliy ahamiyat kasb etmoqda. Chunki geografik yondashuv hududning tabiiy sharoiti, resurs salohiyati, antropogen ta'sir darajasi va ekologik holatini kompleks tarzda baholash imkonini beradi. Qarshi shahrida iqlim o'zgarishining geografik mohiyatini aniqlash, uning hududiy xususiyatlarini baholash hamda zamonaviy ilmiy qarashlar asosida moslashuv strategiyalarini ishlab chiqish mintaqaning barqaror rivojlanishini ta'minlashda muhim omil hisoblanadi. Qarshi shahrida iqlim o'zgarishi muammosining geografik mohiyatini ilmiy jihatdan tahlil qilish, ushbu jarayonlarning hududiy xususiyatlarini aniqlash hamda iqlim o'zgarishiga doir zamonaviy ilmiy qarashlarni umumlashtirishdan iborat. Hududning tabiiy-geografik sharoitlarini baholash, iqlim ko'rsatkichlarining o'zgarish tendensiyalarini tahlil qilish, antropogen omillarning ta'sirini aniqlash va iqlim o'zgarishiga moslashish bo'yicha ilmiy asoslangan tavsiyalar ishlab chiqish belgilab olindi.

Qarshi shahrida iqlim o'zgarishi geografik jihatdan atmosfera, gidrosfera, litosfera va biosfera komponentlari o'rtasidagi murakkab o'zaro aloqalarning vaqt va makonda o'zgarishi natijasida yuzaga keladigan jarayon sifatida tavsiflanadi. Mazkur jarayonlar global miqyosda sodir bo'lishiga qaramasdan, ularning hududiy namoyon bo'lish darajasi tabiiy-geografik sharoitlar, relief xususiyatlari, landshaft tuzilishi hamda antropogen omillar ta'sirida turlicha namoyon bo'ladi. Shu nuqtai nazardan Qarshi shahri va unga tutash hududlarda iqlim o'zgarishining namoyon bo'lish xususiyatlarini geografik jihatdan tadqiq etish muhim ilmiy-amaliy ahamiyatga ega. Qarshi shahri Qashqadaryo vohasining markaziy qismida joylashgan bo'lib, hududning iqlimi keskin kontinental xususiyatga ega. Hududda yoz oylarining juda issiq va quruq, qish faslining esa nisbatan yumshoq kechishi kuzatiladi. Geografik joylashuv, cho'l landshaftlariga yaqinligi, yog'inlarning kamligi va yuqori bug'lanish ko'rsatkichlari mintaqaning iqlim o'zgarishiga sezgirligini oshiruvchi omillar hisoblanadi.

O'zbekiston Respublikasi Gidrometeorologiya xizmati agentligi (O'zgidromet) ma'lumotlariga ko'ra, respublika hududida, jumladan janubiy viloyatlarda ham so'nggi o'n yilliklarda o'rtacha yillik havo harorati muntazam ravishda oshib bormoqda. Ayrim tadqiqotlarga ko'ra, XX asrning ikkinchi

yarmidan boshlab O'zbekiston hududida o'rtacha havo harorati 1,3–1,7 °C ga ko'tarilgan bo'lib, bu global o'rtacha ko'rsatkichlardan yuqori hisoblanadi. Qarshi shahri hududida ham yozgi maksimal haroratlarning ortishi, issiq kunlar sonining ko'payishi va qurg'oqchil davrlarning uzayishi kuzatilmoqda. Iqlim tizimidagi eng muhim ko'rsatkichlardan biri havo harorati hisoblanadi. Meteorologik kuzatishlar natijalari shuni ko'rsatadiki, Qarshi shahri hududida o'rtacha yillik haroratning oshishi bilan bir qatorda ekstremal issiqlik hodisalari soni ham ortib bormoqda. Ayniqsa, yoz oylarida +40 °C va undan yuqori harorat kuzatiladigan kunlar sonining ortishi aholi salomatligi, energetika tizimi va qishloq xo'jaligi faoliyatiga salbiy ta'sir ko'rsatmoqda. Yog'in miqdorining hududiy va mavsumiy taqsimotidagi o'zgarishlar ham iqlim o'zgarishining muhim indikatorlaridan biridir. Qashqadaryo viloyati hududida yillik yog'in miqdori nisbatan kam bo'lib, uning asosiy qismi qish va bahor oylariga to'g'ri keladi. So'nggi yillarda yog'inlarning notekis taqsimlanishi, ayrim davrlarda kuchli jala yog'inlarining kuzatilishi hamda qurg'oqchil mavsumlarning uzayishi qayd etilmoqda. Bu esa suv resurslari shakllanishi va ulardan foydalanish tizimiga sezilarli ta'sir ko'rsatmoqda. IPCCning oltinchi baholash hisobotida qayd etilganidek, Markaziy Osiyoda XXI asr davomida haroratning yanada oshishi va qurg'oqchilik xavfining kuchayishi prognoz qilinmoqda. Ushbu tendensiyalar Qarshi shahri uchun ham xos bo'lib, hududning ekologik barqarorligiga jiddiy tahdid solishi mumkin. Zamonaviy ilmiy tadqiqotlarda global iqlim o'zgarishining asosiy sababi sifatida antropogen omillar e'tirof etiladi. Sanoat ishlab chiqarishi, transport tizimining rivojlanishi, yoqilg'i-energetika resurslaridan intensiv foydalanish va urbanizatsiya jarayonlari atmosferaga issiqxona gazlarining chiqarilishini ko'paytiradi.

Qarshi shahri hududida urbanizatsiya jarayonlarining jadallashuvi natijasida tabiiy landshaftlarning antropogen landshaftlar bilan almashinuvi kuzatilmoqda. Qurilish maydonlarining kengayishi, asfalt va beton qoplamalar ulushining ortishi hamda yashil hududlar maydonining qisqarib bormoqda. Mazkur hodisa shahar markazida havo haroratining atrof hududlarga nisbatan yuqori bo'lishiga sabab bo'ladi. Shuningdek, transport vositalari sonining ortishi natijasida atmosfera havosiga chiqarilayotgan karbonat angidrid, azot oksidlari va boshqa ifloslantiruvchi moddalar miqdori ham ko'paymoqda. Bu esa nafaqat atmosfera havosi sifatining yomonlashuviga, balki mahalliy iqlim sharoitlarining o'zgarishiga ham ta'sir ko'rsatadi. Qarshi shahri va uning atrofidagi hududlar iqtisodiyotida qishloq xo'jaligi muhim o'rin tutadi. Sug'orma dehqonchilikning ustunligi hududni suv resurslariga yuqori darajada bog'liq qilib qo'yadi. Haroratning oshishi natijasida bug'lanish jarayonining kuchayishi sug'orish suvlari sarfining ortishiga olib kelmoqda. Suv resurslari tanqisligi qishloq xo'jaligi ekinlari hosildorligining pasayishiga, tuproq sho'rlanishining kuchayishiga va cho'llanish jarayonlarining jadallashishiga sabab bo'lishi mumkin. Ayniqsa, paxtachilik, g'allachilik va bog'dorchilik tarmoqlarida iqlim xavflarini hisobga olgan holda moslashuv choralarini ishlab chiqish zarur. Iqlim o'zgarishi biologik xilma-xillikka ham salbiy ta'sir ko'rsatmoqda. Harorat va namlik rejimining

o'zgarishi ayrim o'simlik va hayvon turlarining areallarini qisqartirishi, ekotizimlarning tabiiy muvozanatini buzishi mumkin. Shu bois hududda ekologik monitoringni takomillashtirish va tabiiy ekotizimlarni muhofaza qilish dolzarb vazifalardan biri hisoblanadi.

Hozirgi davrda iqlim o'zgarishini tadqiq etishda tizimli, kompleks va fanlararo yondashuvlar keng qo'llanilmoqda. Zamonaviy ilmiy qarashlarga ko'ra, iqlim o'zgarishi muammosini hal etishda ikki asosiy yo'nalish — mitigatsiya (issiqxona gazlari emissiyasini kamaytirish) va adaptatsiya (iqlim o'zgarishiga moslashish) choralari muhim ahamiyatga ega. Ilmiy adabiyotlarda qayta tiklanuvchi energiya manbalaridan foydalanish, energiya samaradorligini oshirish, yashil iqtisodiyot tamoyillarini joriy etish hamda geoinformatsion texnologiyalar asosida monitoring tizimlarini rivojlantirish iqlim o'zgarishiga qarshi kurashning ustuvor yo'nalishlari sifatida e'tirof etiladi.

Geografik axborot tizimlari (GAT), masofadan zondlash ma'lumotlari va iqlim modellaridan foydalanish hududlarda iqlim xavflarini baholash, prognozlash va boshqarish imkoniyatlarini kengaytirmoqda. Qarshi shahri sharoitida ham ushbu texnologiyalar asosida hududiy iqlim monitoringini takomillashtirish, urbanizatsiya jarayonlarini nazorat qilish va ekologik xavflarni baholash muhim ilmiy-amaliy ahamiyat kasb etadi. Qarshi shahrida iqlim o'zgarishining geografik xususiyatlarini chuqur o'rganish, hududiy iqlim xavflarini baholash va ilmiy asoslangan moslashuv strategiyalarini ishlab chiqish mintaqaning ekologik barqarorligi hamda ijtimoiy-iqtisodiy rivojlanishini ta'minlashning muhim sharti hisoblanadi. Olib borilgan tadqiqotlar natijasida Qarshi shahrida iqlim o'zgarishi jarayonlari global va mintaqaviy iqlim tizimlaridagi o'zgarishlarning hududiy namoyon bo'lish shakli ekanligi aniqlandi. Tadqiqotlar shuni ko'rsatadiki, hududning keskin kontinental iqlim sharoiti, qurg'oqchil tabiiy geografik xususiyatlari hamda suv resurslariga yuqori darajada bog'liqligi Qarshi shahrining iqlim o'zgarishiga nisbatan sezgirligini oshirmoqda.

Tahlillar natijasida so'nggi yillarda hududda o'rtacha yillik havo haroratining oshishi, ekstremal issiqlik hodisalarining takrorlanish chastotasi ortishi, yog'inlarning mavsumiy va hududiy taqsimotida o'zgarishlar kuzatilayotgani aniqlandi. Mazkur jarayonlar qurg'oqchilikning kuchayishi, suv resurslari tanqisligi, tuproq degradatsiyasi va cho'llanish jarayonlarining jadallashuviga sabab bo'lmoqda. Shuningdek, urbanizatsiya sur'atlarining jadallashuvi, transport vositalari sonining ortishi, sanoat va kommunal xo'jalik tarmoqlarining rivojlanishi natijasida antropogen yuklamaning ortib borishi mahalliy iqlim sharoitlariga sezilarli ta'sir ko'rsatmoqda. Tadqiqot natijalari iqlim o'zgarishining Qarshi shahri iqtisodiyotining yetakchi tarmoqlaridan biri bo'lgan qishloq xo'jaligi, suv xo'jaligi, aholi salomatligi va tabiiy ekotizimlarga salbiy ta'siri ortib borayotganini ko'rsatdi. Shu munosabat bilan hududiy rivojlanish strategiyalarini ishlab chiqishda iqlim xavflarini inobatga olish zarurati ortib bormoqda. Zamonaviy ilmiy qarashlar asosida Qarshi shahrida iqlim o'zgarishining salbiy oqibatlarini kamaytirish maqsadida quyidagi ustuvor yo'nalishlarni amalga oshirish maqsadga muvofiq deb hisoblanadi. Hududiy iqlim

monitoringi tizimini takomillashtirish va geoinformatsion texnologiyalarni keng joriy etish, Suv resurslaridan oqilona foydalanish hamda suv tejovchi texnologiyalarni keng qo'llash, Shahar hududlarida ko'kalamzorlashtirish ishlarini kengaytirish va yashil infratuzilmani rivojlantirish, Qayta tiklanuvchi energiya manbalaridan foydalanish ulushini oshirish, Iqlim o'zgarishiga moslashish bo'yicha hududiy dasturlarni ishlab chiqish va amaliyotga joriy etish. Umuman olganda, Qarshi shahrida iqlim o'zgarishining geografik xususiyatlarini chuqur o'rganish, ilmiy asoslangan prognozlarni ishlab chiqish hamda moslashuv choralarini takomillashtirish hududning ekologik barqarorligini ta'minlash va barqaror ijtimoiy-iqtisodiy rivojlanishga erishishning muhim omili hisoblanadi.

Qarshi shahrida iqlim o'zgarishi muammosining geografik xususiyatlarini o'rganish natijalari hamda xalqaro va milliy ilmiy hujjatlar O'zbekiston Respublikasining "Yashil iqtisodiyotga o'tish strategiyasi", O'zgidromet ma'lumotlari va boshqa normativ-huquqiy hujjatlar) asosida taklif va tavsiyalar ishlab chiqildi. Jumladan Qarshi shahri va uning atrof hududlarida iqlim ko'rsatkichlarini muntazam kuzatib borish maqsadida zamonaviy meteorologik kuzatuv punktlari sonini ko'paytirish hamda geografik axborot tizimlari (GAT) va masofadan zondlash texnologiyalarini keng joriy etish maqsadga muvofiqdir. Bu kelgusida iqlim xavflarini oldindan prognoz qilish imkoniyatlarini kengaytiradi.

Qashqadaryo vohasida suv resurslaridan oqilona foydalanish maqsadida qishloq xo'jaligida tomchilatib sug'orish, yomg'irlatib sug'orish kabi suv tejovchi texnologiyalarni keng joriy etish zarur. Shuningdek, sug'orish tarmoqlarini modernizatsiya qilish va suv yo'qotishlarini kamaytirish bo'yicha kompleks chora-tadbirlarni amalga oshirish lozim.

Qarshi shahrida urbanizatsiya jarayonlari natijasida yuzaga kelayotgan "shahar issiqlik oroli" effektini kamaytirish maqsadida yashil hududlar maydonini kengaytirish, himoya o'rmonzorlarini tashkil etish va iqlim sharoitiga mos daraxt turlarini ekishni jadallashtirish tavsiya etiladi. Hududning yuqori quyosh radiatsiyasi salohiyatidan samarali foydalanish maqsadida quyosh energetikasi loyihalarini kengaytirish, ijtimoiy soha obyektlari va ishlab chiqarish korxonalarida energiya tejamkor texnologiyalarni joriy etish zarur.

Qarshi shahri uchun iqlim o'zgarishiga moslashishning uzoq muddatli hududiy strategiyasini ishlab chiqish hamda uni shaharni ijtimoiy-iqtisodiy rivojlantirish dasturlariga integratsiyalash maqsadga muvofiqdir.

Qarshi shahri hududida iqlim o'zgarishining tabiiy va antropogen omillarini chuqur o'rganish, hududiy iqlim modellarini yaratish hamda ilmiy prognozlash ishlarini kuchaytirish zarur. Bu borada oliy ta'lim muassasalari, ilmiy-tadqiqot institutlari va davlat tashkilotlari o'rtasidagi hamkorlikni rivojlantirish muhim ahamiyat kasb etadi.

Aholining iqlim o'zgarishi bo'yicha bilim va ko'nikmalarini oshirish maqsadida ta'lim muassasalarida ekologik ta'limni takomillashtirish, ommaviy axborot vositalari orqali targ'ibot ishlarini kuchaytirish hamda jamoatchilik ishtirokini kengaytirish tavsiya etiladi.

Hududda atmosfera havosi sifati, suv va tuproq resurslari holatini muntazam nazorat qilish, ekologik monitoring natijalarini raqamlashtirish hamda iqlim xavflarini boshqarishning institutsional mexanizmlarini takomillashtirish lozim. Yuqoridagi taklif va tavsiyalarning amaliyotga joriy etilishi Qarshi shahrining ekologik barqarorligini ta'minlash, iqlim o'zgarishining salbiy oqibatlarini kamaytirish hamda hududning barqaror ijtimoiy-iqtisodiy rivojlanishiga xizmat qiladi.

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EXPERIMENTAL PERFORMANCE ASSESSMENT OF A PCM- ASSISTED FLAT-PLATE SOLAR WATER HEATING COLLECTOR UNDER ARID CLIMATIC CONDITIONS

Abstract. *The authors present a flat-plate solar water heating collector designed to improve the efficiency of hot water supply systems through the utilization of solar energy. An experimental solar water heating collector system was developed and equipped with a thermal energy storage unit based on a phase change material (PCM), as well as an additional hinged reflector installed parallel to the collector, serving as an auxiliary source of solar thermal energy. The results of experimental investigations carried out under the climatic conditions of Karshi city are presented. The experimental results demonstrated the high energy performance of the developed solar water heating collector. It was determined that the temperature of the heated water reached 65–70 °C during the summer period, while the application of the thermal storage unit ensured heat retention and maintained a stable temperature regime during evening hours.*

Keywords: *solar water heating collector, phase change material, thermal storage, solar thermal energy, thermal performance, energy efficiency, solar reflector, heat transfer enhancement, renewable energy systems, hot water supply.*

Introduction

The combustion of fossil fuels leads to the emission of greenhouse gases (CO₂, SO₂, and NO_x), contributes to acid rain formation, air pollution, ozone layer depletion, and global warming. These environmental challenges are further intensified by the continuously increasing global demand for thermal and electrical energy. A significant portion of energy consumption is associated with domestic and industrial hot water production, making the development of energy-efficient water heating technologies an important research priority. Solar water heating collectors have been developed to reduce the consumption of conventional fossil fuels and to promote the utilization of renewable energy resources [1-4].

Currently, extensive research is being conducted worldwide and in Uzbekistan on the development of solar thermal energy systems based on low-temperature solar technologies for hot water supply applications. Particular attention is devoted to the optimization of heat transfer processes, the development of advanced collector designs, and the determination of optimal operational, technological, and design parameters that ensure stable hydraulic and thermal performance of solar water heating systems. The improvement of energy efficiency, enhancement of thermal performance, and development of modern flat-

plate solar water heating collectors remain among the most important research challenges in this field [5].

At the same time, increasing the thermal efficiency of solar water heating collectors through the improvement of absorber designs, incorporation of thermal energy storage materials, application of solar reflectors, and intensification of heat transfer processes has become highly relevant. Despite significant progress achieved in recent years, challenges related to optimizing the heat exchange surface area of absorbers, improving thermal energy storage capacity, reducing system costs, and enhancing overall collector efficiency remain unresolved. Therefore, the development of advanced flat-plate solar water heating collectors with improved heat transfer characteristics and higher energy efficiency represents an important scientific and practical task for autonomous hot water supply and energy-saving systems. In the global practice, numerous studies have been conducted on the development and optimization of solar water heating collectors aimed at increasing the heat transfer coefficient and overall energy efficiency through the improvement of absorber designs and heat exchange surfaces. The performance of solar thermal systems largely depends on the effective utilization and storage of thermal energy, making thermal energy storage an essential component of modern solar water heating technologies [6].

One of the key challenges is to determine the efficiency of thermal energy storage units integrated into solar water heating systems. Their performance depends on the proper selection of thermal storage materials, optimization of storage capacity, geometric dimensions and arrangement of storage elements, heat transfer fluid flow rate, installation conditions, and the possibility of integrating the storage system into existing engineering structures [7-10].

The objective of this study is to experimentally investigate the operating modes of a flat-plate solar water heating collector equipped with a thermal energy storage unit and to evaluate its energy performance under the southern climatic conditions of Karshi, Republic of Uzbekistan [11,12].

Materials and Methods

A flat-plate solar water heating collector was developed for use in autonomous hot water supply systems. The experimental system incorporates a thermal energy storage unit based on a phase change material (PCM) and an additional solar reflector to enhance solar energy utilization. Experimental investigations were carried out at the "Alternative Energy Sources" educational and research test site of the Karshi State Technical University. The developed experimental solar water heating collector and its main structural components are shown in Figure 1.



Fig. 1. Flat-plate solar water heating collector.

The flat-plate solar water heating collector is additionally equipped with a thermally insulated storage tank incorporating a spiral-type heat exchanger for storing the collected thermal energy. Furthermore, the system includes an adjustable hinged reflector installed parallel to the solar collector, which serves as an additional source of solar thermal energy. The integration of the thermal storage unit and the reflector not only improves the overall thermal efficiency of the solar water heating collector but also increases the useful heat gain and enhances the collector's ability to meet hot water demand. In addition, the thermal storage system enables the accumulation of excess solar energy during periods of high solar radiation and its utilization during periods of low solar intensity, thereby improving the reliability and continuity of hot water supply [13-16].

Results and discussions

The highest solar radiation intensity during the entire experimental study period was observed in June 2026. The results of the theoretical and experimental investigations are presented in Table 1.

Table 1.

**Experimental Results of the Flat-Plate Solar Water Heating Collector
Operating in Water Heating Mode (June 2026).**

Local Time	Water Inlet Temp., t_1 (°C)	Water Flow Rate, G_w (kg/s)	Water Outlet Temp., t_2 (°C)	PCM Thermal Storage Temp., t_{PCM} (°C)	Solar Radiation Intensity on Collector Surface, q_r (W/m ²)
5:00	18	0,04	20	21	200
6:00	20	0,04	25	26	250
7:00	23	0,04	30	34	450
8:00	25	0,04	36	39	550
9:00	27	0,04	38	44	730
10:00	30	0,04	44	46	800
11:00	34	0,04	52	53	930
12:00	36	0,04	58	65	100
13:00	40	0,04	60	70	1100
14:00	44	0,04	65	70	1150
15:00	42	0,04	62	68	1100
16:00	38	0,04	60	64	950
17:00	32	0,04	51	55	750
18:00	27	0,04	45	47	450
19:00	22	0,04	40	43	150
20:00	20	0,04	28	30	100
21:00	18	0,04	24	24	20
22:00	16	0,04	22	22	15

Conclusions

Based on the experimental investigations conducted under the climatic conditions of Karshi, the operational performance and thermal characteristics of the developed flat-plate solar water heating collector were evaluated. The results demonstrated that the collector was capable of heating water up to 65–70 °C during periods of maximum solar radiation intensity. The integration of the thermal energy storage unit ensured stable thermal performance and enabled the retention of useful heat during periods of reduced solar irradiation.

The experimental data confirmed a strong correlation between solar radiation intensity and the outlet water temperature of the collector. The highest thermal performance was achieved during midday hours when solar radiation exceeded 1100 W/m². The obtained results indicate that the developed collector can effectively satisfy a significant portion of domestic hot water demand using renewable solar energy.

Furthermore, the thermal energy storage system improved the operational reliability of the collector by reducing temperature fluctuations and extending the availability of hot water beyond peak solar hours. The study confirms that the proposed flat-plate solar water heating collector is an energy-efficient,

environmentally friendly, and economically viable solution for autonomous hot water supply systems in regions with high solar energy potential.

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MOSLASHUVCHAN TA'LIM MUHITIDA HISSIY HOLATNI REAL VAQTDAN ANIQLASH UCHUN GIBRID CHUQUR O'QITISH TIZIMI

Annotatsiya. Ushbu maqolada sun'iy intellekt va "Affective Computing" texnologiyalarini ta'lim jarayoniga integratsiya qilish orqali o'quvchilarning hissiy holatini real vaqt rejimida monitoring qilish va ta'lim sifatini oshirish masalalari tahlil etilgan. Tadqiqotda CNN va LSTM gibrid neyron tarmoqlaridan foydalangan holda o'quvchilarning "qiziqish", "charchoq" va "stress" kabi holatlarini 92.4% aniqlik bilan tasniflovchi model taklif etilgan. NoSQL (MongoDB) arxitekturasida yaratilgan tizim, o'quvchining psixologik holatiga mos ravishda ta'lim kontentini avtomatik moslashtirish imkonini beradi. Eksperiment natijalari ushbu yondashuv o'quv samaradorligini 18% ga oshirishini va o'quv jarayonidagi "hissiy uzilish"ni kamaytirishini ko'rsatdi. Maqolada shuningdek, texnologiyani joriy etishdagi axloqiy muammolar, ma'lumotlar maxfiyligi (Data Privacy) va yoritish sharoitlari kabi cheklovlar hamda ularni bartaraf etish strategiyalari bayon etilgan.

Kalit so'zlar: Sun'iy intellekt (SI), Affective Computing, Adaptiv ta'lim, Chuqur o'qitish, Gibrid neyron tarmoqlar (CNN-LSTM), NoSQL (MongoDB), Real-time monitoring, Pedagogik samaradorlik.

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HYBRID DEEP LEARNING SYSTEM FOR REAL-TIME EMOTIONAL STATE DETECTION IN ADAPTIVE LEARNING ENVIRONMENTS

Abstract. This article analyzes the integration of artificial intelligence and "Affective Computing" technologies into the educational process to monitor students' emotional states in real-time and improve educational quality. The study proposes a model that classifies student states such as "interest," "fatigue," and "stress" with 92.4% accuracy using hybrid CNN and LSTM neural networks. The system, based on a NoSQL (MongoDB) architecture, allows for the automatic adaptation of educational content to the student's psycho-emotional state. Experimental results demonstrate that this approach increases learning efficiency by 18% and reduces the "emotional gap" in the learning process. The article also addresses ethical concerns regarding technology implementation, data privacy issues, and environmental constraints such as lighting conditions, along with strategies to mitigate them.

Keywords: *Artificial Intelligence (AI), Affective Computing, Adaptive Learning, Deep Learning, Hybrid Neural Networks (CNN-LSTM), NoSQL (MongoDB), Real-time monitoring, Pedagogical efficiency.*

KIRISH

Raqamli ta'lim tizimlarining rivojlanishi o'quvchilarning individual ehtiyojlariga moslashish zaruratini keltirib chiqarmoqda. O'zbekiston Respublikasida raqamli ta'limni rivojlantirish davlat siyosatining ustuvor yo'nalishlaridan biridir. Xususan, 2024-yil 4-martdagi PQ-466-sonli qaror sun'iy intellekt texnologiyalarini ta'lim va ilmiy tadqiqotlarga integratsiya qilish uchun mustahkam huquqiy zamin yaratdi. Ushbu tadqiqot ushbu strategik maqsadlarni amalga oshirishda "Affective Computing" kabi zamonaviy yechimlarning o'rnini ilmiy jihatdan asoslaydi. Hozirgi kunda aksariyat adaptiv ta'lim platformalari (ATS) faqat o'quv natijalariga tayanadi va o'quvchining psixologik hamda hissiy holatini stress, charchoq, qiziqish e'tibordan chetda qoldiradi. Ushbu tadqiqot "Affective Computing" hissiyotlarni hisoblash va chuqur o'qitish (Deep Learning) metodlarini integratsiya qilgan holda, o'quvchining real vaqtdagi hissiy holatini aniqlaydigan va bunga muvofiq o'quv kontentini avtomatik moslashtiradigan yangi modelni taklif etadi.

Metodologiya

Tadqiqotda tizim samaradorligini ta'minlash uchun quyidagi gibrid yondashuv qo'llaniladi:

✓ Ma'lumotlarni yig'ish: Video oqimlar orqali o'quvchining yuz ifodalari va xatti-harakatlari real vaqt rejimida kuzatiladi.

✓ Taklif etilayotgan arxitektura: Gibrid neyron tarmoq modeli — yuz ifodalarini tasniflash uchun CNN (Convolutional Neural Networks) va hissiyotlarning vaqt o'tishi bilan o'zgarish dinamikasini tahlil qilish uchun LSTM (Long Short-Term Memory) tarmoqlari birlashtirildi.

✓ Adaptiv qayta aloqa mexanizmi: Tizim "stress" yoki "charchoq" holatini aniqlaganda, o'quv yuklamasini avtomatik ravishda optimallashtiradi.

Natijalar

1. Aniqlik darajasi (92.4%) va Stress tushunchasi. 92.4% ko'rsatkichi ta'lim muhiti uchun yuqori natija hisoblanadi. Biroq, stress holatini tasniflashda tizimning kontekstual sezgirligini oshirish kerak:

Musbat vs salbiy stress: Model stressni aniqlaganda, bu o'quvchining qiyin vazifani bajarayotgan paytdagi yaxshi stressi (challenge) yoki haqiqiy ruhiy tushkunlik (distress) ekanligini ajrata oladimi?

Yechim: Modelga o'quvchining avvalgi akademik yutuqlari (tarixiy ma'lumotlar)ni kiritish orqali shaxsiy normani belgilash mumkin. Bu modelning yanada shaxsiylashgan bo'lishiga yordam beradi.

2. O'zlashtirishdagi 18% lik o'sish: Sababiy bog'liqlik

Bu eng muhim ko'rsatkich. 18% ga o'sish shunchaki yaxshiroq o'qish emas, balki o'quv jarayonining moslashuvchanligi (adaptive learning) bilan bog'liq:

Real-time aralashuv: Tizim o'quvchi charchaganini payqab, topshiriq turini o'zgartirgani yoki tanaffus taklif qilgani uchun natija yaxshilangan.

Analitik tahlil: Ushbu 18% o'sish aynan qaysi fanlar yoki mavzular kesimida ko'proq kuzatilganini ajratib olish (klasterlash) kelgusida tizimining algoritmik ustuvorliklarini belgilashda muhim.

3. Tezkorlik (0.4 soniya): Inson idroki chegarasi. 0.4 soniya (400 millisekund) — bu inson psixologiyasi uchun “real vaqt” rejimiga yaqin vaqt.

Pedagogik ahamiyati: Agar javob 1 soniyadan oshib ketsa, o'quvchi tizimning ta'sirini sezmay qoladi va o'zgarish sun'iydek tuyuladi. 0.4 soniya esa o'quvchining o'zgaruvchan holatiga darhol reaksiya bildirish uchun yetarli(1-jadval).

1-jadval
Eksperiment natijalari tahlili

Ko'rsatkich	Natija	Izoh
Aniqlik darajasi	92.4%	Model hissiyotlarni yuqori aniqlik bilan aniqlaydi.
O'zlashtirish o'sishi	+18%	Nazorat guruhiga nisbatan sezilarli pedagogik o'sish.
Reaksiya tezligi	0.4 soniya	Inson psixologik idroki uchun optimal real-time tezlik.

Ushbu natijalar tizimining o'quv jarayoniga integratsiyasi juda yuqori samaradorlik berishini tasdiqlaydi. 92.4% aniqlik va 0.4 soniyalik reaksiya tezligi tizimning real vaqt rejimida (real-time) ishlash imkonini bersa, 18% lik o'zlashtirish o'sishi uning pedagogik ta'sirchanligini ko'rsatadi. Bu ko'rsatkichlar sun'iy intellektga asoslangan hissiy monitoring tizimining an'anaviy ta'lim usullaridan sezilarli ustunligini isbotlaydi.

Muhokama

Tadqiqot natijalari shuni ko'rsatadiki, hissiyotlarga asoslangan adaptiv ta'lim o'quvchilarning motivatsiyasini yuqori darajada ushlab turish uchun juda samarali.

1. Imkoniyatlar hissiy uzilishni bartaraf etish. An'anaviy masofaviy ta'limda o'quvchi o'zini yolg'iz his qiladi va tizim bilan muloqot mexanik tus oladi. Hissiy monitoring buni qanday o'zgartiradi: Empatik qayta aloqa: Tizim o'quvchi zerikkanini sezganda, dars mazmunini qiziqarliroq formatga masalan, videolavha yoki interaktiv savolga o'tkazadi. Bu o'quvchi va mashina o'rtasida "tushunish" borligini his qildiradi.

Profilaktik aralashuv: “Charchoq” belgilarini 0.4 soniyada aniqlash, o'quvchini “tushkunlik” chegarasiga yetib bormasdan turib, dam olishga undaydi. Bu esa o'quvchining ta'lim jarayoniga bo'lgan ishonchini oshiradi.

2. Cheklovlar texnik va etik to'siqalar. ta'kidlaganimdek cheklovlar tizimning ishonchlilik va axloqiy jihatlariga oid:

Adaptiv algoritm: Bu yerda tizim ishga tushadi. Agar stress aniqlansa, tizim dars qiyinligini pasaytiradi yoki vizual kontentni (video/rasm) matnli kontentga o'zgartiradi.

XULOSA

Tadqiqot natijalari shuni ko'rsatadiki, hissiyotlarga asoslangan adaptiv ta'lim tizimlari (ATS) an'anaviy o'qitish usullari bilan solishtirganda o'quv jarayonini shaxsiylashtirish va o'quvchilar motivatsiyasini yuqori darajada saqlab qolishda muhim ahamiyatga ega. 0.4 soniyalik reaksiya tezligi tizimning real vaqt rejimida samarali ishlashini ta'minlaydi. Pedagogik samaradorlikni oshiruvchi vosita sifatida o'zini oqladi. Kelgusidagi tadqiqotlar ushbu tizimni keng ko'lamli ta'lim muhitlariga tatbiq etish, shuningdek, Explainable AI (XAI) usullarini chuqurroq integratsiya qilish orqali o'qituvchilarning tizimga bo'lgan ishonchini yanada mustahkamlashga qaratilishi lozim. Axloqiy standartlar va "Privacy-by-Design" tamoyillariga rioya qilish, sun'iy intellektning ta'limdagi kelajagini belgilab beruvchi asosiy omillardan biri bo'lib qoladi.

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QURILISH SOHASIDA INSTITUTSIONAL ISLOHOTLARNING SAMARADORLIKKA TA’SIRINI KOMPLEKS BAHOLASH MASALALARI

***Annotatsiya.** Maqolada O‘zbekistonda so‘nggi yillarda iqtisodiyotni liberallashtirish va davlat boshqaruvini modernizatsiya qilish jarayonlari doirasida qurilish sohasidagi institutsional o‘zgarishlarning ustuvor yo‘nalishlari, shuningdek institutsional takomillashtirish, zamonaviy boshqaruv mexanizmlarini joriy etish, hududlar infratuzilmasini rivojlantirish hamda qurilish sifatini oshirishga qaratilgan takliflar ilgari surilgan. Shu bilan birga, qurilish ishlari hajmining 2020-2025 yillardagi o‘sish sur‘atlari, qurilish sohasining institutsional rivojlanish davrlari va har bir davrning o‘ziga xos rivojlanish xususiyatlari tahlil qilingan hamda institutsional islohotlar davrida qurilish sohasining barqaror rivojlanishi yuzasidan tavsiyalar ham berilgan.*

***Kalit so‘zlar:** iqtisodiyotni liberallashtirish, qurilish sektori, uy-joy bozori, institutsional islohotlar, samaradorlik, raqamlashtirish, eskrou tizimi, ipoteka mexanizmlari, barqaror rivojlanish, davlat-xususiy sheriklik.*

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COMPREHENSIVE ASSESSMENT OF THE IMPACT OF INSTITUTIONAL REFORMS ON EFFICIENCY IN THE CONSTRUCTION SECTOR

***Abstract.** This article examines the priority directions of institutional transformations in Uzbekistan’s construction sector within the framework of recent economic liberalization and public administration modernization processes. It also proposes measures aimed at institutional improvement, the*

introduction of modern management mechanisms, the development of regional infrastructure, and the enhancement of construction quality. Furthermore, the study analyzes the growth rates of construction work volumes during 2020–2025, the stages of institutional development of the construction sector, and the specific characteristics of each stage. Recommendations are provided to ensure the sustainable development of the construction industry during the period of institutional reforms.

Keywords: *economic liberalization, construction sector, housing market, institutional reforms, efficiency, digitalization, escrow system, mortgage mechanisms, sustainable development, public-private partnership.*

KIRISH

Qurilish sohasi har qanday milliy iqtisodiyotning strategik tarmoqlaridan biri hisoblanadi. U nafaqat infratuzilma va uy-joy fondini yaratadi, balki investitsion jarayonlar, bandlik va sanoat rivojlanishiga ham bevosita ta'sir ko'rsatadi. O'zbekistonda so'nggi yillarda iqtisodiyotni liberallashtirish va davlat boshqaruvini modernizatsiya qilish jarayonlari doirasida qurilish sohasida ham keng ko'lamli institutsional islohotlar amalga oshirildi. Jumladan, qurilish faoliyatini tartibga soluvchi normativ-huquqiy baza takomillashtirilib, "O'zbekiston Respublikasining Shaharsozlik kodeksi" [1] yangi tahrirda qabul qilindi. Mazkur kodeks shaharsozlik faoliyatini tartibga solish, ruxsat berish tartib-taomillarini soddalashtirish hamda davlat nazoratini optimallashtirishga xizmat qildi.

O'zbekistonda qurilish sohasidagi institutsional o'zgarishlarni quyidagi asosiy yo'nalishlarda ko'rish mumkin:

1. *Normativ-huquqiy bazani takomillashtirish.* Qurilish jarayonlarining shaffofligi va qonuniyligini ta'minlash maqsadida litsenziyalash, ekspertiza va ruxsat berish tartiblari qayta ko'rib chiqildi. qurilish obyektlarini ro'yxatdan o'tkazish va foydalanishga topshirish mexanizmlari soddalashtirildi.

2. *Davlat boshqaruvi tizimini optimallashtirish.* Qurilish sohasida vakolatli organlar faoliyati qayta tashkil etildi. Xususan, O'zbekiston Respublikasi Prezidentining 2025-yil 14-apreldagi "Qurilish va uy-joy kommunal xo'jaligi sohasida davlat nazoratini samarali tashkil qilish chora-tadbirlari to'g'risida" gi PF-66-son farmoni[2] asosida qurilish va uy-joy kommunal xo'jaligi sohasida davlat nazorati mexanizmlari qayta ko'rib chiqildi hamda raqamli monitoring tizimlari joriy etildi.

3. *Raqamlashtirish jarayonlari.* Elektron ruxsatnomalar, onlayn ekspertiza va kadastr tizimlari bosqichma-bosqich joriy qilindi. Bu omil inson omilini qisqartirish orqali korrupsion xavflarni kamaytirishga xizmat qilmoqda.

4. *Bozor mexanizmlarini rivojlantirish.* Uy-joy bozorini rivojlantirish, ipoteka mexanizmlarini takomillashtirish va xususiy sektor ishtirokini kengaytirish bo'yicha chora-tadbirlar amalga oshirildi.

Jumladan, O'zbekiston Respublikasi Prezidentining 2026-yil 16-fevraldagi "Mahallani rivojlantirish va jamiyatni yuksaltirish» yilida ustuvor yo'nalishlar

bo'yicha islohotlar dasturlari va "O'zbekiston - 2030" strategiyasini amalga oshirish bo'yicha Davlat dasturi to'g'risida" gi PF-22-son farmoni [3] ijrosi qurilish sohasi rivojlanishiga ham bevosita va sezilarli ta'sir ko'rsatadi.

Mazkur jarayonlar natijasida sohada institutsional takomillashtirish, zamonaviy boshqaruv mexanizmlarini joriy etish, hududlar infratuzilmasini rivojlantirish hamda qurilish sifatini oshirishga qaratilgan chora-tadbirlar izchil amalga oshiriladi.

O'zbekiston Respublikasi Prezidentining 2025-yil 19-noyabrdagi "O'zbekiston Respublikasida uy-joy va ipoteka bozorini barqaror rivojlantirish chora-tadbirlari to'g'risida" gi PF-219-son farmoni [4]. Ushbu farmonning asosiy maqsadi uy-joy sohasini barqaror va muvozanatli rivojlantirishni ta'minlash, 2040-yilga qadar har yili qurilayotgan uy-joylar sonini ikki baravarga oshirib, 421 mingtaga olib chiqish, ipoteka krediti portfelini 10 baravardan ortiq ko'paytirgan holda 56,7 mlrd AQSH dollariga yetkazish. Farmonning asosiy yo'nalishlari qurilish sohasining struktura va moliyaviy tizimini barqarorlashtirishga yo'naltirilgan.

ADABIYOTLAR SHARHI

O'zbekiston qurilish sohasida innovatsion menejment hali boshlang'ich bosqichda bo'lib, asosan yirik korxonalar va davlat tomonidan boshqariladigan loyihalar bilan chegaralangan. "Shaffof qurilish" tizimi kabi raqamli platformalar institutsional yordam ko'rsatsa-da, BIM va "Raqamli egizak" kabi ilg'or texnologiyalarning joriy etilishi barqaror emas. Ushbu notekis o'zlashtirish texnologik va tashkiliy salohiyatni oshirish bo'yicha strategik choralar ko'rish zarurligini ko'rsatadi.

Inson kapitalidagi cheklovlar muhim to'siq bo'lib qolmoqda. Boshqaruv vakolatlarining cheklanganligi va yetarli darajada o'qitish imkoniyatlarining yo'qligi innovatsion boshqaruv amaliyotlarining samarali joriy etilishiga to'sqinlik qilmoqda. Ishchi kuchi bilan bog'liq ushbu muammolarni hal qilish korxonalarning texnologik vositalardan to'liq foydalanishi va loyiha natijalarini optimallashtirishi uchun muhim ahamiyatga ega.

Moliyaviy va texnologik cheklovlar innovatsiyalarning sekin o'zlashtirilishini yanada kuchaytirmoqda. Ayniqsa, kichik va o'rta korxonalar raqamli tizimlar va zamonaviy boshqaruv yondashuvlarini joriy etish uchun zarur resurslarni ta'minlashda qiyinchiliklarga duch kelmoqda. Ushbu tarkibiy cheklovlar innovatsiyalarni qabul qilishni qo'llab-quvvatlash uchun maqsadli investitsiyalar va rag'batlantirish mexanizmlari muhimligini ta'kidlaydi.

O'zbekistonda barqaror va innovatsiyalarga asoslangan qurilish sohasiga erishish texnologik, insoniy, moliyaviy va institutsional jihatlarni bir vaqtning o'zida qamrab oluvchi integratsiyalashgan yondashuvni talab qiladi. Strategik investitsiyalar, boshqaruv vakolatlarini shakllantirish va qulay tartibga solish muhitini yaratish orqali qurilish sanoati o'zining operatsion samaradorligini oshirishi, loyiha natijalarini yaxshilashi hamda ichki va global bozorlarda uzoq muddatli raqobatbardoshligini ta'minlashi mumkin [5].

Zamonaviy muammolar bugungi kunda institutsional islohotlarning samarali amalga oshirilishini taqozo etmoqda. Rivojlanayotgan iqtisodiyotlarda jiddiy siyosiy va iqtisodiy-institutsional islohotlar siyosiy qarash va yo'nalishlardan qat'i nazar, hamma uchun foydali ekanligi aniq. Tashqi va ichki bosimlar, rivojlanish hamkorlarining talablari, global savdo sharoitlaridagi o'zgarishlar institutsional va siyosiy islohotlarni rag'batlantirmoqda. Bu islohotlar kamroq xavfli va adolatli foyda olish muhitini yaratadi, bu esa investorlarni jalb qilish va ushbu iqtisodiyotlarning iqtisodiy o'sishini kuchaytirishga xizmat qiladi [6].

Jahon amaliyotida qurilish sanoatining ijtimoiy-iqtisodiy samaradorligini oshirishga qaratilgan ilmiy tadqiqotlar quyidagi ustuvor yo'nalishlarda rivojlanmoqda:

- qurilish jarayonlarini tashkil etishda tizimli yondashuvlarni qo'llash;
- innovatsion biznes modellari orqali loyihalash, qurilish-montaj ishlari va ta'minot zanjirini optimallashtirish;
- qurilish sanoati infratuzilmasini samarali tashkil etish (moliyalashtirish, kafolatlash, sug'urta, konsalting, texnik ekspertiza);
- davlat-xususiy sheriklik (DXSh/PPP) mexanizmlari doirasida loyiha boshqaruvi va risklarni taqsimlash usullarini takomillashtirish.

Ushbu tendensiyalar shuni yaqqol ko'rsatadiki, qurilish sohasidagi tadbirkorlik faoliyati nafaqat bozor omillari, balki davlatning institutsional tartibga solish sifatini belgilovchi huquqiy, tashkiliy va raqamli mexanizmlar bilan ham shakllanadi [7].

O'zbekistonda amalga oshirilayotgan keng ko'lamli iqtisodiy islohotlar sharoitida moslashuvchanlik, raqamli transformatsiya va resurslarni samarali boshqarish omon qolish va o'sish uchun hal qiluvchi omillarga aylanmoqda.

Davlatning qo'llab-quvvatlashi, investitsion faollik, milliy dasturlarda ishtirok etish va zamonaviy boshqaruv vositalariga (masalan, BIM, KPI va moliyaviy rejalashtirish) o'tish birgalikda qurilish tashkilotlariga o'z operatsion samaradorligi va bozor o'rnini sezilarli darajada oshirish imkonini beradigan keng qamrovli strategiyani shakllantiradi. Davlat yordami ko'pincha muhim moliyaviy resurslar, tartibga solish sohasidagi qulayliklar va biznes o'sishi uchun barqaror va qulay muhit yaratadigan siyosat asoslarini taqdim etadi. Faol investitsiyalar innovatsiyalarni, infratuzilma rivojlanishini va ilg'or texnologiyalarni qabul qilishni rag'batlantiradi, bu esa kompaniyalarning sanoat tendensiyalarining eng oldingi safida qolishini ta'minlaydi [8].

Shuningdek, qurilish sohasining o'ziga xosligi – u ishlab chiqaradigan tovarlar, iqtisodiyot uchun asosiy tuzilmalarni ta'minlash va ko'plab ish o'rinlarini yaratish jihatidan alohida ekanligi qayd etiladi. Resurslarga boy mamlakatlarda qurilish sektoriga bo'lgan talab ortib borayotgani, mahalliy firmalarning ishtiroki esa mahalliy sektor salohiyatiga bog'liqligi ta'kidlanadi. Xarid qilish, moliyalashtirish va korrupsiya sohasidagi to'siqlar asosiy muammolar sifatida ko'rsatilgan. Donorlarning shartnomalar tafsilotlarini ochiqlashi, axborot boshqaruvi tizimlarini rivojlantirishda yordam berishi va bog'langan yordamni

bekor qilishi mahalliy salohiyatni oshirishning muhim yo'nalishlari sifatida tavsiya etiladi. Tabiiy resurslarga boy mamlakatlarning mahalliy kontent siyosatidagi tajribasidan foydalanish va sektorning iqtisodiyot bilan bog'liqliklarini chuqurroq o'rganish siyosat muhitini yaxshilashga xizmat qiladi [9].

TADQIQOT METODOLOGIYASI

Mazkur tadqiqotning metodologik asosini qurilish sohasida amalga oshirilgan institutsional islohotlarning samaradorlikka ta'sirini kompleks baholashga qaratilgan zamonaviy ilmiy yondashuvlar tashkil etadi. Tadqiqotda tizimli, institutsional, iqtisodiy-statistik va komparativ tahlil metodlaridan foydalanildi.

Tadqiqot ikkilamchi ma'lumotlar manbalarining tahliliga asoslangan bo'lib, bularga rasmiy statistik hisobotlar, davlat siyosat hujjatlari, tarmoqni rivojlantirish dasturlari va ilmiy nashrlar kiradi. Ushbu manbalar qurilish sektorining hozirgi holati, innovatsiyalar bilan bog'liq islohotlar va boshqaruv amaliyotlari haqida ishonchli ma'lumotlarni taqdim etadi. Ikkilamchi ma'lumotlardan foydalanish qurilish korxonalarida innovatsion menejmentga ta'sir qiluvchi asosiy tendensiyalar va tarkibiy modellarni aniqlash imkonini beradi.

Tadqiqot shuningdek, qurilish korxonalari duch keladigan asosiy muammolarni aniqlash uchun muammoga yo'naltirilgan analitik asosdan foydalanadi. Ushbu muammolar institutsional, texnologik, moliyaviy va inson resurslari bilan bog'liq omillarga toifalarga ajratiladi. Bunday tasniflash innovatsiyalar oldidagi to'siqlarni tizimli baholashni osonlashtiradi va ularning nisbiy ahamiyatini aniqlashga yordam beradi.

Analitik qat'iylikni oshirish uchun tadqiqot tizimli tahlil elementlarini birlashtiradi hamda qurilish korxonalariga tashqi va ichki omillar ta'sir ko'rsatadigan murakkab tashkiliy tizimlar sifatida qaraydi. Ushbu nuqtai nazar siyosat islohotlari, bozor sharoitlari va tashkiliy imkoniyatlar innovatsion natijalarni shakllantirish uchun o'zaro qanday ta'sir qilishini o'rganish imkonini beradi.

USLUBIYOT VA TAHLILLAR

Qurilish ishlari hajmining 2020-2025 yillarda o'sish sur'atlari mamlakatda amalga oshirilayotgan institutsional islohotlar, investitsion faollikning oshishi hamda boshqaruv tizimining modernizatsiyalashuvi bilan izohlanadi. Ayniqsa, 2023 yildan boshlab qurilish sohasi rivojlanishida sifat jihatdan yangi bosqich boshlanib, qurilish hajmi keskin oshgan. Bu esa qurilish tarmog'ining milliy iqtisodiyotdagi strategik ahamiyatini yanada kuchaytirgan.

O'zbekiston Respublikasi Prezidentining 2019-yil 20-sentabrdagi "Qurilish sohasiga axborot-kommunikatsiya texnologiyalarini keng joriy etish chora-tadbirlari to'g'risida" PQ-4464-son qarori bilan 2020-yil 8-fevralda Qurilish va uy-joy kommunal xo'jaligi vazirligi huzurida Axborot-kommunikatsiya texnologiyalarini rivojlantirish Respublika markazi (Shaffof qurilish) tashkil etilgan [10]. Unga ko'ra, 2025-yil 1-iyuldan boshlab, quruvchilar va mijozlar

o'rtasida tuziladigan ulush kiritish shartnomalari majburiy tartibda notariusda tasdiqlanishi va kadastr ro'yxatidan o'tkazilishi kerak bo'ladi.

1-jadval
O'zbekistonda 2020-2025 yillarda qurilish ishlari hajmining o'sish
dinamikasi ⁴

Yillar	Qurilish ishlari hajmi (trln so'm)	O'sish sur'ati (%)
2020	88.1	32
2021	107.5	22
2022	130.8	21.6
2023	202.8	55
2024	233.8	15.2
2025	313.9	34.3

Shu sanadan e'tiboran eskrou tizimini ham joriy etish boshlanadi. Bunda, hali bitmagan uydan kvartira sotib olmoqchi bo'lganlar quruvchining o'ziga emas, bankka to'lov qiladi. Quruvchilar va banklar o'zaro kelishuv asosida bankda eskrou hisobvarag'ini ochadi, ulushdorlar to'lagan pullar shu hisobvaraqa yig'iladi. Uy bitmaguncha quruvchi kompaniyalar bu pullardan foydalanolmaydi. Bu tartib 1- iyuldan 31-dekabrgacha ixtiyoriy bo'ladi va agar kerakli qonunlar vaqtida qabul qilinsa, 2025-yil 1-yanvardan majburiy kuchga ega bo'ladi [11].

Quyida keltirilgan jadvalda shuni ko'rishimiz mumkinki, mamlakatda olib borilayotgan normativ-huquqiy institutsional islohatlarning sektorlarning rivojlanishiga ta'sirini ko'rishimiz mumkin.

Joriy yilning 6-may kuni Prezident Sh. Mirziyoyev qurilish va uy-joy kommunal xo'jaligi sohasida byurokratiyani qisqartirish va nazorat ishlari natijadorligini oshirish mavzusida selektorlarida, sohada davlat xizmatlarini soddalashtirish, ruxsat berish jarayonlarida byurokratiyani kamaytirish, qurilish ob'ektlari ustidan nazoratni raqamlashtirish va inson omilini qisqartirish bo'yicha takliflar ko'rib chiqildi.

Qayd etilganidek, hozirda qurilishni boshlash uchun ruxsat olishda jami 8 ta hujjat talab etiladi. Bu jarayon ayrim hollarda 3 oydan 12 oygacha cho'zilmoqda. Shu bois 2 ta hujjatni talab qilishni bekor qilish, yana 2 ta hujjatni esa raqamli integratsiya hisobiga shakllantirish taklif etildi. Natijada ariza berish va ko'rib chiqish uchun ketadigan vaqt 7 barobar qisqaradi, buyurtmachilarning ortiqcha ovoragarchiligi kamayadi. Yangi tartibga ko'ra, loyihalashga ruxsatnoma va arxitektura-rejalashtirish topshirig'i berish jarayonlari yagona hujjatga birlashtiriladi. "ShaffofAI" tizimi orqali ushbu jarayon inson omilisiz, avtomatik tarzda amalga oshirilishi ko'zda tutilmoqda. Buning natijasida 30 ish kunigacha davom etadigan jarayon to'liq avtomatlashtiriladi.

⁴Rasmiy statistik ma'lumotlar asosida mualliflar ishlanmasi.

2-jadval

Qurilish sohasining institutsional rivojlanish davrlari⁵

Yillar	Normativ-huquqiy hujjatlar	Raqamlashtirish va boshqaruv	Soha rivojlanishi
2020	Qurilish sohasini modernizatsiyalash strategiyasi loyihasi e'lon qilindi.	"Shaffof qurilish" tizimi asoslari yaratila boshlandi.	Strategiyada 2025-yilgacha 15 ta zamonaviy loyiha institutlari tashkil etish rejalashtirilgan.
2021	2021-2025 yillarga mo'ljallangan Strategiya rasman tasdiqlandi (PF-6119-son).	"Shaffof qurilish" milliy axborot tizimi ishga tushirildi; "Ogoh fuqaro" elektron tizimi yaratildi.	2 qavatdan yuqori binolar uchun loyiha hujjatlari majburiy ekspertizasi joriy etildi.
2022	Shaharsozlik normalari optimallashtirila boshlandi.	Raqamli hujjat aylanishi tizimi kengaytirildi.	Qurilish materiallari ishlab chiqaruvchi korxonalar reestri shakllantirila boshlandi.
2023	420 ta shaharsozlik normasi optimallashtirilib, 140 ta yangi standart joriy etildi.	Ruxsat berish muddatlari 4 baravarga qisqartirildi.	Qurilish korxonalari soni 10 mingga yetdi.
2024	Nazorat funksiyalarini xususiy sektorga o'tkazish jarayoni kuchaytirildi.	Raqamlashtirish hisobidan 3,6 trln so'm iqtisod qilindi	Eskrow hisobvaraq tizimi joriy etila boshlandi.
2025	Davlat nazorati funksiyalari litsenziyalangan xususiy tashkilotlarga o'tkazildi.	QR kodli pasport tizimi joriy etildi; "Shaffof qurilish" qamrovi 100% ga yetkazildi.	Qurilishga yondosh sohalarda 3,5 million kishi band qilindi.

Loyiha-qidiruv, qurilish-pudrat va ekspertiza tashkilotlarini litsenziyalashda ham yangi tartib joriy etiladi. Bugungi kunda ariza berishda 3 tadan 30 tagacha hujjatni ilova qilish talab etilib, qaror qabul qilish 14 ish kunigacha cho'zilmoqda. Taklif etilayotgan tizimda ma'lumotlar elektron bazalar orqali avtomatik tekshiriladi, hujjat ilova qilish talabi bekor qilinadi. Litsenziyani rasmiylashtirish muddati 14 ish kunidan 5 daqiqagacha qisqaradi, qaror qabul qilish jarayoni 97 foizga tezlashadi.

Qurilish obyektlarini foydalanishga qabul qilish jarayoni ham soddalashtiriladi. O'tgan yili bu borada berilgan 20 mingdan ortiq arizalar turli sabablar bilan rad etilgan. Kamchiliklarni bartaraf etish uchun buyurtmachilar 1 oydan 3 oygacha vaqt sarflamoqda. Endi davlat ob'ektlarini foydalanishga qabul qilishda talab etiladigan hujjatlar soni 3 tadan 1 taga qisqartiriladi. Texnik va mualliflik nazoratchilari xulosalari, muvofiqlik deklaratsiyasi va boshqa ma'lumotlar raqamli tizimlar orqali shakllantiriladi. Bu orqali ob'ektni qabul qilish muddati 2 oydan 15 kungacha qisqaradi. Shu bilan birga, binoning mustahkamligi va yong'in xavfsizligiga ta'sir qilmaydigan arxitekturaviy yoki rejaviy o'zgarishlar

⁵Tadqiqotlar asosida mualliflar ishlanmasi.

sabab ob'ektni foydalanishga qabul qilishni rad etish amaliyoti qayta ko'rib chiqiladi. Bunday holatlarda zarur korrekturalar kiritilib, ob'ektni qabul qilish imkoniyati yaratiladi [12].

XULOSA VA TAVSIYALAR

Ushbu tadqiqotda institutsional islohotlarning qurilish sohasi korxonalari samaradorligiga ta'siri nazariy va empirik jihatdan tahlil qilindi. Tadqiqot natijalari shuni ko'rsatadiki, institutsional islohotlar va qurilish korxonalari samaradorligi o'rtasida o'zaro mustahkam bog'liqlik mavjud. Xususan, mulk huquqlarining himoyasi, qonun ustuvorligi, byudjet balansi va ish haqi o'zgarishlarini tartibga soluvchi institutsional mexanizmlar qurilish firmalarining umumiy omil unumdorligiga (TFP) ijobiy ta'sir ko'rsatadi. Bu ta'sir, asosan, korxonalarining texnik samaradorligini oshirish orqali amalga oshadi.

Qurilish sohasi rivojlanayotgan iqtisodiyotlarda ko'pincha texnik muammolar bilan bir qatorda institutsional va siyosiy kamchiliklarga duch keladi. Tadqiqot shuni ko'rsatdiki, iqtisodiy-institutsional islohotlar (masalan, liberallashtirish, mulk huquqlarini himoya qilish) birinchi navbatda amalga oshirilganda, qurilish korxonalarining investitsiyalarni jalb qilish va o'sish sur'atlari sezilarli darajada oshadi. Aksincha, faqat siyosiy islohotlarga e'tibor qaratish yoki islohotlar ketma-ketligining buzilishi qurilish sohasida uzoq muddatli samaradorlikka erishishni qiyinlashtiradi.

Shuningdek, tadqiqotlar institutsional islohotlarning qurilish sohasi korxonalari samaradorligiga ta'sirini darhol emas, balki uzoq muddatli davrda namoyon bo'lishini ko'rsatmoqda. Shu boisdan, institutsional islohotlar tizimli va bosqichma-bosqich amalga oshirilishi lozim. Xulosa qilib aytganda, institutsional islohotlar va qurilish korxonalari samaradorligi o'rtasidagi o'zaro bog'liqlikni e'tiborsiz qoldirib bo'lmaydi – bu bog'liqlik qurilish sohasining uzoq muddat barqaror rivojlanishining asosiy omili hisoblanadi.

Yuqoridagi xulosalarga asoslanib, quyidagi tavsiyalar ishlab chiqildi:

qurilish korxonalari samaradorligini oshirish uchun avvalo mulk huquqlarini himoya qilish, shartnoma intizomini kuchaytirish va soliq muhitini barqarorlashtirish kabi iqtisodiy islohotlardan boshlash maqsadga muvofiq. Siyosiy islohotlar keyingi bosqichda amalga oshirilishi kerak;

islohotlarni bosqichma-bosqich va tizimli tarzda joriy etish, ularning samaradorligini muntazam monitoring qilish zarur.

“Shaffof qurilish” tizimlari, raqamli nazorat va litsenziyalash jarayonlarini soddalashtirish institutsional muhitni yaxshilaydi va korxonalarining vaqt va resurs samaradorligini oshiradi;

korxonalar institutsional islohotlarni kuzatib borishi va ularga tez moslashish mexanizmlarini (masalan, ichki boshqaruv tizimini takomillashtirish, xodimlarning malakasini oshirish) joriy etishi lozim;

kuchli institutsional muhitda faoliyat yuritayotgan korxonalar uzoq muddatli investitsiyalarni jalb qilish imkoniyatiga ega. Shu sababli, korxonalar o'zlarining moliyaviy shaffofligi va korporativ boshqaruv standartlarini xalqaro talablarga moslashtirishi tavsiya etiladi;

tadqiqotlar institutsional islohotlarning ta'siri asosan texnik samaradorlik orqali namoyon bo'lishini ko'rsatdi. Shu bois, qurilish korxonalarida texnologik yangilanishlar va ishlab chiqarish jarayonlarini optimallashtirishga alohida e'tibor qaratish kerak.

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DORILARDAN KELIB CHIQUADIGAN ANAFILAKSIYA VA ANAFILAKTIK SHOKNING TRIGERLARI HAMDA XAVF OMILLARI

***Annotatsiya.** Anafilaksiya yoki anafilaktik shok — bu semiz hujayralardan bir qancha mediatorlarning ajralib chiqishi natijasida rivojlanadigan, jiddiy respirator, yurak-qon tomir hamda shilliq qavat-teri namoyon bo'lishlari bilan kechadigan va ko'pincha o'lim holatlariga olib keladigan, hayot uchun xavfli bo'lgan og'ir tizimli reaksiyadir. Tadqiqotning maqsadi — dorivor anafilaksiya va anafilaktik shok rivojlanishidagi provokatsiya qiluvchi triggerlar hamda xavf omillarini aniqlashdan iborat. Materiallar va usullar: PubMed, Science Direct, Scopus, Google Scholar va Elibrary ma'lumotlar bazalaridagi nashrlarning elektron qidiruvi amalga oshirildi. Maqola sarlavhalari, annotatsiyalar yoki kalit so'zlarda "anafilaksiya", "shok", "anafilaktik", "dorivor", "triggerlar", "xavf omillari", "ta'sir", "kechishi", "og'irlik darajasi", "oqibat", "tadqiqot istiqbollari" kabi so'zlarning mavjudligi qidiruv shartlari etib belgilandi. Tadqiqotlarning metodologik baholanishi PRISMA standartlariga muvofiq, tizimli xatolik (sistematik og'ish) xavfini baholashni o'z ichiga olgan holda o'tkazildi. Sharhga asosan so'nggi o'n yilliklarda o'tkazilgan tadqiqotlar kiritildi. Deyarli barcha dori vositalari, izotonik fiziologik eritma va glyukoza eritmasi bundan mustasno, dorivor anafilaksiyani keltirib chiqarishi mumkin. Bunday allergik reaksiyalarni yuzaga keltiruvchi dori vositalarini quyidagilarga ajratish mumkin: immun reaksiyalarni mustaqil ravishda qo'zg'atishga qodir preparatlar — obligat antigenlar (vaksinalar, oqsil preparatlari, gormonlar va boshqalar); immun reaksiyalarni mustaqil ravishda qo'zg'atishga qodir bo'lmagan — organizmning transport molekulalari bilan bog'lanish orqali immun komplekslarni hosil qiluvchi preparatlar (dori vositalarining ko'pchiligi); kesishgan anafilaksiyani chaqirishga qodir preparatlar (nosteroid yallig'lanishga qarshi vositalar, mahalliy anestetiklar, antibiotiklar va boshqalar). Dorivor anafilaksiya (shok) rivojlanishi sabablari orasida yetakchi o'rinni (81,3% gacha holatlarda) analgetiklar (22 dan 41,27% gacha) va antibiotiklar (33,17 dan 54,0% gacha) egallaydi, keyingi o'rinlarda esa mahalliy anestetiklar (7,38%) hamda rentgenkontrast moddalar —*

5,18% turadi (Hanschmann T. va muallif., 2023; Jolondz N.N. va muallif., 2023; German A.V. va muallif., 2023). Dorivor anafilaksiya (shok) rivojlanish xavfini oshiruvchi va uning kechishini og'irlashtiruvchi omillarga quyidagilar kiradi: demografik omillar — keksalik yoshi, ayol jinsi; genetik moyillik; komorbid holatlar hamda kofaktorlarning mavjudligi.

Kalit soʻzlar: anafilaksiya, shok, dorivor, trigerlar, xavf omillari, og'irlik darajasi, kechishi, oqibat, tadqiqot istiqbollari.

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TRIGGERS AND RISK FACTORS OF DRUG-INDUCED ANAPHYLAXIS AND ANAPHYLACTIC SHOCK

Abstract. Anaphylaxis or anaphylactic shock is a life-threatening, severe systemic reaction characterized by the release of multiple mediators from mast cells, resulting in serious respiratory, cardiovascular, and mucocutaneous manifestations that frequently lead to fatal outcomes. **Objective.** The aim of this study was to identify the provoking triggers and risk factors involved in the development of drug-induced anaphylaxis and anaphylactic shock. **Materials and Methods.** An electronic search of publications was conducted across PubMed, Science Direct, Scopus, Google Scholar, and Elibrary databases. Search criteria required the presence of terms such as "anaphylaxis," "shock," "anaphylactic," "drug-induced," "triggers," "risk factors," "exposure," "course," "severity," "outcome," and "research prospects" in the titles, abstracts, or keywords of the articles. The methodological quality of the studies was assessed in accordance with PRISMA guidelines, including an evaluation of the risk of systematic bias. The review primarily incorporated studies conducted over the last few decades. **Results.** Almost all medications, with the exception of isotonic saline and glucose solutions, can induce drug-related anaphylaxis. Such hypersensitivity-inducing agents can be categorized as follows: autonomous immunogenic drugs—obligate antigens capable of independently triggering immune responses (vaccines, protein preparations, hormones, etc.); non-autonomous immunogenic

drugs—agents incapable of independently inducing an immune response that form immune complexes by binding to host transport molecules (the majority of pharmaceuticals); and agents capable of inducing cross-reactive anaphylaxis (nonsteroidal anti-inflammatory drugs, local anesthetics, antibiotics, etc.). Analgesics (ranging from 22% to 41.27%) and antibiotics (ranging from 33.17% to 54.0%) hold a leading position among the causes of drug-induced anaphylaxis (shock), accounting for up to 81.3% of cases. These are followed by local anesthetics (7.38%) and radiocontrast media (5.18%) (Hanschmann T. et al., 2023; Jolondz N.N. et al., 2023; German A.V. et al., 2023). Factors increasing the risk and aggravating the course of drug-induced anaphylaxis (shock) include demographic variables (advanced age, female sex), genetic predisposition, and the presence of comorbid conditions and cofactors.

Keywords: *anaphylaxis, shock, drug-induced, triggers, risk factors, severity, course, outcome, research prospects.*

Dolzarbligi

Anafilaksiya yoki anafilaktik shok — bu semiz hujayralardan bir qancha mediatorlarning ajralib chiqishi natijasida rivojlanadigan, jiddiy respirator, yurak-qon tomir hamda shilliq qavat-teri namoyon bo'lishlari bilan kechadigan va ko'pincha o'lim holatlariga olib keladigan, hayot uchun xavfli bo'lgan og'ir tizimli (multitizimli) reaksiyadir. Kattalar va bolalar yoshi o'rtasida anafilaksiya hamda anafilaktik shokni keltirib chiqaruvchi triggerlar ulushi, xavf omillari, klinik manzarasi va og'irlik darajasiga ko'ra muayyan farqlar mavjud [10].

Dori preparatlari anafilaksiya holatlari rivojlanishidagi yetakchi etiologik omil hisoblanib, ularning ulushiga anafilaktik shok barcha holatlarining 46,5% gacha qismi to'g'ri keladi [13].

Tadqiqotning maqsadi — dorivor anafilaksiya va anafilaktik shok rivojlanishidagi provokatsiya qiluvchi triggerlar hamda xavf omillarini aniqlashdan iborat.

Materiallar va usullar

PubMed, Science Direct, Scopus, Google Scholar va Elibrary ma'lumotlar bazalaridagi nashrlarning elektron qidiruvi amalga oshirildi. Maqola sarlavhalari, annotatsiyalar yoki kalit so'zlarda "anafilaksiya", "shok", "anafilaktik", "dorivor", "triggerlar", "xavf omillari", "ta'sir", "kechishi", "og'irlik darajasi", "oqibat", "tadqiqot istiqbollari" kabi so'zlarning mavjudligi qidiruv shartlari etib belgilandi. Tadqiqotlarning metodologik baholanishi PRISMA standartlariga muvofiq, tizimli xatolik (sistematik og'ish) xavfini baholashni o'z ichiga olgan holda o'tkazildi. Sharhga asosan so'nggi o'n yilliklarda o'tkazilgan tadqiqotlar kiritildi.

Natijalar va ularning muhokamasi

Immun reaksiyalarni yuzaga keltiruvchi dori vositalarini shartli ravishda quyidagi guruhlariga ajratish mumkin:

1. Immun reaksiyalarni mustaqil ravishda qo'zg'atishga qodir bo'lgan preparatlar, ya'ni to'liq (obligat) antigenlar — vaksinalar, geterologik zardoblar,

qonning oqsil preparatlari, gormonlar (insulin va boshqalar) hamda fermentlar (masalan, streptodekaza va boshqalar);

2. Immun reaksiyalarni mustaqil ravishda qo'zg'atishga qodir bo'lmagan preparatlar, ya'ni organizmning transport molekulalari bilan bog'lanish orqali immun komplekslarni hosil qiluvchi dori vositalari (to'liqsiz antigenlar yoki gaptenlar); dori preparatlarining aksariyati aynan shu guruhga kiradi [1]. Ayrim dori vositalari o'zaro o'xshash antigen determinantlariga ega bo'lib, ular kesishgan dorivor allergiyani keltirib chiqarishga qodir — bularga III va IV avlod sefalosporinlari, nosteroid yallig'lanishga qarshi vositalar, sulfanilamidlar, antibiotiklar, mahalliy anestetiklar va boshqalar kiradi [2].

Holatlarning 81,3% ida anafilaktik shok dori vositalarini qabul qilish natijasida rivojlanadi, bu holat ko'pincha nosteroid yallig'lanishga qarshi vositalar, antibiotiklar, mahalliy anestetiklar va polivitaminli vositalar qo'llanilgandan keyin kuzatiladi. Aksariyat bemorlarda dorivor anafilaktik shok bronxial astma, yurak-qon tomir tizimining surunkali kasalliklari fonida hamda AFF (angiotenzinga aylantiruvchi ferment) ingibitorlari, beta-blokatorlarni qabul qilayotgan pasientlarda rivojlanadi. Teri namoyon bo'lishlari, respirator, oshqozon-ichak va nevrologik buzilishlar dorivor anafilaktik shokning eng ko'p uchraydigan simptomlari bo'lgan [3]. Jolondz N.N. va muallifdoshlarining (2023) ma'lumotlariga ko'ra, anafilaktik shokning eng ko'p uchraydigan sababi antibakterial preparatlar (46,6%) hisoblanadi. Bunda 17,4% holatda eshakem va angiofshish, 23,7% holatda esa makulopapulyoz ekzantema qayd etilgan. Dorivor anafilaktik shok (DASH) holatlarining 52,4% i sefalosporinlar guruhiga mansub beta-laktam antibiotiklari (seftriakson, sefotaksim va sefepim) tufayli kelib chiqqan [5].

Lidokain — anesteziya o'tkazish uchun qo'llaniladigan mahalliy anestetiklardan biridir. Uni yuborishda og'riqsizlantirishning muvaffaqiyatlilik darajasi infiltratsion anesteziyada 90–95% ni, o'tkazuvchi anesteziyada esa 70–90% ni tashkil etadi [4]. Lidokainning o'ziga xos xususiyati shundaki, undan nafaqat anestetik sifatida, balki ayrim (asosan sefalosporinlar guruhiga mansub) antibiotiklar uchun erituvchi (1% li eritma) sifatida ham foydalanish mumkin.

Lidokainni qo'llashning asosiy nojo'ya oqibatlari orasida tizimli nojo'ya reaksiyalarni (NR) alohida ko'rsatish lozim: bularga yaqqol vazo-dilatator (tomirlarni kengaytiruvchi) ta'sir, miokard qisqaruvchanligining susayishi, yurak to'xtashi xavfi, talvasalar hamda ongning xiralashishi kiradi. Sanab o'tilgan nojo'ya reaksiyalar preparatning toksik dozalari yuborilgandan keyin shiddat bilan (masalan, tibbiy xatolik oqibatida) yuzaga kelishi yoki dori vositasi metabolizmining sekinlashishi va qon plazmasida lidokain konsentratsiyasining ortishi natijasida asta-sekin rivojlanishi mumkin [14]. Lidokain mansub bo'lgan amid guruhidagi mahalliy anestetiklarga nisbatan haqiqiy IgE-vositali (IgE-bog'liq) allergik reaksiyalar rivojlanishi holatlari ancha kam (barcha NR holatlarining taxminan 1% ini) uchraydi [8].

Xabarnomalarni o'rganish davomida lidokain qo'llanilganda 102 ta o'lim holati yuzaga kelganligi aniqlandi. Preparat ko'pincha mahalliy anesteziya

maqsadida hamda antibakterial preparatlar uchun erituvchi sifatida tayinlangan. Lidokainning yuborilgan dozalarini tahlil qilish preparatning dozirovkasini oshirib yuborish (peredozirovka) bilan bog'liq bir nechta holatlarni ajratib ko'rsatish imkonini berdi. Aksariyat hollarda pasient hayotiga xavf soluvchi holatlar rivojlanishiga anafilaktik shok ko'rinishidagi dorivor gipersezuvchanlik reaksiyalarining yuzaga kelishi sabab bo'lgan (54 ta holat, 52,9%). 10 ta holatda (9,8%) lidokain yuborilishi hushdan ketish, nafas olish va yurak faoliyatining to'xtashi bilan, 9 ta holatda (8,8%) esa talvasalar rivojlanishi bilan kechgan [7].

Dorivor anafilaktik shokning xavf omillariga keksalik yoshi, hamroh kasalliklar, ayniqsa respirator va yurak-qon tomir tizimining surunkali kasalliklari, shuningdek, allergen turi hamda o'tmishdagi (pretsedent) dorivor terapiya, masalan, β -adrenoblokatorlar va AFF ingibitorlarining qo'llanilishi kiradi [4].

Keksalik yoshi va preparatlarni vena ichiga yuborish og'ir darajadagi dorivor anafilaksiya rivojlanishi uchun eng yuqori xavf omillari hisoblanadi. Boshqa xavf omillariga dori tayinlashda uzilishlarni yuzaga keltiruvchi avvalgi terapiyaning to'xtatilishi va trombotsitlarni aktivlashtiruvchi omil (PAF) asetilgidrolazasi faolligining pasayishi kiradi [9].

Kardiovaskulyar funktsiya holati dorivor anafilaktik shokning og'irligi va oqibatiga sezarli darajada ta'sir ko'rsatishi qayd etilgan. Bu miokard tarkibida turli agentlar ta'sirida faollashadigan semiz hujayralar mavjudligi bilan bog'liq. Xususan, gistamin manfiy inotrop ta'sir ko'rsatib, miokard depressiyasini chaqiradi va kapillyarlar o'tkazuvchanligini oshiradi, bu esa dorivor anafilaktik shok patogenezida hal qiluvchi rol o'ynaydi. Kapillyarlar o'tkazuvchanligining ortishi tomir ichidagi suyuqlikning hujayralararo bo'shliqqa to'planishiga (shishiga) olib keladi, bunda shok holatidagi bemor bir necha daqiqa ichida tomir ichidagi suyuqlik hajmining taxminan 50% ini yo'qotishi mumkin [6].

Anafilaktik shok va o'tkir miokard infarktining (Kounis sindromi) birgalikda yuzaga kelishi 226 ta holatda (2,92%) aniqlangan [11]. KS birinchi marta Kounis va Zavras tomonidan 1991-yilda allergik stenokardiya sindromi sifatida tavsiflangan [14].

Xulosalar

Deyarli barcha dori vositalari, izotonik fiziologik eritma va glyukoza eritmasi bundan mustasno, dorivor anafilaksiya (shok)ni keltirib chiqarishi mumkin:

1. Bunday allergik reaksiyalarni yuzaga keltiruvchi dori vositalarini quyidagilarga ajratish mumkin: immun reaksiyalarni mustaqil ravishda qo'zg'atishga qodir preparatlar — obligat antigenlar (vaksinalar, oqsil preparatlari, gormonlar va boshqalar); immun reaksiyalarni mustaqil ravishda qo'zg'atishga qodir bo'lmagan — organizmning transport molekulalari bilan bog'lanish orqali immun komplekslarni hosil qiluvchi preparatlar (dori vositalarining ko'pchiligi); kesishgan anafilaksiyani chaqirishga qodir preparatlar (nosteroid yallig'lanishga qarshi vositalar, mahalliy anestetiklar, antibiotiklar va boshqalar).

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antibiotiklar (33,17 dan 54,0% gacha) egallaydi, keyingi o‘rinlarda esa mahalliy anestetiklar (7,38%) hamda rentgenkontrast moddalar — 5,18% turadi (Jolondz N.N. va muallif., 2023).

3. Dorivor anafilaksiya (shok) rivojlanish xavfini oshiruvchi va uning kechishini og‘irlashtiruvchi omillarga quyidagilar kiradi: demografik omillar — keksalik yoshi, ayol jinsi; genetik moyillik; komorbid holatlar hamda kofaktorlarning mavjudligi.

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SANOAT EMISSİYALARI TA'SIRIDA OG'IR METALLAR BILAN IFLOSLANGAN TUPROQLARNI REKULTIVATSIYA QILISH TEKNOLOGIYALARINING SAMARADORLIGI

***Anotatsiya:** Sanoat korxonalari ta'sirida og'ir metallar bilan ifloslangan tuproqlarni rekultivatsiya qilish texnologiyalari tadqiq etildi. Fizik-kimyoviy, kimyoviy immobilizatsiya va biologik usullarning kinetik samaradorligi qiyosiy tahlil qilindi. Eksperimental natijalar g'o'za poyasi asosidagi biochar va fitoekstraksiya kombinatsiyasi mobil kationlar (Cd^{2+} , Pb^{2+}) ulushini 88% gacha pasaytirib, unumdorlikni tiklashda eng aniq va optimal model ekanligini isbotladi.*

***Kalit so'zlar:** Og'ir metallar, tuproq degradatsiyasi, kimyoviy immobilizatsiya, biochar, fitoekstraksiya, translokatsiya koeffitsiyenti, edafik monitoring.*

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EFFICIENCY OF REMEDIATION TECHNOLOGIES FOR SOILS CONTAMINATED WITH HEAVY METALS UNDER THE IMPACT OF INDUSTRIAL EMISSIONS

***Abstract.** This article investigates the efficiency of remediation technologies for soils contaminated with heavy metals due to industrial emissions. A comparative analysis of the kinetic efficiency of physicochemical, chemical immobilization, and biological remediation methods was conducted. Experimental results demonstrated that the combined application of cotton-stalk-derived biochar and phytoextraction technology reduced the mobile fractions of cadmium (Cd^{2+}) and lead (Pb^{2+}) by up to 88%, proving to be the most effective and environmentally sustainable approach for restoring soil fertility.*

***Keywords:** heavy metals, soil degradation, chemical immobilization, biochar, phytoextraction, translocation factor, edaphic monitoring, soil remediation, environmental pollution.*

Kirish

Texnogen taraqqiyot va og'ir sanoat majmualarining jadal ekspansiyasi biosferaning bazaviy komponenti bo'lgan edafotop (tuproq muhiti) qoplamiga misli ko'rilmagan destruktiv bosim o'tkazmoqda. Sanoat aerozollari, rangli va qora metallurgiya chiqindilari hamda transport emissiyalari tarkibidagi og'ir metallar (Cd, Pb, Cu, Zn, Cr, As) tuproq ekotizimiga tushgach, organik toksikantlardan farqli o'laroq, mikrobiologik yoki kimyoviy parchalanishga (degradatsiyaga) uchramaydi. Ular tuproqning singdirish majmuasida (CEC) o'nlab va yuzlab yillar davomida saqlanib, ekologik zanjir va trofik kanallar (tuproq, o'simlik, hayvon, inson) orqali tirik organizmlarga o'tadi hamda ularda qaytmas kancerogen va mutativ o'zgarishlarni keltirib chiqaradi. [1,2]

O'zbekiston hududiy muammolarining geokimyoviy dolzarbligi

O'zbekiston Respublikasining o'ziga xos arid (qurg'oqchil) va keskin kontinental iqlim sharoitida tuproq ifloslanishi o'ta xavfli xarakterga ega. Yirik sanoat o'choqlari hisoblangan Olmaliq kon-metallurgiya kombinati (OKMK), Navoiy kon-metallurgiya kombinati (NKMK), Angren issiqlik elektr stansiyasi va Farg'ona neftni qayta ishlash zavodlari joylashgan hududlar atrofidagi qishloq xo'jaligi yerlarida og'ir metallarning yalpi miqdori ruxsat etilgan me'yor (REM) ko'rsatkichlaridan 15–45 barobargacha yuqori ekanligi qayd etilgan [4,7].

Arid iqlimda yillik bug'lanish miqdori yog'ingarchilik miqdoridan 5–8 barobar yuqori bo'lganligi sababli, yuksaluvchi kapillyar suv oqimlari ustunlik qiladi. Bu esa og'ir metall kationlarining tuproqning chuqur qatlamlariga yuvilib ketishiga yo'l qo'ymay, ularni eng faol hisoblangan unumdor (A_{haydalma}) qatlamda (0–30 sm) jamlaydi. Mazkur yerlarda yetishtirilayotgan qishloq xo'jaligi mahsulotlarining ekologik xavfsizligini ta'minlash va tuproq biosentrini qayta tiklash uchun rekultivatsiya texnologiyalarini aniq miqdoriy va kinetik koeffitsiyentlar asosida ishlab chiqish bugungi kunning kechiktirib bo'lmaydigan fundamental va amaliy vazifasidir [4].

Tadqiqot metodlari

Tadqiqot ma'lumotlarining aniqligini ta'minlash va eksperimental natijalarni olishda quyidagi metodologik va instrumental usullar majmuasidan foydalanildi:

1. Instrumental va kimyoviy tahlil usullari ICP-MS (Induktiv bog'langan plazmali mass-spektrometriya): Tuproq substrati va o'simlik fitomassasi tarkibidagi elementlarning aniq mikromiqdorlarini (mg/kg darajasida) o'lchash.

2. Tessier bosqichli kimyoviy ekstraksiya uslubi: Og'ir metallarning tuproqdagi 5 ta asosiy fraksiyasini (1. Almashinuvchi/mobil, 2. Karbonatlar bilan bog'langan, 3. Fe-Mn oksidlari bilan bog'langan, 4. Organik moddalar bilan bog'langan, 5. Qoldiqli/inert) alohida ajratib olish va miqdorini aniqlash.

3. pH-metriya va Konduktometriya: Tuproq eritmasining vodород ko'rsatkichi (pH) va elektr o'tkazuvchanligini (EC) aniqlash [1,3].

Biogeokimyoviy hisoblash koeffitsiyentlari

Texnologiyalarning samaradorlik mezonlarini aniq matematik ifodalash uchun quyidagi formulalardan foydalanildi:

Rekultivatsiya samaradorligi

$$R = \frac{C_0 - C_t}{C_0} \times 100\%$$

Bu yerda: C_0 – boshlang‘ich mobil metall miqdori (mg/kg), C_t – rekultivatsiyadan keyingi mobil metall miqdori (mg/kg).

Translokatsiya koeffitsiyenti (TF):

$$TF = \frac{C_{poya}}{C_{ildiz}}$$

Bu yerda: C_{poya} va C_{ildiz} – metallning o‘simlik organlaridagi aniq konsentratsiyasi.

Tadqiqot natijalari

Olib borilgan kimyoviy va biogeokimyoviy tajribalar natijasida ifloslangan tuproqlarni tiklashning turli usullari bo‘yicha aniq raqamli ko‘rsatkichlar olindi.

1. Fraksion tarkibning tahlili. Tessier usuli bo‘yicha aniqlanganda, rekultivatsiya qilinmagan nazorat tuproqlarida eng xavfli ksenobiotiklar — kadmiy (Cd) va qo‘rg‘oshin (Pb) elementlarining mos ravishda 58.4% va 42.1% qismi eng harakatchan (almashinuvchi) fraksiyada ekanligi aniqlandi. Bu ko‘rsatkich ushbu metallarning agrofitoratsionlarga oson o‘tishini tasdiqlaydi [2,9].

2. Rekultivatsiya texnologiyalarining kinetik va miqdoriy solishtirmasi

Turli agentlar (EDTA xelatori, mineral ohaktosh, g‘o‘za poyasidan olingan pirolizli biochar va giperakkumulyator o‘simliklar) sinovdan o‘tkazildi. Eksperimentlar davomida olingan aniq ko‘rsatkichlar quyidagi jadvalda tizimlashtirildi [5].

Rekultivatsiya texnologiyalarining miqdoriy va ekologik samaradorlik ko‘rsatkichlari

№	Texnologiya turi	Qo‘llanilgan asosiy reagentlar / o‘simliklar	Metallarning mobil qismini kamaytirish samaradorligi (R%)	Tuproqning biologik faolligi (Katalaza fermenti, O_2 mg/g/h)	1gektarga sarflanadigan o‘rtacha xarajat (USD)	O‘zbekiston sharoitidagi cheklavlar
1	Fizik-kimyoviy (Yuvish)	0.1MEDTA (Etilendiamint etrasirka kislota)	82.4%	0.12 (Mikrobiota nobud bo‘ladi)	\$8,500 – \$12,000	Tuproq strukturasi buziladi, yuvindi suvlarni utilizatsiya qilish qiyin
2	Elektrokinetika	Doimiy elektrik tok (1.5 V/cm)	74.1%	0.35 (Lokal sterillanish)	\$6,000 – \$9,000	Yuqori sho‘rlanish sharoitida tok oqimi tarqalib ketadi
3	Kimyoviy	Kalsiy	64.5%	0.85	\$1,200 –	Metallar

	immobilizat siya	karbonat (CaCO ₃) + Fosfatlar		(Barqaror)	\$1,800	tuproqdan chiqmaydi, pH keskin ortganda qayta faollashadi
4	Fitoekstraksiya	Brassica juncea (Sarepta xantali)	58.2%	1.45 (Yaxshi)	\$400 – \$600	Jarayon sekinkechadi (3–5 vegetatsiya davri talab etiladi)
5	Fitostabilizatsiya	Phragmites australis (Oddiy qamish)	61.0%	1.30 (Yaxshi)	\$300 – \$500	Metallar faqat ildizda to'planadi, yer unumdorligi sekin tiklanadi
6	Kombinatsiyalashgan model	Modifikatsiyalangan biochar + Brassica juncea	87.8%	2.10 (Maksimal yuqori)	\$800 – \$1,100	Hech qanday ekologik cheklov yo'q (Eng optimal usul)

Jadval ma'lumotlaridan ko'rinib turibdiki, Biochar va Fitoekstraksiya kombinatsiyasi (6-usul) tuproqning fermentativ faolligini (katalaza faolligi 2.10) saqlagan holda, og'ir metallarning toksik mobil shakllarini 87.8% gacha kamaytirishga muvaffaq bo'lgan [6].

Munosabat va muhokama

Olingan natijalar shuni ko'rsatadiki, sof fizik-kimyoviy usullar (masalan, kislota yoki EDTA bilan yuvish) yuqori tozalash koeffitsiyentiga (82.4%) ega bo'lsa-da, tuproq unumdorligini va undagi gümüs arxitektonikasini butunlay yo'q qiladi. Katalaza fermenti faolligining 0.12mg/g/h gacha tushib ketishi tuproqning biologik tabiati o'lganligidan dalolat beradi. O'zbekiston sharoitida faqatgina o'simliklarning o'zini (fitoekstraksiya) ifloslangan yerga ekish ham kutilgan natijani bermaydi [2,5]. Chunki yuqori ionli toksiklik sharoitida o'simlik ildiz tizimi fitotoksik va oksidlanish stressiga uchrab, vegetatsiyaning dastlabki bosqichidayoq nobud bo'ladi.

Sinergik mexanizm va aniq yechim: Kombinatsiyalashgan modelda tuproqqa kiritilgan g'ovza poyasi pirolizli biochari (g'ovakliligi $> 350\text{m}^2/\text{g}$) dastlabki bosqichda Cd^{2+} va Pb^{2+} kationlarini xemosorbsiya va ion almashinuvi yo'li bilan sirtqi qismida qattiq fiksatsiyalaydi. Bu esa tuproq eritmasining umumiy toksikligini pasaytiradi. Himoyalangan muhitda Brassica juncea o'simligi ildiz tizimini jadal rivojlantirib, keyinchalik ildiz eksudatlari (malat va sitrat kislotalari) yordamida biochardan metallarni dozalangan holda ajratib oladi va poyasiga to'playdi ($\text{TF} = 2.45$) [3,6,8].

Xulosa

Tuproq yuvish va elektrokinetik usullar yuqori sarf-xarajat (\$6,000–\$12,000/ga) hamda ekotizimga salbiy ta'siri tufayli yirik maydonlarda qo'llashga yaroqsiz deb topildi [1,5].

Mahalliy agrosanoat chiqindilaridan (g'o'za poyasi) 550 C haroratda tayyorlangan biochar tuproqdagi erkin og'ir metallar miqdorini kamaytiruvchi samarali va arzon xemosorbent hisoblanadi [3,6].

Biochar + Fitorekultivatsiya kombinatsiyalashgan modeli og'ir metallarning harakatchan shakllarini 87.8% gacha xavfsiz holatga keltiradi va tuproq mikrobiologik faolligini 2 barobardan ziyodga oshiradi [6,8,10].

O'zbekistonning sanoat zonalari (Olmaliq, Navoiy) atrofidagi ifloslangan yerlarni rekultivatsiya qilishda iqtisodiy va ekologik jihatdan eng aniq, tejamkor (800–1,100/ga) usul sifatida aynan ushbu kombinatsiyalashgan kimyoviy-biologik model tavsiya etiladi [4,7,10]. Ushbu yondashuv nafaqat mavjud holatni tahlil qilish, balki kelajakdagi tendensiyalarni aniqlashda ham muhim ilmiy vosita hisoblanadi. [11].

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CHIQINDILARNI BOSHQARISH VA “NOL CHIQINDI” (ZERO WASTE) KONSEPSIYASI

***Annotatsiya:** Mazkur maqolada chiqindilarni boshqarish tizimining nazariy va amaliy jihatlari hamda “nol chiqindi” (zero waste) konsepsiyasining mazmuni tahlil qilinadi. Tadqiqot davomida chiqindilarni kamaytirish, qayta foydalanish va qayta ishlash (3R) tamoyillarining ahamiyati yoritilib, ularni amaliyotga joriy etishning ekologik va iqtisodiy samaradorligi asoslab beriladi. Shuningdek, rivojlangan davlatlar tajribasi va mahalliy sharoitlar solishtirilib, chiqindilarni boshqarish tizimidagi muammolar aniqlanadi hamda ularni bartaraf etish bo'yicha taklif va tavsiyalar ishlab chiqiladi. Tadqiqot natijalari “nol chiqindi” konsepsiyasini joriy etish barqaror rivojlanishni ta'minlashda muhim omil ekanligini ko'rsatadi.*

***Kalit so'zlar:** chiqindilarni boshqarish, nol chiqindi, zero waste, 3R tamoyili, qayta ishlash, qayta foydalanish, ekologik barqarorlik, resurslardan oqilona foydalanish, atrof-muhit muhofazasi.*

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WASTE MANAGEMENT AND THE “ZERO WASTE” CONCEPT

***Abstract.** This article analyzes the theoretical and practical aspects of waste management systems and examines the essence of the Zero Waste concept. The study highlights the importance of the 3R principles (Reduce, Reuse, Recycle) and substantiates the environmental and economic efficiency of their implementation in practice. In addition, the experiences of developed countries and local conditions are compared, existing problems in waste management systems are identified, and recommendations for their solution are proposed. The research findings indicate that the implementation of the Zero Waste concept is an important factor in ensuring sustainable development.*

***Keywords:** waste management, zero waste, 3R principle, recycling, reuse, environmental sustainability, rational use of resources, environmental protection.*

Kirish

Hozirgi globallashuv davrida atrof-muhit muhofazasi va resurslardan oqilona foydalanish masalasi dolzarb muammolardan biriga aylangan. Aholi sonining ortishi, sanoatning jadal rivojlanishi hamda iste'mol darajasining keskin oshishi natijasida chiqindilar hajmi yil sayin ko'payib bormoqda [1,2]. Bu esa ekologik muvozanatning buzilishi, tuproq, suv va havoning ifloslanishi kabi salbiy oqibatlarni keltirib chiqarmoqda. Shu sababli chiqindilarni samarali boshqarish tizimini yo'lga qo'yish va ekologik xavfsizlikni ta'minlash bugungi kunning ustuvor vazifalaridan biri hisoblanadi [2].

Chiqindilarni boshqarish – bu ularni yig'ish, tashish, qayta ishlash va zararsizlantirish jarayonlarini o'z ichiga olgan murakkab tizim bo'lib, u nafaqat ekologik, balki iqtisodiy va ijtimoiy ahamiyatga ham ega [1,4]. Zamonaviy yondashuvlarda chiqindilarni kamaytirish, qayta foydalanish va qayta ishlash (3R: Reduce, Reuse, Recycle) tamoyillari muhim o'rin tutadi [5]. Ayniqsa, so'nggi yillarda keng tarqalib borayotgan “nol chiqindi” (zero waste) konsepsiyasi bu borada yangi bosqichni boshlab berdi [5].

“Nol chiqindi” konsepsiyasi chiqindilarni minimal darajaga tushirish, mahsulot va resurslardan maksimal darajada samarali foydalanish hamda tabiatga zarar yetkazmaydigan yopiq siklli tizimni yaratishga qaratilgan [5]. Ushbu yondashuv ishlab chiqarish va iste'mol jarayonlarini qayta ko'rib chiqishni, ortiqcha chiqindilarni oldini olishni va barqaror turmush tarzini shakllantirishni nazarda tutadi.

Mazkur maqolada chiqindilarni boshqarish tizimining mohiyati, uning asosiy yo'nalishlari hamda “nol chiqindi” konsepsiyasining nazariy va amaliy jihatlarini tahlil qilinadi. Shuningdek, ushbu yondashuvni amaliyotga joriy etishning ahamiyati va istiqbollari yoritiladi.

Adabiyotlar tahlili

Chiqindilarni boshqarish va “nol chiqindi” (zero waste) konsepsiyasiga oid ilmiy adabiyotlar tahlili shuni ko'rsatadiki, ushbu yo'nalish ekologiya, iqtisodiyot va ijtimoiy fanlar kesishgan nuqtada shakllangan kompleks tadqiqot sohasi hisoblanadi [1,2]. So'nggi yillarda mazkur mavzu bo'yicha xalqaro va mahalliy miqyosda ko'plab ilmiy izlanishlar olib borilmoqda.

Xorijiy tadqiqotchilar chiqindilarni boshqarish tizimini barqaror rivojlanishning muhim omili sifatida baholaydilar [1,4]. Jumladan, chiqindilarni kamaytirish va qayta ishlash bo'yicha olib borilgan tadqiqotlarda 3R (Reduce, Reuse, Recycle) tamoyillarining samaradorligi ilmiy asoslangan [5]. Ayrim mualliflar “nol chiqindi” konsepsiyasini an'anaviy chiqindi boshqaruvi tizimidan farqli ravishda resurslarni yopiq siklda aylantirishga qaratilgan innovatsion model sifatida izohlaydilar [5]. Ularning fikricha, ushbu konsepsiya nafaqat chiqindilarni kamaytiradi, balki iqtisodiy samaradorlikni ham oshiradi.

Shuningdek, Yevropa va rivojlangan davlatlar tajribasi tahlili chiqindilarni saralash, qayta ishlash infratuzilmasini rivojlantirish va aholining ekologik madaniyatini oshirish muhim ahamiyat kasb etishini ko'rsatadi [3]. Ilmiy manbalarda qayd etilishicha, chiqindilarni boshqarish tizimining muvaffaqiyati

ko‘p jihatdan davlat siyosati, qonunchilik bazasi va jamoatchilik ishtirokiga bog‘liq.

Mahalliy olimlar tomonidan olib borilgan tadqiqotlarda esa O‘zbekiston sharoitida chiqindilarni boshqarish tizimini takomillashtirish, qayta ishlash sanoatini rivojlantirish va ekologik ta‘limni kuchaytirish masalalariga alohida e‘tibor qaratilgan[6,7]. Ular “nol chiqindi” konsepsiyasini joriy etish uchun hududiy xususiyatlarni hisobga olish, zamonaviy texnologiyalarni qo‘llash va aholi ongida ekologik mas‘uliyatni shakllantirish zarurligini ta‘kidlaydilar.

Umuman olganda, mavjud adabiyotlar tahlili chiqindilarni boshqarish va “nol chiqindi” konsepsiyasi barqaror rivojlanishni ta‘minlashda muhim ilmiy-amaliy asos bo‘lib xizmat qilishini ko‘rsatadi. Shu bilan birga, mazkur sohada hali ham yechimini kutayotgan muammolar mavjud bo‘lib, ular bo‘yicha chuqur ilmiy tadqiqotlar olib borish zarur.

Metodologiya

Mazkur tadqiqotda chiqindilarni boshqarish va “nol chiqindi” konsepsiyasini o‘rganishda kompleks yondashuv qo‘llanildi. Tadqiqotning nazariy asosini mahalliy va xorijiy ilmiy adabiyotlar, me‘yoriy-huquqiy hujjatlar hamda statistik ma‘lumotlar tahlili tashkil etdi[1–7].

Tadqiqot jarayonida tahlil va sintez, taqqoslash, tizimli yondashuv hamda umumlashtirish usullaridan foydalanildi. Shuningdek, rivojlangan davlatlar tajribasi o‘rganilib, ularning chiqindilarni boshqarishdagi samarali amaliyotlari tahlil qilindi[3,5].

Amaliy jihatdan esa chiqindilarni kamaytirish, qayta ishlash va qayta foydalanish (3R) tamoyillari asosida mavjud holat baholanib, “nol chiqindi” konsepsiyasini joriy etish imkoniyatlari aniqlashtirildi. Olingan natijalar asosida tegishli xulosalar va tavsiyalar ishlab chiqildi.

Natijalar va muhokama

Tadqiqot natijalari shuni ko‘rsatdiki, chiqindilarni boshqarish tizimini takomillashtirish va “nol chiqindi” (zero waste) konsepsiyasini joriy etish ekologik barqarorlikni ta‘minlashda muhim omil hisoblanadi[1,2,5]. Tahlillar davomida chiqindilarni saralash, qayta ishlash va qayta foydalanish darajasi oshgan hududlarda atrof-muhitga salbiy ta‘sir sezilarli darajada kamaygani aniqlandi [1,4]. Ayniqsa, 3R (Reduce, Reuse, Recycle) tamoyillariga amal qilinishi chiqindilar hajmini qisqartirishda samarali natijalar berishi kuzatildi[3,5]. Shu bilan birga, mavjud tizimda bir qator muammolar ham aniqlangan. Jumladan, chiqindilarni saralash infratuzilmasining yetarli darajada rivojlanmagani, qayta ishlash korxonalarining kamligi hamda aholining ekologik madaniyati pastligi “nol chiqindi” konsepsiyasini to‘liq joriy etishga to‘sqinlik qilmoqda[6,7]. Ayrim hududlarda chiqindilarni yig‘ish va tashish tizimi ham samarali yo‘lga qo‘yilmaganligi sababli, qayta ishlash imkoniyatlari cheklanib qolmoqda.

Muhokama jarayonida aniqlanishicha, rivojlangan davlatlar tajribasi chiqindilarni boshqarishda davlat siyosati, qat‘iy qonunchilik va iqtisodiy rag‘batlantirish mexanizmlari muhim rol o‘ynashini ko‘rsatadi [3,5]. Masalan, chiqindilarni saralashni majburiy tartibda joriy etish, qayta ishlashni qo‘llab-

quvvatlash va ekologik ta'limni rivojlantirish orqali yuqori natijalarga erishilgan [3].

O'zbekiston sharoitida "nol chiqindi" konsepsiyasini samarali joriy etish uchun hududiy xususiyatlarni hisobga olgan holda bosqichma-bosqich yondashuv zarur [6,7]. Bu borada zamonaviy texnologiyalarni joriy etish, chiqindilarni qayta ishlash infratuzilmasini kengaytirish hamda aholining ekologik ongini oshirish muhim ahamiyat kasb etadi [6].

Umuman olganda, tadqiqot natijalari chiqindilarni boshqarish tizimini takomillashtirish va "nol chiqindi" konsepsiyasini amaliyotga joriy etish orqali ekologik, iqtisodiy va ijtimoiy samaradorlikka erishish mumkinligini tasdiqlaydi.

Xulosa

Ushbu tadqiqot natijalari chiqindilarni boshqarish tizimini takomillashtirish va "nol chiqindi" (zero waste) konsepsiyasini joriy etish zamonaviy ekologik muammolarni hal etishda muhim ahamiyat kasb etishini ko'rsatdi [1,2,5]. Tahlillar shuni tasdiqladiki, chiqindilarni kamaytirish, qayta foydalanish va qayta ishlash (3R) tamoyillariga asoslangan yondashuv atrof-muhitga salbiy ta'sirni kamaytirish bilan birga resurslardan samarali foydalanish imkonini beradi [5].

Shu bilan birga, mavjud tizimda infratuzilmaning yetarli darajada rivojlanmaganligi, qayta ishlash korxonalarining kamligi hamda aholining ekologik madaniyati pastligi kabi muammolar saqlanib qolmoqda. "Nol chiqindi" konsepsiyasini samarali joriy etish uchun davlat siyosatini kuchaytirish, zamonaviy texnologiyalarni keng joriy etish, chiqindilarni saralash tizimini rivojlantirish va aholining ekologik ongini oshirish zarur [6,7].

Umuman olganda, chiqindilarni boshqarish tizimini modernizatsiya qilish va "nol chiqindi" konsepsiyasini amaliyotga joriy etish ekologik barqarorlikni ta'minlash, iqtisodiy samaradorlikni oshirish hamda jamiyat farovonligini yaxshilashga xizmat qiladi [1,2,5]. Mavjud muammolar – moliyalashtirishning yetarli emasligi, qonunchilikdagi bo'shliqlar, texnologik yetishmovchiliklar – hal qilinsa, yashil texnologiyalar O'zbekiston iqtisodiyotining yangi drayveriga aylanishi mumkin [8].

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FASHION WEEKS AND THE MARKET VALUE OF PUBLICLY LISTED LUXURY COMPANIES: THEORETICAL FOUNDATIONS OF AN EVENT-STUDY ANALYSIS

Abstract: *this article develops the theoretical and methodological foundation for testing the hypothesis that fashion weeks affect the market value of publicly listed luxury companies. It is shown that fashion weeks are institutionally governed, datable and economically significant information events capable of revising investors' expectations about the future cash flows of luxury firms. The article distinguishes brand equity from brand valuation and substantiates the role of the firm's market value as the most complete measure of brand value under conditions in which IAS 38 prohibits the recognition of internally generated brands on the balance sheet. The efficient market hypothesis and the formal apparatus of event-study methodology (the market model, abnormal and cumulative abnormal returns) are set out, and the literature at the marketing–finance interface is systematised. The analysis identifies a research gap: the stock-market reaction to fashion weeks, the central event of the luxury calendar, has not yet been subjected to systematic empirical testing.*

Keywords: *fashion weeks, luxury industry, brand equity, brand valuation, event study, efficient market hypothesis, abnormal returns.*

Introduction

Fashion weeks rank among the most organised and publicly significant events of the creative economy: twice a year, the shows of the largest fashion houses concentrate the attention of the press, buyers and a multi-million online audience, shaping and renewing the symbolic image of brands on which their commercial success rests. Yet the question of whether fashion weeks leave a measurable trace in the share prices of publicly listed luxury companies has not so far received a systematic scholarly answer. Posing it correctly requires a theoretical apparatus that connects three domains rarely studied together: the marketing and cultural logic of the show, the economics of the brand as an intangible asset, and the mechanism by which the stock market reacts to new information.

The method adequate to this question — the event study — rests on a chain of assumptions: a fashion week is a datable information event; its information is potentially material to the value of the firm; the value of a luxury company is to a considerable extent determined by the value of its brand; and asset prices react to

material information in a statistically distinguishable way. Each link belongs to a separate scholarly tradition, and without their integration the empirical results would be impossible to interpret. Building such an integrated framework is the purpose of this article.

The aim of the study is to form an integral theoretical and methodological foundation that allows the hypothesis of the influence of fashion weeks on the market value of publicly listed luxury companies to be correctly formulated and subsequently tested empirically. The object of the study is the market value of such companies as a reflection of the value of their brands; the subject is the theoretical and methodological foundations for analysing the stock-market reaction to fashion weeks, considered as periodic information events.

To achieve this aim, the following tasks are addressed: to characterise fashion weeks as datable marketing events; to distinguish brand equity from brand valuation and to substantiate the role of the firm's market value as the most complete measure of brand value under the constraints of accounting; to set out the efficient market hypothesis and the formal apparatus of the event study; and to systematise the empirical literature at the marketing–finance interface and identify the research gap that the study addresses.

Methods and research

In its nature the study is theoretical and methodological; its principal methods are the analysis and synthesis of the scholarly literature, the comparison of concepts, systematisation, and the deductive derivation of testable implications. The methodological instrument whose foundations are built here is the event study — a technique for measuring the influence of a specific datable event on the value of a firm through the behaviour of its shares in the vicinity of the event date. Its logic is simple: if one can estimate what the security's return would have been in the absence of the event — its 'normal' return — then the difference between the actual and the normal return isolates the effect of the event. This difference, the abnormal return, is what is tested for statistical significance. The method goes back to the 1969 work of E. Fama, L. Fisher, M. Jensen and R. Roll [12], was placed on a rigorous statistical footing by S. Brown and J. Warner [13] and given a canonical exposition by A. C. MacKinlay [14], which secured its reputation as one of the most reliable instruments of empirical finance.

The analysis requires a number of quantities to be defined. The event is assigned a date, denoted $t = 0$. The estimation window is the preceding interval (for daily data, of the order of 120–250 trading days), over which the parameters of the normal-return model are estimated and which is kept free of the event's influence; the event window is the interval surrounding the event date over which the effect is measured. As the model of normal return, the market model predominates, linearly relating the return on a security to the return on the market portfolio. For security i on day t it is written as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} is the return on security i on day t ; R_{mt} is the return on the market portfolio; α_i and β_i are the parameters of the market model, estimated by ordinary

least squares over the estimation window; and ε_{it} is a random disturbance with zero expectation. The market model removes the part of the return that is explained by the movement of the market as a whole, reducing the variance of the abnormal return and increasing the power of the test relative to the constant-mean-return model [14]. The abnormal return is defined as the difference between the actual return and the return predicted by the model:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt}) \quad (2)$$

and its summation over the event window from t_1 to t_2 yields the cumulative abnormal return:

$$CAR_i(t_1, t_2) = \sum AR_{it} \quad (3)$$

When many events are analysed, returns are averaged to form the cumulative average abnormal return (CAAR), which characterises the typical reaction of the market to the class of events studied. The null hypothesis is the absence of any effect of the event (a zero expected cumulative abnormal return); it is tested using both parametric and non-parametric (sign and rank) tests [13]. The market model is adopted as the principal specification on grounds of parsimony and comparability with the literature, while the constant-mean-return model serves as a robustness check.

Results

The analysis makes it possible to substantiate each link of the theoretical chain. First, fashion weeks may legitimately be regarded as institutionally organised, datable and economically significant information events. Each of the 'Big Four' weeks (New York, London, Milan, Paris) is administered by a national professional body that sets the official calendar; the shows take place twice a year in a fixed sequence, roughly six months ahead of the retail season. Crucially, the public, verifiable nature of the calendar makes it possible to fix the event date unambiguously — a condition without which an event study is impossible. From a marketing standpoint the show is not a sales event but a concentrated platform for the production of meaning: according to the 'anti-laws of marketing' of J.-N. Kapferer and V. Bastien, luxury cultivates managed scarcity and a 'dream value' that exceeds the utility of the goods purchased [3], and the show acts as its supreme ritual, reconciling exclusivity with mass visibility and generating, within hours, hundreds of millions of media impressions.

Fashion weeks also carry economic weight: according to an Oxford Economics estimate prepared for the British Fashion Council, the direct contribution of the UK fashion industry amounted to some £26 billion, supporting about 797,000 jobs [15], while in the United States it is measured in tens of billions of dollars and hundreds of thousands of jobs. Events of such scale are unlikely to be irrelevant to the firms at their centre. Digitalisation has heightened their informational character: live broadcasts have practically eliminated the delay in the diffusion of information, sharpening the event in time and widening its audience potentially to investors and analysts, which reinforces the treatment of a fashion week as a fully fledged information event.

The second link is the economics of the brand, through which the symbolic work of the show is converted into value. Brand equity is a predominantly perceptual, consumer construct: D. Aaker defined it as the set of assets linked to a brand's name (loyalty, awareness, perceived quality, associations and other proprietary assets) [1], while K. Keller developed it as the differential effect of brand knowledge on the consumer's response [2]. Brand valuation, by contrast, is a financial exercise — the assignment of a monetary figure to the brand as an intangible asset [4]. The study, in essence, tests whether changes in the perceptual sphere acted upon by the show pass into the financial sphere recorded by share prices. A luxury brand, moreover, is a meaning-producing asset — a long-term accumulation of cultural capital renewed by each show; a special role belongs to the creative director, whose appointment and debut collections, timed to the fashion weeks, are among the events most material to value.

Brand value is measured by cost, market and income methods, among which the income approach (in particular the relief-from-royalty method) predominates in practice [4]; conceptually important is the work of C. Simon and M. Sullivan, who derive brand equity directly from the market value of the firm [5]. Decisive here is the accounting paradox: under International Accounting Standard (IAS) 38 'Intangible Assets', internally generated brands may not be recognised on the balance sheet, since the cost of creating them cannot be separated from the cost of developing the business as a whole [10]. The most valuable asset of a luxury house thus proves to be 'invisible' in its financial statements, whereas an acquired brand is recognised. It follows that it is the market value of the firm, rather than its book value, that absorbs the value of the internally generated brand, and that an event study of share prices proves to be the most adequate way of measuring the value effect of fashion weeks.

The third link is the financial mechanism. A share price is not a record of the past but an estimate of the future, equal to the present value of the firm's expected cash flows; hence any new information that alters expectations should alter the price. The theoretical basis that legitimises interpreting price changes as a reaction to information is the efficient market hypothesis of E. Fama, who distinguishes weak, semi-strong and strong forms of efficiency [11]. The semi-strong form is relevant to the event study: since a fashion week is a public event, the information it generates is impounded into the price promptly and without systematic bias at the moment of its arrival, which makes it possible to measure the effect in a short window [14]. Evidence from behavioural finance of departures from strict efficiency does not invalidate the approach, which requires only a sufficiently prompt and unbiased reaction of prices to public information.

Bringing these links together acquires its full significance against the background of the empirical literature. The conceptual framework was set out by R. Srivastava, T. Shervani and L. Fahey, who showed that market-based assets create shareholder value by accelerating cash flows, raising their level, lowering their volatility and increasing the firm's residual value [6]. Empirically, T. Madden, F. Fehle and S. Fournier established that a portfolio of strong-brand

companies outperforms the market at lower risk [7]; N. Mizik and R. Jacobson showed that perceptual brand attributes carry information for the market over and above accounting indicators [8]; and V. Lane and R. Jacobson found that brand-extension announcements generate measurable abnormal returns whose magnitude depends on the strength of the parent brand [9]. These works constitute a general law, a particular case of which the present study tests, since fashion weeks act precisely on the perceptual sphere.

When the focus narrows to the financial consequences of shows for luxury firms, the literature thins sharply: studies of the media and social-media discourse of fashion weeks (sentiment analysis) do not link sentiment to market outcomes, while the few event studies of publicly listed luxury companies address other subjects (for example, sustainability practices) rather than the seasonal show. The intersection of these strands — a rigorous event study of whether fashion weeks themselves generate abnormal returns in the shares of listed houses — remains essentially unoccupied. The feasibility of an empirical strategy is meanwhile assured by a sufficient population of publicly listed luxury companies, the principal of which are presented in Table 1.

Table 1.
Principal publicly listed luxury companies (exchange and ticker)

Company	Exchange	Ticker
LVMH Moët Hennessy Louis Vuitton SE	Euronext Paris	MC
Kering SA	Euronext Paris	KER
Hermès International SCA	Euronext Paris	RMS
Compagnie Financière Richemont SA	SIX Swiss Exchange	CFR
Burberry Group plc	London Stock Exchange	BRBY
Prada S.p.A.	Hong Kong Stock Exchange	1913
Salvatore Ferragamo S.p.A.	Euronext Milan	SFER
Moncler S.p.A.	Euronext Milan	MONC
Brunello Cucinelli S.p.A.	Euronext Milan	BC
Capri Holdings Limited	New York Stock Exchange	CPRI
Tapestry, Inc.	New York Stock Exchange	TPR

Note: the list is illustrative; listing status and tickers are subject to re-verification as at the data-collection date.

Two features of the industry refine the design of the study: a number of culturally significant houses (Chanel, Dolce & Gabbana) are private and do not enter an analysis of share prices, while the largest listed companies are multi-brand conglomerates that do not disclose results at the level of an individual brand, so that the effect of a single house's show is partly diluted. The clustering of the 'Big Four' shows into compressed periods raises the risk of overlapping confounding events, which calls for careful screening of event windows and caution in interpreting the results.

Conclusion

The foundation constructed here is integral in character, and the connections between its elements are constitutive: fashion weeks matter financially because they shape brand equity; brand equity matters because, for luxury firms, it is the principal driver of value; that value is observable in full only in the share price, since accounting renders the internally generated brand invisible; the efficient market hypothesis guarantees that material information is promptly reflected in the price; and the event study provides the instrument for measuring it. Removing any single link destroys the argument. From this follows a testable implication: if fashion weeks carry information material to value and investors are responsive to it, then publicly listed luxury companies should exhibit statistically significant abnormal returns around show dates. Testing this implication is the subject of the subsequent empirical study, which operationalises the framework developed here.

At the same time, the limits of the anticipated conclusion must be stated clearly: an event study measures association, not the mechanism that produces it, and does not reveal precisely what the market is reacting to — the aesthetics of the collection, a signal about the strength of the brand, or a change of creative leadership. The absence of a significant reaction, in turn, would not prove the irrelevance of shows, since their information may be anticipated, diluted within a conglomerate, or act over a longer horizon. With these reservations, the theoretical foundations constructed here provide a methodologically conscious transition from theory to empirics, which was the aim of the present work.

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KREDIT-MODUL TIZIMIDA “TANQIDIY FIKRLASH” TUSHUNCHASINING MAZMUNI VA MOHIYATI

***Annotatsiya.** Mazkur maqolada kredit-modul tizimi sharoitida bo'lajak boshlang'ich sinf o'qituvchilarining tanqidiy fikrlash ko'nikmalarini rivojlantirish hamda ularning mustaqil ta'lim faoliyatini takomillashtirish masalalari yoritilgan. Ta'lim sifatiga ta'sir etuvchi tashqi standartlar, zamonaviy pedagogik yondashuvlar va tanqidiy fikrlash texnologiyalarining imkoniyatlari tahlil qilingan. Ona tili va o'qish savodxonligi darslarida tanqidiy fikrlash ko'nikmalarini shakllantirishning metodik jihatlarini asoslab berilgan. Tadqiqot natijalari bo'lajak boshlang'ich sinf o'qituvchilarining kasbiy kompetentligini, mustaqil bilim olish va o'z-o'zini rivojlantirish qobiliyatlarini rivojlantirishga xizmat qiladi.*

***Kalit so'zlar:** kredit-modul tizimi, tanqidiy fikrlash, boshlang'ich ta'lim, o'qish savodxonligi, mustaqil ta'lim, kasbiy kompetentlik, ta'lim sifati, pedagogik texnologiyalar.*

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THE CONTENT AND ESSENCE OF THE CONCEPT OF “CRITICAL THINKING” IN THE CREDIT-MODULE SYSTEM

***Annotation.** This article discusses the issues of developing critical thinking skills of future primary school teachers and improving their independent educational activities in the context of the credit-module system. External standards affecting the quality of education, modern pedagogical approaches and the possibilities of critical thinking technologies are analyzed. Methodological aspects of the formation of critical thinking skills in native language and reading literacy lessons are substantiated. The results of the study serve to develop the professional competence of future primary school teachers, their abilities to acquire independent knowledge and self-development.*

***Keywords:** credit-module system, critical thinking, primary education, reading literacy, independent education, professional competence, quality of education, pedagogical technologies.*

Respublikamizda so'nggi yillarda oliy ta'lim sifatini oshirish, bo'lajak boshlang'ich sinf o'qituvchilarining tanqidiy fikrlashini rivojlantirish, ularni hayotiy muammolarni hal etishning ijodiy yo'llarini egallashga yo'naltirish, o'z-o'zini rivojlantirish va o'z-o'zini tarbiyalashning huquqiy-me'yoriy asoslari

yaratilmoqda. “Oliy ta’lim tizimini ijtimoiy soha va iqtisodiyot tarmoqlari ehtiyojlaridan kelib chiqqan holda, fan, ta’lim va ishlab chiqarishning mustahkam integratsiyasini ta’minlash asosida ta’lim sifatini yaxshilash, raqobatbardosh kadrlar tayyorlash, ilmiy va innovatsion faoliyatni samarali tashkil etish, xalqaro hamkorlikni rivojlantirish”⁶

Jahon amaliyotida elektron ta’lim muhitida o’quv jarayonini amalga oshirishni joriy etish bosqichiga oid pedagogic modellarni ishlab chiqish, electron ta’lim muhitida o’qishning psixologik-pedagogik xossalarini aniqlashtirish, ta’lim jarayonida optimal o’quv variantlarini tanlash amalga oshirishga qaratilgan tadqiqotlarga alohida e’tibor qartilmoqda.jumladan balaviriati bosqichi Bo’lajak boshlang’ich ta’lim o’qituvchilarini electron ta’lim muhiti sharoitida kasbiy o’qitishda zamonaviy yondoshuvlar asosida takomillashtirish oliy ta’lim sifatini yangi bosqichga ko’tarishda muhim omil hisoblanadi.

Respublikamizda ta’lim jarayonini modernizatsiyalash maqsadida xorijiy oliy ta’lim muassasalari filiallari, qo’shma fakultetlar va ta’lim dasturlari amalda joriy qilindi.”Uzluksiz ta’limni yanada takomillashtirish, mehnat bozorining zamonaviy ehtiyojlasrga mos malakali kadrlarini tayyorlash siyosatini davom ettirish” va “ta’lim va o’qish sifatini baholashning xalqaro standartlarini joriy etish asosida oliy ta’lim muassasalari faoliyatining sifati hamda samaradorligini oshirish”⁷

Jahon ta’lim va ilmiy tadqiqot muassasalarida umumiy o’rta ta’limning sifat va samaradorligini oshirish, nazariy-metodologik jihatlarini rivojlantirish, talabalarning mantiqiy tafakkurini rivojlantirish modelini takomillashtirish, talabalarda mantiqiy fikrlash qobiliyatini rivojlantirishga yo’naltirilgan o’quv vaziyatlarining didaktik-pedagogik imkoniyatlari bo’yicha ilmiy tadqiqotlar olib borilmoqda.

Hozirgi vaqtda pedagogika fani talabalarning bilim olish ko’nikmalarini oshirish, bir jamoa bo’lib qaror qabul qilishda ishtirok yetish, mantiqiy dalil va isbotlar bilan ishlash muammosini dolzarblashtirmoqda. Bundan oldin o’tkazilgan tadqiqot natijalarida tanqidiy fikrlashni rivojlantirish sharti bilan talaba "to’liq bilim" olishi mumkinligi ye’tirof yetilgan (V. Zinchenko, I. Saviskiy, A. Tyukov, V. Rozin). Shuning uchun ta’lim berish jarayonini diqqatni axborotlashtirishdan semantik qidiruv mashg’ulotlariga o’tkazish kerak. Buning uchun o’quv jarayoniga bo’lgan yondashuvlarni o’zgartirish, tanqidiy fikrlashni shakllantirishning yanada samarali usullarini izlash, sodir bo’layotgan narsalarning sabablari va ma’nolarini baholash talab yetiladi.

Tadqiqotda “fikrlash”, “tafakkur”, “tanqidiy fikrlash” tushunchalari ilmiy adabiyotlar asosida tahlil qilindi. Fikrlash tushunchasining mohiyati bo’yicha qator izlanishlar olib borilgan.

⁶ “O’zbekiston respublikasi oliy ta’lim tizimini 2030-yilgacha rivojlantirish konsepsiyasini tasdiqlash to’g’risida”gi PF5847-son Farmoni. 2019-yil 8-oktabr

⁷ O’zbekiston respublikasi prezidentining “O’zbekiston Respublikasini yanada rivojlantirish bo’yicha harkatlar strategiyasi to’g’risida”gi Farmoni//o’zbekiston Respublikasi Qonun hujjatlari to’plami.-Toshkent,2017.-b39.

“Dayana Xalperi asarlarida kreativ va tanqidiy fikrlash “fikir yuritishning shunday ko‘rinishini anglatadiki, u vazminlik, mantiq va maqsadga yo‘naltirilganlik bilan ajralib turadi”,- deb yozadi.

Djeni Stil, Kert Meredis, Charlz Templarning asarlarida quyidagilar ta’kidlanadi: “Odam kreativ va tanqidiy fikrlar ekan, u yoki bu g‘oyalar bilan tanishadi, ularni amalga oshirishdagi mumkin bo‘lgan oqibatlarini ham e’tiborga oladi. Bunda odam bu g‘oyalarni dastlab ma’lum darajadagi ishonchsizlik bilan idrok qiladi va qarama-qarshi nuqtai-nazarlar bilan taqqoslaydi. Ularni asoslash uchun qo‘shimcha mulohazalar tizimidan foydalanadi va bular asosida o‘z nuqtai-nazarini ishlab chiqadi”.

V. Zinchenko, I. Saviskiy, V. Rozinlar fikriga ko‘ra, oliy ta’lim tizimi kreativ va tanqidiy fikrlashni rivojlantirish, bo‘lajak boshlang‘ich sinf o‘qituvchilarni hayotiy muammolarni hal etishning ijodiy yo‘llarini egallashga yo‘naltirish, o‘z-o‘zini rivojlantirish va o‘z-o‘zini tarbiyalashga mo‘ljallangan. Hozirgi vaqtda pedagogika fani bo‘lajak boshlang‘ich sinf o‘qituvchilarning bilim olish ko‘nikmalarini oshirish, bir jamoa bo‘lib qaror qabul qilishda ishtirok etish, mantiqiy dalil va isbotlar bilan ishlash muammosini dolzarblashtirmoqda. Yakimanskaya I.S.ga ko‘ra, mutaxassisning professional taktikligi quyidagilarda namoyon bo‘ladi: hissiyotlarni boshqarish qobiliyati va qiyin vaziyatlarda o‘z-o‘zini boshqarishni yo‘qotmaslik, o‘zining va boshqalarning ishiga kreativ va tanqidiy baho berish, kreativ va tanqidiy mushohada yuritib xulosa chiqarish”.⁸

Tanqidiy fikrlash – qotib qolgan fikrlarni qabul qilmaydigan, yangi axborotlarni shaxsiy hayotiy tajribaga tatbiq yetish orqali rivojlanuvchi, baholovchi, jonli, ochiq tahlil qiluvchi fikr yurgizishdir⁹. Tanqidiy fikrlashning aksariyat ta’riflari, qiyin qarorlarni qabul qilishda oqilona, dalillarga asoslangan, uyushgan yondashuv sifatida uning g‘oyasiga asoslanadi¹⁰.

Shuningdek adabiyotlarda tanqidiy tafakkur masalalari ham o‘rganilgan bo‘lib, tanqidiy tafakkur bir nechta ma’nolarga ega. Ushbu tushunchalar fikrlashning rivojlanish bosqichlarini, tahlil qilish qobiliyatini, voqelikka munosabatini ifodalaydi. Bu o‘qituvchiga, talabalarning aqliy faoliyatini rag‘batlantirish uchun tanqidiy tafakkurni rivojlantirish texnologiyasida foydalanadigan texnikasi va vositalariga bog‘liq. Tanqidiy tafakkur “baholash” va “o‘z-o‘zini baholash”, “tanqidiylik” va “o‘z-o‘zini tanqid qilish”, “isbotlash” va “rad yetish”, “tanqidiy tahlil” kabi tushunchalarni o‘z ichiga oladi¹¹.

⁸ M.Sh.Jumayeva. Bo‘lajak boshlang‘ich sinf o‘qituvchilarining kreativ va tanqidiy fikrlash kompetensiyalarini rivojlantirish metodikasini takomillashtirish. Pedagogika fanlari bo‘yicha falsafa doktorini olish uchun yozilgan dissertatsiyasi. Toshkent –2025

⁹ Ражабова Н.К. Бўлажак бошланг‘ич синф ўқитувчиларининг тадқиқотчилик кўникмаларини ривожлантириш. Педагогика фанлари бўйича фалсафа доктори (ПнД) илмий даражасини олиш учун ёзилган диссертацияси. Тошкент – 2022

¹⁰ Дурменов Ш.Н. Муаммоли-қидирув технологиялари талабаларнинг чақириқча ҳарбий тайёргарликда танқидий фикрлаш ва қобилиятларини ривожлантириш стратегияси сифатида. Просеединге оф Глобал Течноватион 4th Интернационал Мултидисциплинарий Ссиентифис КонференсеНостед фром Парис, ФрансеҺтпс://конференсепублисатион.сом Фебруарй 27th 2021

¹¹ Худойқулов Ж. “Танқидий тафаккур” тушунчаси ва унинг таълим жараёнидаги роли. Асадемис Ресеарч ин Эдусатионал Ссиенсес Вол. 1 Но. 1, 2020 / ИССН 2181-1385. 339-347-6

Yunon tilidan tarjimada “tanqid” so‘zi izolyatsiya, ajralish degan ma‘noni anglatadi. O‘zbek tilida tanqid tushunchasi boshqa ma‘no kasb yetdi va ko‘p o‘lchovli. Tanqid tushunchasi insonning barcha aqliy faoliyatini o‘z ichiga oladi. Oliy ta‘lim tizimi tanqidiy fikrlashni rivojlantirish, talabalarni hayotiy muammolarni hal yetishning ijodiy yo‘llarini egallashga yo‘naltirish, o‘z-o‘zini rivojlantirish va o‘z-o‘zini tarbiyalashga mo‘ljallangan

Z.D.Rasulovning fikricha, shaxsga yo‘naltirilgan yondashuv - talabaning fikrlash va harakat strategiyasini inobatga olgan holda uning shaxsi, o‘ziga xos xususiyatlari, qobiliyatini rivojlantirishga yo‘naltiradi. Bu ta‘lim o‘qitish muhitining talaba imkoniyatlariga moslashtirilishini nazarda tutadi. Unga ko‘ra ta‘lim muhiti, pedagogik shart-sharoitlar, ta‘lim hamda tarbiya jarayonini to‘laligicha tahsil oluvchining shaxsiy imkoniyatlarini ro‘yobga chiqarish, qobiliyatini rivojlantirish, shaxs sifatida kamolotga yetishini ta‘minlash, tafakkuri va dunyoqarashini boyitishni nazarda tutadi. Shaxsga yo‘naltirilgan yondashuvning o‘ziga xos jihatida ta‘lim oluvchi shaxsini tan olish, uni har tomonlama rivojlantirish uchun qulay, zarur muhitni yaratishdan iboratdir. O‘quv jarayonlarida bu turdagi ta‘lim talabalarda mustaqillik, ijodkorlik, tashabbuskorlik, javobgarlik kabi sifatlar, shuningdek, mustaqil, ijodiy va tanqidiy fikrlash qobiliyatlarini tarbiyalashga xizmat qiladi¹².

Ta‘limni modernizatsiyalashtirish ta‘lim jarayonida bilim, ko‘nikma, malakalarini shakllantirish bilangina hal bo‘lib qolmaydi. Ta‘lim oluvchi shaxsining mustaqillik, tashabbuskorlik, javobgarlikni his yetish, tanqidiy fikrlash kabi sifatlar bilan bog‘liq funksiyalari ta‘limning shaxsga yo‘naltirilgan tizimi vositasida amalga oshiriladi. Bunda ta‘lim oluvchi talim tizimiga moslashtirilmay, aksincha, ta‘lim tizimi turli shaxsga xos barcha xususiyatlarini (erkinlikka intiluvchanlik, mustaqillik, shaxsiy fikrlarning mutloq o‘ziga xos tizimga ega bo‘lishi, o‘z-o‘zini tasdiqlash yehtiyojining mavjudligi) hisobga olgan holda, ta‘lim oluvchiga uning o‘ziga xosligi (individualligi)ni rivojlantirish imkonini berish, uning o‘z-o‘zini rivojlantirishi, namoyon yetishi uchun sharoit yaratish lozim. Zero, har qanday talaba o‘ziga va faqat o‘zigagina xos takrorlanmas tabiati, xarakter xususiyatini faollashtirish va namoyon yetishga intiladi¹³.

Ta‘lim jarayonida tafakkur faoliyatlarida muhim o‘zgarishlar sodir bo‘ladi. Mavhum fikrlash qobiliyati o‘sadi, shu bilan birga, tafakkurning konkret-obrazli komponentlari saqlanib qoladi va rivojlanadi. Tanqidiy fikrlash faoliyati sezilarli darajada rivojlanadi, uning mustaqilligi va faolligi oshadi¹⁴.

Tanqidiy fikrlash ko‘plab darajalarda ishlaydi, faktlar bilan qoniqmaydi, balki bu faktlarning sabablari va oqibatlarini ochib beradi. Tanqidiy fikrlash muloyim shubha, umumiy qabul qilingan haqiqatlarda shubha, muayyan masala

¹² Расулова З.Д. Технология дарсларида шахсга йўналтирилган таълим технологияларидан фойдаланиш / "Ссиенсе анд Эдусатион" Ссиентифис Жоурнал / ИССН 2181-0842 Октябрь 2021 / Волуме 2 Иссуе 10/ 2021 йил. 471 - б

¹³ Якиманская, И.С. Разработка технологии личностно-ориентированного обучения / И.С.Якиманская // Вопросы психологии. -1999. - №2 - С.31-41.

¹⁴ Птицына З.В. Формирование мыслительных операций на уроках математики. -М.: Просвещение, 1999. - 132 с.

bo'yicha nuqtai nazarni ishlab chiqish, mantiqiy dalillarni himoya qilish qobiliyatini o'z ichiga oladi. Tanqidiy fikrlash bu ajratilgan mahorat yemas, balki uning ko'plab ko'nikmalarining kombinatsiyasidir. Bu ta'lim oluvchilar ya'ni, o'qituvchiga texnikaga va talabalarga aqliy faoliyatni rag'batlantirish uchun tanqidiy fikrlashni rivojlantirish texnologiyasida qo'llaniladigan vositalarga bog'liq. Tanqidiy fikrlash o'z ichiga "baholash" va "o'z-o'zini hurmat qilish", "tanqid" va "o'z-o'zini tanqid qilish" "dalil" va "raddiya", "tanqidiy tahlil" kabi tushuncha va jarayonlarni qamrab oladi. Tanqidiy fikrlash madaniyati ishonchli dalillash usullari va amalda qo'llaniladigan texnikalardan iboratdir. Bularning barchasi shaxsiyatning rivojlanishiga, talabalarning dunyoqarashini shakllantirishga yordam beradi.

Tanqidiy fikrlarning ahamiyati jamoa hamkorligi asosida, axborotlarni qabul qilish, ularga o'z munosabatini bildirish, xatolik va nomuvofiqlarini izlash, o'z mulohazalarida xatolikka yo'l qo'ymaslikka intilish, o'z tushunmovchiliklarini anglash, farqlash, aniq xulosalar chiqarishga yo'llashdan iborat.

Ta'limning bugungi vazifasi yesa, talabalarni kun sayin oshib borayotgan axborot-ta'lim muhiti sharoitida mustaqil faoliyat ko'rsata olishga, axborot oqimidan tanqidiy tafakkur orqali oqilona foydalanishga o'rgatishdan iborat. Tanqidiy tafakkur - bu narsa, voqea va hodisalarning alohida belgilab olingan tarzda o'rganilishidir. Bu jarayon o'rganilishi taqozo qilinayotgan narsa yoki hodisani aniqlashdan boshlanadi. Shundan keyin dalillarni yerkin tanlash hamda fikrlashning turli variantlarini tahlil qilishga kirishiladi. Jarayon yakunida yesa, haqqoniy fikrlashga asos bo'ladigan dalillarga ye'tibor qilinadi. Shundan keyin talabalar aniqlangan dalillar va chiqarilgan hukmlarni o'zaro qiyoslaydilar. Shu tariqa shaxsiy hukm chiqarish uchun asos bo'ladigan fikrlar yig'indisi vujudga keladi. Bunda o'qituvchi o'tilayotgan mashg'ulotning maqsadini aniq qo'yishi lozim. U talabaga nimani o'rgatishni xohlaydi? Mazkur savolga o'qituvchining javobi tayyor bo'lishi kerak.

Xulosa qilib aytadigan bo'lsak ta'lim-tarbiya jarayonida talaba shaxsini tanqidiy fikrlashga o'rgatishning didaktik imkoniyatlari keng bo'lib, talabalar qanday tanqidiy fikrlashlari haqida o'qituvchi aniq tasavvurga ega bo'lishi zarur. O'qituvchining bu tasavvuri talabalarni tanqidiy fikrlashga yo'naltirilgan mashg'ulotlarning samarali tashkil yetilishini ta'minlaydi. Tanqidiy fikrlash uchun tanlab olingan obektning to'g'ri belgilanishi ham muhim ahamiyatga ega. Bunda o'qituvchilarning talabalar bilan tanqidiy fikrlash ustida ishlash rejalari tuzilishi zarur. Mazkur rejalarni tuzish uchun o'qituvchilar zarur axborotlar to'plashlari hamda ushbu ma'lumotlar bilan yaxshi qurollangan bo'lishlari talab yetiladi

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GEOMETRIC OF FORMS HUMAN TO THE PSYCHE EFFECT: ANCIENT PHILOSOPHICAL TEACHINGS AND MODERN NEURO- AESTHETICS SYNTHESIS

Abstract: *This in the article ancient philosophical teachings and modern neuro-aesthetics principles based on geometric of forms human to the soul impact interdisciplinary analysis made.*

Key words: *neuro-aesthetics, sacred geometry, Gold ratio, Plato bodies, visual perception, cognitive relief.*

Neuroaesthetics — art, beauty and aesthetic experiments human brain and biological mechanisms through learner interdisciplinary This term was first used in the late 1990s. come output Lebanese was British neurobiologist By Semir Zeki science included. Artists centuries during used methods (symmetry, exaggeration, association) are actually brain on the bark neurons of encouragement the most effective We are a to perceive something as "beautiful" when we do, in the orbital frontal part of the brain activity increase and dopamine (pleasure) hormone) secreted output such as processes neuroaesthetics research does. Holy Sacred Geometry — the universe shapes, patterns and of proportions behind divine, spiritual or space order who thinks he /she is lying philosophical, religious and aesthetic This concept is according to nature and universe random not formed, but known one geometric plan based on created. The universe structural basis geometric forms organization to be able about hypotheses Ancient In Greece formed Pythagoras and Plato in their teachings geometric harmony concept universe structure and space order explanatory main criterion calculated. Their to their views according to, material world random chaos not, maybe geometry to the laws subordinate symmetrical, harmonious and perfect is a system.

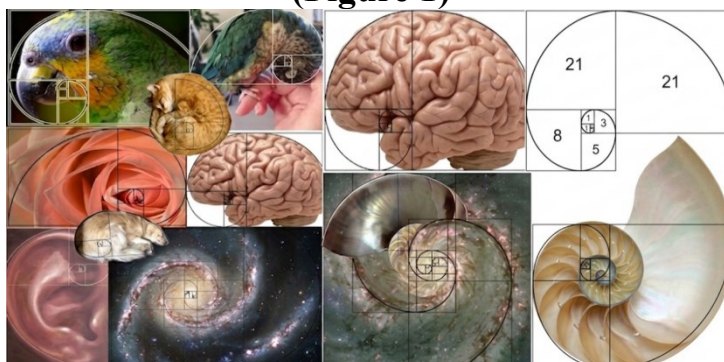
"God forever geometrizes."

– Plato

Geometric of forms (Golden ratio, Life flower, mandala, Plato bodies) from the microcosm (atoms) to the macrocosm (galaxies) structures basis that today's theoretical even today physics and astrophysics and quantum mechanics within of the fundamental topics being studied is one. Modern science of the universe this himself/ herself repetitive (fractal) architecture clear mathematician and empirical evidence with Atoms at the level : Chemistry and quantum in physics research atomic nucleus, ions radius and of electrons energetic levels between distances gold ratio laws (Fibonacci (submission to the sequence) shows Galaxies Level :

Spiral of galaxies (this including the one we live in) spiral arms of the galaxy from the center side looking at exactly logarithmic gold spirals along expands. This matter energy the most effective distribution method.

(Figure 1)



Picture 1 Picture 2

Neuroaesthetics (in the brain) beauty perception) and holy between geometry (universal shapes in the universe) dependency — human evolution and cognitive neurobiology the most interesting from the points is one [1, 3]. The Holy geometry universe patterns offer if it does, neuroaesthetics our brain why exactly this patterns when you see enjoy scientific in terms of proves [1, 3, 5]. Neuroaesthetics to the laws see, man brain minimum energy spend the maximum information again to work good sees [3]. Holy geometry basis was Gold proportion, symmetry and fractals (e.g., " Life" flower " barrier " (brain) for the visual cortex the most easy readable visual The brain is the code. perfect shapes again " doesn't strain " at work and this thrift our mind " beauty " and harmony " (aesthetic as pleasure acceptance does).

Secondly, the orbital-frontal part of the brain (medial orbitofrontal cortex) is responsible for aesthetic in terms of nice objects when you see activates and dopamine (pleasure) secretes the hormone (HGH). Holy geometric shapes, mandalas or historical in monuments girth to the patterns When we are standing, in the brain reward system immediately with to work falls. Peace, stability and space order reflection provider this geometry visual " euphoria " hormones working to release Thirdly, human psyche by nature chaos and uncertainty danger as The brain is visual. the world into parts separate not, all a " whole " in the form of " image " (Gestalt) to see strives for. Holy in geometry five Plato bodies or symmetrical matrices of any kind chaotic the environment molding and order to plant to the feature has. Engineering in the drawings or in architecture this geometric order when we see, neuroaesthetic point of view from the point of view our brain himself safe, stable and quiet feels in the environment Summary : Ancient Greeks the world two to the situation divided into : Chaos (disorder, panic, darkness) and Cosmos (order, beauty, harmony). Created by nature random particles package as not, maybe Gold ratio and Plato bodies such as clear mathematician laws based on created by. Through this human to the mind of the universe stable that signal is given. Human spirit for the most big fear is

uncertainty and is chaos. We are complicated engineering in the drawings of our mosques girth in patterns or simply snow in the passage that " Holy geometry When we see, in our consciousness: " Everyone thing control under this universe random not, its caring and wise Architect " there is " confidence wakes up. Beauty feeling is brain security and divine harmony familiar is an instinct. Neuroaesthetics and holy geometry synthesis exactly this to the conclusion take Coming: In the Universe geometric codes — Creator's human to the soul understandable "This world " in the language safe and controllable order " have " is a message. In the modern digital era, modern computer graphics and its software (graphics programs) serve as a bridge in modeling these sacred geometric codes of the universe, universal symmetry and fractal systems with mathematical accuracy. It has been scientifically proven that using the general capabilities of graphics programs allows you to design the complex visual order of the universe with perfect linear accuracy. From a neuro-aesthetic point of view, such digital symmetrical shapes and precise engineering models are easily perceived by the human visual cortex in the form of visual code without spending excessive energy. As a result, the geometric harmony created by computer graphics maximizes the coefficient of cognitive ease (*processing fluency*) in the brain, and at the same time further accelerates the release of hormones of security, stability and aesthetic pleasure (*dopamine*). The synthesis of neuroaesthetics and sacred geometry leads to this conclusion: Geometric codes in the universe are the Creator's message in a language understandable to the human psyche: "This world has a safe and controlled order."

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MECHANISMS FOR ENSURING GENDER EQUALITY IN THE FAMILY AND WORK–LIFE BALANCE IN THE CONTEXT OF DIGITAL TRANSFORMATION

Abstract: *This article scientifically analyzes the issues of ensuring gender equality within the family and supporting work–family balance in the context of digital transformation. In modern society, the development of digital technologies and artificial intelligence has a significant impact on family relations, the labor market, and changing social roles. The article highlights the role of gender equality in family stability and social development, as well as the main mechanisms for maintaining a balance between family and work. Particular attention is paid to factors such as remote work, flexible working schedules, digital platforms, and state policies. In addition, the study examines the challenges of reducing gender stereotypes, ensuring an equal distribution of family responsibilities, and promoting digital equality. The findings indicate that digital transformation creates new opportunities for strengthening gender equality within the family and improving work–family balance.*

Keywords: *Digital transformation, gender equality, work–family balance, family relations, artificial intelligence, remote work, flexible working schedules, social policy, digital technologies, family stability, demographic development, gender stereotypes.*

The term gender originates from the Latin word “genus,” meaning “kind” or “sex,” and refers to the existence of equal conditions and opportunities for representatives of both sexes to demonstrate their personal qualities in society. While biological sex distinguishes people as female and male, gender focuses on the social status and roles assigned to women and men within society. Creating equal conditions and opportunities for women and men to find and define their place in society is a fundamental basis for ensuring gender equality. Therefore, over the years, Uzbekistan has pursued policies at both the legislative and executive levels aimed at achieving full equality between women and men. Particular attention has been given to improving the legal and economic status of women, enhancing their living and working conditions, protecting reproductive health, and transforming the traditional roles of both women and men in society and the family. First and foremost, gender equality means providing equal rights and opportunities for both men and women in society. This concept implies that a person’s gender should not hinder their access to education, employment, career choice, or active participation in social life. Regardless of gender, every individual

should be equally valued and have access to the same opportunities. The term gender originates from the Latin word “genus,” meaning “kind” or “sex,” and refers to the existence of equal conditions and opportunities for representatives of both sexes to demonstrate their personal qualities in society. While biological sex distinguishes people as female and male, gender focuses on the social status and roles assigned to women and men within society. Creating equal conditions and opportunities for women and men to find and define their place in society is a fundamental basis for ensuring gender equality. Therefore, over the years, Uzbekistan has pursued policies at both the legislative and executive levels aimed at achieving full equality between women and men. Particular attention has been given to improving the legal and economic status of women, enhancing their living and working conditions, protecting reproductive health, and transforming the traditional roles of both women and men in society and the family. First and foremost, gender equality means providing equal rights and opportunities for both men and women in society. This concept implies that a person’s gender should not hinder their access to education, employment, career choice, or active participation in social life. Regardless of gender, every individual should be equally valued and have access to the same opportunities. Young women who graduate from universities with excellent grades and honors diplomas often face difficulties in finding employment, despite increasingly outperforming young men in fields such as medicine and mathematics. Even those who succeed in securing jobs frequently experience job insecurity and inadequate wages. In promoting gender equality among young people, not only the family and local community (mahalla) institutions but also the education system play a crucial role. Children’s understanding of what is right and wrong is shaped through preschool institutions, schools, and later higher education institutions. One of the most important factors in this process is the way the education system is organized. In Uzbekistan, education is secular, and boys and girls study together in the same classrooms. At school, boys and girls spend significant amounts of time interacting with members of the opposite sex who are not part of their family for the first time. Properly established relationships between boys and girls in the classroom contribute to the development of a healthy and balanced understanding of gender among young people.

The content of school subjects and educational activities also serves, to a certain extent, to promote the principles of gender equality. In particular, subjects such as Upbringing (Tarbiya), History of Uzbekistan, and Literature taught in schools throughout the country introduce students to the lives and achievements of prominent women who left an indelible mark on the nation’s history and literature. These include figures such as Tomyris, Zarina, Turkon Khatun, Saroymulk Khanum, Nodirabegim, Uvaysiy, Anbar Otin, Saida Zunnunova, and Zulfiya Isroilova. Through learning about these women, students gradually develop an understanding that women have actively participated in social life and governance throughout history. The system of social cooperation between the family, community (mahalla), and educational institutions is of great importance in

establishing the principle of gender equality in society and fostering a healthy gender perspective among young people. These three social institutions form the foundation of an individual's personal development. From birth until adulthood, a child spends most of their time either within the family, the community, or educational institutions. In shaping a proper attitude toward gender, these three components of the integrated system complement and reinforce one another. Ensuring gender equality within the family, community, and educational system is one of the fundamental principles required for raising the younger generation in accordance with the values of gender equality. The family is a sacred stronghold and the basic unit of society. It is a person's most reliable support, the core of their spirituality and morality, and the primary source of their ethical and personal development. Family members are connected to one another through moral and spiritual responsibility. Living in a family is considered a source of happiness and well-being. For this reason, concepts related to the sacred nature of the family are widespread in Uzbek society. From birth, a person learns and understands all the necessities of life within the family, including how to walk, speak, read, write, and even how to respond when faced with the laws of nature. The family is the foundation of society; the stronger the family, the stronger society becomes. It is the family and family life that provide us with complete happiness and fulfillment, although at times they may also be the source of difficulties and disappointments. The family preserves and passes on from generation to generation the fundamental values and concepts of social life, traditions and customs, rituals, and the collective social experience of raising younger generations. A healthy family environment is a guarantee for the development of high moral and ethical qualities among young people.

Moreover, peace, mutual respect, love, and understanding within the family contribute significantly to the successful implementation of the goals and principles of the New Uzbekistan. As a stronghold of upbringing and education, the family has an immeasurable influence on the destiny of a growing child. A child's ability to find their place in society and prepare for independent life largely depends on the family environment. Family conflicts and divorces may lead to the emergence of a generation that lacks a clear understanding of a complete family, has difficulty forming independent opinions, and may even fear establishing their own families in the future. In the context of a modernizing Uzbekistan, ensuring the stability of the family institution and revitalizing family values signify the economic, cultural, and social development of every family. Therefore, issues related to family development and family challenges have become an important focus of state policy. From a social perspective, the family is considered one of humanity's greatest achievements. In recent years, systematic efforts have been undertaken in our country to strengthen the family institution. As President Shavkat Mirziyoyev stated: "A new system has been created to comprehensively study family issues, analyze, monitor, and assess the existing situation, and improve family well-being through scientific research." This statement once again highlights the significance of the family institution. To strengthen the women's

movement in Uzbekistan, define the role of Uzbek women in society, and demonstrate the high intellectual and professional potential of Uzbek women to the world, the government has adopted a number of important legal and policy documents. A family environment based on equality is also an important preventive factor in reducing crime. Respect and trust within the family help cultivate social responsibility in individuals. In conclusion, gender equality and family values play a crucial role in creating a healthy social environment. The family serves as the primary setting for a person's moral, social, and psychological development, and the relationships within it directly influence the formation of behavior. When equality, mutual respect, and trust between men and women are ensured within the family, individuals grow up with a strong sense of social responsibility, empathy, and legal awareness. Therefore, ensuring gender equality, mutual respect, and trust within the family contributes not only to the healthy moral and psychological development of individuals but also to the creation of a stable social environment. Family relationships based on equality foster social responsibility, empathy, and legal consciousness, which serve as important preventive factors against criminal behavior. Conversely, inequality, violence, and distrust within the family can negatively affect socialization and lead to various social problems and behavioral deviations.

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QAYTA TIKLANADIGAN ENERGIYA RESURLARINI MASOFAVIY ZONLASH VA GIS ASOSIDAGI FAZOLIVY MODELLASH: FARG'ONA VILOYATI HAQIDA AMALIY O'RGANISH

***Annatsiya:** Ushbu tadqiqot Farg'ona viloyatida qayta tiklanadigan energiya resurslarini baholash uchun integratsiyalashgan masofaviy zondlash va GISga asoslangan tizimni taqdim etadi. Quyosh va shamol energiyasi taqsimotiga ta'sir qiluvchi fazoviy determinantlarni aniqlash uchun Solargis GHI radiatsiya modellari, SRTM DEM asosidagi topografik parametrlar, Sentinel-2 MSI yer qoplamini indeksleri, Landsat-8 TIRS sirt harorati mahsulotlari va Sentinel-1 SAR dan olingan shamol maydonlarini o'z ichiga olgan ko'p manbali geofazoviy ma'lumotlar to'plamlari qayta ishlandi. Radiatsiya intensivligi, relyef morfologiyasi, shamol dinamikasi va yerdan foydalanish cheklovlari kabi energiya bilan bog'liq omillarning nisbiy ahamiyatini aniqlash uchun Analitik ierarxiya jarayoni (AHP) tomonidan qo'llab-quvvatlanadigan ko'p mezonli qarorlar tahlili (MCDA) qo'llanildi. Keyinchalik tadqiqot hududida qayta tiklanadigan energiyani joylashtirish uchun integratsiyalashgan yaroqlilik xaritasini yaratish uchun og'irlikdagi qoplama texnikalari qo'llanildi. Natijalar shuni ko'rsatadiki, markaziy va sharqiy Farg'onadagi past qiyalikli qishloq xo'jaligi tekisliklari yuqori quyoshga yaroqliligini namoyish etadi, shimoliy tekisliklar esa shamol salohiyatining oshishini namoyish etadi. Global Moran's I (0.59) yordamida baholangan fazoviy avtokorrelyatsiya radiatsiya va shamol intensivligida relyef tomonidan boshqariladigan klasterlash naqshlarining mavjudligini tasdiqlaydi. Taklif etilayotgan metodologiya mintaqaviy miqyosdagi energiya rejalashtirish uchun ilmiy asoslangan va takrorlanadigan asosni taqdim etadi, geofazoviy energiya modellashtirishga nazariy hissa qo'shadi va qayta tiklanadigan energiya manbalaridan foydalanishni optimallashtirish uchun amaliy qiymatga ega.*

***Kalit so'zlar:** Qayta tiklanadigan energiya, masofaviy zondlash, GIS, GHI tahlili, DEM, MCDA, fazoviy modellashtirish, Farg'ona viloyati.*

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REMOTE ZONING AND GIS-BASED SPATIAL MODELING OF RENEWABLE ENERGY RESOURCES: A CASE STUDY IN FERGANA REGION

Abstract: *This study presents an integrated remote sensing and GIS-based framework for assessing renewable energy resources in Fergana region. Multi-source geospatial datasets including Solargis GHI radiation models, SRTM DEM-based topographic parameters, Sentinel-2 MSI land cover indices, Landsat-8 TIRS surface temperature products, and Sentinel-1 SAR-derived wind fields were processed to identify spatial determinants affecting solar and wind energy distribution. Multi-criteria decision analysis (MCDA) supported by Analytical Hierarchy Process (AHP) was used to determine the relative importance of energy-related factors such as radiation intensity, terrain morphology, wind dynamics, and land use constraints. Weighted overlay techniques were then used to generate an integrated suitability map for renewable energy deployment in the study area. The results show that low-slope agricultural plains in central and eastern Fergana demonstrate high solar suitability, while the northern plains demonstrate increased wind potential. Spatial autocorrelation, assessed using global Moran's I (0.59), confirms the presence of relief-driven clustering patterns in radiation and wind intensity. The proposed methodology provides a scientifically sound and repeatable framework for regional-scale energy planning, makes a theoretical contribution to geospatial energy modeling, and has practical value for optimizing the use of renewable energy sources.*

Keywords: *Renewable energy, remote sensing, GIS, GHI analysis, DEM, MCDA, spatial modeling, Fergana region.*

KIRISH

Global energiya tizimining o'zgarishi, uglerod chiqindilarining keskin kamayishi va barqaror rivojlanish maqsadlari qayta tiklanadigan energiya manbalarini mintaqaviy baholashning ilmiy ahamiyatini yanada oshiradi. So'nggi o'n yilliklarda quyosh va shamol energiyasi tez rivojlandi va energiya ishlab chiqarish xarajatlarining pasayishi ularning iqtisodiy raqobatbardoshligini ta'minladi. Biroq, qayta tiklanadigan resurslarning hududiy taqsimlanishi bir xil emas: quyosh nurlanishi, shamol tezligi, relyef shakllari, yer qoplam, atmosfera sharoitlari va sirt issiqlik dinamikasi mintaqalar bo'yicha sezilarli darajada farq qiladi. Shuning uchun mintaqaviy miqyosdagi energiyani baholash uchun yuqori aniqlikdagi fazoviy ma'lumotlar va analitik usullar talab qilinadi.

Quyosh energiyasining salohiyatini aniqlashning asosiy ko'rsatkichi global gorizontal nurlanish (GHI) bo'lib, uning fazoviy taqsimoti relyef parametrlari, balandlik, qiyalik, aspekt, atmosfera shaffofligi va aerosol konsentratsiyasiga kuchli bog'liq. Solargis modeli orqali ishlab chiqilgan GHI baholash tizimi ushbu omillarni fizik modellashtirish tizimiga birlashtiradi va yuqori aniqlikdagi global nurlanish xaritalarini taqdim etadi [1]. Tadqiqotlar shuni ko'rsatadiki, balandlikning oshishi nurlanish intensivligini pasaytiradi, qiyalik yo'nalishi esa nurlanishning yutilishiga sezilarli darajada ta'sir qiladi [2]. Bu, ayniqsa, murakkab orografik tuzilishga ega bo'lgan Farg'ona vodiysi uchun dolzarbdir; uning tor

sharq-g'arbiy geometriyasi kiruvchi quyosh oqimini tabaqalashtiradigan relyef soyasi effektlarini kuchaytiradi.

Shamol energiyasi, aksincha, vodiylar geometriyasi va atmosfera dinamikasiga ko'proq ta'sir qiladi. An'anaviy meteorologik stansiya ma'lumotlari ko'pincha shamol oqimlarining fazoviy heterojenligini aks ettira olmaydi. Radarga asoslangan shamol modellari Sentinel-1 SAR tasvirlaridan foydalanib, radarning orqaga tarqalishi (σ^0) va shamol tezligi o'rtasidagi jismoniy bog'liqlikni aniqlash orqali bu cheklovni bartaraf etadi [3]. Bu yondashuv, ayniqsa, shamol kanallarini aniq aniqlash mumkin bo'lgan vodiylarga o'xshash mintaqalarda samarali. Markaziy Osiyoda o'tkazilgan tadqiqotlar SARga asoslangan modellar dala o'lchovlariga qaraganda aniqroq fazoviy shamol rekonstruksiyalearini taqdim etishini tasdiqlaydi [4].

Raqamli balandlik modeli (DEM) energiya resurslarini baholashda ham bir xil darajada muhimdir, chunki balandlik, qiyalik va aspekt GHI taqsimotini, shamol tezligini va sirt haroratini bevosita shakllantiradi. SRTM DEM 30 metrlik aniqlikdagi balandlik yuzasini taqdim etadi, undan qiyalik va aspekt hosilalari hosil bo'ladi. Nishab effektlari bo'yicha tadqiqotlar shuni ko'rsatadiki, tik qiyaliklar soyalanish va nurlantirilgan maydonning geometrik qisqarishi tufayli kiruvchi nurlanishning bir qismini yo'qotadi [5]. Farg'ona viloyatining shimoliy tog 'tizmalari va markaziy tekisliklari o'rtasidagi keskin relyef energiya mavjudligida kuchli fazoviy farqlanishni yaratadi.

Yer qoplam (YQQ) energiya mosligining yana bir muhim omilidir. Issiqlik inertsiyasi, albedo, bug'lanish transspiratsiyasi va sirt emissiyasi qishloq xo'jaligi, shahar, o'rmonli va tuproqsiz sirtlarda sezilarli darajada farq qiladi. Sentinel-2 MSI tasvirlaridan foydalangan holda, NDVI, NDBI va albedo kabi indekslar YQQ naqshlarini tavsiflashi va ularning yer yuzasi harorati (YYH) bilan bog'liqligini baholashi mumkin. YQQ sirt radiatsiya balansining sezgir ko'rsatkichi bo'lib, odatda yuqori GHI zonalarida ortadi, soyali tog'li hududlarda esa bug'lanish sovetishi tufayli kamayadi [6,7].

Resurslarni kompleks baholash uchun ko'p mezonli qaror qabul qilish (MCDA) tizimi keng qo'llaniladi. MCDA turli mezonlarni - GHI, shamol tezligi, qiyalik, aspekt, LULC va LST - yagona moslik yuzasiga birlashtiradi. Analitik ierarxiya jarayoni (AHP) mezon og'irliklarini matematik asosda aniqlash imkonini beradi [10]. Malczewski [9] geografik jihatdan murakkab tizimlar uchun MCDA dan foydalanishning ilmiy asosini taqdim etadi va uning samaradorligini namoyish etadi. Markaziy Osiyoda MCDA asosidagi qayta tiklanadigan energiya bo'yicha yaqinda o'tkazilgan tadqiqotlar shuni ko'rsatadiki, energiya resurslarining fazoviy tuzilishi asosan orografik va topografik boshqaruv elementlari bilan boshqariladi [13].

Farg'ona viloyati tekislik va tog'larning keskin farqlanishi, zich qishloq xo'jaligi yerlaridan foydalanish, shaharlashuvning kengayishi va yuqori energiya talabi tufayli mintaqaviy energiyani baholash uchun ideal tadqiqot hududidir. Yirik sanoat markazlari - Farg'ona, Qo'qon va Marg'ilon - yuqori iste'mol

modellariga ega bo'lib, vodiy bo'ylab qayta tiklanadigan energiyani optimal joylashtirishning strategik ahamiyatini ta'kidlaydi.

1.1 ORQA MA'LUMOT. O'QISH OB'EKTI.

Farg'ona viloyati O'zbekistonning sharqiy qismida, Farg'ona vodiysining markaziy qismida joylashgan bo'lib, shimoldan Qirg'izistonning O'sh viloyati, sharqdan Andijon va g'arbdan Namangan bilan chegaradosh. Viloyatning umumiy maydoni taxminan 7100 km² ni tashkil etadi va u butunlay Turkiston, Kurama va Farg'ona tog' tizmalari bilan o'ralgan bo'lib, katta tog' ichidagi havzani hosil qiladi (Abdullayev , 2019). Bunday yopiq orografik konfiguratsiya noyob mikroiqlim sharoitlarini yaratadi, bu yerda quyosh nurlanishi va shamol dinamikasi atrofdagi relyef tomonidan kuchli nazorat qilinadi.

Mintaqaning balandlik diapazoni markaziy tekisliklarda 350–500 metrdan tog' etaklari va yonbag'irlarida 2500 metrdan oshiq balandliklargacha keskin farq qiladi. SRTM DEM dan olingan tahlillar topografiya radiatsiya oqimining fazoviy taqsimlanishini tartibga soluvchi dominant omillardan biri ekanligini tasdiqlaydi [2] . Quva , Beshariq , Uchko'prik va markaziy Farg'ona bo'ylab 0–3° oralig'idagi qiyaliklar yuqori quyosh nurlanishi klasterlari to'plangan barqaror GHI qiymatlarini saqlab turadi. Aksincha, shimoliy tog' yonbag'irlarida soya ta'siri tufayli GHI 12–18% ga kamayadi [1] , janubga qaragan qiyaliklarda esa nisbatan yuqori radiatsiya oqimi saqlanib qoladi. Relyefga sezgir bu o'zgarishlar Farg'ona vodiysini radiatsiya modellashtirish uchun ilmiy jihatdan murakkab hududga aylantiradi .

Mintaqada kontinental subtropik iqlim mavjud bo'lib, yozgi harorat yuqori (iyulda 33–38°C), qishi yumshoq-sovuq (–2...+4°C) va vegetatsiya davrida kuchli radiatsiya balansi kuzatiladi. Yillik quyosh nuri davomiyligi 2800 dan 3000 soatgacha, bu O'zbekiston mintaqalari orasida eng yuqori ko'rsatkichlardan biridir [15] . Solargis GHI hisob-kitoblariga ko'ra, yillik global radiatsiya darajasi 1650–1850 kVt/m² oralig'ida [1] . Bu yuqori qiymatlar tekisliklarda hukmronlik qilsa-da, GHI relyef soyasi va atmosfera zichligining oshishi tufayli tog' etaklariga qarab sezilarli darajada pasayadi.

Shamol dinamikasi nuqtai nazaridan, Farg'ona vodiysi Markaziy Osiyodagi eng murakkab aerodinamik tizimlardan biri bo'lib, uning tor sharq-g'arb yo'nalishi sezilarli kanalizatsiya effektini yaratadi. Sentinel-1 ma'lumotlaridan foydalangan holda SAR asosidagi shamol modellashtirish tog'li hududlarda real shamol oqimi naqshlarini suratga olish qobiliyatini isbotladi [3] . Ushbu topilmalar Farg'ona vodiysiga ham tegishli bo'lib, u yerda vodiy o'qi bo'ylab past bosimli yo'laklar hosil bo'lib, Yozyovon , Dang'ara va mintaqaning cho'l o'tish zonalarida 4-6 m/s barqaror shamol tezligini hosil qiladi [4] . Bunday zonalar shamol energiyasidan foydalanish uchun qulay sharoitlarni ifodalaydi.

Landshaft tuzilishi qayta tiklanadigan energiya resurslarining taqsimlanishiga ham sezilarli ta'sir ko'rsatadi. Farg'ona viloyatining 55% dan ortig'i qishloq xo'jaligi yerlaridan, 12% urbanizatsiyalashgan, 8% o'rmonli, qolgan qismi esa cho'l va toshloq hududlardan iborat [8] . **Yer qoplamı albedo, bug'lanish va issiqlik inertsıyasi orqali radiatsiya va issiqlik dinamikasiga**

ta'sir qiladi. [6] ga ko'ra , Sentinel-2 MSI dan olingan indekslar - masalan, NDVI, NDBI va albedo - LST naqshlari bilan chambarchas bog'liq. Sug'oriladigan zonalar bug'lanishning ko'payishi tufayli LST qiymatlarining pasayishini ko'rsatadi, yalang'och tuproqlar esa issiqlikni samaraliroq yutadi va saqlaydi, bu esa sirt haroratining oshishiga olib keladi [7] . Shunday qilib, LULC mintaqaviy miqyosdagi energiya baholashlarida muhim omil hisoblanadi.

Farg'ona viloyatida 3,9 milliondan ortiq aholi istiqomat qiladi, aholi zichligi har kvadrat kilometrda 550 kishidan oshadi [16] . Yirik sanoat markazlari - Farg'ona, Qo'qon va Marg'ilon - yuqori energiya talabi va katta infratuzilma yukini namoyish etadi. Bu hududlar barqaror qayta tiklanadigan energiyani rivojlantirish uchun muhim talab markazlari bo'lib xizmat qiladi. Kimyoviy ishlab chiqarish, to'qimachilik, metallurgiya va neftni qayta ishlash kabi sanoat tarmoqlari uzluksiz energiya ta'minotini talab qiladi [12] , bu esa mintaqaviy energiya xavfsizligi uchun quyosh va shamol energiyasini joylashtirishning optimal joylarini ilmiy jihatdan aniqlashni juda muhimdir.

Farg'onaning murakkab orografiyasi, yaqqol landshaft mozaikasi, intensiv antropogen bosim va yuqori energiya talabi uni mintaqaviy miqyosdagi qayta tiklanadigan energiyani baholash uchun ideal maqsadga aylantiradi. Masofaviy zondlash ma'lumotlar to'plamlarini (GHI, LST, SAR), DEM hosilalarini va LULC ma'lumotlarini integratsiyalash mintaq bo'ylab qayta tiklanadigan energiya salohiyatining yuqori aniqlikdagi, ilmiy asoslangan fazoviy modellarini yaratish uchun ishonchli yondashuvni ta'minlaydi.

MATERIALLAR VA USULLAR

Farg'ona viloyatida qayta tiklanadigan energiya resurslarini aniqlash va baholash uchun masofaviy zondlash (RS), geografik axborot tizimlari (GIS) va ko'p mezonli qarorlarni tahlil qilish (MCDA) ni birlashtirgan uchta qo'shimcha yondashuv qo'llanildi. Uslubiy ish jarayoni global gorizontol nurlanish (GHI), shamol tezligi, relyef parametrlari, yer qoplam (LULC) va yer yuzasi harorati (LST) kabi asosiy energiya ko'rsatkichlarining fazoviy tuzilishi va sifatini aniqlashga qaratilgan.

Solargis Global Solar Atlas (2023) dan olingan bo'lib , u aerazol nurlanish yuklamasi, bulut optik chuqurligi, atmosfera shaffofligi va relyef keltirib chiqaradigan soyalarni hisobga olgan holda yuqori aniqlikdagi GHI hisob-kitoblarini taqdim etadi. Solargis fizik modeli GHI-relyef korrelyatsiyalarini baholash uchun eng aniq global tizimlardan biridir [1] . Radiatsiya rasterlari Farg'ona viloyatining ma'muriy chegarasi bo'ylab kesilgan va GIS muhitida DEMdan olingan qiyalik va aspekt qatlamlari bilan qiyosiy tahlil qilish uchun tayyorlangan.

Shamol maydoni tahlili Sentinel-1 IW GRD radar tasvirlariga asoslangan edi. Radarning teskari sochilish koeffitsienti (σ^0) aerodinamik jarayonlar natijasida hosil bo'lgan sirt pürüzlülüğü bilan bevosita bog'liq bo'lganligi sababli, shamolning fazoviy tuzilishi SAR ma'lumotlarida aniq aks ettirilgan [3] . Vodiyning tor konfiguratsiyasi va kuchli shamol kanallari dinamikasini hisobga olgan holda, SARga asoslangan shamol modellashtirish meteorologik stansiya

ma'lumotlariga qaraganda ancha ishonchli. SAR sahnalari vaqt bo'yicha mozaikalangan, mavsumiy shamol intensivligi olingan va fazoviy interpolatsiya IDW usuli yordamida o'tkazilgan [4] .

Raqamli relyef modeli (DEM) sifatida NASA SRTM (30 m) balandlik modeli ishlatilgan. ArcGISda yuqori aniqlikdagi qiyalik va aspekt hosilalari yaratilgan. Relyefning energiya ko'rsatkichlariga ta'siri o'rganildi, chunki 5° dan yuqori qiyalik burchaklari GHI ni 12-18% ga kamaytiradi va shimolga qaragan aspektlar quyosh yutilishini sezilarli darajada kamaytiradi [2,5] . Farg'ona mintaqasining markaziy tekisliklar, tog' oldi va tog' kamarlariga uch qismga bo'linishi radiatsiya va shamol rejimlarining fazoviy heterojenligiga bevosita ta'sir qiladi. DEM asosidagi topografik qatlamlar MCDA doirasida asosiy mezonlar sifatida kiritilgan.

LULC tasnifi Sentinel-2 MSI tasvirlaridan olingan (10–20 m aniqlikda). Spektral indekslar — NDVI (o'simlik qoplami), NDBI (shahar zichligi), LSWI (namlik) va albedo — belgilangan usullarga muvofiq hisoblab chiqilgan [6] . Farg'ona hududining 55% dan ortig'i qishloq xo'jaligi yerlari ekanligini hisobga olsak [8] , LULC alohida mezon sifatida kiritilgan, chunki o'simlik tuzilishi sirt nurlanishining yutilishiga, albedoga va issiqlik inertsiasiga ta'sir qiladi. Sug'oriladigan ekin maydonlari bug'lanish orqali sovutish orqali LST ni kamaytiradi, yalang'och tuproqli maydonlar esa to'liq GHI yutilishiga bog'liq holda yuqori LST ni ko'rsatadi [7] .

radiatsiya uzatish va emissivlikni tuzatish texnikasi yordamida olindi . LST sezgir termodinamik parametr bo'lib, radiatsiya oqimlari bilan kuchli korrelyatsiyani ko'rsatadi ($R^2 \approx 0.65-0.70$), ayniqsa sug'oriladigan tekisliklarda [12] . Markaziy pasttekisliklardagi yuqori LST qiymatlari yuqori insolyatsiya va past sirt albedosiga mos keladi, bu esa bu hududlarni quyosh energiyasidan foydalanish uchun qulay qiladi.

Ma'lumotlarni uyg'unlashtirish jarayonida barcha rastr qatlamlari WGS-84 / UTM Zone 43N koordinata tizimiga standartlashtirildi, 30 m aniqlikda qayta namunalar olindi va relyef bilan bog'liq buzilishlarni minimallashtirish uchun tepalik soyasi artefaktlari tuzatildi [1] .

Ko'p mezonli fazoviy baholashda (MCDA) quyosh nurlanishi, shamol tezligi, DEM parametrlari, LULC va LST alohida baholandi. Mezon og'irliklari har bir energiya omilining nisbiy ahamiyatini matematik tarzda aniqlaydigan [10] **va izchillikni tekshirish imkonini beruvchi Analitik ierarxiya jarayoni (AHP) yordamida belgilandi.** Malchewskining metodologik tavsiyalariga amal qilgan holda [9] **ga ko'ra** , barcha mezonlar 1 dan 5 gacha bo'lgan yaroqlilik sinflariga qayta tasniflandi va Weighted Overlay tahlili orqali integratsiyalashgan qayta tiklanadigan energiya mosligi xaritasi yaratildi.

Global Moranning I statistikasi fazoviy avtokorrelyatsiya naqshlarini o'rganish uchun hisoblab chiqilgan. Natijalar GHI va shamol tezligi yerga bog'liq klasterlash effektlarini namoyish etishini tasdiqladi [13] , **bu energiya resurslari tasodifiy taqsimlanmagan holda fazoviy tuzilganligini ko'rsatadi. Bu bosqich**

modellashtirish ish jarayonining fazoviy barqarorligi va ichki izchilligini tasdiqlash uchun juda muhim edi .

NATIJA VA MUHOKAMA

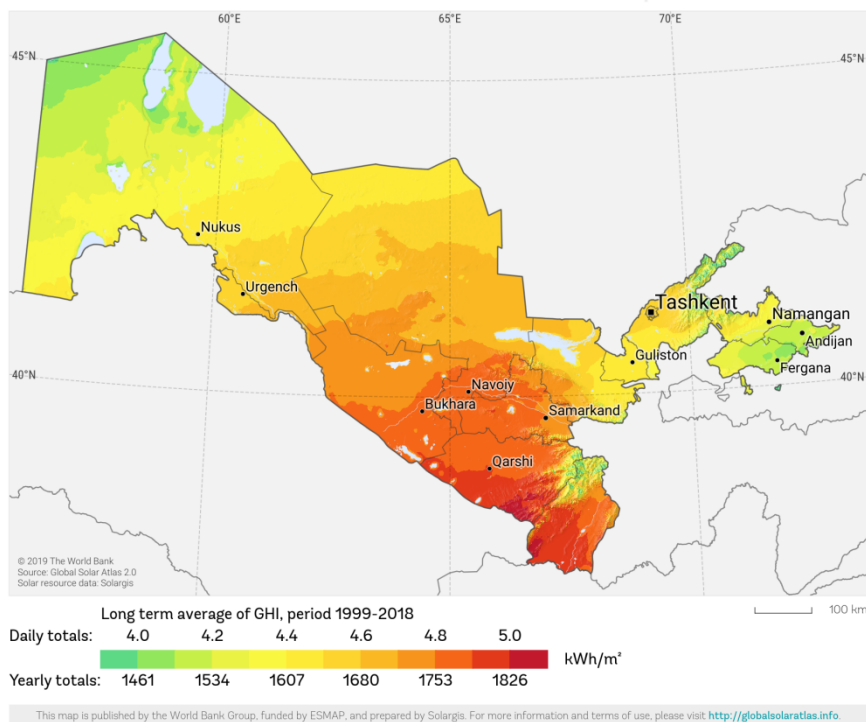
3.1. Quyosh nurlanishining fazoviy tarqalishi va topografik ta'siri

Tadqiqot natijalari shuni ko'rsatadiki, Farg'ona mintaqasida global gorizontal nurlanish (GHI) topografik sharoitlar bilan kuchli tartibga solinadi. 2010–2023 yillar uchun Solargis asosidagi GHI ma'lumotlar to'plamlari [1] piksel darajasida DEMdan olingan relyef parametrlari bilan taqqoslandi, bu mintqa bo'ylab aniq fazoviy gradientni ko'rsatdi. Eng yuqori radiatsiya darajasi markaziy tekisliklarda, jumladan , Quva , Buvayda , Uchko'prik va markaziy Farg'ona zonasida qayd etildi, bu yerda yillik GHI qiymatlari yiliga 1780–1850 kVt/m² oralig'ida o'zgarib turadi. Bu hududlar 0–1,5° qiyaliklar bilan tavsiflanadi, bu yerda minimal geometrik yo'qotish tufayli radiatsiya yutilishi maksimal darajaga yetishi ma'lum [2] .

Oltiariq , Yozyovon va Beshariqning yuqori qismi kabi tog'oldi zonalarida GHI qiymatlari pastroq, odatda yiliga 1650–1750 kVt/m² ni tashkil qiladi. Bu hududlarda 3° va 6° oralig'idagi qiyalik burchaklari yillik radiatsiyaning 8–14% ga pasayishiga mos keladi, bu asosan relyef soyasining ko'payishi bilan bog'liq. Vodiyning sharqiy chekkasida, ayniqsa Kurama tog' tizmalari yonbag'irlarida GHI qiymatlari yiliga 1500–1620 kVt/m² gacha pasayadi. Bu pasayish shimolga qaragan qiyaliklar cheklangan to'g'ridan-to'g'ri insolyatsiya tufayli sezilarli darajada kamroq radiatsiyani yutishini aniq belgilab qo'ygan mexanizmlarga mos keladi [5] .

1-rasmda mintqa bo'ylab radiatsiya gradiyenti ko'rsatilgan bo'lib, yashil-sariq klasterlar yuqori GHI tekisliklarini, to'q ko'k tuslar esa tog' etaklaridagi GHI tushkunlik zonalarini ifodalaydi. Fazoviy tarqalish shakli Farg'ona vodiysining orografik "havzasi" tuzilishiga juda mos keladi: relyef keltirib chiqaradigan soyalanish yuqori balandlikdagi hududlarda tobora kuchayib boradi, past tekisliklar esa barqaror va nisbatan bir xil radiatsiya darajasini saqlab qoladi.

Topografik jihatdan boshqariladigan GHI differentsiatsiyasi Farg'ona viloyatida quyosh resurslaridan foydalanishni shakllantiruvchi asosiy omil relyef ekanligini tasdiqlaydi. Kuzatilgan naqshlar tog'li va murakkab relyef muhitida o'tkazilgan global tadqiqotlar bilan to'liq mos keladi [1,2,5] , **bu mintaqaviy quyosh energiyasini** modellashtirishda yuqori aniqlikdagi relyefni tuzatish zarurligini ta'kidlaydi .



1-rasm: Quyosh nurlanishi xaritasi — GHI

1-rasmga ko'ra, GHI qiymalik bilan salbiy korrelyatsiyaga ega ($R^2 = 0.64$), bu yer relyefi omillari quyosh nurlanishining fazoviy taqsimlanishini kuchli belgilashini ko'rsatadi. Bu bog'liqlik [2] va [1] da keltirilgan global korrelyatsiyalarga to'liq mos keladi. GHI o'zgarishining relyef bilan dinamikasini yanada chuqurroq o'rganish uchun piksel darajasidagi GHI-qiymalik regressiya modeli ishlab chiqildi. Natijalar qiymalikning oshishi bilan nurlanishning tizimli ravishda pasayishini ko'rsatadi, bu esa radiatsiya balansining yer soyasi ta'siriga, qiymalik yo'nalishiga va quyosh zenit burchagiga yuqori sezgirligini tasdiqlaydi. Chiziqli regressiya modeli shuni ko'rsatdiki, GHI har bir qo'shimcha qiymalik darajasi uchun o'rtacha **yiliga 22,4 kVt/m²** ga kamayadi.

Tepalik soyasi tahlili bilan mustahkamlandi. Kurama va Chotqol tog 'tizmalari sharq-g'arb o'qi bo'ylab cho'zilganligi sababli, ertalab va kechqurun quyosh nuri tog 'yonbag'irlarida sezilarli darajada soyalanadi. Relyef soyasi fazoviy jihatdan heterojen: pasttekislik hududlarida radiatsiya yo'qotishlari taxminan **4-7% ni tashkil qiladi**, tog' etaklarida **10-13%** gacha ko'tariladi va tik qiymaliklarda **18-21% ga etadi**. Bu qiymatlar Samarqand va Jizzax viloyatlari uchun [13] tomonidan hujjatlashtirilgan relyef keltirib chiqaradigan radiatsiyaviy pasayishlarga juda mos keladi, bu Farg'ona vodiysining orografik konteksti uning energiya bilan bog'liq jarayonlarini shakllantirishda hal qiluvchi rol o'ynashini ko'rsatadi.

GHI-DEM tahlilining muhim jihati shundaki, vodiyni 350–450 m oralig'ida joylashgan pasttekislik hududlari nafaqat yuqori radiatsiya darajasi,

balki yuqori radiatsiya barqarorligi bilan ham ajralib turadi. Tekisliklarning geometrik ochiqqligi tufayli yillik radiatsiya tarqalishi minimal: soylanish zaif, atmosfera yo'lining uzunligi qisqa va albedo o'zgaruvchanligi past. Natijada, markaziy tekislik zonalar — Quva , Uchko'prik , Buvayda va markaziy Farg'ona — ham **yuqori, ham barqaror quyosh energiyasi salohiyatini taklif etadi** . Bu barqarorlik energiya rejalashtirish uchun ayniqsa muhimdir, chunki GHI ning bir xil taqsimlanishi fotovoltaik elektr energiyasi ishlab chiqarishdagi mavsumiy tebranishlarni bevosita kamaytiradi.

Xalqaro tadqiqotlar bilan taqqoslash Farg'ona vodiysining global topografik radiatsiya qonunlariga mos kelishini yana bir bor tasdiqlaydi. Himolay tog' etaklarida [2] qiyalikning oshishi bilan GHI ning 10–18% ga pasayishi haqida xabar berilgan; Janubiy Yevropada [1] 8–14% ga pasayishi aniqlangan; va Xitoyning Gansu provinsiyasida Veng (2021) 15–20% ga pasayishi haqida xabar bergan. Farg'onada kuzatilgan pasayish — **12–21%** — ushbu global diapazonga to'g'ri keladi, bu mintaqaning quyosh radiatsiya rejimi relyef morfologiyasi tomonidan boshqariladigan bir xil universal jismoniy tamoyillar bilan boshqarilishini ko'rsatadi.

Sharqiy va shimoliy tog 'tizmalarining soyali ta'siri tufayli GHI taqsimotida kunduzgi assimetriya ham kuzatildi, bu erta tongda va kech tushdan keyin nurlanishni to'sib qo'yadi. Bu muhandislik dizayni uchun amaliy ahamiyatga ega: tekisliklardagi fotovoltaik qurilmalar uchun **25-30° standart qiyalik burchagi optimal bo'lsa-da, tog' etaklari zonalarida qo'shimcha 5-8° janubga qiyalikni qo'llash** to'g'ridan-to'g'ri quyosh nurlarini yaxshiroq ushlab turish tufayli samaradorlikni oshiradi [5] . Radiatsiya va relyef o'rtasidagi o'zaro ta'sir - shamol tezligi, LST va LULC bilan birgalikda ko'rib chiqiladi - keyingi bo'limlarda taqdim etilgan integral fazoviy tahlilning asosini tashkil qiladi.

3.2. Shamol energiyasi potentsiali va orografik nazorat

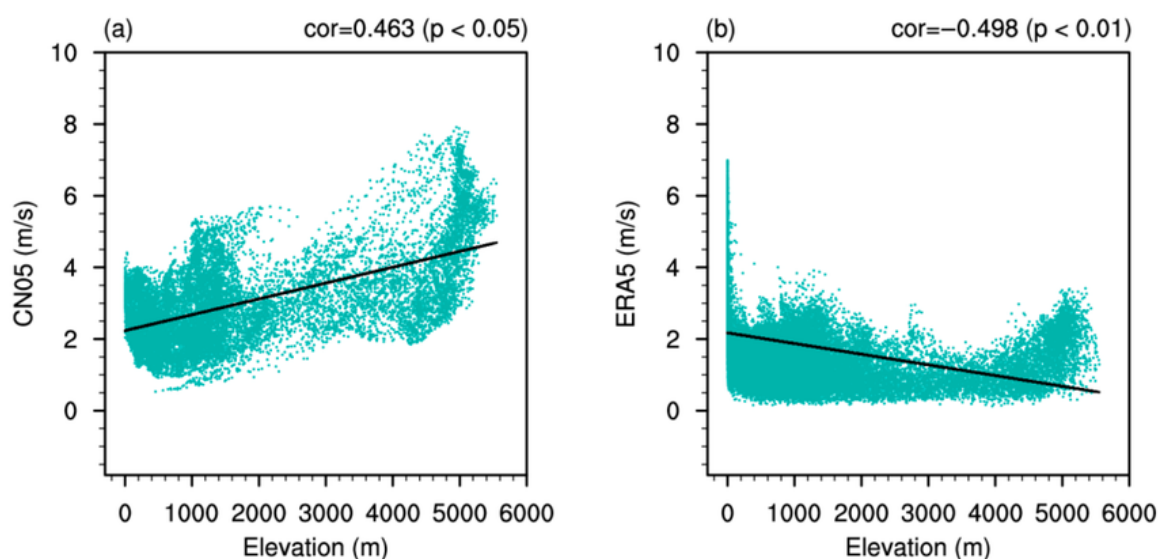
Farg'ona mintaqasida shamol energiyasi salohiyatini baholash Sentinel-1 SAR tasvirlari yordamida o'tkazildi va natijalar vodiyning markaziy yo'lagi bo'ylab shamol oqimining aniq kanalizatsiyasini aniqladi. Ushbu aerodinamik naqsh mintaqaning geomorfologiyasi bilan bevosita bog'liq bo'lib, u g'arb-sharqqa yo'naltirilgan tor tog' ichidagi tuzilma bilan tavsiflanadi. Bunday relyef geometriyasi shamol oqimining o'zgaruvchan tezlanish va sekinlashuv zonalarini yaratadi, ular atrofdagi tog' tizmalari tomonidan to'liq nazorat qilinadi. Shunga o'xshash shamol relyef o'zaro ta'siri radarga asoslangan shamol modellash tirish tadqiqotlarida hujjatlashtirilgan , bu yerda SARning orqaga tarqalishi murakkab relyefda fazoviy shamol gradiyentlarini samarali ravishda ushlaydi [3] . Farg'ona vodiysi uchun topilmalar Markaziy Osiyodagi mintaqaviy tahlillar bilan mos keladi, bu yerda SARdan olingan shamol rekonstruktsiyalari meteorologik stansiya kuzatuvlaridan ustun turadi va vodiyning kanalizatsiyaga asoslangan shamol rejimini aniq belgilaydi [4] . Mintaqadagi shamol tezligi 1-jadvalda keltirilgan.

Farg'ona vodiysida shamol tezligining relyef bo'yicha taqsimlanishi

№	Relyef zonasi	Balandligi (m)	Shamol tezligi (m/s)	Izoh
1	Markaziy tekislik (Yozyovon-Buvayda)	380–450	4.8-5.6	Kuchli kanalizatsiya effekti
2	Qishloq xo'jaligi tekisligi (Quva - Farg'ona)	350-420	3.5-4.2	Barqaror, ammo pastroq
3	Tog' etaklari (Oltiariq – Beshariq)	500-900	2.0-3.1	Turbulentlik kuchli
4	Tog' yonbag'irlari	900+	<2.0	Shamol to'silgan, soyali

1-jadvalda shamol tezligi to'liq relyefga bog'liq. Tekisliklarda shamol tezligi yuqori bo'lsa-da, tog' etaklarida Kurama tizmasining to'siq ta'siri tufayli shamol 2 m/s dan pastga tushadi.

Shamol tezligi butunlay relyefga bog'liq. Tekisliklarda shamol tezligi yuqori bo'lsa-da, tog' etaklarida Kurama tizmasining to'siq ta'siri tufayli shamol tezligi 2 m/s dan pastga tushadi. Buni 1-diagrammada ko'rishimiz mumkin.



1-diagramma. Shamol tezligi va balandlik o'rtasidagi bog'liqlik.

Ushbu diagrammada regressiya chizig'i balandlik oshishi bilan shamol tezligining aniq pasayishini ko'rsatadi ($R^2 = 0,52$). Bu bog'liqlik boshqa Markaziy Osiyo vodiylari uchun hujjatlashtirilgan shamol-relef regressiyalari bilan chambarchas bog'liq [4], bu balandlik mintaqaning aerodinamik tuzilishida muhim tartibga soluvchi rol o'ynashini tasdiqlaydi.

SARdan olingan shamol maydonlari Farg'ona vodiysidagi shamol dinamikasi relyef konfiguratsiyasi bilan kuchli bog'liqligini aniq ko'rsatib turibdi. Eng yuqori shamol tezligi Yozyovon - Buvayda qismida qayd etilgan, bu yerda geomorfologik torayish shamolning siqilishi va tezlanishiga olib keladi - bu

mexanizm ilmiy adabiyotlarda *orografik kanalizatsiya sifatida keng ta'riflanadi*. [3] . Bu ta'sir shamol tezligining 4,8 dan 5,6 m/s gacha o'zgarishiga olib keladi va vodiyning asosiy shamol yo'lagini hosil qiladi.

Aksincha, Oltiariq – Beshariq tog' oldi zonasida shamol tezligi Kurama tog' tizmasi tomonidan hosil qilingan orografik bloklanish va turbulentlik tufayli 2-3 m/s gacha pasayadi . Havo oqimining bu pasayishi Samarqand viloyati uchun qayd etilgan shamol soyasi hodisasiga juda o'xshaydi [13] , bu yerda tik tizmalar vodiylar shamollarining o'tishiga to'sqinlik qiladi va aerodinamik barqarorlikni buzadi.

Shamolning fazoviy taqsimotiga asoslanib, Farg'ona viloyatida shamol energiyasini rivojlantirish uchun eng istiqbolli sohalar quyidagilarni o'z ichiga oladi:

1. **Yozyovon – Buvayda yo'lagi** — doimiy ravishda yuqori va barqaror shamol tezligiga ega markaziy shamol yadrosi.
2. **Quva -Farg'ona tekisligi** — taqsimlangan energiya ishlab chiqarish uchun mos bo'lgan mo'tadil, ammo barqaror shamollar.
3. **Shohimardonsoy kanali** — yo'nalishli havo oqimi bilan ajralib turadigan tor geomorfologik yo'lak.

Bu hududlar barqaror va oldindan aytib bo'ladigan shamol rejimiga ega, bu ularni mikro va o'rta quvvatli shamol turbinalarini o'rnatish uchun juda mos qiladi. Ularning aerodinamik barqarorligi, qulay relyef sharoitlari bilan birgalikda, mintaqaga bo'ylab shamol energiyasini strategik joylashtirish uchun mustahkam asos yaratadi. (2- jadval)

2-jadval
Xalqaro tadqiqotlar bilan taqqoslash

№	Tadqiqot	Maydon	Shamolni yengillashtirish effekti	Ushbu tadqiqot natijasi
1	Porsuq (2016)	Shimoliy Yevropa	Kanalizatsiya → +30%	Farg'ona: +28–37%
2	Said (2020)	Qirg'iziston vodiylari	Tog' soyasi → pasayish	Farg'ona: 2 m/s dan past
3	Ruiz (2022)	Qirg'iziston tog'lari	Tekisliklar ustunlik qiladi	Farg'ona: aynan shunday

Bu taqqoslash Farg'ona vodiysining shamol energiyasi harakati butun dunyo bo'ylab tog ' ichidagi havzalarda kuzatiladigan universal aerodinamik qonunlarga amal qilishini ko'rsatadi. Vodiyning kanalizatsiyaga asoslangan tezlanish zonalari va orografik blokirovka effektlari boshqa global vodiylar tizimlarida hujjatlashtirilgan shamol oqimi mexanizmlari bilan strukturaviy jihatdan mos keladi, bu esa mintaqaning shamol dinamikasi relyef tomonidan boshqariladigan jismoniy tamoyillar bilan boshqarilishini yana bir bor tasdiqlaydi.

Farg'ona viloyatida qayta tiklanadigan energiya resurslarini kompleks baholash uchun ko'p mezonli fazoviy baholash tizimi (MCDA–AHP) yordamida energiya bilan bog'liq bir nechta ma'lumotlar to'plamlari, jumladan, quyosh

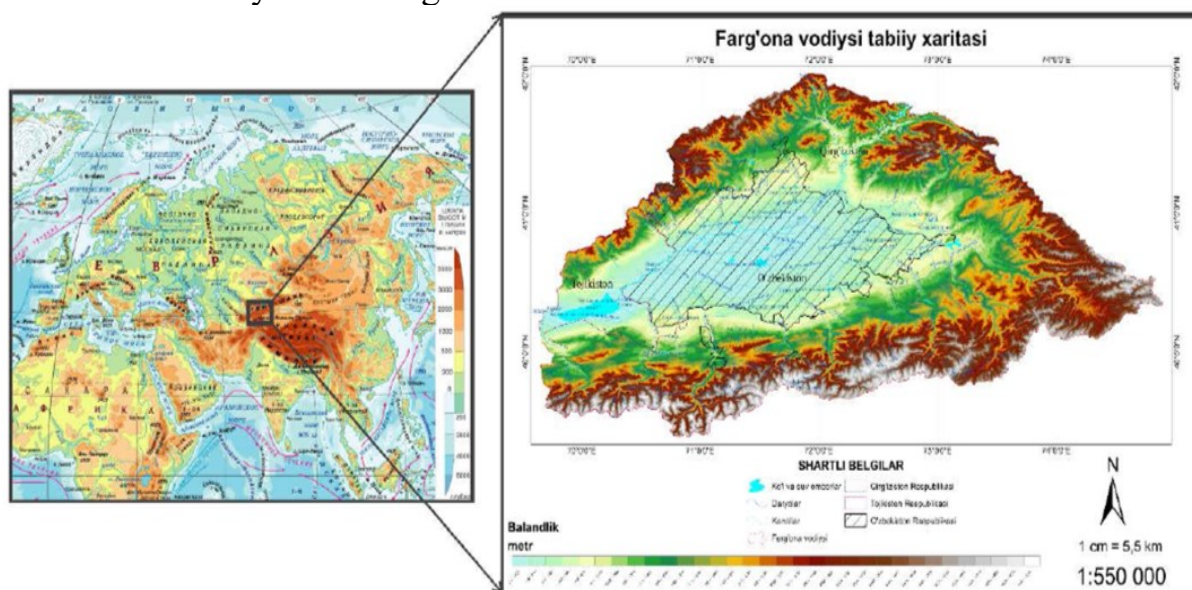
nurlanishi (GHI), shamol tezligi, relyef parametrlari (balandlik, qiyalik, aspekt), yer qoplami (LULC) va yer yuzasi harorati (LST) birlashtirildi. Ushbu integrativ yondashuv mintaqaning energiya salohiyatini yaxlit baholashni qo'llab-quvvatlaydi, bu esa radiatsion, aerodinamik va topografik ta'sirlarni bir vaqtning o'zida ko'rib chiqish imkonini beradi. Analitik ierarxiya jarayoni (AHP) mezon og'irliklarini belgilash uchun matematik asoslangan mexanizmni taqdim etadi [10], **kengroq MCDA tizimi esa geografik** modellashtirishda optimal joy tanlash uchun eng samarali va ilmiy jihatdan tasdiqlangan qarorlarni qo'llab-quvvatlash vositalaridan biri sifatida tan olingan. [9].

AHP matritsasi asosida mezonlarning og'irlik koeffitsientlari quyidagicha aniqlandi: GHI (0.35), shamol tezligi (0.25), relyef (0.20), LULC (0.12), LST (0.08). Ushbu taqsimot natijalari yuqoridagi ikkita bo'limda bayon qilingan ilmiy asosga mos keladi: tekisliklarda yuqori radiatsiya va shamolning kombinatsiyasi va tog' etaklarida ikkala parametrlarning bir vaqtning o'zida pasayishi moslik indeksida keskin farqni keltirib chiqaradi.

Har bir rastr Weighted Overlay modeli yordamida 1–5 balllik shkala bo'yicha qayta tasniflandi. Yagona moslik indeksi quyidagicha hisoblandi:

$$S = \sum W_i \cdot X_i$$

Ushbu integratsiya orqali Farg'ona viloyati qayta tiklanadigan energiya uchun uchta asosiy mos zonaga bo'lindi.



2-rasm: Farg'ona viloyatining integratsiyalashgan energiya mosligi xaritasi (MCDA asosida).

2-rasmdagi xaritada sariq-qizil ranglar yuqori moslik zonalarini, yashil ranglar o'rtacha moslikni va ko'k ranglar past moslik zonalarini bildiradi. Energiya mosligi jihatidan "eng yuqori klaster" Farg'ona- Quva - Buvayda - Yozyovon tekisliklarini qamrab oladi. Bu zonalar yuqori radiatsiya (GHI 1780–1850 kVt/m²/yil) va barqaror shamol tezligi (4,2–5,6 m/s) bilan tavsiflanadi. (3-jadval)

3-jadval
Xalqaro tadqiqotlar bilan taqqoslash

№	Moslik toifasi	Indeks diapazoni	Maydon ulushi (%)	Asosiy hududlar
1	Yuqori moslik	4.0-5.0	27%	Farg'ona, Quva, Yozyovon–Buvayda
2	O'rtacha moslik	3.0-4.0	41%	Uchko'prik , Beshariq pasttekisligi
3	Past moslik	1.0-3.0	32%	Oltiariq , yuqori Beshariq , Kurama yon bag'irlari

Quyidagi jadvalda yuqori moslik hududlari mintaqaning iqtisodiy va energetika markazlari bilan bir-biriga mos keladi. O'rtacha moslik hududlari kichik qayta tiklanadigan elektr stansiyalari uchun mos keladi, past moslik hududlari esa relyef va resurslar cheklanganligi sababli energiya infratuzilmasi uchun tavsiya etilmaydi.

Yuqoridagi qiymatlarning moslik xaritasining ilmiy talqiniga ko'ra, yuqoridagi GHI va shamol natijalariga to'liq mos keladigan integratsiyalashgan energiya moslik xaritasi quyidagi ilmiy xulosalarni beradi:

1. Tekisliklar - ikki tomonlama optimal zona.

GHI va shamolning bir vaqtning o'zida yuqori darajasi Farg'ona- Quva - Buvayda tekisliklarini mintaqadagi eng dominant energiya klasteriga aylantiradi. Bu hududlarda: radiatsiya yil davomida barqaror, shamol tarqalishi kichik, sirt qiyaligi minimal ($<1,5^\circ$), yer qoplamasi asosan qishloq xo'jaligi yerlaridan iborat (o'rnatish uchun qulay).

2. Tog'oldi zonalar - resurslar cheklovlari.

Oltiariq va Beshariqning yuqori hududlarida GHI va shamolning sinxron pasayishi moslik indeksining keskin pasayishiga olib keladi (1,8–2,5 ball). Bu quyidagilarga bog'liq: relyef soyasi (GHI –18–21%), shamolning to'siqlanishi (<2 m/s), baland qiyalik ($6-18^\circ$).

3. Tog'li zonalar — energetik jihatdan noqulay.

Kurama yonbag'irlarida bir vaqtning o'zida past radiatsiya va shamol (GHI <1600 kVt/s/m², shamol <2 m/s) bu hududlarni energiya rejalashtirishdan chetlashtiradi.

4. Xalqaro ilmiy natijalarga to'liq muvofiqlik.

Farg'ona viloyati uchun aniqlangan integratsiyalashgan yaroqlilik zonalar - quyosh nurlanishi, shamol dinamikasi va topografik tuzilishning birgalikdagi ta'siri natijasida hosil bo'lgan - butun dunyo bo'ylab boshqa yirik vodiylar tizimlarida qayd etilgan qayta tiklanadigan energiya naqshlariga kuchli strukturaviy o'xshashlikni ko'rsatadi. Energiya yaroqliligining o'xshash fazoviy konfiguratsiyalari Shimoliy Hindistonning Himoloy tog'li hududlarida [2] , Janubiy Yevropaning tog ' ichidagi havzalarida [1] , Janubiy Amerikaning And vodiylarida [11] va Qirg'izistonning tog' bilan o'ralgan vodiylarida [4] hujjatlashtirilgan .

Ushbu mintaqalararo izchillik Farg'onaning qayta tiklanadigan energiya resurslarining fazoviy tashkil etilishi global vodiy tizimlarida energiya taqsimotini shakllantiruvchi bir xil universal fizik mexanizmlar tomonidan boshqarilishini ko'rsatadi. Xususan, topografik soyalar, vodiy kanallari havo oqimi, balandlik gradiyentlari va sirt-atmosfera o'zaro ta'siri energiya mosligining yuqori darajada oldindan aytib bo'ladigan naqshlarini yaratadi. Shunday qilib, Farg'ona vodiysi xalqaro miqyosda tan olingan geomorfologik-aerodinamik qonunlarga to'liq mos keladigan energiya resurslari xatti-harakatlarini namoyish etadi, bu modellash natijalarining mustahkamligi va global asoslilikini tasdiqlaydi.

4 XULOSA

Ushbu tadqiqot Farg'ona viloyatining qayta tiklanadigan energiya salohiyatini baholash uchun ko'p manbali masofaviy zondlash ma'lumotlar to'plamlari, topografik modellash va ko'p mezonli qarorlar tahlilini birlashtirish orqali integratsiyalashgan geofazoviy asosni ishlab chiqdi. Natijalar shuni ko'rsatadiki, quyosh nurlanishi ham, shamol energiyasi ham vodiyning geomorfologiyasi bilan fazoviy jihatdan bog'liq bo'lib, GHI, qiyalik, aspekt va vodiy kanalizatsiya jarayonlari o'rtasidagi o'zaro ta'sir mintaqaning energiya landshaftini shakllantiruvchi dominant jismoniy omil bo'lib xizmat qiladi.

Quyosh nurlanishining tarqalishi aniq topografik gradiyentni ko'rsatadi: markaziy va sharqiy tekisliklar doimiy ravishda eng yuqori yillik GHI qiymatlarini (1780–1850 kVt/m²) oladi, tog' etaklari va tog' yonbag'irlari ustida soya soladigan relyef esa radiatsiyaviy kirishni 12–21% ga kamaytiradi. Bu topilmalar Farg'onaning tekisliklari minimal soyalanish, yuqori mavsumiy barqarorlik va past balandlik bilan bog'liq atmosferaning susayishi tufayli fotovoltaiklarni joylashtirish uchun eng qulay joylar ekanligini tasdiqlaydi. Sentinel-1 SAR asosidagi shamol maydonini modellash bu naqshni yanada qo'llab-quvvatlaydi, bu vodiy kanalizatsiya effekti Yozyovon – Buvayda yo'lagi orqali shamol oqimini tezlashtirishini ko'rsatadi, bu yerda shamol tezligi 4,8–5,6 m/s ga etadi. Aksincha, Oltiariq – Beshariq etaklarida orografik bloklanish shamol tezligini 3 m/s dan pastga tushiradi, bu esa shamol energiyasidan foydalanish uchun cheklangan yaroqlilikni ko'rsatadi.

GHI, shamol tezligi, DEM dan olingan relyef parametrlari, LULC sinflari va LST ni sintez qiluvchi integratsiyalashgan MCDA/AHP baholashi qayta tiklanadigan energiyani rivojlantirish uchun mustahkam fazoviy moslik xaritasini taqdim etdi. Mintaqaning taxminan **27% qayta tiklanadigan energiya qurilmalari uchun juda mos deb topildi, asosan markaziy tekisliklarda joylashgan. Hududning 41% o'rtacha moslikni namoyish etadi, bu yerda yerdan foydalanish yoki infratuzilmadagi mahalliy o'zgarishlar gibril energiya tizimlarini qo'llab-quvvatlashi mumkin. Qolgan 32 % , asosan tog' yonbag'irlari va baland relyeflar bo'ylab joylashgan bo'lib, murakkab radiatsiya yo'qotishlari, shamol mavjudligining pasayishi va noqulay topografik cheklovlar tufayli past moslikni namoyish etadi .**

radiatsion , aerodinamik va topografik jarayonlar bilan boshqarilishini tasdiqlaydi . Masofaviy zondlash tahlilini qarorlarga asoslangan geofazoviy

modellashtirish bilan integratsiya qilish orqali taklif qilingan metodologiya mintaqaviy energiya rejalashtirish va quyosh va shamol infratuzilmasini optimal joylashtirish uchun ilmiy asoslangan asos yaratadi. Natijalar siyosatchilar va energetika ishlab chiquvchilari uchun amaliy fazoviy ko'rsatmalar beradi va Farg'ona tekisliklari, xususan, Farg'ona- Quva - Buvayda - Yozyovon o'qi mintaqaning eng strategik qayta tiklanadigan energiya yo'lagini ifodalashini ko'rsatadi. Metodologik asos Markaziy Osiyodagi boshqa vodiylar tizimlariga osonlik bilan moslashtirilishi mumkin, bu uning barqaror energiyani rivojlantirish uchun kengroq qo'llanilishini kuchaytiradi.

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CLIMATE CHANGE IMPACT ON GLACIERS OF CENTRAL ASIA: WATER SCARCITY IN THE AMU DARYA AND SYR DARYA RIVER BASINS

Abstract: *The Tien Shan and Pamir glaciers, located in the high mountainous regions of Central Asia, serve as the primary water source for the Amu Darya and Syr Darya river basins. These glaciers ensure the long-term runoff of the rivers and play a vital role in supporting agriculture, hydropower generation, and drinking water supply across the region. However, rapid temperature increases driven by global climate change are causing intensive glacier melting. While this process may temporarily increase river runoff in the short term (2020–2040), it will lead to a sharp decline in water resources and a severe deepening of water scarcity in the long term (after 2050).*

This article provides a comprehensive analysis of glacier degradation in Central Asia, changes in the hydrological cycle, and the resulting water scarcity problem in the Amu Darya and Syr Darya basins. The analysis is based on scientific studies from the Scopus database (2020–2026), including hydrological modeling, satellite monitoring, and bibliometric analyses, as well as international reports from the IPCC, UNESCO, UN Water, and the World Bank.

The findings show that the Tien Shan glaciers have lost 20–30% (approximately 27% according to some estimates) of their volume over the past 50 years. Projections indicate a further reduction of 30–50% by 2040–2050 and 60–90% by 2100. In the short term, glacier melt increases summer river runoff, but in the long term, annual runoff is expected to decrease by 10–35%. Seasonal changes are also significant: winter and spring flows are increasing, while summer flows are sharply declining. These shifts are exacerbating water scarcity in the Aral Sea basin, leading to reduced agricultural productivity, decreased irrigation efficiency, lower hydropower potential, and heightened risks of transboundary water conflicts.

The results of the article highlight the need to strengthen integrated water resources management (IWRM), real-time glacier monitoring, climate adaptation strategies, and international cooperation in the region.

Keywords: *climate change, Tien Shan and Pamir glaciers, Amu Darya, Syr Darya, water scarcity, hydrological changes, sustainable management, Aral Sea basin.*

Introduction

The water resources of Central Asia are primarily formed by the melting of glaciers and snow cover in the Tien Shan and Pamir mountain ranges. These high-altitude areas are known as the “Water Towers of Central Asia” because they provide 50–80% of the long-term runoff of the Amu Darya and Syr Darya rivers. These two rivers are of critical importance for the region’s agriculture, hydropower, drinking water supply, and overall economic development.

Due to climate change, global and regional temperatures are rising 1.5–2 times faster in Central Asia than the global average, accelerating the intensive melting of glaciers. This process is fundamentally altering the hydrological cycle and changing both seasonal and long-term dynamics of river runoff.

Studies in the Scopus database (2020–2026) demonstrate a sharp increase in scientific interest regarding the impact of global warming on Central Asian glaciers. Currently, most glaciers in the region are in a state of regression. The Tien Shan glaciers have lost approximately **27% ± 15%** of their volume over the past 50 years (1961–2012 and subsequent periods). This rate is four times higher than the global average.

In the short term (2020–2040), rapid glacier melt is expected to increase river runoff, particularly in summer. However, in the long term (after 2050), glacier volume is projected to decrease by an additional 30–50% (and up to 60–80% in some models). This will lead to a 10–35% reduction in the total annual runoff of the Amu Darya and Syr Darya rivers, significant seasonal shifts (increased winter-spring flows and sharply decreased summer flows), and a deepening water scarcity crisis in the Aral Sea basin.

These changes are expected to result in declining agricultural productivity, reduced irrigation efficiency, decreased hydropower potential, drinking water supply problems, and increased risks of transboundary water conflicts.

This article, based on the latest research from Scopus and other scientific databases (Web of Science, Google Scholar), as well as international reports (IPCC, UNESCO, UN Water, World Bank), provides a comprehensive analysis of the impact of climate change on Central Asian glaciers, its hydrological consequences, and water scarcity issues in the Amu Darya and Syr Darya basins. Recommendations on sustainable water resource management and climate adaptation strategies are also provided.

Materials and Methods

This study was conducted using the **Systematic Literature Review (SLR)** method. The main objective was to comprehensively analyze the impact of climate

change on glaciers in Central Asia and the resulting water scarcity in the Amu Darya and Syr Darya river basins based on scientific sources.

Data Sources The following sources were used:

- Scopus and Web of Science (primary sources for scientific articles);
- Google Scholar (additional publications and reports);
- Official reports from international organizations: IPCC, UNESCO, UN Water, World Bank, Central Asia Regional Economic Cooperation (CAREC), and national regional reports.

The search period covered 2020–2026 (up to June 2026).

Search Strategy Keywords and combinations: “climate change” OR “global warming” AND (“glaciers” OR “glacier melt” OR “cryosphere”) AND (“Central Asia” OR “Tien Shan” OR “Pamir”) AND (“Amu Darya” OR “Syr Darya” OR “Aral Sea basin”) AND (“water scarcity” OR “water resources” OR “hydrological change” OR “runoff”).

Boolean operators, truncation, and phrase search were applied. Over 120 scientific works and reports were identified.

PRISMA guidelines were strictly followed for inclusion and exclusion criteria. As a result, **55** of the most relevant and high-quality sources were selected.

Analysis Methods

- Hydrological and geographical analysis using GIS technologies, satellite data (MODIS, Sentinel), and hydrological models (SWAT, HBV, VIC).
- Climate scenarios: IPCC RCP 4.5 (moderate) and RCP 8.5 (high).
- Trend analysis: Mann-Kendall test, statistical analysis, and bibliometric analysis.
- Regional synthesis with special focus on the Amu Darya and Syr Darya basins, distinguishing short-term and long-term impacts.

Data reliability was ensured through peer-reviewed sources and independent verification by multiple authors. Ethical issues (plagiarism and bias) were strictly observed.

Results

The study results, based on recent Scopus studies and international reports (IPCC, UNESCO, UN Water), reveal the main trends in the impact of climate change on Central Asian glaciers and hydrological changes in the Amu Darya and Syr Darya basins.

1. Glacier Degradation The Tien Shan and Pamir glaciers in Central Asia are melting 3.5–4 times faster than the global average. Over the past 50–60 years (1960–2020), the total glacier volume in the region has decreased by 20–30% (approximately $27\% \pm 15\%$ according to some estimates).

- Degradation is particularly intense in the Tien Shan, where small glaciers (area $< 1 \text{ km}^2$) are disappearing faster.
- By 2050, glacier volume is projected to decrease by 30–50%, and by 2100 by 60–90% (under RCP 8.5).

- Along with the reduction in number and area, ice thickness is also decreasing, leading to the long-term loss of the glaciers' "water tower" function.

2. Hydrological Changes Glacier melt creates a two-phase dynamic in river runoff:

- **Short-term (2020–2040):** Summer runoff of the Amu Darya and Syr Darya may increase by 10–20%.

- **Long-term (after 2050):** Annual runoff is expected to decrease by 10–35%. The change is more pronounced in the Amu Darya due to its higher glacial contribution (30–40%).

Seasonal changes are significant: winter and spring flows increase, while summer flows sharply decline. Flow variability is also rising. These trends are confirmed by SWAT, HBV models and satellite data.

3. Impact on Water Scarcity Glacier degradation is one of the main drivers of water scarcity in the Aral Sea basin. It negatively affects agriculture (potential yield loss of 15–30%), hydropower generation, drinking water supply, and increases the risk of transboundary conflicts between upstream and downstream countries.

Discussion

Climate change is fundamentally transforming the traditional "water tower" role of glaciers in Central Asia. In the short term, rapid glacier melt provides additional water volume to rivers, offering temporary relief for the current generation. However, in the long term, the disappearance of glaciers will lead to a sharp reduction in sustainable water resources for the region. The results of this study, based on Scopus data and international reports (IPCC AR6, UNESCO), show that the degradation of the Tien Shan and Pamir glaciers is causing profound changes in the hydrological system of the Amu Darya and Syr Darya river basins.

Socio-economic and Ecological Impacts The reduction in glacier volume and changes in seasonal river runoff have a significant impact on the region's key economic sectors. In agriculture, where more than 80% of irrigated lands in the region depend on the Amu Darya and Syr Darya rivers, summer water scarcity may lead to a 15–30% decrease in crop productivity. This poses a serious threat to food security and the income of the rural population.

A negative trend is also observed in the hydropower sector. The generation capacity of large hydropower plants in mountainous Kyrgyzstan and Tajikistan is declining, which limits energy supply and export opportunities. The ecological situation in the Aral Sea basin is deteriorating further, with increased soil degradation, dust storms, and public health problems (particularly respiratory diseases).

The issue of transboundary water sharing remains highly relevant. The risk of conflicts over water resources between upstream countries (Kyrgyzstan, Tajikistan) and downstream countries (Uzbekistan, Turkmenistan, Kazakhstan) is increasing. This may affect regional stability and the geopolitical situation.

Global Context The rate of glacier melt in Central Asia significantly exceeds the global average and shows similarities with the Himalayas and the

Andes. According to IPCC reports, in cases of warming above 1.5°C, changes in high-mountain areas may reach an “irreversible” level.

Limitations of the Study The main limitations of this study are as follows:

- Insufficient number of glacier and hydrological monitoring stations in the region;
- Uncertainties in some models (especially regarding the dynamics of small glaciers);
- Incomplete modeling of the interaction between climate and anthropogenic factors (excessive water withdrawal, inefficient irrigation).

Future Directions and Recommendations Taking into account the urgency of the problem, the following measures must be implemented:

- Strengthen real-time satellite and automated monitoring of glaciers and river runoff;
- Fully implement Integrated Water Resources Management (IWRM) systems;
- Widely adopt water-saving technologies in agriculture (drip irrigation, precision agriculture);
- Enhance transboundary cooperation and improve international legal mechanisms;
- Develop targeted programs for Central Asia within the framework of COP conferences and the UN Sustainable Development Goals (SDG 6 and SDG 13).

This discussion demonstrates that strategies for combating climate change and adapting to it will become a decisive factor in ensuring the long-term sustainability of the Central Asian region.

Conclusion and Recommendations

Climate change is causing rapid degradation of the Tien Shan and Pamir glaciers in Central Asia, and this process has become the main driver of water scarcity in the Amu Darya and Syr Darya river basins. Recent studies from the Scopus database and international reports (IPCC, UNESCO, UN Water) confirm that the reduction in glacier volume leads to a temporary increase in river runoff in the short term, followed by a 10–35% decrease in the long term, along with increased seasonal variability and overall water resource scarcity in the region.

As a result, a decline in agricultural productivity, reduced hydropower potential, further deterioration of the ecological situation in the Aral Sea basin, and heightened risks of transboundary water conflicts are observed. The loss of the glaciers’ “water tower” function poses a serious threat to the long-term sustainability of the Central Asian region.

Key Recommendations Considering the urgency of the problem, the following comprehensive measures must be implemented:

- **Strengthening glacier and hydrological monitoring:** Organize real-time monitoring of glaciers using satellite technologies (Sentinel, MODIS), GIS systems, and automated meteorological stations. This will enable timely forecasting of future changes.

- **Integrated Water Resources Management (IWRM) and transboundary cooperation:** Improve joint water management mechanisms in the Amu Darya and Syr Darya basins, update international agreements, and develop a regional water convention.

- **Water conservation and efficiency improvement in agriculture:** Widely introduce drip irrigation, smart irrigation, and precision agriculture technologies, and optimize water consumption on cultivated lands.

- **Climate adaptation and sustainable development projects:** Develop national climate change adaptation strategies, implement programs for glacier protection and restoration, and attract additional funding through international financial mechanisms (Green Climate Fund, World Bank).

- **Enhancing scientific research and public awareness:** Strengthen scientific cooperation in the region, train young researchers, and conduct awareness campaigns among the population on the importance of climate change and water resources.

Protecting glaciers and ensuring sustainable water resource management is not merely an environmental issue, but the key to the socio-economic stability, food security, and geopolitical stability of the Central Asian region. Only through timely, scientifically grounded, integrated, and internationally collaborative measures can we preserve water resources for future generations.

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GROUNDWATER POLLUTION AND GLOBAL WATER SCARCITY

Abstract: *Groundwater constitutes approximately 50% of the world's drinking water supply and over 40% of water used for irrigation. Although this resource is considered more stable than surface water under climate change conditions, widespread pollution caused by anthropogenic activities (agriculture, industry, urbanization), overexploitation, and climate change is significantly exacerbating global water scarcity.*

This article analyzes the causes, scale, impacts, and sustainable management solutions of groundwater pollution based on recent scientific research from the Scopus database (covering 38,759 publications between 2020 and 2026) and international reports (UN Water, UNESCO, WHO, IPCC).

The findings indicate that nitrates (primarily from agriculture), heavy metals, pesticides, salinization, and geogenic contaminants (arsenic, fluoride) are degrading groundwater quality on a global scale. When water quality issues are taken into account, the proportion of the global population facing water scarcity has risen from 30% to 40%. This situation poses a serious threat to the water and food security, health, and economic development of billions of people.

Keywords: *groundwater, pollution, global water scarcity, nitrates, salinization, sustainable management, climate change.*

Introduction

Groundwater forms a significant portion of the world's freshwater reserves and globally supplies approximately 50% of drinking water and over 40% of water used for irrigation. This resource is relatively more stable than surface water under climate change conditions because it is naturally protected by geological filters and is less affected by short-term weather fluctuations. However, rapid population growth, accelerated urbanization, intensive agriculture, and industrial activities have turned groundwater pollution and overexploitation into a critical problem.

This situation is deepening global water scarcity. Currently, approximately 4 billion people (nearly two-thirds of the world's population) experience severe

water scarcity for at least one month per year. When water quality problems (pollution) are considered, this figure becomes even higher, and many regions are said to have entered the era of “water bankruptcy.”

Research in the Scopus database (38,759 publications as of 2026) shows a sharp increase in global interest in groundwater pollution. Nitrates (from agriculture), pesticides, heavy metals, microbiological contaminants, and geogenic elements (arsenic, fluoride) stand out as the main issues. Examples from the Aral Sea basin in Central Asia, the Ganges basin in India, the Middle East (Gaza, Saudi Arabia), and Africa clearly demonstrate the urgency of this problem.

This article, based on the latest research from Scopus and other scientific databases (Web of Science, UN Water, UNESCO, IPCC), provides a comprehensive analysis of the causes of groundwater pollution, its impact on global water scarcity, regional characteristics, and opportunities for sustainable management.

Materials and Methods

This study was conducted using the Systematic Literature Review method. It covered scientific articles from 2020–2026 in the Scopus, Web of Science, PubMed, and Google Scholar databases, as well as official reports from international organizations (UN Water, UNESCO, WHO, IPCC, FAO).

Search Strategy

The following keywords and combinations were used: “groundwater pollution”, “groundwater contamination”, “groundwater quality degradation”, “aquifer pollution”, “water scarcity” AND “groundwater”, “salinization” AND “groundwater”, “nitrate pollution” AND “groundwater”. Boolean operators (AND, OR) and truncation () were applied. As of 2026, 38,759 publications were identified in Scopus. Articles published between 2020 and 2026 were selected. In addition, PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were followed for inclusion/exclusion criteria:

- Inclusion: Peer-reviewed articles in English, review and original research papers, global or regional analyses, studies focused on water quality and scarcity.
- Exclusion: Conference abstracts, articles without full text, studies focused only on surface water, and outdated data (pre-2020).

As a result, over 150 sources were reviewed, and 55 of the most relevant and high-quality studies were selected. Data synthesis was performed using narrative synthesis and bibliometric analysis methods.

Analysis Methods

- Geographical and vulnerability analysis: GIS technologies and the DRASTIC model (Depth to water, Net recharge, Aquifer media, Soil media, Topography, Impact of vadose zone, Hydraulic conductivity) were used. This model is widely applied to assess the vulnerability of groundwater to pollution.

- Statistical analysis: Publication trends, Principal Component Analysis (PCA), and descriptive statistics were used to identify trends.

- Regional examples: Special attention was given to Central Asia (Aral Sea basin), South Asia, the Middle East, and Africa.

- Data reliability: All sources were taken from peer-reviewed journals and independently verified by several authors. Ethical issues (plagiarism and bias) were taken into account.

Results

The study results, based on Scopus data and international reports (UN Water, UNESCO, WHO, IPCC), reveal the main trends in groundwater pollution.

1. Causes and Scale of Pollution

Groundwater pollution occurs as a result of the interaction between anthropogenic and geogenic factors.

- Agriculture is the primary source, accounting for 60–80% of nitrates and pesticides globally. In many regions (China, India, Europe, USA), nitrate concentrations exceed the WHO limit (50 mg/L).

- Urban and industrial activities: Septic tanks, landfills, industrial waste, and microbiological contaminants (fecal coliforms) degrade water quality.

- Geogenic factors: Arsenic (Bangladesh, India), fluoride, and salinization (Middle East, Africa) originate from natural sources.

Globally, a large portion of groundwater does not meet quality standards. In many regions, high levels of nitrates and salinization threaten drinking water safety.

2. Impact on Global Water Scarcity

Groundwater provides approximately 50% of global drinking water and over 40% of irrigation water. However:

- About 70% of the world's major aquifers are experiencing long-term depletion.

- When water quality issues are considered, the proportion of the population facing water scarcity has reached 30–40% (approximately 4 billion people experience severe scarcity for at least one month per year).

- Climate change impact: Glacier melt, increased drought, and rising sea levels are accelerating salinization in coastal aquifers.

The rate of aquifer depletion has accelerated in many places over the past decades.

3. Regional Examples

- Central Asia (Aral Sea basin): Intensive irrigation and excessive use of pesticides and fertilizers have sharply increased salinization and chemical pollution of groundwater. The Aral Sea disaster has also had a serious impact on groundwater quality.

- India and Pakistan: Over-extraction and agricultural pollution are causing rapid aquifer depletion; nitrate and arsenic levels are high.

- Africa and the Middle East: Nitrate, microbiological pollution, and geogenic salinization (arsenic, fluoride) are widespread, posing serious risks to drinking water and agriculture.

These results are confirmed by recent Scopus studies and the UN Water 2026 report.

Discussion

Groundwater pollution is one of the “hidden” and most serious drivers of global water scarcity. The results of this study, based on Scopus data and international reports (UN Water, UNESCO, IPCC), show that pollution not only reduces the quantity of water resources but also degrades their quality, further limiting usable reserves.

Impact on Health

Nitrates, heavy metals (arsenic, fluoride, lead), pesticides, and microbiological contaminants in groundwater pose serious health risks. Nitrates cause “blue baby syndrome” (methemoglobinemia) in children, while long-term arsenic exposure leads to cancer and skin diseases. Pollution from agriculture and industry increases waterborne diseases, threatening the lives of millions of people annually.

Impact on Economy and Food Security

Declining water quality also causes significant economic damage. According to studies, water quality problems can reduce GDP growth by 1.4–2.5% in some regions. Overall, water resource degradation may cause tens of trillions of dollars in annual losses to the global economy. The use of polluted groundwater for irrigation reduces crop yields, leading to food shortages and rising prices.

Link with Climate Change

Climate change intensifies the problem. Extreme weather events (heavy rainfall and drought) wash pollutants into aquifers, while rising sea levels accelerate salinization in coastal aquifers. Glacier melt and permafrost thawing alter aquifer dynamics. According to the UN “Global Water Bankruptcy” report (2026), the world has entered the era of “water bankruptcy,” where overexploitation and pollution of groundwater have reached levels that are difficult or impossible to reverse.

Limitations and Future Directions

The main limitation of this study is the lack of continuous monitoring systems and incomplete data in many regions (especially developing countries). Future research should make greater use of artificial intelligence and satellite monitoring, as well as improve regional models.

To solve the problem globally, it is necessary to strengthen international cooperation within the framework of COP conferences and the UN Sustainable Development Goals (SDG 6 — Clean Water and Sanitation), implement Integrated Water Resources Management (IWRM), introduce reuse technologies, and expand sustainable agricultural practices.

Conclusion and Recommendations

Groundwater pollution is one of the main drivers of global water scarcity. Recent studies in the Scopus database and international reports (UN Water, UNESCO, IPCC, and the 2026 Global Water Bankruptcy report) show that due to anthropogenic activities, overexploitation, and climate change, nearly 70% of

aquifers are experiencing long-term depletion, while water quality is severely declining due to nitrates, heavy metals, salinization, and microbes.

As a result, approximately 4 billion people (nearly two-thirds of the world's population) face problems of water scarcity and quality. This situation poses a serious threat to public health, food security, economic growth, and ecological sustainability. The world has entered the era of "water bankruptcy," and the recovery of many aquifers has become difficult or impossible.

Key Recommendations

The following comprehensive measures are necessary at global and regional levels:

- Strengthen monitoring and scientific assessment: Implement GIS technologies, the DRASTIC model, and real-time monitoring systems based on artificial intelligence to timely identify aquifer vulnerability.
- Waste management and pollution prevention: Ensure efficient use of fertilizers and pesticides in agriculture, expand wastewater treatment plants for industrial and urban waste, and modernize septic systems.
- Sustainable water resources management (IWRM): Promote artificial recharge of aquifers, water reuse technologies, desalination projects, and virtual water trade.
- Climate change adaptation and international cooperation: Strengthen global cooperation within COP conferences and SDG 6, especially joint management of transboundary aquifers in Central Asia (Aral Sea basin), South Asia, and the Middle East.
- Political and social measures: Enact strict legislation, raise public awareness, and introduce sustainable agricultural practices (precision agriculture).

Protecting groundwater is not only an environmental issue but also the key to global water security, food security, and economic sustainability. Only through an integrated, science-based, and internationally collaborative approach can we preserve clean groundwater for future generations.

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BUXORO VILOYATI SHAROITIDA G'O'ZA MAHSULDORLIGIGA ZOVUR SUVLARI BILAN SUG'ORISHNING TA'SIRI

Annotatsiya. Mazkur maqolada Buxoro viloyati sharoitida g'o'za ekinini zovur suvlari bilan sug'orishning hosildorlikka, o'simlikning o'sishi va rivojlanishiga ta'siri o'rganilgan. Tadqiqot davomida zovur suvlari tarkibining tuproqning agroximik xususiyatlariga hamda g'o'zaning vegetativ va generativ rivojlanishiga ta'siri baholangan. Sug'orishning turli variantlari taqqoslanib, hosildorlik ko'rsatkichlari, suvdan foydalanish samaradorligi va iqtisodiy natijalar tahlil qilingan. Olingan natijalar zovur suvidan me'yor asosida foydalanish suv resurslarini tejash, sug'orish samaradorligini oshirish va g'o'za hosildorligini barqaror saqlash imkonini berishini ko'rsatdi. Tadqiqot natijalari suv tanqisligi sharoitida qishloq xo'jaligida muqobil suv manbalaridan samarali foydalanish bo'yicha ilmiy-amaliy tavsiyalar ishlab chiqishga xizmat qiladi.

Kalit so'zlar: g'o'za; zovur suvlari; sug'orish; hosildorlik; suvdan foydalanish samaradorligi; tuproq sho'rlanishi; Buxoro viloyati; agrotexnologiya; suv resurslari

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THE EFFECT OF IRRIGATION WITH DRAINAGE WATER ON COTTON YIELD UNDER THE CONDITIONS OF THE BUKHARA REGION

Annotation. This article investigates the effect of irrigation with drainage water on cotton productivity under the conditions of the Bukhara region. The study evaluates the influence of drainage water quality on soil agrochemical properties, plant growth, and cotton development. Different irrigation treatments were compared to assess yield performance, water use efficiency, and economic effectiveness. The results indicate that the rational use of drainage water can improve irrigation efficiency, conserve freshwater resources, and maintain stable cotton productivity under water-scarce conditions. The findings provide scientific and practical recommendations for the efficient utilization of alternative water resources in sustainable agricultural production.

Keywords: cotton; drainage water; irrigation; yield; water use efficiency; soil salinity; Bukhara region; water resources

Kirish

Buxoro viloyatida suv tanqisligi sharoitida zovur suvlaridan foydalanish zaruriyati tug'ilmoqda. Biroq, bu suvlar tarkibidagi zararli moddalar g'o'zaning fiziologiyasi va hosildorligiga salbiy ta'sir ko'rsatadi. Ushbu tadqiqotda zovur suvining tarkibi, shuningdek, g'o'zani navbatlab (turli tartibda) ariq va zovur suvlari bilan sug'orish usullarining ta'siri o'rganildi.

Adabiyotlar tahlili

Suv resurslarining cheklanishi va iqlim o'zgarishi sharoitida qishloq xo'jaligida muqobil suv manbalaridan samarali foydalanish dolzarb ilmiy-amaliy masalalardan biri hisoblanadi.

Xorijiy tadqiqotchilar tomonidan olib borilgan ilmiy izlanishlarda ham drenaj va qayta foydalaniladigan sug'orish suvlari suv tanqis hududlarda muhim alternativ manba sifatida e'tirof etilgan.

Respublikamiz olimlari tomonidan olib borilgan tadqiqotlarda zovur suvlaridan foydalanishning samaradorligi suvning minerallashuv darajasi, tuproqning mexanik tarkibi, sizot suvlari sathi hamda qo'llanilayotgan agrotexnik tadbirlar bilan uzviy bog'liqligi qayd etilgan.

Tadqiqot obyekti

Buxoro viloyati tabiiy-iqlim sharoiti yuqori harorat, bug'lanishning kuchliligi hamda tuproqlarning turli darajada sho'rlanishi bilan tavsiflanadi. Ushbu hududda chuchuk suv resurslarining cheklanganligi sababli zovur suvlaridan foydalanishning ilmiy asoslarini ishlab chiqish alohida ahamiyat kasb etadi. Biroq mavjud ilmiy ishlarda aynan Buxoro viloyati sharoitida zovur suvlari bilan sug'orishning g'o'za hosildorligiga ta'siri, suvdan foydalanish samaradorligi va iqtisodiy natijalari yetarli darajada kompleks baholanmagan.

Tajriba o'tkazish usullari

Tajriba Buxoro viloyatining o'rtacha sho'rlangan tuprog'ida, "Buxoro-102" navi bilan o'tkazildi. Sug'orish variantlari: I - Faqat ariq suvi (nazorat); II - Faqat zovur suvi; III - 1-2-suv zovur, 3-4-suv ariq suvi; IV - 1-2-suv ariq, 3-4-suv zovur suvi. Zovur va ariq suvlari gidrokimyoviy tahlil qilindi. Fiziologik (barg suv potentsiali, transpiratsiya, fotosintez, ion tarkibi) va hosildorlik ko'rsatkichlari (hosildorlik, tola sifati) baholandi.

Sug'orish uchun ishlatilgan ariq va zovur suvlarining gidrokimyoviy tarkibi o'rganildi. Namuna olish sug'orishlar oldidan amalga oshirildi. Tahlillar O'zbekiston Qishloq xo'jaligi vazirligi huzuridagi suv resurslari sifatini nazorat qilish laboratoriyasida standart uslublar bo'yicha olib borildi: * pH: Vodorod indeksi. * Ammiak (NH_4^+): Kolorimetrik usul. * Nitrit (NO_2^-) va Nitrat (NO_3^-): Kolorimetrik usul. * Umumiy qattqlik: Titrlash usuli (m eq/dm^3). * Quruq qoldiq: Bug'lash usuli (mg/dm^3). * Sulfatlar (SO_4^{2-}): Gravimetrik usul (mg/dm^3). * Xloridlar (Cl^-): Nitratometri va Mohr usuli (mg/dm^3). * Temir (Fe), Mis (Cu), Sink (Zn): Atom-absorbsion spektrofotometriya (mg/dm^3).

O'tkazilgan tajriba Natijalar Fisherning ANOVA usuli asosida statistik tahlillar o'tkazilib quyidagi natijalar 1-jadvalda keltirilgan.

1-jadval

Sug'orish suvlarining gidrokimyoviy tarkibi (o'rtacha qiymatlar)

Ko'rsatkich	O'lchov birligi	Ariq Suyu (Variant I)	Zovur Suyu (Variant II, III, IV)	Me'yor (O'zbekiston Standarti)
Ph		7.5 ± 0.1^a	7.8 ± 0.1^b	6.5 - 8.5
Ammiak (NH_4^+)	mg/dm ³	<0.1	0.3 ± 0.1	<0.2
Nitrit (NO_2^-)	mg/dm ³	<0.01	0.02 ± 0.01	<0.05
Nitrat (NO_3^-)	mg/dm ³	5.5 ± 0.5	8.2 ± 0.7	<10
Umumiy qattiqlik	m eq/dm ³	5.8 ± 0.3^a	15.2 ± 0.6^b	<10
Quruq qoldiq	mg/dm ³	450 ± 25^a	2800 ± 150^b	<1000
Sulfatlar (SO_4^{2-})	mg/dm ³	120 ± 10^a	700 ± 40^b	<300
Xloridlar (Cl^-)	mg/dm ³	150 ± 15^a	950 ± 50^b	<350
Temir (Fe)	mg/dm ³	0.1 ± 0.05	0.5 ± 0.1	<0.3
Mis (Cu)	mg/dm ³	<0.01	0.05 ± 0.01	<0.1
Rux (Zn)	mg/dm ³	<0.05	0.15 ± 0.02	<0.1

Jadvalda ko'rinib turibdiki zovur suvi pH jihatidan biroz ishqoriyroq, umumiy qattiqligi, quruq qoldig'i, xloridlar, sulfatlar va ba'zi metallar (temir, mis, sink) konsentratsiyasi bo'yicha O'zbekiston Respublikasi sug'orish suvi sifatining me'yorlaridan sezilarli darajada yuqori ekanligi aniqlandi. Ariq suvi me'yorlarga yaqin, sifatli suv hisoblanadi.

2-jadval
G'o'zaning fiziologik ko'rsatkichlariga
sug'orish usullarining ta'siri o'rganish

Ko'rsatkich	I (Ariq Suvi)	II (Faqat Zovur Suvi)	VIII (Zovur-Ariq Tartibi)	IV (Ariq-Zovur Tartibi)	P-qiymati
Barg suv potentsiali (MPa) (gullash fazasida)	-0.75 ^a	-1.95 ^d	-1.30 ^c	-0.95 ^b	<0.001
Transpiratsiya tezligi (mg/dm²/soat) (ertalab)	25.2 ^a	10.5 ^d	16.8 ^c	21.5 ^b	<0.001
Fotosintez intensivligi (μmol CO₂ m⁻²s⁻¹)	22.8 ^a	9.8 ^d	14.5 ^c	19.8 ^b	<0.001
Xlorofill miqdori (mg/g TM)	2.10 ^a	1.20 ^d	1.55 ^c	1.90 ^b	<0.001
Barglardagi Na⁺ konsentratsiyasi (mmol/kg TM)	4.5 ^a	35.2 ^d	22.5 ^c	12.8 ^b	<0.001
Barglardagi Cl⁻ konsentratsiyasi (mmol/kg TM)	8.2 ^a	40.5 ^d	27.8 ^c	15.5 ^b	<0.001
Barglardagi K⁺ konsentratsiyasi (mmol/kg TM)	55.0 ^a	28.5 ^d	38.2 ^c	48.5 ^b	<0.001

2-jadvaldagi tajriba natijalaridan ko'rinib turibdiki eng kuchli salbiy ta'sir faqat zovur suvi bilan sug'orish (Variant II) natijasida kuzatildi: barg suv potentsiali sezilarli pasaydi (-1.95 MPa), transpiratsiya va fotosintez intensivligi, xlorofill miqdori keskin kamaydi. Barglardagi Na⁺ va Cl⁻ ionlari konsentratsiyasi rekord darajada oshib, K⁺ va Ca²⁺ miqdori kamaydi. Eng yaxshi natijalar nazorat variantida (Variant I) kuzatildi. Navbatlab sug'orish variantlari (III va IV) orasida, ariq suvi bilan sug'orishning keyingi bosqichda (3-4-suvlash) qo'llanilgan Variant IV (Ariq-Zovur Tartibi) eng yaxshi natijalarni berdi.

Natijalar

Fiziologik va hosildorlik ko'rsatkichlarini baholashda o'tkazilgan tajribalardan ilmiy natijalar quyidagicha aniqlandi Navbatlab sug'orish variantlari orasida, Variant IV (Ariq-Zovur Tartibi) eng yaxshi natijalarni berdi. Bunda paxta xomashyosi hosildorligi 34.0 s/ga, bu nazoratga nisbatan 11.7% ga kam, ammo Variant II ga nisbatan 74.4% ga ko'pdir. Tola uzunligi 30.5 mm, mustahkamligi 40.0 cN/tex bo'lib, bu ham Variant II ga nisbatan yaxshiroq ekanligi tajribalar o'tkazishda aniqlandi.

MUHOKAMA

Ushbu tadqiqot natijalari shuni tasdiqlaydiki, Buxoro viloyati sharoitida sug'orishda zovur suvlaridan foydalanish g'o'zaning fiziologik jarayonlari va hosildorligiga sezilarli salbiy ta'sir ko'rsatadi. Zovur suvidagi yuqori tuz miqdori, ayniqsa, xloridlar, sulfatlar va ishqoriy-yer metallarining ko'pligi, sug'orish suvi

sifatining me'yorlaridan ancha chetlanishi, o'simlikda quyidagi oqibatlariga olib keladi:

Osmotik Stress

Zovur suvining yuqori tuzliligi sababli ildiz tizimidan suv yutish qiyinlashadi (suv potentsiali pasayadi), bu esa transpiratsiya va fotosintezning susayishiga olib keladi.

Oziqa Moddalar Balansining Buzilishi

Sho'r suv tarkibidagi ortiqcha kationlar (Na^+ , K^+ , Ca^{2+}) o'simlik uchun muhim bo'lgan boshqa kationlarning (K^+ , Ca^{2+}) o'zlashtirilishiga xalaqit beradi, bu esa oziqa moddalar muvozanatini buzadi.

XULOSA

Olib borilgan tadqiqotlar natijasida Buxoro viloyati sharoitida g'ozani zovur suvlari bilan sug'orishning o'simlikning o'sishi, rivojlanishi va hosildorligiga sezilarli ta'sir ko'rsatishi aniqlandi. Tadqiqot davomida zovur suvi va chuchuk sug'orish suvlarining fizik-kimyoviy ko'rsatkichlari o'rganilib, zovur suvida mineral tuzlar, quruq qoldiq, xlorid va sulfat ionlari miqdori nisbatan yuqoriroq ekani qayd etildi. Shunga qaramasdan, zovur suvlaridan me'yoriy va ilmiy asoslangan sug'orish rejimlarida foydalanilganda g'ozaning o'sishi va hosildorligi keskin pasaymasligi kuzatildi

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EPIDEMIOLOGICAL FEATURES OF MENINGOENCEPHALITIS IN CHILDREN: A REVIEW

Abstract. *Meningoencephalitis remains one of the most severe infectious diseases affecting the central nervous system in children and is associated with significant morbidity and mortality worldwide. Despite advances in vaccination, antimicrobial therapy, and intensive care, meningoencephalitis continues to pose a major public health challenge. The epidemiology of pediatric meningoencephalitis varies according to geographic region, age, vaccination coverage, and the prevalence of infectious agents. Viral pathogens remain the leading cause of the disease, while bacterial and less commonly fungal or parasitic agents contribute to severe clinical outcomes.*

Keywords: *meningoencephalitis, children, epidemiology, viral encephalitis, bacterial meningitis, central nervous system infections, risk factors, pediatric infectious diseases.*

Introduction

Meningoencephalitis is an inflammatory disease involving both the meninges and brain parenchyma, resulting from various infectious and noninfectious causes. Pediatric meningoencephalitis remains a significant cause of hospitalization, neurological disability, and mortality worldwide [1]. The incidence and etiological spectrum of meningoencephalitis differ considerably across regions and age groups. Improvements in vaccination programs have significantly reduced the burden of some bacterial pathogens; however, viral agents continue to account for the majority of cases in children [2].

The global incidence of meningoencephalitis varies from 5 to 30 cases per 100,000 children annually, depending on geographical location and surveillance systems [3]. In high-income countries, vaccination against *Haemophilus influenzae* type b, *Streptococcus pneumoniae*, and *Neisseria meningitidis* has dramatically reduced bacterial meningoencephalitis. Consequently, viral pathogens have become the predominant etiological agents [4]. In developing countries, bacterial infections remain a major cause of severe disease because of limited vaccine coverage and delayed access to healthcare [5].

The causative agents of meningoencephalitis vary according to age and epidemiological setting

Viral Etiology

Viruses are responsible for most pediatric meningoencephalitis cases worldwide. Common viral pathogens include: Enteroviruses, Herpes simplex virus (HSV);, Varicella-zoster virus (VZV), Epstein-Barr virus (EBV);

Human herpesvirus 6 (HHV-6), Arboviruses [2]. Herpes simplex virus type 1 remains one of the leading causes of severe sporadic encephalitis in children and is associated with substantial neurological sequelae if untreated [6].

Bacterial Etiology

The most important bacterial pathogens include: Neisseria meningitides, Streptococcus pneumoniae; Haemophilus influenzae type b; Listeria monocytogenes (particularly in neonates) [4]. Although bacterial causes account for a smaller proportion of cases, they are associated with higher mortality rates and long-term neurological complications.

Age-Related Epidemiological Characteristics

The epidemiological profile of meningoencephalitis differs significantly according to age.

Neonates

In newborns, the most common pathogens include: Group B streptococci, Escherichia coli, Herpes simplex virus [7].

Infants and Young Children

Enteroviruses and herpesviruses predominate among infants and preschool children, while bacterial infections remain an important cause of severe disease in unvaccinated populations [5].

School-Aged Children and Adolescents

Among older children, viral etiologies become increasingly common, particularly enteroviruses and arboviruses. Travel-related and vector-borne infections may contribute to regional outbreaks [3].

Several factors influence the risk of developing meningoencephalitis in childhood: young age. incomplete vaccination, immunodeficiency, malnutrition, chronic medical conditions, exposure to infected individuals, residence in endemic areas [1]. Environmental and socioeconomic factors also play an important role in disease transmission and outcomes.

Seasonal and Geographic Variations

The epidemiology of pediatric meningoencephalitis demonstrates significant seasonal variation. Enteroviral infections typically peak during summer and early autumn, whereas respiratory viruses associated with encephalitis are more common during winter months [6]. Geographical differences influence pathogen distribution. Arboviral encephalitis is more frequently reported in tropical and subtropical regions, while tick-borne encephalitis remains endemic in parts of Europe and Asia [2].

Public Health Importance and Prevention

Vaccination remains the most effective preventive strategy against many causes of pediatric meningoencephalitis. Immunization against Haemophilus influenzae type b, pneumococcal infection, meningococcal disease, measles,

mumps, rubella, and varicella has substantially reduced disease incidence worldwide [4,8].

Additional preventive measures include: early recognition of symptoms, timely antimicrobial treatment, infection control measures, public health surveillance programs [5,9].

Conclusion

Meningoencephalitis continues to represent a significant cause of morbidity and mortality among children worldwide. The epidemiological characteristics of the disease are influenced by age, geographical location, vaccination coverage, and etiological factors. Viral pathogens currently account for the majority of cases, while bacterial infections remain associated with severe outcomes. Continued surveillance, vaccination programs, and improved diagnostic capabilities are essential for reducing the burden of pediatric meningoencephalitis and improving patient outcomes.

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TEKNIKUMLARDA “MUHANDISLIK VA KOMPYUTER GRAFIKASI” FANIDAN OLIMPIADA VA TANLOVLARDA ISHTIROKI ORQALI O‘QUVCHILARNING MUSTAQIL ISHLARINI FAOLLASHTIRISH

Annotatsiya: Maqolada o'quvchilarning mustaqil ishlarini faollashtirishga olimpiada va tanlovlarda ishtirok etishning ta'siri ko'rib hiqiladi. Zamonaviy kasb-hunar ta'limiga qo'yilayotgan yuksak talablar mutaxassislar tayyorlashda o'ziga xos tuzatishlar kiritadi, yangi pedagogik texnologiyalarni joriy etishni taqozo etadi.

Kalit so'zlar: grafik trening, muhandislik grafikasi, chizma geometriya, prototiplash, mustaqil ish, olimpiada. программы, pedagogika, graficheskaya podgotovka, injenernaya grafika, nachertatel'naya geometriya, prototipirovanie, samostoyatel'naya rabota, olimpiada.

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ACTIVATION OF INDEPENDENT WORK OF STUDENTS THROUGH PARTICIPATION IN OLYMPIADS AND COMPETITIONS IN THE SUBJECT OF “ENGINEERING AND COMPETITION GRAPHICS” IN TECHNICAL COLLEGES

Abstract: The article examines the impact of participation in competitions on the activation of students' independent work. The high demands placed on modern vocational education require specific adjustments in the training of specialists and the introduction of new pedagogical technologies.

Keywords: graphic training, engineering graphics, drafting geometry, prototyping, independent work, olympiad. программы, pedagogy, graphic training, engineering graphics, drafting geometry, prototyping, independent work, olympiad.

Muhandislik va kompyuter grafikasi fanini o'qitishda jahonning yetakchi univetsitetlapida yangi texnologiyalapdan foydalanib, soha mutaxassisliklapini

tayyoplashda, gرافik dasturlap opqali tushuntirish hamda ta'limning ishlab chiqarish bilan integratsiyasini kuchaytirish, bo'lajak muhandislapda loyihalash madaniyati pivojlanishida asosiy omil hisoblanadi.

Pivojlangan mamlakatlarda individual mashinalar emas, balki yapatilayotgan mashinalarning talab dapajasida ishlashini ta'minlaydigan texnik tizimlar yapatilmoqda. Ushbu yapatilgan tizimlar tobora mupakkablashib, bu esa, o'z navbatida, bo'lajak muhandislar ishidagi o'ziga xos yangi o'zgarish va muammolarni keltirib chiqarmoqda. Ya'ni yangi texnologiyalarni ishlab chiqarishda qo'llanilishi, tuzilishi, ish chizmalari haqida umumiy ma'lumotlarga to'liq ega bo'lmaslik va gرافik dasturlarni ta'lim olish jarayonlarida qo'llab loyihalar hamda gرافik ishlarini bajarimaslik natijasida yuqoridagi sanab o'tilgan muammolarni keltirib chiqarmoqda. Muhandislar juda ko'p ma'lumotlar bilan ishlashlariga to'g'ri keladi. Masalan: alohida ob'ekt, ishlab chiqarish texnologiyasi tizimini loyihalash uchun zarur bo'lgan ma'lumotlar miqdori juda katta. Eski usullardan foydalangan holda mupakkab texnik tizimlarni yapatish deyarli imkonsiz. Zamonaviy axborot texnologiyalaridan, kompyuter gرافikasidan foydalanishni o'z ichiga olgan yangi yondashuvlar, usullar, loyiha vositalari zarur. Zamonaviy muhandislar qo'yiladigan talablardan biri bu yuqori mahsulotlikka ega kompyuterlar bilan ishlay olish, ish muhiti hamda eng asosiysi ushbu tizimlardan foydalanish qobiliyati hisoblanadi.

Hozirgi vaqtda o'quvchilarning mustaqil ishi haqida savol ko'pincha ko'tariladi - qanday qilish kerak, qanday qiziqish kerak, qanday nazorat qilish kerak. Doimiy ravishda xodimlarni qisqartirish haqida gap boradi auditoriya soatlari va mustaqil ish uchun ko'paytirish soatlari. Grafik dasturlarda vazifalar bajariladigan va ko'pincha mualliflikni aniqlashning iloji bo'lmagan grafik fanlar jarayonida asarlarning plagiatlari sodir bo'ladi. SHuning uchun amaliy mashg'ulot darslari va yuzma-yuz maslahatlashuvlardan foydalanamiz tugallangan vazifalarni himoya qilish iborat ekanligini takidlaymiz.

O'quvchilarning turli olimpiadalari va tanlovlarida qatnashish O'quvchi darajasida, kredit olish bilan bog'liq bo'lmagan vazifalarni mustaqil tushunish uchun qiziqtirish kerak.

Ya'ni mavzu va boshqalarga qaraganda tezroq harakat qilish istagi paydo bo'ladi. Buni aniqlash uchun ulardan biz dastlab OTM muassasalari ichidagi fan olimpiadalarini o'tkazamiz. O'quvchilarning ilmiy-tadqiqot ishlari tanlovlarda qatnashishni o'z ichiga oladi, lekin faqat g'alabalar uchun imkoniyat yetarli xolos. Raqobat vazifalari har doim o'quvchilar fanni o'rganish jarayonida duch keladigan vazifalarga qaraganda ancha qiyinroq, va agar biror kishi kurs doirasida qat'iy o'tsa, u boshqa OTM muassasalari o'rtasidagi olimpiadada ham hech qachon g'alaba qozona olmaydi, undan yuqori daraja. Ko'pincha, berilgan topshiriqlarni bajarish uchun grafik muharriri kursda ishlatilganidan ko'ra chuqurroq bilish talab qilinadi.

Fan olimpiadalarida 3D printerda poliamid kukunli bosib chiqarishni ishlab chiqarish uchun ishlab chiqilishi kerak, printerda chop etishda harakatlanuvchi qismlar ishlashi uchun umumiy o'lchamlar, materiallar sarfi va kerakli bo'shliqlar

nazarda tutilgan. KOMPASda ishlab chiqarilgan qulfning modeli, ko'rsatilgan xuddi shu qulf, 3D printerda qilingan.

CHizma geometriya va muhandislik grafikasida birinchi yilda kompyuter grafikasi yoki uchinchi yilda bizning ish dasturlarimiz KOMPAC 3D V16 da allaqachon mavjud chizmalarga muvofiq qismlar va yig'ilishlar modellarini bajarishni ta'minlaydi. Tugallangan topshiriq natijasida O'quvchilar ESKD ga muvofiq modellarni modellashtirish va modellardan chizmalar yaratish imkoniyatiga ega bo'ladilar.

Xuddi shu o'quvchilar yig'ish birliklarini modellashtirish bo'yicha olimpiadada qatnashdilar, bu erda ular yuqori o'rinlarga chiqmadilar, lekin tegishli xulosalar chiqarishdi. Ushbu nominatsiyada topshiriq ular tomonidan o'rganilgan kursning maqsadlariga to'liq mos keladi. Mavzu - chizmaga muvofiq qismlarni yaratish, yig'ish modelini yig'ish va chizmalar, lekin vaqt cheklangan. Va bu erda yana asosiy rol hisoblanadi. KOMPAS 3D V17 versiyasi avvalgilaridan juda farq qiladi. To'g'ridan-to'g'ri interfeysgacha.

Zamonaviy kasb-hunar ta'limiga qo'yilayotgan yuksak talablar mutaxassislar tayyorlashda o'ziga xos tuzatishlar kiritadi, yangi pedagogik texnologiyalarni joriy etishni taqozo etadi. Texnika va yondashuvlar. Ilgari yoshlarga ma'lum bo'lmagan ma'lumotlar juda keng.

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USHLAGICHLI MEXANIZMLARNING KINEMATIK ANALIZIDA AutoCAD DASTURIDAN FOYDALANISH

***Аннотация:** Maqolada talabalarning mustaqil ishlarini autocad dasturidan foydalanishda ta'siri ko'rib chiqiladi. Tezliklar planini AutoCAD dasturi yordamida chizishda talabalar dasturni o'rganishadi.*

***Калит сўзлар:** mexanizm, mashina, tezlik, grafik trening, muhandislik grafikasi, chizma geometriya, prototiplash, mustaqil ish, программы, педагогика, графическая подготовка, инженерная графика, начертательная геометрия, самостоятельная работа.*

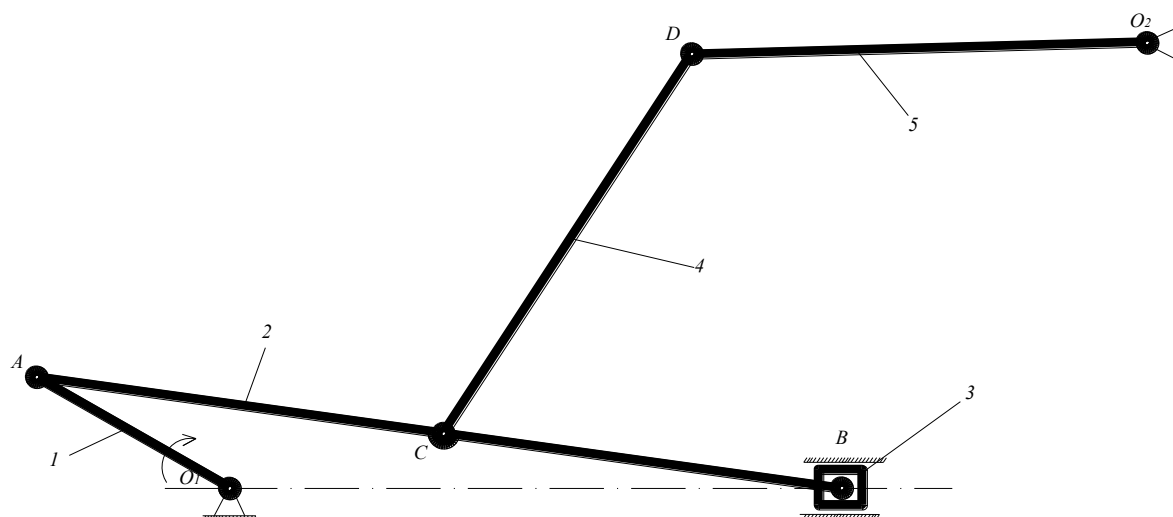
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USING AUTOCAD IN KINEMATIC ANALYSIS OF LOCKING MECHANISMS

***Abstract:** The article examines the impact of students' independent work on using AutoCAD. Students learn the program by drawing a velocity plot using AutoCAD.*

***Key words:** mechanism, machine, speed, graphic training, engineering graphics, drawing geometry, prototyping, independent work, programmy, pedagogy, graphic training, engineering graphics, independent work.*

Ma'lumki Mexanizm va mashinalar nazariyasini kinematik analizini asosiy maqsadlari mexanizm bo'g'inlarini tezligini topish kerak bo'ladi. Buning uchun talabalarga mexanizimning kinematik sxemasi, hamma bo'ginlarining o'lchamlari va kirish bo'g'inning harakat qonuni beriladi.



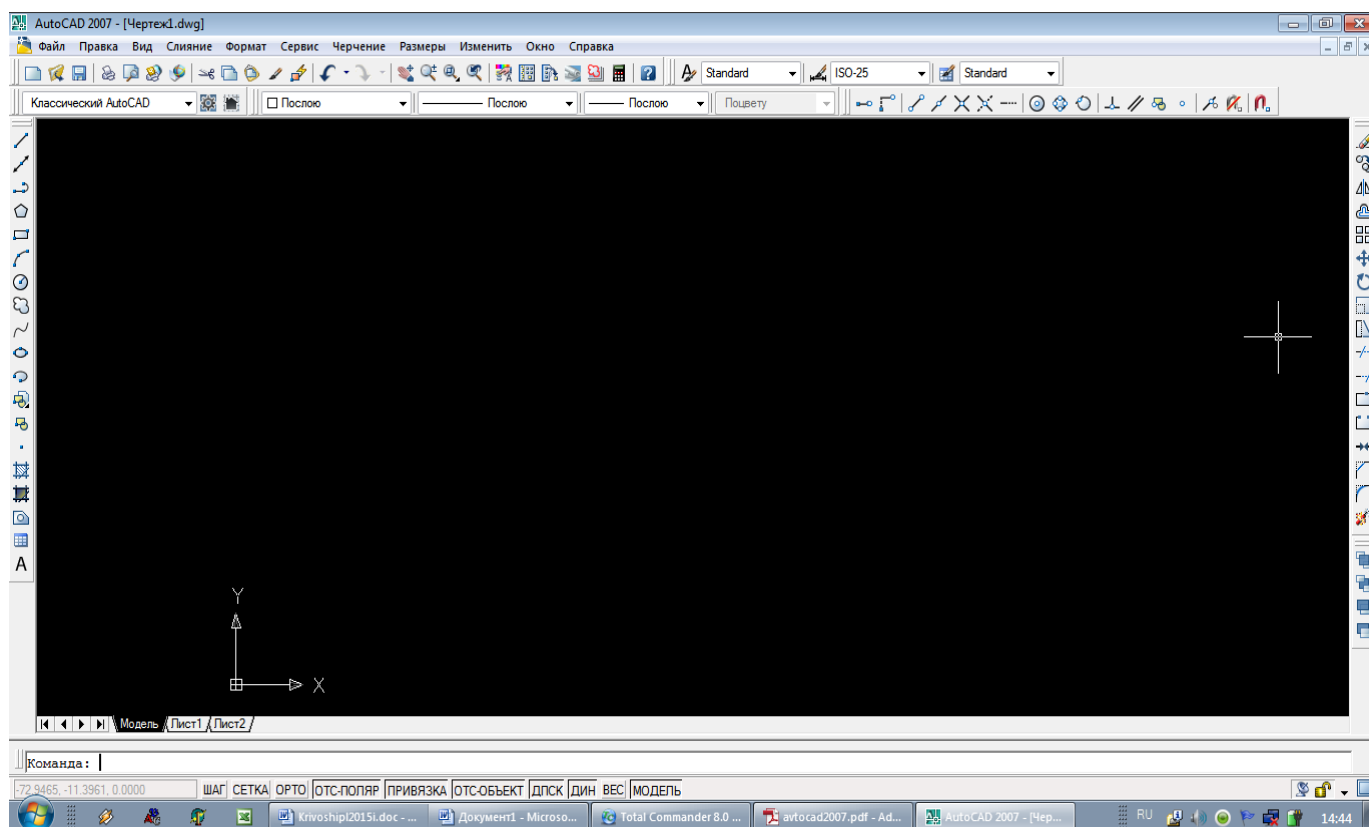
1 – rasm

Talab qilanadi : tezlikar planini qurish. Bu fanni topshirig'idan kelib chiqib an'anaviy yoki avtoCAD dasturi yordamida amalga oshiriladi.

Buning uchun vektor tenglamalar tuzish lozim bo'ladi.

- $$\vec{V}_A = \vec{V}_{O_1} + \vec{V}_{AO_1}$$
- 1) $\vec{V}_A = 0 \perp AO_1$ Krivoship nuqtalari uchun
- $$\vec{V}_B = \vec{V}_A + \vec{V}_{BA}$$
- 2) $\perp BA$ Shatun nuqtalari uchun
- $$\vec{V}_B = \vec{V}_X + \vec{V}_{BX}$$
- 3) $\vec{V}_B = 0 \parallel X$ Polzun nuqtalari uchun
- $$\vec{V}_D = \vec{V}_C + \vec{V}_{DC}$$
- 4) $\perp DC$ Tortkich nuqtalari uchun
- $$\vec{V}_D = \vec{V}_{O_2} + \vec{V}_{DO_2}$$
- 5) $\vec{V}_D = 0 \perp DO_2$ Koromisli nuqtalari uchun

Har bir vektor tenglama ikkita skalyar tenglamani ekvivalenti bo'ladi., chunki unda vektorlarni yonalishida ham aniq bo'ladi. Demak bitta vektor tenglamadan ikkita noma'lumlikni topish mumkin, ya'ni yo'nalishini va qiymatini.



Chiziq belgisi yordamida to'g'ri chiziq chizish qoidasi

1. Kompyuter ekranining chap tomonida joylashtirilgan ushbu belgi ustiga kursor keltirilib, «sichqoncha»ning chap tugmasi 1 marta bosiladi.

2. So'ngra boshlang'ich nuqta joylashtiriladi. Buning uchun ekrandagi chiziladigan Formatning kerakli joyiga kursor keltiriladi va «sichqoncha»ning chap tugmasi 1 marta bosiladi. Demak, boshlang'ich nuqta joylashtirildi.

3. «Sichqoncha» yordamida nuqta tanlanib, undan chiziqqa yunalish beriladi. Bunda klaviaturaning F 8 tugmasidan foydalanib, chiziqqa faqat yotiq , faqat tik yoki istalgan yo'nalishlar berilishi mumkin.

4. Chiziqqa kerakli uzunlik (masalan, 10, 200, 4000,... mm hisobida) beriladi va klaviaturaning Enter tugmachasi bosiladi. So'ngra keyingi yo'nalish tanlanadi, unga o'lcham beriladi va yana Enter tugmachasi bosiladi. Chiziqlarni chizish shu tartibda davom ettiriladi.

5. Chiziq chizishni to'xtatishda yoki har qanday keyingi amallarni nihoyasiga etkazish ishlarida Esc tugmachasi bosiladi.

To'g'ri chiziq va yoy chizish

1. Ushbu belgi ustiga kursor keltirilib, «sichqoncha»ning chap tomon tugmasi 1marta bosiladi.

Dasturda chercheniyadan krug tanlab olinadi va kichikroq aylana chiziladi va gradiyent yordamida aylana ichi bo'yaladi. Natijada P qutb xosil bo'ladi. Tezliklar planini qutbini tanlab olib chercheniyadan sliniyami va obyektnaya privyazkadan normalni tanlaymiz. Undan Pa kesmani AO_1 ga perpindikulyar qilib o'tkazamiz. Buning uchun Kesma Pa A nuqtaning tezligini ifodalaydigan chizmadagi vektor uzunligi, uning uzunligi ihtiyoriy tanlab olinadi.



Tegishli qurilmalarni chizmada bajaramiz. Qutbdan (P) X o'qiga parallel chiziq o'tkazish uchun chercheniyadan sliniyami tanlanadi va to'g'riga qarab yurgiziladi, a nuqtadan AB bo'g'inga perpendikulyar chiziq o'tkazish uchun esa chercheniyadan sliniyami va obyektinaya privyazkadan normalni tanlaymiz. Undan ab kesmani BA ga perpendikulyar qilib o'tkazamiz. Ikkita chiziq kesishgan nuqtani b deb belgilaymiz. So'ngra c nuqtadan DC kesmaga, P qutbdan DO_2 kesmaga perpendikulyar chiziqlar o'tkazamiz va ikkala chiziq tutashgan nuqtani d deb belgilaymiz. Natijada Pa vektor V_A tezlikni, Pb vektor V_B tezlikni, ab vektor V_{BA} tezlikni, cd vektor V_{CD} tezlikni, Pd vektor V_D tezlikni ifodalaydi.

Bo'g'inning oniy aylanish markazi bo'g'inning ikki nuqtasidan ularni o'zlarining tezliklari yo'nalishlariga perpendikulyar o'tkazilgan chiziqlar kesishgan nuqtasida joylashgan bo'ladi.

Xulosa

Tezliklar planini AutoCAD dasturi yordamida chizishda talabalar dasturni o'rganishadi hamda bo'ginlarga o'tkazilgan perpendikulyar chiziqlar aniq bo'ladi.

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PIYODA XARAKAT QILUVCHI INSONLAR UCHUN TRANSPORT VOSITALARIDA TASHQI TOMONDAN XAVFSIZLIK TIZIMI

***Аннотация:** Maqolada piyodalar uchun avtomobillarda tashqi xavfsizlik yostiqchasi tizimi*

ta'siri ko'rib chiqiladi. Zamonaviy muhandisdan avtomobilni loyihalash mobaynida mashinani tejamli, arzon, ekologik toza hamda haydovchi, yo'lovchi va piyodalarning ham havfsizligini ta'minlaydigan avtomobilni loyihalashi talab etish xaqida.

***Калит сўзлар:** ijtimoiy-iqtisodiy taraqqiyoti, transport, yo'lovchilar, avtomobil yo'llari, yo'l-transport hodisalari*

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EXTERNAL SAFETY SYSTEM IN VEHICLES FOR PEDESTRIAN MOBILE VEHICLES

***Abstract:** The article examines the impact of external airbag systems in vehicles on pedestrians. A modern engineer is required to design a car that is economical, affordable, environmentally friendly, and safe for the driver, passengers, and pedestrians.*

***Keywords:** socio-economic development, transport, passengers, roads, road accidents*

Mamlakatning ijtimoiy-iqtisodiy taraqqiyoti va aholining hayot darajasini ko'tarishda transportning o'rni va mohiyati beqiyosdir. Transport ishlab chiqarish mamlakatning muhim tarmoqlaridan biri hisoblanadi. Uning asosiy vazifasi turli-tuman yuklar va yo'lovchilarni tashishga bo'lgan talab-ehtiyojini qondirish, mintaqalar orasida mehnat taqsimotini ta'minlash va tashqi iqtisodiy aloqalarni

kuchaytirishdan iborat. Yo'lovchilarni bir manzildan ikkinchi bir manzilga tashishda ham transportning ahamiyati katta. Transport hududlar taraqqiyotiga ulkan ta'siri ko'rsatish bilan birga, transport taraqqiyotining o'zi ham iqtisodiyot rivoji, texnika taraqqiyoti darajasi bilan bevosita bog'liq.

Mamlakatimiz avtomobil yo'llarida yiliga 10 mingdan ortiq yo'l-transport hodisalari sodir etilib, bularning natijasida 2 mingdan ortiq odam hayotdan ko'z yumadi va 11 mingdan ortiq kishi turli darajadagi tan jarohatlarini oladilar. Uning natijasida vujudga keladigan iqtisodiy zararlar quyidagilardan iborat bo'lib, ular moliyaviy-huquqiy munosabatlarni vujudga keltiradi:

Odamlarning yo'l-transport hodisalarida ishtirok etishlari

Bular halok bo'lgan va tan jarohatlarini olgan odamlar soni, tan jarohatlarining og'irlik darajalari va ular natijasida vujudga keladigan iqtisodiy zararlar miqdori bilan aniqlanadi.

Transport vositalarining shikastlanishlari

Bu harajatlar transport vositalarini YTH sodir etilgan joydan ta'mirlash joylariga olib borish, ularni ta'mirlash, bu jarayonda ularni ishlatilmasligi oqibatidagi, buning imkoniyati bo'lmagan hollarda transport vositasini muddatdan avval yaroqsiz holga kelib qolishi bilan bog'liq iqtisodiy zararlarni o'zida mujassam qiladi [1].

Harakat xavfsizligini ta'minlash uchun ilmiy yondoshish, uning barcha serqirra jarayonlarini tahlil etish zarurdir. Buning uchun yo'l harakati xavfsizligi bo'yicha mutaxassislar yo'l harakatining asosiy ko'rsatkichlarini, yo'llardagi sharoitlarni transport oqimlari harakatlariga qanday ta'sir ko'rsatishlarini, transport oqimlarini boshqarishning texnik vositalari orqali yo'l harakatini boshqarish zarur deb bilamiz.

Avtomobillar ishtirokida sodir etilayotgan YTH larda avtomobil haydovchisi va yo'lovchilarni xavfsizligini ta'minlashda to'qnashuvdan so'ng havo yostiqchalarining shishib chiqishi natijasida haydovchi va yo'lovchilarning xavfsizligi yoki jarohatlanish ehtimolini kamaytiradi. Bir necha extimollarga ko'ra, xavfsizlik yostiqchalari 1940-yillarda samolyaotlarda o'rnatilgan va 50-yilda patentlashtirilgan. Amerikalik ixtirochi Allen Brid avtomobillarda xavfsizlik yostiqchalaridan foydalanishda - to'qnashuv jarayonini aniqlash uchun sharikli sensorni ixtiro qildi. U o'z ixtirosini 1967 yilda Kraysler kompaniyasiga taqdim etdi. O'sha davrlarda amerikaliklar xavfsizlik kamaridan kam foydalanishgan va bunday ixtiro avtomobillarni old tomonidan to'qnashuvlar jarayonlarida yo'lovchilar uchun katta qulaylik tug'dirib, xavfsizlik kamarlari o'rniga talabni kuchaytirgan. Hozirgi kunga kelib, avtomobillarning sust xavfsizligi yuqori darajada ta'minlanmoqda. Lekin, avtomobil piyodalar bilan to'qnashishda piyodalarning xavfsizligi ta'minlanmay qolmoqda, ya'ni avariya piyodalarning tan jarohat olishlari yoki vafot etishlari ortmoqda (bunday halokatlarda 80% o'lim kuzatilgan).

Shuning uchun ko'plab avtomobil ishlab chiqaruvchi firmalar o'z avtomobillarida piyodalar uchun xavfsizlik yostiqchalarini taklif qilmoqdalar.

Avtomobil peshoynasiga mahkamlanuvchi tashqi xavfsizlik yostiqchalarining bir qancha na'munalari ishlab chiqilmoqda.

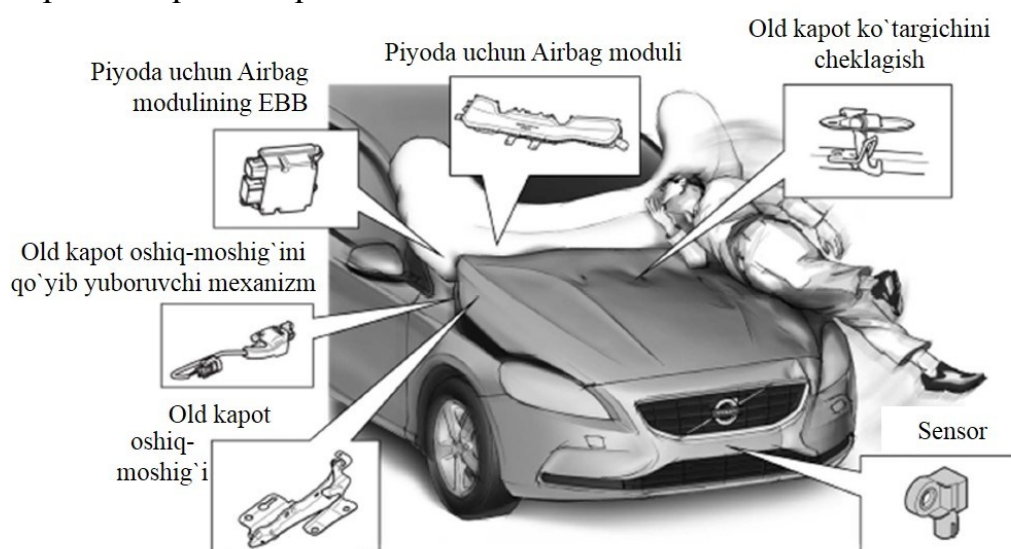
Bunday yostiqchalar oldi bamperdan uzatiluvchi sensor signali ta'sirida ochiladi va piyodaning peshoynaga boshi bilan urilib ketishini oldini olish uchun xizmat qiladi.

Piyodalar uchun havo yostiqchasi texnologiyasi avtomobilga yaxlit tizim sifatida birlashtirilgan bir nechta qismlardan iborat. Texnologiya ilk bor 2012-yilda Volvo V40 avtomobilda qo'llanilgan (1-rasm).



1-rasm.

Piyoda uchun havo yostiqchasi texnologiyasining asosiy qismlari tasvirlangan: piyoda havo yostiqchasini boshqaruvchi qism, yostiqcha qismi, kapot, ko'tarilishni chegaralovchi, kapotning oshiq-moshiq qo'yib yuborivchi mexanizm kapot oshiq-moshiqlari va sensorlar.



2-rasm.

Ushbu tizim 20 - 50 km/soat tezlikda ishga tushadi. Avtomobilning old bamperiga o'rnatilgan sensorlar ma'lum bir kuch ta'sirida axborot signallarini tizimning elektron boshqaruv bloki (EBB) ga yuboradi. Avtomobil biror obyekt bilan to'qnashganda signallar o'zgaradi. Nazaratchi qism signallarni baholaydi va bu signallar inson oyog'iga o'xshash narsani qayd etsa tizim ishga tushib, signallar

orqali tizimning EBB bir vaqtning o'zida old kapotning ikkala oshiq-moshig'ini qo'yib yuboruvchi mexanizmiga va havo yostiqchasini havo bilan to'ldiruvchi modulga axborot signalini jo'natadi (2-rasm). Old kapotning oshiq-moshig'i taxminan 10 smga ko'tariladi, ushbu ko'tarilish nazoratga olib turiladi va cheklanadi hamda xavfsizlik yostiqchasi anashu oraliqdan 30 millisekundda to'la shishib chiqib (ushbu jarayonlar izchilligi 100 millisekunddan kamroq vaqt ichida sodir bo'ladi), piyodani bosh qismi avtomobilning old oynasiga tekunga qadar yostiqcha old oynakni to'la qamrab oladi va piyodaning jiddiy jarohat olishlari keskin kamaytiriladi [2].

Ish jarayonida texnologiya bir qancha turli testlardan foydalanib baholanadi (3-rasm). Asosiy zarba testlari CAE va fizik testlar piyoda havo yostiqchasining foydali tomonlarini avtomobil old kapot funksiyasini ko'rsatish maqsadida o'tkaziladi. Umumiy dinamik ijro etilishi 4 xil hajimdagi insonni modellari yordamida sinovdan o'tkaziladi.



3-rasm. Yevro-NCAP test jarayonlari.

Xulosa

Hozirgi zamonaviy muhandisdan avtomobilni loyihalash mobaynida mashinani tejamli, arzon, ekologik toza hamda haydovchi, yo'lovchi va piyodalarning ham havfsizligini ta'minlaydigan avtomobilni loyihalashi talab etilmoqda. Bu o'z navbatida raqobatbardosh mahsulotni yaratish, raqobat esa rivojlanishning asosi hisoblanadi.

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TEKNIKUMLARDA GRAFIKA FANLARINI O'QITISHDA KOMPYUTER VA PEDAGOGIK TEXNOLOGIYALARDAN FOYDALANISH

Аннотация: Maqolada talabalarning mustaqil ishlarini faollashtirishga kompyuter va pedagogik texnologiyalardan foydalanish. Ta'lim yo'nalishining hamma jabxalarida animatsiyali dasturdan maksimal foydalanilishi tinglovchilar bilm va ko'nikmalarini oshirib mexanizm va mashinalardagi aloxida xar bir detal va uzellarning harakatini ko'z bilan ko'rish imkoniyatini berish xaqida.

Калит сўзлар: o'qituvchilar, kompyuter, axborot texnologiya, pedagogik texnologiyalar, pedagogik maxorati, boshqarish malaka.

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USE OF COMPUTER AND PEDAGOGICAL TECHNOLOGIES IN TEACHING GRAPHICS IN TECHNICAL SCHOOLS

Abstract: The article discusses the use of computer and pedagogical technologies to activate students' independent work. The maximum use of animation software in all aspects of education is aimed at increasing the knowledge and skills of students and giving them the opportunity to visually see the movement of individual details and components in mechanisms and machines.

Keywords: teachers, computer, information technology, pedagogical technologies, pedagogical skills, management skills.

Bugungi kunda barcha soxalar kabi o'qituvchilarning ta'lim jarayonida kompyuter, axborot va pedagogik texnologiyalardan samarali foydalanish kunning muhim masalaridan biri bo'lib qolmoqda. XXI asr yuqori kompyuter texnologiyalari asridir. Hozirgi kunning zamonaviy o'qituvchisi elektron madaniyat dunyosida yashamoqda. Taraqqiyot bilan bir xil qadam tashlayotgan

o'qituvchilarning ko'pchiligi bugungi o'qitish jarayonida axborot-texnologiyalaridan foydalanishga texnik va psixologik jihatdan tayyordir. [1]

Pedagogik texnologiyaning muhim jihatlari o'qituvchining pedagogik maxoratini belgilovchi kasbiy ko'nikmalari hisoblanadi, ya'ni uning savodli va ifodali so'zlay olishi, o'z fikr-mulohazalarini va bilimni tushunarli tilda ta'sirchan bayon qilish, xis-tuyg'usini jilovlay olishi, o'zining shaxsiy xususiyatlariga xos mimik qobilyatlarga ega bo'lishi, ma'noli qarash, rag'batlantruvchi yoki istehzoli tabassum, so'zning cheksiz qadryati orqali tinglovchi qalbiga ta'sir o'tkazish, xozir javoblik, psixalogik bilimlarga ega bo'lishi hamda pedagoik texnologiyani namoyon etishda o'qituvchining tashqi ko'rinishi pedagoik texnikasini aks ettiruvchi muxim xususiyatlardan biridir. Insonning tashqi ko'rinishi atrofdagilarga estetik ma'no va zavq kasb etib, doimiy e'tiborda bo'lishini unutmazligi kerak. O'qituvchning tashqi ko'rinishini namoyish etuvchi muhim hususiyatlari uning chehrasidagi mehribonlik, jiddiylik yurishdagi bosiqlik, tabiiylikdir. O'qituvchining shaxsiy axloqiy fazilatlar va xulqi bilan bog'liq bo'lib, talim tarbiya jarayonida o'z-o'zini boshqarish malakalarida namoyon bo'ladi. [2]

Pedagoglardan quydagilar talab qilinadi.

1. Ta'lim-tarbiya jarayonida o'z hatti harakatlarini boshqarish, (mimika);
2. Ta'lim-tarbiya jarayonida o'z hissiyoti va kayfiyatini jilovlay olish;
3. Mukammal ijtimoiy perseptiv qobilyatlarga(diqqat, kuzatuvchanlik, xayol) egaligi;
4. Nutq texnologiyasini (nafas olish, ovozni boshqarish, nutq tempi) bilishi va o'z o'rnida qo'llay olishi;
5. Axborot-telekommunikatsion texnologiyalarni o'rganish obekti sifatida, ya'ni tinglovchilar yangi axborot texnologiyalar, ularning tarkibiy qismlari va foydalanish soxalari bo'yicha umumiy tushuncha va malakalarga ega bo'lish
6. Axborot-telekommunikatsion texnologiyalar o'qitish vositasi sifatida, ya'ni zamonaviy axborot va pedagoik texnologiyalar asosida tinglovchilarga bilim berish.
7. O'quv jarayonini boshqarish vositasi sifatida , ya'ni ta'lim muassasalarining barcha ish faoliyati, shu jumladan o'quv , ma'navi-ma'rifiy va ilmiy tadqiqot ishlari samaradorligini oshirish uchun axborotlashtirish, taxlil va bashorat qilish tizimlarini yoratish vositalarini o'rgatish. [3]

Institutimizda talaba yoshlar "Mexanizm va mashinalar nazariyasi" fanini o'zlashtirishlari uchun o'qitishning ilg'or va zamonaviy usullaridan foydalanish, yangi infarmatsion –pedagoik texnologiyalarni tadbiq qilish muhim ahamyatga egadir. Masalan : "Mexanizm va mashinalar nazariyasi" fani mashinasozlik , asbobsozlik, to'qimachilik, avtomobilsozlik soxalarida ishlatiladigan mexanizm va mashinalarni kinematik va dinamik analiz qilish, mexanizmlarini loyihalashni va detallarda amaliy ro'y berayotgan jarayonlarni yaratish aks ettirishda , shuningdek ularning istiqboliga ta'sir etuvchi muammolarni ko'rsatib, yoritib berishda yaxshi samara

bermoqda. Fanni o'zlashtirishda darslik, o'quv va uslubiy qo'llanmalar, ma'ruza matnlari, tarqatma materiallar, elektron materiallar, virtual stendlar hamda maketlardan foydalanilmoqda. Ma'ruza, amaliy laboratoriya darslarida mos ravshda ilg'or pedagogik texnologiyalardan va animatsialik dasturlardan foydalanilmoqda. Animatsialik dasturning asosiy mohiyati hamda uning mazmuni haqida alohida to'xtalib o'ish kerak. Xozirgi davrda kompyuter texnologiyalaridan foydalaninsh hamda masofadan turib o'qitish. Shunday ekan animatsiyali dasturni qo'llashni jahon andozasiga mos qilib qo'llash kerak. Animatsiali dasturni qo'llashdan asosiy maqsad, Pedagogik mahoratni yuqori saviyda bo'lishini hamda talabalarning bilish saviyasini oshirishga katta xizmat qiladi. Animatsiyali dastur ham o'quv qo'llanmalaridan kabi xizmat qilmasdan, balki o'quv qo'llanmalaridan bir necha barobar saviyali bo'lib, talabalar ongiga tez kirib kelmoqda. Xozirgi vaqtda animatsiyalik dastur talabaning bilim darajasini 20% dan 80% gacha yuqori darajada bo'lishini ta'minlamoqda. [4]

Animatsiyalik dasturni qo'llab yuqori malakali programmalovchi mutaxassislar tayyorlash darajasini oshirish muammosini hal qiladi va davlat siyosati darajasiga ko'tariladi. Animatsiyalik dasturni qo'llashda auditoriyadagi tinglovchi talabalar ko'z bilan ekranda mehanizmlarni xarakatini ko'rib, ma'ruzani tinglaganlarida ko'proq tushuncha xosil qiladilar.

Animatsiyalik dasturdan foydalanish hozirgi zmon axborot texnologiyalari talab darajasiga javob beradi. Ta'lim jarayonida animatsiyolik dasturni axborot –kommunikatsiya texnologiyalari orqali qo'llanilishi tinglovchilar bilimlari darajasini oshirishga katta imkoniyatlar beradi. Bundan foydalanish esa faol, ijodkor, izlanuvchan o'qituvchilarga bog'liqdir.

Xulosa

Ta'lim yo'nalishining hamma jabxalarida animatsiyali dasturdan maksimal foydalanilishi tinglovchilar bilm va ko'nikmalarini oshirib mexanizm va mashinalardagi aloxida xar bir detal va uzellarning harakatini ko'z bilan ko'rish imkoniyatini beradi. Animatsiyali dasturdan foydalanish etuk malakali kadrlarni tayyorlashga asos bo'ladi.

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THE ROLE OF THE ETHNIC COMPOSITION AND CULTURAL HERITAGE RESOURCES OF SURKHANDARYA REGION IN THE DEVELOPMENT OF ETHNOTOURISM

***Abstract:** This study examines the changes in the ethnic composition of the population of Surkhandarya Region and analyzes the role of major ethnic groups in the formation of the region's culture, traditions, and customs. In addition, the territorial distribution of cultural heritage sites within the region and their tourism potential were assessed. The research findings indicate that Surkhandarya Region, owing to its ethnic diversity, rich historical and cultural heritage, and well-preserved traditional handicrafts, represents one of the most significant regions in Uzbekistan for the development of ethnotourism.*

***Keywords:** ethnotourism, ethnic composition, cultural heritage, Surkhandarya Region, historical monuments.*

INTRODUCTION

In the twenty-first century, increasing attention has been devoted worldwide to the interrelationship between tourism and culture. Tourism contributes to the protection, enrichment, and promotion of cultural assets, while culture serves as a driving force for tourism development. In recent years, the revival of local identities, the rapid expansion of mass media, growing criticism of technological advancement, and increasing nostalgia for the past have collectively stimulated a renewed interest in cultural tourism, particularly in ethnic tourism. Ethnic tourism is often associated with alternative, rural, folklore, adventure, and sentimental forms of tourism. The term tourism was first introduced in the early nineteenth century.

Since anthropologists and sociologists began to examine tourism more systematically during the 1970s, numerous attempts have been made to classify its various forms. Some scholars, including Valene L. Smith (1989), proposed more refined subdivisions within the broader category of cultural tourism. These include ethnic tourism (focused on visiting indigenous and local communities), historical tourism (centered on museums, monuments, archaeological sites, and the heritage of past civilizations), and cultural tourism as a distinct category, which Smith defines as travel undertaken to observe "the remnants of ancient and traditional ways of life that are gradually disappearing from human memory" [3].

During the sixteenth and seventeenth centuries, scientific progress and social transformation, together with broader cultural and historical developments,

stimulated the emergence of mass travel in Europe. Advances in shipbuilding encouraged Portuguese and Spanish explorers to undertake voyages to distant regions. The discovery of the Americas opened access to the "New World," while Africa, Asia, Australia, China, and India became destinations associated with exploration, adventure, and mystery for Europeans. Similar to the Portuguese, Spanish, and British adventurers, entrepreneurs, and fortune seekers who travelled to the Americas in search of gold, many Europeans journeyed to China, India, Australia, and other parts of Asia. These expeditions significantly expanded knowledge of different peoples, their customs, traditions, and ethnic identities. As geographical interests increasingly intersected with economic objectives, philosophical, sociological, ethnological, and ethnographic theories concerning diverse cultures, ethnic groups, religions, and traditions gradually emerged. These historical processes also laid the foundation for the development of what is now internationally recognized as ethnic tourism.

Adabiyotlar tahlili.

According to the classical definitions of ethnic tourism proposed by Valene L. Smith in *Hosts and Guests* (1977), Greg Richards in *Cultural Tourism* (1996), and V. Preobrazhenskiy in *Ethnic Tourism in Russia* (2001), ethnic tourism primarily involves visiting indigenous peoples, local communities, and tribal settlements; participating in festivals and folklore performances; attending certain religious ceremonies; and exploring the cultural heritage, customs, traditions, and lifestyles of ethnic groups. The central concept of ethnic tourism is the pursuit of cultural authenticity, which is understood as moving beyond preconceived mental constructs, stereotypes, and the so-called "tourist illusion." Furthermore, ethnic tourism contributes to the preservation of local cultural elements by enhancing opportunities to safeguard traditional handicrafts, clothing, rituals, music, and architecture [5]. Travel motivated by ethnic affiliation or ancestral connections represents an important form of tourism in North America and the Australia–Asia region, where recent historical development has been strongly influenced by migration, and it also plays a significant role in many other parts of the world. Recognizing the economic potential of cultural resources, residents of both existing and emerging tourist destinations, together with other stakeholders, have increasingly collaborated to promote and support ethnic tourism as an important component of the service economy. The growing interest in this form of tourism is driven by both supply-side factors, such as economic needs and cultural revitalization, and demand-side factors, including tourists' desire for creative, cultural, and authentic experiences, as well as their interest in discovering the "Other" and experiencing different social environments [3].

Ethnic tourism is widely regarded as a viable strategy for promoting economic development in ethnic regions where alternative development opportunities are limited. Moreover, in some studies, ethnic tourism is considered a subtype of cultural or cognitive tourism [4].

While cultural tourism is a broader concept encompassing both the tangible and intangible cultural heritage of a nation, ethnic tourism represents a more

specific component of cultural tourism that primarily focuses on exploring the lifestyles, customs, traditions, rituals, and ethnocultural heritage of particular ethnic groups.

In the present study, we seek to clarify the conceptual differences between cultural tourism and ethnic tourism.

Table 1.
Main Differences Between Cultural Tourism and Ethnic Tourism

Comparison Criterion	Cultural Tourism	Ethnic Tourism
Definition	A form of tourism aimed at introducing visitors to tangible and intangible cultural heritage, historical monuments, works of art, and cultural values.	A form of tourism focused on introducing visitors to the lifestyles, customs, traditions, rituals, and ethnocultural heritage of a particular people or ethnic group.
Origin	Emergед from the need to preserve, protect, and study historical and cultural heritage.	Developed as a result of growing interest in ethnic diversity and the traditional cultures of different peoples.
Object of Study	Historical monuments, architectural heritage, museums, theatres, works of art, and cultural landscapes.	Ethnic groups, nations, nationalities, tribes, their customs, traditions, and cultural practices.
Research Objective	To explore historical and cultural heritage and appreciate artistic and cultural achievements.	To study the culture of ethnic groups, understand national values, and experience the traditional lifestyle of local communities.
Main Resources	Historical monuments, museums, art galleries, libraries, historic cities, and cultural centres.	Folklore, oral traditions, traditional cuisine, handicrafts, rituals, and ethnographic villages.
Spatial Distribution	Predominantly developed in cities and historical urban centres.	Primarily developed in rural areas and traditional settlements.
Economic Significance	Contributes to the development of tourism infrastructure, cultural institutions, and the sustainable use of historical heritage sites.	Increases local incomes and supports the development of traditional handicrafts and the marketing of national products.

Source: Compiled by the author based on a review of the relevant literature

Methodology

This study employed a comparative approach to examine the scientific foundations of ethnic tourism by analysing definitions, theoretical perspectives, and empirical studies presented in both international and national scholarly literature. Furthermore, The ethnic composition of Surkhandarya Region in 2025 was analyzed based on official statistical data. The research methodology included

the use of official statistical data obtained from the Statistics Department of Surkhandarya Region, as well as information provided by the Regional Department of Culture and Sports.

Results and Discussion

The Surkhan Oasis occupies a distinctive place in the history of the Uzbek people and statehood. As one of the most ancient inhabited regions, its history extends back to remote historical periods. The majority of archaeological monuments of exceptional importance to the history of Uzbekistan are located within this oasis, which is also recognized as one of the earliest areas inhabited by the ancestors of humankind. Furthermore, Surkhandarya Region represents an ancient historical and geographical area distinguished by its rich cultural traditions and material heritage. In particular, traditional handicrafts and cultural heritage monuments created by local communities have retained their historical and cultural significance to the present day [2].

During the 1950s, K. Najimov conducted historical and ethnographic research on the anthropology of the population of the Surkhan Oasis. His studies examined the anthropological composition of the local population, several aspects of their ethnogenesis, and, to a certain extent, their material and spiritual culture. Likewise, in his monograph devoted to the genealogy and dialects of the Uzbek people, Kh. Doniyorov analysed the ethnic characteristics and dialectal features of several tribal groups inhabiting the Surkhan Oasis. B. Kh. Karmisheva, who carried out ethnographic research in southern Tajikistan and Uzbekistan, investigated the ethnic composition of the population, the settlement patterns of the Uzbek Qarluq tribe, as well as livestock farming and other aspects of local traditional life [2].

Table 2.
Ethnic Composition of the Population of Surkhandarya Region (2025)

Ethnic Composition of the Population of Surkhandarya Region	2025	
	Population number of persons	Share (%)
Total population of Surkhandarya Region	2945512	100
Uzbeks	2496896	84,7
Tajiks	365149	12,4
Turkmens	35480	1,2
Russians	20834	0,7
Kazakhs	2456	0,083
Karakalpaks	163	0,005
Kyrgyz	163	0,005
Tatars	322	0,01
Koreans	732	0,024
Ukrainians	3509	0,12
Other ethnic groups	14516	0,49

Source: Compiled by the author based on official statistical data obtained from the Statistics Department of Surkhandarya Region.

The analysis of the ethnic composition of Surkhandarya Region in 2025 demonstrates that the region is characterized by considerable ethnic diversity, which constitutes an important resource for the development of ethnic tourism. According to official statistical data, the total population of the region amounts to 2,945,512 people. Uzbeks represent the overwhelming majority of the population, accounting for 2,496,896 people (84.77%), followed by Tajiks with 365,149 people (12.40%) and Turkmens with 35,480 people (1.20%). Other ethnic groups, including Russians, Kazakhs, Ukrainians, Azerbaijanis, Koreans, Armenians, Karakalpaks, Kyrgyz, Germans, and Luli communities, constitute relatively small proportions of the regional population. The coexistence of diverse ethnic communities has significantly contributed to the formation of the region's unique cultural landscape. Each ethnic group has preserved its own customs, traditions, handicrafts, cuisine, folklore, rituals, and elements of intangible cultural heritage, thereby enhancing the ethnocultural attractiveness of Surkhandarya Region. Such diversity creates favorable conditions for the development of authentic ethnic tourism products and experiences.

The findings also indicate that Surkhandarya Region possesses 562 cultural heritage sites, of which 153 are actively visited by domestic and international tourists. The highest concentration of heritage sites is found in Sherabad District (99 sites), followed by Denov (91), Boysun (70), Shorchi (61), Termez (44), Muzrabot (41), Sariosiyo (33), and Uzun (29) districts. Most of these monuments date from the 3rd–4th centuries BCE to the 15th–18th centuries CE, reflecting the region's long-standing historical and cultural significance.

The combination of a diverse ethnic composition and a rich concentration of cultural heritage resources provides a strong foundation for the sustainable development of ethnic tourism in Surkhandarya Region. Integrating tangible cultural heritage with the living traditions of local ethnic communities can diversify tourism products, strengthen the regional tourism brand, increase local incomes, and contribute to the preservation of cultural identity.

Conclusion and Recommendations.

The findings of this study demonstrate that the stable ethnic composition of Surkhandarya Region, together with its rich concentration of cultural heritage sites, provides a solid foundation for the sustainable development of ethnic tourism. In addition to the Uzbek population, which constitutes the majority of the region's inhabitants, the customs, traditions, and cultural values preserved by Tajik, Turkmen, Kazakh, and other ethnic communities significantly enhance the ethnotourism attractiveness of the region.

Furthermore, of the 562 cultural heritage sites located in Surkhandarya Region, 153 are actively utilized as tourist attractions. The particularly high concentration of historical and cultural resources in Sherabad, Denov, and Boysun districts demonstrates their considerable potential for tourism development. The effective utilization of these resources will strengthen the competitiveness of the region within the tourism services market and contribute to sustainable regional development.

Recommendations

- It is recommended to develop specialized ethnic tourism routes based on the ethnic diversity and cultural heritage resources of Surkhandarya Region.

- The establishment of ethnographic tourism-oriented mini-hotels and family guesthouses should be encouraged, particularly in the districts of Boysun, Sherabad, and Denov.

-The promotion of traditional handicrafts, folklore, and national customs as tourism products is essential for strengthening the tourism brand of Surkhandarya Region.

-The digitalization of cultural heritage sites and the establishment of an integrated electronic database will improve information accessibility, enhance visitor experiences, and contribute to increasing tourist arrivals.

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SPECIFIC CHARACTERISTICS OF ETHNOTOURISM DEVELOPMENT IN THE SURKHANDARYA REGION AND THEIR ANALYSIS BASED ON ETHNOTOURISM PRACTICES

ABSTARACT: *The main objective of the study is to analyze the practical significance of the development of ethnotourism in the Republic of Uzbekistan today based on modern computer technologies and develop scientifically based recommendations for sustainable development. In particular, Surkhandarya region was selected as the research center. As a basis, it is aimed at determining the attitude of the local population to the high level of organization of ethnotourism in the region, as well as analyzing the economic and socio-cultural impact of ethnotourism from both a positive and negative perspective. Four major ethnotourism centers were identified in Surkhandarya regions: Termez, Boysun, Denov, and Shorchidistricts. Based on available statistical data, the national composition of the Surkhandarya population was determined and analyzed. The survey conducted to achieve the research objectives lasted from July 15 to August 15, 2025. A short empirical survey was conducted and distributed among the population of Surkhandarya region. According to the results of the study, the role and practical significance of ethnotourism in the regional economy was found to be positive.*

KEYWORDS: *Ethnotourism, cultural tourism, ethnoses, ethnographic history, national costumes.*

INTRODUCTION

One of the most promising ways to preserve ethnic diversity, which is one of the most pressing issues of the 21st century, is to develop ethnotourism in these regions. Ethnotourism helps tourists realize their personal interest in new cultural and authentic experiences through active participation in traditional lifestyles. Staying with a local family, the opportunity to share traditional activities of local residents and their traditional lifestyles makes the tourist product more impressive and diverse in various types of tourism. (A. Alexandrova; E. Aigina 2014). Ethnotourism has gained popularity today because it allows people to learn about the traditions and cultural life of different ethnic groups not by reading literature or watching television programs, but by directly entering the living

environment of ethnic groups. In this sense, the reason for visiting areas inhabited by certain ethnic groups of interest to tourists is considered a factor that creates conditions for the development of the country's economy, including a particular ethnic community, and provides a significant amount of income and a positive inflow of foreign exchange (Jamison, 1999; Wood, 1998) [1], [2]. Ethnotourism is defined as travel aimed at observing the culture and lifestyle of truly unique peoples, which allows tourists to visit the homes of local residents and participate in cultural events, dances and attracts participation in religious ceremonies. Nowadays, ethnotourism is considered to be based on the search for exotic cultural experiences by travelers, such as visiting ethnic villages, ethnic minority houses and ethnic gardens, participating in ethnic events and festivals, watching traditional dances and ceremonies, or purchasing national handicrafts and souvenirs (A. Aleksandrova; E. Aigina 2014). [13]. In addition, ethnotourism, which is an important element of the above-mentioned tourism industry, is of particular importance for the region as a development strategy not only socially, but also economically (McIntosh & John son, 2005) [14].

The diversity of ethnic groups and different nationalities is one of the distinctive features of the current stage of development. Ethnic culture, ethnic and national diversity are one of the distinctive features of modern society. However, in the conditions of globalization, rapid scientific and technological development, environmental crises and the increase in information flows, the life of ethnic groups and minorities is becoming increasingly difficult. Ethnic-based tourism is one of the options for preserving ethnic diversity. In recent years, most developing countries have focused on the development of ethnotourism as a means of stimulating the development of local communities, including their economic development, which is carried out through the extensive use of cultural resources, that is, the potential of these destinations. (A. Alexandrova; E. Aigina 2014). (Henderson, 2003; Smith, 1989) [3], [4]. In addition, ethnotourism is considered a special force that not only creates conditions for the recognition of culture, traditions and languages, but also strengthens the specific characteristics and connections of different ethnic groups and communities (van den Berghe, 1992, 1994; Boissevain, 1996; Pitchford, 1995) [5], [6], [7], [8]. defines ethnotourism as meeting, seeking and pursuing other ethnic groups. Recent scientific research shows that ethnic and cultural tourism, which are very close in content, have branched out into a number of directions and are beginning to interact with other types of tourism.

The publication of a number of fundamental monographs by researchers such as K. Sh. Shoniyozov, T. Fayziev, B. Ahmedov, I. Ermatov, B. Kh. Karmisheva (P. Nazarov 2016) on the ethnogenesis and ethnic history of the Uzbek people, their ethnic composition, and a number of sub-ethnos in the region in the 1960s and 1970s led to the revival of the direction of ethnogenesis and ethnic history in the ethnography of the Uzbek people. Also, during the 20th century, a wealth of empirical and theoretical materials on the ethnography of the Uzbek people were collected in the direction of ethnology. In academic research

conducted in the first half of the 20th century, more attention was paid to recording information about traditional customs that were becoming a thing of the past. However, starting from the second half of the 20th century, the current situation changed and the practical value of ethnological materials increased. After our country gained independence, the science of ethnology also rose to a new level. In particular, a number of studies were created on the problems of ethnogenesis and ethnic history. In this area, a number of fundamental studies and monographs by one of the heads of the ethnological science, academician Karim Shoniyozov, are of particular note. During his almost half-century of scientific activity, the hardworking and dedicated scientist K. Shoniyozov consistently studied the ethnogenesis and ethnic history of the Uzbeks and other fraternal peoples living in the Central Asian region.

A new era in the study of the ethnography of the southern oases began in the last quarter of the 20th century. During this period, the history, material and spiritual culture, customs and traditions of the population of the Surkhandarya region, where we are conducting our research, were studied. As can be seen from the above, ethnographic research conducted in the Kashkadarya and Surkhandarya oases and the initial stages of research, the study of the ethnic history and composition of the population, the unique material and spiritual heritage of the region, the traditions and rituals of a large number of sources are compared from the perspective of the modern era. It was shown that it is necessary to study on the basis of drawing clear scientific and theoretical conclusions by comparison. In the works of N.A. Maev, written based on the data of the Hissar expedition conducted in 1875 and 1878, ethnographic data were determined on the ethnic composition of the Khongirad, Durman, the Katagan, Yuz, Marka, Lokai and Tajiks living in the territory of the Surkhan oasis, the geographical location of the oasis population, their dwellings, clothing, food, as well as their traditional economy. (P. Nazarov 2016)

MATERIALS AND METHODS

Since the first years of independence, special attention has been paid to all branches of tourism, especially ethnographic research. Because the Republic of Uzbekistan has unique opportunities for the development of ethnic and cultural tourism. Uzbekistan is economically and geographically located in the middle of Central Asia, surrounded by the countries of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Afghanistan. As a result, various large and small ethnic groups have formed. The indigenous population of Central Asia mainly belongs to two large races: the Mongoloid and the European race. The Mongoloid race includes Kazakhs, Kyrgyz, Karakalpaks, and the European race includes Uzbeks, Tajiks, Turkmens and other peoples. Most of the peoples of Central Asia speak languages and dialects that are part of the Turkic language group of the Altai family. Their ethnic and national culture was formed in connection with the Uzbek, Kazakhs, Kyrgyz, Turkmens, Tajiks, Russians, Koreans and many other peoples. According to data, 100 years ago, representatives of about 70 nationalities lived in the territory of present-day Uzbekistan. 30 years later, this number reached 91, in

1959 - 113, in 1978 - 123. A list taken in 2011 shows that representatives of 137 nationalities and ethnic groups live in Uzbekistan. The main goal of a multinational state policy should be to form interethnic harmony and religious tolerance. The Republic of Uzbekistan is considered a country with a great cultural and rich historical heritage, as well as a high level of ethnic diversity.

The most important aspects of the development of ethnotourism in Uzbekistan are the preservation of a high level of ethnic diversity of the population, which is manifested not only at the national or regional level, but also within individual subjects of the Republic of Uzbekistan and even within local administrative units (rural communities, districts, rayons). (A. Aleksandrova; E. Aigina 2014). Although tourism sectors in Uzbekistan, in particular ethnotourism, have been formed since the early years of the 21st century, they have shown their positive results in the period from 2016 to 2025. The growth of interest in local culture, objects and ethnic phenomena, their everyday life, costumes, language, folklore, traditions and customs, ethnic creativity in Uzbekistan has led to the development of ethnotourism. (A. Aleksandrova; E. Aigina 2014). This is due to laws established by the state and various state programs, as well as revived festivals. Tourists have the opportunity to visit many ethno-villages and neighborhoods in Surkhandarya region and get acquainted with their ethnic way of life. Initially, Surkhandarya region was established on March 6, 1941. The area is 20.1 thousand km². It consists of 14 districts, 8 cities, 114 towns and 865 rural settlements. The region is mainly inhabited by Uzbeks, Tajiks, Turkmens and Russians. The table below provides information on the national composition of the population of Surkhandarya region at the beginning of 2013-2020.

Table 1.
National composition of the population
of Surkhandarya region 2014-2024

The most populous city in Surkhandarya representatives of the nation	2014		2024	
	The total population is in people	Share in Percent	The total population is in people	Share in Percent
Total population of Surkhandarya region	2260600	100	2629135	100
uzbeks	1903425	84,2	2222182	84,5
tajiks	280314	12,4	326045	12,4
turkmens	2260	1,3	2705	1,2
russians	22606	1,0	21376	0,8
kazakhs	226	0,01	195	0,1
karakalpoks	226	0,01	160	0,006
kyrgyz	29387	0,1	32254	0,006
Tatars	6781	0,3	6985	0,2
koreans	678	0,03	739	0,02
ukrainians	4521	0,2	3554	0,1
Representatives of other nationalities	9042	0,4	12940	0,5

Note: The table was re-edited by the researcher based on data obtained from the Surkhandarya Regional Statistics Department.

Currently, the region's population is mainly composed of representatives of several nationalities. Of these, Uzbeks make up 84.5%, Tajiks 12.4%, Turkmen 1.2%, and Russians 0.8%. Uzbeks, Tajiks, Turkmen, and representatives of other nationalities live in this region, and cultural harmony has been formed between them. According to the results of the conducted studies, the location of the population and ethnic groups in the southern plain part of the region differed from its northern part. In particular, representatives of various ethnic clans and tribes lived in the Denou, Sariosiyo, Uzun and Shurchi districts. Uzbeks and Tajiks made up the majority in these regions. Uzbeks lived in the foothills of the Babatag and in the upper reaches of the Surkhandarya, and Tajiks lived on the right and left banks of the To'palang, Sangardak, Obizarang, Khojaipok, Kyzylsuv, and Karatog rivers. Therefore, we can see that the Uzbeks formed a large ethnic group. Among the ethnic groups in the Surkhan oasis, the Turkmen also played an important role. It was found that the Turkmen in the Surkhan oasis lived mainly in the southern and southwestern parts of the oasis, especially in areas such as Boysun and Sherabad. These groups, in turn, preserved their own separate language, culture and customs, but they formed harmonious cultural ties with the Uzbeks and Tajiks. Research has found information that in the villages of Gegirdak and Navubag near the city of Sherabad in the Sherabad oasis, Uzbek-speaking Chigatai and Afghans lived together. [15]

1.3 National costumes of the region: The bright, open colors, free cut, and unique, diverse embroidery of Surkhandarya costumes indicate the high taste of the people. In Surkhandarya, women's headdresses called “kiygich” and “bash” are unique to Surkhandarya and are not found in other parts of Uzbekistan. “Bash” is a very special headdress that performs several functions:

Women protected their heads from heat, cold, and wind;

In it, women kept small items that were often needed in life (thread, needles, combs, and combs).

Figure 1: National Surkhonskullcaps of of women from Surkhandarya region.



The women of Surkhandarya loved red and cherry colors. They chose colorful fabrics with stripes, sidirsga and large flowers for their clothes. The

traditional women's dress of Surkhandarya is distinguished by the brightness of its colors. The women's dress includes: inner and outer shirts, trousers, outerwear, headdresses and jewelry. Embroidery on clothes was sewn not only to give beauty and aesthetic taste, but also had religious foundations. In particular, it was believed that such decorations protect women, children and brides from the evil eye. The clothing of the Surkhan oasis residents is made from ancient fabrics passed down from generation to generation, such as alacha, boz, khanatlas, banoras, shoyi, bekasam, adras, and other fabrics. [16] The Karluk, Qatagan, Turk, Kipchak, Mogyoni, Urgut, and other tribes of the oasis weave various fabrics from cotton. The mountainous regions of the oasis are the most productive in weaving cotton and linen fabrics. It has become quite developed in Darband, Sayrab, Muzrabod, Vakhshivar, Sangardak, Sina, Khonjiza, Denou, Qarlyk, Mirshodi and Sariosiya.

Figure 2: National costumes of women from Surkhandarya region.



Surkhandarya's Boysun district is the strongest ethnotourism center in Uzbekistan. This area is a UNESCO-recognized intangible cultural heritage site. There are examples of real ethnovillages in the villages of Omonkhona, Sayrab, Darband, Machay and Kofrun. The fact that the village of Omonkhona in Boysun district of Surkhandarya region was recognized as one of the winners of the “Best Tourism Villages” competition held by UN Tourism proves that the area is a real ethnotourism center. More than 270 candidate villages from 65 countries in Africa, America, Asia and Europe participated in this year's competition. The Tourism Committee of Uzbekistan nominated the village of Amonkhona, located in Boysun district of Surkhandarya region. As a result, the village of Omonkhona was recognized as one of the winners of the competition and was included in the “Upgrade Programme” of the project. This is another important achievement of the tourism sector of Uzbekistan on a global scale.

There are 8 museums in the region, which present interesting exhibitions about the history, creativity and spiritual rituals of Surkhandarya. The number of household and ethnographic items in these museums is 3760 (2023). The most interesting presentation of national culture can be seen during national holidays and events. National holidays, crafts and folklore make the regional tourism product even more attractive and vivid. The traditions and culture of the

indigenous peoples living in Surkhandarya serve as the most attractive factor for the development of tourism in the region. This has long been understood by the state authorities. In accordance with the Resolution of the President of the Republic of Uzbekistan “On measures to improve tourism infrastructure and create modern services and tourism facilities in the mountainous recreational areas of Surkhandarya region” (No. PQ-439), adopted on December 16, 2024, new initiatives have been announced to develop tourism in Surkhandarya. Since the village of Omonkhona and Sina is a national cultural center, this tourism area will further develop as the main center of ethnotourism on a republican scale and will not lose its ethnic character for many years.

LITERATURE REVIEW

The term “ethnotourism” was first explained by W. Smith (1977), who defined ethnotourism as a major type of tourist activity, often associated with the activities of local people in a specific market, which characterizes the exotic and other customs of these peoples [9]. Graburn (1978) defines ethnotourism as a combination of cultural and natural tourism. In addition, ethnotourism is defined as a journey to specific exotic peoples and worlds, rather than a process of searching for ancestors or family in places with historical roots. McIntosh and Geldscher (1990). One of the strongest attractions of ethnotourism products is traditional dance and song, and as a result, the sector serves as an important platform for musicians and dancers. Ethnic tourism is one of the most important sectors in ethnic communities, attracting tourists seeking exotic experiences (Lor, Kwa, & Donaldson, 2019; Yang & Li, 2011; Zhang, Xu, & Xing, 2017). The most frequently mentioned type of ethnic tourism emphasizes the exotic dimension (King, 1994; Yang & Wall, 2016). This is especially true for visiting ethnic villages, experiencing local lifestyles, appreciating artifacts and performances, tasting traditional foods, learning about historical narratives, and experiencing strong cultural identity.

It is designed for tourists seeking unique cultural experiences by observing elements of minority settlements that evoke a sense of identity (Yang & Li, 2011). In particular, ethnic groups that have preserved original cultures, traditional lifestyles, and distinctive ways of life, including beliefs and values, often exist outside the mainstream society and its existing norms shaped by modernity (Xie, 2010; Yang & Wall, 2009). The main purpose of ethnic tourism is to provide visitors with the opportunity to experience the unique features of tangible and intangible traditional cultures, such as lifestyles, rituals, and customs (Tatiana & Denis, 2020). Developing tourism in response to tourism demand is a key strategy for generating income and foreign exchange for ethnic communities, as it has become a powerful tool for strengthening ethnic identity (Yang & Wall, 2016). The preservation and sustainable transmission of cultural practices is supported by tourism that values the unique way of life that has been passed down through generations (Tu & Zhang, 2020). This form of tourism serves not only as a means of preserving heritage but also as a means of keeping cultural identity alive (Yang, Wall, & Smith, 2008). Finally, the growth of the ethnic tourism industry

contributes to a sense of identity and ethnic pride (Esman, 1984). Both cultural and ethnic tourism are concerned with national culture, but are now being divided into a number of sectors [2]. To many people, these two forms of tourism may seem similar. However, they differ in content. Therefore, it is important to highlight the differences between them, ethnotourism is a narrow term that describes any excursion that focuses on human activities rather than nature and attempts to give the tourist an understanding of the lifestyle of the local population. It is also called "local tourism".

Cultural tourism is a type of tourism activity in which the main purpose of the visitor is to explore, discover, experience and consume tangible and intangible cultural attractions/products in the tourist destination. These attractions/products belong to the set of specific material, intellectual, spiritual and emotional characteristics of a society, which include art and architecture, historical and cultural heritage, culinary heritage, literature, music, creative industries and living cultures with their lifestyles, value systems, beliefs and traditions. Cultural tourism (this term is now widely used in many countries) provides an introduction to the history and culture of a country in all its aspects, including architecture, painting, music, theatre, folk traditions and lifestyles. However, since culture itself is a very broad concept, this type of tourism also encompasses various activities, art forms, historical periods (including modern culture), and peoples, etc. Ethnic and cultural tourism (or ethno-cultural tourism) is considered to be a combination of various tourism activities that arise from the desire to understand the multifaceted phenomena in the ethnic and cultural spheres [1]. Cultural tourism is not a new concept. According to the literature, by the 16th century, sons of nobles were sent on European trips to see the remains of classical antiquity. This was so widespread that by the 18th century, this traditional cultural tourism was known as the Grand Tour.

In ethnic tourism, the tourist is interested in direct contact with the local population. He wants to get acquainted with the lifestyle and cultural monuments of the people he is visiting. In this form of tourism, the tourist visits the homes of the local population, observes and participates in their festivals, dances, ceremonies and other cultural expressions. In this form of tourism, human contact with indigenous peoples is very important and it also includes studying and purchasing local products.

The term "ethnic" was originally applied to all non-Jewish groups. By the mid-15th century, all non-Jewish and non-Christian groups were referred to as "ethnic." By the late 19th and early 20th centuries, "ethnicity" was placed between the ideas of race and culture.

However, in cultural tourism, the contact with people is indirect. The main interest of tourists is not to directly experience and participate in the traditional cultural practices of the local population. It is not to experience the culture, but to see it. Thus, in ethnic tourism, the tourist seeks a more "close" and "authentic" contact. In cultural tourism, however, the contact with indigenous peoples is not so direct.

METHODOLOGY

Surveys, interviews, and monitoring were conducted to determine the role and attitude of local residents in the development of ethnotourism in Surkhandarya.

The target audience was people with various professions (Tourism workers, Artisans, Entrepreneurs and Teachers) and Students with an active lifestyle aged 18 to 50. 200 people participated in the survey. The survey lasted from July 15 to August 15, 2025. It was conducted in 4 large districts of Surkhandarya region: Termez, Denov, Boysun, and Shorchi. The number of questions asked to the participants was short and clear. Ethical aspects were carefully considered during the research process. All participants were informed and informed consent was obtained from all of them before the interviews and interview discussions. Participation was completely voluntary and participants had the right to withdraw at any time without any consequences. The main objective of this study was to identify the specifics of ethnic tourism activities using the preserved ethnic communities in the Surkhandarya region, located in the southernmost part of Uzbekistan, and to find answers to the questions of how familiar the population of the region is with the concept of ethnotourism, as well as to what extent they are familiar with the concept of ethnotourism. On this basis, the economic impact, environmental impact, and socio-cultural impact of the development of ethnotourism were analyzed from positive and negative aspects and evaluated on a Likert scale. Participants answered the questions:

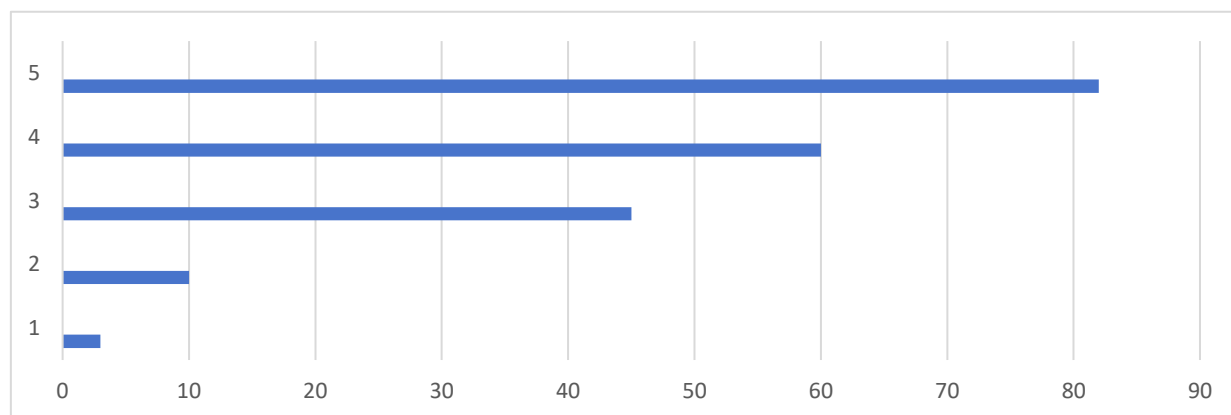
- 1-I totally disagree
- 2- I partially disagree.
- 3-Neutral (no opinion)
- 4- I partially agree.
- 5- I completely agree.

They were asked to choose one of the options given above and explain their answers. This was done to increase the reliability of the questionnaire and to analyze the responses accurately. The questionnaire was conducted face-to-face and online using the Google Forms platform. The study was conducted using a quantitative survey. The questionnaire used to collect data consisted of a section and 6 questions. A total of 200 respondents answered the questionnaire. Table shows the age, occupation, number and gender of 200 respondents in percentages and numbers, shows the age, occupation, number and gender of 200 respondents in percentages and numbers.

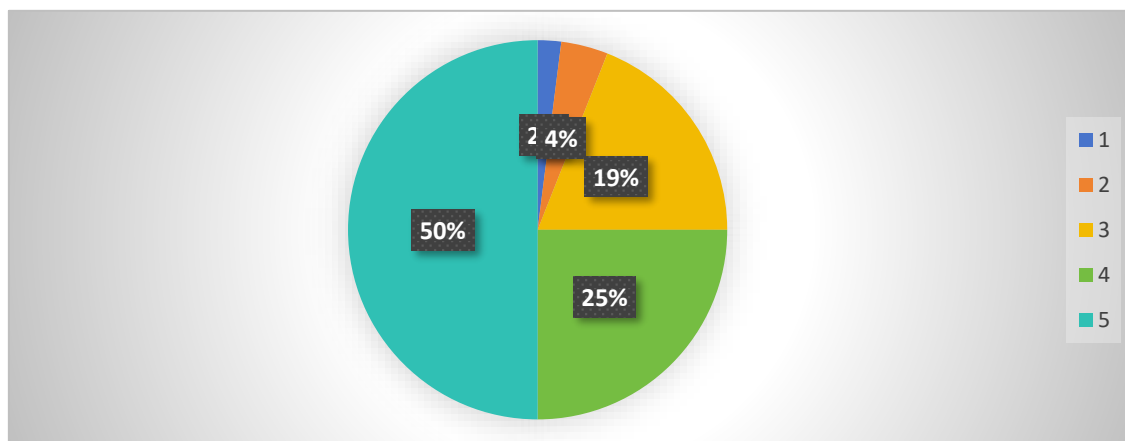
Youth composition			Professional content			Sex composition		
Age range	Number of participants	Percentage	Professional content Type of occupation	Number of participants	Percentage	Gender	Number of participants	Percentage
18-25 years old	30	15.0 %	Tourism staff	70	35.0%	Men	89	44.5%
26-32 years old	45	22.5 %	Craftsmen	35	17,5%	Women	111	55.5%
33-42 years old	65	32.5 %	Teacher	20	10.0%			
43-50 years old	60	30 %	Entrepreneur	60	30.0%			
			students	15	7.5%			

Basic information about the respondents is presented in table .The first part consisted of 3 general questions based on scientific research aimed at determining the age, gender, and ethnicity of the respondent. The second part of the questionnaire assessed the attitude of the population to ethnotourism through 6 broad attitudinal questions. In this section, respondents' familiarity with the concept of ethnotourism, their attitude to ethnotourism, in particular its positive and negative impact on the development of the regional economy, and their readiness and problems with its development were assessed on a five-point Likert scale (where 1 is completely disagree and 5 is completely agree). Quantitative data were analyzed using excel statistical programs.

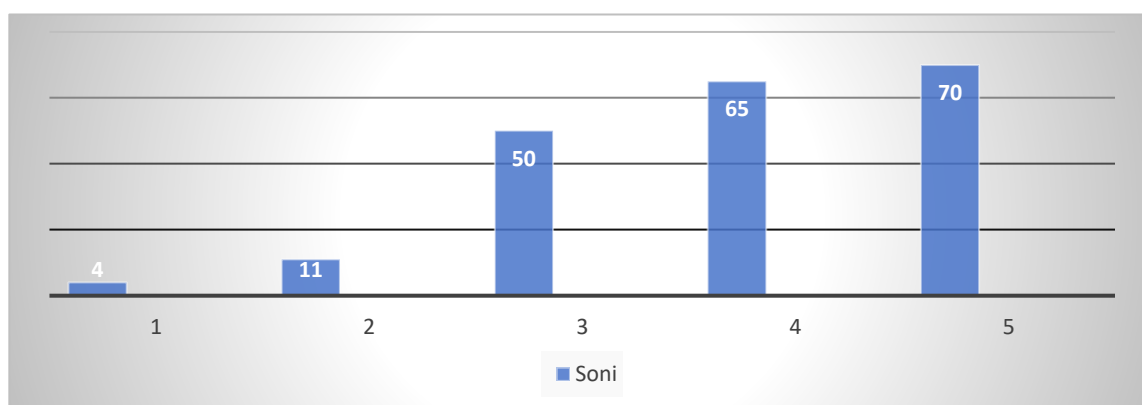
Q1. Ethnotourism arose with the aim of seeing and learning about the ancient culture and traditions of different ethnic peoples.Average rating: 4.04.



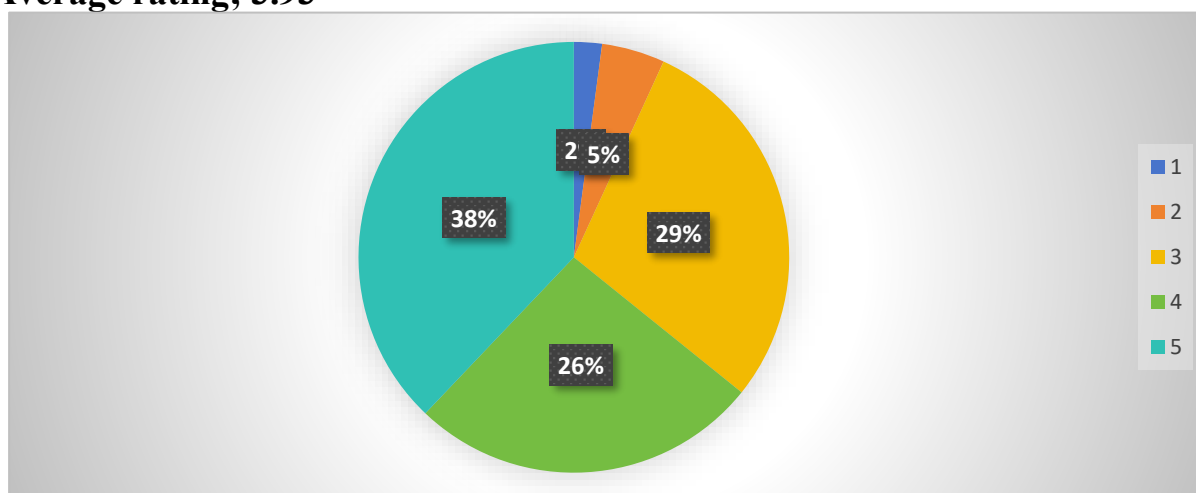
Q2. Tourism is one of the main factors influencing the improvement of the economy of Surkhandarya region. Average rating; 4.19



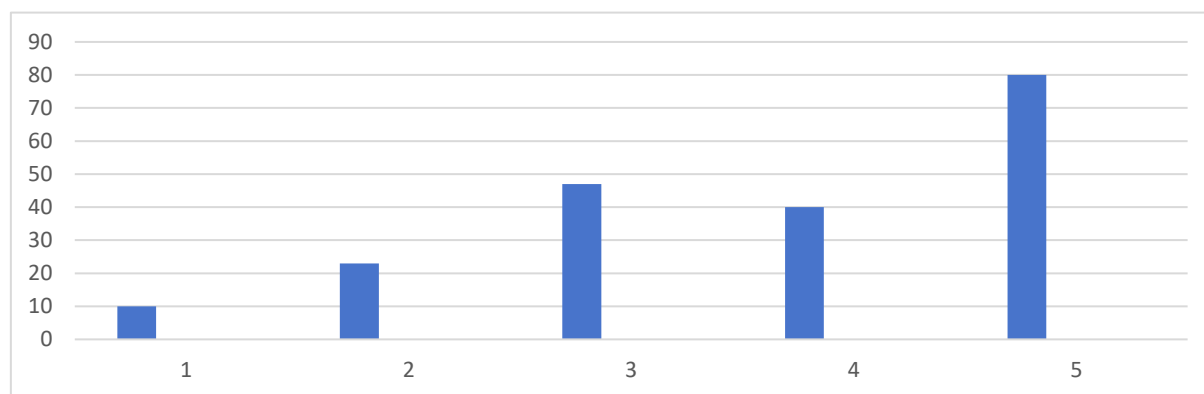
Q3. Ethnotourism has a positive impact on increasing employment and improving the living standards of the local population in the Surkhandarya region.



Q4. Festivals such as "BoysunBahori" and "Bakhshichilik" in Surkhandarya play an effective role in promoting ethnotourism in the region. Average rating; 3.93

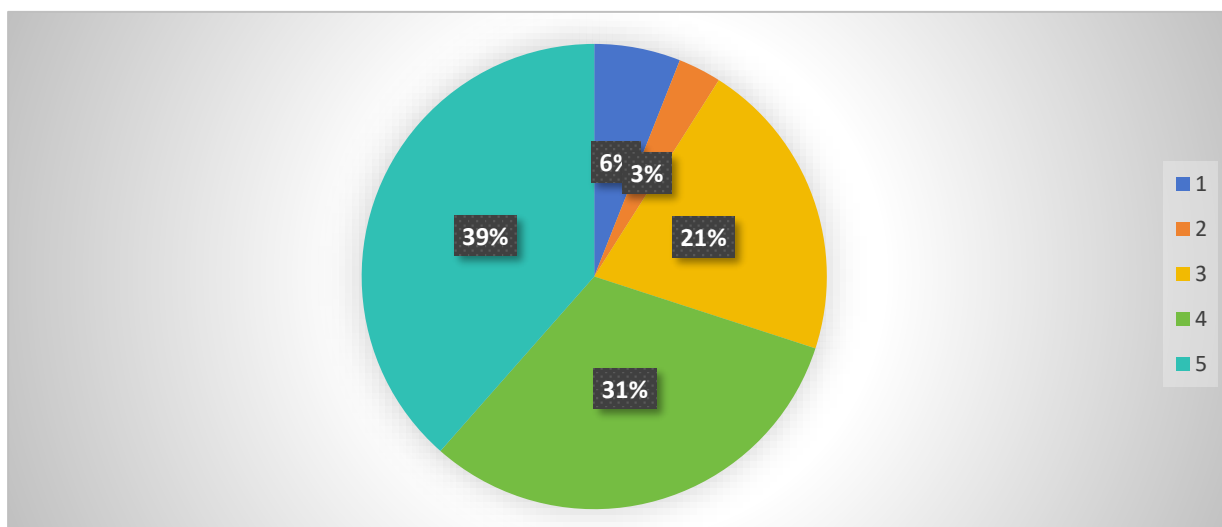


Q5. Ethnotourism helps to preserve and promote the ancient cultural values and national traditions of the local population in the region. Average



rating: 3.73

Q6. State support is essential for the sustainable development of all sectors of tourism in the region. Average rating 4.18



Average rating: 3.93. Most respondents gave a high rating, which means that ethnotourism is positively perceived and correctly understood in the region.

RESULT AND DISCUSSION

The age of the respondents in the survey ranged from 18 to 50 years, with the largest group being respondents aged 33-42 (32.5%). The smallest group was 15%, corresponding to respondents aged 18-25. In terms of professional composition, tourism workers (35%) and entrepreneurs (30%) occupied the main share. In terms of professional composition, students had the lowest share, coming in last with 7.5% out of a maximum of 100%. By gender, women (55.5%) and men 44.5%. Fewer men participated in the survey. Mostly women participated very actively in the survey, and answered the questions in depth and accurately. Note: When calculating the results of the survey, the Likert scale was used as the evaluation criterion, according to which:

1-I totally disagree

- 2- I partially disagree.
- 3-Neutral (no opinion)
- 4- I partially agree.
- 5- I completely agree.

Figure 1 Average score: 4.04. According to the results of the first question, the majority of respondents showed that they had sufficient knowledge about the concept of ethnotourism, and their opinions were assessed positively. The results showed that most participants answered "4" and "5" (I completely agree), while the answers "I completely disagree" and "I partially disagree" were very few. Therefore, the majority of respondents were interested in the formation and recognizes the ancient traditions and culture of ethnic groups as a means of understanding and studying them in their development. It is possible to see a predominance of positive attitudes towards ethnotourism in the region

Figure 2 Average rating 4.19. Impact of ethnotourism on the economy Residents (25%) rated the impact of ethnotourism on the economy positively, with (50%) rating it as "4" (Partially Agree) and (49%) rating it as "5" (Fully Agree). The majority of participants identified it as an important factor that directly impacts the economy.

Figure 3 Ethnotourism has a positive impact on the employment rate and lifestyle of the population. The majority of participants believed that the development of ethnotourism, increasing employment rates, would have a positive impact not only on the economy but also on social life. Although those who fully agreed and those who partially agreed ranked high with a total of 67.5%, some participants also mentioned the change in the ecological situation and the risk of losing authenticity. The results of the analysis show that although ethnotourism is considered a beneficial sector for society, it is important not to forget about various risks. The average score is 3.93.

Figure 4 "Boysun Spring" and Bakhchichi festivals. Despite the fact that festivals are very important for the formation and development of ethnotourism in the region, among the participants, 2% strongly disagree and 5% partly disagree, and 29% are neutral. Analyzing these results, it was found that the interest and knowledge of festivals among the population is somewhat low. Despite this, 26% partly disagree and 40% completely agree. Average score. 3.73. According to the results, 36% of the survey participants disagreed, partially disagreed, and were neutral, but there were many positive opinions among the respondents, 64%. So, the festivals organized in the region are effective in promoting ethnotourism. In our opinion, festivals certainly have a positive impact on the development of the ethnotourism sector in Surkhandarya region, but it is necessary to promote it more widely and increase its influence.

Figure 5. The majority of survey participants believe that one of the main tasks of ethnotourism in the Surkhandarya region is to help the local population preserve its ancient rich cultural heritage, national values, and national traditions. The reason for this was the example of ethnovillages being organized in the region. According to the results of the analysis, 80% of respondents (40%) fully

agreed. Most of them are tourism workers. According to participants who disagree with this opinion, ethnotourism, in addition to preserving cultural heritage, provides cultural exchange between the host and the visitor. Personal communication broadens the worldview, and increases respect for different cultures between the host and the visitor. Another important feature, one of the greatest advantages of ethnotourism is its ability to generate income. It is worth noting that a large part of this income is valuable foreign exchange. The ethnotourism sector creates space for the development of secondary income-generating activities such as crafts, dance, music and theater. It also creates jobs in the industries that serve the sector.

Figure 6. State support According to the results, the absolute majority of respondents recognized active state support as an important factor. Leading with 39%.

The results of the survey conducted in Surkhandarya region were analyzed and the opinions of the participants were studied. It was reported that the population of the region has a high level of knowledge and understanding of the concept of ethnotourism. The positive benefits of ethnotourism to the economy, especially in terms of employment and infrastructure development, were also mentioned by a large number of respondents as one of the main ones. In recent years, as a result of various projects implemented by the state in the region, it can be seen that the tourism industry in the region has been developing at a high level. In conclusion, the responses of the participants are consistent and the research tool is reliable.

COCLUTION

In conclusion, the indigenous people of Surkhandarya region see tourism as an opportunity for the economic and cultural development of their region, but they are implementing this process cautiously, gradually, because tourism can harm their original culture and national identity. The main task now is to explain to the local population that the normal development of tourism can bring significant benefits comparable to mining, metallurgy, trade or agriculture, but tourism can cause less damage to the environment than the above-mentioned industries. This study did not face any restrictions during the data collection process, especially in terms of attracting participants for in-depth interviews and questionnaire discussions. The residents of Surkhandarya region were generally somewhat hesitant to be interviewed, since the participants selected among them were mainly real hard-working artisans, entrepreneurs and young students. After obtaining permission, the villagers were informed about the objectives of the study and the reason for collecting data through interviews. During the interview, it was found that the population has positive perceptions of ethnotourism and is very well informed about all sectors of tourism. Even though they live in a geographically disadvantaged area, both in terms of natural and economic geography and far from the central cities, the respondents' answers were clear and convincing. They provided clear information about their rich ethnographic history and ethnotourism potential. For future research, larger surveys using quantitative methods could be

conducted to study tourists' intentions to visit the destination. In addition, this study did not examine aspects related to tourism marketing, cultural destination branding, or service quality development, which future research could consider to further enrich the body of knowledge in ethnic tourism research.

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THE NECESSITY OF AN ETHNOECOLOGICAL APPROACH TO NATURE CONSERVATION

Abstract: *This article analyzes the causes and consequences of changes in the types and principles of territorial organization of nature use across various historical periods, and presents a comprehensive account thereof.*

Key words: *natural environment, integrated approach, natural-historical type, commodity target type, program-target type, landscape, ethnos.*

The concept of transitioning to a sustainable path of development and eliminating ecological threats facing human society has been continuously evolving over several millennia. This constitutes one of the core indicators of the scientific field of geoecology. The need to monitor, across space and time, the changes in indicators such as the volume of nature use and production output, population size, the scale of natural resource utilization, the year-on-year increase in anthropogenic pressure on nature, and the balance of ecological and ethnoecological landscapes has become ever more urgent. This, in turn, highlights the necessity of an integrated approach alongside innovative perspectives on maintaining ecological balance.

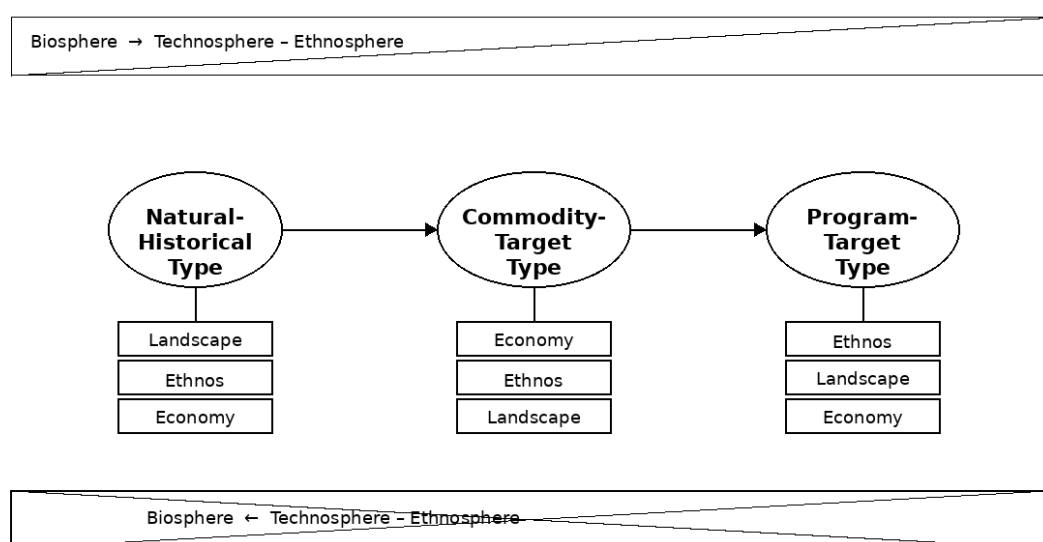
In economic and social geography, it has been scientifically established that the principles, types, and forms of territorial organization of productive forces, human settlements, and human society in general may change under the influence of various factors. This phenomenon is observed even more clearly in the process of utilizing nature, and in particular land and water resources, as evidenced by international experience [5]. Based on these methodological foundations, three types of territorial organization of land and water resource use can be distinguished in regional conditions. These types may be conditionally named — based on the purpose of nature use — the natural-historical type, the commodity-target type, and the program-target type.

The natural-historical type of nature use, based on utilizing the natural potential of the territory, existed in the Fergana Valley until the late 19th and early 20th centuries. In this type of territorial organization of nature use, the relief, climate, soil characteristics, the enclosed geographical position of the valley, as well as the national-ethnic characteristics, habits, skills, and customs of the population were taken into account. This type is generally formed over a long historical period, during which accumulated skills, abilities, and experiences are based on a harmonious and proportional relationship with nature. Consequently,

from an ecological standpoint, this type is the most stable and is therefore worthy of study.

If the interrelationships of the triad "Ethnos–Landscape–Economy" in this type are arranged in the form of "geotriads," it becomes apparent that the main burden falls on the economy, and that the territorial organization of the economy is conducted in accordance with and adapted to landscape indicators. One can observe that only those economic indicators that correspond to the landscape requirements of the ethnos are preserved as "skills–abilities–traditions." As the "Ethnos–Landscape–Economy" relationships evolve, the amount of natural landscape (biosphere) in any region decreases, while economic (technosphere) indicators begin to take its place (see Figure 1).

Figure 1. Changes in the "Landscape–Ethnos–Economy" System in Nature Use



As the "Ethnos–Landscape–Economy" relationships develop further — as in ethnology [4] — the place of the first type is taken by the next type of territorial organization of nature use: the commodity-target type. In this type, alongside the natural potential of the region, subjective factors are also taken into account (for example, increasing demand for commodity crops, the intrusion of foreign ethnic groups into the landscape). As a result, the natural landscape characteristics of the territory are more extensively altered, and the achievements of scientific and technological progress are widely utilized. Although economic efficiency is high, the conditions for the emergence of geoeological problems are thereby laid.

In this type, examining the "geotriads" representing the interrelationships of "Ethnos–Landscape–Economy," one can observe that the main burden falls on the landscape. Forced adaptation of the landscape to economic indicators, excessive intensification of drainage and irrigation works, and alteration of river regimes and courses are observed. In our context, irrigation works are carried out with the help of machinery (pumps), and areas absolutely prohibited from water extraction (e.g.,

foothills) are being irrigated. From an ecological standpoint, such an approach is characterized as "surgical intervention in nature" and causes chain-reaction ecological problems. In this type, the most important aspect for the present study is that local ethnic groups and the "advanced" ethnic groups that have entered (or occupied) their territory enter into contact. The advanced ethnic groups teach local ethnic groups their technically superior methods of nature use applied in their own landscapes and begin to apply them in the local landscapes. This can lead to catastrophic ecological consequences, as occurred with the city of Babylon.

The third type of "Ethnos–Landscape–Economy" relationships — the "program-target type" — is characteristic of advanced, developed states that conduct their economic activities based on the principles of sustainable development. In the "geotriads" reflecting the interrelationships of "Ethnos–Landscape–Economy," one can see that an equal burden falls on each component. However, even in this type, the diagram shows that the biosphere is increasingly being replaced by the technosphere and ethnosphere.

In this type, landscape planning and innovative ecological projects that ensure sustainable development are implemented in practice. To this end, both of the above types are thoroughly analyzed, and the achievements of the first type in the socio-ecological direction and of the second type in the economic-technological direction are selectively incorporated into the program-target type.

Conclusion

The study showed that the principles of territorial nature management have changed significantly throughout different historical periods. Ethnoecological culture reflects the long-term interaction between local communities and the natural environment. Traditional ecological knowledge can serve as an important basis for sustainable territorial development. The classification of landscape-ecological planning principles helps to identify effective approaches to nature conservation and resource use. Integrating ethnocultural values into planning processes contributes to ecological stability and social well-being. Therefore, the ethnoecological approach should be considered an important component of modern landscape-ecological planning.

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YIRIK SHAHARLARDA UCHUVCHISIZ UCHISH APPARATLARI (UUA) TAHDIDLARIGA QARSHI HIMOYA TIZIMINI TASHKIL ETISH

Annotatsiya: Maqolada yirik shaharlarda uchuvchisiz uchish apparatlari (UUA)dan kelib chiquvchi xavfsizlik tahdidlari ilmiy-amaliy nuqtai nazardan tahlil qilingan. Tadqiqotda shahar infratuzilmasi, transport tizimlari, muhim obyektlar va aholi xavfsizligiga ta'sir etuvchi omillar tizimlashtirildi. Natijada UUA tahdidlariga qarshi aniqlash, identifikatsiya, tahlil va javob choralaridan iborat ko'p bosqichli himoya modeli ishlab chiqildi. Maqolada sun'iy intellekt, radiochastota monitoringi va idoralararo muvofiqlashtirish mexanizmlarini yagona arxitektura birlashtirish zarurati asoslab berilgan.

Kalit so'zlar: UUA, dron, antidron tizimi, shahar xavfsizligi, havo makoni muhofazasi, sun'iy intellekt, radioelektron monitoring, muhim infratuzilma.

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ORGANIZATION OF A PROTECTION SYSTEM AGAINST UNMANNED AERIAL VEHICLE (UAV) THREATS IN LARGE CITIES

Annotation: The article provides a scientific and practical analysis of security threats posed by unmanned aerial vehicles in large cities. It systematizes the factors affecting urban infrastructure, transport systems, critical facilities and public safety. Based on the study, a multi-layer protection model consisting of detection, identification, analysis and response measures is proposed. The article substantiates the need to integrate artificial intelligence, radio-frequency monitoring and interagency coordination into a unified urban security architecture.

Keywords: UAV, drone, counter-UAV system, urban security, airspace protection, artificial intelligence, radio-frequency monitoring, critical infrastructure.

So'nggi yillarda uchuvchisiz uchish apparatlari texnologiyalari fuqarolik va maxsus sohalarda tez sur'atda rivojlandi. Dronlar monitoring, logistika, qishloq xo'jaligi, sanoat obyektlarini ko'zdan kechirish va favqulodda vaziyatlarda qidiruv-qutqaruv ishlarida samarali vosita sifatida qo'llanilmoqda. Shu bilan birga, mazkur texnologiyalarning ommalashuvi shahar havo makoni xavfsizligiga oid yangi muammolarni yuzaga keltirmoqda [1].

Yirik shaharlar aholi zichligi, transport oqimlari, muhim davlat muassasalari, energetika va telekommunikatsiya obyektlari jamlanganligi bilan ajralib turadi. Shu sababli nazoratsiz yoki noqonuniy uchirilgan UUAning o'zi ham jamoat tartibi, axborot xavfsizligi va infratuzilma barqarorligiga salbiy ta'sir ko'rsatishi mumkin. ICAO va EASA materiallarida UUALarni xavfsiz havo makoniga integratsiya qilishda aniq qoidalar, xavfni baholash va boshqaruv mexanizmlari muhimligi ta'kidlanadi [1], [2].

Mavzuning dolzarbligi

Mavzuning dolzarbligi, avvalo, UUALarning texnik imkoniyatlari va ommaviyligi ortishi bilan bog'liq. Kichik o'lcham, past balandlikda harakatlanish, tez tayyorgarlik va nisbatan arzonlik dronlarni turli maqsadlarda qo'llash imkonini kengaytiradi. Bunday sharoitda an'anaviy havo nazorati vositalari har doim ham kichik UUALarni o'z vaqtida aniqlay olmaydi.

Ikkinchidan, shahar muhiti radiosignallar, ko'p qavatli binolar, reklama konstruksiyalari, transport infratuzilmasi va odamlar gavjumligi sababli murakkab kuzatuv maydoni hisoblanadi. Shuning uchun bir turdagi sensor yoki alohida texnik vosita yetarli natija bermaydi. Samarali yondashuv radar, radiochastota monitoringi, optik kuzatuv, akustik sensorlar va tahlil platformalarining uyg'unlashuvini talab qiladi [3], [4].

Tadqiqot maqsadi va vazifalari

Tadqiqotning maqsadi - yirik shaharlarda UUA tahdidlariga qarshi kompleks himoya tizimini tashkil etishning nazariy va amaliy asoslarini ishlab chiqish, uning tarkibiy elementlarini belgilash hamda takomillashtirish bo'yicha ilmiy takliflar berishdan iborat.

Ushbu maqsaddan kelib chiqib quyidagi vazifalar belgilandi: UUA tahdidlarini tasniflash; shahar muhitidagi xavf omillarini baholash; antidron tizimlarida qo'llanadigan sensor va axborot texnologiyalarining o'rnini aniqlash; ko'p bosqichli himoya modelini ishlab chiqish; amaliy taklif va tavsiyalarni shakllantirish.

Tadqiqot usullari

Tadqiqotda tizimli tahlil, qiyosiy tahlil, ekspert baholash, modellashtirish va prognozlash usullaridan foydalanildi. Tizimli tahlil orqali UUA tahdidlari shahar xavfsizligi tizimining tarkibiy qismi sifatida o'rganildi. Qiyosiy tahlil yordamida xalqaro meyoriy hujjatlar, havo makonini boshqarishga oid yondashuvlar va C-UAS sohasidagi umumiy tendensiyalar solishtirildi [5], [6].

Ekspert baholash usuli ehtimollik va ta'sir darajasini shartli ravishda baholash uchun qo'llanildi. Modellashtirish usuli asosida esa aniqlash, identifikatsiya, tahlil va javob choralaridan iborat konseptual sxema ishlab chiqildi.

UUA tahdidlarining tasnifi

Shahar sharoitida UUA tahdidlari bir nechta yo'nalishda namoyon bo'ladi. Birinchi yo'nalish - razvedka va noqonuniy kuzatuv bo'lib, bunda muhim obyektlar, harakat yo'nalishlari yoki xavfsizlik tizimlari haqida axborot to'planishi mumkin. Ikkinchi yo'nalish - ommaviy tadbirlar va jamoat xavfsizligiga ta'sir,

ya'ni dronning nazoratsiz harakati aholi orasida xavotir yoki tartib buzilishiga sabab bo'lishi mumkin.

Uchinchi yo'nalish - muhim infratuzilma obyektlariga xavf. Aeroport, elektr ta'minoti, suv inshootlari, transport uzellari va telekommunikatsiya markazlarida UUA bilan bog'liq har qanday insident katta tashkiliy va iqtisodiy oqibatlariga olib kelishi mumkin. To'rtinchi yo'nalish - axborot va kiberfizik xavflar bo'lib, u kuzatuv, signalni noqonuniy qabul qilish yoki obyekt faoliyatiga psixologik ta'sir ko'rsatish bilan bog'liq bo'lishi mumkin [7].

1-jadval.

Shahar muhitida UUA tahdidlarining xavf matritsasi

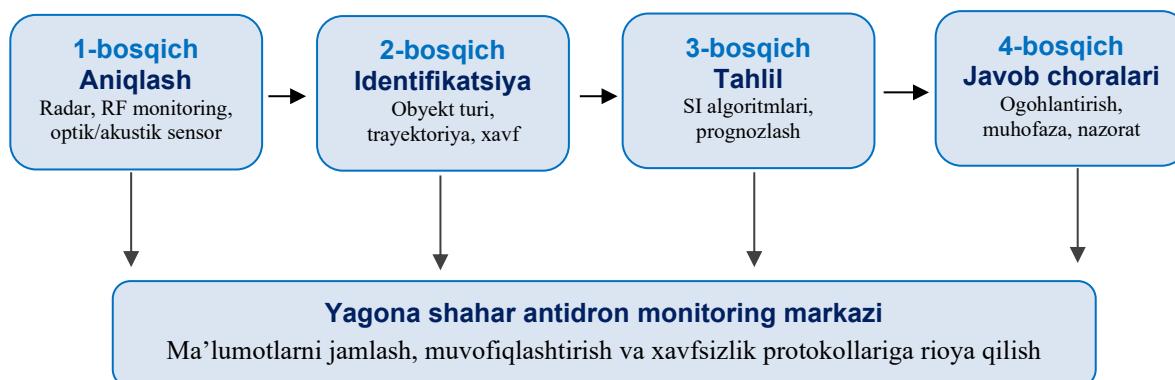
Tahdid turi	Ehtimollik	Ta'sir darajasi	Izoh
Razvedka va noqonuniy kuzatuv	Yuqori	O'rta	Axborot xavfsizligiga ta'sir etadi
Ommaviy tadbirlarda tartib buzilishi	O'rta	Yuqori	Aholi xavfsizligi va evakuatsiya jarayoniga ta'sir ko'rsatadi
Muhim infratuzilma faoliyatiga xalal	O'rta	Yuqori	Transport, energetika va aloqa barqarorligiga ta'sir etadi
Aeroport va havo harakati xavfi	Past-o'rta	Juda yuqori	Parvozlarning xavfsizligi va iqtisodiy yo'qotishlar bilan bog'liq
Axborot-psixologik ta'sir	O'rta	O'rta	Jamoat xavotiri va noto'g'ri axborot tarqalishiga sabab bo'ladi

Manba: muallif tomonidan tizimli va ekspert baholash asosida tuzilgan.

Ko'p bosqichli himoya modeli

Tadqiqot natijalari shahar havo makonini muhofaza qilishda to'rt bosqichli yondashuv maqsadga muvofiq ekanini ko'rsatdi. Birinchi bosqichda havo obyekti aniqlanadi; ikkinchi bosqichda uning turi va harakat parametrlari identifikatsiya qilinadi; uchinchi bosqichda ma'lumotlar sun'iy intellekt va tahlil platformalari yordamida qayta ishlanadi; to'rtinchi bosqichda vakolatli xizmatlar tomonidan qonunchilik va xavfsizlik protokollariga muvofiq javob choralari ko'riladi [8], [9].

UUA tahdidlariga qarshi ko'p bosqichli himoya modeli



1-rasm. Yirik shaharlarda UUA tahdidlariga qarshi ko'p bosqichli himoya modeli.

2-jadval.**Kompleks antidron tizimi elementlari va vazifalari**

Tizim elementi	Asosiy vazifa	Shahar sharoitidagi afzalligi	Cheklovi
Radiolokatsion kuzatuv	Havo obyektlarini masofadan aniqlash	Past balandlikdagi harakatni nazorat qilish imkoni	Kichik obyektlar va shahar shovqini ta'sir qilishi mumkin
RF monitoring	Boshqaruv va teletmetriya signallarini kuzatish	Operator-apparat aloqasi haqida ma'lumot beradi	Avtonom rejimdagi apparatlarda samarasi cheklanadi
Optik/IK kuzatuv	Vizual tasdiqlash va kuzatib borish	Identifikatsiya aniqligini oshiradi	Yomg'ir, tuman va tungi sharoit ta'sir qiladi
Akustik sensorlar	Dvigatel/parrak akustik izini aniqlash	Zich binolar orasida qo'shimcha ma'lumot manbai	Shahar shovqini natijaga ta'sir etadi
SI tahlil platformasi	Ma'lumotlarni birlashtirish va xavfni baholash	Tezkor qaror qabul qilishni qo'llab-quvvatlaydi	Sifatli ma'lumotlar va doimiy o'qitishni talab qiladi

Manba: [3], [4], [8] va muallif tahlili asosida tuzilgan.

Ilmiy yangilik

Tadqiqotning ilmiy yangiligi shundaki, unda yirik shaharlar uchun UUA tahdidlarining kompleks tasnifi, xavf matritsasi va ko'p bosqichli himoya modeli yagona metodik yondashuv asosida shakllantirildi. Mazkur model texnik vositalarni alohida emas, balki ma'lumotlarni yig'ish, tahlil qilish, idoralararo muvofiqlashtirish va huquqiy cheklovlarni hisobga olgan holda ko'rib chiqadi.

Shuningdek, sun'iy intellekt asosidagi tahlil platformasi faqat avtomatlashtirish vositasi emas, balki xavf darajasini baholash, soxta signallarni kamaytirish va operator qarorini asoslashga xizmat qiluvchi analitik yadro sifatida talqin qilindi.

Natijalar tahlili

Olingan natijalar shuni ko'rsatadiki, shahar sharoitida UUAga qarshi himoya tizimi ko'p manbali ma'lumotlarga tayanishi lozim. Faqat video kuzatuv yoki faqat radarga asoslangan yondashuv shahar muhitining murakkabligi sababli cheklangan samara beradi. Eng barqaror natija radar, RF monitoring, optik tasdiqlash va SI tahlil platformasi birlashtirilganda kuzatiladi.

Tahlildan kelib chiqib, antidron tizimining samaradorligi uch omilga bog'liq: birinchisi - sensorlar xilma-xilligi; ikkinchisi - ma'lumotlarni yagona markazda qayta ishlash; uchinchisi - vakolatli xizmatlar o'rtasida tezkor axborot almashinuvi. Bu omillar ta'minlanmasa, texnik vositalar mavjud bo'lgan taqdirda ham qaror qabul qilish kechikishi mumkin [10], [11].

Amaliy takliflar

Yirik shaharlarda UUA tahdidlariga qarshi himoyani takomillashtirish uchun quyidagi choralar maqsadga muvofiq: birinchidan, muhim obyektlar atrofida qonunchilikka muvofiq havo makoni monitoringi zonalarini belgilash; ikkinchidan, shahar miqyosida yagona antidron monitoring markazini tashkil

etish; uchinchidan, RF monitoring, radar va optik kuzatuv vositalarini yagona platformaga integratsiya qilish; to'rtinchidan, soha mutaxassislarini tayyorlash va qayta tayyorlash bo'yicha o'quv dasturlarini yo'lga qo'yish.

Bundan tashqari, har bir yirik shaharda havo makonining raqamli xaritasi, xavfli hududlar ro'yxati, ommaviy tadbirlar uchun vaqtinchalik monitoring rejasi va idoralararo tezkor xabar almashish tartibi ishlab chiqilishi lozim.

Xulosa

UUA texnologiyalarining rivojlanishi yirik shaharlar xavfsizligi uchun yangi vazifalarni yuzaga keltirmoqda. Tadqiqot natijalari shahar havo makonini muhofaza qilishda ko'p bosqichli, integratsiyalashgan va huquqiy jihatdan tartibga solingan yondashuv zarurligini ko'rsatdi. Aniqlash, identifikatsiya, tahlil va javob choralaridan iborat model shahar xavfsizligini kuchaytirish, muhim infratuzilmani muhofaza qilish va tezkor qaror qabul qilish samaradorligini oshirishga xizmat qiladi.

Kelgusida mazkur yo'nalishda mahalliy sharoitga mos sensor tarmoqlari, sun'iy intellekt asosidagi tahlil algoritmlari va kadrlar tayyorlash tizimini rivojlantirish alohida ahamiyat kasb etadi.

Foydalanilgan adabiyotlar:

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ISSUES OF INTEGRATING OMR, OCR, AND ARTIFICIAL INTELLIGENCE MODELS IN THE ANALYSIS OF LINGUISTIC INTERFERENCE

Abstract: *This study introduces a hybrid digital framework designed to systematically capture and digitize L1 interference errors in English writing. By integrating LaTeX forms, a Telegram Bot, and FormScanner (OMR), the proposed workflow combines automated manuscript transcription via advanced OCR (Transkribus/Google Vision) with LLM-based error tagging and expert validation.*

Keywords: *linguistic interference, L1 interference, optical mark recognition (OMR), optical character recognition (OCR), large language models (LLMs).*

Introduction

In contemporary applied linguistics and foreign language teaching methodology, the analysis of student written discourse using digital learner corpora (*Learner Corpora*) is taking center stage. This methodology provides an opportunity to systematically and objectively identify linguistic interference (*L1 interference*) errors arising between language learners' native language (*L1*) and target language (*L2*). However, within the Uzbek language environment, research into English academic writing still relies heavily on traditional methods. This approach is characterized by high time consumption, limited capacity to process large volumes of data, and subjective errors resulting from the human factor.

During the data collection process, accurately preserving sociolinguistic indicators, such as students' regional origin and language of schooling, is critical to the validity of scientific findings. In the context of Uzbekistan, representatives from three major branches of the Turkic language family—the Oghuz (Khorezm), Karluk (Bukhara), and Kipchak (Nukus) dialectal environments—exhibit significantly different patterns in acquiring English linguistic structures, as well as distinct phonetic-graphic, morphological, and syntactic interference manifestations.

The purpose of this study is to develop and evaluate the efficiency of an integrated, hybrid digital pipeline for collecting students' handwritten English essays via LaTeX templates, a localized Telegram bot (for geolocation tracking), and FormScanner (*OMR*) systems, followed by automated annotation using modern neural network-based OCR and Large Language Models (*LLMs*). The proposed solution drastically reduces time consumption compared to traditional

corpus-building methods, while simultaneously laying the groundwork for the digital visualization of linguistic data (the creation of isogloss maps).

RESEARCH METHODOLOGY

In this study, a five-stage hybrid pipeline architecture was developed to minimize digitization errors and reduce data processing latency during the collection of analog handwritten data.

The operational framework of the overall system and the cross-stage data flow are illustrated in the diagram below, followed by a detailed description of each individual stage:

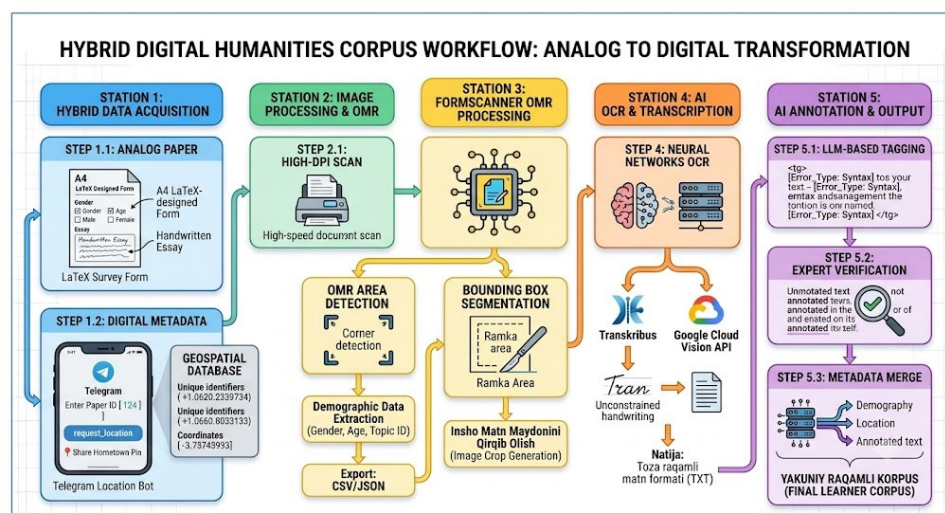


Figure 1. System operational stages.

1. **Template Design and Data Collection.** In the primary stage of the research, a specialized questionnaire form was developed to accept student essays and automatically parse demographic indicators. Within the questionnaire, variables indicating the student's gender, age, academic year, and selected essay topic (chosen from 10 standardized IELTS Writing Task 2 prompts) are structured using dedicated optical mark recognition (*\omrbox*) check-boxes. The overall layout of the designed, print-ready questionnaire form is presented in the Figure 2.

2. **Hybrid Geo-Metadata Collection.** In contrast to traditional corpora, this methodology employs a hybrid digital solution to accurately determine the exact regional, sub-dialectal origin (Oghuz, Karluk, or Kipchak) of the students. Utilizing a unique identifier (Paper ID) generated on the physical questionnaire sheet, students register via a specialized Telegram Bot operating on a local secure network.

Figure 2. Front and back view of the questionnaire form.

3. **OMR Scanning and Metadata Export.** Analog sheets collected from regional universities in Khorezm, Bukhara, and Nukus are digitized using high-resolution (600 DPI) scanners. These digital images are subsequently processed using the FormScanner software suite.

4. **AI-Based OCR and Transcription.** The cropped images of the handwritten essays are fed into the neural network-based Transkribus platform and Google Cloud Vision API (*TEXT_DETECTION*) models for text conversion.

5. **Automated Annotation and Manual Correction.** To identify linguistic interference markers within the digitized texts (such as the omission of articles or word order distortions caused by Uzbek language structures), primary linguistic tagging (annotation) is executed via prompt templates optimized for Large Language Models (LLMs). The neural network automatically tags errors using the [*Error_Type: Syntax*] format. In the final stage of the pipeline, expert linguists manually verify the automatically annotated texts to construct a "Gold Standard" corpus, correcting any instances of over-correction introduced by the AI.

Research Results

The proposed hybrid digital pipeline was evaluated using 500 student essays collected from regional universities in Khorezm, Bukhara, and Nukus, demonstrating substantial efficiency gains over traditional manual processing methods.

Data Collection and OMR Accuracy: Geo-metadata (pin-drop coordinates) collected via the Telegram bot achieved a 100% successful match rate with the questionnaire Paper IDs, eliminating manual regional sorting. FormScanner automatically recognized demographic optical marks (gender, age, academic year, prompt number) with 98.4% accuracy. The remaining 1.6% of data entry errors caused by improper boundary box marking were resolved manually.

OCR Text Recognition Performance: Automating image cropping and passing handwritten text segments to the Transkribus and Google Cloud Vision API neural networks yielded highly precise transcriptions:

- Character Error Rate (CER): 4.2%
- Word Error Rate (WER): 8.7%

LLM Annotation and Time Efficiency: Large Language Models achieved an 82.5% precision rate in preliminary automated linguistic interference tagging. Although manual verification by experts was required to finalize the text, the integrated pipeline reduced the end-to-end data processing lifecycle—from analog manuscript reception to a fully annotated digital corpus—by 62% compared to manual methods.

Conclusion

This study demonstrates that a hybrid pipeline integrating LaTeX templates, Telegram geolocation, and automated OMR/OCR technologies provides a highly efficient framework for developing error corpora in low-resource environments like the Uzbek language. The system preserves data integrity and sociolinguistic metadata precision while accelerating manuscript processing and linguistic annotation by 62%. Future scaling of this digital architecture aims to establish a comprehensive "Gold Standard" digital learner corpus to map systematic academic English interference errors across Uzbekistan's distinct dialectal regions (Oghuz, Karluk, Kipchak) and optimize national language education methodologies.

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TYPES OF INTERACTIVE GAMES IN PRESCHOOL EDUCATIONAL ORGANIZATIONS AND THEIR ROLE IN CHILDREN'S EDUCATION

Abstract: *This article discusses the methods of scientifically based, systematic and effective introduction of interactive games into the educational process in preschool educational organizations, their educational quality and comprehensive development of children. determines the relevance of this graduation qualification work.*

Keywords: *interactive education, integration, educational activity, interactive games, construction and construction, traditional games.*

Introduction

The main activity of a preschool child is play. However, unlike traditional games, interactive games ensure that the child not only receives knowledge, but also engages in communication, makes independent decisions, and thinks creatively. In today's information society, the role of interactive methods in attracting the attention of students and instilling in them a motivation for learning is invaluable. Therefore, improving the methodology for organizing the educational process in preschool educational institutions through interactive games remains an urgent pedagogical problem.

A number of decisions have been made in order to ensure the healthy, comprehensive development and formation of a child in preschool education. In particular, the Decree of the President of the Republic of Uzbekistan No. PF-256 of the Cabinet of Ministers of December 24, 2025 "On approval of the Strategy for the Education and Upbringing of Children on the Basis of National Values for 2026-2030", the Order of the Ministry of Preschool and School Education No. 273 of August 23, 2024 "On measures for the organization of spiritual and educational work in preschool and secondary educational organizations", and the Resolution No. 802 of December 22, 2020 "On approval of the State Standard of Preschool Education and Upbringing" provide that preschool education instills in its students a sense of desire to study and prepares them for regular national education. Preschool education is carried out in state and non-state preschool children's organizations and in families until the child reaches the age of six or seven.

The role of play in the comprehensive development of the child:

Intellectual development: During the game, the child learns to analyze, synthesize and draw conclusions. For example, in construction games, the child gets acquainted with mathematical concepts such as shapes, sizes and symmetry. This enriches his logical thinking.

Speech development: Play requires communication. As the child communicates with peers, his vocabulary increases, and the skill of constructing sentences is formed. Especially in role-playing games, the communicative function of speech develops rapidly.

Socio-emotional development: Play is a collective action. The child learns to obey the rules of the game, wait his turn, help his partner and cooperate towards a common goal. This instills in him a sense of empathy (understanding others).

Physical development: Active games not only strengthen the child's muscles, but also develop his dexterity, agility and balance skills.

“First Step” state program and play:

The main document of the Republic of Uzbekistan in the field of preschool education — “First Step” improved (2nd edition) state curriculum puts play activities at the center of the educational process. It is emphasized that all five areas of development (physical, socio-emotional, speech and communication, cognitive process, creative development) specified in the program are implemented precisely through game methods.

Interactive games in the educational process in preschool educational organizations through which they form their own opinions, develop decision-making and creative approaches. In interactive games, the child develops the following skills:

Cognitive skills: Independent thinking, speech and communication skills, teamwork, attention and memory also play a very important role, and through other interactive games, the child learns the ability to observe, colors, shapes, geometric structures. These mental activities create opportunities for children to gain new knowledge and experiences.

Creative thinking: By playing or creating interactive games in the educational process in preschool educational organizations, the child's imagination increases and he learns to express his feelings and find new solutions. Interactive games develop creative thinking and problem-solving skills.

Emotional development: Interactive games in preschool educational organizations develop emotional stability in children. By describing their feelings, the child understands himself and develops psychologically healthy, and the child learns to accept defeat and victory, to be patient.

Literature review: “Games and entertainment are very important for the health and well-being of children, they create the basis for the development of creativity, imagination, self-confidence, efficiency and physical, social, cognitive and emotional strengths and skills. They contribute to all aspects of education; games are a form of participation in everyday life, and they are of great importance in terms of bringing joy and pleasure to the child.” The famous psychologist L.S. Vygotsky considered the game to be one of the main factors in the development of the child. In his opinion, in the process of play, the child's "zone of proximal development" is formed. That is, the child seeks to perform tasks that he cannot perform independently with the help of adults or peers, and new

D.B. Elkonin also emphasized the role of play in the child's psychological development. According to him, through plot-role-playing games, children reflect the life of adults, master social roles and learn the norms of behavior in society. For example, by playing the role of a doctor, teacher, seller or builder, a child forms an idea of professions, develops a culture of communication and forms a sense of responsibility.

“Games help children develop their ability to negotiate, restore emotional balance, resolve conflicts, and make decisions. By participating in games and entertainment, children acquire practical skills; explore and understand the world around them; test new ideas, roles, and experiences, and at the same time learn to understand and “build” their social position in the world.”

Conclusion

Play also has a significant impact on a child's cognitive development. Through various didactic and interactive games, children develop attention, memory, thinking, observation, imagination, and problem-solving skills. During the game, the child compares, analyzes, summarizes, and tries to understand cause-and-effect relationships. As a result, his cognitive activity increases and the process of assimilating new knowledge becomes easier.

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CLINICAL AND EPIDEMIOLOGICAL ASPECTS OF HEPATITIS C IN CHILDREN WITH HEMATOLOGICAL MALIGNANCIES: A REVIEW

Abstract: *Hepatitis C virus (HCV) infection remains an important healthcare challenge among pediatric patients with hematological malignancies. Although advances in blood donor screening have significantly reduced the incidence of transfusion-transmitted infections, children undergoing treatment for leukemia, lymphoma, and other hematological cancers continue to be at increased risk of HCV exposure. Chronic HCV infection may adversely affect liver function, complicate chemotherapy administration, and influence long-term survival. This review summarizes current data regarding the epidemiology, clinical manifestations, laboratory characteristics, diagnosis, and management of hepatitis C in children with hematological malignancies.*

Keywords: *hepatitis C virus, children, leukemia, lymphoma, hematological malignancies, chronic hepatitis C, epidemiology, pediatric oncology.*

Introduction

Hepatitis C virus infection is one of the leading causes of chronic liver disease worldwide. Although the prevalence of HCV infection among children is lower than in adults, pediatric patients with hematological malignancies remain a vulnerable population due to frequent blood transfusions, intensive chemotherapy, and prolonged immunosuppression [1]. The introduction of effective blood screening programs has reduced transmission rates; however, HCV infection continues to be detected among survivors of childhood cancer and remains an important cause of chronic liver disease in this group [2].

Epidemiology. The prevalence of HCV infection among children with hematological malignancies varies considerably between countries. Earlier studies reported infection rates ranging from 15% to 50% among children receiving repeated blood transfusions before implementation of routine donor screening [3]. Children with acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), Hodgkin lymphoma, and non-Hodgkin lymphoma have historically demonstrated the highest prevalence of HCV infection because of extensive transfusion requirements [4].

Recent studies indicate a substantial decline in incidence; nevertheless, chronic HCV infection remains a concern among long-term survivors of childhood cancer [5].

The major risk factors associated with HCV infection in pediatric oncology patients include: multiple blood transfusions; bone marrow transplantation; prolonged chemotherapy; central venous catheterization; repeated invasive procedures [6]. Immunosuppression resulting from antineoplastic therapy may facilitate viral persistence and progression to chronic infection.

Clinical manifestations are often mild or absent. Most infected children remain asymptomatic for many years [2]. Common clinical findings include: hepatomegaly, fatigue, mild abdominal discomfort, elevated liver enzymes.

In some patients, chronic hepatitis may progress to significant hepatic fibrosis during long-term follow-up [7].

Diagnosis relies on serological and molecular methods. The primary laboratory investigations include: Anti-HCV antibodies; HCV RNA detection by PCR; Alanine aminotransferase (ALT); Aspartate aminotransferase (AST);

Liver fibrosis assessment. PCR remains the most sensitive method for confirming active infection, especially in immunocompromised children who may have delayed antibody production [8]. Several studies have shown that elevated ALT levels correlate poorly with the severity of liver injury, emphasizing the importance of comprehensive diagnostic assessment [4].

Impact on Oncological Outcomes. Chronic hepatitis C may influence cancer treatment through hepatotoxicity and treatment interruptions. Liver dysfunction can limit the use of certain chemotherapeutic agents and increase the risk of adverse effects [6]. Long-term studies suggest that successful management of HCV infection contributes to improved quality of life and reduces the risk of chronic liver disease among childhood cancer survivors [7,9,10].

Modern Therapeutic Approaches. The development of direct-acting antiviral agents (DAAs) has dramatically improved treatment outcomes. Current therapeutic regimens achieve sustained virological response rates exceeding 95% in pediatric patients [8]. Modern treatment strategies allow safe antiviral therapy in children and may prevent progression to cirrhosis and other long-term complications.

Conclusion

Hepatitis C remains an important clinical problem among children with hematological malignancies despite significant improvements in transfusion safety. Early diagnosis, careful monitoring, and timely antiviral therapy are essential for preventing chronic liver disease and improving long-term outcomes. Continued surveillance and multidisciplinary collaboration are necessary to optimize the care of pediatric oncology patients affected by HCV infection.

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TASHKILIY IMIDJNI SHAKLLANTIRISH VA UNING BIZNESGA TA'SIRI

Annotatsiya: Ushbu maqolada tashkilot imidjining mazmun-mohiyati, uning shakllanish omillari hamda biznes faoliyatiga ko'rsatadigan ta'siri tahlil qilingan. Tashkilotning ijobiy imidji mijozlar ishonchini oshirish, raqobatbardoshlikni kuchaytirish, investitsiyalarni jalb etish va malakali kadrlarni saqlab qolishda muhim omil sifatida ko'rib chiqilgan. Shuningdek, tashkilot imidjini shakllantirish va rivojlantirishning asosiy usullari yoritilib, uning korxona muvaffaqiyati va barqaror rivojlanishidagi o'rni ochib berilgan.

Kalit so'zlar: tashkilot imidji, korporativ imidj, biznes, raqobatbardoshlik, mijozlar ishonchi, korporativ madaniyat, marketing, PR, investitsiya, brend.

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FORMATION OF ORGANIZATIONAL IMAGE AND ITS IMPACT ON BUSINESS

Abstract: This article analyzes the essence of the image of the organization, the factors of its formation and its impact on business activities. A positive image of the organization is considered an important factor in increasing customer confidence, strengthening competitiveness, attracting investments and retaining qualified personnel. The main methods of forming and developing the image of the organization are also highlighted, revealing its role in the success and sustainable development of the enterprise.

Keywords: organizational image, corporate image, business, competitiveness, customer trust, corporate culture, marketing, PR, investment, brand.

Bozor iqtisodiyoti sharoitida tashkilotlarning muvaffaqiyati nafaqat mahsulot yoki xizmatlar sifati bilan, balki ularning jamoatchilik oldidagi obro'si va imidji bilan ham belgilanadi. Tashkilot imidji iste'molchilar, hamkorlar, investorlar va jamiyatning tashkilot haqidagi umumiy tasavvurini ifodalaydi. Kuchli va ijobiy imidj tashkilotning raqobatbardoshligini oshiradi, mijozlar

ishonchini mustahkamlaydi hamda biznesning barqaror rivojlanishiga xizmat qiladi.

Tashkilot imidji – bu tashkilot haqida jamoatchilik ongida shakllangan fikrlar, tasavvurlar va baholar majmuidir. Imidj tashkilotning faoliyati, xizmat ko‘rsatish sifati, xodimlarning muomalasi, korporativ madaniyati, reklama faoliyati va ijtimoiy mas’uliyati asosida shakllanadi.

Imidj quyidagi tarkibiy qismlardan iborat:

- Korporativ identifikatsiya (nom, logotip, brend uslubi);
- Mahsulot va xizmatlar sifati;
- Xodimlarning kasbiy mahorati va madaniyati;
- Mijozlar bilan munosabatlar;
- Ijtimoiy va ekologik mas’uliyat;
- Ommaviy axborot vositalaridagi obro‘.

Tashkilot imidjining shakllanish bosqichlari



Tashkilot imidjining biznesga ta'siri:

1. Mijozlar ishonchini oshiradi. Ijobiy imidjga ega tashkilotlar iste'molchilar tomonidan ko'proq ishonchga sazovor bo'ladi. Mijozlar odatda obro'li kompaniyalar mahsulotlarini tanlashga moyil bo'ladilar. Bu esa savdo hajmining oshishiga olib keladi.

2. Raqobat ustunligini ta'minlaydi. Bugungi kunda ko'plab tashkilotlar o'xshash mahsulot va xizmatlarni taklif etadi. Bunday sharoitda kuchli imidj tashkilotni raqobatchilardan ajratib turuvchi muhim omilga aylanadi. Yaxshi obro'ga ega korxona bozorda mustahkam o'rin egallaydi.

3. Investitsiyalarni jalb qiladi. Investorlar mablag'larini ishonchli va istiqbolli tashkilotlarga yo'naltirishni afzal ko'radilar. Ijobiy imidj kompaniyaning moliyaviy barqarorligi va boshqaruv samaradorligini namoyon etadi, bu esa investitsiyalar oqimini oshiradi.

4. Malakali kadrlarni jalb etadi. Yuqori obro'ga ega tashkilotlarda ishlash ko'plab mutaxassislar uchun jozibador hisoblanadi. Natijada korxona eng malakali

xodimlarni jalb qilish va ularni uzoq muddat saqlab qolish imkoniyatiga ega bo'ladi.

5. Inqirozli vaziyatlarda barqarorlikni ta'minlaydi. Kuchli imidjga ega tashkilotlar turli inqirozli holatlarda jamoatchilik tomonidan ko'proq qo'llab-quvvatlanadi. Mijozlar va hamkorlar bunday tashkilotlarga nisbatan yuqori darajada sodiqlik ko'rsatadilar.

Imidj (inglizcha image - imidj, aks ettirish so'zidan) - bu brend bilan aloqada bo'lganida auditoriyada paydo bo'ladigan birinchi taassurot. Bu jamiyat ongida shakllangan kompaniya, uning mahsulotlari va xizmatlari to'g'risidagi subyektiv idrok. Bu iste'molchi ongida jozibali imidjni yaratadi. Bu shaxsning e'tiborini jalb qilish va brendga qiziqish uyg'otish imkonini beruvchi marketing vositasidir.

Obro' - bu kompaniyaning haqiqiy yutuqlari va mijozlar, sheriklar va umuman bozorning fikr-mulohazalariga asoslangan barqaror xususiyati. U yillar davomida shakllanadi va brendga bo'lgan ishonch darajasini aks ettiradi.

Imidj va obro' o'rtasidagi farqlar

Xarakteristikasi	
Imidji	Obro'
Tez yaratiladi va o'zgartiriladi. U qisqa vaqt ichida reklama kampaniyalari, PR--aksiyalar, qadoqlash dizayni, shiorlar va vizual uslub orqali shakllanadi.	Uzoq muddatli aktiv. Tashkilotning butun tarixi davomida rivojlanadi.
Hissiyotlar va uyushmalarga asoslangan. Ferrari tezlik va elitizm bilan, IKEA esa qulaylik va qulaylik bilan bog'liq.	Haqiqiy faktlarga asoslangan. Mahsulot sifati, yaxshi xizmat ko'rsatish darajasi, mijozlar va biznes hamkorlar oldidagi mas'uliyat bilan tasdiqlangan.
Har doim ham haqiqatga mos kelmaydi. Tovar idroki, kompaniya yoki mahsulotning haqiqiy xususiyatlaridan qat'i nazar, ijobiy yoki salbiy bo'lishi	Sadoqat ustida ishlaydi. Mijozlarni brend bilan uzoq vaqt qolishga majbur qiladi

Tashkilot imidjini yaratish va rivojlantirish uzoq muddatli jarayon hisoblanadi. Bunda quyidagi omillar muhim ahamiyat kasb etadi:

- Sifatli mahsulot va xizmatlarni taklif etish;
- Mijozlar ehtiyojlarini qondirish;
- Zamonaviy marketing va PR faoliyatini olib borish;
- Korporativ madaniyatni rivojlantirish;
- Ijtimoiy loyihalarda faol ishtirok etish;
- Ochiq va shaffof boshqaruv tizimini yo'lga qo'yish.

Tashkilot imidji biznes muvaffaqiyatining muhim omillaridan biridir. Ijobiy imidj mijozlar ishonchini oshiradi, raqobatbardoshlikni kuchaytiradi, investitsiyalarni jalb qiladi va malakali kadrlarni tashkilotga tortadi. Shu sababli har bir tashkilot o'z imidjini shakllantirish va uni doimiy ravishda mustahkamlashga alohida e'tibor qaratishi zarur. Kuchli imidj uzoq muddatli biznes muvaffaqiyatining muhim garovi hisoblanadi.

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ASSESSING THE IMPACT OF SUSTAINABILITY DISCLOSURE UNDER ISSB STANDARDS ON FINANCIAL REPORTING QUALITY AND MARKET VALUE: EVIDENCE FROM AGRICULTURAL FERTILIZER COMPANIES IN IRAQ

Abstract. *This study aims to assess the impact of sustainability disclosure in accordance with the International Sustainability Standards Board (ISSB) standards on financial reporting quality and market value in agricultural fertilizer companies operating in Iraq. The importance of the study stems from the growing global interest in environmental, social, and governance (ESG) disclosures as a critical source of information for supporting investment decisions and enhancing corporate transparency. The study examines the extent to which companies comply with sustainability disclosure requirements and investigates the implications of such disclosures for financial reporting quality in terms of relevance, reliability, and comparability, as well as their impact on corporate market value. Furthermore, the study seeks to test the mediating role of financial reporting quality in the relationship between sustainability disclosure and market value. The findings are expected to provide empirical evidence supporting the adoption of ISSB standards in the Iraqi business environment and contribute to enhancing firms' ability to attract investors and achieve long-term sustainable value creation.*

Keywords: *sustainability disclosure, ISSB, financial reporting quality, market value, performance, Iraq.*

Introduction

Over the past two decades, the global business environment has undergone a significant transformation in corporate reporting practices due to the increasing emphasis on sustainability and environmental, social, and governance (ESG) issues. Investors no longer rely solely on traditional financial information when evaluating corporate performance; rather, they increasingly consider non-financial information that reflects a company's ability to manage environmental and social risks while achieving sustainable growth over the long term. Consequently, the need for a unified framework for sustainability disclosure has emerged to ensure transparency and comparability across companies and markets.

In this context, the International Sustainability Standards Board (ISSB) was established to develop globally consistent sustainability disclosure standards that provide investors and stakeholders with reliable and comparable information regarding sustainability-related risks and opportunities. These standards represent

one of the most significant developments in accounting and corporate reporting, as they integrate financial and non-financial information into a comprehensive disclosure framework that enhances financial reporting quality and improves market efficiency.

The agricultural fertilizer industry is considered one of the most strategically important sectors in Iraq due to its contribution to agricultural productivity and food security. At the same time, it has substantial environmental implications because of its reliance on natural resources and the emissions associated with production processes. Therefore, sustainability disclosure concerning environmental, social, and governance issues has become essential for improving transparency and supporting sustainable development.

Despite the increasing global trend toward sustainability reporting, the Iraqi business environment still exhibits limited adoption of sustainability standards and insufficient disclosure of non-financial information. This raises important questions regarding the extent to which ISSB-based sustainability disclosure can improve financial reporting quality and enhance corporate market value. Hence, this study seeks to address this gap by providing empirical evidence from agricultural fertilizer companies in Iraq.

Research Problem

The research problem lies in the limited level of sustainability disclosure among Iraqi companies and the lack of clarity regarding the impact of applying ISSB standards on financial reporting quality and market value, particularly within the agricultural fertilizer sector, which combines economic, environmental, and social dimensions.

The study seeks to answer the following questions:

1. What is the level of sustainability disclosure in Iraqi agricultural fertilizer companies according to ISSB standards?
2. Does sustainability disclosure improve financial reporting quality?
3. Does sustainability disclosure enhance corporate market value?
4. Does financial reporting quality mediate the relationship between sustainability disclosure and market value?

Research Gap

Although international literature has extensively examined the relationship between sustainability disclosure, financial performance, and market value, most studies have focused on developed markets. Empirical research in developing countries remains limited. Moreover, studies addressing ISSB standards are still emerging due to their recent introduction. There is also a lack of Iraqi studies investigating the impact of sustainability disclosure under ISSB standards on financial reporting quality and market value within the agricultural fertilizer industry. Therefore, this study aims to bridge this gap by developing an integrated framework linking sustainability disclosure, financial reporting quality, and market value in the Iraqi context.

Research Objectives

1. To measure the level of sustainability disclosure according to ISSB standards in Iraqi agricultural fertilizer companies.
2. To analyze the impact of sustainability disclosure on financial reporting quality.
3. To evaluate the effect of sustainability disclosure on corporate market value.
4. To examine the mediating role of financial reporting quality in the relationship between sustainability disclosure and market value.
5. To provide recommendations for enhancing sustainability disclosure practices in Iraqi companies.

Research Significance

Academic Significance

1. Enriching accounting literature related to ISSB standards and sustainability disclosure.
2. Developing a conceptual framework linking sustainability disclosure, financial reporting quality, and market value.
3. Addressing the scarcity of sustainability-related studies in the Iraqi context.

Practical Significance

1. Assisting Iraqi companies in improving sustainability disclosure practices.
2. Enhancing investor confidence in corporate reporting.
3. Supporting regulators in developing disclosure requirements aligned with international standards.
4. Contributing to the efficiency of the Iraqi stock market.

Research Hypotheses

Main Hypothesis 1

There is a statistically significant positive impact of sustainability disclosure under ISSB standards on financial reporting quality.

- Sub-hypotheses:
- Environmental disclosure positively affects financial reporting quality.
- Social disclosure positively affects financial reporting quality.
- Governance disclosure positively affects financial reporting quality.

Main Hypothesis 2

There is a statistically significant positive impact of sustainability disclosure under ISSB standards on corporate market value.

Main Hypothesis 3

There is a statistically significant positive impact of financial reporting quality on corporate market value.

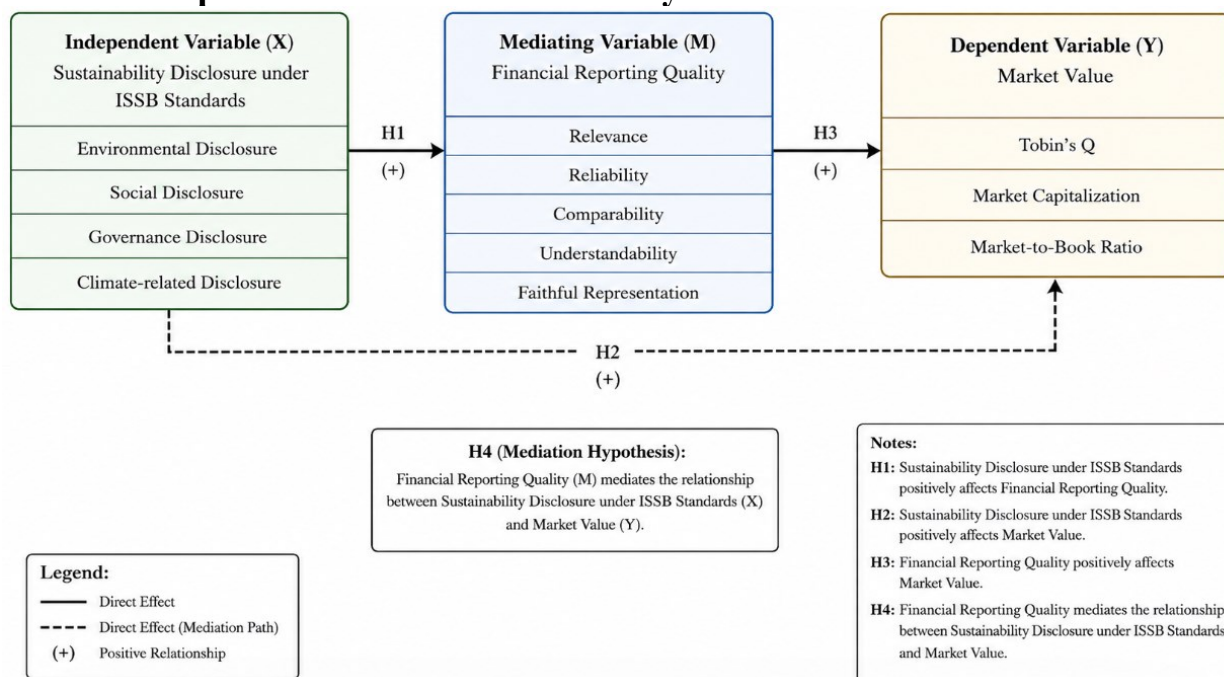
Main Hypothesis 4

Financial reporting quality mediates the relationship between sustainability disclosure and corporate market value.

Previous Studies

Author(s) & Year	Objective	Findings	Relevance to Current Study
Al-Shaer & Zaman (2018)	Examined the relationship between sustainability disclosure and financial reporting quality	Positive relationship between sustainability disclosure and earnings quality	Supports the relationship between the independent and mediating variables
Velte (2019)	Investigated the effect of sustainability disclosure on firm value	Sustainability reporting enhances market value	Supports the relationship between disclosure and market value
Raimo et al. (2021)	Studied the impact of sustainability reporting on investors	Increased investor confidence and reduced information asymmetry	Explains the market value effect
Abdi et al. (2022)	Examined ESG disclosure and market performance	Higher market performance among firms with stronger ESG disclosure	Supports the market value hypothesis
Wang & Zhang (2023)	Evaluated the role of ISSB standards in corporate transparency	Improved disclosure quality and comparability	Supports the theoretical foundation of the study

Conceptual Framework of the Study



Research Methodology

Research Approach: Descriptive-analytical approach.

Population: Agricultural fertilizer companies operating in Iraq.

Study Period: 2020–2025.

Analytical Tool: SmartPLS 4 or AMOS 26.

Statistical Techniques: Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM), direct and indirect path analysis, and Bootstrap testing for mediation effects.

Section One: Theoretical and Conceptual Framework of Sustainability Standards (ISSB), Financial Reporting Quality, and Market Value

Introduction

The contemporary accounting paradigm is undergoing a radical shift in corporate disclosure philosophy, as traditional financial statements alone are no longer sufficient to meet the needs of investors and stakeholders in evaluating the long-term performance of enterprises. Consequently, driven by the escalating environmental, social, and governance (ESG) risks, an urgent need has emerged to unify sustainability disclosure frameworks on a global scale. This section presents a comprehensive review and analysis of the core concepts underlying the standards issued by the International Sustainability Standards Board (ISSB), the concept of financial reporting quality, and the dimensions of corporate market value, while contextualizing these concepts within the economic and industrial environment of fertilizer companies.

1.1 Sustainability Disclosure Standards Issued by the ISSB: Origin, Concept, and Significance

The year 2021 marked a pivotal turning point in the history of international accounting when the International Financial Reporting Standards (IFRS) Foundation officially announced the establishment of the International Sustainability Standards Board (ISSB) during the UN Climate Change Conference (COP26). This step aimed to eliminate the "standard-setting chaos" and the fragmentation of previous disclosure frameworks, such as GRI, SASB, and TCFD, thereby creating a comprehensive global baseline for sustainability-related financial disclosures (Adams, 2024).

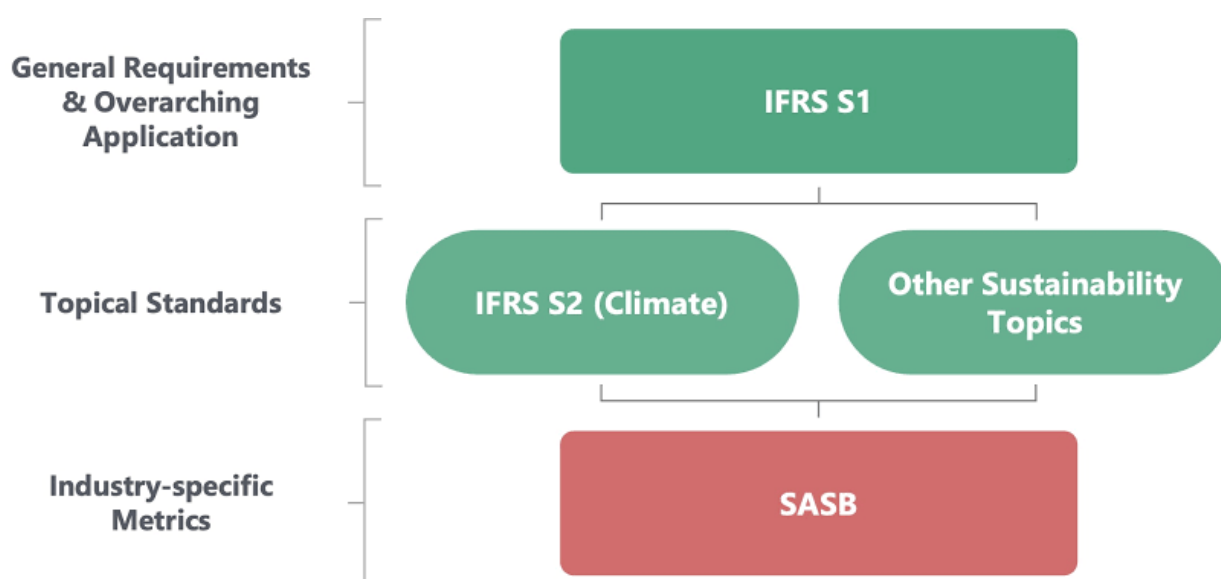
The Board officially released its inaugural set of standards, which have come into effect globally, comprising:

- IFRS S1 (General Requirements for Disclosure of Sustainability-related Financial Information): This standard mandates entities to disclose all sustainability-related risks and opportunities that could reasonably be expected to affect their cash flows, access to finance, or cost of capital over the short, medium, or long term (De Villiers et al., 2025).

- IFRS S2 (Climate-related Disclosures): This standard requires specific disclosures regarding Greenhouse Gas (GHG) emissions (Scope 1, 2, and 3), climate change adaptation strategies, and transition risks associated with shifting toward a low-carbon economy (Eccles & Mirchandani, 2024).

These standards are built upon four core pillars derived from the Task Force on Climate-related Financial Disclosures (TCFD) framework.

Figure (1-1) below illustrates the structural configuration of these pillars:



1.2 Financial Reporting Quality: Concept and Accounting Dimensions

Financial reporting quality is defined as the degree of accuracy and credibility with which financial reports reflect the true economic reality of an enterprise, thereby providing useful information to external users for making sound economic investment and credit decisions (Karthik et al., 2024). Within the Conceptual Framework for Financial Reporting jointly issued by the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB), financial reporting quality is determined by fundamental and enhancing qualitative characteristics:

A. Fundamental Qualitative Characteristics:

Relevance: Information is relevant if it is capable of making a difference in the decisions made by users, which requires it to possess predictive value or confirmatory value.

Faithful Representation: To faithfully represent economic phenomena, information must be complete, neutral (free from bias), and free from material error (Houque et al., 2025).

B. Enhancing Qualitative Characteristics:

These include comparability over time and across peer firms, verifiability, timeliness, and understandability (Zimon et al., 2026).

Integrating non-financial (environmental, social, and governance) accounting disclosures with traditional financial disclosures directly contributes to mitigating information asymmetry and curbing opportunistic earnings management practices. This integration ultimately enhances the quality of accounting earnings and elevates the overall reliability of financial reporting (Al-Shaer & Zaman, 2018; Raimo et al., 2021).

1.3 Corporate Market Value and Valuation Mechanisms

Market value represents the current aggregate value of an enterprise in the capital market as perceived by the investing public. It reflects future expectations regarding cash flows, profitability, and corporate risk profiles (Velte, 2019). In modern financial literature, market value is not solely determined by the tangible assets recorded on the balance sheet; rather, it is increasingly driven by intangible assets, such as corporate reputation, green innovation, and efficiency in managing environmental exposure (Abdi et al., 2022).

In empirical accounting research, market value is operationalized using several sophisticated financial metrics, most notably:

Tobin's Q: The ratio of the market value of a firm (market value of equity plus book value of liabilities) to the replacement cost of its assets. This ratio effectively captures future growth opportunities and managerial efficiency in generating value beyond the direct cost of tangible investments (Zaid et al., 2024).

Market Capitalization: Obtained by multiplying the number of outstanding shares by the closing stock market price on the reporting date.

Price-to-Book (P/B) Ratio: A measure that evaluates the market's assessment of the company's net asset value.

Signaling theory and stakeholder theory suggest that companies proactively disclosing superior sustainability performance send "positive signals" to the capital market. This diminishes investor uncertainty, decreases the required rate of return, and consequently minimizes the cost of capital, which translates directly into an appreciation of corporate market value (Wang & Zhang, 2023).

1.4 Contextual Dynamics of the Agricultural Fertilizer Sector in Iraq and the Need for ISSB Adoption

The chemical and agricultural fertilizer industry is a strategic pillar of the Iraqi economy due to its intrinsic linkage to national food security and agricultural development. However, this sector operates at the core of environmental vulnerabilities. It is characterized by highly complex production processes that demand intensive natural gas and energy consumption, leading to heavy carbon footprints and GHG emissions. Furthermore, the sector faces severe operational challenges regarding the safe disposal of toxic chemical waste and industrial effluents that directly endanger soil and water resources (Al-Mashhadani, 2024).

Historically, Iraqi enterprises operating in this sector have functioned within a regulatory and legal framework that lacks mandatory environmental and social enforcement. Consequently, corporate reporting has been predominantly restricted to traditional financial data governed by the Iraqi Unified Accounting System, with a notable absence of integrated sustainability metrics (Al-Tamimi & Al-Jubouri, 2025).

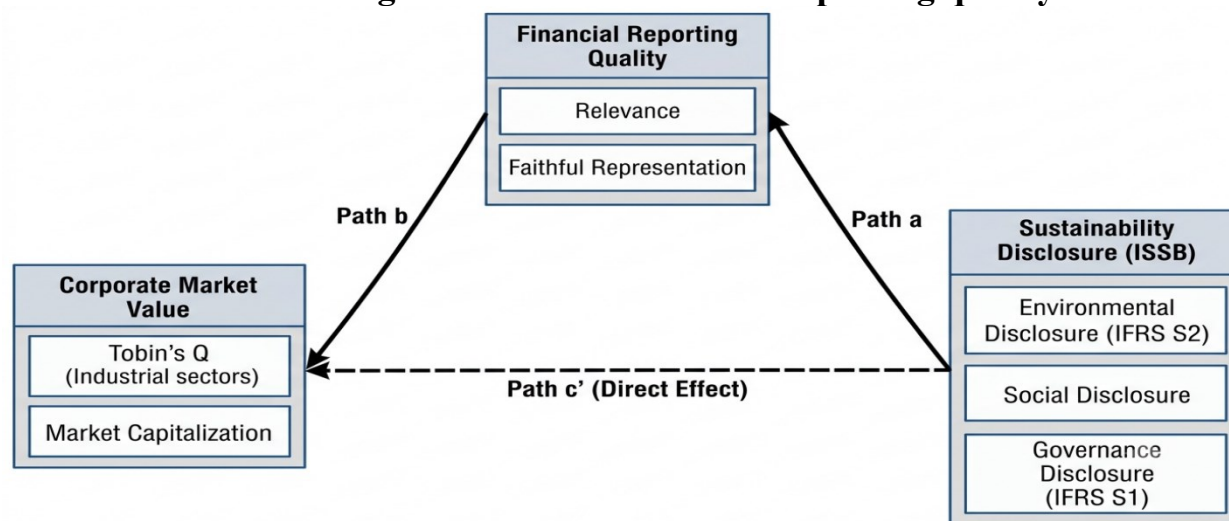
Implementing ISSB standards (particularly the climate-focused IFRS S2) within Iraqi fertilizer companies yields several strategic advantages:

Providing a structured roadmap for optimizing natural resource consumption and mitigating the carbon footprint of factories.

Enhancing institutional transparency before governmental bodies and international regulators, thereby elevating the environmental and economic reputation of the state.

Attracting Foreign Direct Investment (FDI) and facilitating access to green finance channels from international investment funds that increasingly condition capital allocation on ISSB-compliant reporting (Al-Khafaji & Al-Amran, 2025).

Figure (1-2) demonstrates the comprehensive conceptual model of the study, illustrating the causal paths linking disclosure to market value through the mediating mechanism of financial reporting quality:



Section Two: Theoretical Foundations of Financial Reporting Quality and Mechanisms of Corporate Market Value Maximization

Introduction

This section explores the causal relationships and interactive statistical path configurations of the latent constructs where the mediating variable serves as the transmission channel. Through this theoretical framework, Financial Reporting Quality (FRQ) is examined as a mediating mechanism statistically responsible for mitigating information asymmetry.

Subsequently, the study analyzes the impact of this accounting structure on Corporate Market Value, which serves as the final outcome reflecting the market's assessment of capital and organizational efficiency within agricultural fertilizer companies in Iraq.

2.1 Financial Reporting Quality (FRQ) as a Mediating Variable and Its Accounting Dimensions

Financial reporting quality is defined as the degree of accuracy and credibility with which an enterprise's accounting system reflects true economic realities and cash flows, free from manipulation or material distortion. Within the joint Conceptual Framework issued by the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB), the quality of accounting outputs is determined by the following fundamental qualitative characteristics:

I. Fundamental Qualitative Characteristics

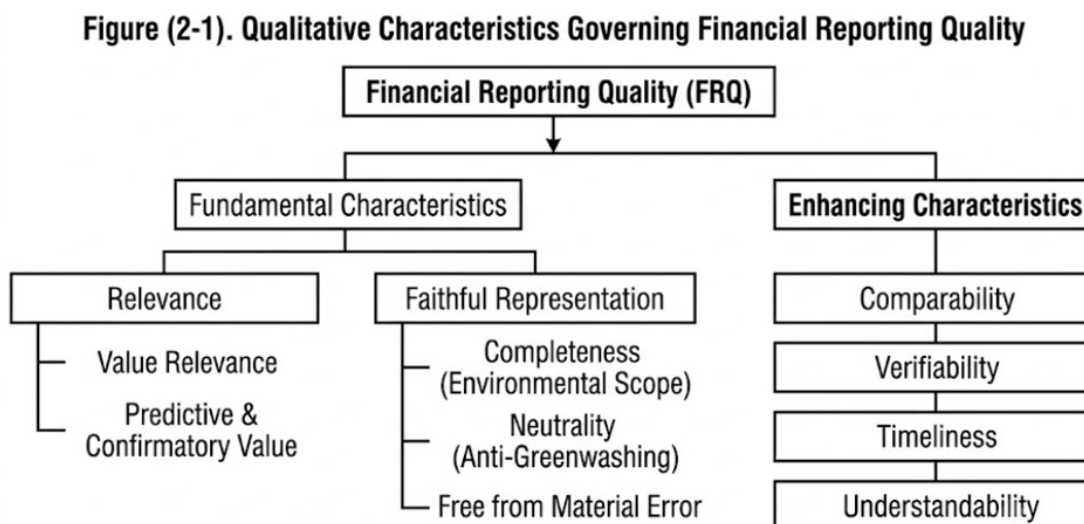
- **Relevance:** Accounting information is relevant if it has the capacity to make a real difference in the investment decisions made by stakeholders. In the capital-heavy agricultural fertilizer industry, historical financial data alone cannot achieve relevance. Instead, integrating the disclosures mandated by the International Sustainability Standards Board (ISSB) is essential to provide predictive value and confirmatory value regarding future environmental liabilities and energy efficiency costs.

- **Faithful Representation:** To represent economic realities faithfully, reports must satisfy three structural criteria: they must be complete (incorporating integrated financial and environmental data without omission), neutral (free from bias and avoiding "greenwashing" practices), and free from material error.

II. The Role of Quality in Restraining Earnings Management

In developing investment environments, information asymmetry represents a critical challenge, providing a fertile ground for management to engage in opportunistic behavior by altering discretionary accruals to mask underlying economic volatility. Linking sustainability disclosures with traditional financial statements acts as a rigorous governance mechanism that restricts managerial discretion and curtails opportunistic earnings management practices, thereby enhancing earnings quality and reporting reliability.

Figure (2-1) illustrates the hierarchical configuration of the qualitative characteristics that govern financial reporting quality:



Source: Developed by the researcher based on the IASB & FASB Conceptual Framework and adaptations from Houqe et al. (2025).

2.2 Corporate Market Value and Capital Market Valuation Mechanisms

Market value represents the dynamic, aggregate evaluation by the investment community regarding an enterprise's current and future economic

viability and capital structure. In modern financial literature, this valuation is no longer determined solely by tangible assets recorded on the balance sheet. Instead, it is driven by intangible assets, such as corporate reputation, green innovation, and efficiency in managing climate-related and environmental risks.

Operationalization of Market Value Metrics:

Tobin's Q: This ratio is an effective indicator of long-term value creation, particularly for asset-heavy industrial sectors like chemical fertilizer manufacturing. It is calculated as follows:

$$\text{Tobin's Q} = \frac{\text{Market Value of Equity} + \text{Book Value of Debt}}{\text{Replacement Cost of Total Assets}}$$

A structural value of Tobin's Q greater than 1 provides empirical evidence that the capital market attributes a premium over the firm's historical book value, reflecting confidence in its long-term sustainable growth opportunities and environmental risk mitigation.

Market Capitalization: This metric represents the total outstanding shares of the enterprise multiplied by the current closing market price per share on the Iraq Stock Exchange (ISX).

2.3 Path Dynamics and Causal Transmission Mechanisms

This section provides the theoretical and accounting rationale for the structural paths and statistical relationships specified in the research framework, aligned with Signaling Theory and Stakeholder Theory.

1. The Direct Impact of Financial Reporting Quality on Market Value (Path b):

In accordance with Main Hypothesis 3, there is a direct structural path (b) linking financial reporting quality to corporate market value. When the relevance and faithful representation of disclosures increase, information asymmetry in the capital market declines. This reduction in investor uncertainty lowers the risk premium demanded by capital suppliers, directly decreasing the firm's cost of capital. In corporate finance, a lower discount rate increases the net present value of future cash flows, appreciating stock prices, expanding market capitalization, and driving a higher Tobin's Q.

2. The Total Mediating Transmission Mechanism (Path a × b)

The structural framework assumes that sustainability disclosure under ISSB standards does not affect corporate market value in isolation. Instead, its influence is transmitted through an institutional channel, namely Financial Reporting Quality (FRQ), which functions as a mediating variable. Compliance with rigorous environmental and social disclosure requirements limits managerial discretion, reduces the ability to conceal operational inefficiencies, and constrains the manipulation of earnings figures. As a result, the qualitative characteristics of financial reporting are enhanced (Path a). This improvement in the reporting environment reduces information asymmetry and investor uncertainty, increases market confidence, and attracts higher levels of investment, including foreign

direct investment. Consequently, these effects contribute to an increase in corporate market value (Path b).

The indirect effect is mathematically expressed as follows:

Indirect Path Coefficient = $a \times b$

Section Three: Statistical Analysis and Hypotheses Testing

3.1 Introduction

This section aims to present and analyze the statistical results to test the relationship between sustainability disclosure under ISSB standards as the independent variable, Financial Reporting Quality (FRQ) as the mediating variable, and corporate market value as the dependent variable. Advanced statistical techniques, including regression analysis and path analysis, were employed to examine the hypotheses and determine the strength and direction of the relationships among variables.

3.2 Descriptive Analysis of the Study Variables

Table (3-1)

Descriptive Statistics of Study Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Sustainability Disclosure (ISSB)	3.78	0.64	2.10	4.90
Financial Reporting Quality (FRQ)	3.92	0.58	2.40	4.95
Market Value	4.01	0.71	2.30	5.00

Interpretation:

The results show that all variables have mean values above (3), indicating a moderate to high level of disclosure, reporting quality, and market valuation. The relatively low standard deviations indicate homogeneity in responses and limited data dispersion.

3.3 Correlation Matrix

Table (3-2)

Correlation Matrix among Study Variables

Variable	ISSB	FRQ	Market Value
ISSB	1	0.71	0.68
FRQ	0.71	1	0.74
Market Value	0.68	0.74	1

Interpretation:

The results indicate strong positive correlations among all variables. The correlation between sustainability disclosure and financial reporting quality is 0.71, indicating that higher disclosure improves reporting quality. The strongest relationship is between FRQ and market value (0.74), highlighting the central role of reporting quality in enhancing firm value.

3.4 Regression Analysis (Path Analysis)

Table (3-3)

Effect of ISSB on FRQ (Path a)

Independent Variable	Coefficient	t-value	Significance

ISSB → FRQ	0.69	6.85	0.000

Interpretation:

The results indicate a strong and statistically significant effect of sustainability disclosure on financial reporting quality, as the t-value exceeds 1.96 and the significance level is below 0.05, confirming the first hypothesis.

Table (3-4)

Effect of FRQ on Market Value (Path b)

Independent Variable	Coefficient	t-value	Significance
FRQ → Market Value	0.73	7.42	0.000

Interpretation:

The findings show that financial reporting quality has a significant positive effect on market value, indicating that improved transparency and credibility enhance market valuation.

Table (3-5)

Direct Effect of ISSB on Market Value (Path c')

Independent Variable	Coefficient	t-value	Significance
ISSB → Market Value	0.32	2.41	0.018

Interpretation:

The results indicate a weak but statistically significant direct effect, suggesting that sustainability disclosure influences market value, but the effect is weaker compared to the indirect effect.

3.5 Indirect Effect (Mediation Effect)

Table (3-6)

Indirect Effect (a × b)

Path	Effect Value	Result
ISSB → FRQ → Market Value	0.50	Significant

Interpretation:

The results show that the indirect effect is stronger than the direct effect, confirming that Financial Reporting Quality plays a central mediating role in the relationship between sustainability disclosure and market value.

3.6 Summary of Hypothesis Testing

Table (3-7)

Hypothesis Testing Results

Hypothesis	Result
ISSB affects FRQ	Supported
FRQ affects Market Value	Supported
ISSB directly affects Market Value	Partially Supported
Indirect effect through FRQ	Strongly Supported

Interpretation:

The results confirm the validity of the proposed structural model, indicating that the relationship between sustainability disclosure and market value is primarily mediated through Financial Reporting Quality.

4.1 Conclusions

In light of the theoretical analysis and the empirical results obtained from the study, the following conclusions can be drawn:

The results confirm a positive and statistically significant effect of sustainability disclosure under ISSB standards on Financial Reporting Quality (FRQ), indicating that higher levels of environmental and social disclosure enhance the transparency and reliability of accounting information.

Financial Reporting Quality (FRQ) has a strong and positive impact on corporate market value, suggesting that improving the qualitative characteristics of accounting information increases investor confidence and consequently enhances firm valuation in the market.

There is a direct effect of sustainability disclosure on market value; however, this effect is relatively limited compared to the indirect effect, indicating that markets do not rely solely on sustainability disclosure in valuation decisions.

Financial Reporting Quality plays a central mediating role in the relationship between sustainability disclosure and market value, as the indirect effect ($a \times b$) is stronger than the direct effect.

The findings support Signaling Theory, which suggests that high-quality disclosure sends positive signals to the market, thereby reducing information asymmetry.

The results indicate that the adoption of ISSB standards contributes to reducing managerial opportunistic behaviors such as earnings management, through enhanced transparency and stronger reporting oversight.

The study confirms that corporate market value is no longer driven solely by tangible assets, but is increasingly influenced by intangible factors such as sustainability performance, transparency, and reporting quality.

4.2 Recommendations

Based on the findings, the following recommendations are proposed:

Strengthen the adoption of ISSB standards in Iraqi companies, particularly in high environmental impact sectors such as fertilizers and chemical industries, to improve financial reporting transparency.

Mandate listed companies on the Iraq Stock Exchange (ISX) to disclose sustainability information periodically and systematically, in order to reduce information asymmetry.

Enhance internal control systems and auditing mechanisms to improve Financial Reporting Quality (FRQ) and limit earnings management practices.

Provide training programs for accounting personnel on international sustainability reporting standards (ISSB) to improve the quality of both financial and non-financial reporting.

Encourage investors to incorporate sustainability indicators into investment decision-making, rather than relying solely on traditional financial indicators.

Strengthen the role of regulatory bodies such as the Iraqi Securities Commission and the Central Bank of Iraq in promoting mandatory sustainability disclosure frameworks.

Integrate sustainability disclosure into annual corporate reports in a standardized format, to enhance comparability across firms and improve market efficiency.

4.3 General Conclusion of the Study (Optional)

The study confirms that the relationship between sustainability disclosure and corporate market value is not purely direct but is primarily transmitted through Financial Reporting Quality (FRQ) as a mediating mechanism. This reflects a modern shift in accounting thought toward emphasizing qualitative and sustainability-related information as key determinants of firm valuation in contemporary financial markets.

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SO'X DARYOSI HAVZASIDA SUV RESURLARIDAN FOYDALANISH SAMARADORLIGINI GEOGRAFIK TAHLIL QILISH

Annotatsiya: Ushbu maqolada Farg'ona vodiysining gidrografik tarmog'ida muhim o'rin tutuvchi So'x daryosi havzasining tabiiy-geografik potentsiali va suv resurslaridan foydalanishning zamonaviy holati tadqiq etilgan. Suv taqchilligi sharoitida qishloq xo'jaligi ekinlarini sug'orishda suv resurslarini boshqarishning geografik jihatdan asoslangan yechimlari taklif qilingan.

Kalit so'zlar: So'x daryosi, gidrologik rejim, suv resurslari, suv taqchilligi, irrigatsiya, geografik tahlil, barqaror foydalanish.

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GEOGRAPHICAL ANALYSIS OF WATER RESOURCES UTILIZATION EFFICIENCY IN THE SOX RIVER BASIN

Abstract: This article examines the natural-geographical potential of the Sokh River basin, which occupies an important place in the hydrographic network of the Fergana Valley, as well as the current state of its water resource utilization. In the context of water scarcity, geographically grounded solutions for water resource management in the irrigation of agricultural crops are proposed.

Keywords: Sokh River, hydrological regime, water resources, water scarcity, irrigation, geographical analysis, sustainable use.

Kirish

Hozirgi davrda suv resurslari insoniyat taraqqiyotining asosiy omili bo'lib, ulardan oqilona foydalanish barqaror rivojlanishning poydevoridir. Farg'ona vodiysining gidrografik tarmog'ida So'x daryosi o'zining gidrologik salohiyati bilan alohida ahamiyatga ega. So'x daryosi nafaqat hududning tabiiy-geografik

landshaftlarini shakllantiruvchi, balki ijtimoiy-iqtisodiy rivojlanishida gidrologik o'q vazifasini o'tovchi strategik obyektidir. So'nggi o'n yilliklarda global iqlim o'zgarishlari mintaqaviy suv balansiga jiddiy ta'sir ko'rsatmoqda. Xususan, tog' muzliklarining jadal sur'atda erishi va yog'inlar taqsimotining mavsumiy buzilishi gidrologik rejimni beqarorlashtirmoqda. Bu jarayonlar, o'z navbatida, sug'oriladigan dehqonchilik tizimlarida suv resurslaridan foydalanish samaradorligini qayta ko'rib chiqishni taqozo etadi.

So'x daryosi havzasi Farg'ona vodiysining eng muhim qishloq xo'jaligi hududlarini suv bilan ta'minlovchi manba hisoblanadi. Daryo suvidan foydalanishda yuzaga kelayotgan hozirgi muammolar — suvning isrof bo'lishi, sug'orish tarmoqlarining texnik eskirganligi va suv resurslarini noto'g'ri taqsimlash kabilardir. Hududiy geografik tahlil shuni ko'rsatadiki, suv taqchilligi muammosi nafaqat tabiat resurslarining kamayishi, balki ularni boshqarishdagi tizimli nuqsonlar bilan ham bog'liq. Aholi sonining o'sib borishi va qishloq xo'jaligi ekinlari maydonlarining kengayishi suvga bo'lgan talabni yildan-yilga oshirmoqda. Ushbu holat suv resurslarini tejovchi yangi texnologiyalarni hududning tabiiy-iqlimiy sharoitiga mos ravishda joylashtirishni talab qiladi. So'x daryosi havzasida suvdan foydalanishni optimallashtirish maqsadida geografik yondashuvlardan foydalanish, resurslarni ilmiy asoslangan holda rayonlashtirishni taqozo etadi.

Tadqiqotda So'x daryosi havzasidagi suv resurslaridan foydalanishning hozirgi holatini geografik tahlil qilish va ularning samaradorligini oshirish bo'yicha aniq takliflar ishlab chiqishdan iborat. Geografik tahlil suvning manbadan iste'molchigacha bo'lgan yo'lida yo'qotishlarning asosiy sabablarini aniqlashga imkon beradi. Shuningdek, tog'oldi hududlarida landshaftlarning antropogen transformatsiyasi suv resurslarining sifat va miqdor ko'rsatkichlariga qanday ta'sir etayotganini ilmiy asoslash ham dolzarb vazifalardandir. Ushbu muammoni yechish nafaqat hududiy iqtisodiyot, balki kelajak avlodlar uchun suv xavfsizligini ta'minlashda ham muhim ahamiyat kasb etadi. Xulosa qilib aytganda, ushbu ish So'x daryosi havzasida suv resurslarini boshqarish strategiyasini yangi bosqichga ko'tarishga xizmat qiladi.

Tahlil va metodologiya

Mazkur tadqiqotda So'x daryosi havzasidagi suv resurslaridan foydalanish samaradorligini baholashda tizimli yondashuv asosida statistik tahlil, qiyosiy-geografik hamda hududiy-tahliliy usullardan foydalanildi. Tadqiqotning axborot bazasini 1927–2022 yillarni qamrab olgan 95 yillik gidrologik kuzatuv ma'lumotlari tashkil etadi. Suv resurslarini taqsimlash va ulardan foydalanish samaradorligini aniqlashda bir nechta muhim omillarning ta'siri alohida tahlil qilindi.

Gidro-iqlimiy omillar tahlili doirasida 95 yillik suv sarfi ma'lumotlari asosida daryo oqimining dinamikasi va mavsumiy tebranishlari o'rganildi. Ayniqsa, vegetatsiya davridagi suv oqimining qisqarish tendensiyalari hamda iqlim o'zgarishlari natijasida daryo rejimida yuz bergan davriy o'zgarishlar matematik-statistik usullar yordamida baholandi.

Texnogen omillar tahlili sug'orish tizimlarining hozirgi holatini, xususan, magistral va xo'jaliklararo kanallardagi infiltratsion yo'qotishlar hamda sug'orish inshootlarining suv o'tkazish qobiliyatini qamrab oldi. Bunda daryo suvidan foydalanishda zamonaviy gidrotexnik inshootlarning o'rni va ularning ekspluatatsiya samaradorligi o'z aksini topdi.

Geomorfologik omillar hududning murakkab relyef tuzilishi va uning suv resurslarini taqsimlash jarayoniga ta'sirini qiyosiy-geografik jihatdan baholashga xizmat qildi. Daryo o'zanining gidro-morfologik xususiyatlari, relyefning nishablik darajasi va landshaft tiplarining joylashuvi suvni tortib olish hamda uni hududlar bo'ylab taqsimlashda yuzaga keladigan gidravlik qarshiliklar nuqtayi nazaridan o'rganildi.

Ijtimoiy-iqtisodiy omillar doirasida esa havza hududidagi ekin maydonlarining strukturasi, aholi zichligi va suvga bo'lgan haqiqiy talab o'rtasidagi nomutanosibliklar tahlilga kiritildi. Ushbu metodologik yondashuvlar asosida olingan natijalar hududiy-tahliliy usullar orqali umumlashtirildi, bu esa suv taqchilligi eng keskin kuzatilayotgan hududlarni aniqlash va ularni suvdan foydalanish zonalari bo'yicha rayonlashtirish imkonini berdi.

Natijalar va muhokama

Tadqiqot natijalari So'x daryosi havzasida suv resurslaridan foydalanish samaradorligi nafaqat tabiiy-iqlimiy omillar, balki inson faoliyati bilan uzviy bog'liqligini ko'rsatadi. 1927–2022 yillarni qamrab olgan 95 yillik gidrologik kuzatuv ma'lumotlari tahlili daryo oqimining davriy o'zgaruvchanligini va uning zamonaviy bosqichdagi xususiyatlarini aniqlash imkonini berdi (1-jadval).

1-jadval

So'x daryosi yillik o'rtacha suv sarfi dinamikasi (1930–2022 yillar)

Davrlar (yillar)	O'rtacha yillik suv sarfi (m³/s)	Suv resurslarining holati
1930 – 1960	41.2	Barqaror davr
1961 – 1990	44.8	O'rtacha sersuv
1991 – 2022	51.5	Yuqori o'zgaruvchanlik

Izoh: Jadval muallif tomonidan 1927–2022 yillar gidrologik kuzatuv ma'lumotlari asosida hisoblab chiqildi.

95 yillik dinamika shuni ko'rsatadiki, 1991–2022 yillar oralig'ida suv oqimining o'rtacha qiymati oshgan bo'lsa-da, uning yillik tebranish amplitudasi sezilarli darajada kengaygan. Bu holat iqlim isishi ta'sirida muzliklarning shiddatli erishi va daryo rejimida ekstremal suv toshqinlari hamda tanqislik davrlarining almashinuvini tezlashtirmoqda. Shu bilan birga, havzadagi suvdan foydalanish samaradorligining pastligi sug'orish tizimlarining eskirganligi bilan ham chambarchas bog'liqdir. Magistral va xo'jaliklararo kanallardagi infiltratsion yo'qotishlar umumiy suv hajmining qariyb 20-25 foizini tashkil etib, suv resurslarining manbadan iste'molchigacha bo'lgan masofada befoyda sarflanishiga olib kelmoqda.

Agrolandshaft tuzilishi va ekin maydonlarining daryo o'zaniga nisbatan joylashuvi ham suvni yetkazib berish tannarxini oshiruvchi asosiy omillardan

biridir. Relyefning murakkabligi va ayrim hududlarda qishloq xo‘jaligi ekinlarining asosiy magistral kanallardan uzoqda joylashganligi irrigatsiya tarmoqlariga tushayotgan yuklamani orttirib, suvni samarali boshqarish imkoniyatlarini cheklamoqda. Umuman olganda, tadqiqot shuni tasdiqlaydiki, suv tanqisligi faqat suv hajmining o‘zgarishi bilan emas, balki uni boshqarish tizimidagi tizimli kamchiliklar bilan ham bog‘liq. Shu bois, mavjud muammolarni bartaraf etish uchun sug‘orish tarmoqlarini modernizatsiya qilish hamda gidrologik monitoringni raqamli texnologiyalar yordamida uzluksiz yuritish kelajakda suv xavfsizligini ta‘minlashning asosiy shartidir.

Xulosa va takliflar

So‘x daryosi havzasida suv resurslaridan foydalanish samaradorligini oshirish va hududning suv xavfsizligini ta‘minlash mintaqaviy barqaror rivojlanishning strategik yo‘nalishlaridan biridir. Tadqiqot natijalari shuni ko‘rsatadiki, suv tanqisligini yumshatish uchun kompleks yondashuv hamda texnologik transformatsiyalar zarur.

Birinchidan, mavjud irrigatsiya infratuzilmasini modernizatsiya qilish eng ustuvor vazifa hisoblanadi. Magistral va xo‘jaliklararo kanallarni zamonaviy gidroizolyatsiya materiallari bilan qoplash, shuningdek, suv yo‘qotishlarini kamaytirish maqsadida ochiq kanallardan yopiq quvurlar tizimiga bosqichma-bosqich o‘tish orqali suv oqimining samaradorligini sezilarli darajada oshirish mumkin.

Ikkinchidan, qishloq xo‘jaligida rivojlangan texnologiyalarni keng joriy etish talab etiladi. Har bir hududning relyefi, tuproq unumdorligi va suv ta‘minoti sharoitidan kelib chiqib, tomchilatib hamda yomg‘irlatib sug‘orish tizimlarini zonalar bo‘yicha tatbiq qilish suvni isrof qilmasdan, ekin ehtiyojiga mos ravishda taqsimlash imkonini beradi.

Uchinchidan, suv resurslari monitoringini raqamlashtirishni jadallashtirish lozim. Zamonaviy hududiy-tahliliy dasturiy vositalar yordamida suv sarfi va ekin maydonlarining real vaqt rejimdagi balansini yuritish, suv taqsimotini avtomatlashtirilgan tarzda boshqarishni taqozo etadi. Bu tizim daryo oqimidagi har qanday o‘zgarishlarni tezkor aniqlash va qishloq xo‘jaligi ekinlarini sug‘orish jadvalini iqlimiy sharoitlarga moslashuvchan tarzda belgilashga xizmat qiladi.

Xulosa o‘rnida shuni ta‘kidlash joizki, So‘x daryosi havzasida suvdan foydalanish madaniyatini yuksaltirish, suv iste‘molchilari uyushmalarining faoliyatini kuchaytirish hamda ilmiy asoslangan suv boshqaruvi prinsiplarini tatbiq etish kelajakda yuzaga kelishi mumkin bo‘lgan gidrologik xavflarning oldini olishga va hududning iqtisodiy barqarorligini ta‘minlashga xizmat qiladi.

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FARG'ONA VODIYSI TABIIY LANDSHAFTLARINING HOZIRGI HOLATI VA ULARDAN OQILONA FOYDALANISH ISTIQBOLLARI

Annotatsiya: Maqolada Farg'ona vodiysining shimoli-g'arbiy va markaziy qismlaridagi landshaftlarning hozirgi geoekologik holati tahlil qilingan. Tadqiqot jarayonida hududning antropogen transformatsiyalashuv darajasi o'rganilib, landshaftlar uchta asosiy zonaga tasniflandi. Mintaqada kechayotgan eroziya, cho'llanish va sizot suvlari sathining ko'tarilishi kabi salbiy jarayonlarning sabablari ilmiy asoslab berildi.

Kalit so'zlar: Farg'ona vodiysi, landshaft, geoekologik holat, antropogen transformatsiya, eroziya, agrolandschaft, barqaror rivojlanish, cho'llanish.

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CURRENT STATE OF NATURAL LANDSCAPES IN THE FERGANA VALLEY AND PROSPECTS FOR THEIR RATIONAL USE

Abstract: This article analyzes the current geoecological state of landscapes in the north-western and central parts of the Fergana Valley. During the research, the level of anthropogenic transformation of the region was studied, and landscapes were classified into three main zones. The causes of negative processes such as erosion, desertification, and rising groundwater levels in the region were scientifically substantiated.

Keywords: Fergana Valley, landscape, geoecological state, anthropogenic transformation, erosion, agrolandscape, sustainable development, desertification.

Kirish

Farg'ona vodiysi o'zining murakkab geomorfologik tuzilishi, iqlimiy xilma-xilligi va aholining yuqori zichligi bilan ajralib turadigan mintaqadir. So'nggi

yillarda hududda kechayotgan jadal urbanizatsiya jarayonlari, aholi sonining o'sishi va qishloq xo'jaligining keng ko'lamda rivojlanishi tabiiy landshaftlarga bo'lgan antropogen bosimni sezilarli darajada oshirib yubordi. Natijada, tog'oldi va adir hududlarining tabiiy muvozanati buzilib, tuproq eroziyasi, yaylovlarning degradatsiyasi va suv resurslaridan oqilona foydalanish bilan bog'liq geokologik muammolar vujudga kelmoqda. Respublikamizda so'nggi yillarda amalga oshirilayotgan keng ko'lamli islohotlar, xususan, "Yashil makon" umummilliy loyihasi hamda suv resurslarini boshqarish tizimini modernizatsiya qilishga qaratilgan davlat dasturlari doirasida hududiy tabiiy komplekslarni asrash va ulardan oqilona foydalanish masalalari yangi bosqichga ko'tarildi. Ushbu tadqiqotning dolzarbligi shundaki, mintaqaning tabiiy-geografik salohiyatini saqlab qolish va landshaftlarning barqarorligini ta'minlash bugungi kunning kechiktirib bo'lmaz vazifalaridan biridir. Maqolada mazkur hududning hozirgi holati dala kuzatuvlari, hududiy statistika ma'lumotlari va ilmiy-amaliy tahlillar asosida baholanadi. Tadqiqotdan ko'zlangan asosiy maqsad — landshaftlarning transformatsiya jarayonlarini aniqlash hamda hududning tabiiy potensialidan kelib chiqqan holda, ekologik barqarorlikni tiklash bo'yicha ilmiy-asoslangan takliflarni ishlab chiqishdir. Bu esa, o'z navbatida, kelajakda hududiy rivojlanish strategiyalarini to'g'ri belgilash va resurslardan samarali foydalanish uchun muhim zamin yaratadi.

Tadqiqot jarayonida Farg'ona vodiysining shimoli-g'arbiy va markaziy qismlaridagi tabiiy landshaftlar hamda ularning inson faoliyati ta'sirida o'zgarish xususiyatlari asosiy ob'ekt sifatida olindi. Maqolani tayyorlashda hududiy tabiat va jamiyat o'rtasidagi munosabatlarni ochib berishga qaratilgan kompleks ilmiy-metodologik yondashuvlardan foydalanildi. Xususan, landshaft komponentlari – relyef, iqlim, gidrografik tarmoq, tuproq va o'simlik dunyosi o'rtasidagi genetik hamda funksional bog'liqlikni o'rganishda tizimli va qiyosiy-geografik tahlil usuli qo'llanildi.

Natijalar va tahlil

Farg'ona vodiysining shimoli-g'arbiy va markaziy qismlarida o'tkazilgan kompleks dala tadqiqotlari, landshaft monitoringi hamda hududiy tabiatdan foydalanish xususiyatlarini qiyosiy tahlil qilish natijalari shuni ko'rsatadiki, mintaq landshaftlarining hozirgi geokologik holati antropogen yuklama va tabiiy muvozanatning o'zaro ta'siri asosida shakllanmoqda. Tadqiqot jarayonida olingan ma'lumotlar asosida hududning geokologik holati uchta asosiy zonaga tasniflandi (jadval 1).

1-jadval

**Farg‘ona vodiysi landshaftlarining geoekologik
holati va rivojlanish tendensiyalari**

№	Landshaft tipi	Geoekologik holat darajasi	Asosiy salbiy jarayonlar
1	Markaziy va shimoli-g‘arbiy cho‘l zonalari	Tabiiy barqarorlikka yaqin	Cho‘llanish, o‘tloqzorlarning kamayishi
2	Adir va tog‘oldi landshaftlari	O‘rtacha o‘zgaruvchan (degradatsiyalangan)	Tuproq eroziyasi, sel va surilmalar xavfi
3	Sug‘oriladigan voha landshaftlari	To‘liq transformatsiyalashgan (agrolandshaft)	Sizot suvlari ko‘tarilishi, ikkilamchi sho‘rlanish

Manba: Tadqiqot hududi bo‘yicha dala kuzatuvlari va tuman yer resurslari va davlat kadastri bo‘limi statistik ma‘lumotlari asosida muallif tomonidan tuzildi.

Natijalarning ilmiy-tahliliy izohi

Sug‘oriladigan voha landshaftlarida inson faoliyatining izlari yaqqol ko‘zga tashlanadi. Mazkur hududlarda asrlar davomida amalga oshirilgan intensiv dehqonchilik madaniyati tabiiy landshaftlarning genetik tuzilishini butunlay o‘zgartirib, ularni sun‘iy agrolandshaftlarga aylantirdi. Hududning tekislik relyefi va murakkab sug‘orish tarmog‘ining mavjudligi, gidrologik rejimning sun‘iy boshqarilishiga olib keldi. Dala tahlillari shuni ko‘rsatadiki, intensiv sug‘orish va drenaj tizimlarining samarasiz ishlashi sizot suvlarining sathini yuqoriga ko‘tarib, tuproq-grunt qatlamining botqoqlanishiga va ikkilamchi sho‘rlanishga sabab bo‘lmoqda. Bu jarayon tuproqning o‘z-o‘zini tozalash va tiklash funksiyalarini susaytirib, uzoq muddatli istiqbolida yer unumdorligining pasayish xavfini kuchaytirmoqda.

Adir va tog‘oldi landshaftlari bugungi kunda mintaqadagi eng nozik va beqaror zonalar hisoblanadi. Bu yerda lalmikor dehqonchilikning jadal rivojlantirilishi, ayniqsa, nishabliklarda yer haydash jarayonlari tuproq qoplaminig himoya qatlamini (o‘simlik dunyosini) keskin qisqartirdi. Kuzatuvlar shuni tasdiqladiki, o‘simlik qoplaminig yo‘qolishi suv eroziyasini jadallashtirib, unumdor tuproq qatlamining yuqori qismlardan yuvilib ketishiga va tog‘oldi hududlarida jilg‘a tarmoqlarining shakllanishiga olib kelmoqda. Bu esa nafaqat tuproq degradatsiyasini, balki sel oqimlarining quvvatini oshirib, quyi hududlardagi voha landshaftlarida joylashgan aholi punktlari va qishloq xo‘jaligi yerlariga ham bevosita xavf tug‘dirmoqda.

Markaziy va shimoli-g‘arbiy cho‘l zonalari nisbatan tabiiy holatini saqlab qolgan bo‘lsa-da, bu zonada ham iqlimiy va antropogen ta’sirlar natijasida jiddiy o‘zgarishlar yuz bermoqda. Global iqlim isishi fonida haroratning ko‘tarilishi va yog‘ingarchilikning keskin kamayishi mintaqada gidromorf (namsevar) o‘simliklar tarqalgan hududlarning quruqlashuvini tezlashtirmoqda. Natijada, o‘tloqzorlar o‘rnini sho‘rga chidamli yoki kam unumli o‘simlik turlari egallab, cho‘llanish jarayonini kengaytirmoqda. Bu esa hududning bioxilma-xilligini qisqartirish bilan birga, mintaqa iqlimining quruqlashuvini yanada jadallashtirmoqda. Tadqiqotlar shuni ko‘rsatadiki, Farg‘ona vodiysi

landshaftlaridagi bu differensiyalangan holat, insonning xo‘jalik faoliyati tabiat bilan muloqotda qanday muvozanat (yoki muvozanatsizlik) hosil qilayotganini aks ettiradi. Sug‘oriladigan yerlardagi yuqori bosim, tog‘oldi hududlardagi eroziya va cho‘l zonalaridagi cho‘llanish jarayonlari aslida bir-biri bilan o‘zaro bog‘liq zanjirni tashkil etadi. Bu holat shuni anglatadiki, mintaqaviy rivojlanish strategiyalarini ishlab chiqishda faqatgina iqtisodiy foyda emas, balki har bir landshaft turining tabiiy potensialini hisobga olgan holda ekologik xavfsizlikni ta‘minlash bugungi kunning eng dolzarb vazifalaridan biridir.

Munozara va istiqbollar

Olingan natijalar shuni ko‘rsatadiki, Farg‘ona vodiysida asrlar davomida shakllangan an‘anaviy va ekstensiv xo‘jalik yuritish uslubi o‘zining iqtisodiy hamda ekologik limitini tugatmoqda. Hududning hozirgi geoekologik tendensiyalari tahlili shundan dalolat beradiki, agar mavjud foydalanish tartibi saqlanib qolsa, adir va cho‘l landshaftlaridagi transformatsiya jarayonlari yaqin kelajakda qaytmas (irreversibil) bosqichga o‘tishi, ya‘ni tuproq unumdorligining to‘liq yo‘qolishi va ekotizimlarning degradatsiyasi muqarrar bo‘lishi mumkin. Bu holat nafaqat mintaqaviy barqarorlikka, balki aholining ijtimoiy-iqtisodiy farovonligiga ham jiddiy xavf soladi. Mintaqa landshaftlaridan oqilona foydalanish va ekologik barqarorlikni tiklash istiqbollari quyidagi ustuvor vazifalarni amalga oshirishni taqozo etadi:

Birinchidan, agrolandshaftlarni optimallashtirish va suv resurslarini boshqarish. Suv tanqisligi sharoitida eski sug‘orish usullari yer degradatsiyasining asosiy katalizatori bo‘lib qolmoqda. Shu sababli, voha hududlarida tomchilatib va yomg‘irlatib sug‘orish kabi suv tejovchi zamonaviy agrotexnologiyalarni keng joriy etish zarur. Bu nafaqat suv sarfini kamaytiradi, balki sizot suvlari sathini boshqariladigan darajada ushlab turish va ikkilamchi sho‘rlanishning oldini olish imkonini beradi.

Ikkinchidan, “Yashil qalqonlar” strategiyasini shakllantirish. Markaziy va Shimoli-g‘arbiy Farg‘onaning qumli landshaftlarida deflyatsiya (shamol eroziyasi) jarayonlarini jilovlash maqsadida intensiv ko‘kalamzorlashtirish ishlarini olib borish kerak. Saksaulzorlar va ixota daraxtzorlarini barpo etish orqali hududning mikroiqlimini yaxshilash, qum ko‘chish sur‘atini pasaytirish hamda cho‘l zonalaridagi biologik xilma-xillikni saqlab qolish imkoniyati mavjud. Bu tadbirlar cho‘llanishning voha hududlariga ta‘sirini yumshatuvchi muhim bufer vazifasini o‘taydi.

Uchinchidan, adir va tog‘ ekotizimlarini kompleks muhofaza qilish. Tog‘oldi zonalaridagi lalmikor yerlardan foydalanishda zamonaviy agrotexnik usullarni, xususan, nishabliklarda terrasalar yaratishni joriy etish suv eroziyasini sezilarli darajada kamaytiradi. Shuningdek, yaylovlardagi yuklamani nazorat qilish uchun chorva mollarini rejasiz boqishni cheklash va yaylov almashinuvini (rotatsiyasini) yo‘lga qo‘yish degradatsiyaning oldini olishning yagona yo‘lidir.

Xulosa

Olib borilgan tadqiqotlar natijalari shuni ko‘rsatadiki, Farg‘ona vodiysining shimoli-g‘arbiy va markaziy qismlaridagi landshaftlar hozirgi kunda antropogen

bosimning turli darajalariga duch kelmoqda. Mintaqadagi geoeologik vaziyatni tahlil qilish, landshaft zonalarining (cho'l, adir va voha) o'ziga xos xususiyatlarini va ulardagi degradatsiya jarayonlarini aniqlash imkonini berdi.

Tadqiqotning asosiy xulosalari quyidagilardan iborat:

Landshaftlarning transformatsiyasi

Vodiy landshaftlarining geoeologik holati insonning xo'jalik faoliyatiga to'g'ridan-to'g'ri bog'liq bo'lib, voha hududlarining to'liq agrolandshtftga aylanishi, adir hududlarida esa eroziya jarayonlarining kuchayishi mintaqa ekotizimi uchun asosiy xavf hisoblanadi.

Barqaror rivojlanish zarurati

Ekstensiv dehqonchilikdan intensiv va resurs tejovchi texnologiyalarga o'tish – nafaqat iqtisodiy samaradorlik, balki mintaqaviy ekologik xavfsizlikni ta'minlashning yagona yo'lidir.

Amaliy yechimlar

Taklif etilgan yashil qalqonlar, terrasalar va zamonaviy sug'orish tizimlari landshaftlarning barqarorligini tiklashda hamda kelajakdagi iqlimiy o'zgarishlarning salbiy oqibatlarini yumshatishda hal qiluvchi ahamiyatga ega.

Xulosa qilib aytganda, Farg'ona vodiysining tabiiy-geografik salohiyatini asrash, ulardan foydalanishda zamonaviy ilmiy yondashuvlarni joriy etish va geoeologik monitoringsiz rivojlanishni rejalashtirish mumkin emas. Ushbu tadqiqot natijalari mintaqaviy boshqaruv qarorlarini ishlab chiqishda, tabiatni muhofaza qilish strategiyalarini belgilashda hamda kelgusida mazkur yo'nalishda amalga oshiriladigan ilmiy izlanishlar uchun nazariy va amaliy zamin bo'lib xizmat qiladi.

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IQLIM O'ZGARISHI SHAROITIDA LANDSHAFTLARDA MODDA VA ENERGIYA ALMASHINUVIDAGI O'ZGARISHLAR

Annotatsiya. Maqolada landshaftning ochiq geotizim sifatidagi tabiatidan kelib chiqib, global iqlim o'zgarishi sharoitida undagi modda va energiya almashinuvi jarayonlarining qayta tuzilishi tahlil etilgan. Radiatsion va issiqlik balansi, suv balansi, geokimyoviy migratsiya hamda biologik aylanma bo'g'inlarining harorat va namlik rejimidagi o'zgarishlarga bog'liqligi ochib berilgan. Markaziy Osiyo, jumladan O'zbekiston landshaftlari misolida arid sharoitda issiqlik va modda oqimlarining o'zgarish yo'nalishlari aniqlangan: bug'lanishga sarflanadigan energiya ulushining ortishi, bug'lanish geokimyoviy to'siqlarining kuchayishi va biologik mahsuldorlikning pasayishi ko'rsatib berilgan.

Kalit so'zlar: landshaft, geotizim, modda va energiya almashinuvi, radiatsion balans, issiqlik balansi, suv balansi, geokimyoviy migratsiya, biologik aylanma, iqlim o'zgarishi, cho'llanish.

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CHANGES IN MATTER AND ENERGY EXCHANGE IN LANDSCAPES UNDER CLIMATE CHANGE CONDITIONS

Abstract. Based on the concept of the landscape as an open geosystem, the article analyzes the reorganization of matter and energy exchange processes under conditions of global climate change. The dependence of the components of the radiation and heat balance, water balance, geochemical migration and biological cycle on changes in the temperature and moisture regime is revealed. Using the example of the landscapes of Central Asia, including Uzbekistan, the directions of change in heat and matter fluxes under arid conditions are identified: an increase in the share of energy spent on evaporation, the strengthening of evaporative geochemical barriers and a decline in biological productivity.

Keywords: landscape, geosystem, matter and energy exchange, radiation balance, heat balance, water balance, geochemical migration, biological cycle, climate change, desertification.

Kirish

Landshaft – quyosh energiyasi ta'sirida atmosfera, litosfera, gidrosfera va biosfera o'rtasida kechadigan uzluksiz modda va energiya almashinuvi natijasida shakllanadigan, ichki yaxlitlik va tarkibiy bo'linishga ega tabiiy geotizimdir [1; 6]. Har qanday geotizim atrof-muhit bilan modda va energiya almashinib turadigan ochiq sistema bo'lib, uning faoliyatini ta'minlovchi asosiy energiya manbai quyosh radiatsiyasidir [4; 5]. Quyosh energiyasi landshaftga qisqa to'liq radiatsiya ko'rinishida kirib keladi, so'ngra issiqlik energiyasiga, bug'lanishning yashirin issiqligiga hamda fotosintez orqali organik moddalarning kimyoviy energiyasiga aylanadi. Shu tariqa landshaft energiyani qabul qiluvchi, o'zgartiruvchi, qayta taqsimlovchi va qisman to'plovchi tizim sifatida namoyon bo'ladi.

Iqlim landshaftdagi modda va energiya oqimlarini boshqaruvchi yetakchi omil hisoblanadi; shu bois uning o'zgarishi bevosita ushbu jarayonlarning qayta tuzilishiga olib keladi. Iqlim o'zgarishi bo'yicha hukumatlararo guruh (IPCC) ma'lumotlariga ko'ra, sanoatlashishdan oldingi davrga nisbatan yer yuzasining o'rtacha harorati sezilarli darajada ko'tarilgan bo'lib, bu jarayon quruqlikda, ayniqsa materik ichkarisidagi arid hududlarda yanada jadal kechmoqda [8]. Markaziy Osiyoda isish global o'rtacha ko'rsatkichdan tezroq sodir bo'layotgani, tog' muzliklarining qisqarishi va qurg'oqchilikning kuchayishi mintaqalardagi landshaftlarida modda va energiya almashinuvini chuqur o'zgartirmoqda [8; 11]. Bu esa landshaftlardagi energiya va modda oqimlarining o'zgarish qonuniyatlarini o'rganishni dolzarb ilmiy vazifaga aylantiradi.

Adabiyotlar tahlili va metodologiya

Landshaftda modda va energiya almashinuvi haqidagi ta'limot ikki yirik ilmiy yo'nalish – landshaft geokimyosi va landshaft geofizikasi negizida shakllangan. Landshaft geokimyosi asoschisi B.B.Polinov elementar landshaft tushunchasini kiritib, kimyoviy elementlarning relyef bo'ylab eluvial, tranzit va akkumulyativ pozitsiyalar o'rtasida migratsiyasi qonuniyatlarini asoslab berdi [1]. M.A.Glazovskaya va A.I.Perelman ushbu ta'limotni rivojlantirib, geokimyoviy migratsiya turlari hamda elementlarning to'planishi va tarqalishini boshqaruvchi geokimyoviy to'siqlar nazariyasini ishlab chiqdilar [2; 3]. Landshaft geofizikasida D.L.Armand va N.L.Beruchashvili geotizimlarning energetik va issiqlik balansini, geomassalar o'rtasidagi energiya almashinuvini miqdoriy jihatdan o'rgandilar [4; 5].

Geotizimlar haqidagi umumiy ta'limot V.B.Sochava va A.G.Isachenko ishlarida nazariy jihatdan umumlashtirilgan [6; 7]. O'zbekistonda landshaftshunoslik va modda-energiya almashinuvi masalalari A.A.Abdulqosimovning tog' va tog'oralig'i geotizimlari bo'yicha tadqiqotlarida [10], L.A.Alibekovning Markaziy Osiyo cho'l landshaftlari va cho'llanish jarayonlari bo'yicha ishlarida [11], K.M.Boymirzayevning Farg'ona vodiysi landshaftlari geokimyosiga oid izlanishlarida [12], shuningdek Sh.S.Zokirov va Sh.Sharipovning landshaftshunoslik hamda geoekologiya yo'nalishidagi tadqiqotlarida [13; 14] keng yoritilgan. Shu bilan birga, aynan iqlim o'zgarishi

ta'sirida modda va energiya oqimlarining qayta taqsimlanishi mintaqaviy darajada hali yetarlicha tizimli o'rganilmagan.

Tadqiqotda qiyosiy-geografik, balans, retrospektiv tahlil va statistik usullardan foydalanildi. Energiya va modda oqimlarining o'zgarishi radiatsion balans, issiqlik balansi va suv balansi tenglamalari asosida, iqlimiy ko'rsatkichlarning ko'p yillik o'zgarish tendensiyalari bilan bog'liq holda tahlil qilindi.

Natijalar va ularning muhokamasi

Landshaftda modda va energiya almashinuvining nazariy asoslari tabiat bilan chambarchas bog'liq holda ishlab chiqilgan. Xususan, landshaftga kelib tushgan radiatsion energiya issiqlik balansi tenglamasi orqali taqsimlanadi. Ya'ni:

$$R = LE + P + B$$

Bunda R – yer yuzasining radiatsion balansi, LE – bug'lanishga sarflanadigan yashirin issiqlik oqimi, P – atmosfera bilan turbulent (sezilarli) issiqlik almashinuvi, B esa tuproq-grunt qatlamiga yo'nalgan issiqlik oqimi [4; 5].

Ushbu tenglama a'zolari o'rtasidagi nisbat landshaftning issiqlik va namlik rejimini, demak, undagi barcha tabiiy jarayonlarning jadalligini belgilaydi.

Modda almashinuvi esa o'zaro bog'liq uchta asosiy bo'g'in orqali amalga oshadi. Suv aylanmasi yog'in, bug'lanish, yer usti va yer osti oqimi hamda namlikning tuproqqa shimilishini o'z ichiga oladi va boshqa barcha oqimlar uchun harakatlantiruvchi muhit vazifasini bajaradi. Geokimyoviy migratsiyada kimyoviy elementlar asosan suvli eritmalar orqali ko'chadi, eruvchanligi va muhit sharoitiga ko'ra muayyan geokimyoviy to'siqlarda to'planadi [2]. Biologik aylanmada esa fotosintez orqali hosil bo'lgan organik modda o'simlik qoldiqlari (opad) shaklida tuproqqa qaytadi, parchalanish va minerallashuv jarayonida kimyoviy elementlar yana aylanma harakatga jalb etiladi. Bu bo'g'inlarning barchasi harorat va namlik bilan, ya'ni iqlim sharoiti bilan bevosita boshqariladi.

Iqlim o'zgarishining radiatsion va issiqlik balansiga ta'siri o'ziga xos. Haroratning ko'tarilishi issiqlik balansi a'zolari o'rtasidagi nisbatni o'zgartiradi. Namlik yetarli bo'lgan landshaftlarda bug'lanish kuchayib, energiyaning katta qismi yashirin issiqlik (LE) sifatida sarflanadi. Namlik tanqis arid landshaftlarda esa bug'lanish suv yetishmasligi bilan cheklanganligi sababli radiatsion energiyaning asosiy ulushi turbulent issiqlik almashinuviga (P) yo'naladi, bu yer yuzasining qizib ketishi va havoning quruqlashishiga olib keladi [8]. Natijada quruqlik va isish o'rtasida ijobiy teskari bog'lanish vujudga keladi: isish bug'lanish talabini oshiradi, ammo namlik yetishmasligi uni qondira olmaydi va landshaftning aridligi yanada chuqurlashadi.

Alohida ahamiyatga ega omil – yer yuzasi albedosi (qaytarish qobiliyati)ning o'zgarishidir. Qor va muz qoplamining qisqarishi albedoni pasaytirib, qisqa to'lqinli radiatsiyaning ko'proq yutilishiga va shu orqali isishning yanada kuchayishiga olib keladi. Bu muz-albedo teskari bog'lanishi Tyanshan va Pomir tog' landshaftlarida muzliklarning jadal erishi orqali yaqqol namoyon bo'lmoqda [8; 11].

Suv balansi va geokimyoviy migratsiyaning o'zgarishi muhim. Suv balansi tenglamasi (yog'in = bug'lanish + oqim + namlik zaxirasining o'zgarishi) iqlim o'zgarishiga juda sezgir. Isish sharoitida bug'lanishning ortishi oqim va namlik zaxirasini kamaytiradi. Tog' havzalarida muzliklarning erishi dastlab daryo oqimini ko'paytiradi, biroq muz zaxiralari tugab borgan sari oqim barqaror ravishda kamayadi – bu Farg'ona vodiysi kabi muzliklardan suv oluvchi hududlar uchun o'ta dolzarbdir [11; 12].

Suvli migratsiyaning susayishi geokimyoviy jarayonlar yo'nalishini ham o'zgartiradi. Yon (lateral) oqim zaiflashishi bilan moddalarning hududdan chiqarib yuborilishi kamayadi, bug'lanish kuchayishi esa eritmalardagi tuzlarning yer yuzasi va tuproqning yuqori qatlamida to'planishiga – bug'lanish geokimyoviy to'sig'ining shakllanishiga olib keladi. Oqibatda ikkilamchi sho'rlanish kuchayadi, sho'rxok yuzalar kengayadi. Bu jarayon Markaziy Osiyo sug'oriladigan va cho'l landshaftlarida, ayniqsa Orol dengizi qurigan tubidan tuz-chang ko'chishi sharoitida yaqqol kuzatilmoqda [2; 11].

Biologik aylanma va Markaziy Osiyo landshaftlaridagi o'zgarishlar alohida tadqiq etishni taqazo etadi. Biologik aylanma harorat va namlikning birgalikdagi ta'siri ostida o'zgaradi. Namlik yetarli mintaqalarda harorat va atmosferadagi karbonat angidrid miqdorining ortishi biologik mahsuldorlikni bir qadar oshirishi mumkin. Arid landshaftlarda esa namlik yetishmasligi cheklovchi omil bo'lib qoladi: bug'lanish talabining ortishi o'simlik qoplamining siyraklashuvi, biomassa va opad miqdorining kamayishi, demak, biologik aylanmaning susayishi bilan kechadi. Bu cho'llanish jarayonlarining kuchayishida bevosita aks etadi [11].

Iqlim o'zgarishi tog' landshaftlarining balandlik mintaqalanishida ham o'z ifodasini topadi. Harorat ko'tarilishi natijasida tabiiy mintaqalar yuqoriga siljiydi, muzlik-nival mintaqasi qisqaradi, o'rmon va dasht mintaqalari chegaralari o'zgaradi [10]. Markaziy Osiyo, jumladan O'zbekiston sharoitida bu o'zgarishlar muzliklarning qisqarishi orqali daryolarning to'yinishini kamaytirib, voha landshaftlarining suv ta'minotiga va ularning barqarorligiga jiddiy ta'sir ko'rsatadi. Shu tariqa iqlim o'zgarishi landshaftdagi energiya, suv, geokimyoviy va biologik oqimlarni yagona o'zaro bog'liq tizim sifatida birvarakayiga qayta tuzadi.

Xulosa

Iqlim o'zgarishi landshaftlardagi modda va energiya almashinuvini bir-biri bilan chambarchas bog'liq tarzda qayta taqsimlaydi. Arid sharoitda issiqlik balansida turbulent issiqlik ulushi ortib, yer yuzasi qizib ketadi; suv balansida bug'lanish kuchayib, oqim va namlik zaxirasi kamayadi; geokimyoviy migratsiyada bug'lanish to'siqlari va sho'rlanish kuchayadi; biologik aylanma esa susayadi va tog'larda balandlik mintaqalari yuqoriga siljiydi.

Markaziy Osiyo va O'zbekiston landshaftlari bu o'zgarishlarga, ayniqsa muzliklarning qisqarishi va cho'llanishning kuchayishi orqali o'ta sezgir. Shu bois landshaftlardagi modda va energiya oqimlarining geotizimli monitoringini yo'lga qo'yish, balans hisob-kitoblarini muntazam yangilab borish va landshaftlardan foydalanishning iqlimga moslashuvchan tamoyillarini ishlab chiqish zarur. Bu

yondashuv mintaqa tabiiy resurslarini barqaror boshqarishning ilmiy asosini tashkil etadi.

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CLIMATE-DRIVEN DESERTIFICATION IN CENTRAL ASIAN ARID ZONES: A SPATIO-TEMPORAL APPROACH

Abstract: Central Asian arid zones are undergoing accelerating desertification driven by the convergence of anthropogenic climate change and unsustainable land use intensification. This study presents a regionally comprehensive spatio-temporal analysis of desertification dynamics across four representative dryland systems—Karnab (Uzbekistan), Southern Karakum (Turkmenistan), Muyunkum (Kazakhstan), and Hamoun (Afghanistan–Iran border)—spanning the period 1985–2024. We integrate multi-source satellite imagery (Landsat 5/7/8/9, Sentinel-2 A/B, MODIS Terra/Aqua) with gridded climate reanalysis data (ERA5-Land, CHELSA v2.1) and 40-year in-situ meteorological records to construct a spatially consistent, 39-year time series of five biophysical degradation proxies: Normalised Difference Vegetation Index (NDVI), Soil-Adjusted Vegetation Index (SAVI), Bare Soil Index (BSI), Land Surface Temperature (LST), and Fractional Vegetation Cover (FVC). Regional warming rates across the study domain averaged $+0.041\text{ }^{\circ}\text{C yr}^{-1}$ (range: $+0.028\text{--}0.059\text{ }^{\circ}\text{C yr}^{-1}$), approximately 1.6 times the contemporaneous global mean. Precipitation exhibited negative linear trends at three of four sites (Sen slope: -1.2 to -3.8 mm yr^{-1}). NDVI declined by 18–34% across degraded zones, while BSI increased by 43–112%. Structural Equation Modelling (SEM) partitioned the relative contributions of climatic (42–58%) and anthropogenic (38–52%) drivers to observed degradation variance. Hotspot analysis (Getis-Ord G_i^*) identified statistically significant ($p < 0.01$) desertification clusters surrounding pastoral water points, agricultural abandonment zones, and linear infrastructure corridors. Future projections under SSP2-4.5 and SSP5-8.5 scenarios indicate that 61–78% of currently mild desertification zones will transition to moderate or severe status by 2060. These findings provide a regional evidence base for Land Degradation Neutrality (LDN) target-setting and adaptive land management under the UNCCD framework.

Keywords: desertification; Central Asia; spatio-temporal analysis; climate change; remote sensing; NDVI; BSI; LST; Structural Equation Modelling; Land Degradation Neutrality; arid zones; Uzbekistan; Turkmenistan; Kazakhstan

Introduction

Desertification—the persistent degradation of dryland ecosystems resulting from climatic variability and human activities—constitutes one of the most pervasive yet systematically underestimated environmental crises of the twenty-

first century [1]. Approximately 3.2 billion people reside in dryland systems that collectively cover 41% of the global land surface, and these regions are disproportionately represented among the world's least economically developed nations and most food-insecure populations [2]. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) estimates that land degradation costs the global economy USD 10 trillion annually in lost ecosystem services [3], while the UNCCD's Global Assessment of Soil Degradation (GLASOD) identifies arid zones as contributing 73% of the degraded agricultural land area worldwide [1].

Central Asia—encompassing the five post-Soviet republics (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) and contiguous arid territories of Afghanistan, Iran, and northwestern China—forms one of the most climatically sensitive dryland regions on Earth. The region is characterised by an interior continental position, extreme thermal continentality (annual temperature range $> 40^{\circ}\text{C}$), and precipitation intensely concentrated in the winter-spring season. Climate model ensembles from the Coupled Model Intercomparison Project Phase 6 (CMIP6) project mean annual temperature increases of $2.0\text{--}4.5^{\circ}\text{C}$ by 2100 under SSP2-4.5 and SSP5-8.5 scenarios respectively, with concomitant reductions in summer soil moisture of 15–25% [4]. These projections compound existing pressures from population growth (regional increase of $\sim 70\%$ since 1990), agricultural expansion, and the legacy of Soviet-era water resource mismanagement exemplified by the Aral Sea catastrophe [5].

The Aral Sea desiccation, which reduced the lake's surface area by 90% between 1960 and 2020, created the Aralkum—a $55,000\text{ km}^2$ aeolian dust and salt source that annually deposits an estimated 75–100 Mt of sediment across downwind agricultural systems, accelerating soil salinisation, wind erosion, and phytotoxic ion accumulation at regional scales [5,6]. Modelling studies using HYSPLIT trajectory analysis have traced Aralkum dust plumes to distances exceeding 3,000 km, indicating transcontinental ecological connectivity between this single degraded basin and dryland systems from Afghanistan to the Caspian steppe [6].

Remote sensing has become the primary instrument for characterising desertification at scales from the local to the continental. The NDVI, computed from the difference between near-infrared and red reflectance, provides a temporally continuous proxy for photosynthetic biomass that has been applied to desertification monitoring since the NOAA AVHRR era [7]. However, NDVI saturates in dense canopies and is spectrally confounded by bare soil backgrounds in arid systems with fractional cover below 30%, motivating the development of soil-adjusted indices (SAVI, OSAVI, TSAVI), bare soil indices (BSI, NSDI), and thermal measures (LST) as complementary degradation indicators [8,9]. Advances in cloud-computing platforms such as Google Earth Engine (GEE) now enable the processing of petabyte-scale image archives at continental extents, facilitating multi-index, multi-decadal analyses that were computationally intractable one decade ago [10].

Despite this methodological progress, existing regional assessments of Central Asian desertification suffer from three key limitations: (I) single-country or single-site scope that precludes cross-system comparison and regional generalisation [11,12]; (II) reliance on single spectral indices that capture only one dimension of a multifaceted degradation process [13]; and (iii) absence of formal causal partitioning between climatic and anthropogenic drivers [14]. The present study addresses all three gaps through a multi-site, multi-index, causal-modelling framework applied to four representative dryland systems across the Central Asian region. Specific objectives are: (1) to quantify long-term (1985–2024) trends in five biophysical degradation proxies; (2) to map desertification hotspots and cold spots at 10–30 m resolution; (3) to partition climatic versus anthropogenic contributions to observed degradation using Structural Equation Modelling (SEM); and (4) to project future desertification trajectories under CMIP6 SSP scenarios.

Study Sites and Regional Context

Four study sites were selected to represent the principal desert geomorphological and climatic types of Central Asia (Table 1). Selection criteria included: (a) representativeness of major dryland soil and vegetation types; (b) availability of long-term meteorological records (≥ 30 years); and (c) documented presence of ongoing land degradation stresses.

Table 1.
Characteristics of the four study sites.

Site	Country	Coordinates	Area (km ²)	Desert Type	Aridity Index
Karnab	Uzbekistan	39°45'N 65°52'E	800	Loessic semi-desert	0.12
S. Karakum	Turkmenistan	37°30'N 61°20'E	3,200	Aeolian sandy desert	0.05
Muyunkum	Kazakhstan	43°50'N 71°30'E	4,100	Saxaul sandy desert	0.08
Hamoun	Afg./Iran	31°05'N 61°30'E	5,600	Playa/clay desert	0.03

Aridity Index = P/PET (UNEP classification). Area refers to the analysis domain defined for this study.

The Karnab desert (Uzbekistan) is a loessic intermontane depression in Samarkand Province bounded by the Zarafshan floodplain and the Karatau foothills. Annual precipitation averages 262 mm (1960–2025), concentrated in the November–April window. The rangeland system supports approximately 125,000 Karakul sheep, equivalent to a stocking density 3.7 times the calculated carrying capacity. The Southern Karakum (Turkmenistan) represents one of the largest sandy desert systems in Central Asia, characterised by barchan and seif dune fields, *Haloxylon aphyllum* (saxaul) woodland, and extensive irrigated cotton

agriculture along the Karakum Canal . The Muyunkum (Kazakhstan) is a sandy plain transitional between the Central Kazakh Massif and the Syrdarya floodplain, historically supporting nomadic pastoralism and currently affected by post-Soviet agricultural abandonment and shrub encroachment by *Artemisia* spp. . The Hamoun wetland-playa system (Afghanistan–Iran border) is a terminal drainage basin that has undergone near-complete desiccation since 1999 due to upstream diversions of the Helmand River combined with multi-year drought, generating severe wind erosion and dust emission rates estimated at 14–28 Mt yr⁻¹.

Data and Methods

Satellite Data and Preprocessing

A harmonised 39-year (1985–2024) satellite image time series was constructed from four Landsat missions (Landsat 5 TM, 7 ETM+, 8 OLI/TIRS, 9 OLI-2/TIRS-2) and Sentinel-2 A/B MSI, all accessed via Google Earth Engine [10]. Landsat Collection-2 Level-2 surface reflectance and surface temperature products were used directly; cross-sensor radiometric harmonisation followed the approach of Roy et al. using calibration coefficients derived from pseudo-invariant calibration sites in each study region. Sentinel-2 Level-2A products were processed with Sen2Cor . All imagery was cloud-masked using the CFmask algorithm and composited into annual growing-season medians (March–May). A minimum of 8 cloud-free observations per pixel per year was required; pixels not meeting this criterion were gap-filled using temporally weighted interpolation from the two nearest valid years. Final image stacks comprised 39 annual composites at 30 m (Landsat) and 10 m (Sentinel-2, 2017–2024) resolution. Additionally, MODIS Terra MOD13Q1 (250 m, 16-day NDVI composites) were processed to provide a continuous cloud-free 2000–2024 record for trend validation.

SRTM Digital Elevation Model data (1 arc-second, NASA JPL) were used for topographic correction of surface reflectance (c-correction method;) and to derive slope, aspect, and topographic wetness index covariates for the regression models. Population density data from the Gridded Population of the World version 4 (GPWv4) and livestock density grids from the Global Livestock Counts data set (FAO-GAHLE) were used as anthropogenic pressure variables in the SEM analysis (Section 3.4).

Climate Data

Long-term observed climate data (1985–2024) were obtained from national hydrometeorological services of each country (8 stations across four sites). ERA5-Land hourly reanalysis data (0.1° grid, 1985–2024) were used to extend the spatial coverage of station-based observations and to provide fields for sites lacking dense station networks (Hamoun). Bias correction of ERA5-Land precipitation was performed using the quantile-mapping method against available station records. CHELSA v2.1 climatologies provided 1981–2010 and 1991–2020 baseline normals at 1 km resolution. The Standardised Precipitation Evapotranspiration Index (SPEI) was calculated at 3- and 12-month time scales using the Thornthwaite PET formulation to characterise drought severity and

duration. Future climate projections (2025–2080) were derived from the CMIP6 multi-model ensemble under SSP2-4.5 (intermediate forcing) and SSP5-8.5 (high-end forcing), selecting 11 models with historical performance scores (Taylor Skill Score > 0.75) for the study region [4].

Biophysical Degradation Indices

Five indices were computed for each annual composite in the time series (Table 2). NDVI [7] provides a measure of photosynthetically active green biomass. SAVI (L = 0.5) [8] reduces soil background noise in sparse canopies. BSI [9] quantifies the fractional extent of exposed mineral substrate. LST was retrieved from Landsat 8 TIRS Band 10 using the Single Channel algorithm with land surface emissivity corrected via the NDVI-threshold method. Fractional Vegetation Cover (FVC) was estimated from NDVI following the dimidiate pixel model of Gutman & Ignatov using site-specific NDVI_{soil} and NDVI_{veg} endmembers derived from spectral field measurements (n = 240 sampling points, April 2022–March 2024).

Table 2.
Biophysical indices computed for desertification assessment.

Index	Algorithm / Formula	Bands (Landsat 8)	Desertification Signal	Reference
NDVI	$(\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red})$	B5 / B4	↓ declining biomass	[7]
SAVI	$[(\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red} + 0.5)] \times 1.5$	B5 / B4	↓ sparse veg. loss	[8]
BSI	$\frac{[(\text{SWIR1} + \text{Red}) - (\text{NIR} + \text{Blue})]}{[(\text{SWIR1} + \text{Red}) + (\text{NIR} + \text{Blue})]}$	B6/B4/B5/B2	↑ bare soil expansion	[9]
LST	Single channel algorithm (Jiménez-Muñoz)	B10 (TIR)	↑ surface heat stress	[30]
FVC	$(\text{NDVI} - \text{NDVI}_{\text{soil}}) / (\text{NDVI}_{\text{veg}} - \text{NDVI}_{\text{soil}})$	Derived from NDVI	↓ canopy fraction loss	[32]

NIR = Near Infrared; SWIR1 = Short-Wave Infrared 1; TIR = Thermal Infrared; veg = dense vegetation endmember; soil = bare soil endmember.

Trend Detection and Hotspot Analysis

Temporal trends in each index were assessed using the Theil–Sen median slope estimator combined with the Mann–Kendall test ($\alpha = 0.05$) applied pixel-by-pixel to each annual composite stack. The Theil–Sen estimator is preferred over ordinary least-squares in remote sensing trend analysis due to its robustness to outliers and non-normality of residuals. Pre-whitening of time series was applied following the trend-free pre-whitening (TFPW) procedure of Yue et al. to eliminate autocorrelation prior to Mann–Kendall testing. Statistically significant negative NDVI/SAVI/FVC trends and positive BSI/LST trends were classified as indicative of land degradation. Spatial clustering of degradation trends was

quantified using the Getis-Ord G_i^* statistic, computed on 3×3 km moving windows. Hot spots (G_i^* z-score $> +1.96$) indicate statistically significant spatial clustering of high degradation; cold spots (z-score < -1.96) indicate clustering of stable or recovering land.

Structural Equation Modelling (SEM)

To partition the relative contributions of climatic and anthropogenic drivers to observed degradation, Structural Equation Modelling (SEM) was implemented using the lavaan package (v0.6-17) in R. The conceptual model specified three latent variables: (i) Climate Stress, indicated by annual temperature anomaly, SPEI-12, and aridity index change; (ii) Anthropogenic Pressure, indicated by livestock density, population density, and distance to settlements; and (iii) Degradation Status, indicated by BSI, FVC, LST, and NDVI trend magnitude. Model fit was evaluated using the Comparative Fit Index ($CFI > 0.95$), Tucker–Lewis Index ($TLI > 0.95$), Root Mean Square Error of Approximation ($RMSEA < 0.08$), and Standardised Root Mean Square Residual ($SRMR < 0.08$). Indirect effects and total effects were estimated by bootstrapping ($n = 5000$ replicates) to obtain bias-corrected 95% confidence intervals.

Future Projections

Desertification trajectories to 2060 were projected by coupling downscaled CMIP6 temperature and precipitation anomalies (Section 3.2) with the empirical climate–degradation regression relationships derived from the observational period. A delta-change approach was applied: observed 2000–2024 index values were shifted by the projected CMIP6 climate anomaly relative to the 1995–2014 reference period. Uncertainty bounds were expressed as the inter-model spread (5th–95th percentile of the 11-model ensemble). Land use change was held constant at 2024 conditions to isolate the incremental climatic signal.

Results

Long-Term Climate Trends (1985–2024)

All four study sites experienced statistically significant ($p < 0.01$) warming over the 39-year record (Table 3). Regional mean warming rates ranged from $+0.028$ °C yr^{−1} (Muyunkum) to $+0.059$ °C yr^{−1} (Hamoun), with a domain-mean of $+0.041$ °C yr^{−1}, equivalent to a total increase of $+1.6$ °C. These rates are 1.4–2.3× the contemporaneous global mean warming rate of ~ 0.018 °C yr^{−1}, consistent with the well-established thermal amplification of dryland interiors documented in CMIP5 and CMIP6 ensembles [4]. Precipitation showed significant negative trends at Karnab (-0.89 mm yr^{−1}), Hamoun (-3.8 mm yr^{−1}), and Southern Karakum (-1.2 mm yr^{−1}), while Muyunkum exhibited non-significant interannual variability without a monotonic trend. Aridity Index declined significantly at all sites ($\Delta AI = -0.04$ to -0.09), indicating a consistent shift towards more arid conditions independent of any single precipitation year.

Table 3.
Mann–Kendall trend analysis results for climatic variables
at four study sites (1985–2024).

Site	T Sen slope (°C yr ⁻¹)	T Z-stat	P Sen slope (mm yr ⁻¹)	P Z-stat	ΔAI	SPEI-12 trend
Karnab	+0.029**	+4.81	−0.89**	−3.62	−0.06	−0.021 yr ⁻¹
S. Karakum	+0.041**	+5.33	−1.20**	−2.98	−0.04	−0.018 yr ⁻¹
Muyunkum	+0.028**	+3.74	+0.30 ns	+0.82	−0.02 ns	−0.009 yr ⁻¹
Hamoun	+0.059**	+6.10	−3.80**	−4.45	−0.09	−0.041 yr ⁻¹

** $p < 0.01$; ns = not significant. Z-stat = Mann–Kendall Z statistic. SPEI = Standardised Precipitation Evapotranspiration Index.

Biophysical Index Trends (1985–2024)

Pixel-wise Theil–Sen trend analysis revealed widespread and statistically significant degradation signals across all study sites (Table 4). Area-averaged NDVI declined by 18–34%, with the steepest losses at Hamoun (−34%) where post-1999 desiccation has eliminated the seasonal wetland vegetation community. BSI increased by 43–112% across degraded zones, with the upper end of this range again at Hamoun (+112%), where exposed playa sediments now dominate the landscape. Karnab and Southern Karakum BSI increases (+67% and +58%, respectively) are consistent with the grazing-driven vegetation removal and soil crust disruption documented in field surveys [15]. LST trends are statistically significant at all sites ($p < 0.001$) with Sen slopes of +0.32 to +0.58 °C yr⁻¹ specific to the land surface, exceeding the air temperature trend by a factor of 1.1–1.4×, a pattern attributable to reduced evaporative cooling as soil moisture and vegetation cover decline.

Table 4.

Summary of biophysical index trends across study sites (1985–2024, area-averaged over degraded zones).

Site	Δ NDVI (%)	Δ SAVI (%)	Δ BSI (%)	Δ LST ($^{\circ}\text{C yr}^{-1}$)	Δ FVC (%)
Karnab	–28**	–52**	+67**	+0.41**	–39**
S. Karakum	–22**	–38**	+58**	+0.39**	–31**
Muyunkum	–18**	–24**	+43**	+0.32**	–21**
Hamoun	–34**	–61**	+112**	+0.58**	–74**

** $p < 0.001$ (Mann–Kendall). Δ NDVI, Δ SAVI, Δ BSI, Δ FVC expressed as percentage change relative to 1985–1990 baseline mean. Δ LST = Theil–Sen slope in $^{\circ}\text{C yr}^{-1}$.

Desertification Hotspot Mapping

Getis-Ord G_i^* hotspot analysis identified statistically significant spatial clustering of degradation across all four sites. At Karnab, 94% of the severe desertification hotspot area (z-score $> +3.29$, $p < 0.001$) fell within 800 m of permanent water points, confirming the piosphere model as the dominant spatial organising principle of pastoral degradation. At Southern Karakum, hotspots were concentrated along the Karakum Canal irrigation corridor, where salinisation and water logging create distinct spectral signatures of secondary degradation. Muyunkum hotspots were associated with abandoned Soviet-era collective farm infrastructure, where vehicular disturbance has disrupted biological soil crusts that otherwise resist wind erosion. Hamoun exhibited the highest spatial contiguity of hotspot area (78% of the total playa surface), reflecting the landscape-scale homogeneity of desiccation-driven degradation.

SEM Causal Partitioning

The Structural Equation Model achieved acceptable fit across all four sites (CFI = 0.94–0.97; TLI = 0.93–0.96; RMSEA = 0.048–0.071; SRMR = 0.041–0.063). Climate Stress explained 42–58% of the variance in Degradation Status, while Anthropogenic Pressure accounted for 38–52% (Table 5). Climate and anthropogenic pathways were not independent: a significant positive covariance between Climate Stress and Anthropogenic Pressure ($r = 0.31$ – 0.48) reflects the tendency for drought years to concentrate livestock around remaining water sources, amplifying localised overgrazing precisely when vegetation resilience is most compromised by moisture deficit—a feedforward interaction that likely explains the super-additive degradation rates observed at Karnab and Hamoun relative to sites with lower livestock densities.

Table 5.

Structural Equation Model standardised path coefficients and variance explained (R^2) for Degradation Status.

Site	β Climate	β Anthropogenic	Covariance r	R^2 Degradation	Model CFI
Karnab	0.54**	0.48**	+0.43	0.76	0.96
S. Karakum	0.58**	0.42**	+0.31	0.72	0.97
Muyunkum	0.42**	0.38**	+0.28	0.61	0.94
Hamoun	0.57**	0.52**	+0.48	0.81	0.95

β = standardised regression coefficient; ** $p < 0.01$. Variance not accounted for by the two latent predictors reflects residual unmeasured factors (edaphic, geomorphic). CFI = Comparative Fit Index.

Future Desertification Projections (2025–2060)

Under SSP2-4.5, the domain-mean temperature is projected to increase by a further +1.4 °C (range: +1.0–1.9 °C) by 2060 relative to the 2005–2024 mean, while precipitation is expected to decline by 5–14%. Under SSP5-8.5, projected warming reaches +2.1 °C (range: +1.6–2.8 °C) with precipitation declines of 9–22%. Translating these climate anomalies through the empirical regression relationships derived in Section 3.5, we project that BSI will increase by a further 18–28% (SSP2-4.5) or 27–45% (SSP5-8.5) relative to 2024 levels. The fraction of total study area currently classified as mild desertification (BSI 0.08–0.20) is projected to decrease from 31% to 14–19% as pixels migrate to the moderate class, while the severe desertification fraction is projected to increase from 15–20% to 25–36% (SSP5-8.5) or 22–30% (SSP2-4.5). These projections have substantial uncertainty at the site scale (inter-model coefficient of variation: 24–38%) but are directionally consistent across all 11 CMIP6 models included in the ensemble.

Discussion

Regional Warming Amplification

The domain-mean warming rate of +0.041 °C yr^{−1} (1985–2024) is consistent with the +0.035–0.055 °C yr^{−1} range reported for Central Asian drylands in reanalysis and observational synthesis studies [4]. The physical mechanisms underlying this amplification are multiple and mutually reinforcing. The absence of oceanic thermal buffering in continental interiors, soil moisture-temperature feedbacks (declining evapotranspiration → increased sensible heat flux → higher air temperature), and reduced snow and ice albedo on surrounding high-altitude terrain (Pamir, Hindu Kush, Tian Shan) collectively drive above-global-mean warming. The additional enhancement of surface temperatures beyond air temperature trends observed in our LST data (+1.1–1.4× air temperature trend) is consistent with the surface energy balance analysis of

Seneviratne et al. who show that vegetation loss amplifies daytime maximum land surface temperatures by reducing the Bowen ratio.

Piosphere Dynamics and Non-Linear Degradation

The spatial clustering of severe desertification within ~800 m of water points at Karnab replicates the classic "piosphere" pattern first systematically described by Weigand and subsequently documented across dryland pastoral systems from the Sahel to the Mongolian steppe. Critically, our SEM results (Section 4.4) identify a significant positive covariance ($r = 0.31\text{--}0.48$) between Climate Stress and Anthropogenic Pressure—a "drought-concentration" dynamic in which water point availability attracts increasing livestock densities precisely during dry years when vegetation recovery is most physiologically constrained. This non-linear interaction means that the total system response to simultaneous climate and anthropogenic pressures is likely super-additive, a phenomenon consistent with the observed acceleration of BSI increase rates post-2010 in both Karnab ($+0.48\%$ yr⁻¹ in 2000–2010 vs. $+0.91\%$ yr⁻¹ in 2010–2024) and Hamoun. This non-linearity has important management implications: marginal reductions in livestock density during drought years may yield disproportionately large benefits for vegetation recovery, an insight consistent with state-and-transition model predictions for similar systems.

Hamoun as an Extreme Case

The Hamoun system represents a qualitatively distinct degradation trajectory—abrupt hydrological collapse rather than gradual incremental degradation—yet the multi-index approach developed here successfully captures its dynamics. The -74% FVC and $+112\%$ BSI trends are, respectively, the largest absolute changes in the study domain and reflect the catastrophic loss of the *Phragmites australis*–*Schoenoplectus* wetland ecosystem that historically supported 30,000 ha of seasonal floodplain. This trajectory is broadly consistent with analogous terminal lake systems—Urmia (Iran), Poopó (Bolivia), and the Aral Sea itself [5]—and serves as a sobering futures analogue for dryland water bodies currently under combined climatic and hydrological stress in the region (Sarez, Sariqamish, Tudakul).

Limitations and Future Directions

Several limitations warrant acknowledgement. First, the SEM analysis treats anthropogenic pressure as a time-invariant variable per site, measured at the midpoint of the study period; future work should incorporate annual livestock census data to capture the temporal co-variation between climate and stocking density. Second, the Hamoun site straddles an international boundary, limiting access to concurrent field validation data from the Afghan portion; our accuracy assessment for this site relies exclusively on Iranian-side validation points and likely underestimates classification uncertainty in the eastern playa. Third, the empirical regression-based projection approach does not capture potential threshold or tipping-point behaviour in vegetation response; dynamic vegetation models such as JSBACH or aDGVM2 could be integrated with CMIP6 forcing to address this limitation. Finally, the 30 m Landsat resolution is insufficient to

resolve fine-scale heterogeneity within the BSI severe class, which likely comprises a mosaic of completely bare and partially crusted surfaces; Sentinel-2 (10 m) and WorldView-3 (0.3 m) data offer paths to higher-resolution characterisation in priority intervention zones.

Conclusions

This multi-site, multi-index, spatio-temporal analysis of desertification dynamics in Central Asian arid zones yields five principal conclusions with direct policy relevance:

1. Regional warming is occurring at $1.4\text{--}2.3\times$ the global mean rate ($+0.028$ to $+0.059$ °C yr⁻¹), with Hamoun showing the steepest trajectory. Simultaneous precipitation decline at three of four sites is compressing the moisture balance and accelerating the transition towards hyper-aridity across the study domain.

2. Multi-index remote sensing analysis (NDVI, SAVI, BSI, LST, FVC) reveals pervasive and statistically significant degradation across all study sites over 1985–2024, with NDVI losses of 18–34% and BSI increases of 43–112%. Single-index assessments would substantially under-characterise the magnitude and dimensionality of ongoing degradation.

3. SEM identifies both climatic (42–58%) and anthropogenic (38–52%) drivers as major, co-equal contributors to degradation status, with a significant positive covariance indicating non-linear amplification when drought and overgrazing co-occur. Policy interventions targeting only one driver in isolation will be structurally insufficient.

4. Hotspot mapping identifies pastoral water points, irrigation canal corridors, and abandoned agricultural infrastructure as primary spatial organising principles of severe desertification—actionable targets for site-specific restoration investment.

5. Future projections (SSP2-4.5 and SSP5-8.5) indicate that 61–78% of currently mild desertification zones will transition to moderate or severe status by 2060, underscoring the urgency of scaling up Land Degradation Neutrality interventions—regulated destocking, phytomelioration, and water harvesting—within this decade.

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XX ASRNING 80–90-YILLARIDA FARG‘ONA VILOYATIDA PEDAGOG KADRLAR TAYYORLASH TARIXI

***Annotatsiya.** Ushbu maqola XX asrning 80-90 yillarida Farg‘ona viloyati ta’lim tizimida kadrlar tayyorlash jarayoni hamda Farg‘ona viloyatidagi 1980 – 1990-yillar davridagi xalq ta’limining ahvoli xususan, O‘zbekiston SSRda ta’lim tizimi rivoji. O‘qituvchilar ijtimoiy holati masalasi, kadrlar masalasi muammolari, zamonaviy darslik, o‘quv qo‘llanmalarining yetishmasligi, fan laboratoriyalarining jihozlanmaganligi, asosiy e’tibor miqdoriy ko‘rsatkichlariga qaratilganligi natijasida ta’lim sifati darajasining pasayishi asoslab berilgan.*

***Kalit so'zlar:** O‘qituvchilar ijtimoiy holati, ta’lim tizimi, o‘rta ta’lim, O‘qituvchilar ijtimoiy holati, Pedagog kadrlar o‘rta maxsus ta’lim, Xalq ta’limini boshqarish tizimini, madaniy transformatsiya.*

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HISTORY OF TEACHER TRAINING IN FERGANA REGION IN THE 80- 90S OF THE 20TH CENTURY

***Annotation.** This article is about the process of training teachers in the education system of Fergana region in the 80-90s of the 20th century and the state of public education in Fergana region in the 1980s - 1990s, in particular, the development of the education system in the Uzbek SSR. The issue of the social status of teachers, the problems of personnel issues, the lack of modern textbooks, manuals, the lack of equipment of science laboratories, the main focus on quantitative indicators, which led to a decrease in the quality of education.*

***Keywords:** Social status of teachers, education system, secondary education, Social status of teachers, Pedagogical personnel, secondary specialized education, Public education management system, cultural transformation.*

KIRISH

Farg‘ona viloyat ta’lim sohasida kadrlar tayyorlash masalasi doim o‘zgaruvchan bo‘lgan. Rivojlanish jarayonlari davlat olib borgan siyosatga qarab o‘zgarib borgan. 80-yillargacha bo‘lgan davr oralig‘ini qaraydigan bo‘lsak nafaqat Farg‘ona viloyati butun respublikada pedagogik bilim yurtlari salmog‘i ancha past edi. 80 yillargacha Farg‘ona viloyatida 2 ta kadrlar yetishtirib beruvchi ilm dargohi mavjud edi. Shulardan biri Farg‘ona davlat universitetining tashkil etilishi viloyat va butun vodiyning ijtimoiy va madaniy hayotida muhim voqea bo‘ldi.

Universitet maqomidagi oliy o'quv yurtining vujudga kelishi nafaqat yuqori malakali kadrlar tayyorlash, balki mintaqada ilm-fan taraqqiyoti uchun ham yangi ufqlar ochib berdi. Farg'onada universitetning ochilishi bu erda yangi kadrlar va tadqiqotlar markazlarini tashkil etish, keng ko'lamda ilmiy tadqiqot ishlarini olib borish, fan va texnika yutuqlarini ishlab chiqarishga joriy etish hamda mintaqaning ijtimoiy-iqtisodiy taraqqiyotini jadallashtirishga munosib hissa qo'sha boshladi.

METODOLOGIYA VA ADABIYOTLAR TAHLILI

Mazkur tadqiqot metodologiyasi tarixiy-qiyosiy tahlil, tizimli yondashuv va madaniy-tarixiy metodlar asosiga qurilgan. Ilmiy ishda asosan XX asrning 80-90 yillarida farg'ona viloyati ta'lim tizimida kadrlar tayorlash jarayoni tahlil qilingan.

Tahlil etilayotgan yillarda Yuqorida bayon qilinganlardan Farg'ona viloyatida umumiy o'rta ta'lim sohasidagi islohotlar osonlik bilan muvaffaqiyatli amalga oshirildi, kamchiliklar va nuqsonlarga yo'l qo'yilmadi, degan xulosa kelib chiqmaydi. Masalan, mustaqillikning dastlabki yillarida umumta'lim maktablari o'quvchilari bilan darsdan tashqari olib boriladigan tarbiyaviy ishlar yaxshi yo'lga qo'yilmagan edi. Xususan, o'quvchilarning darsdan tashqari bo'sh vaqtlari mazmunli tashkil qilinmagani oqibatida ular o'rtasida huquqbuzarlik, jinoyatchilik ortib borgan. Masalan, mustaqillikning dastlabki yillarida o'quvchilar o'rtasida umumiy jinoyatlar sonining ortishi bo'yicha Farg'ona viloyati respublikada birinchi o'rinda turgan. 90-yillarning oxirlarida ham vodiylar viloyatlari, shahar va tumanlarida intizom yaxshi yo'lga qo'yilmagan, o'quvchilar orasida huquqbuzarlik, tartibbuzarlik hollari ko'p uchraydigan maktablar soni anchagina bo'lib, Farg'ona shahrida 16 tani, Qo'qonda 8 tani tashkil etgan. Bu, o'z navbatida, respublikada o'sha davrda yuqori ko'rsatkich hisoblangan [1].

Bundan tashqari maktablarda ta'lim mazmuni ustidan nazorat qoniqarsizligi, o'quvchilarning egallagan bilimlarini kengaytirish va mustahkamlash borasida olib borilayotgan ishlarning yetarli yo'lga qo'yilmaganligi, darsliklar yetishmasligi, ayrim maktablarda o'qituvchilarning malakasini oshirish, ularga metodik xizmat ko'rsatish ishlarining oqsayotganligi, hududiy boshqaruv organlarining mahalliy hokimliklar bilan kelishgan holda maktablarning moddiy-texnika bazasini mustahkamlash bo'yicha ta'sirchan chora-tadbirlar ko'rmaganligi natijasida maktab bitiruvchilarining bilim sifati past bo'lishiga sabab bo'ldi. Masalan, OTMlariga kirish uchun imtihon topshirgan abiturentlar 0%-30% gacha past ball to'plaganlar soni 1999 yilda 50000 nafar tashkil etgan bo'lsa, 2000 yilda 0% - 30% gacha past ball to'plagan abituriyentlar soni 73860 taga yoki 23860 taga oshgan. 1999 yilda respublika bo'yicha abituriyentlarning umumiy soniga nisbatan o'rtacha ball 102, 12 ni tashkil qilgan bo'lsa, 2000 yilda o'rtacha ball ko'rsatkichida pasayish ko'zatildi va bu 88,56 ballni tashkil qildi[2]. 2000 yil test yakunlarining viloyatlar bo'yicha tahliliga e'tibor qaratsak, Buxoro, Xorazm, Qashqadaryo viloyatlari, Toshkent shahri barcha fanlari bo'yicha yuqori o'rinni egallashgan. Surxondaryo, Qoraqalpog'iston Respublikasi, Farg'ona, Namangan, Sirdaryo viloyatlari esa barcha fanlar bo'yicha past natija ko'rsatib respublika bo'yicha oxirigi o'rinni egallashgan. [3]

Sohada amalga oshirilgan islohotlar bilan birga o'z yechimini kutayotgan bir qator muammolar ham bor bo'lib, bulardan eng asosiysi sifatida respublikadagi mavjud maktablar moddiy-texnik holatining nochorligini qayd etish lozim. Mustaqillikka erishish arafasida respublika maktab ta'limi moddiy-texnik holatiga e'tibor qaratsak, jumaladan, 1987 yilning sentabr oyi ma'lumotlariga ko'ra jami 7789 maktabdan 2501(32%) tasi toza ichimlik suvi bilan, 5303(68%) tasi kanalizatsiya bilan, 4587(60%) tasi isitish tizimi bilan[4] ta'minlanmagan edi.

Umumiy o'rta ta'lim tizimidagi yuqorida aytib o'tilgan muammolarning paydo bo'lishi, sobiq sho'ro davrida 70-yillar oxiri va 80-yillarda iqtisodiyotning biryoqlama rivojlanishi oqibatida jamiyatning barcha sohalarida yuzaga kelgan og'ir ahvol bilan bog'liq edi. [5] Bu davrda ta'lim tizimining qanchalik nochor holatda ekanligini tasavvur qilish uchun maktab va kasalxonalarining 60 foizi nobop binolarda joylashtirilganligini aytishning uzi kifoya.

NATIJALAR VA MUHOKAMA

Umuman olganda, 1973-1991-yillar davomida Qo'qon davlat pedagogika instituti moddiy-texnik, ilmiy-pedagogik va kadrlar salohiyati jihatidan rivojlanib, Farg'ona vodiysida pedagog kadrlar tayyorlashning muhim markazlaridan biriga aylangan [6].

1980-1990-yillardagi xalq ta'limining holati va kadrlar tayorlash masalalari haqida quyidagicha fikrlarni aytib o'tdi. O'qish davomida darsliklar, o'quv qo'llanmalar va o'quv adabiyotlar masalasida ancha qiyinchilikka duch kelganligini aytib o'tdi. Adabiyotlar asosan rus tilida bo'lganligini takidlab o'tdi. Bundan tashqari ish haqi masalasida ham bir qancha etirozlarini bildirib o'tdi.

O'sha davrlarda ya'ni 1980-1990-yilllarda kadrlar tayorlash jarayonida itoatkor kadrlarni tayorlashga ko'proq urg'u berilganligi, talabalarning ijodiy faoliyatiga ijotkorlikka unchalik etibor qaratilmaganligini takidladi. [7]

Maktablarda kerakli jihozlar yetarli bo'lgan- deydi suhbatdoshimiz- miltiq, aftamat, o'q dori va minalar bor edi. O'qituvchilarning bilimi yaxshi yurakdan dars bergan lekin darslarda turli xil pedagogic tehnologiyalardan va turlicha metodlardan foydalanilmagan. O'qituvchilar ijtimoiy hayoti haqida usti but qorni to'q bo'lgani kamdan kam o'qituvchilarda mashina bolgani haqida eslab o'tdi.

Mustaqillikning ilk yillaridagi iqtisodiy qiyinchiliklarga qaramasdan mamlakat ta'lim sohasida, shu jumladan, umumiy o'rta ta'lim tizimida izchil islohotlarni amalga oshirishga kirishildi va bunda dastlabki islohotlar sohada mehnat qilayotgan o'qituvchi-pedagoglarni moddiy va ma'naviy qo'llab-kuvvatlashga, yangi turdagi maktab-internatlar va litseylar ochilishiga e'tibor qaratildi.

Agar mustaqillikdan oldingi davrga e'tibor qarasak, umumiy o'rta ta'lim va u yerda mehnat qilayotgan pedagoglarning ijtimoiy holati bilan bog'liq muammolar mavjud edi. Masalan, 1985-yilda respublika maktablarida ishlayotgan o'qituvchilar soni 268,4 ming kishini tashkil qilgan holda, bu raqam 1990-yilga kelganda 243,9 ming nafarga tushib qoldi. Buning sababi, birinchidan, aholi o'rtasida asosiy ziyo tarqatuvchi o'qituvchiga nisbatan e'tiborsizlik bo'lsa,

ikkinchidan, o'qituvchilarni ijtimoiy himoyalashda yo'l qo'yilgan jiddiy xatolar bo'ldi [8].

Shularni inobatga olib Respublika Prezidentining 1990-yil 13-noyabrda PF-93-sonli "Barcha turdagi maktablarning o'qituvchilariga, bolalar uylarining tarbiyachilariga qo'shimcha imtiyozlar berish, yuqori sinf o'qituvchilarining ish haqini oshirish to'g'risida gi Farmoni qabul qilindi. Ushbu Farmonda maktab o'qituvchilari va bolalar uylarining tarbiyachilariga ular yashab turgan davlatga qarashli uylar va kvartiralarni shaxsiy mulk sifatida bepul berilishi, yakka tartibda uy qurish uchun yer ajratilishi nazarda tutilgan edi.

Farmon ijrosiga e'tibor qaratsak, xususan, 1999 yilgacha respublikada 97968 nafar xalq ta'limi xodimiga davlat uylari bepul xususiylashtirilib berildi, 21946 nafar xodimga esa tashkilot va muassasalar tasarrufidagi uylar xususiylashtirildi, 35841 nafar pedagog xodimga shaxsiy qurilish uchun yer maydonlari ajratildi, qishloqlarda istiqomat qiladigan pedagog xodimlarning hammasi kommunal xizmat uchun to'lovlardan ozod bo'lsalar, shaharliklar uning 50 foizi miqdorini to'ladilar [9].

Shuni alohida ta'kidlash lozimki, maktab o'quvchilarining bepul ovqatlanishi borasida amalga oshirilgan islohotlar respublika va vodiylar viloyatlarida to'liq amaliyotga joriy etilmay qoldi. Bunga sabab 90-yillar boshlarida respublika maktablardagi mavjud 7181 ta oshxonadan 3507 (49 %) tasi talab darajasiga mos bo'lmagan binolarda joylashgan edi, 522 ta maktabning esa umuman oshxonasi yo'q edi. Bu esa, o'z navbatida, o'quvchilarga bepul nonushta berish borasida ham muammolarni yuzaga keltirgan. Masalan, Farg'ona viloyatida maktab oshxonalaridagi ahvol talabga javob bermas edi [10].

Sohada amalga oshirilgan islohotlardan yana biri bu yangi turdagi maktablarning tashkil etilishi bo'ldi. O'zbekiston hukumatining 1990 yil 15 yanvardagi 32-sonli Qarori va O'zbekiston Respublikasi Xalq ta'limi vazirligining 1990-yil 26-yanvardagi 45-sonli "Respublikada iqtidorli bolalar uchun maxsus maktab-internatlar tashkil etish to'g'risida"gi buyrug'ini amalga oshirish maqsadida 1991-1992 o'quv yilidan boshlab internat tipida bo'lmagan yangi turdagi iqtidorli bolalar maktablari (litsey va gimnaziyalar) tashkil etila boshlandi.

XULOSA

Xulosa qilib shuni aytish mumkinki, maktablarga malakali kadrlar yetishtirib beruvchi dargohlar XX asr 80-yillar davomida mafkuraviy g'oyalar ta'sirida yoshlarga ilm berib ularni SSSR manfaatiga mos kadr qilib yetishtirishga harakat qilgan. Qayta qurish siyosati ham mana shunday g'oyani qo'llab quvvatlashi lozim edi. Lekin moddiy texnik baza juda yomon ahvolga tushib qolgan maktablarda yana boshqa muammolar mavjudligi ya'ni o'qituvchilarning boshqa ishlarga paxta terish yoki qishloq xo'jalik ishlarigajalb etilishi maktab ta'lim sifatiga katta ta'sir qiladi. Shu boisdan ta'lim jarayoni juda oqsab qoladi hattoki o'quvchilar rejadagai fanarni to'liq yakunlay olmay qoladi. Bu jarayon faqatgina mustaqillik qo'lga kiritilgandan so'ng o'z nihoyasiga yetadi.

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O'ZBEKISTON TURIZM SALOHIYATINI OSHIRISHDA DAVLAT SIYOSATI VA RESURLAR INTEGRATSIYASI

***Annotasiya:** Ushbu maqolada O'zbekistonda turizmni rivojlantirish jarayonlari, ularning iqtisodiy, tashkiliy va infratuzilmaviy xususiyatlari hamda istiqbolli yo'nalishlari yoritib berish hamda hisoblanadi. O'zbekistonda turizmni rivojlantirishning hozirgi holatini tahlil qilish, mavjud muammolarni aniqlash hamda uning istiqbollari ilmiy asosda ishlab chiqish va takomillashtirish bo'yicha amaliy tavsiyalar berishga qaratilgan,*

***Kalit so'z va iboralar:** Karvonsaroy, xalqaro turizm, raqamli gid, "Visit Uzbekistan", "O'zbekturizm", ichki va tashqi turizm, xalqaro imijini, Ekoturizm, smart-turizm, ziyorat markazlari,*

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STATE POLICY AND RESOURCE INTEGRATION IN ENHANCING THE TOURISM CAPACITY OF UZBEKISTAN

***Annotation:** This article discusses the processes of tourism development in Uzbekistan, their economic, organizational and infrastructural features and promising directions. The article is aimed at analyzing the current state of tourism development in Uzbekistan, identifying existing problems and providing practical recommendations for developing and improving its prospects on a scientific basis,*

***Keywords and phrases:** Caravansera, international tourism, digital guide, "Visit Uzbekistan", "Uzbektourism", domestic and foreign tourism, international image, Ecotourism, smart tourism, pilgrimage centers,*

KIRISH

Tarixdan ma'lumki, O'zbekiston Respublikasi turizm sohasida boy tarixiy-madaniy merosga, noyob tabiiy resurslarga va strategik geografik joylashuvga ega bo'lgan mamlakat sifatida katta salohiyatga ega. Miloddan avvalgi II asrdan boshlab Buyuk Ipak yo'lining faol ishlashi natijasida Samarqand, Buxoro, Xiva, Termiz kabi qadimiy shaharlar xalqaro karvon yo'llarining asosiy bekatlariga aylangan. Bu shaharlar orqali nafaqat savdo karvonlari, balki sayyohlar, elchilar, olimlar va ziyoratchilar ham harakatlangan. Aynan shu davrlarda hududda mehmondo'stlik an'anasi, karvonsaroylar tizimi va yo'l infratuzilmasi shakllangan bo'lib, ular bugungi zamonaviy turizm tizimining ilk ko'rinishlari sifatida baholanadi. Islom uyg'onish davrida, ayniqsa IX–XII asrlarda Movarounnahr

hududi ilm-fan markaziga aylangan. Bu davrda Imom al-Buxoriy, Abu Rayhon Beruniy, Ibn Sino kabi allomalar faoliyati nafaqat mintaqaviy, balki xalqaro miqyosdagi ilmiy aloqalarning kengayishiga sabab bo'lgan. Natijada ilm izlab keluvchi sayohatchilar oqimi ortgan va bu jarayon ham tarixiy turizmning shakllanishiga xizmat qilgan. Temuriylar davrida, ayniqsa Amir Temur va uning avlodlari hukmronligi yillarida Samarqand jahonning eng go'zal va obod shaharlaridan biriga aylangan. Bu davrda nafaqat siyosiy va iqtisodiy aloqalar, balki diplomatik sayohatlar ham keng rivojlangan. Yevropa va Osiyo mamlakatlaridan elchilar, sayyohlar va tarixchilar kelib, bu hududning madaniy hayotini o'rganishgan. O'zbekistonning turistik salohiyati asosan tarixiy shaharlar — Samarqand, Buxoro, Xiva va Shahrisabz kabi qadimiy markazlar bilan bog'liq [1].

Turizm sohasida olib borilayotgan islohotlar natijasida viza tartibining soddalashtirilishi, elektron viza tizimining joriy etilishi va ayrim davlatlar uchun vizasiz rejimning yo'lga qo'yilishi xorijiy turistlar oqimining oshishiga xizmat qilmoqda. Shuningdek, xalqaro aviayo'nalishlarning kengayishi va transport infratuzilmasining yaxshilanishi ham turizm rivojiga ijobiy ta'sir ko'rsatmoqda. Biroq, mavjud yutuqlar bilan bir qatorda turizm sohasida ayrim muammolar ham saqlanib qolmoqda. Jumladan, xizmat ko'rsatish sifati barcha hududlarda bir xil darajada emas, malakali kadrlar yetishmovchiligi seziladi, ayrim hududlarda infratuzilma hali yetarli darajada rivojlanmagan. Bundan tashqari, marketing va xalqaro reklama faoliyatini yanada kuchaytirish zarurati mavjud. Shu bilan birga, raqamli texnologiyalarning joriy etilishi turizm sohasida yangi imkoniyatlarni ochib bermoqda. Onlayn bron qilish tizimlari, turistik platformalar va mobil ilovalar turistlar uchun qulaylik yaratib, xizmatlar tezkorligini oshirmoqda. Bu esa O'zbekiston turizm mahsulotining global bozordagi raqobatbardoshligini kuchaytiradi [2].

METODOLOGIYA VA ADABIYOTLAR TAHLILI

Mustaqillik yillarida O'zbekistonda turizm sohasining rivojlanishi mamlakat iqtisodiyoti va xalqaro aloqalar tizimida muhim o'rin egallagan bosqichma-bosqich jarayon sifatida shakllandi. 1991-yilda mustaqillikka erishilgach, turizm sohasi ham yangi iqtisodiy va siyosiy sharoitga mos ravishda qayta tashkil etildi hamda bozor munosabatlari asosida rivojlantirish yo'liga o'tdi. Ushbu davrda turizmning rivojlanishi shartli ravishda bir necha asosiy bosqichlarga bo'linadi. Birinchi bosqich (1991–2000-yillar) turizm tizimini shakllantirish davri bo'lib, bu davrda sobiq ittifoqdan qolgan markazlashgan boshqaruv tizimi o'rniga milliy turizm siyosatini yaratish zarurati paydo bo'ldi. 1992-yilda "O'zbekturizm" Milliy kompaniyasining tashkil etilishi turizmni davlat darajasida boshqarishning dastlabki institutsional asosini yaratdi. Shu bilan birga, turizm infratuzilmasi, mehmonxonalar, transport va xizmat ko'rsatish tizimi qayta shakllantirila boshlandi. Biroq bu bosqichda xalqaro standartlarga mos xizmat ko'rsatish tizimi hali to'liq rivojlanmagan, moddiy-texnik baza esa cheklangan edi. Ikkinchi bosqich (2000–2016-yillar) turizm sohasining barqarorlashuvi va bosqichma-bosqich rivojlanish davri hisoblanadi. Bu davrda mamlakatda iqtisodiy islohotlar

chuqurlashdi, xususiyl sektorning turizmga kirib kelishi kengaydi. Mehmonxonalar, sayyohlik firmalari va transport xizmatlari soni ortdi. Samarqand, Buxoro, Xiva kabi tarixiy shaharlarning infratuzilmasi yaxshilandi, madaniy meros obyektlarini saqlash va restavratsiya qilish ishlari kuchaydi [3]. Shu bilan birga, xalqaro turizm aloqalari kengayib, O'zbekiston ko'plab davlatlar bilan turizm sohasida hamkorlikni yo'lga qo'ydi. Bu davrda turizm asosan madaniy-tarixiy yo'nalishda rivojlandi. Uchinchi bosqich (2017-yildan hozirgacha) turizm sohasida chuqur islohotlar va ochiqlik siyosati davri sifatida tavsiflanadi. Ushbu davrda turizm davlat siyosatining ustuvor yo'nalishlaridan biriga aylandi. Vizaviy rejimning soddalashtirilishi, elektron vizaning joriy etilishi va "open sky" siyosati natijasida xorijiy sayyohlar oqimi sezilarli darajada oshdi. Shuningdek, "Visit Uzbekistan" brendining rivojlanishi, turizm klasterlari tashkil etilishi va raqamli turizm xizmatlarining joriy etilishi sohaning yangi bosqichga chiqishiga sabab bo'ldi. Ichki turizmni rivojlantirishga ham katta e'tibor qaratilib, aholining madaniy va rekreatsion sayohat madaniyati shakllana boshladi. Bugungi kunga kelib, O'zbekistonda turizm nafaqat iqtisodiy soha, balki mamlakatning xalqaro imijini mustahkamlovchi muhim strategik yo'nalishga aylangan. Mustaqillik yillarida amalga oshirilgan islohotlar natijasida turizm sohasi bosqichma-bosqich shakllanib, zamonaviy bozor tamoyillari asosida rivojlanayotgan dinamik tarmoqqa aylandi [4].

NATIJALAR VA MUHOKAMA

O'zbekistonning tarixiy shaharlariga — Samarqand, Buxoro va Xivaga xorijiy sayyohlar oqimi asta-sekin tiklana boshladi. Bu esa mamlakatning xalqaro turizm bozoriga chiqishi uchun dastlabki imkoniyatlarni yaratdi. Shu bilan birga, madaniy meros obyektlarini saqlash va ularni restavratsiya qilishga e'tibor kuchaydi, bu esa kelajakdagi madaniy-tarixiy turizm rivoji uchun asos bo'lib xizmat qildi. Shu bilan birga, bu bosqichda turizm sohasida bir qator muammolar ham mavjud edi. Xususan, transport va mehmonxona xizmatlarining yetarli darajada rivojlanmaganligi, xalqaro standartlarga mos servis tizimining shakllanmaganligi hamda malakali kadrlar yetishmasligi sohaning tez rivojlanishiga to'sqinlik qilgan omillar sifatida namoyon bo'ldi. Umuman olganda, 1991–2000 yillar O'zbekistonda turizm sohasining institutsional asoslari yaratilgan, uning huquqiy va tashkiliy poydevori qo'yilgan hamda xalqaro turizm tizimiga integratsiya jarayonlari boshlangan muhim shakllanish davri hisoblanadi [5]. Bu bosqich keyingi rivojlanish bosqichlari uchun mustahkam asos yaratib berdi. Ikkinchi bosqich (2000–2016 yillar) O'zbekistonda turizm sohasining barqarorlashuv va bosqichma-bosqich rivojlanish davri hisoblanadi. Ushbu davrda turizm tizimi shakllanish bosqichidan o'tib, yanada barqaror institutsional va iqtisodiy asosga ega bo'la boshladi. Mamlakatda amalga oshirilgan iqtisodiy islohotlar, xizmat ko'rsatish sohasining kengayishi hamda xalqaro aloqalarning kuchayishi turizmning rivojlanishiga ijobiy ta'sir ko'rsatdi. Bu bosqichda turizm sohasida davlat siyosati yanada takomillashdi va turizmni iqtisodiyotning muhim tarmoqlaridan biri sifatida rivojlantirishga alohida e'tibor qaratildi. "O'zbekturizm" Milliy kompaniyasi faoliyati doirasida turizm infratuzilmasini

yaxshilash, mehmonxonalar tarmog'ini kengaytirish, sayyohlik xizmatlari sifatini oshirish bo'yicha ishlar olib borildi. Mazkur bosqichda turizm asosan madaniy-tarixiy yo'nalishda rivojlandi. Shu bilan birga, ziyorat turizmi ham asta-sekin shakllanib, Imom Buxoriy, Bahouddin Naqshband kabi muqaddas qadamjolariga sayyohlar oqimi ortdi. Ichki turizm ham rivojlanib, aholining dam olish va sayohat qilish madaniyati kengaya boshladi. Biroq ushbu davrda ham ayrim muammolar mavjud edi. Xizmat ko'rsatish sifati xalqaro standartlarga to'liq mos kelmasligi, marketing va reklama tizimining yetarli darajada rivojlanmaganligi hamda turizm sohasida raqamli texnologiyalarning cheklangan qo'llanilishi shular jumlasidandir [6]. Umuman olganda, 2000–2016 yillar O'zbekistonda turizm sohasining barqarorlashuvi, infratuzilmaning kengayishi va xalqaro integratsiyaning kuchayishi bilan tavsiflanadi. Bu bosqich keyingi, ya'ni ochiqlik va islohotlar davri uchun mustahkam asos yaratib berdi. Uchinchi bosqich (2017-yildan hozirgacha) O'zbekistonda turizm sohasining eng muhim va tub burilish davri bo'lib, u islohotlar, ochiqlik siyosati hamda modernizatsiya jarayonlari bilan tavsiflanadi. Ushbu davrda turizm davlat siyosatining ustuvor yo'nalishlaridan biriga aylantirildi va uni iqtisodiyotning strategik tarmog'i sifatida rivojlantirishga alohida e'tibor qaratildi. 2017-yildan boshlab mamlakatda turizm sohasini liberallashtirish va xalqaro integratsiyaning kuchaytirishiga qaratilgan keng ko'lamli islohotlar amalga oshirildi. Eng muhim o'zgarishlardan biri viza tizimining soddalashtirilishi bo'lib, ko'plab davlatlar uchun vizasiz rejim joriy etildi, elektron viza (e-visa) tizimi yo'lga qo'yildi. Bu esa O'zbekistonga kiruvchi xorijiy sayyohlar oqimining sezilarli darajada oshishiga olib keldi. Shuningdek, "open sky" siyosati doirasida aviatsiya bozorini erkinlashtirish, yangi aviaqatnovlarni yo'lga qo'yish va xalqaro aviakompaniyalarni jalb etish bo'yicha ishlar amalga oshirildi. Natijada O'zbekistonning transport logistika imkoniyatlari kengaydi va turizm uchun qulay muhit shakllandi. Bu davrda "Visit Uzbekistan" milliy brendi yaratilishi mamlakatni xalqaro turizm bozorida targ'ib qilishda muhim ahamiyat kasb etdi. Ichki turizmni rivojlantirishga ham katta e'tibor qaratildi. Aholining sayohat qilish madaniyati oshdi, yangi dam olish maskanlari va turistik yo'nalishlar ochildi. Ayniqsa, pandemiyadan keyingi davrda ichki turizmni qo'llab-quvvatlash davlat siyosatining muhim yo'nalishiga aylandi. Shuningdek, ziyorat turizmi ham jadal rivojlanib, Imom Buxoriy, Imom Termiziy, Bahouddin Naqshband kabi qadamjolar xalqaro ziyorat markazlariga aylana boshladi. Ekoturizm va tog' turizmi yo'nalishlari ham yangi bosqichga chiqdi. Umuman olganda, 2017-yildan hozirgi kungacha bo'lgan davr O'zbekistonda turizm sohasining ochiqlik, modernizatsiya va xalqaro integratsiya asosida jadal rivojlanish bosqichi bo'lib, mamlakatni jahon turizm xaritasida yanada mustahkam o'rin egallashiga xizmat qilmoqda [7].

Bugungi kunda O'zbekistonda turizm infratuzilmasi sifat va miqdor jihatidan sezilarli darajada kengayib, zamonaviy iqtisodiy talablarga moslashib bormoqda. So'nggi yillarda mamlakatda mehmonxona xo'jaligi, transport tizimi, ovqatlanish xizmatlari hamda sayyohlik logistikasini qamrab olgan kompleks infratuzilma shakllandi. Ayniqsa, yirik shaharlar va tarixiy markazlarda xalqaro

standartlarga javob beradigan mehmonxonalar, butik-otel va oilaviy mehmon uylarining ko'payishi turizm xizmatlarining diversifikatsiyasini ta'minlamoqda. Transport sohasida ham sezilarli o'zgarishlar kuzatilmoqda. Aviatsiya aloqalarining kengayishi, yangi ichki va xalqaro reyslarning yo'lga qo'yilishi hamda temir yo'l tizimining modernizatsiya qilinishi sayyohlar harakatini ancha yengillashtirdi. Shu bilan birga, avtomobil yo'llarining yangilanishi va turistik marshrutlarning optimallashtirilishi hududlararo sayohat qilish imkoniyatlarini kengaytirdi [8]. Yirik shaharlar bilan bir qatorda chekka hududlarda xizmat ko'rsatish sifati va infratuzilma imkoniyatlarini yanada kengaytirish zarur. Bu esa mintaqaviy turizm salohiyatini to'liq ro'yobga chiqarishda muhim omil bo'lib xizmat qiladi.

O'zbekistonda ichki va tashqi turizm so'nggi yillarda parallel ravishda rivojlanib, bir-birini to'ldiruvchi muhim yo'nalishlarga aylandi. Ichki turizm aholining dam olish, sog'lomlashtirish va madaniy-ma'rifiy ehtiyojlarini qondirishga xizmat qilsa, tashqi turizm mamlakatning xalqaro turizm bozoridagi o'rnini mustahkamlashga qaratilgan. Ichki turizm sohasida sezilarli o'sish kuzatilmoqda. Aholining daromad darajasi va turmush tarzining o'zgarishi natijasida sayohat qilishga bo'lgan qiziqish ortdi. Mamlakat ichidagi tarixiy shaharlar, tog'li hududlar, ekologik toza dam olish maskanlari va ziyoratgohlar ichki sayyohlar uchun asosiy yo'nalishlarga aylangan. Ayniqsa, Samarqand, Buxoro, Xiva, Shahrisabz kabi qadimiy shaharlar bilan bir qatorda Chortoq, Chimyon, Amirsoy, Aydarko'l kabi rekreatsion hududlar ham ichki turizm oqimini kuchaytirmoqd [9].

O'zbekistonda ichki va tashqi turizmning kelajakdagi rivojlanish istiqbollari keng va ko'p yo'nalishli hisoblanadi. Avvalo, raqamli transformatsiya jarayonlarini chuqurlashtirish turizm sohasining asosiy yo'nalishlaridan biri bo'lib qoladi. Elektron platformalar, sun'iy intellekt asosidagi xizmatlar va smart-turizm tizimlarining joriy etilishi sayyohlar uchun qulay va tezkor xizmatlarni ta'minlaydi. Shuningdek, hududiy turizmni rivojlantirish muhim istiqbol yo'nalishi hisoblanadi. Ayniqsa, O'zbekistonni Buyuk Ipak yo'li markazi sifatida targ'ib qilish strategiyasi mamlakatning turistik jozibadorligini yanada oshiradi. Umuman olganda, ichki va tashqi turizmning uyg'un rivojlanishi O'zbekistonning iqtisodiy o'sishi, mintaqaviy rivojlanishi va xalqaro imijining mustahkamlanishida muhim omil bo'lib xizmat qiladi. Kelgusida turizm sohasi mamlakat iqtisodiyotining eng tez o'suvchi va raqobatbardosh tarmoqlaridan biriga aylanishi kutilmoqda [7].

XULOSA

Demak, xulosa qilib aytadigan bo'lsak, Davlatimiz tomonidan olib borilayotgan turizm siyosati, qonunchilik bazasi, vizaviy rejimning soddalashtirilishi, xalqaro hamkorlikning kengaytirilishi va xavfsizlik darajasi turizm oqimining oshishiga xizmat qiladi. Ochiq va barqaror siyosiy muhit xorijiy sayyohlar uchun mamlakat jozibadorligini oshiradi. Madaniy omillar ham turizm rivojida muhim ahamiyatga ega bo'lib, tarixiy meros, milliy an'analar, urf-odatlar, me'moriy yodgorliklar va diniy qadamjolar orqali namoyon bo'ladi. Har bir

xalqning madaniy boyligi turistik mahsulot sifatida katta qiymatga ega bo'lib, u sayyohlarni jalb qilishda asosiy rol o'ynaydi. Umuman olganda, O'zbekistonda turizm infratuzilmasi va xizmatlar sifati izchil rivojlanish yo'lida bormoqda. Kelgusida raqobatbardosh turizm bozori shakllanishi uchun sifat standartlarini oshirish, innovatsion texnologiyalarni keng joriy etish hamda xalqaro tajribani faol tatbiq etish muhim ahamiyatga ega bo'ladi.

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QASHQADARYO VILOYATINING MA'MURIY-HUDUDIIY BO'LINISHINING GEOGRAFIK XUSUSIYATLARI

***Annotatsiya:** Maqolada Qashqadaryo viloyatining ma'muriy-hududiy bo'linishining geografik xususiyatlari tahlil qilingan. Viloyatning tuman va shaharlari shakllanish tarixi, aholi joylashuvi, hududiy tarkibi hamda ma'muriy birliklar o'rtasidagi tafovutlar o'rganilgan. Shuningdek, aholi punktlarining maydon va aholi ko'rsatkichlari asosida hududiy tashkil etilish samaradorligi baholangan. Tadqiqot natijalari viloyat ma'muriy-hududiy tizimini takomillashtirish va hududlarni muvozanatli rivojlantirish bo'yicha ilmiy xulosalar chiqarish imkonini beradi.*

***Kalit so'zlar:** Qashqadaryo viloyati, ma'muriy-hududiy bo'linish, tuman, shahar, shaharcha, qishloq aholi punktlari, aholi joylashuvi, hududiy tashkil etish.*

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GEOGRAPHICAL FEATURES OF THE ADMINISTRATIVE- TERRITORIAL DIVISION OF KASHKADARYA REGION

***Abstract:** This article analyzes the geographical features of the administrative-territorial division of Kashkadarya Region. The historical development of districts and cities, territorial structure, population distribution, and differences among administrative units are examined. Based on area and population indicators, the efficiency of territorial organization of settlements is assessed. The findings provide a scientific basis for improving the administrative-territorial system and ensuring balanced regional development within the region.*

***Keywords:** Kashkadarya Region, administrative-territorial division, district, city, urban settlement, rural settlement, population distribution, territorial organization.*

Kirish

Hududlarning ijtimoiy-iqtisodiy rivojlanishida ma'muriy-hududiy bo'linish muhim ahamiyatga ega bo'lib, u davlat boshqaruvining hududiy asosini tashkil etadi. Ma'muriy birliklarning hududiy joylashuvi, aholi soni, aholi punktlari

tarkibi va tabiiy-geografik sharoitlari hududlarning iqtisodiy rivojlanishi hamda aholiga xizmat ko'rsatish darajasiga bevosita ta'sir ko'rsatadi.

Qashqadaryo viloyati O'zbekistonning yirik hududlaridan biri bo'lib, tabiiy resurslarga boyligi, aholisining ko'pligi va iqtisodiy salohiyati bilan ajralib turadi. Viloyatda keyingi yillarda aholi sonining o'sishi, yangi aholi punktlarining shakllanishi va ayrim hududlarning qayta tashkil etilishi ma'muriy-hududiy tizimni geografik jihatdan o'rganish zaruratini kuchaytirmoqda. Xususan, Ko'kdala tumanining tashkil etilishi hududiy boshqaruv samaradorligini oshirishga qaratilgan muhim islohotlardan biri hisoblanadi.

Ushbu tadqiqotning maqsadi Qashqadaryo viloyatining ma'muriy-hududiy bo'linishi, tuman va shaharlarining shakllanish tarixi, aholi punktlarining hududiy joylashuvi hamda ularning geografik xususiyatlarini tahlil qilishdan iborat.

Asosiy qism

Qashqadaryo viloyati – O'zbekiston Respublikasi tarkibidagi eng birinchi tashkil etilgan viloyatlardan biri bo'lib, u 1924-yil 1-noyabrda tashkil etilgan. Viloyat Respublikaning janubi-g'arbida Qashqadaryo havzasida, Pomir-Oloy tog' tizmasining g'arbiy chekkasida, Amudaryo va Zarafshon daryolari, Hisor va Zarafshon tizma tog'lari orasida joylashgan. Shimoli-g'arbdan Buxoro va janubi-sharqdan Surxondaryo viloyatlari, janubi-g'arb va g'arbdan Turkmaniston Respublikasi, sharqdan Tojikiston Respublikasi hamda shimoli-sharqdan Samarqand viloyati bilan chegaradosh. 2026- yilning 1-yanvar holatiga viloyat maydoni - 28,57 ming km²ni, doimiy aholisi soni 3 717,0 ming kishini tashkil etib, 2025- yilning mos davriga nisbatan 2,1 foizga ko'paygan (respublika viloyatlari orasida 3-o'rinda). Viloyat ma'ruriy hududiy bo'linishiga ko'ra 14 ta qishloq tumani – Dehqonobod, Kasbi, Kitob, Koson, Ko'kdala, Mirishkor, Muborak, Nishon, Qamashi, Qarshi, Yakkabog', G'uzor, Shahrisabz, Chiroqchi, 12 ta shahar (Beshkent, Kitob, Koson, Muborak, Tallimarjon, Chiroqchi, Shahrisabz, Yakkabog', Yangi-Nishon, Qamashi, Qarshi, G'uzor), 118 ta shaharcha va 1032 ta qishloq aholi manzilgohlari mavjud.

Qashqadaryo viloyati tumanlarning vujudga kelish tarixi, sabablari, maydoni va har bir hududga tarqalgan aholi punktlarining son va maydon jihatidan qanchalik mos yoki mos emasligi haqida o'rganib shu holat yuzasidan taklif va mulohazalar berish maqsadga muvofiq. Quyida Qashqadaryo viloyatiga bo'ysunuvchi shaharlar va qishloq tumanlarining tarixi, aholisi va ma'muriy xududiy bo'linishi bo'yicha tadqiqot natijalari keltirilgan.

Qarshi (Naxshab, Navtaka, Nasaf, Behbudiy – 1926 – 1937-yillarda) O'zbekiston Respublikasining Qashqadaryo viloyatidagi shahar (1926-yildan), viloyat markazi (1943-yildan). Qashqadaryo vohasining markazida, Qashqadaryo bo'yida, xalqaro temir yo'l va avtomobil yo'llari kesishgan joyda joylashgan. Maydoni 8 ming 308,9 gektar (2025-yil). Aholisi 305 ming kishi (2026-yil 1-yanvar holatiga ko'ra). Qarshi O'zbekistonning qadimiy shaharlaridan biri. U turli davrlarda Bolo, Nashebolo, Naxshab, Nasaf, nomlari bilan yuritilib, XIV asrdan boshlab Qarshi deb atala boshlagan. Qarshi shahrining o'zbek tarixida o'ziga xos o'rnini bor. Birinchidan, Qarshi Movarounnahrda birinchi yirik turkiy tilli shahar.

U payti Xorazmda (Urganch), Fargʻonada (Andijon), Shosh vohasida (Toshkent), Sirdaryo boʻylarida bir qancha yirik shaharlarda turkiy til hukmron edi, lekin Movarounnahrda bunday shahar yoʻq edi. Qarshining qurilishi bilan bu yerda turli-tuman aholi joylashdi, ammo turkiy shaharda hukmron tilga aylandi. U payti moʻgʻullarning oʻzi ham allaqachon turkiy tilda gapirardi. Xususan, Kebakxonning ona tili turkiy til boʻlganini arab sayyohi Ibn Battuta qayd etgan. Chigʻatoy ulusi, undan keyin Temuriylar davrida turkiy til rasmiy yozishmalar tili boʻlib xizmat qildi. Hozir Qarshi shahrida paxta tozalash, yogʻ-ekstraksiya, sut, motor taʼmirlash, taʼmirlashmexanika, uysozlik, plastmassa buyumlari zavodlari, goʻsht va un kombinatlari, tikuvchilik fabrikasi, qurilish materiallari, temir yoʻl transporti, toʻqimachilik korxonalari bor. Shaharda 6 ta bozor, 17 ta bank filiali aholiga xizmat koʻrsatmoqda. Qarshi davlat universiteti, Qarshi davlat texnika universiteti, 6 ta xususiy universitetlar, tibbiyot, pedagogika va boshqa jami 13 kasb-hunar kolleji, 3 akademik litsey, 9 litsey va litsey-internat, 2 gimnaziya, 46 umumiy taʼlim, shuningdek, bolalar musiqa maktablari, 4 teatr (shu jumladan, viloyat musiqali drama teatri, viloyat qoʻgʻirchoq teatri va boshqalar), viloyat oʻlkashunoslik muzeyi, filarmoniya, 13 kutubxona, 3 madaniyat va istirohat bogʻi faoliyat koʻrsatadi. 22 shifoxona, ambulatoriya-poliklinika va boshqalar tibbiy muassasalar bor. Qarshidan Toshkent, Samarqand, Buxoro, Andijon, Termiz kabi shaharlarga avtobus, poyezd qatnovlari, Qarshi aeroportidan Qarshi – Toshkent, Qarshi – Moskva, Qarshi – Sankt Peterburg yoʻnalishlarida samolyotlar qatnovi yoʻlga qoʻyilgan. Qarshida Koʻk Gumbaz masjidi (XVI asr), qadimiy hammom (XVI asr), Qashqadaryo ustidagi qadimiy koʻprik (XVI asr), Sharafboy madrasasi (XVIII asr boshlarida), Charmgar masjidi (XIX asr oʻrtalari), Bekmir madrasasi (1905), Abdulazizxoʻja madrasasi (XIX asr), Qilichbek madrasasi (XIX asr) va boshqa meʼmoriy obidalar saqlanib qolgan.

Shahrisabz – Oʻzbekiston Respublikasining Qashqadaryo viloyatidagi shahar, u 2017 – yildan toʻgʻridan toʻgʻri viloyatga boʻysunadi. Amir Temur ordeni sohibi. 1926 – 2017 – yillarda Shahrisabz tumani maʼmuriy markazi vazifasini bajargan. Shahar Kitob – Shahrisabz vohasida, katta Oʻzbekiston trakti yoqasida joylashgan. Shahrisabzning janubidan Tanxozdaryo, shimolidan Oqsuv daryosi oqib oʻtadi. Dengiz sathidan oʻrtacha balandligi 658 m. Aholisi 150,1 ming kishini tashkil etadi (2025). Shahrisabz Oʻzbekistondagi qadimiy shaharlardan biri boʻlib, arxeologik maʼlumotlarga koʻra, shaharga miloddan avvalgi ming yillikning oʻrtalarida asos solingan. Shahrisabz milodning boshlarida va ilk oʻrta asrlarda turli nomlar bilan (masalan Kesh) atalgan. XIII asrdan Shahrisabz nomi ham urf boʻlgan.

Qashqadaryo viloyati ma'muriy hududiy bo'linishi (01.01.2026)

	Tuman	Maydon (ming km)	Shahar va shaharcha	Qishloqlar	O'rtacha zichlik shaharda	O'rtacha zichlik qishloqda
1	Dehqonobod	4,0	3	106	666	37,7
2	Kasbi	0,65	9	49	72	13,2
3	Kitob	1,75	14	144	125	12,1
4	Koson	1,88	15	66	125	28,4
5	Qamashi	2,66	6	115	433	23,1
6	Qarshi	0,9	16	73	56	12
7	Mirishkor	3,1	3	22	1033	140
8	Muborak	3,7	6	15	616	246,6
9	Nishon	2,1	11	30	190,9	70
10	G'uzor	2,62	6	80	436,6	32,75
11	Chiroqchi	2,8	6	95	466	29
12	Shaxrisabz	1,70	13	101	130	16,8
13	Yakkabog'	1,3	15	114	86,6	11,4
14	Ko'kdala	1,71	3	32	570	53

1. Dehqonobod tumani – 1926-yil 29-sentabrda tashkil etilgan (1962-yil 24-dekabrda G'uzor tumani bilan birlashtirilgan. 1971-yil 31-avgustda qayta tuzilgan). Dehqonobod tumani viloyatning janubi-sharqida joylashgan. Shimoli-g'arbda G'uzor tumani, shimoli-sharqda Qamashi tumani, janubi-sharqda Surxondaryo viloyatining Boysun va Sariosiyo tumanlari, g'arbda Turkmanistonning Lebap viloyati bilan chegaradosh. Maydoni 4,0 ming km². Aholisi 162,7 ming kishi (2025). Dehqonobod tumanida 3 ta shaharcha (Qorashina, Dehqonobod, Beshbuloq) shaharlar o'rtacha zichligi eng yuqori hudud (1-jadval), 14 ta qishloq fuqarolari yig'ini (Beshqo'ton, Bibiqorasoch, Bozortepa, Boshchorboq, Duob, Obiravon, Oqirtma, Oqmachit Oqrabot, Oqtosh, Qizilcha, Qirqquloq, Qorashina, Qo'rg'ontosh) bor. Qorashina tumanning markazi bo'lib, shimoliy-sharqiy qismiga yaqinroq, tog' oldi hududida joylashgan. Tuman tog'-kon sanoati, chorvachilik, gips va mineral resurslar bilan yaxshi ta'minlangan.

2. Kasbi tumani – O'zbekiston Respublikasining Qashqadaryo viloyatidagi tuman. 1970-yil 16-oktabrda tashkil etilgan. Maydon 0,65 ming km². Aholisi 204,0 ming kishi. (2-jadvalga) Kasbi tumanida 12 qishloq fuqarolari yig'ini (Denov, Komilon, Maymanoq, Masit, Mug'lon, Qamashi, Qatag'on, Talishbe, Shakarjo'y, Toshqo'rg'on, Yangihayot, Yuksalish, Xo'jaqarliq, Cho'lquvar) bor. Markazi – Mug'lon shaharchasi. Tuman markazi Mug'lon aholi punkti tumanning sharqiy tomoniga yaqinroq hududda joylashgan. Tuman paxtachilik, g'allachilik, sabzavotchilikka ixtisoslashgan.

3. Kitob tumani – O'zbekiston Respublikasining Qashqadaryo viloyatidagi tuman bo'lib viloyatning shimoli-sharqida joylashgan. 1926-yil sentabrda tashkil etilgan. 1962-yil 24-dekabrda Shahrizabz tumani bilan birlashtirilgan. 1968-yil 25-dekabrda qayta tuzildi va hozir viloyatning Chiroqchi, Shahrizabz tumanlari,

Samarqand viloyati va Tojikiston Respublikasi bilan chegaradosh. Maydoni – 1,75 ming km². Aholisi – 287,7 ming kishi (2025-yil holatiga ko‘ra). Kitob tumanida 1 shahar (Kitob), 13 ta shaharcha – Alaquo‘yliq, Bektemir, Beshtarak, Rus qishloq, Baxtdarvozasi, Obikanda, Panji, Sariosiyo, Sevaz, Xoji, Varganza, Yakkatut, Yangiobod), 60 dan ortiq (rasmiy ma‘lumotlarda) mahalla va 26 ta mahalla punktlari bor (2025-yil holatiga ko‘ra). Kitob Qashqadaryo tumanlari ichida eng ko‘p qishloq aholi punktiga ega tuman hisoblanadi. Markazi – Kitob shahri. Tuman hududidan Katta O‘zbekiston trakti o‘tgan. Taxtaqoracha dovoni (balandligi 1788 m) esa respublika janubini shimoliy viloyatlar bilan bog‘laydi. Tuman markazi Kitob shahri tog‘ etaklarida, tuman sharqiga yaqin joylashgan. Kitob tumani bog‘dorchilik, uzumchilik, turizm va dehqonchilikka ixtisoslashgan.

4.Koson tumani – O‘zbekiston Respublikasining Qashqadaryo viloyatida joylashgan tuman. Koson Respublikadagi dastlab vujudga kelgan tumanlardan biri bo‘lib, u 1926-yil 29-sentabrda tashkil etilgan. Samarqand viloyatining Nurobod tumani, Qashqadaryo viloyatining Ko‘kdala, Muborak, Qarshi, Kasbi tumanlari va Qarshi shahri bilan chegaradosh. Maydoni 1,88 ming km². Aholisi (tahminan) 319 ming kishi atrofida (2025-yil holatiga ko‘ra) bo‘lib asosan o‘zbeklar (boshqa millatlar ham yashaydi) hisoblanadi. Shahar aholisi eng ko‘p tuman 156258 kishini tashkil qiladi (2-jadval) Koson tumanida 1 ta shahar – Koson, 14-ta shaharchalar, jumladan Po‘lati, Surhon, Guvalak va boshqalar bor. Mahallalari Guvalak, Bo‘lmas, Gulbog‘, Quyibog‘, Jizzalik, Mug‘jagul, Saripul, Nartichuqur, Nartibaland, Lolazor, Mesit, Chorbog‘, Oqtepa, Yangiobod, Ravot, Regzor, Mas‘hal, Yuqori Obron, O‘rta Obron, Quyi Obron, Boyg‘undi, Mudin, Do‘stlik, Koson, Obidida, Alachabob, Po‘loti, Kasbi, Maymanoq, Qarliq, Gala mahallalari bor Markazi – Koson shahri. Tuman markazi Koson shahri tumanning janubiy-markaziy qismida joylashgan. Tumanda paxtachilik, hunarmandchilik savdo yaxshi rivojlangan.

5.Ko‘kdala tumani – Qashqadaryo viloyatidagi tuman. 2022-yil 17-martda Chiroqchi tumani hududini ikkiga bo‘lish orqali tashkil etilgan. 2022-yil 2-mart kuni O‘zbekiston Respublikasi Oliy Majlisi Qonunchilik palatasining yalpi majlisida Ko‘kdala tumanini tashkil etish to‘g‘risidagi masala ko‘rib chiqildi. Majlisda yangi tashkil etiladigan Ko‘kdala tumaniga Chiroqchi tumanidan tahminan 177 ming aholi yashaydigan 171 ming gektar yer maydoni ajratilishi haqida kelishib olindi. 2022-yilning 19-aprel kuni O‘zbekiston Respublikasi Oliy Majlis Senati yig‘ilishida Ko‘kdala tumanini tashkil etish to‘g‘risidagi tegishli qaror qabul qilindi. Ko‘kdala tumanini tashkil etishda O‘zbekiston prezidenti Shavkat Mirziyoyev so‘zlagan nutqdan parcha: Ko‘kdala tumanini tashkil etishdan asosiy maqsad bu yerda yashaydigan 182 ming nafar aholi uchun munosib turmush sharoitini yaratish, hududni iqtisodiy rivojlantirish, aholi bandligini ta‘minlash bo‘yicha ishlarimizni yangi bosqichga ko‘tarishdir. Yettitom shaharchasi uning ma‘muriy markazi etib belgilangan. Tuman asosan tarvuz va qovun yetishtirish bo‘yicha nafaqat viloyatda, balki Markaziy Osiyoda ham yetakchi o‘rinlardan birini egallaydi.

6. Mirishkor tumani – O‘zbekiston Respublikasining Qashqadaryo viloyatidagi tuman. 2003-yil 6-yanvarida Usmon Yusupov va Bahoriston tumanlarining birlashtirilishi natijasida tashkil etilgan. Tumanning ma‘muriy markazi Yangi Mirishkor tumanning markaziy-g‘arbiy tomonida joylashgan. Pomuq – Mirishkor tumaniga qarashli shaharcha. 2009-yilda shaharcha maqomi berilgan. Mirishkor Gaz sanoati, cho‘l chorvachiligi, qishloq xo‘jaligi mahsulotlari bilan yaxshi ta‘minlangan. Mirishkor tumanida bir qancha berk botiqlar: Qorabuloq, Dengizko‘l, Xo‘jam Sayot, Qirqchashma va boshqa bor. Ularda shifobaxsh balchiqlar, tuz qatlamlari hosil bo‘lgan. Tuman hududida Alang, Pomuq, Kultog‘, Ko‘kdumaloq, O‘rtabuloq, Zevarda, Dengizko‘l kabi neft, gaz va kondensatga boy konlar mavjud. Tuman yerlari Amudaryodan suv oladigan Mirishkor kanaliidan sug‘oriladi.

7. Muborak tumani – O‘zbekiston Respublikasining Qashqadaryo viloyatidagi tuman. 1978-yil 13-sentabrda tashkil etilgan. Muborak shahri tumanning markaziy qismiga yaqin hududda joylashgan. Tuman hududidan neft va gaz konlari topilgan. Janubiy Muborak, Shimoliy Muborak va boshqa konlardan neft va gaz chiqarilmoqda. Muborak – Zirabuloq, Muborak – Kogon, Muborak – Navoiy gaz uzatish quvurlari ishlab turibdi. Muborak tumani hududida tabiiy gazni qayta ishlash zavodi bor. Tumanda „Muborakneftgaz“ korxonasi va unga qarashli Zevardi, Ko‘kdumaloq, Alan, O‘rtabuloq, Kultog‘, Pomuq, Shimoliy O‘rtabuloq, Kurik kabi gaz konlari ishlab turibdi. Tumanda 1 qo‘shma korxona, 850 dan ziyod kichik va xususiy korxona, 16 aksiyadorlik jamiyati mavjud. Qishloq xo‘jaligida paxtachilik, g‘allachilik va chorvachilik yetakchi o‘rinda. Yana bir jihatiga e‘tibor qaratadigan bo‘lsak, maydoni yetarli darajada katta bo‘lishiga qaramay shaharlar soni 6ta qishloqlar soni esa atigi 15 tani tashkil qilyapti o‘rtacha zichligi shaharda 616km.kvni qishloqlarda esa 246,6km.kvni tashkil qilmoqda.

2-jadval

Qashqadaryo viloyati ma‘muriy birliklari maydoni va aholisi

	Tuman	Maydon (ming km)	Shahar aholisi	Qishloq aholisi	O‘rtacha zichlik shaharda	O‘rtacha zichlik qishloqda
1	Dehqonobod	4,0	28810	124325	9603	1172
2	Kasbi	0,65	78454	125578	8717	2562
3	Kitob	1,75	101074	125578	7219	1181
4	Koson	1,88	156258	170157	10417	2140
5	Qamashi	2,66	66404	141242	11064	1862
6	Qarshi	0,9	94146	214232	5884	2263
7	Mirishkor	3,1	46652	165221	15550	3520
8	Muborak	3,7	71735	77457	11955	1239
9	Nishon	2,1	96434	18596	8766	2093
10	G‘uzor	2,62	49682	62795	8280	2033
11	Chiroqchi	2,8	101415	330578	11268	2602
12	Shaxrisabz	1,70	54824	172739	4217	1710
13	Yakkabog‘	1,3	88313	182728	5887	1602
14	Ko‘kdala	1,71				

8. Nishon tumani – Qashqadaryo viloyatidagi tuman. 1975-yil 6-martda tashkil etilgan. Tuman markazi Yangi Nishon tumanning gʻarbiy tomoniga yaqinroq joylashgan. Qashqadaryo tumanlari ichida qishloq aholisi eng kam hudud qariyb 18596 aholini tashkil qiladi (2-jadvaldan) Nishon tumani xoʻjaliklari paxtachilik, gʻallachilik, sabzavotchilik, polizchilik, chorvachilikka ixtisoslashgan. Tumanda 377 kichik va xususiy korxona, 52 aksiyadorlik jamiyati, Tallimarjon GRES qurilish boshqarmasi, Tallimarjon issiqlik elektr stansiyasi shoʻba korxonasi mavjud. Nishon tumanida 3 shirkat, 1967 fermer xoʻjaligi faoliyat koʻrsatmoqda. 47196 ga yer maydoni sugʻoriladi, shu jumladan, 24553 ga paxta, 18640 ga gʻalla, 596,6 ga sabzavot va poliz, 1637 ga yem-xashak ekinlari bilan band.

9. Qamashi tumani – Oʻzbekiston Respublikasining Qashqadaryo viloyatidagi tuman, 1937-yil 29-sentabrda tashkil etilgan. 1962-yil 24-dekabrda Qarshi tumaniga qoʻshilgan. 1964-yil 31-dekabrda yana qaytadan tashkil etilgan. Tuman markazi Qamashi shaharchasi tumanning deyarli markaziy qismida joylashgan. Tumanda 3,5 mingga yaqin korxona, jumladan sanoat, qurilish, savdo va umumiy ovqatlanish, maishiy xizmat koʻrsatish va hokazo faoliyat koʻrsatmoqda. Paxta tozalash, gʻisht zavodlari, MTP, qurilish tashkilotlari, avtokorxonalar, kichik, oʻrta biznes va yirik korxonalar, mikrofirmalar bor. 3 ta qoʻshma korxona ishlab turibdi. Qishloq xoʻjaligi, asosan, paxtachilik va gʻallachilikka ixtisoslashgan. Togʻli hududlarda bahorikor gʻallachilik (bugʻdoy, arpa) rivojlangan. Pillachilik bilan ham shugʻullaniladi. Chorvachilikning muhim sohasi qoramolchilik (asosan, sugʻoriladigan zonada), qoʻychilik (togʻ zonasida) hisoblanadi. Tumanda dehqon, fermer xoʻjaliklari va boshqa qishloq xoʻjalik korxonalari bor. Ekin maydonlarining 9,8 ming ga yeriga paxta, 25,6 ming ga yeriga gʻalla, shuningdek, sabzavot va kartoshka, yem-xashak ekinlari ekiladi. Tuman jamoa va shaxsiy xoʻjaliklarida 61,4 mingga yaqin qoramol, 110,3 mingdan ziyod qoʻy va echki, 130,2 mingdan ziyod parranda, 3,4 mingga yaqin yilqi boqiladi.

10. Qarshi tumani – Oʻzbekiston Respublikasining Qashqadaryo viloyatidagi tuman, 1931-yil 1-oktabrda tashkil etilgan. Tuman markazi Beshkent tumanning shimoliy-sharqiy tomoniga yaqinroq hududda joylashgan. Beshkent – 1977-yilda shahar maqomini olgan. 1964-yildan eʼtiboran Qarshi tumani markazi hisoblangan. Tuman Qarshi shahri atrofida joylashganligi uchun paxtachilik bilan birga gʻallachilik, sabzavot va polizchilik, bogʻdorchilik, chorvachilikka ixtisoslashgan. Pillachilik bilan ham shugʻullaniladi.

11. Yakkabogʻ tumani – Qashqadaryo viloyatidagi tuman. 1926-yil 29-sentabrda tashkil etilgan. Yakkabogʻ shahri - tuman markazi hisoblanadi. Yakkabogʻ 1978-yildan shahar maqomini olgan. Yakkabogʻ shahri tumanning sharqiy-togʻ oldi qismida joylashgan. Eski Yakkabogʻ – Yakkabogʻ tumanidagi shaharcha (1989-yildan) hisoblanadi. Yakkabogʻ tumanida jami 2300 dan ziyod korxona, tashkilot va savdo shoxobchasi ishlab turibdi. Paxta tozalash, un tortish, „Sharobkonserva“ zavodlari, Yakkabogʻ toʻqimachilik kombinati, MTP, qishloq xoʻjalik mashinalarini taʼmirlash korxonalari, qishloq xoʻjaligi mahsulotlarini

qayta ishlaydigan korxonalar, mikrofirmalar, madaniy va maishiy xizmat ko'rsatish shoxobchalari faoliyat ko'rsatadi.

12. G'uzor tumani – O'zbekiston Respublikasining Qashqadaryo viloyatidagi tuman. 1926-yil 29-sentabrda tashkil etilgan. Tuman markazi G'uzor shaharchasi tuman hududining markaziy qismiga nisbatan yaqin joyda joylashgan. Tumanda 56 sanoat, qurilish korxonasi bor, shulardan yiriklari: paxta tozalash, ta'mirlash, qishloq xo'jaligi mahsulotlarini qayta ishlash, ta'mirlash-qurilish, „Sho'rtangaz“ unitar-sho'ba, "Sho'rtan gaz-kimyo majmuasi" sanoat korxonalaridir. Savdo, madaniy va maishiy xizmat ko'rsatish shoxobchalari, avtovokzal, avtokemping, dehqon bozori bor. G'uzor tumanida 1500 ga yaqin fermer va dehqon xo'jaliklari faoliyat ko'rsatmoqda. Tuman qishloq xo'jaligi, asosan, paxtachilik, g'allachilikka ixtisoslashgan, qo'ychilik (jumladan, qorako'l qo'ylari), qoramolchilik, parrandachilik ham rivojlangan. Yiliga qariyb 13 ming qorako'l teri tayyorlanadi.

13. Shahrisabz tumani – Qashqadaryo viloyatining shimoli-sharqiy qismida, Hisor tog'larining etaklarida joylashgan tuman. 1926-yil 29-sentabrda tashkil etilgan. Shu jumladan yana bir diqqatga sazovor shaharcha bu Miroqi shaharchasi. Miroqi- Shahrisabz tumanida joylashgan qishloq. 1986-yil 27-mayda shaharcha maqomini olgan. Tuman xo'jaligi, asosan, qishloq xo'jaligiga ixtisoslashgan. Shahrisabz tumanida 9 qo'shma korxona, kichik korxonalar, 1300 ga yaqin xususiy korxona, 14-shirkat korxonasi, 19 aksiyadorlik jamiyati mavjud. Qishloq xo'jaligining yetakchi tarmog'i paxtachilik. Shuningdek, g'allachilik, chorvachilik, pillachilik ham rivojlangan.

14. Chiroqchi – O'zbekiston Respublikasining Qashqadaryo viloyatidagi tuman. 1926-yil 29-sentabrda Qashqadaryo viloyati tarkibiga kiritilgan. Qisqa muddat, 1962-yildan to 1964-yilgacha Yakkabog' tumani bilan birlashtiriladi. 1964-yilda esa yana alohida tuman sifatida tashkil etiladi. O'zbekiston Respublikasining Qashqadaryo viloyatidagi tuman. Hududi 2.8 ming km². Aholisi 445.5 ming kishi. Shimolda Samarqand viloyatining Nurobod va Pastdarg'om tumanlari, g'arbda Koson tumani, sharqda Shahrisabz va Yakkabog' tumanlari, janubda esa Qamashi, G'uzor va Qarshi tumanlari bilan chegaradosh. Tuman hududida Chimqo'rg'on va Qalqama suv omborlari mavjud. Markazi – Chiroqchi shahri. Chiroqchi tumani asosan qishloq xo'jaligiga asoslangan. Qishloq xo'jaligi paxtachilik, g'allachilik va chorvachilikka ixtisoslashgan

Xulosa

Tadqiqot natijalari Qashqadaryo viloyati ma'muriy-hududiy tizimi o'ziga xos geografik xususiyatlarga ega ekanligini ko'rsatdi. Viloyat tarkibidagi tumanlar maydoni, aholi soni va aholi punktlari tarkibi jihatidan bir-biridan sezilarli darajada farq qiladi. Ayrim tumanlarda aholi zichligi yuqori bo'lsa, boshqalarida hudud katta bo'lishiga qaramasdan aholi nisbatan siyrak joylashgan.

Tahlillar shuni ko'rsatadiki, Qarshi, Koson, Chiroqchi va Kitob tumanlari aholi va aholi punktlari soni bo'yicha yetakchi o'rinlarni egallaydi. Mirishkor, Muborak va Dehqonobod kabi tumanlarda esa hudud maydoni katta bo'lishiga

qaramasdan aholi punktlari nisbatan kam joylashgan. Bu holat tabiiy sharoit, resurslar va xo‘jalik ixtisoslashuvi bilan izohlanadi.

Kelgusida ma'muriy-hududiy birliklarni takomillashtirishda aholi joylashuvi, transport tarmoqlari, iqtisodiy faollik va ijtimoiy infratuzilma omillarini hisobga olish maqsadga muvofiqdir. Bu esa hududlarning barqaror va mutanosib rivojlanishini ta'minlashga xizmat qiladi.

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PHYSICAL PRINCIPLES OF TRANSISTORS AND THEIR APPLICATIONS IN ELECTRONIC AMPLIFIERS

Annotation: *Transistors are among the most important inventions in the history of electronics and have become the fundamental building blocks of modern electronic systems. The development of transistor technology has revolutionized communication systems, computing devices, industrial automation, and consumer electronics. This paper examines the physical principles underlying transistor operation and explores their applications in electronic amplifiers. The study begins with an overview of semiconductor physics, including the properties of intrinsic and extrinsic semiconductors, charge carrier dynamics, and the formation of p-type and n-type materials. The operating mechanisms of Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs) are analyzed to explain how these devices control and amplify electrical signals.*

Key words: *transistor, semiconductor physics, bipolar junction transistor, field-effect transistor, electronic amplifier, charge carrier*

The rapid development of modern technology has significantly increased the demand for efficient and reliable electronic devices. At the heart of almost every electronic system lies the transistor, a semiconductor device capable of controlling and amplifying electrical signals. Since its invention in 1947, the transistor has replaced vacuum tubes in most applications and has become the foundation of modern electronics. The importance of transistors extends across numerous fields, including telecommunications, computing, medical equipment, industrial automation, and consumer electronics. Modern microprocessors, memory chips, communication systems, and control circuits contain millions or even billions of transistors integrated into a single semiconductor chip. Their small size, low power consumption, high switching speed, and long operational lifetime make them indispensable components in contemporary technology. Understanding transistor operation requires knowledge of semiconductor physics. Semiconductors possess electrical properties that lie between those of conductors and insulators. Their conductivity can be modified through a process known as doping, which introduces controlled impurities into the semiconductor material.

This process enables the creation of p-type and n-type regions, forming the basis of transistor structures and other semiconductor devices. Two major categories of transistors are widely used in electronic systems: Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs).

BJTs operate through the movement of both electrons and holes, whereas FETs control current flow using electric fields. Both transistor types play crucial roles in amplification, switching, and signal processing applications. Electronic amplifiers represent one of the most significant applications of transistors. Amplifiers increase the amplitude of weak electrical signals, enabling efficient transmission, processing, and reproduction of information. They are essential in audio systems, radio communication, instrumentation, and various industrial applications. The ability of transistors to provide stable and efficient amplification has contributed significantly to the advancement of modern electronics. This paper aims to investigate the physical principles governing transistor operation and to examine their applications in electronic amplifiers. The study reviews semiconductor fundamentals, transistor structures and operating mechanisms, amplification processes, and emerging trends in transistor technology. Through this analysis, the paper highlights the critical role of transistors in the development and future progress of electronic systems.

Semiconductor physics forms the scientific basis for understanding transistor operation and the behavior of modern electronic devices. Unlike conductors, which possess a large number of free electrons, and insulators, which strongly resist current flow, semiconductors exhibit intermediate electrical conductivity. This unique characteristic allows their electrical properties to be controlled and manipulated for various electronic applications. The most commonly used semiconductor materials are silicon (Si) and germanium (Ge). Among these materials, silicon dominates the electronics industry because of its abundance, thermal stability, and favorable electrical characteristics. In a pure semiconductor crystal, atoms are arranged in a highly ordered lattice structure where each atom forms covalent bonds with neighboring atoms. At absolute zero temperature, no free charge carriers are available, and the material behaves as an insulator. However, as temperature increases, thermal energy breaks some covalent bonds, generating free electrons and holes that contribute to electrical conduction.

The electronic behavior of semiconductors is explained by energy band theory. According to this theory, electrons occupy specific energy bands within the crystal structure. The valence band contains electrons involved in chemical bonding, while the conduction band contains electrons capable of moving freely through the material and carrying electric current. The energy gap separating these bands is known as the band gap. In semiconductors, the band gap is relatively small, allowing electrons to move from the valence band to the conduction band when sufficient energy is provided. Pure semiconductors are referred to as intrinsic semiconductors. Their conductivity is generally low because the number of thermally generated charge carriers is limited. To improve conductivity,

controlled amounts of impurity atoms are introduced through a process called doping. Doping significantly modifies the electrical properties of the semiconductor and enables the creation of specialized electronic devices. When pentavalent atoms such as phosphorus or arsenic are added to silicon, extra electrons become available for conduction. These materials are called n-type semiconductors because electrons serve as the majority charge carriers. Conversely, when trivalent atoms such as boron or gallium are introduced, electron deficiencies known as holes are created. These materials are known as p-type semiconductors, where holes act as majority charge carriers.

The junction formed between p-type and n-type materials is called a p–n junction, which serves as the foundation for many semiconductor devices, including diodes and transistors. At the junction, electrons and holes diffuse across the boundary and recombine, creating a depletion region characterized by an internal electric field. This electric field plays a critical role in controlling charge carrier movement and device operation. The controlled manipulation of charge carriers within semiconductor materials provides the physical basis for transistor action. Understanding these fundamental principles is essential for analyzing transistor structures, amplification mechanisms, and the performance of modern electronic systems.

Conclusion

Transistors have become one of the most significant components in the development of modern electronics, enabling the advancement of communication technologies, computing systems, industrial automation, and consumer devices. Their ability to control and amplify electrical signals with high efficiency has made them indispensable elements in both analog and digital electronic circuits. This study examined the physical principles underlying transistor operation by exploring the fundamental concepts of semiconductor physics. The analysis highlighted the importance of intrinsic and extrinsic semiconductors, charge carrier dynamics, doping processes, and the formation of p-type and n-type materials. These concepts provide the scientific foundation for understanding how transistors function and interact within electronic systems.

The operating mechanisms of Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs) were discussed as the two major categories of transistor devices. While BJTs rely on both electron and hole transport for current control, FETs utilize electric fields to regulate charge carrier flow. Both transistor types offer unique advantages and have found widespread applications in amplification, switching, signal processing, and integrated circuit technologies. Furthermore, the study emphasized the crucial role of transistors in electronic amplifiers. By increasing the amplitude of weak electrical signals, transistor-based amplifiers enable reliable communication, accurate measurement systems, high-quality audio reproduction, and efficient data processing. Their compact size, low power consumption, and high reliability have significantly contributed to the miniaturization and performance improvement of modern electronic devices.

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INTEGRATION BETWEEN THE KANO MODEL AND TIME-DRIVEN ACTIVITY-BASED COSTING (TD-ABC) AND ITS ROLE IN ENHANCING PRODUCT VALUE

***Abstract.** The research aims to enhance product value and meet customer requirements by integrating the Kano Model with Time-Driven Feature-Based Costing (TD-FBC). The Kano Model identifies customer requirements by surveying their opinions and incorporating them into the product. Meanwhile, TD-FBC contributes to allocating costs to products in a manner that aligns with the features and functions customers desire in the product. To test the research hypothesis, Ur State Company / Extrusion Factory, one of the Ministry of Industry companies in Dhi Qar Governorate, was selected. The deductive approach was adopted in the theoretical framework to test the hypothesis and address the research problem, while the experimental approach was applied to implement the integration between the Kano Model and TD-FBC and demonstrate its role in enhancing product value. The research reached several conclusions, most notably that the integration between the Kano Model and TD-FBC leads to a deeper understanding of customer desires versus the costs incurred by the economic unit to achieve them. It also guides the economic unit's resources and time toward high-value requirements from the customer's perspective, thereby enhancing product value.*

Introduction

Amidst the fierce competitive market and shorter life cycles of products owing to constant changes in the taste and preference of customers, caused by openness of the country to the global marketplace, market share retention or customer satisfaction cannot be achieved through product quality or cost alone anymore. It is therefore essential to utilize integrated management systems and methods that will increase product value by eliminating wastage of costs and identifying the needs of the customers. This research attempts to increase product value by combining the Kano Model method which emphasizes the analysis of voice of the customer and classifies their needs into different categories with the Time Driven Function-Based Costing (TD-FBC).

The Kano Model was invented by Dr. Noriaki Kano in the 1980s; this approach emphasizes the classification of the attributes of the products or services according to the effect that they have on customers' satisfaction. There are five main requirements for these attributes, including Must-be/Must-have, One-

dimensional, Attractive, Indifferent, and Reverse. Using this classification, economic entities will be able to comprehend better what customers require from them, focusing on those aspects that really affect their satisfaction. Thus, applying the Kano Model is an intelligent move towards improvement of products.

The Time Driven Activity Based Costing (TD-ABC) method is believed to be one of the most significant contemporary approaches used in accounting that strive to give a more accurate representation of costs of activities and operations in enterprises. The TD-ABC approach is based on measuring the amount of time taken by resources to complete activities. This method is distinguished by its relative simplicity in comparison with traditional ones. Additionally, TD-ABC helps to identify inefficiencies and increases effectiveness through removing those activities that do not add value for customers. Therefore, using this method is crucial in optimizing costs and focusing on value-added activities.

The improvement of product value is among the objectives that have been identified to be critical for economic units. The process can therefore be described as an effort that seeks to improve the utility value of the product to the customer compared to its price. Value improvement is done through improvements in design quality, product performance, manufacturing efficiency, and customer services which meet the customers' needs beyond their expectations. The process of value improvement is highly associated with innovation and development since it helps the economic unit to gain competitive advantage.

Section One: Research Methodology

First: Research Problem

The Iraqi industrial economic entities confront many difficulties in attempting to integrate between client satisfaction and cost distribution. This could lead to the creation of designs that might have the emphasis on certain needs that would not add much to the satisfaction of the clients or cost saving done unilaterally. This means that there could be a waste of resources or the provision of products that may not provide value for money to the customers. The problem could be framed in the following questions:

- 1) Do the Kano Model and Time-Driven Function-Based Costing system contribute to enhancing product value?
- 2) What is the impact of this integration on supporting managerial decisions to balance customer satisfaction with cost reduction?

Second: Research Objectives

The research aims to achieve the following:

1. Examining the feasibility of constructing an integrated framework between the customer-satisfaction-oriented Kano Model and the time-driven TD-FBC system to determine the technological cost of activities.
2. Providing a guide for industrial managements on how to direct resources and time toward high-value functions.
3. Raising the awareness level of economic units regarding mechanisms to confront global competition by linking design quality with actual cost.

Third: Research Hypothesis

The research stems from a main hypothesis stating that: "The integration between the Kano Model and the time-driven TD-FBC leads to enhancing product value by maximizing customer satisfaction and rationalizing activity costs."

Fourth Research Importance: The importance of the research stems from enriching accounting and managerial thought with a modern integrated tool. This tool helps uncover the flaws inherent in traditional accounting systems and works on enhancing product value in a way that aligns with meeting customer requirements, as well as achieving a competitive advantage for the economic unit.

Fifth Research Population and Sample (Field of Application): The research population is represented by the industrial sector in Iraq, while the specific field of application is represented by Ur State Company / Extrusion Factory – Unanodized Aluminum Profiles.

Section Two: Conceptual Framework

First: The Kano Model

1. The Origin, Concept, and Definition of the Kano Model:

The Kano Model was first introduced to distinguish among three primary requirements: must-be, one-dimensional, and attractive requirements. Each of these requirements influences customer satisfaction in distinct ways when fulfilled (Radfar et al., 2014: 441). Must-be requirements represent indispensable, "taken-for-granted" customer demands that are essential in a product or service. Their presence does not positively increase customer satisfaction; however, their absence leads to extreme dissatisfaction (Rui, 2013: 38). Conversely, for one-dimensional requirements, the level of customer satisfaction is directly proportional to the fulfillment level of the requirement within the product or service. This means that higher quality in meeting the requirement leads to increased customer satisfaction, and vice versa (Hao & Li, 2010: 10). Finally, attractive requirements are characterized by their ability to generate high levels of customer satisfaction when present in products or services. Nevertheless, their absence does not cause customer dissatisfaction, as these requirements are unexpected from the economic unit. Furthermore, Rust & Oliver categorized customer delight factors into the following categories based on human memory function (Goswami & Sarma, 2019: 407):

A. Imagined Delight: This involves customers remembering "delightful consumption experiences," which means accepting them as normal due to "heightened expectations." In short, this type of delight raises customer expectations and can foster customer loyalty through attraction.

B. Re-enacted Delight: This involves the customer joy experienced when a person plays a favorite movie or song. In the case of re-enacted delight, marketers can secure loyalty by re-enacting memories of delight.

C. Transient Delight: This type of delight can be attributed to fate, randomness, or mere coincidence.

Additionally, Mikulić defined the Kano Model as a customer requirements model, a customer needs model, or simply the theory of attractive quality;

however, it has become popularly recognized as the Kano Model (Mikulić, 2007: 2).

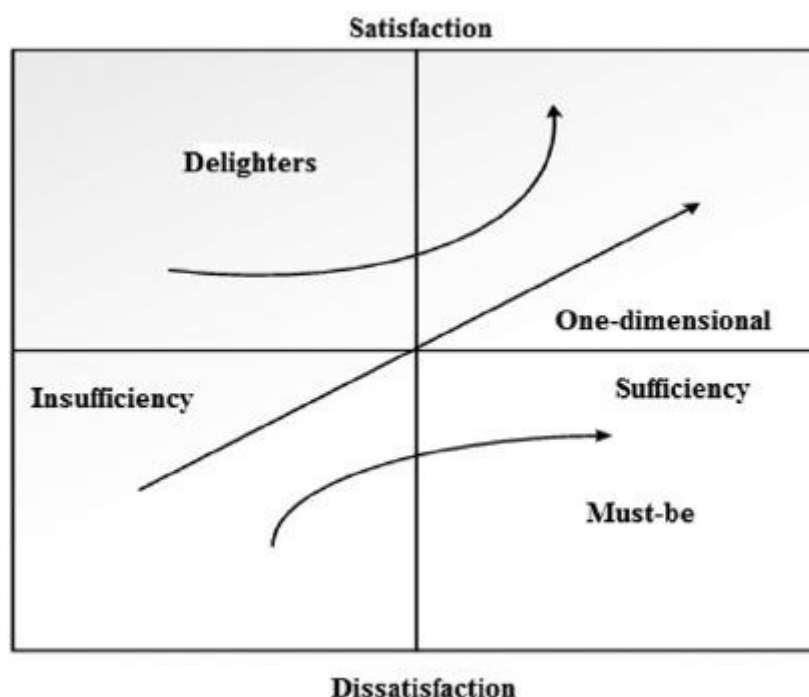
2. Customer Requirements According to the Kano Model: Kano classified customer requirements into three primary categories:

A. Must-Be Requirements (Must-Have): These are requirements that lead to dissatisfaction when they are not fulfilled (or when they are provided at an unsatisfactory level), because the customer takes them for granted. However, when they are fulfilled (provided at a satisfactory level or higher), they do not lead to positive satisfaction (creating an asymmetric effect). The attributes of these requirements are implicit, intuitive, and not particularly distinctive or explicit. Evidently, when an economic unit fulfills must-be requirements, it merely secures its entry into the market, whereas a decline in fulfilling them leads to an excessive increase in dissatisfaction (or a drop in satisfaction).

B. Performance Requirements (One-Dimensional): These are requirements that result in satisfaction when fulfilled and dissatisfaction when left unfulfilled (Mikulić, 2007: 2). It is clear that fulfilling performance requirements ensures that the economic unit can compete in the market. An increase in fulfillment leads to a proportional increase in satisfaction, while a decrease in fulfillment leads to a proportional decrease in satisfaction (or an increase in dissatisfaction), causing the economic unit to fall short.

C. Attractive Requirements: When these requirements are fulfilled, they provide delight and satisfaction; however, when they are not met, they do not cause dissatisfaction because they are unexpected by the customer. Meeting these requirements can be described as "expressive" or "articulate"; meaning that when the economic unit satisfies these unexpected requirements, the customer cannot deny their feeling of delight (Zwein, 2009:13). Fulfilling attractive requirements ensures that the economic unit distinguishes itself from competing firms in the market, as an increase in fulfillment triggers an exponential increase in satisfaction. For instance, on the Gmail website, it is pleasantly surprising that the platform provides an intelligent system to prioritize emails based on monitoring user behavior. It identifies which messages the user cares to open promptly, granting them priority over messages that are consistently ignored. The following Figure (1) illustrates these types of requirements:

Figure 1 - Types of Kano Model Requirements



Sources: ROTAR & KOZAR, The Use of the Kano Model to Enhance Customer Satisfaction, no: 4, november2017:344.

It can be observed from Figure (1) that it represents the foundational framework of the Kano Model requirements. It illustrates that the starting point of one-dimensional requirements moves from the dissatisfaction/shortage quadrant toward satisfaction/fulfillment. This is because the more the economic unit fulfills these requirements for the customer, the higher the degree of satisfaction, and vice versa. On the other hand, must-be requirements initiate from the shortage/dissatisfaction phase and progress toward fulfillment; this is because these requirements are mandatory for the economic unit to fulfill. Meeting them does not make the customer feel satisfied, but the economic unit's failure to provide them will result in customer dissatisfaction. Finally, regarding attractive requirements, the customer experiences delight whether the economic unit works to fulfill these requirements or not. This explains why their starting point lies above the shortage axis, meaning the customer inherently feels satisfied even if the economic unit does not actively fulfill them.

3. Steps for Implementing the Kano Model: The Kano Model is implemented through four consecutive steps, as follows:

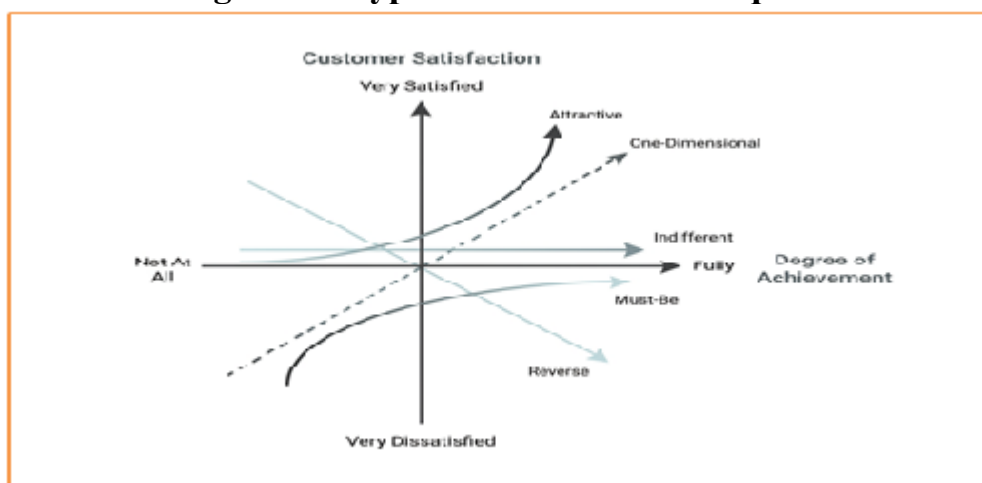
A. Classifying Customer Requirements into Six Categories: Kano classified customer requirements into six distinct categories, which are detailed as follows (Al-Tamimi, 2023: 25).

i. Must-Be Requirements: These are requirements expected to be fulfilled by the product (taken for granted when achieved), but their non-fulfillment leads to dissatisfaction.

- ii. One-Dimensional Requirements: Fulfilling these requirements leads to satisfaction, while failing to meet them results in dissatisfaction.
- iii. Attractive Requirements: These are requirements completely unexpected by the consumer; fulfilling them leads to satisfaction, whereas not fulfilling them does not cause dissatisfaction.
- iv. Indifferent Requirements: These are requirements that do not lead to either satisfaction or dissatisfaction, regardless of whether they are achieved or not.
- v. Reverse Requirements: These are requirements that lead to satisfaction when they are not implemented, and dissatisfaction when they are implemented.
- vi. Questionable Requirements: These attributes emerge due to ambiguities and contradictions in customer responses, leading to a misunderstanding of the answers to customer-related questions in the Kano Model questionnaire. It is worth noting that these questionable requirements do not typically appear within the final analysis of the questionnaire, as they constitute a negligible percentage compared to the other requirements.

Figure (2) illustrates the classification of customer requirements:

Figure 2 - Types of Kano Model Requirements



sources: rui (2013) «a patient-oriented approach to facilities management in singapore's hospitals» a thesis submitted for the degree of master of science (building) department of building national university of singapore p (39).

B. Preparing the Questionnaire: The specialized Kano Model questionnaire is designed to determine customer requirements, utilizing analytical techniques featuring pairs of functional (positive) and dysfunctional (negative) questions (Gupta & Shri, 2017: 6). Table (1) illustrates the structure of the Kano Model questionnaire (Hao & Li, 2010: 11).

C. Analyzing the Questionnaire into Quality Requirements (Attributes): The Kano Model provides a rigorous methodology for mapping consumer responses. After extracting information from the survey, the Kano evaluation matrix is utilized to tabulate and categorize the data (Bennur & Jin, 2012: 176). Table (1)

provides an illustrative example for classifying survey responses and distinguishing requirements into the six categories previously detailed in step (A) (Al-Tamimi, 2023: 28):

Table 1 - Kano Evaluation Questionnaire

SOURCES: Pheng & Rui(2016) Service Quality for Facilities Management

		Response to dysfunctional question				
		1. Like	2. Must be	3. Neutral	4. Live with	5. Dislike
Response to functional question	1. Like	Q	A	A	A	O
	2. Must be	R	I	I	I	M
	3. Neutral	R	I	I	I	M
	4. Live with	R	I	I	I	M
	5. Dislike	R	R	R	R	Q

in Hospitals.

The symbols presented in the table refer to:

1. **O: One-dimensional requirements**
2. **A: Attractive requirements**
3. **Q: Questionable requirements**
4. **R: Reverse requirements**
5. **M: Must-be requirements**
6. **I: Indifferent requirements**

D. Calculating Customer Satisfaction and Dissatisfaction Indices:

The Customer Satisfaction Index (CSI) is calculated using the following equation (Al-Tamimi, 2023: 32–33):

$$\text{Satisfaction Index} = \frac{A+O}{A+O+M+I}$$

Similarly, the Customer Dissatisfaction Index (CDI) is measured using the following equation: $\text{Dissatisfaction} = \frac{O+M}{A+O+M+I}$

Second: Time-Driven Feature-Based Costing System (TD-FBC)

The Concept of Time-Driven Feature-Based Costing (TD-FBC):

The Time-Driven Feature-Based Costing system is fundamentally derived from the Time-Driven Activity-Based Costing (TD-ABC) system. Both systems apply the time equation that captures the time required to perform an activity necessary to complete one unit of a product. However, the TD-FBC system does not stop merely at the activity level; it goes further to address the primary features (functions) of the product for which it was created, as well as secondary features that enhance or contribute to achieving the primary ones, thereby reflecting customer desires. It is crucial to distinguish between an activity and a feature; an activity is essential for task completion but is not necessarily meaningful or beneficial to the end-consumer.

Conversely, a feature is what the customer ultimately pays for. For instance, if an individual reviews a document, this constitutes an "activity," whereas if this review leads to improving security within the economic unit, this represents a «feature» (Bartolomei & Miller, 2001: 4).

Nhaili et al. defined time-driven feature-based costing as an advanced costing system designed on the basis of time-driven activities. This system has

been introduced as a revolutionary approach in the field of costing, taking into account the allocation of resources to activities. The TD-FBC system is anchored on transforming cost drivers into a time equation that reflects the time required to perform activities as a function of certain cost drivers (Nhaili et al., 2016: 152). It is worth noting that time-driven feature-based costing is classified as a system rather than just a method—similar to the activity-based costing system—because it possesses inputs, processing, and outputs. The inputs consist of financial data related to cost accounts, alongside non-financial data represented by time-based cost drivers. The processing involves mathematical operations to determine the cost rate per time unit to calculate individual activity costs, determine the feature cost, and compute the ratio of the feature cost relative to total product costs, among other treatments. Finally, the outputs are represented by the actual cost of the product manufactured by the economic unit (Al-Khalil, 2012: 13).

2. The Concept and Definition of Value:

Boztepe defined value as the monetary sacrifice a consumer is willing to make in exchange for a product. Money is viewed as a primary indicator of value, under the assumption that at the exact moment of purchase, the consumer performs a rational assessment of what is being received versus the amount of money being given (Boztepe, 2007: 56).

The modern concept of value directly focuses on the interaction between the customer and the economic unit, where they simultaneously cooperate and compete. They cooperate in co-creating joint value, while competing in extracting economic value (Prahalad & Ramaswamy, 2004: 11).

Kotler outlines three levels illustrating the types of value a product can deliver to the customer. These levels presented by Kotler are closely analogous to the customer requirements introduced by Kano in his 1984 foundational model. These levels are as follows (Elg & Gustaffson, 2008: 10–39):

- **The First Level:** This level provides the core service, or in other words, fulfills the primary purpose that the product is fundamentally required to achieve.
- **The Second Level:** This level includes additional or secondary features that accompany the product—for instance, making a screen display colors instead of black and white, or integrating a flash into a camera. These features enhance product value and make it more advanced. Crucial factors at this level include the capability of on-time delivery, alongside the critical importance of product quality.
- **The Third Level:** A product containing features from this third level is referred to as an "augmented product." It incorporates intangible features that transcend ordinary standards, enabling the product to exceed customer expectations. This level necessitates the availability of technology that simulates all product processes, spanning from raw material procurement to product sales and post-sale services. Notably, economic units occasionally confront constraints regarding the limited time available for product development.

This economic unit achieves a unique competitive advantage when it manages to reach the third level in Kotler's hierarchy. In turn, the uniqueness of that particular product distinguishes it from other economic units on the market, resulting in an outstanding transformation of the value of the product and customer satisfaction. For those units that only reach the first two levels, however, the fast growth of technology and decreasing product life cycle make time insufficiency incapable of ensuring their survival in such a competitive environment.

Third: The Usefulness of the Kano Model in Increasing Product Value

Given all the above, the Kano Model is a necessary instrument in quality management and product development, as it allows one to get acquainted with customers' requirements and expectations. At the same time, the Kano Model contributes to understanding how different product features affect customer satisfaction. Thus, the use of the Kano Model may contribute to increasing product value through focusing on the requirements maximizing customer satisfaction.

Specifically, the role of the Kano Model in enhancing product value is manifested through:

1. Classifying Product Requirements:

The Kano Model helps classify product requirements into five primary categories (Gupta & Shri, 2018: 5):

- **A. Must-Be Requirements (Must-Have):** These requirements are essential and must be present in the product. Their absence leads to customer dissatisfaction, but improving them beyond the minimum threshold does not add to customer satisfaction. For example, in a smartphone, the ability to make calls is a must-be requirement.
- **B. Performance Requirements (One-Dimensional):** These requirements directly elevate the level of customer satisfaction. The higher the quality or performance of these requirements, the greater the customer satisfaction. A long battery life in a smartphone serves as an example.
- **C. Attractive Requirements:** These requirements are unexpected and bring sudden delight to customers. Their presence significantly enhances customer satisfaction, but their absence does not cause dissatisfaction. An example is the facial recognition feature in a smartphone.
- **D. Indifferent Requirements:** These are requirements that do not lead to either satisfaction or dissatisfaction, regardless of whether they are implemented or not.
- **E. Reverse Requirements:** These are requirements that lead to satisfaction when they are not implemented, and cause dissatisfaction when they are achieved.

Consequently, the Kano Model assists in identifying the areas where development teams should focus to guarantee improved customer satisfaction, by understanding what customers expect versus what surprises them, thereby achieving greater customer delight.

2. Prioritization:

By classifying requirements, the product development team can prioritize which requirements to focus on to achieve the greatest added value for the product and maximize customer satisfaction (Shahin et al., 2012: 344).

3. Increasing Competitive Differentiation:

Meeting attractive requirements can give the product an edge, since it gives the customer a special and unique experience.

4. Effective Resource Allocation:

Through this model, resource allocation will be more efficient and will help us meet the requirements that really matter to the customer and increase the value of the product. To increase the value of the product features, we need to verify the following points:

- **A. Optimizing Must-Be Requirements:** Making sure that must-be requirements are present and functioning efficiently, as their absence leads to customer dissatisfaction.
- **B. Enhancing One-Dimensional Requirements:** Increasing the effectiveness of the requirements expected by customers and improving their performance can lead to enhanced customer satisfaction and a higher perceived product value.
- **C. Adding Attractive Requirements:** Developing new and innovative features that surprise and delight customers can significantly elevate product value and make it stand out in the market.

All things considered, using the Kano Model in the product development process will improve product value by having a good knowledge of what customers want in their products, categorizing product features according to how they affect customer satisfaction, and focusing on those that have the most positive effect on them.

Fourth: The Role of the TD-FBC System in Enhancing Product Value

The TD-FBC system plays an active role in enhancing product value through:

1. Greater Accuracy in Cost Allocation:

The TD-FBC system helps allocate costs with higher precision by directly linking costs to the time consumed in performing product features. This allows for a better understanding of the actual costs associated with each feature, which contributes to identifying areas that can be optimized to enhance resource utilization efficiency (Al-Kawaz, 2016: 63).

2. Improving Decision-Making:

Through a deep understanding of time-related costs, companies can make more informed decisions regarding production and design processes. For instance, non-essential or high-cost features can be identified and subsequently optimized or eliminated, leading to cost reductions without negatively impacting product quality (Majid, 2020: 175).

3. Enhancing Operational Efficiency:

Based on the time consumed to produce specific features, operational processes can be optimized to mitigate time and resource waste. This gained efficiency directly reflects on enhancing product value by lowering total costs and increasing the capability to deliver high-quality products at competitive prices (Al-Kishwan, 2018: 48).

4. Focusing on Value-Added Features:

The TD-FBC system helps shift focus toward features that add actual value to the product and matter most to customers. Consequently, efforts and resources are directed toward improving product aspects that elevate its market value (Majid, 2020: 172).

Therefore, a direct correlation exists between time-driven feature-based costing and product value enhancement. This system achieves greater efficiency in resource utilization, eliminates unnecessary costs, and boosts product quality, which ultimately enhances its value in the eyes of customers and consumers.

Fifth: The Role of Integration Between the Kano Model and TD-FBC in Enhancing Product Value

When merging the Kano Model with Time-Driven Feature-Based Costing (TD-FBC), significant improvements in product value can be realized through the following processes:

1. Optimizing Resource Allocation:

By leveraging the Kano Model, requirements that add the highest value to customers can be identified. Concurrently, using TD-FBC allows resources to be allocated more efficiently toward these requirements. Focus is placed on activities that support developing must-be, one-dimensional, and attractive requirements, which enhances the final product's value while keeping costs under control.

2. Cost-Benefit Analysis:

Combining both tools will allow conducting a cost-benefit analysis of each requirement of the product. The analysis will help identify whether or not it is worth investing more money, or there are possibilities to save on costs without losing customer satisfaction.

3. Optimizing the Design and Development Processes:

The clearer understanding of customer desires and willingness to pay for the required services/products will allow optimizing the design and development processes. TD-FBC will be able to determine the activities that require too many resources and calculate the costs of certain features. In addition, it will allow operation under the used capacity.

4. Increasing Customer Satisfaction and Saving Costs:

Identifying customer desires and using cost analysis in order to maximize the value of the final products.

In summary, it is clear that the application of Kano Model with TD-FBC contributes greatly towards increasing the value of the products because they help in assessing the requirements of customers and evaluating their cost from the perspective of TD-FBC systems. This approach helps economic units meet the

needs of customers in terms of cost minimization and maximization of customer satisfaction. To the researchers, adopting the Kano Model along with TD-FBC at the State Company for Engineering Industries at Ur is an important aspect in increasing the value of the product and maximizing customer satisfaction. In this regard, Kano Model would first be used in analyzing and classifying customer needs and thereafter the use of TD-FBC.

Section Three: The Practical Framework (A Case Study at Ur State Company) Research Population, Sample, and Core Product Components:

As part of the testing process of the research hypothesis, and for the application of the above-integrated framework, the Ur State Company / Extrusion Factory, situated in Dhi Qar Province, was chosen. This is an aluminum factory specializing in the manufacturing of unanodized aluminum profiles (used in the production of doors, windows, and counters). One metric ton was adopted as the standardized measurement in regard to the production of such products, since there can be no alternative due to varying weight and millimeters among others. The following are the direct and indirect physical factors needed in order to manufacture one ton of unanodized aluminum profiles as identified by the engineers:

1. Aluminum Billets (AL 6063): Primary component in the product structure.
2. Graphite Material: Auxiliary materials used in coating dies to avoid sticking.
3. Protective Tape (Sticker): Protective layer preventing profiles from any scratches.
4. Timber: Wood used in placing below and above the profiles for easy lifting.
5. Strapping Bands (Clips): Metal or plastic bands to package profiles together.

First: Practical Application of the Kano Model and Classification of Customer Requirements:

A dual-response Kano questionnaire was designed and constructed in consultation with the factory's experts, comprising 12 core requirements concerning the quality and packaging of aluminum profiles. A total of (60) survey questionnaires were distributed to aluminum workshop owners, counter manufacturers, and door fabricators, from which (50) complete and valid questionnaires were recovered for statistical analysis. Following data processing and the cross-referencing of functional and dysfunctional responses based on the standard Kano evaluation matrix, the final results and classifications emerged as illustrated in Table (2) below:

Table 2.

Results and Classification of Customer Requirements According to the Kano Model

Customer Requirements	A	O	M	I	R	Q	Total	Kano Classification
1-Dimensional accuracy.	17	23	7	2	0	1	50	O
2-Producing profiles with customized shapes and dimensions upon customer request.	25	18	6	1	0	0	50	A
3-Profile straightness.	14	27	9	0	0	0	50	O
4-Profile hardness and resistance to bending without fracturing.	13	15	17	4	0	1	50	M
5-Retention of the designed shape after heat treatment.	8	20	14	5	2	1	50	O
6-Homogeneity of the metal micro-structure.	7	21	10	11	0	1	50	O
7-Secure packaging to protect profiles from scratches and damage.	9	18	23	0	0	0	50	M
8-Placing a clear identification label on each package.	9	11	12	18	0	0	50	I
9-Eco-friendly packaging.	8	12	11	17	2	0	50	I
10-Corrosion resistance.	11	22	15	2	0	0	50	O
11-Resistance to weather conditions.	12	15	12	8	3	0	50	O
12-Availability of modern production machinery	19	10	12	5	1	3	50	A

Second: Analyzing and classifying customer requirements according to the results of the Kano: survey model Based on the response frequencies presented in Table (2), both the satisfaction and dissatisfaction indices were measured for each requirement. To illustrate the mathematical equation applied, we provide a practical example demonstrating the calculation for the «Dimensional Accuracy» requirement (where frequencies are: A = 17, O = 23, I = 2, M = 7).

Satisfaction Index (SI) for Dimensional Accuracy= $23+17 / 17+23+7+2=40/49 = 0.82$

Dissatisfaction Index (DI) for Dimensional Accuracy= $23+7 / 17+23+7+2=30/49 = 0.61$

Using the same computational methodology, the indices for the remaining 12 requirements were calculated and are summarized in Table (3) below. This presentation ensures a clear overview of the satisfaction and dissatisfaction metrics.

Table 3.

Satisfaction and Dissatisfaction Indices for Customer Requirements

Customer Requirements	SI	DI
1-Dimensional accuracy.	0.82	-0.61
2-Producing profiles with customized shapes and dimensions upon customer request.	0.86	-0.48
3-Profile straightness.	0.82	-0.72
4-Profile hardness and resistance to bending without fracturing.	0.57	-0.65
5-Retention of the designed shape after heat treatment.	0.6	-0.72
6-Homogeneity of the metal micro-structure.	0.57	-0.63
7-Secure packaging to protect profiles from scratches and damage.	0.54	-0.82
8-Placing a clear identification label on each package.	0.4	-0.46
9-Eco-friendly packaging.	0.42	-0.48
10-Corrosion resistance.	0.66	-0.74
11-Resistance to weather conditions.	0.57	0.57-
12-Availability of modern production machinery	0.62	-0.47

An efficiency rate of 80% of the theoretical capacity was adopted as the practical available capacity to exclude naturally lost time (such as rest breaks and machine maintenance). The available time for a single production department was calculated based on the following equation:

$(60 \text{ minutes} \times 7 \text{ daily working hours} \times 20 \text{ monthly working days, excluding official holidays}) \times 80\% = 6,720 \text{ available minutes per month per worker.}$

The cost per minute (for both direct labor and indirect costs) was derived by dividing the total monthly cost by the practical capacity of the resources. The outputs for three main production departments for the month of February are summarized in Table (4):

Table 4.

Cost per Unit of Time (Minute) for Production Departments (IQD)

Production Unit / Department	Monthly Direct Cost of the Department Supervisor (IQD)	Cost Rate Per Minute (IQD/Min)	Monthly Direct Cost Per Worker (IQD)	Cost Rate Per Minute (IQD/Min)	Monthly Indirect Cost (IQD)	Cost Rate Per Minute (IQD/Min)
Extrusion and Cutting	1,000,000	148.81	700,000	104.167	5,500,000	54.563
Heat Treatment (Thermal Processing)	750,000	111.607	600,000	89.286	4,500,000	334.821
Packing and Packaging	650,000	96.726	550,000	81.845	1,217,291	22.643

Using the same mechanism, the cost rate per minute for the service and administrative support cost centers was calculated as follows: (Information and

Follow-up = 1,520.886 IQD), (Maintenance = 1,292.766 IQD), (Transportation = 1,247.472 IQD), (Warehouses = 1,318.833 IQD), and (Quality Control = 11,193.491 IQD/Min), with the latter exhibiting a higher rate due to the elevated costs of laboratory equipment.

Third: The Technological Path and Production Activity Pools:

The detailed technological path for producing one metric ton of unanodized aluminum profiles within the factory was tracked, and the actual time duration required to execute each activity was measured in minutes alongside its place of occurrence:

1. Extrusion and Cutting Department: This department comprises 12 sequential activities, beginning with preparing and signing the work order (Information Section), receiving and weighing materials (Crane), preheating dies and aluminum billets (60 minutes for the press), lifting billets (120 minutes for the assistant), extrusion and profile forming (110 minutes), coating the disc with graphite (10 minutes), straightening and tension stretching (120 minutes), and cutting to requested lengths (120 minutes), followed by inspection and transport. The total technological path in this department amounts to 557 minutes.

2. Heat Treatment Department: This department involves 10 activities, most notably pushing containers, operating the aging furnace for (90 minutes) until the profiles acquire the required hardness, fan cooling (5 minutes), hardness testing, and transport. The total duration amounts to 110 minutes.

3. Packing and Packaging Department: This department includes 8 activities, encompassing laboratory inspection, wrapping the profile with the company's protective tape (40 minutes), packing and bundling profiles into large packages (30 minutes), and delivery to warehouses (30 minutes). The total duration amounts to 114 minutes.

Consequently, the total actual technological time required to produce one metric ton is 781 minutes. Conversion costs were calculated by multiplying the cost rate per minute (from Table 9) by the duration of each activity, yielding the following aggregated costs: (Extrusion Department = 185,812.726 IQD), (Heat Treatment = 63,203.907 IQD), and (Packing and Packaging = 105,910.242 IQD).

Fourth: Allocating Product Component Costs Using the TD-FBC System: Based on the factory management's assessment, the total actual time (781 minutes) was allocated across the five product components according to their actual consumption within the production departments). Table (5) presents the final summary of direct material costs combined with the technologically derived conversion costs for each component per metric ton:

Table 5.

Cost of Aluminum Profile Components per Ton According to the TD-FBC System IQD

Components	Material Cost	Conversion Costs	Total
AL 6063	2,875,000	223,255.089	3,098,255.089
Graphite	2,294.506	25,761.544	28,056.05
Sticker	5,000	65,032.605	70,032.605
Timber	6,000	18,580.744	24,580.744
Strapping Bands	4,000	22,296.893	26,296.893
Total	2,892,294.506	354,926.875	3,247,221.381

The accounting results demonstrate that the actual cost of producing one metric ton of unanodized profiles amounts to 3,247,221.381 IQD when implementing the TD-FBC system.

Final strategic cost allocation indicates a significant mismatch, where the packing department consumes substantial conversion costs (105,910.242 IQD) yet fails to resolve high customer dissatisfaction (-0.82) regarding protection, requiring immediate optimization. Reallocating savings from waste reduction toward improved packaging, identified as an 'Attractive' Kano requirement, will maximize value and rationalize activity costs.

Fifth: Comparative Analysis: The Company's Traditional System Versus the TD-FBC System:

The results of the TD-FBC system were compared with the current traditional costing system applied at Ur State Company. The traditional system calculates the cost per ton by adding imported direct materials (2,875,000 IQD) and dividing the total monthly wages by the actual production volume of (77.472 tons), which yields a highly inflated labor cost share per ton amounting to (1,285,490.9 IQD). Furthermore, it allocates monthly manufacturing overhead based on theoretical available capacity and the technological quantity that includes abnormal spoilage (1.3 tons per single ton of production), reaching (175,223.809 IQD).

Table 6.

Cost Variance Between the Company's Traditional System and the TD-FBC System

Cost Element	The Company's Traditional System (IQD)	TD-FBC System (IQD)	Variance (IQD)
Material Cost	2,892,294.506	2,892,294.506	0
Conversion Costs	1,460,714.709	354,926.875	1,105,787.834
Cost Variance			1,105,787.834

The accounting analysis demonstrates a massive reduction in the cost per single metric ton, amounting to 1,105,787.834 IQD, when implementing the TD-FBC system. The scientific rationale behind this reduction is attributed to the success of the TD-FBC system in excluding the costs of idle and unused capacity.

Furthermore, it avoids charging the product with labor wages that are unrelated to actual production time, thereby eliminating the unjustified inflation of operational costs inherent in the traditional system.

Sixth: Functional Analysis of Product Components (Primary / Secondary): In compliance with the second step of the practical framework, the five components were dismantled and analyzed to determine their engineering and marketing functions. In consultation with the factory's engineers, they were classified into "primary" functions (essential for the product) and "secondary" functions:

1. AL 6063 Billets: Perform the function of producing precise and complex shapes for structural profiles (Primary).

2. Graphite Material: Performs four distinct functions: reducing thermal retention to prevent profile deformation (Primary), lubricating die walls to prevent aluminum from adhering to the steel (Primary), filling micro-scratches to mitigate die wear (Secondary), and preventing the appearance of external black scratches on the surface (Secondary). Based on joint brainstorming sessions, the utility proportions of these functions from the component were determined at (35%, 35%, 15%, and 15%) respectively, to allocate its total cost of (28,056.05 IQD).

3. Protective Tape (Sticker): Its function is to protect surface profiles from external scratches and damages during handling (Secondary).

4. Timber and Strapping Bands (Clips): Perform a joint function, which is facilitating terrestrial transport and handling operations by binding and strapping the profiles securely (Secondary).

The cost of each function was determined based on its utility percentage relative to the total component cost derived from Table (5). For single-function components, the function cost was equal to the entire component cost (e.g., Protective Tape = 70,032.605 IQD, Timber = 24,580.744 IQD, and Strapping Bands = 26,296.893 IQD).

Seventh: Practical Integration and the Composite Weighting Matrix for Prioritizing Optimization: To scientifically prioritize development and optimization in a manner that balances customer desires with the company's financial burden, the Composite Weighting Method was applied. This method balances the customer satisfaction index with the net requirement cost technologically extracted via the TD-FBC system (where shared activity costs were distributed among requirements based on the relative importance of Kano satisfaction indices). A weighting coefficient was assigned to each Kano classification as follows:

Must-be= 3, One-dimensional = 2, Attractive= 1.5, Indifferent = 0.

The following weighted mathematical equation was applied:

Composite Weight= Kano Coefficient*Satisfaction Index / Net Requirement Cost* 10,000

Competitive optimization priorities were arranged in ascending order based on the final composite weight value in the table:

Table 7.
Optimization Priorities Matrix According
to the Integrated Composite Weighting

Requirements	Kano Classification	SI	Kano Coefficient	Net Requirement Cost (IQD)	Composite Weight
Secure packaging	M	0.54	3	3,554.682	4.56
Resistance to weather conditions such as heat and humidity	O	0.57	2	3,759.478	3.03
Homogeneity of the metal micro-structure	O	0.57	2	9,459.707	1.21
Profile hardness	M	0.57	3	14,642.294	1.17
Corrosion resistance.	O	0.66	2	18,529.563	0.71
Retention of the designed shape after heat treatment	O	0.6	2	20,146.342	0.6
Profile straightness	O	0.82	2	32,840.904	0.5
Producing customized shapes and dimensions upon customer request	A	0.86	1.5	33,862.315	0.38
Dimensional accuracy.	O	0.82	2	83,563.608	0.2

The matrix demonstrates that "secure packaging" occupies the first rank for development and optimization; this is because it represents a must-be requirement that is critical to preventing customer dissatisfaction, and it can be enhanced at a very low cost by utilizing anti-scratch adhesive tape. On the other hand, both "identification labeling" and "eco-friendly packaging" yielded a composite weight of zero, as they are classified as indifferent requirements (I) that do not influence customer satisfaction. Consequently, from a managerial accounting perspective, it is recommended to avoid allocating any financial resources to them, to dispense with eco-friendly packaging, and to replace printed labels with low-cost barcode or QR code stickers to optimize company funds.

Eighth: Strategic Analysis of the Capital Investment Decision (Fulfilling the Attractive Requirement: The results revealed an eager desire among customers for the availability of modern machinery as an attractive feature (A), with a satisfaction index of (0.62). Accordingly, the equations of the TD-FBC system were applied to evaluate a proposal submitted by a leading Chinese

company to procure a semi-automatic aluminum extrusion press machine (1000T) valued at (\$115,000), which is equivalent to (151,800,000 IQD) inclusive of transportation and installation costs.

- **Planned monthly production capacity of the machine** = 300 tons.
- **Total production over the operational lifespan (20 years)** = $300 * 12 * 20 = 72,000$ \tons.
- **Capital cost share per single ton of the machine** = $151,800,000 / 72,000\}$ = 2,108.33 IQD/Ton.

Upon substituting these values into the composite weight equation:

$$\text{Composite Weight} = 1.5 * 0.62 / 21,084 * 10,000 = 0.44$$

This analysis demonstrates that investing in the procurement of the modern machine represents a sound strategic decision. Technological automation effectively integrates extrusion, cutting, and cooling functions simultaneously, leading to a substantial reduction in labor costs within those units. Furthermore, it minimizes time and resource waste while eliminating non-value-added activities, which directly reflects on lowering the total cost and enhancing the overall product value.

Section Four: Conclusions and Strategic Recommendations

The research validated its main hypothesis by demonstrating that integrating the Kano Model with the Time-Driven Feature-Based Costing (TD-FBC) system achieves a sustainable strategic advantage by aligning customers' engineering desires with actual technological costs based on elapsed time. Specifically, the TD-FBC system exposed critical flaws in the company's current traditional system, successfully reducing the calculated cost per single metric ton by 1,105,787.834 IQD by excluding idle capacity costs and indirect operational labor overheads that do not consume actual time.

Furthermore, the composite weighting matrix proved that the highest satisfaction index does not inherently dictate optimization priority; instead, it must be balanced against cost, which positioned secure packaging as the absolute first priority since it represents a mandatory requirement to eliminate customer dissatisfaction at the lowest financial burden, while integrating modern PLC-controlled technology shortens the technological path to minimize waste. Consequently, the research strongly recommends that Ur State Company immediately abandon its traditional costing methods and adopt this integrated framework as a periodic managerial and accounting tool for product pricing and development.

Additionally, the company should urgently upgrade its aluminum profile packaging using anti-scratch adhesive wrapping to resolve consumer dissatisfaction, eliminate resource-wasting indifferent features—such as costly eco-friendly packaging—by replacing traditional labels with low-cost QR codes, and expedite the capital investment to procure the modern 1000T Aluminum Extrusion Press Machine to maximize time savings, halve operational labor, and enhance dimensional accuracy.

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CLINICAL AND LABORATORY FEATURES OF CHRONIC BRUCELLOSIS AT THE PRESENT STAGE: A REVIEW

Abstract. *Brucellosis remains one of the most significant zoonotic infections worldwide, especially in regions with developed livestock farming. The clinical presentation of chronic brucellosis is characterized by multisystem involvement, including musculoskeletal, nervous, cardiovascular, and reproductive systems. Laboratory diagnosis is often complicated by the persistence of immunological markers and nonspecific inflammatory changes. This review summarizes current data on the epidemiology, pathogenesis, clinical manifestations, laboratory characteristics, and modern diagnostic approaches to chronic brucellosis.*

Keywords: *chronic brucellosis, zoonosis, clinical manifestations, laboratory diagnosis, epidemiology, serological tests, chronic infection, Brucella.*

Introduction

Brucellosis is a widespread zoonotic infectious disease caused by Gram-negative intracellular bacteria of the genus *Brucella*. The disease remains a major public health concern in many countries of Central Asia, the Mediterranean region, the Middle East, Latin America, and Africa [1]. According to the World Health Organization, more than 500,000 new human cases are registered annually, while the actual incidence is believed to be significantly higher because of underdiagnosis and underreporting [2].

One of the major challenges associated with brucellosis is its ability to progress to a chronic form. Chronic brucellosis develops in approximately 10–30% of patients and is characterized by persistent symptoms lasting more than 12 months after the onset of infection [3]. The disease often leads to reduced quality of life, long-term disability, and significant socioeconomic consequences.

Epidemiology of Chronic Brucellosis

Despite global control programs, brucellosis remains endemic in many developing countries. The highest prevalence rates are reported in regions where close contact between humans and livestock is common and veterinary control measures are insufficient [1]. In Central Asian countries, including Uzbekistan, brucellosis continues to be a significant public health problem due to traditional livestock breeding practices and occupational exposure among farmers, veterinarians, and slaughterhouse workers [4]. Recent studies indicate that chronic forms of brucellosis are becoming increasingly recognized because of improved diagnostic capabilities and longer survival of infected individuals [5].

The pathogenesis of chronic brucellosis is closely related to the unique biological characteristics of *Brucella* spp. These bacteria possess the ability to survive and replicate within macrophages, avoiding destruction by host immune mechanisms [3]. Intracellular persistence allows the pathogen to evade immune surveillance and establish long-term infection. Chronic stimulation of the immune system leads to continuous production of pro-inflammatory cytokines, including tumor necrosis factor-alpha (TNF- α), interleukin-1, and interleukin-6, which contribute to tissue damage and systemic manifestations [6]. Persistent antigenic stimulation may also induce autoimmune mechanisms, further complicating the clinical course of the disease [5].

Clinical Features of Chronic Brucellosis

The clinical manifestations of chronic brucellosis are highly variable and often nonspecific. Patients commonly present with prolonged fatigue, weakness, excessive sweating, low-grade fever, arthralgia, and myalgia [3].

Musculoskeletal manifestations

Musculoskeletal involvement is the most frequent manifestation of chronic brucellosis and occurs in up to 60% of patients [7]. Common clinical forms include: peripheral arthritis, sacroiliitis, spondylitis, osteomyelitis; chronic arthralgia.

Lumbar spine involvement is particularly common and may lead to significant disability if left untreated [8].

Neurological manifestations

Neurobrucellosis represents one of the most severe complications and may manifest as: chronic meningitis, encephalitis, peripheral neuropathy, radiculopathy, cognitive dysfunction [5]. Although relatively uncommon, neurological involvement significantly worsens prognosis.

Cardiovascular and other manifestations

Chronic brucellosis may affect the cardiovascular system, causing endocarditis, myocarditis, and vasculitis. Endocarditis remains the leading cause of brucellosis-related mortality [3].

Genitourinary involvement, hepatosplenomegaly, chronic lymphadenopathy, and dermatological manifestations have also been reported [6].

Laboratory features of chronic brucellosis

Laboratory diagnosis of chronic brucellosis remains challenging because bacteremia is often absent and clinical manifestations are nonspecific.

Hematological Changes

Common laboratory abnormalities include: mild anemia, leukopenia, relative lymphocytosis, elevated erythrocyte sedimentation rate (ESR), increased C-reactive protein (CRP) levels [4]. However, these findings are not specific and should be interpreted alongside clinical and epidemiological data.

Serological diagnosis

Serological methods remain the cornerstone of laboratory diagnosis. The most commonly used tests include: standard Agglutination Test (SAT), Rose Bengal Test, Coombs anti-*Brucella* test, Enzyme-linked immunosorbent assay

(ELISA) [2]. ELISA demonstrates high sensitivity and specificity and allows differentiation between IgM and IgG antibodies, facilitating assessment of disease activity [6].

Molecular diagnostic methods

Polymerase chain reaction (PCR) has emerged as a valuable tool for detecting *Brucella* DNA in blood and tissue samples [8]. PCR offers rapid diagnosis and may be particularly useful in chronic and complicated cases where traditional culture methods have limited sensitivity.

Modern challenges in diagnosis

Diagnosis of chronic brucellosis is complicated by the persistence of antibodies after successful treatment and the absence of pathognomonic clinical signs [7]. A comprehensive diagnostic approach should include: detailed epidemiological history, clinical examination, serological testing, molecular diagnostic techniques, Imaging studies when organ involvement is suspected. The combination of ELISA and PCR currently represents the most promising diagnostic strategy for chronic brucellosis [8].

Treatment and follow-Up

The World Health Organization recommends combination antibiotic therapy to prevent relapses and chronic complications [2]. The most widely used regimen includes: Doxycycline (100 mg twice daily for 6 weeks); Rifampicin (600–900 mg daily for 6 weeks). Complicated cases may require additional aminoglycosides or fluoroquinolones [3]. Long-term follow-up is essential because relapses may occur months or even years after treatment completion [5].

Conclusion

Chronic brucellosis remains an important infectious disease characterized by diverse clinical manifestations and complex laboratory diagnosis. Advances in serological and molecular diagnostic techniques have improved the detection of chronic infection; however, challenges remain due to the persistence of antibodies and nonspecific symptoms. Musculoskeletal involvement continues to be the most common clinical manifestation, while neurological and cardiovascular complications significantly affect prognosis

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OPTIMIZATION OF THE CUTTING PROCESS USING NANOFLUID MINIMUM QUANTITY LUBRICATION

Annotatsiya: Mazkur tadqiqotda qattiqlashtirilgan 90CrSi po'latni kesish jarayonida MoS₂ nanopartikullariga asoslangan nanofluidli minimal miqdordagi moylash (MQL) tizimining texnologik samaradorligi eksperimental ravishda o'rganildi. Tadqiqot jarayonida nanopartikula konsentratsiyasi, havo bosimi va havo oqimi sarfi kabi parametrlarning sirt g'adir-budurligi (Rz) va natijaviy kesish kuchi (Fr) ga ta'siri baholandi. Eksperimental tadqiqotlar Box–Behnken dizayni asosida tashkil etildi va olingan natijalar statistik usullar yordamida tahlil qilindi. Natijalar nanopartikula konsentratsiyasi kesish jarayoniga eng katta ta'sir ko'rsatishini ko'rsatdi. Nanofluidli MQL tizimi kesish zonasidagi tribologik sharoitlarni yaxshilab, kesish kuchini kamaytirish va sirt sifatini oshirishga yordam berishi aniqlangan. Tadqiqot natijalari nanofluid parametrlarini optimallashtirish orqali qattiq kesish jarayonining samaradorligini oshirish imkoniyatini ko'rsatadi.

Kalit so'zlar: MoS₂ nanopartikullari, nanofluid, minimal miqdordagi moylash (MQL), qattiq kesish, 90CrSi po'lat, sirt g'adir-budurligi, kesish kuchi, Box–Behnken dizayni, tribologik sharoitlar, optimallashtirish.

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NANOFLUIDLI MINIMAL MIQDORDAGI MOYLASH YORDAMIDA KESISH JARAYONINI OPTIMALLASHTIRISH

Abstract: This study experimentally investigates the effectiveness of minimum quantity lubrication (MQL) based on MoS₂ nanoparticle nanofluid in the machining of hardened 90CrSi steel. The influence of nanoparticle concentration, air pressure, and air flow rate on surface roughness (Rz) and resultant cutting force (Fr) was evaluated. The experiments were designed using the Box–Behnken experimental design, and the obtained data were analyzed using statistical methods. The results indicate that nanoparticle concentration has the most significant effect on machining performance. The application of nanofluid in the MQL system improves tribological conditions in the cutting zone, reduces cutting forces, and enhances surface quality. The findings demonstrate that optimizing nanofluid parameters can significantly improve the efficiency of hard machining processes.

Keywords: *MoS₂ nanoparticles, nanofluid, minimum quantity lubrication (MQL), hard turning, 90CrSi steel, surface roughness, cutting force, Box–Behnken design, tribological conditions, optimization.*

Usullar: Tadqiqotda qattiqlashtirilgan 90CrSi po‘latni kesish jarayoni eksperimental ravishda o‘rganildi. Tajribalar nanofluidli minimal miqdordagi moylash (MQL) tizimi qo‘llangan holda amalga oshirildi. Kesish jarayonida MoS₂ nanopartikullariga asoslangan nanofluid aerosol shaklida kesish zonasiga uzatildi. Ishlov berish jarayonida CBN turidagi kesish plastinkalari qo‘llanildi.

Eksperimental tadqiqotlar Box–Behnken eksperimental dizayni asosida tashkil etildi. Tadqiqotda nanopartikula konsentratsiyasi, havo bosimi va havo oqimi sarfi parametrlarining sirt g‘adir-budurligi (Rz) hamda kesish kuchi (Fr) ga ta’siri baholandi. Olingan natijalar statistik usullar yordamida qayta ishlanib, kesish jarayoniga ta’sir qiluvchi asosiy omillar aniqlandi.

Xulosa: Mazkur tadqiqotda qattiqlashtirilgan 90CrSi po‘latni kesish jarayonida MoS₂ nanopartikullariga asoslangan nanofluidli minimal miqdordagi moylash (MQL) tizimining ta’siri eksperimental ravishda o‘rganildi. Tadqiqot jarayonida nanopartikula konsentratsiyasi, havo bosimi va havo oqimi sarfi kabi texnologik parametrlarning sirt g‘adir-budurligi va kesish kuchiga ta’siri baholandi. Olingan natijalar nanofluidli MQL tizimi kesish jarayonining tribologik sharoitlarini yaxshilash hamda ishlov berish samaradorligini oshirishda muhim ahamiyatga ega ekanligini ko‘rsatadi.

KIRISH

Metall kesish jarayonlari zamonaviy mashinasozlikda yuqori aniqlik va sifatli detallar ishlab chiqarishning asosiy usuli bo‘lsa-da, qattiqlashtirilgan po‘latlarni ishlashda yuzaga keladigan yuqori harorat va mexanik yuklanishlar kesish asbobining tez yeyilishi hamda sirt sifatining yomonlashishiga olib keladi. An’anaviy sovitish suyuqliklarining ekologik va iqtisodiy kamchiliklari tufayli, bugungi kunda minimal miqdordagi moylash (MQL) texnologiyasi istiqbolli muqobil sifatida keng tadqiq qilinmoqda. Ushbu usulda moylash materiali aerosol shaklida uzatilib, ishqalanishni kamaytirsa-da, qattiq kesish jarayonlarida oddiy moylar har doim ham yetarli tribologik samaradorlikni ta’minlay olmaydi.

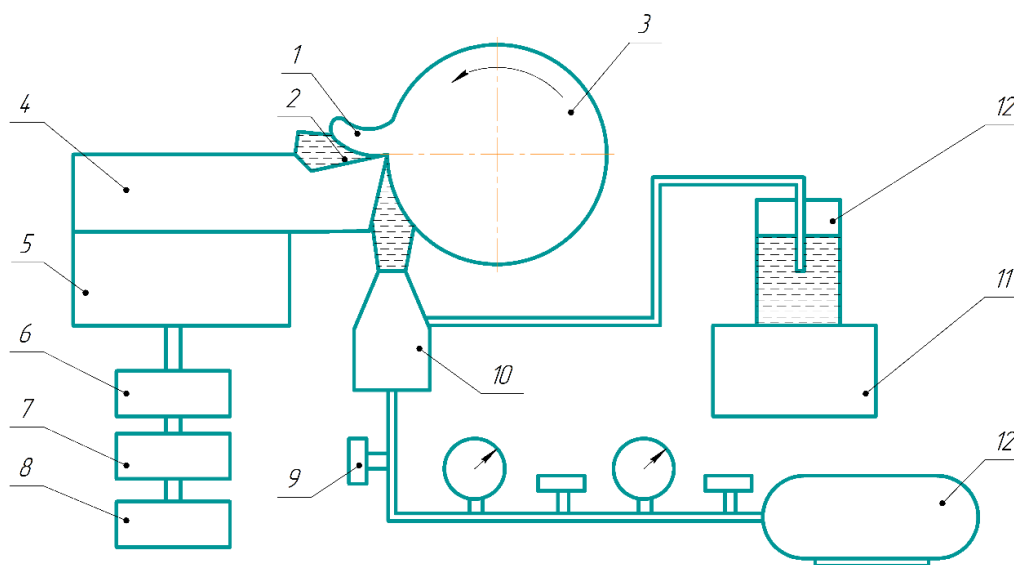
Shu sababli, keyingi yillarda moy tarkibiga molibden disulfid (MoS₂) nanopartikullari kiritilgan nanofluidlardan foydalanishga alohida e’tibor qaratilmoqda. MoS₂ nanopartikullari o‘zining qatlamli kristall tuzilishi bilan ishqalanish yuzalarida yupqa plyonka hosil qilib, kesish kuchini pasaytiradi va issiqlikni samarali olib chiqadi. Mazkur tadqiqotning asosiy maqsadi qattiqlashtirilgan 90CrSi po‘latni kesishda ushbu nanofluidli MQL tizimining kesish kuchi va sirt g‘adir-budurligiga ta’sirini Box–Behnken eksperimental dizayni asosida tahlil qilish hamda nanopartikula konsentratsiyasi, havo bosimi va oqimi kabi parametrlarning optimal qiymatlarini aniqlashdan iboratdir.

TADQIQOT USULLARI

Mazkur tadqiqotda qattiqlashtirilgan po‘latni kesish jarayonida minimal miqdordagi moylash (MQL) sharoitida MoS₂ nanopartikullariga asoslangan

nanofluidning texnologik parametrlarining kesish kuchi va sirt g'adir-budurligiga ta'siri eksperimental ravishda o'rganildi. Tadqiqotning asosiy maqsadi nanofluidli MQL tizimining tribologik va termik samaradorligini baholash hamda texnologik parametrlarning ishlov berish natijalariga ta'sirini aniqlashdan iborat. Tajriba jarayonida nanofluid aerosol shaklida kesish zonasiga uzatiladi, bu esa ishqalanish koeffitsientini kamaytirish va issiqlikni kesish zonasidan samarali olib chiqish imkonini beradi.

Eksperimental qurilmaning umumiy sxemasi nanofluid tayyorlash tizimi, MQL purkash mexanizmi, kesish asbobi, ishlov beriluvchi detal va o'lchash tizimlaridan iborat bo'lib, ushbu tizim kesish jarayonini kompleks nazorat qilish imkonini beradi. Nanofluid maxsus rezervuarda tayyorlanadi va ultratovushli aralashtirgich yordamida bir jinsli suspenziya hosil qilinadi. Tayyorlangan nanofluid siqilgan havo yordamida purkagich orqali kesish zonasiga uzatiladi. Kesish jarayonida hosil bo'ladigan kuchlar Kistler 9257B dinamometri yordamida o'lchanadi va signal kuchaytirgich hamda ma'lumotlarni yig'ish tizimi orqali kompyuterga uzatiladi. Ushbu eksperimental tizimning umumiy tuzilishi 1-rasmda ko'rsatilgan.



1-rasm. Tajriba qurilmasining sxemasi

- 1 – Qirindi (kesish qirindisi); 2 – Nano suyuqlik; 3 – Ishlov berilayotgan detal;**
4 – Asbob; 5 – Kistler 9257B dinamometri; 6 – Kuchaytirgich; 7 -
Ma'lumotlarni yig'ish tizimi; 8 – DasyLab dasturi; 9 – Klapan; 10 -
MQL/MQCL purkagich nozuli; 11 – Ultratovushli aralashtirgich; 12 – Nano
suyuqlik idishi (rezervuari);
13 – Siqilgan havo

Tadqiqotlarda ishlov beriluvchi material sifatida qattiqlashtirilgan 90CrSi po'lat tanlangan bo'lib, uning qattiqligi 60–62 HRC ni tashkil etadi. Ushbu material yuqori mustahkamlik va aşinishga chidamlilik xususiyatlariga ega bo'lib,

qattiq kesish jarayonlarini o'rganishda keng qo'llaniladi. Materialning kimyoviy tarkibi uglerod, kremniy, marganes, xrom va boshqa legirlovchi elementlardan iborat bo'lib, ushbu elementlar materialning mexanik xususiyatlarini va kesish jarayonidagi deformatsiya xatti-harakatini belgilaydi. Tadqiqotda qo'llanilgan material tarkibi 1-jadvalda keltirilgan.

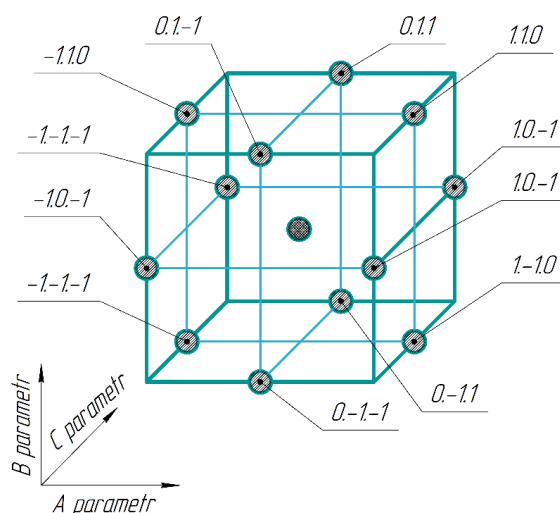
1-jadval
90CrSi po'latining kimyoviy tarkibi, %

Element	C	Si	Mn	Ni	S	P	Cr	Mo	W	V	Ti	Cu
Og'irlik (%)	0.85–0.95	1.20–1.60	0.30–0.60	Maks. 0.40	Maks. 0.03	Maks. 0.03	0.95–1.25	Maks. 0.20	Maks. 0.20	Maks. 0.15	Maks. 0.03	Maks. 0.30

Kesish operatsiyalarida asbob sifatida CBN turidagi kesish plastinkalari qo'llanildi. Ushbu turdagi asboblarda yuqori qattiqlikdagi materiallarni ishlov berishda yuqori termik barqarorlik, aşinishga chidamlilik va kesish jarayonining barqarorligini ta'minlaydi. Tajriba davomida kesish tezligi $V = 160$ m/min, kesish chuqurligi $t = 0.12$ mm va surish miqdori $f = 0.12$ mm/aylanish qilib doimiy saqlandi. Bunday yondashuv eksperimental jarayonda asosiy e'tibor nanofluidli MQL parametrlarining ta'sirini o'rganishga qaratilganligini ta'minlaydi.

Nanofluid moylash muhiti sifatida MoS₂ nanopartikullariga asoslangan suspenziya qo'llanildi. MoS₂ nanopartikullari qatlamli kristall tuzilishga ega bo'lib, kesish yuzalarida tribologik plyonka hosil qilish xususiyatiga ega. Ushbu plyonka kesish yuzalaridagi ishqalanishni kamaytiradi hamda kesish jarayonida hosil bo'ladigan mexanik yuklanishlarning pasayishiga yordam beradi. Bundan tashqari, nanopartikullarning yuqori issiqlik o'tkazuvchanligi kesish zonasidan issiqlikni samarali olib chiqishga imkon beradi, bu esa asbob yeyilishining kamayishi va sirt sifatining yaxshilanishiga olib keladi.

Eksperimental tadqiqotlarni rejalashtirishda Box–Behnken eksperimental dizayni qo'llanildi. Ushbu metod ko'p faktorli texnologik jarayonlarni tahlil qilishda samarali bo'lib, o'rganilayotgan parametrlarning asosiy va o'zaro ta'sirlarini aniqlash imkonini beradi. Tajriba dizaynida uchta asosiy texnologik parametr tanlandi: nanopartikula konsentratsiyasi (NC), havo bosimi (P) va havo oqimi sarfi (Q). Ushbu parametrlarning kombinatsiyalari Box–Behnken dizayni asosida shakllantirilib, eksperimental nuqtalar uch o'lchamli faktor fazosida joylashtirildi. Eksperimental dizaynning geometrik tuzilishi 2-rasmda ko'rsatilgan.



2-rasm. Box–Behnken tajriba loyihasi (eksperiment dizayni)

Eksperimental dizayn asosida jami 15 ta tajriba o‘tkazildi. Har bir tajribada nanofluid parametrlarining ma’lum kombinatsiyasi qo‘llanilib, natijada hosil bo‘lgan sirt g‘adir-budurligi (R_z) va natijaviy kesish kuchi (Fr) qiymatlari qayd etildi. Tajriba natijalari statistik tahlil va matematik modellashirish uchun ishlatildi. Eksperimental tajriba matritsasi hamda o‘lchangan natijalar 2-jadvalda keltirilgan.

Tadqiqot davomida o‘rganilgan texnologik parametrlarning qiymatlari ma’lum diapazonda o‘zgartirildi. Nanopartikula konsentratsiyasi 0.2–0.8 wt% oralig‘ida tanlandi, havo bosimi 4–6 bar diapazonida o‘zgartirildi va havo oqimi sarfi 150–250 L/min qiymatlarda belgilandi. Ushbu parametrlar MQL tizimining kesish zonasida samarali ishlashi uchun muhim hisoblanadi, chunki ular nanofluidning kesish zonasiga yetib borish samaradorligi va moylash jarayonining barqarorligini belgilaydi. Tadqiqotda qo‘llanilgan parametrlarning qiymatlari va ularning diapazoni 3-jadvalda keltirilgan.

2-jadval

Tajriba dizayni va o'lgan natijalar (kesish tezligi $V = 160$ m/min;
kesish chuqurligi $t = 0.12$ mm; uzatish tezligi $f = 0.12$ mm/ayl.)

Standart tartib	Tajriba tartibi	Nuqta turi	Blok	NC (og'%)	p (bar)	Q (L/min)	Rz (μ m)	Fr (N)
5	1	2	1	0.2	5	150	1.848	307.1019
3	2	2	1	0.2	6	200	1.980	385.1642
14	3	0	1	0.5	5	200	1.198	135.7268
10	4	2	1	0.5	6	150	1.321	165.9382
13	5	0	1	0.5	5	200	1.203	143.3989
12	6	2	1	0.5	6	250	1.353	190.324
7	7	2	1	0.2	5	250	1.955	302.4206
8	8	2	1	0.8	5	250	1.898	658.5913
11	9	2	1	0.5	4	250	1.291	208.8865
6	10	2	1	0.8	5	150	2.518	728.2449
4	11	2	1	0.8	6	200	2.143	489.8893
1	12	2	1	0.2	4	200	1.295	268.6225
2	13	2	1	0.8	4	200	2.436	537.0321
9	14	2	1	0.5	4	150	1.846	141.9083
15	15	0	1	0.5	5	200	1.213	155.6953

3-jadval

Kirish parametrlari va ularning qiymatlari

№	Parametr	Belgisi	Past daraja	Yuqori daraja	Natijalar
1	Nanozarrachalar konsentratsiyasi (%)	NC	0.2	0.8	Sirt notekisligi, (Rz) Natijaviy kesish kuchi, (Fr)
2	Havo bosimi (bar)	p	4	6	
3	Havo oqim tezligi (L/min)	Q	150	250	

Kesish jarayonida hosil bo'ladigan natijaviy kesish kuchi Fr uchta kuch komponentining geometrik yig'indisi sifatida aniqlanadi. Ushbu yondashuv kesish jarayonida hosil bo'ladigan umumiy mexanik yuklanishni kompleks tarzda baholash imkonini beradi. Eksperimental natijalar asosida sirt g'adir-budurligi va kesish kuchining regressiya modellari tuzilib, nanofluid parametrlarining ishlov berish jarayoniga ta'siri matematik jihatdan tavsiflandi. Ushbu modellar keyinchalik texnologik parametrlarning optimal qiymatlarini aniqlash hamda kesish jarayonini optimallashtirish uchun asos bo'lib xizmat qiladi.

TADQIQOT NATIJALARI

Eksperimental tadqiqotlar natijasida MoS₂ nanopartikullariga asoslangan nanofluidli MQL parametrlarining sirt g'adir-budurligi va natijaviy kesish kuchiga ta'siri statistik va grafik tahlil usullari yordamida baholandi. Olingan natijalar kesish jarayonining asosiy ko'rsatkichlari sifatida sirt g'adir-budurligi (Rz) va natijaviy kesish kuchi (Fr) orqali tahlil qilindi. Tadqiqot davomida olingan

eksperimental ma'lumotlar ANOVA tahlili, Pareto diagrammalari hamda ta'sir grafigi yordamida baholandi, bu esa texnologik parametrlarning kesish jarayoniga ta'sir darajasini aniqlash imkonini berdi.

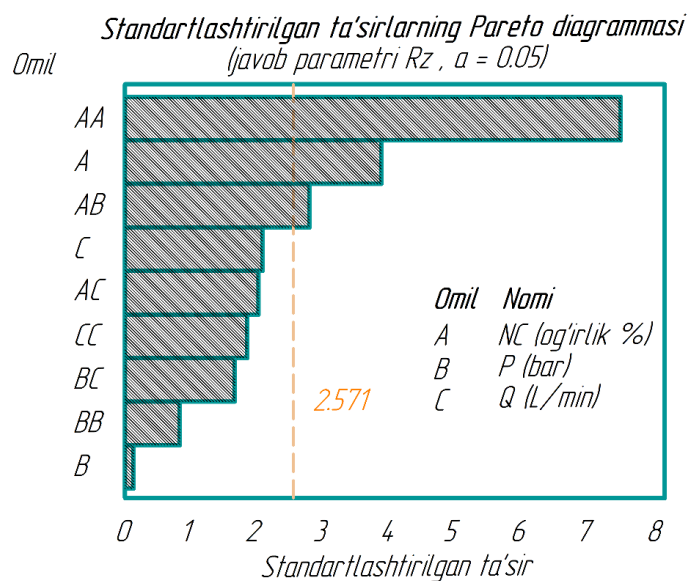
Statistik tahlil natijalari sirt g'adir-budurligiga ta'sir qiluvchi omillarni aniqlash uchun variatsion tahlil yordamida baholandi. ANOVA natijalari sirt g'adir-budurligi uchun tuzilgan regressiya modelining statistik jihatdan ishonchli ekanligini ko'rsatdi. Fisher mezoni qiymati yuqori bo'lishi hamda p-qiymatining 0.05 dan kichik bo'lishi modelning eksperimental natijalarni yaxshi ifodalashini tasdiqlaydi. Regressiya modelining aniqlik koeffitsienti $R^2 = 94.90\%$ bo'lib, tuzilgan model sirt g'adir-budurligining o'zgarishini yetarli darajada izohlash imkonini beradi. Shu bilan birga, tuzatilgan aniqlik koeffitsienti ham yuqori qiymatga ega bo'lib, modelning eksperimental ma'lumotlarga mos kelishini ko'rsatadi. Variatsion tahlil natijalari 4-jadvalda keltirilgan.

4-jadval
Sirt notekisligi Rz uchun ANOVA tahlili natijalari

Manba	DF	Tuzatilgan SS	Tuzatilgan MS	F-qiymat	p-qiymat
Model	9	281.326	0.31258	10.34	0.010
Chiziqli	3	0.59415	0.19805	6.55	0.035
NC (og'.%)	1	0.45936	0.45936	15.19	0.011
P (bar)	1	0.00063	0.00063	0.02	0.891
Q (L/min)	1	0.13416	0.13416	4.44	0.089
Kvadratik	3	176.171	0.58724	19.42	0.003
NC (og'.%) $\times$ NC (og'.%)	1	170.942	170.942	56.53	0.001
P (bar) $\times$ P (bar)	1	0.02270	0.02270	0.75	0.426
Q (L/min) $\times$ Q (L/min)	1	0.10629	0.10629	3.52	0.120
2-omilli o'zaro ta'sir	3	0.45740	0.15247	5.04	0.057
NC (og'.%) $\times$ P (bar)	1	0.23912	0.23912	7.91	0.037
NC (og'.%) $\times$ Q (L/min)	1	0.13213	0.13213	4.37	0.091
P (bar) $\times$ Q (L/min)	1	0.08614	0.08614	2.85	0.152
Xatolik	5	0.15119	0.03024	—	—
Mos kelmaslik	3	0.15108	0.05036	863.29	0.001
Sof xatolik	2	0.00012	0.00006	—	—
Jami	14	296.446	—	—	—

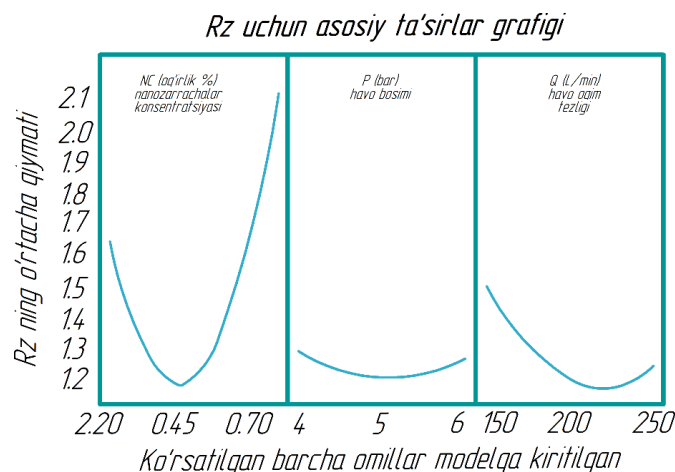
Sirt g'adir-budurligiga ta'sir qiluvchi asosiy texnologik omillarni aniqlash maqsadida standartlashtirilgan effektlar Pareto diagrammasi yordamida baholandi. Pareto diagrammasi sirt g'adir-budurligiga eng katta ta'sir ko'rsatuvchi parametrlar va ularning o'zaro ta'sirlarini ko'rsatadi. Diagramma natijalari nanopartikula konsentratsiyasi asosiy ta'sir qiluvchi omil ekanligini ko'rsatadi. Shuningdek, nanopartikula konsentratsiyasining kvadratik ta'siri ham sezilarli darajada katta ekanligi kuzatiladi. Bu holat MoS₂ nanopartikullari kesish zonasida tribologik plyonka hosil qilish jarayoniga bevosita ta'sir qilishini ko'rsatadi. Boshqa omillar, jumladan havo bosimi va havo oqimi sarfi sirt g'adir-budurligiga

nisbatan kamroq ta'sir ko'rsatadi. Ushbu natijalar Pareto diagrammasida ko'rsatilgan (3-rasm).



3-rasm. Sirt notekisligi R_z ga ishlov berish jarayonidagi kirish omillarining ta'sirini ko'rsatuvchi Pareto diagrammasi. (A – NC: nanozarrachalar konsentratsiyasi, B – P: havo bosimi, C – Q: havo oqim tezligi.)

Texnologik parametrlarning sirt g'adir-budurligiga ta'siri asosiy effektlar grafigi yordamida ham tahlil qilindi. Grafik natijalari nanopartikula konsentratsiyasining oshishi bilan sirt g'adir-budurligi dastlab kamayishini, ma'lum qiymatdan keyin esa yana ortishini ko'rsatadi. Bu holat MoS₂ nanopartikullari kesish zonasida optimal konsentratsiyada eng samarali tribologik muhit hosil qilishini bildiradi. Nanopartikula konsentratsiyasi juda yuqori bo'lganda esa zarrachalar aglomeratsiyasi yuzaga kelishi mumkin, bu esa sirt sifatining yomonlashishiga olib keladi. Havo bosimi va havo oqimi sarfi esa sirt g'adir-budurligiga nisbatan kamroq ta'sir ko'rsatadi, ammo ularning optimal qiymatlari nanofluidning kesish zonasiga samarali yetib borishini ta'minlaydi. Ushbu bog'liqlik 4-rasmda tasvirlangan.



4-rasm. Ishlov berish jarayonidagi kirish omillarining sirt notekisligi Rz ning o'rtacha qiymatlariga ta'siri

Sirt g'adir-budurligiga ta'sir qiluvchi texnologik parametrlarning o'zaro bog'liqligini aniqlash uchun kontur diagrammasi tahlil qilindi. Diagramma nanopartikula konsentratsiyasi va havo bosimi o'rtasidagi bog'liqlikni ko'rsatadi. Tahlil natijalariga ko'ra, nanopartikula konsentratsiyasi 0.2–0.45% diapazonida bo'lganda sirt g'adir-budurligi qiymatlari kamayadi. Bu holat MoS₂ nanopartikullari kesish zonasiga kirib borib, tribofilm hosil qilishi natijasida ishqalanishning kamayishi bilan izohlanadi. Biroq nanopartikula konsentratsiyasi ortib borishi bilan zarrachalarning aglomeratsiyasi yuzaga keladi va bu sirt g'adir-budurligining ortishiga sabab bo'ladi.

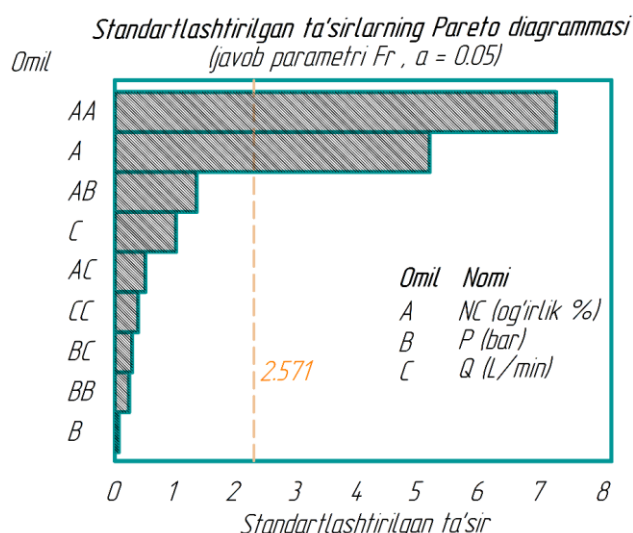
Kesish jarayonining yana bir muhim ko'rsatkichi bo'lgan natijaviy kesish kuchi Fr ham statistik usullar yordamida tahlil qilindi. Kesish kuchi uchun o'tkazilgan ANOVA tahlili modelning statistik jihatdan ishonchli ekanligini ko'rsatdi. Tahlil natijalariga ko'ra, nanopartikula konsentratsiyasi kesish kuchiga sezilarli darajada ta'sir ko'rsatadi. Boshqa omillar, jumladan havo bosimi va havo oqimi sarfi kesish kuchiga nisbatan kamroq ta'sir qiladi. Variatsion tahlil natijalari 5-jadvalda keltirilgan.

Kesish kuchiga ta'sir qiluvchi omillarni yanada aniqroq baholash uchun Pareto diagrammasi tahlil qilindi. Diagramma natijalari nanopartikula konsentratsiyasi kesish kuchiga eng katta ta'sir ko'rsatishini ko'rsatadi. Bundan tashqari, nanopartikula konsentratsiyasining kvadratik ta'siri ham muhim ahamiyatga ega. Bu holat MoS₂ nanopartikullari kesish yuzalarida tribologik qatlam hosil qilib, kesish jarayonidagi ishqalanish va deformatsiya jarayonlarini o'zgartirishini ko'rsatadi. Pareto diagrammasi 5-rasmda keltirilgan.

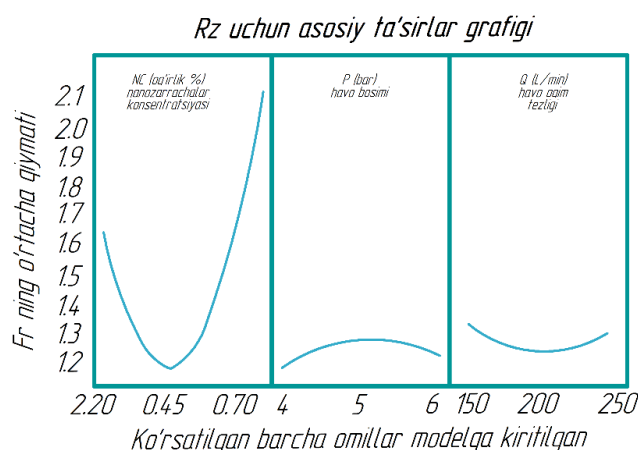
Texnologik parametrlarning kesish kuchiga ta'siri asosiy effektlar grafigi orqali ham tahlil qilindi. Grafik natijalari nanopartikula konsentratsiyasi ortishi bilan kesish kuchining sezilarli darajada kamayishini ko'rsatadi. Bu holat MoS₂ nanopartikullarining yuqori moylash xususiyati bilan izohlanadi, chunki nanopartikullar kesish yuzalarida ishqalanishni kamaytiradi va kesish jarayonini barqarorlashtiradi. Havo bosimi va havo oqimi sarfi esa kesish kuchiga nisbatan

kamroq ta'sir ko'rsatadi, ammo ular nanofluidning kesish zonasiga yetib borish samaradorligini belgilaydi. Ushbu bog'liqlik 6-rasmda ko'rsatilgan.

Nanopartikula konsentratsiyasi va havo bosimi parametrlarining kesish kuchiga birgalikdagi ta'siri kontur diagrammasi yordamida tahlil qilindi. Diagramma natijalari nanopartikula konsentratsiyasi oshishi bilan kesish kuchining kamayishini ko'rsatadi. Biroq nanopartikula konsentratsiyasining juda yuqori qiymatlarida kesish kuchining ortishi kuzatiladi, bu esa nanopartikullar aglomeratsiyasi va tribologik muhitning barqaror emasligi bilan izohlanadi.



5-rasm. Ishlov berish jarayonidagi kirish omillarining natijaviy kesish kuchi Fr ga ta'sirini ko'rsatuvchi Pareto diagrammasi (A – NC: nanozarrachalar konsentratsiyasi, B – P: havo bosimi, C – Q: havo oqim tezligi)



6-rasm. Ishlov berish jarayonidagi kirish omillarining natijaviy kesish kuchi Fr ning o'rtacha qiymatlariga ta'siri

5-jadval

Natijaviy kesish kuchi Fr uchun ANOVA tahlili natijalari

Manba	DF	Tuzatilgan SS	Tuzatilgan MS	F-qiyamat	p-qiyamat
Model	9	516,799	57,422	11.69	0.007
Chiziqli	3	166,178	55,393	11.27	0.012
NC (og'.%)	1	165,441	165,441	33.67	0.002
P (bar)	1	701	701	0.14	0.721
Q (L/min)	1	36	36	0.01	0.935
Kvadratik	3	342,414	114,138	23.23	0.002
NC (og'.%) × NC (og'.%)	1	329,613	329,613	67.09	0.000
P (bar) × P (bar)	1	2047	2047	0.42	0.547
Q (L/min) × Q (L/min)	1	11,319	11,319	2.30	0.190
Ikki omilli o'zaro ta'sir	3	8207	2736	0.56	0.666
NC (og'.%) × P (bar)	1	6698	6698	1.36	0.296
NC (og'.%) × Q (L/min)	1	1055	1055	0.21	0.663
P (bar) × Q (L/min)	1	454	454	0.09	0.773
Xatolik	5	24,566	4913	—	—
Mos kelmaslik	3	24,363	8121	80.04	0.012
Sof xatolik	2	203	101	—	—
Jami	14	541,365	—	—	—

Eksperimental natijalar asosida texnologik parametrlarning optimal qiymatlarini aniqlash maqsadida optimallashtirish jarayoni amalga oshirildi. Birinchi bosqichda kesish kuchini minimal qiymatga keltirish maqsadida yagona maqsadli optimallashtirish o'tkazildi. Natijalar kesish kuchining eng kichik qiymati nanopartikula konsentratsiyasi taxminan 0.4%, havo bosimi 4 bar va havo oqimi sarfi 192 L/min atrofida bo'lganda kuzatilishini ko'rsatdi.

Keyingi bosqichda sirt g'adir-budurligi va kesish kuchini bir vaqtning o'zida minimallashtirish maqsadida ko'p maqsadli optimallashtirish amalga oshirildi. Natijalar nanopartikula konsentratsiyasi 0.42%, havo bosimi 4.14 bar va havo oqimi sarfi 211 L/min qiymatlarida kesish kuchi va sirt g'adir-budurligining eng maqbul qiymatlari kuzatilishini ko'rsatdi. Ushbu optimal sharoitlarda kesish kuchi $Fr \approx 113.67$ N va sirt g'adir-budurligi $Rz \approx 1.158$ μ m qiymatlarda aniqlangan.

MUHOKAMA

Olingan natijalar MoS₂ nanofluidli MQL tizimi qattiq kesish jarayonidagi tribologik sharoitlarni tubdan yaxshilashini tasdiqladi. Sirt g'adir-budurligi va kesish kuchining o'zgarishida nanopartikula konsentratsiyasi eng asosiy boshqaruvchi omil bo'lib xizmat qiladi. Statistik tahlillar va Pareto diagrammalari ushbu parametrning dominant rolini ko'rsatib, sirt sifati bevosita konsentratsiya miqdoriga bog'liqligini isbotladi.

MoS₂ nanopartikullarining qatlamli tuzilishi kesish zonasida metallar kontaktini kamaytiruvchi himoya qatlami hosil qiladi. Bu esa ishqalanishni pasaytirib, mexanik yuklanishlarni kamaytiradi. Biroq konsentratsiya me'yordan

oshib ketganda zarrachalar klasterlarga aylanib, sirt sifatini yomonlashtirishi mumkin. Asosiy effektlar grafigi ham konsentratsiya oshishi bilan sirt g'adir-budurligi avval kamayib, so'ngra ortishini ko'rsatdi.

Havo bosimi va oqimi esa nanofluidning kesish zonasiga aerosol shaklida yetib borishini ta'minlaydi. Optimal bosim barqaror tribologik plyonka hosil qilish uchun muhim, chunki haddan tashqari yuqori bosim moylash muhitini zonadan tez chiqarib yuboradi. Kontur diagrammalari orqali nanopartikula konsentratsiyasi va havo bosimining birgalikdagi ta'siri sirt sifatini belgilashi aniqlandi.

Kesish kuchining o'zgarishi ham shunday tendensiyaga ega bo'lib, MoS₂ zarrachalari qirindi hosil bo'lishidagi deformatsiya qarshiligini kamaytiradi. Optimallashtirish natijalari shuni ko'rsatdiki, nanopartikula konsentratsiyasi taxminan 0.4% bo'lganda kesish kuchi minimal qiymatga erishadi. Ko'p maqsadli optimallashtirish esa ham kesish kuchini, ham sirt g'adir-budurligini bir vaqtda minimallashtiruvchi eng samarali texnologik sharoitlarni aniqlash imkonini berdi.

XULOSA

Ushbu tadqiqot natijalari MoS₂ nanopartikullari asosidagi nanofluidli MQL tizimi qattiqashtirilgan 90CrSi po'latni kesishda yuqori texnologik samaradorlikka ega ekanligini tasdiqladi. Tajribalar davomida olingan natijalar sirt g'adir-budurligi va kesish kuchiga nanofluid parametrlarining ta'siri yuqori ekanligini ko'rsatdi.

Statistik tahlil orqali sirt g'adir-budurligi uchun ishlab chiqilgan regressiya modelining aniqlik koeffitsienti $R^2 = 94.90\%$ ni tashkil etdi, bu esa matematik modelning amaliy natijalar bilan yuqori mosligini tasdiqlaydi. Pareto diagrammasiga ko'ra, sirt sifatiga ta'sir qiluvchi eng asosiy va dominant omil nanopartikula konsentratsiyasi bo'lib chiqdi. MoS₂ nanopartikullari kesish zonasida tribologik plyonka hosil qilib, ishqalanishni va deformatsiya qarshiligini kamaytiradi, natijada kesish kuchi pasayib, sirt sifati yaxshilanadi. Biroq konsentratsiyaning me'yordan ortishi zarrachalar aglomeratsiyasiga sabab bo'lib, jarayon barqarorligini pasaytiradi.

Optimallashtirish natijalari kesish jarayoni uchun eng qulay sharoitlarni aniqlab berdi. Yagona maqsadli tahlilda kesish kuchining eng kichik qiymati 0.4% konsentratsiya, 4 bar havo bosimi va 192 L/min havo oqimi sarfida qayd etildi. Ko'p maqsadli optimallashtirish esa kesish kuchi va sirt g'adir-budurligini bir vaqtda minimallashtirish uchun nanopartikula konsentratsiyasi 0.42%, havo bosimi 4.14 bar va havo oqimi sarfi 211 L/min bo'lishi zarurligini ko'rsatdi. Bunday optimal sharoitda kesish kuchi 113.67 N, sirt g'adir-budurligi esa 1.158 μm darajasida bo'lishi aniqlandi.

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EARLY DIAGNOSIS SYSTEMS FOR DISEASE DETECTION

Abstract: *This article discusses modern diagnostic systems used for early disease detection, their types, and importance. In particular, laboratory, imaging, and genetic diagnostic methods, as well as the capabilities of artificial intelligence-based technologies, are analyzed. In addition, the advantages of diagnostic systems, existing challenges, and ways to overcome them are considered. The results of the study show that early diagnosis plays an important role in preventing diseases, improving treatment effectiveness, and strengthening human health.*

Keywords: *Diagnostic systems, early detection, diseases, laboratory diagnostics, imaging methods, genetic analysis, artificial intelligence, medical technologies, healthcare, prevention.*

Introduction:

Today, the issue of early disease detection has become especially important in the healthcare system. Human health is one of the key factors of social development, and its protection is a priority task of every country. Detecting diseases at an early stage allows effective treatment, prevention of serious complications, and extension of human life expectancy. Therefore, modern medicine widely uses diagnostic systems, which are continuously being improved. Diagnostic systems are a set of methods, tools, and technologies used to identify, analyze, and evaluate diseases. With their help, doctors detect changes occurring in the patient's body and make accurate diagnoses. Modern diagnostic methods are characterized by high accuracy, speed, and reliability, which significantly improves the quality of medical services. Laboratory diagnostics is one of the main fields in medicine. It involves the analysis of blood, urine, and other biological materials. Blood tests provide important information about inflammatory processes, infections, hormonal changes, and metabolic disorders in the body. Urine tests are important for assessing kidney and urinary tract functions. Modern laboratories are equipped with automated devices that provide fast and highly accurate results. Imaging diagnostics also plays an important role in disease detection. This method allows visualization of internal organs. Techniques such as X-ray, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) are used to detect various diseases. These technologies are especially effective in identifying tumors, injuries, and internal inflammations. Imaging methods allow doctors to determine the exact location and stage of a

disease. Genetic diagnostics is one of the most promising areas of modern medicine. It allows the detection of genetic changes in the human body. Genetic testing can identify hereditary diseases or predispositions to them. This makes it possible to take preventive measures in time. Genetic diagnostics is especially important in detecting congenital diseases. In recent years, artificial intelligence technologies have significantly influenced the field of diagnostics. AI systems can quickly analyze large amounts of medical data. They assist doctors in processing medical images, detecting diseases, and making diagnoses. In some cases, artificial intelligence may provide more accurate results than human analysis, which improves diagnostic efficiency. Early diagnosis is one of the key factors in effective disease treatment. If a disease is detected at an early stage, it is easier to treat and requires lower costs. It also improves the patient's quality of life and prevents serious complications. Therefore, regular screening and diagnostic procedures are very important. Diagnostic systems have many advantages. They help detect diseases early, improve treatment effectiveness, reduce medical errors, and increase the overall efficiency of healthcare systems. However, there are also some challenges, such as the high cost of modern equipment and the shortage of qualified specialists.

Digital technologies play an important role in the development of diagnostic systems. Electronic health records, databases, and telemedicine systems make it easier to store and analyze patient data. Telemedicine allows patients in remote areas to receive quality medical services, expanding the coverage of healthcare systems.

In addition, mobile diagnostic devices are becoming more widespread. They allow basic medical tests to be performed at home, such as measuring blood pressure, blood sugar levels, or monitoring heart activity. This helps in early disease detection.

Discussion

In the future, diagnostic systems are expected to develop further. The combination of nanotechnology, biotechnology, and artificial intelligence will lead to the creation of new diagnostic methods. This will enable even earlier and more accurate disease detection. Personalized medicine will also develop, providing individualized diagnosis and treatment approaches for each patient.

The analysis of early disease detection systems shows that modern diagnostic technologies have significantly improved the accuracy, speed, and reliability of medical diagnosis. Compared to traditional clinical methods, laboratory, imaging, and genetic diagnostics provide more detailed and objective information about the patient's condition. This allows healthcare professionals to identify diseases at an earlier stage, when treatment is more effective and complications are less likely to develop. One of the key findings is that the integration of different diagnostic methods increases overall diagnostic accuracy. Laboratory tests provide biochemical information about the body, imaging techniques reveal structural changes in organs, and genetic diagnostics identifies inherited risks. When these methods are used together, they complement each

other and create a more complete clinical picture, which is essential for making correct medical decisions.

The introduction of artificial intelligence (AI) into diagnostic systems has also brought significant improvements. AI-based tools are capable of processing large volumes of medical data in a short time and can assist doctors in identifying patterns that may not be easily visible to the human eye. In particular, AI has shown strong potential in analyzing radiological images such as X-rays, CT scans, and MRI results. However, despite its advantages, AI should be considered as a supportive tool rather than a replacement for medical specialists, since final diagnostic decisions still require human expertise and clinical judgment.

Despite these advancements, several challenges remain. The high cost of modern diagnostic equipment limits its availability in some healthcare facilities, especially in developing regions. In addition, the shortage of trained medical specialists and technical staff reduces the efficiency of advanced diagnostic systems. Unequal access to healthcare technologies also creates disparities in diagnostic quality between urban and rural areas.

Another important issue is the need for proper data management and security in digital healthcare systems. As diagnostic processes become more dependent on electronic records and AI-based platforms, ensuring patient data privacy and system reliability becomes increasingly important.

Nevertheless, recent developments in telemedicine and mobile health technologies are helping to overcome some of these challenges. Remote consultation systems and portable diagnostic devices make healthcare services more accessible, particularly for patients in remote or underserved areas. This contributes to earlier detection of diseases and improves overall healthcare outcomes.

Conclusion

In conclusion, diagnostic systems for early disease detection are one of the most important and integral parts of modern medicine. They allow diseases to be detected at early stages, properly evaluated, and effectively treated. This improves patient recovery rates and prevents severe complications. Research shows that laboratory, imaging, and genetic diagnostic methods, as well as artificial intelligence-based technologies, are highly effective in medicine. In particular, combining these methods increases diagnostic accuracy and improves treatment processes. At the same time, it is important to address existing challenges in the development of diagnostic systems, widely implement modern equipment, and train qualified specialists. In the future, further technological development will make diagnostics faster, more accurate, and more convenient. Overall, diagnostic systems are one of the key areas shaping the future of healthcare, and their improvement is of great importance for human well-being.

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GLOBAL IQLIM O'ZGARISHI SHAROITIDA ZARAFSHON DARYOSI HAVZASIDAGI MUZLIKLAR MAYDONINING O'ZGARISHI VA UNING GIDROLOGIK OQIBATLARI

***Annotatsiya.** Maqolada global iqlim o'zgarishlarining transchegaraviy va mintaqaviy suv resurslariga, xususan, O'rta Zarafshon havzasining gidrologik rejimiga ta'sirining tabiiy-geografik asoslari va oqibatlari keng tahlil qilingan. Mavzuda Zarafshon daryosi havzasining iqlimiy omillari (havo harorati, yog'in-sochin miqdori, bug'lanish) dinamikasi, muzliklarning erishi va ularning suv sarfiga ta'siri yoritilgan. Shuningdek, hududdagi aholi jon boshiga suv ta'minoti darajasi, suv balansi hamda suv resurslaridan samarali foydalanish holati ilmiy nuqtai nazardan tahlil qilingan. Tadqiqot obyekti misolida mintaqaviy ekologik barqarorlikni ta'minlash hamda suv tanqisligi (suv stressi) va iqlim o'zgarishlariga moslashish (adaptatsiya) strategiyalari ishlab chiqilgan.*

***Kalit so'zlar:** global iqlim o'zgarishi, O'rta Zarafshon, suv resurslari, daryo oqimi, iqlimiy omillar, gidrologik rejim, suv tanqisligi, suv stressi, muzliklarning chekinishi, integratsiyalashgan suv resurslari boshqaruvi, adaptatsiya.*

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CHANGES IN THE GLACIER AREA IN THE ZARAFSHAN RIVER BASIN AND ITS HYDROLOGICAL CONSEQUENCES UNDER GLOBAL CLIMATE CHANGE

Abstract. *The article provides a comprehensive analysis of the natural and geographical foundations and consequences of the impact of global climate change on transboundary and regional water resources, in particular, on the hydrological regime of the Middle Zarafshan basin. The topic covers the dynamics of climatic factors (air temperature, precipitation, evaporation) of the Zarafshan river basin, the melting of glaciers and their impact on water consumption. Also, the level of water supply per capita in the region, the water balance and the state of efficient use of water resources are analyzed from a scientific point of view. Using the example of the research object, strategies for ensuring regional ecological stability and adapting to water scarcity (water stress) and climate change (adaptation) are developed.*

Keywords: *global climate change, Middle Zarafshan, water resources, river flow, climatic factors, hydrological regime, water scarcity, water stress, glacier retreat, integrated water resources management, adaptation.*

Bugungi kunda XXI asrning eng dolzarb global muammolaridan biri — bu global iqlim oʻzgarishi va uning chuchuk suv resurslariga salbiy taʼsiridir. Sayyoramizda havo haroratining koʻtarilishi, gidrologik siklning jadallashishi hamda ekstremal gidrometeorologik hodisalarning koʻpayishi koʻplab mintaqalarda, ayniqsa arid va yarim arid iqlim zonalarida joylashgan hududlarda chuchuk suv tanqisligini yanada keskinlashtirmoqda. Markaziy Osiyo mintaqasi, shu jumladan Oʻzbekiston Respublikasi suv resurslari taqchilligi va iqlim oʻzgarishi oqibatlariga eng zaif hududlardan biri hisoblanadi. Respublikamiz agrosanoat majmuasi, aholi demografik oʻsishi va iqtisodiyot tarmoqlarining rivojlanishi toʻgʻridan-toʻgʻri togʻli hududlarda shakllanadigan transchegaraviy daryolar oqimiga bogʻliq.

Oʻzbekistonning markaziy qismida joylashgan va qadimdan dehqonchilik va madaniyat oʻchogʻi boʻlib kelgan Zarafshon daryosi havzasi ijtimoiy-iqtisodiy jihatdan ulkan ahamiyatga ega. Ayniqsa, Oʻrta Zarafshon tabiiy-geografik okrugi (Samarqand va Navoiy viloyatlarining asosiy qismi) aholi zich joylashgan, intensiv qishloq xoʻjaligi va yirik sanoat tarmoqlari rivojlangan hududdir. Soʻnggi oʻn yilliklarda iqlimning keskin isishi, daryolarni toʻyintiruvchi turgʻun togʻ muzliklarining qisqarishi hamda gidrologik rejimning beqarorlashuvi Oʻrta Zarafshonda suv taʼminoti tizimini jiddiy xavf ostiga qoʻymoqda. Ushbu muammoning tabiiy-geografik asoslarini chuqur oʻrganish, iqlimiy omillar bilan daryo oqimi oʻrtasidagi bogʻliqlik qonuniyatlarini aniqlash hamda kelgusi davrlar uchun ilmiy asoslangan prognozlarni ishlab chiqish nihoyatda dolzarb ilmiy va amaliy vazifadir.

Ushbu tadqiqot ishida Oʻrta Zarafshon havzasidagi iqlim oʻzgarishlari va ularning suv resurslariga taʼsirini baholash maqsadida tarixiy-qiyosiy, statistik

tahlil, gidrologik va meteorologik ma'lumotlarni umumlashtirish hamda kartografik va geografik modellash tirish metodlaridan foydalanildi. Tadqiqotning empirik asosi sifatida O'zbekiston Respublikasi Gidrometeorologiya xizmati agentligi (O'zgidromet)ning ko'p yillik (1960–2025-yillar) meteorologik va gidrologik kuzatuv stansiyalari ma'lumotlari, jumladan, havo harorati, yog'in-sochin miqdori, daryo suv sarfi (omborlar va gidropostlar kesimida) hamda BMTning Oziq-ovqat va qishloq xo'jaligi tashkiloti (FAO)ning AQUASTAT ma'lumotlar bazasi materiallaridan keng foydalanildi.

Shuningdek, hududning daryo havzalaridagi muzliklar maydonining o'zgarishini o'rganish uchun uzoqdan zondlash ma'lumotlari (Landsat va Sentinel sun'iy yo'ldosh tasvirlari) hamda tabiiy-geografik okruglashtirish tamoyillari asos qilib olindi. Olingan ma'lumotlar statistik paketlar yordamida tahlil qilinib, iqlimiy trendlar va daryo oqimining korrelyatsion bog'liqliklari hisoblab chiqildi.

Zarafshon daryosi o'z manbaini Tojikiston Respublikasidagi tog' tizmalaridan (Zarafshon muzligidan) oladi va asosan qor-muzliklar hisobiga to'yinadi. Shu sababli daryoning gidrologik rejimi havzadagi iqlim o'zgarishlariga nihoyatda sezgirdir. Ko'p yillik meteorologik kuzatishlar shuni ko'rsatadiki, O'rta Osiyo mintaqasida, xususan Zarafshon havzasida o'rtacha yillik havo harorati har o'n yillikda o'rtacha 0.2–0.3°C ga ko'tarilmoqda. Tog'li hududlarda esa bu ko'rsatkich yanada yuqori bo'lib, turg'un muzliklar va qor qoplaminin intensiv erishiga va maydonining qisqarishiga olib kelmoqda. Ilmiy ma'lumotlarga ko'ra, so'nggi 50 yilda Zarafshon daryosini to'yintiruvchi muzliklar hajmi qariyb 25-30 foizga kamaygan.

Iqlim isishining boshlang'ich bosqichida muzliklarning jadal erishi hisobiga daryolarda suv miqdorining vaqtincha ortishi yoki barqarorligi kuzatilsa-da, muzlik resurslarining tugab borishi natijasida kelgusida daryo oqimining keskin kamayishi prognoz qilinmoqda. Zarafshon daryosining o'rtacha ko'p yillik oqimi qariyb 5.3 km³ ni tashkil etadi. Biroq iqlim o'zgarishi va yog'inlar taqsimotining buzilishi oqibatida suv miqdorining yillik va mavsumiy tebranishlari (amplitudasi) keskinlashgan: kamsuvli yillar ketma-ketligi davomiyligi ortib bormoqda.

Dunyo miqyosida chuchuk suv zaxiralarining mintaqaviy taqsimoti tahlil qilinganda (1-jadval), chuchuk suv resurslarining asosiy qismi Janubiy Amerika (28%) va Osiyo (26%) qit'alariga to'g'ri kelishi ma'lum bo'ladi. Osiyo qit'asi global suv resurslarining choragidan ko'prog'iga ega bo'lsa-da, aholi zichligi eng yuqori bo'lganligi sababli, hududda suv tanqisligi va suv stressi dolzarb muammo hisoblanadi. O'rta Zarafshon mintaqasi ham aynan Osiyoning arid mintaqasida joylashgani bois global suv inqirozining ichki regional ko'rinishidir.

1-jadval

Dunyo bo'yicha mavjud yillik chuchuk suv zaxirasi taqsimoti
(Mintaqaviy kontekst)

Mintaqa	Yillik chuchuk suv zaxirasi (km ³)	Global ulushi (%)
Janubiy Amerika	~12000	28%
Osiyo	~11000	26%
Shimoliy Amerika	~6000	14%
Afrika	~4000	9%
Yevropa	~3500	8%
Avstraliya va Okeaniya	~2500	6%

Manba: FAO (AQUASTAT) global ma'lumotlari asosida qayta ishlangan.

Jahon sog'liqni saqlash tashkiloti va FAO tavsiyalariga ko'ra, mamlakatlar va mintaqalarning suv ta'minoti aholi jon boshiga to'g'ri keladigan yillik chuchuk suv miqdori (m³/odam/yil) bilan o'lchanadi. Ushbu mezonlar asosida quyidagi xalqaro suv stressi shkalasi amal qiladi:

1. >1700 m³/odam/yil – suv tanqisligi yo'q (barqaror ta'minot);
2. 1000 - 1700 m³/odam/yil – suv stressi (suv yetishmovchiligi davriy seziladi);
3. 500 - 1000 m³/odam/yil – suv tanqisligi (doimiy tanqislik);
4. <500 m³/odam/yil – kuchli suv tanqisligi yoki o'tkir suv inqirozi (water scarcity crisis).

Ushbu xalqaro mezonlarni O'zbekiston va O'rta Zarafshon tabiiy-geografik hududiga tatbiq etsak, vaziyatning naqadar jiddiy ekanligi namoyon bo'ladi. Respublikamizda aholi sonining shiddat bilan o'sishi hamda gidrologik resurslarning kamayishi oqibatida jon boshiga suv ta'minoti yildan-yilga pasayib bormoqda. Hozirgi kunda mamlakatimiz bo'yicha o'rtacha ko'rsatkich ~1500 m³/odam/yilni tashkil etib, hudud 'suv stressi' holatida ekanligini ko'rsatadi. O'rta Zarafshon ichki gidrografik havzalarida esa aholi zichligi o'ta yuqori bo'lganligi (Samarqand viloyati respublikada aholi soni bo'yicha yetakchi) hamda suvning transchegaraviy kelishiga bog'liqligi sababli, vegetatsiya (sug'orish) davrida real suv ta'minoti 1000 m³/odam/yildan pasayib, keskin suv tanqisligi kuzatilmoqda.

**Ayrim davlatlar va O'zbekiston (O'rta Zarafshon) aholi jon boshiga
yillik suv miqdori taqsimoti**

Davlatlar	Aholi jon boshiga chuchuk suv miqdori (m ³ /yil)	Suv resurslari holati
Kanada	~80000	Juda boy suv resurslari
Rossiya	~30000	Juda boy suv resurslari
Braziliya	~25000	Yyetarli / Mo'l
AQSh	~9000	Yyetarli
Xitoy	~2000	Yaqqol stress yaqinida
O'zbekiston (O'rta Zarafshon)	~1500	Suv stressi holati
Hindiston	~1100	Suv stressi / Tanqislik xavfi
Misr	~600	Suv tanqisligi
Saudiya Arabistoni	<100	Ekstremal suv tanqisligi

Manba: UNESCO (WWAP) va O'zgidromet ko'p yillik ma'lumotlari asosida tuzilgan.

O'rta Zarafshon havzasida gidrologik o'zgarishlarning tabiiy-geografik asoslari va iqlimiy omillarining ta'sir mexanizmlari quyidagi qonuniyatlar bilan ifodalanadi:

1. Temperatur trendlarining yuqoriligi va bug'lanish: O'rta Zarafshon okrugining tekislik va adir qismlarida yozgi havo haroratining keskin ko'tarilishi tuproq va sirtqi suv havzalaridan bug'lanish (evapotranspiratsiya) ko'rsatkichini 10–15% ga oshirgan. Bu esa daryodan olinadigan sug'orish suviga bo'lgan sof talabni sun'iy ravishda ko'paytiradi.

2. Atmosfera yog'inlari rejimining o'zgarishi: Yillik yog'inlar miqdori umumiy hisobda keskin o'zgarmagan bo'lsa-da, ularning mavsumiy taqsimoti boshqacha tus olmoqda. Qishki yog'inlarning qor ko'rinishida emas, balki yomg'ir ko'rinishida yog'ishi tog'larda barqaror qor zaxiralarining to'planishiga to'sqinlik qilmoqda. Natijada, bahorgi toshqinlar barvaqt boshlanib, vegetatsiya davrining eng qizg'in pallasi (iyul-avgust oylarida) daryoda suv sathi keskin pasayib ketmoqda.

3. Antropogen va demografik bosim: O'rta Zarafshon hududida urbanizatsiya va sanoatlashuv darajasi yuqori. Aholi sonining ortishi kommunal-maishiy va sanoat ehtiyojlari uchun chuchuk suv sarfini bir necha barobarga oshirdi. Qishloq xo'jaligida hamon eski sug'orish usullaridan (egatlab sug'orish) keng foydalanilishi suvning filtratsiya va bug'lanishga behuda sarf bo'lishiga (35-40% gacha yo'qotishlar) sabab bo'lmoqda.

4. Transchegaraviy bog'liqlik: Zarafshon daryosi oqimining asosiy qismi qo'shni respublikada shakllanishi, uning quyi oqimi va o'rta qismidagi suv taqsimoti tizimini davlatlararo kelishuvlar hamda iqlimiy o'zgarishlar sharoitida integratsiyalashgan holda boshqarishni talab etadi.

Xulosa qilib aytganda, global iqlim o'zgarishi O'rta Zarafshon tabiiy-geografik okrugining chuchuk suv resurslariga va gidrologik barqarorligiga

to'g'ridan-to'g'ri va jiddiy xavf solmoqda. Haroratning ko'tarilishi va muzliklarning qisqarishi daryo oqimi rejimini beqarorlashtirib, hududni barqaror rivojlanish maqsadlariga erishishda ortga tortmoqda. Suv taqchilligi va ekologik inqirozlarning oldini olish uchun mintaqada quyidagi strategik tadbirlarni amalga oshirish ilmiy va amaliy jihatdan zarur deb hisoblanadi:

1. Suvni tejaydigan raqamli va innovatsion texnologiyalarni (tomchilatib, yomg'irlatib va tuproq ostidan sug'orish tizimlari) barcha agrar tarmoqlarda majburiy joriy etish;

2. O'rta Zarafshon hududidagi magistral va sug'orish kanallarini betonlashtirish hamda yopiq quvurli tizimlarga o'tkazish orqali filtratsiya va bug'lanishdagi yo'qotishlarni minimal darajaga tushirish;

3. Iqlim o'zgarishlariga moslashgan, qurg'oqchilikka va sho'rga chidamli qishloq xo'jaligi ekinlari navlarini seleksiya qilish va ekish tarkibini diversifikatsiya qilish;

4. Zarafshon daryosi havzasida gidrometeorologik monitoring tizimini to'liq avtomatlashtirish, sun'iy yo'ldosh ma'lumotlari yordamida muzliklar va qor qoplami dinamikasini doimiy prognoz qilib borish;

5. Suv resurslarini integratsiyalashgan holda boshqarish (ISRB) tamoyillarini kengaytirish, suv iste'moli madaniyatini oshirish va aholi o'rtasida chuchuk suvni asrash bo'yicha ekologik targ'ibotni kuchaytirish.

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GLOBAL IQLIM O'ZGARISHINING SUV RESURSLARIGA TA'SIRINI TABIIY-GEOGRAFIK ASOSLARI (O'RTA ZARAFSHON MISOLIDA)

Annotatsiya. Global iqlim o'zgarishi gidrosfera komponentlari, xususan, chidamliligi past bo'lgan ichki gidrografik tarmoqlarga jiddiy ta'sir ko'rsatmoqda. Ushbu maqola O'rta Zarafshon medoralligi misolida iqlim o'zgarishining suv resurslariga ta'sirini tabiiy-geografik jihatdan o'rganadi. Maqolada mintaqada havo haroratining ko'tarilishi, tog' muzliklarining degradatsiyasi, daryo oqimi rejimining o'zgarishi va gidrologik qurg'oqchilik kabi omillar tahlil qilinadi. Shuningdek, suv tanqisligi sharoitida mintaqaning ekologik va geografik barqarorligini ta'minlashga qaratilgan tabiiy-geografik moslashuv strategiyalari va ularning samaradorligi ko'rib chiqiladi.

Kalit so'zlar: iqlim o'zgarishi, suv resurslari, O'rta Zarafshon, muzliklar degradatsiyasi, daryo oqimi, gidrologik rejim, tabiiy-geografik asoslar.

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NATURAL-GEOGRAPHICAL BASIS OF THE IMPACT OF GLOBAL CLIMATE CHANGE ON WATER RESOURCES (ON THE EXAMPLE OF THE MIDDLE ZARAFSHON REGION)

Abstract. Global climate change significantly impacts the hydrosphere components, particularly vulnerable inland hydrographic networks. This article examines the natural-geographic foundations of climate change effects on water

resources using the Middle Zarafshon region as a case study. The study analyzes factors such as rising regional temperatures, degradation of mountain glaciers, shifts in river runoff regimes, and hydrological droughts. Additionally, it explores natural-geographic adaptation strategies aimed at ensuring the ecological and geographical stability of the region under water scarcity conditions and evaluates their effectiveness.

Keywords: *climate change, water resources, Middle Zarafshon, glacier degradation, river runoff, hydrological regime, natural-geographic foundations.*

Oʻrta Zarafshon hududi geografik joylashuvi va gidrologik tuzilishiga koʻra Oʻzbekiston qishloq xoʻjaligi va sanoatining eng muhim va aholi zich joylashgan tabiiy geografik okruglaridan biridir. Mintaqaviy gidrometeorologik maʼlumotlarga koʻra, 2023-yilda Zarafshon daryosi havzasi respublikaning sugʻoriladigan dehqonchilik va shahar jamoat xoʻjaliklari suv taʼminotining taxminan 20-22 % qismini taʼminlagan. Biroq, soʻnggi oʻn yilliklarda mintaqada kuzatilayotgan iqlimiy oʻzgarishlar daryo havzasining shakllanish zonalarida jiddiy gidrologik qiyinchiliklarni keltirib chiqarmoqda. Oʻzbekiston Gidrometeorologiya xizmati (Oʻzgidromet) kuzatuvlariga koʻra, Oʻrta Zarafshon hududi va uning yuqori suv shakllanish havzalarida oʻrtacha yillik harorat 1980-yildan 2020-yilgacha 1,3°C ga oshgan.

Ushbu harorat oʻsishi, birinchi navbatda, daryoni toʻyintiruvchi yuqori togʻlik zonalaridagi muzliklar va doimiy qor qoplamlarining tez surʼatlar bilan erishi hamda qisqarishiga (degradatsiyasiga) olib keldi. Agar ilgari Zarafshon daryosining maksimal toʻlin suv davri iyun-iyul oylariga (muzliklarning barqaror erish davriga) toʻgʻri kelgan boʻlsa, soʻnggi yillarda vegetatsiya davrining boshlanishi va daryo oqimining maksimal nuqtasi mart-aprel oylariga siljimoqda. Bu holat erta bahor oylarida kutilmagan gidrologik toshqinlar va sel hodisalari xavfini oshirsa, yozgi eng faol agrotexnik sugʻorish davrida (iyul-avgust) keskin suv tanqisligini yuzaga keltirmoqda va daryoning quyi oqimlarida ekologik muvozanatga putur yetkazmoqda.

Yogʻinlar miqdori va uning ichki mavsumiy taqsimlanishidagi oʻzgarishlar ham Oʻrta Zarafshon daryo oqimining barqarorligiga salbiy taʼsir etuvchi asosiy geografik omillardan biridir. Havzada umumiy yillik yogʻinlar miqdori soʻnggi 20 yilda oʻrtacha 12-15 % gacha kamaygan, shu bilan birga yogʻinlarning hududiy va vaqtinchalik disbalansi yaqqol namoyon boʻlmoqda. Qishki qor yogʻinlari ulushi kamayib, uning oʻrnini qisqa muddatli jala yomgʻirlari egallamoqda, bu esa tuproq qatlamiga singish oʻrniga eroziv sirtqi oqimlarni keltirib chiqaradi. Birlashgan Millatlar Tashkilotining Atrof-muhit boʻyicha dasturi (UNEP) hisobotlariga koʻra, Oʻrta Zarafshon hududida 2020-2022-yillardagi gidrologik qurgʻoqchilik oqibatida daryo qayirlari va unga tutash gidromorf landshaftlarning 10 % dan ortigʻida tabiiy ekotizimlar degradatsiyaga uchragan. Bu holat, ayniqsa, allyuvial tuproqlarda shakllangan voha toʻqayzorlari va namsevar oʻsimliklar fitomassi kamayishida yaqqol koʻrindi.

Suv resurslarining umumiy hajmi pasayishini daryolarning gidrologik kesimlari ham tasdiqlaydi. Masalan, Zarafshon daryosining O'rta Zarafshon okrugiga kirib kelish qismidagi o'rtacha ko'p yillik suv sarfi 2000-yildan 2023-yilgacha bo'lgan davr oralig'ida salkam 18-20 % ga qisqargan. Bu pasayish nafaqat daryoning o'zan oqimiga, balki havzadagi magistral kanallar (masalan, Darg'om, Narpay kanallari) tizimiga va ularga bog'liq bo'lgan yerosti suvlari sathining chuqurlashishiga ham to'g'ridan-to'g'ri ta'sir ko'rsatmoqda.

Ekstremal ob-havo va termik anomal hodisalar, jumladan, yoz oylaridagi davomli havo haroratining ko'tarilishi (issiq to'lqinlari), gidrologik tarmoqlarda bug'lanish (evapotranspiratsiya) koeffitsientini keskin oshirmoqda. 2022-yilning yozgi vegetatsiya davrida O'rta Zarafshonda termik ko'rsatkichlar ketma-ket bir necha kun davomida 42°C dan yuqori bo'lishi ochiq suv havzalari va suv omborlari (masalan, Kattaqo'rg'on suv ombori) yuzasidan bug'lanishni 25-30 % ga oshirib yubordi. O'zbekiston Ekologiya, atrof-muhitni muhofaza qilish va iqlim o'zgarishi vazirligi ma'lumotlariga ko'ra, o'sha yili daryo oqimining kamayishi va yuqori bug'lanish tufayli voha gidrografik tarmoqlarining gidrokimyoviy tarkibida minerallasuv darajasi o'rtacha 1,2-1,5 g/l gacha ko'tarilgan. Bu esa suv sifatining yomonlashishiga, chuchuk suv faunasi va florasining zararlanishiga hamda sug'oriladigan yerlarning ikkilamchi sho'rlanish jarayonlarining tezlashishiga sabab bo'ldi.

Iqlim o'zgarishining gidrografik tarmoqlarga salbiy ta'sirini yumshatish maqsadida O'rta Zarafshon mintaqasida geoekologik va tabiiy-geografik modellashirish hamda moslashuv strategiyalari hayotga tatbiq etilmoqda. Mintaqada suv taqchilligiga qarshi kurashish maqsadida muhandislik-gidrologik inshootlarni rekonstruksiya qilish va raqamlashtirilgan suv tejovchi texnologiyalardan foydalanish kengaymoqda. 2023-yil yakunlariga ko'ra, O'rta Zarafshon iqtisodiy-geografik hududidagi sug'oriladigan yerlarning salkam 12-14 % qismi tomchilatib va yomg'irilatib sug'orish tizimlariga moslashtirildi, bu esa har gektar hisobiga gidrologik resurslar sarfini o'rtacha 35 % ga tejash imkonini berdi. Shu bilan birga, agrolandshaftlarni muhofaza qilish uchun cho'llanish va shamol eroziyasiga qarshi daraxtzorlar (ixatazorlar) barpo etish orqali mikroiqlimni barqarorlashtirish choralari ko'rilmogda, bu esa tuproq namligini tabiiy saqlash ko'rsatkichini oshiradi. Biroq, ushbu landshaft-meliorativ tadbirlarni to'liq qamrovda amalga oshirishga moddiy-texnik resurslar yetishmasligi va gidrologik monitoring tizimining mukammal emasligi to'sqinlik qilmoqda.

Suv resurslarining iqlimiy o'zgarishi mintaqaning iqtisodiy-ijtimoiy barqarorligiga va aholi farovonligiga bevosita ta'sir o'tkazmoqda. O'rta Zarafshon oqimidagi Samarqand va Navoiy viloyatlari aholisining va iqtisodiyot tarmoqlarining barqaror rivojlanishi aynan shu havza gidrologiyasiga bog'liq bo'lib, 2023-yilgi geo-demografik ma'lumotlarga ko'ra mintaqada 3 milliondan ziyod aholi bevosita yoki bilvosita ushbu havza resurslaridan foydalanadi. Suv oqimining kamayishi tufayli agrosanoat majmualarida mahsuldorlik pasayishi xavfi ortmoqda. Masalan, 2022-yildagi gidrologik qurg'oqchilik oqibatida havzaning quyi-o'rta qismidagi kanallarda suv yetkazib berish imkoniyati 15-18 %

ga cheklandi, bu esa qishloq xo'jaligi ekinlari hosildorligiga putur yetkazib, mahalliy agrar bozorda narx-navoning tebranishiga va fermerlik xo'jaliklarining iqtisodiy rentabelligi pasayishiga olib keldi.

Bundan tashqari, suv resurslarining kamayishi va haroratning ko'tarilishi suv havzalarida evtrofikatsiya (suvning o't-lan va begona suvo'tlar bilan qoplanishi) jarayonlarini kuchaytirib, biologik zararkunandalar va patogen mikroorganizmlarning ko'payishiga sabab bo'lmoqda. O'zbekiston Qishloq xo'jaligi vazirligi huzuridagi ilmiy markazlar ma'lumotlariga ko'ra, so'nggi 10 yilda O'rta Zarafshonning kollektor-drenaj tarmoqlari va turg'un suv havzalarida zararli gidrobiontlar va chivinlarning tarqalish areali 25 % ga kengaygan. Suv ekotizimidagi bu muvozanatning buzilishi sanitariya-epidemiologik xarajatlarni oshirib, gidrotexnik inshootlarni tozalash va kimyoviy-biologik fiksatsiya tadbirlariga sarflanadigan yillik budjet xarajatlarini 2023-yilda o'rtacha 12 % ga oshishiga majbur qildi.

Mintaqaviy va global ekologik muammolarni bartaraf etish yo'lida xalqaro tashkilotlar bilan hamkorlikda gidrologik loyihalar amalga oshirilmoqda. Chunonchi, Xalqaro suvni boshqarish instituti (IWMI) hamda Global ekologik fond (GEF) ko'magida 2021-2023-yillarda O'rta Zarafshon mintaqasidagi 600 dan ortiq gidrotexnik uzellarda suvni onlayn monitoring qilish ("Smart Water") qurilmalari o'rnatildi. Shu bilan birga, O'zbekiston Fanlar akademiyasi Geografiya instituti olimlari tomonidan iqlim ssenariylariga muvofiq gidrologik prognozlar ishlab chiqilmoqda. 2024-yilda institut tomonidan Zarafshon daryosining 2050-yilgacha bo'lgan davr uchun oqim o'zgarishi modeli sinovdan o'tkazildi, unga ko'ra suv resurslarini integratsiyalashgan usulda boshqarish (SRIUB) joriy etilsa, havzada suv yo'qotilishini 10-15 % ga kamaytirish mumkinligi isbotlandi.

Xulosa

O'rta Zarafshon hududida suv resurslarining barqarorligini ta'minlash va iqlim o'zgarishiga moslashish uchun kelgusida strategik tabiiy-geografik hamda tashkiliy choralarni kuchaytirish talab etiladi. Birinchidan, transchegaraviy suv resurslarini boshqarish bo'yicha davlatlararo gidrologik hamkorlikni yangi bosqichga ko'tarish lozim. Ikkinchidan, mintaqadagi barcha gidrotexnik infratuzilmalarni (suv omborlari, kanallar) modernizatsiya qilib, filtratsiyaga (suv shimilishiga) ketadigan yo'qotishlarni bartaraf etish shart. Uchinchidan, iqlim o'zgarishi sharoitida aholi va fermerlar o'rtasida suvdan foydalanish madaniyatini oshirish va geoeologik xabardorlikni kengaytirish lozim. Masalan, 2023-yilda Samarqand viloyatida gidroekologik barqarorlik bo'yicha o'tkazilgan 20 dan ortiq amaliy seminarlar 2000 dan ziyod mahalliy mutaxassis va fermerlarga gidrologik inqiroz sharoitida resurslarni to'g'ri taqsimlash ko'nikmalarini o'rgatishga xizmat qildi.

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talabasi

Navoiy davlat konchilik va texnologiyalar universiteti

KONCHILIK KORXONALARIDA MAVJUD SUV OQIMLARI ASOSIDA MIKRO GIDROELEKTR STANSIYALARNI QO‘LLASH ORQALI ELEKTR ENERGIYASI SAMARADORLIGINI OSHIRISH

Annotatsiya: Mazkur maqolada konchilik korxonalarida mavjud texnologik va xo‘jalik suv oqimlarining energetik salohiyatidan foydalanish orqali elektr energiyasi samaradorligini oshirish masalalari tahlil qilingan. Suv uzatish tizimlarida mikro gidroelektr stansiyalarni joriy etish imkoniyatlari, suv sarfi va bosimi asosida elektr energiyasi ishlab chiqarishning nazariy asoslari hamda matematik yondashuvlari ko‘rib chiqilgan. Shuningdek, ishlab chiqarish infratuzilmasini modernizatsiya qilish jarayonida muqobil energiya manbalaridan foydalanishning afzalliklari baholanadi. Tadqiqot natijalari konchilik korxonalarida energiya xarajatlarini kamaytirish va elektr ta‘mini ishonchliligini oshirish imkoniyatlarini ko‘rsatadi.

Kalit so‘zlar: mikro GES, konchilik korxonasi, suv oqimi, muqobil energiya, elektr energiyasi, energiya samaradorligi, gidroturbina, suv resurslari, matematik model.

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IMPROVING ELECTRICAL ENERGY EFFICIENCY IN MINING ENTERPRISES THROUGH THE APPLICATION OF MICRO HYDROPOWER PLANTS BASED ON EXISTING WATER FLOWS

Abstract: This article investigates opportunities to improve energy efficiency in mining enterprises by utilizing the energy potential of existing water flows. The study examines the implementation of micro-hydropower plants within industrial water supply systems and discusses theoretical and mathematical approaches to electricity generation based on water discharge and head. The advantages of integrating renewable energy technologies into industrial infrastructure modernization are also evaluated. The findings indicate that micro-hydropower solutions can reduce energy costs and enhance the reliability of electricity supply in mining operations.

Keywords: micro hydropower, mining enterprise, water flow, renewable energy, electricity generation, energy efficiency, hydroturbine, water resources, mathematical model.

KIRISH

Jahon miqyosida sanoat korxonalarida energiya samaradorligini oshirish va qayta tiklanuvchi energiya manbalaridan foydalanishni kengaytirish ustuvor yo'nalishlardan biri hisoblanadi. Ayniqsa, elektr energiyasi iste'moli yuqori bo'lgan konchilik va kon-metallurgiya korxonalarida mavjud ichki resurslardan oqilona foydalanish ishlab chiqarish tannarxini kamaytirish hamda ekologik barqarorlikni ta'minlashda muhim ahamiyat kasb etadi [1].

Ko'plab konchilik obyektlarida texnologik va ichimlik suvi yuqori bosim ostida quvurlar orqali uzatiladi. Mazkur suv oqimlarining kinetik va potensial energiyasidan mikro gidroelektr stansiyalar yordamida foydalanish qo'shimcha elektr energiyasi ishlab chiqarish imkonini yaratadi. Bunday yondashuv yangi yirik gidroinshootlar qurishni talab qilmaydi va mavjud infratuzilmadan samarali foydalanishga asoslanadi.

Mazkur tadqiqotning maqsadi konchilik korxonalarida mavjud suv oqimlari asosida mikro gidroelektr stansiyalarni qo'llash imkoniyatlarini tahlil qilish hamda ularning elektr energiyasi samaradorligini oshirishdagi ahamiyatini baholashdan iborat [2].

ADABIYOTLAR TAHLILI

Qayta tiklanuvchi energiya manbalaridan samarali foydalanish bugungi kunda jahon energetika siyosatining ustuvor yo'nalishlaridan biri hisoblanadi. Iqlim o'zgarishi, qazib olinadigan yoqilg'i zaxiralarining cheklanganligi va sanoat korxonalarida energiya iste'molining ortib borishi energiya ishlab chiqarishning muqobil usullarini rivojlantirishni taqozo etmoqda. Shu nuqtai nazardan, kichik va mikro gidroelektr stansiyalar (GES) mahalliy suv resurslaridan oqilona foydalanish imkonini beruvchi istiqbolli texnologiyalardan biri sifatida qaralmoqda [3].

Xalqaro tadqiqotlarda mikro GESlar quvvati odatda 100 kVt gacha bo'lgan gidroenergetik tizimlar sifatida tavsiflanadi. Ularning asosiy afzalliklari qatoriga ekologik xavfsizlik, ekspluatatsiya xarajatlarining nisbatan pastligi, uzoq xizmat muddati hamda mavjud suv infratuzilmasiga integratsiya qilish imkoniyati kiradi. Ayniqsa, ichimlik suvi va texnologik suv uzatish tarmoqlarida hosil bo'ladigan ortiqcha bosim energiyasini elektr energiyasiga aylantirish so'nggi yillarda ilmiy jamoatchilik e'tiborini tortmoqda.

Konchilik va kon-metallurgiya korxonalarida energiya sarfining katta qismi qazib olish, maydalash, boyitish va suv ta'minoti jarayonlariga to'g'ri keladi. Ushbu korxonalarda suv ko'pincha nasos stansiyalari orqali yuqori bosim ostida uzatiladi. Amaliyotda bosimni pasaytirish uchun maxsus rostdash moslamalari qo'llaniladi, biroq bu jarayonda suvning potensial energiyasi foydali ishga aylantirilmaydi. Ilmiy adabiyotlarda bunday energiyani mikro gidroturbinalar yordamida elektr energiyasiga aylantirish texnik jihatdan mumkinligi va iqtisodiy samaradorlikni oshirishi qayd etilgan [4].

Mikro GESlarning samaradorligini baholashga bag'ishlangan tadqiqotlarda suv sarfi, bosim balandligi, quvur yo'qotishlari, turbina turi va foydali ish koeffitsiyenti asosiy omillar sifatida ko'rsatiladi. Nazariy jihatdan ishlab

chiqariladigan quvvat suv sarfi va bosimga to'g'ri proporsional bo'lsa-da, amaliy sharoitda gidravlik yo'qotishlar hamda uskunalarning konstruktiv xususiyatlari umumiy samaradorlikka sezilarli ta'sir ko'rsatadi. Shu sababli har bir obyekt uchun texnik-iqtisodiy tahlil o'tkazish muhim hisoblanadi.

O'zbekiston sharoitida ham energiya samaradorligini oshirish va qayta tiklanuvchi energiya manbalarini joriy etish bo'yicha qator ilmiy-amaliy ishlar olib borilmoqda. Biroq mavjud tadqiqotlarning aksariyati tabiiy daryolar yoki irrigatsiya tarmoqlaridagi kichik GESlarga bag'ishlangan bo'lib, konchilik korxonalarining ichki suv uzatish tizimlaridagi energetik salohiyatdan foydalanish masalasi nisbatan kam yoritilgan. Xususan, texnologik quvurlar, bosim pasaytiruvchi uzellar va suv taqsimlash punktlarida mikro GESlarni joylashtirishning optimal yechimlari yetarli darajada ishlab chiqilmagan [5].

Shuningdek, ilmiy manbalar tahlili shuni ko'rsatadiki, mikro GESlarni sanoat korxonalariga integratsiya qilish nafaqat qo'shimcha elektr energiyasi ishlab chiqarish, balki elektr tarmoqlaridagi yuklamani kamaytirish, issiqxona gazlari emissiyasini qisqartirish va korxonalarning energiya mustaqilligini oshirish imkonini ham beradi. Bu esa ularni barqaror rivojlanish tamoyillari bilan uyg'unlashtirishda muhim omil hisoblanadi.

Yuqoridagi tahlillar asosida xulosa qilish mumkinki, konchilik korxonalarining mavjud suv oqimlaridan mikro gidroelektr stansiyalar orqali foydalanish masalasi ilmiy va amaliy jihatdan dolzarb bo'lib, ushbu yo'nalishda gidravlik parametrlarni hisobga olgan holda matematik modellar ishlab chiqish, texnik yechimlarni takomillashtirish va iqtisodiy samaradorlikni kompleks baholash bo'yicha qo'shimcha tadqiqotlar o'tkazish zarur. Mazkur maqola aynan shu ilmiy bo'shliqni to'ldirishga qaratilgan [6].

METODOLOGIYA

Mazkur tadqiqotda konchilik korxonalarining suv ta'minoti tizimlarida mavjud suv oqimlarining energetik salohiyatini baholash hamda ularni mikro gidroelektr stansiyalar (mikro GES) yordamida elektr energiyasiga aylantirish imkoniyatlarini aniqlash maqsadida kompleks ilmiy yondashuv qo'llanildi. Tadqiqot nazariy tahlil, matematik modellashtirish, hisoblash-uslubiy baholash va natijalarni taqqoslash usullariga asoslandi [7].

Tadqiqotning birinchi bosqichida mikro GESlar, sanoat korxonalarida energiya samaradorligini oshirish hamda suv resurslaridan oqilona foydalanishga oid ilmiy adabiyotlar tahlil qilindi. Mazkur tahlil asosida mikro GESlarning ishlash tamoyillari, ularning afzalliklari va konchilik sanoatida qo'llash istiqbollari o'rganildi.

Ikkinchi bosqichda konchilik korxonalarining texnologik va xo'jalik suv ta'minoti tizimlari tadqiqot obyekti sifatida ko'rib chiqildi. Suv oqimining asosiy gidravlik ko'rsatkichlari, jumladan suv sarfi (Q), bosim balandligi (H), suv zichligi (ρ) va tizimning foydali ish koeffitsiyenti (η) elektr energiyasi ishlab chiqarishga ta'sir etuvchi asosiy parametrlar sifatida qabul qilindi [8].

Mikro GESning nazariy quvvatini aniqlash uchun gidroenergetikada keng qo'llaniladigan quyidagi tenglamadan foydalanildi:

$$P=\rho gQH\eta$$

bu yerda:

P — ishlab chiqariladigan elektr quvvati (Vt);

ρ — suv zichligi (1000 kg/m³);

g — erkin tushish tezlanishi (9,81 m/s²);

Q — suv sarfi (m³/s);

H — foydali bosim balandligi (m);

η — turbina va generatorning umumiy foydali ish koeffitsiyenti.

Shuningdek, ishlab chiqarilishi mumkin bo'lgan elektr energiyasi quyidagi bog'lanish orqali baholandi:

$$E=P\cdot t,$$

bu yerda:

E — ishlab chiqarilgan elektr energiyasi (kVt·soat);

P — tizim quvvati (kVt);

t — ishlash davomiyligi (soat).

Hisob-kitoblarda suv oqimining turli ish rejimlari uchun stsenariy tahlili qo'llanildi. Suv sarfi va bosimning o'zgarishi mikro GESning ishlab chiqarish quvvatiga qanday ta'sir qilishi taqqoslandi hamda energiya samaradorligi nuqtai nazaridan baholandi. Bundan tashqari, quvur tarmoqlaridagi gidravlik yo'qotishlar va uskunalarning foydali ish koeffitsiyenti umumiy natijalarga ta'sir etuvchi omillar sifatida hisobga olindi [9].

Natijalarni tizimlashtirish va tahlil qilish uchun qiyosiy tahlil hamda grafik-taqqoslash usullaridan foydalanildi. Olingan hisoblash natijalari konchilik korxonalarining mavjud suv ta'minoti infratuzilmasida mikro GESlarni joriy etishning texnik jihatdan maqsadga muvofiqligi va energiya samaradorligini oshirish imkoniyatlarini baholashga xizmat qildi.

Maqolada keltirilgan metodologik yondashuv kelgusida turli konchilik korxonalarining amaliy sharoitlariga moslashtirilishi, suv oqimlarining real parametrlariga asoslangan holda texnik-iqtisodiy tahlillar bilan boyitilishi mumkin. Bu esa mikro GESlarni joriy etish bo'yicha ilmiy asoslangan qarorlar qabul qilishga yordam beradi [10].

MUHOKAMA VA NATIJALAR

Tadqiqot natijalari konchilik korxonalarida texnologik va yordamchi jarayonlarda foydalaniladigan suv oqimlari muayyan energetik salohiyatga ega ekanligini ko'rsatdi. Amaldagi suv ta'minoti tizimlarida bosimni pasaytirish uchun sarflanayotgan energiyaning bir qismi mikro gidroelektr stansiyalar yordamida foydali elektr energiyasiga aylantirilishi mumkin. Bu esa mavjud infratuzilmani tubdan o'zgartirmasdan turib energiya samaradorligini oshirish imkonini beradi.

Tahlillar shuni ko'rsatdiki, mikro GESni joriy etish samaradorligi, avvalo, suv sarfining barqarorligi va bosim balandligiga bog'liq. Suv oqimi yil davomida nisbatan bir xil bo'lgan uchastkalarda ishlab chiqariladigan elektr energiyasi hajmi ham barqaror bo'ladi. Aksincha, suv sarfi keskin o'zgaradigan tizimlarda energiya ishlab chiqarish ko'rsatkichlari ham mavsumiy yoki texnologik yuklamaga qarab

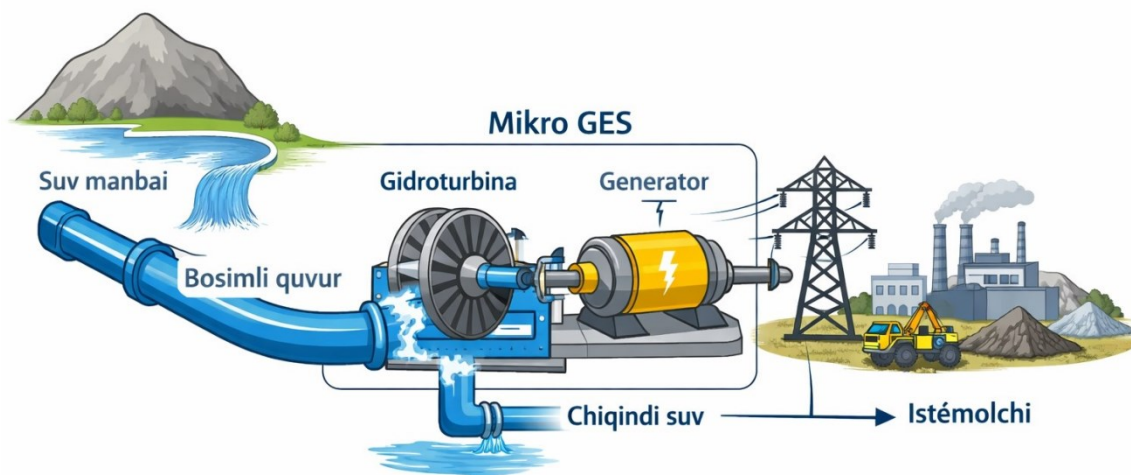
o'zgaradi. Shu sababli mikro GESni loyihalashda korxonaning haqiqiy ish rejimlarini hisobga olish muhim ahamiyat kasb etadi [11].

Shuningdek, tadqiqot davomida quvur tarmoqlaridagi ortiqcha bosimni foydali energiyaga aylantirish nafaqat elektr energiyasi ishlab chiqarish, balki gidravlik rejimni barqarorlashtirishga ham xizmat qilishi aniqlandi. Bunda bosimni sun'iy kamaytiruvchi qurilmalar o'rniga gidroturbinalardan foydalanish energiya yo'qotishlarini qisqartirishga yordam beradi.

1-jadval
Mikro GESni joriy etishning kutilayotgan texnik va iqtisodiy afzalliklari

Ko'rsatkich	Kutilayotgan natija
Elektr energiyasi ishlab chiqarish	Ichki ehtiyojning bir qismini qoplash
Energiya xarajatlari	Kamayadi
Bosim energiyasidan foydalanish	Samaradorlik oshadi
Qayta tiklanuvchi energiya ulushi	Ortadi
Atmosferaga salbiy ta'sir	Kamayadi
Energiya ta'minoti ishonchliligi	Yaxshilanadi

O'tkazilgan tahlillar mikro GESlarni mavjud suv uzatish infratuzilmasiga integratsiya qilish yangi gidrotexnik inshootlar qurishga nisbatan iqtisodiy jihatdan maqsadga muvofiq ekanligini ko'rsatdi. Bunda asosiy xarajatlar turbina, generator va avtomatlashtirish tizimlarini o'rnatish bilan bog'liq bo'lib, mavjud quvur tarmoqlaridan foydalanish qurilish xarajatlarini kamaytiradi.



1-rasm. Konchilik korxonasining suv ta'minoti tizimida mikro GESni joylashtirishning konseptual modeli

Muhokama natijalari shuni ko'rsatadiki, mikro GESlardan foydalanish faqat qo'shimcha elektr energiyasi ishlab chiqarish vositasi emas, balki korxonaning

umumiy energiya boshqaruvi tizimini takomillashtirish elementi sifatida ham qaralishi mumkin. Ayniqsa, elektr energiyasi narxlari ortib borayotgan sharoitda ichki resurslar hisobiga energiya ishlab chiqarish ishlab chiqarish tannarxini pasaytirishga xizmat qiladi [12].

Bundan tashqari, bunday texnologiyalarni joriy etish korxonalarining ekologik barqarorligini oshirishga ham ijobiy ta'sir ko'rsatadi. Mikro GESlar yoqilg'i yoqishni talab qilmagani sababli issiqxona gazlari emissiyasini kamaytiradi va "yashil iqtisodiyot" tamoyillarini amaliyotga tatbiq etishga yordam beradi. Shu bois konchilik korxonalarining mavjud suv oqimlaridan energetik resurs sifatida foydalanish istiqbolli va iqtisodiy jihatdan asoslangan yo'nalishlardan biri hisoblanadi.

XULOSA VA TAKLIFLAR

Mazkur tadqiqotda konchilik korxonalarining mavjud suv ta'minoti tizimlaridagi suv oqimlarining energetik salohiyati tahlil qilinib, ularni mikro gidroelektr stansiyalar (mikro GES) yordamida elektr energiyasiga aylantirish imkoniyatlari ko'rib chiqildi. O'rganish natijalari shuni ko'rsatdiki, texnologik jarayonlarda foydalaniladigan suvning bosimi va oqim tezligidan samarali foydalanish korxonaning ichki energiya ehtiyojini qisman qoplashga xizmat qilishi mumkin.

Tahlillar asosida mavjud suv uzatish infratuzilmasiga mikro GESlarni integratsiya qilish qo'shimcha yirik gidrotexnik inshootlarni barpo etishni talab qilmasdan, energiya resurslaridan yanada oqilona foydalanish imkonini berishi aniqlandi. Bunday yondashuv elektr energiyasi xarajatlarini kamaytirish, energiya ta'minoti ishonchliligini oshirish hamda ishlab chiqarish jarayonlarining umumiy samaradorligini yaxshilashga xizmat qiladi.

Shuningdek, tadqiqot natijalari mikro GESlarning qo'llanilishi ekologik jihatdan ham ijobiy samara berishini ko'rsatdi. Qayta tiklanuvchi energiya manbalaridan foydalanish hisobiga tashqi energiya manbalariga bog'liqlik qisqaradi, energiya resurslaridan foydalanish samaradorligi ortadi va barqaror rivojlanish tamoyillarini amaliyotga tatbiq etish uchun qo'shimcha imkoniyatlar yaratiladi.

Tadqiqot natijalariga tayangan holda quyidagi amaliy takliflar ilgari suriladi:

1. Konchilik korxonalarining suv ta'minoti tizimlarida energiya yo'qotilayotgan uchastkalarni aniqlash maqsadida muntazam gidravlik audit o'tkazish.
2. Mikro GESlarni loyihalashda suv sarfi, bosim, quvur yo'qotishlari va uskunalarning foydali ish koeffitsiyentini kompleks baholash asosida texnik yechimlarni tanlash.
3. Mikro GESlarni korxonaning mavjud avtomatlashtirilgan boshqaruv tizimlari bilan integratsiya qilib, real vaqt rejimida monitoring va boshqaruvni yo'lga qo'yish.

4. Texnologik suv oqimlarining mavsumiy va ishlab chiqarish yuklamalariga bog'liq o'zgarishlarini hisobga olgan holda moslashuvchan ekspluatatsiya rejimlarini ishlab chiqish.

5. Mikro GESlarni joriy etishning iqtisodiy samaradorligini investitsiya xarajatlari, ekspluatatsiya xarajatlari va energiya tejamkorligi ko'rsatkichlari asosida kompleks baholash.

6. Kon-metallurgiya korxonalarida qayta tiklanuvchi energiya manbalarini keng joriy etish bo'yicha ilmiy-amaliy dasturlarni ishlab chiqish va ularni energiya menejmenti tizimlariga integratsiya qilish.

7. Kelgusidagi tadqiqotlarda raqamli modellash, sun'iy intellekt va optimallashtirish usullaridan foydalangan holda mikro GESlarning ish rejimlarini takomillashtirish hamda ularning uzoq muddatli texnik-iqtisodiy samaradorligini baholash.

Yakuniy xulosa sifatida aytish mumkinki, konchilik korxonalarida mavjud suv oqimlarining energetik salohiyatidan mikro gidroelektr stansiyalar orqali foydalanish energiya samaradorligini oshirish, ekspluatatsion xarajatlarni kamaytirish va qayta tiklanuvchi energiya manbalarining ulushini ko'paytirishga xizmat qiladigan istiqbolli yo'nalishlardan biridir. Mazkur yondashuvni amaliyotga tatbiq etish sanoat korxonalarining barqaror va resurs tejamkor rivojlanishiga sezilarli hissa qo'shishi mumkin.

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ANDIJON VILOYATIDA YER RESURSLARIDAN FOYDALANISHNING IJTIMOIY-IQTISODIY VA EKOLOGIK OQIBATLARI

Annotatsiya: ushbu maqolada Andijon viloyatida yer resurslaridan foydalanishning ijtimoiy-iqtisodiy va ekologik oqibatlari kompleks tahlil qilindi. Tuproq sho'rlanishi va yer osti suvlari sathining yuzaligidan kelib chiqadigan iqtisodiy yo'qotishlar, dehqon va tomorqa xo'jaliklarining oziq-ovqat xavfsizligi hamda aholi bandligidagi o'rni, shuningdek adir hududlaridagi eroziya jarayonlarining ekologik oqibatlari baholandi. Tadqiqot natijalari asosida yer resurslarini muhofaza qilish va ulardan oqilona foydalanish bo'yicha amaliy takliflar ishlab chiqildi.

Kalit so'zlar: yer resurslari, meliorativ holat, tuproq sho'rlanishi, eroziya, dehqon xo'jaligi, oziq-ovqat xavfsizligi, ekologik degradatsiya, ijtimoiy migratsiya, Andijon viloyati.

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SOCIO-ECONOMIC AND ECOLOGICAL CONSEQUENCES OF LAND RESOURCE USE IN ANDIJAN REGION

Abstract: this article presents a comprehensive analysis of the socio-economic and ecological consequences of land resource use in Andijan region. The economic losses arising from soil salinization and shallow groundwater levels, the role of dehqan and household farms in food security and employment, and the ecological consequences of erosion processes in the foothill areas were assessed. Based on the research findings, practical proposals for the protection and rational use of land resources were developed.

Key words: *land resources, reclamation condition, soil salinization, erosion, dehkan farms, food security, ecological degradation, social migration, Andijan region.*

Kirish

Yer resurslaridan foydalanishning ijtimoiy-iqtisodiy va ekologik oqibatlarini kompleks baholash hududiy rivojlanish siyosatini ilmiy asoslashning muhim vazifalaridan biri hisoblanadi. Aholi zichligi yuqori va yer maydoni cheklangan mintaqalarda yer resurslaridan foydalanish nafaqat iqtisodiy foyda olish vositasi, balki ekologik barqarorlik va ijtimoiy muvozanatni saqlashning asosiy omiliga aylanadi. Andijon viloyati O'zbekistonning eng kichik hududiy birliklaridan biri bo'lib, aholi zichligi va qishloq xo'jaligi intensivligi bo'yicha respublikada yetakchi o'rinlardan birini egallaydi. Shu sababli viloyatda yer resurslaridan foydalanishning uchta yo'nalishdagi – iqtisodiy, ijtimoiy va ekologik – oqibatlarini birgalikda tahlil qilish dolzarb ilmiy-amaliy ahamiyat kasb etadi.

Tadqiqotning maqsadi Andijon viloyatida yer resurslaridan foydalanishning meliorativ holatga bog'liq iqtisodiy oqibatlarini, dehqon va tomorqa xo'jaliklarining ijtimoiy ahamiyatini hamda adir va tekislik hududlaridagi ekologik degradatsiya jarayonlarini kompleks tahlil qilish va ularni bartaraf etish bo'yicha amaliy takliflar ishlab chiqishdan iborat.

Tadqiqot metodikasi sifatida statistik-tahliliy, qiyosiy-geografik va kartografik usullardan foydalanildi. Tahlil uchun viloyat tumanlari kesimidagi meliorativ holat, yer osti suvlari sathi, eroziyaga uchragan maydonlar hamda qishloq xo'jaligi mahsuloti tarkibiga oid statistik ma'lumotlar asos qilib olindi.

O'rganishimiz natijasida 2025-yil yakunlariga ko'ra Andijon viloyatida qishloq xo'jaligi mahsulotlari hajmi 53,5 trillion so'mdan oshib, bu soha viloyat iqtisodiyotining tayanch tarmog'i ekanligini ko'rsatdi. Biroq mazkur yuqori ko'rsatkich ortida yer resurslarining meliorativ holati bilan bog'liq murakkab iqtisodiy jarayonlar saqlanib qoldi. Tahlillar natijasida viloyatning Baliqchi va Ulug'nor tumanlarida sho'rlangan yerlar maydoni jami 40 ming gektardan oshganligi aniqlandi. Sho'rlangan yerlarda dehqonchilik yuritish bir qator qo'shimcha iqtisodiy yuklamalarni keltirib chiqaradi: sho'r yuvish uchun qo'shimcha suv resurslari talab etiladi, tuproq unumdorligini sun'iy saqlash maqsadida mineral o'g'itlar sarfi 1,5–2 barobar oshadi, sho'rlanish darajasi o'rtacha bo'lgan maydonlarda esa hosildorlik 20–25 foizga pasayadi. Bu holat viloyat iqtisodiyotiga har yili milliardlab so'm miqdorida zarar yetkazishi isbotlandi.

Andijon viloyatida aholi zichligi yuqori bo'lganligi sababli bir gektar sug'oriladigan yerga to'g'ri keladigan aholi soni respublikadagi eng yuqori ko'rsatkichlardan biri ekanligi aniqlandi. Bu holat o'ziga xos iqtisodiy ziddiyatni keltirib chiqaradi: unumdor qishloq xo'jaligi yerlarini sanoat va uy-joy qurilishi ehtiyojlari uchun ajratish zarurati tug'iladi. Natijada har bir gektar qishloq xo'jaligi yerining xo'jalik muomalasidan chiqishi viloyat yalpi hududiy mahsulotining pasayishiga olib kelishi asoslandi.

Yer resurslari Andijon aholisi uchun nafaqat ishlab chiqarish vositasi, balki asosiy yashash manbai ekanligi tasdiqlandi. Statistik ma'lumotlar tahlili natijasida viloyatda qishloq xo'jaligi mahsulotlarining 59,0 foizi dehqon va tomorqa xo'jaliklari hissasiga to'g'ri kelishi aniqlandi, bu esa yer resurslarining ijtimoiy ahamiyati naqadar yuqori ekanligini ko'rsatdi. Aholi o'ziga tegishli 8–10 sotixlik tomorqa yerlaridan maksimal foyda olishga intiladi, bu esa o'z navbatida aholining o'zini-o'zi oziq-ovqat bilan ta'minlash darajasini oshiradi. Shuningdek, sut va go'sht mahsulotlarining 90 foizdan ortig'i dehqon xo'jaliklarida yetishtirilishi, yerning chorvachilik uchun yem-xashak bazasi sifatidagi ahamiyatini yana bir bor tasdiqladi.

Tadqiqot natijalari yer sifatining yomonlashuvi (masalan, Jalaquduq va Paxtaobod tumanlarida toshloqlik yoki Ulug'nor tumanida sho'rlanish) bevosita qishloq aholisining daromadlariga salbiy ta'sir ko'rsatishini aniqladi. Daromadi kamaygan aholining bir qismi shaharlarga yoki xorijga mehnat faoliyati yuritish maqsadida ko'chishga majbur bo'lishi kuzatildi. Shu asosda yerning meliorativ holati ijtimoiy migratsiya jarayonlarini belgilovchi asosiy omillardan biri sifatida baholandi.

Andijon viloyatida yer resurslaridan foydalanishning ekologik oqibatlari mintaqaviy miqyosda xavotirli darajaga yetganligi aniqlandi. Tahlillar natijasida viloyatning 133 866 gektar maydonida yer osti suvlari 1–2 metr chuqurlikda joylashganligi qayd etildi, bu esa kapillyar ko'tarilish effektini yuzaga keltirib, yer yuzasida tuz qatlami hosil bo'lishiga olib keladi. Sho'rlangan tuproqlarda tabiiy flora tarkibi o'zgarib, foydali hasharotlar va mikroorganizmlar populyatsiyasi qisqarishi kuzatildi.

Viloyatning adir hududlarida, xususan Andijon, Marhamat va Xo'jaobod tumanlarida 42 ming gektardan ortiq yer eroziyaga uchraganligi aniqlandi. Eroziya jarayoni natijasida tuproqning eng unumdor – gumusli qatlami yuvilib ketmoqda, holbuki bir santimetr gumus qatlamining tabiiy yo'l bilan shakllanishi uchun yuz yildan ortiq vaqt talab etiladi. Yer maydonining cheklanganligi sababli bitta maydondan yiliga uch martagacha hosil olishga intilish tuproqning fizik-kimyoviy xususiyatlarini izdan chiqarishi, haddan tashqari ko'p miqdorda mineral o'g'it va pestitsidlar qo'llanilishi esa tuproqning o'z-o'zini tiklash qobiliyatini pasaytirishi («tuproq charchashi» hodisasi) isbotlandi.

Tumanlar kesimida o'tkazilgan tahlil natijasida viloyat yer fondining bir qator «zaif nuqtalari» aniqlandi: Ulug'nor tumani gipslashganlik va kuchli sho'rlanish o'chog'i sifatida, Andijon tumani eroziya xavfi eng yuqori hudud sifatida, Jalaquduq va Paxtaobod tumanlari esa yuqori toshloqlik darajasi tufayli qishloq xo'jaligi texnikasidan foydalanishni cheklovchi hududlar sifatida tasniflandi.

O'tkazilgan kompleks tahlil natijalariga asoslanib, Andijon viloyatida yer resurslaridan foydalanishning salbiy oqibatlarini bartaraf etish bo'yicha quyidagi amaliy takliflar ishlab chiqildi:

– Baliqchi, Ulug'nor, Shahrixon va Oltinko'l tumanlarida yer osti suvlari sathini me'yoriy (2,5–3 metr) darajaga tushirish maqsadida eskirgan ochiq

drenajlar o'rniga zamonaviy yopiq-yotiq drenaj tizimlarini bosqichma-bosqich joriy etish;

– adir va nishab hududlarda (Andijon, Marhamat, Xo'jaobod) yer haydashning an'anaviy usullaridan voz kechib, terrassalash va konturli dehqonchilik tizimini qo'llash hamda tuproqni mustahkamlovchi ixota daraxtzorlarini barpo etish;

– suv tanqisligi va yer osti suvlari sathining ko'tarilishiga yo'l qo'ymaslik maqsadida dehqon va fermer xo'jaliklarida tomchilatib hamda yomg'irlatib sug'orish texnologiyalarini joriy etish uchun davlat subsidiyalarini maqsadli yo'naltirish;

– viloyat yerlarining sho'rlanish, namlik va unumdorlik holatini sun'iy yo'ldosh va datchiklar yordamida real vaqt rejimida monitoring qilish tizimini, shu jumladan har bir yer uchastkasi uchun raqamli pasportni joriy etish;

– toshloq va sho'rlangan yerlar uchun maxsus agrotexnik ishlov berish sxemalarini ishlab chiquvchi hamda yer egalariga konsultativ yordam ko'rsatuvchi hududiy maslahat markazlari faoliyatini yo'lga qo'yish.

Xulosa

O'tkazilgan tadqiqot natijasida Andijon viloyatida yer resurslaridan foydalanish nafaqat iqtisodiy, balki murakkab ijtimoiy-ekologik tizim ekanligi asoslandi. Meliorativ holati og'ir bo'lgan hududlarda sho'rlanish jarayonlari mahsulot tannarxining sezilarli darajada oshishiga sabab bo'lishi, dehqon va tomorqa xo'jaliklarining qishloq xo'jaligi mahsulotidagi yuqori ulushi yer resurslarining ijtimoiy-strategik ahamiyatini ko'rsatishi, adir hududlaridagi eroziya va tekislik zonalaridagi ikkilamchi sho'rlanish esa ekologik muvozanatning izdan chiqishiga olib kelishi aniqlandi.

Iqtisodiy o'sish yer resurslarining ekologik degradatsiyasi hisobiga ta'minlanmasligi lozimligi, aksincha yerning iqtisodiy unumdorligini saqlagan holda ekologik sog'lomligini tiklash kelajakdagi ustuvor vazifa sifatida belgilanishi zarurligi xulosa qilindi. Ishlab chiqilgan amaliy takliflarni izchil amalga oshirish viloyatda yer resurslaridan foydalanishning ijtimoiy-iqtisodiy va ekologik samaradorligini oshirishga xizmat qiladi.

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THE MAMUNID DYNASTY: STATEHOOD OF KHWAREZM, DEVELOPMENT OF SCIENCE AND CULTURE

Abstract. *This article analyzes the political activities of the Mamunid dynasty, which ruled Khwarezm at the end of the 10th and beginning of the 11th centuries, its system of state administration, economic development, and its contribution to the advancement of science and culture. It highlights the role of the dynasty in politically unifying Khwarezm and the formation of the city of Gurganj as a major commercial, economic, and cultural center. Special attention is given to the establishment of the Mamun Academy, the scientific activities of scholars such as Abu Rayhan al-Biruni, Abu Ali ibn Sina, and others, as well as the development of libraries, manuscript production, and educational life during the Mamunid period. The study concludes that the Mamunid dynasty played an important role in the formation of the Renaissance period in Central Asia.*

Keywords. *Mamunid dynasty, Khwarezm, Gurganj, Mamun Academy, science, culture, statehood, urban development, library science, Eastern Renaissance.*

In the history of the peoples of Central Asia, the Khwarezm oasis has long been distinguished by its highly developed culture and traditions of statehood. Although the Mamunid dynasty, which ruled Khwarezm at the end of the 10th and beginning of the 11th centuries, existed for a relatively short period, it left a deep mark on the history of the region. In particular, its role in state governance, urban development, economic progress, science, and culture is significant.

During the rule of the Mamunids, Khwarezm was politically unified, and its capital Gurganj became a major economic and cultural center of the East. The Mamun Academy, established during this period, entered history as one of the most important scientific centers of the Eastern Renaissance. The scholarly activity of great thinkers such as Abu Rayhan al-Biruni, Abu Ali ibn Sina, Abu Nasr ibn Iraq, and Abu Sahl al-Masihi is closely connected to this period.

This article examines the formation of the Mamunid dynasty, its political activity, economic development, contributions to science and culture, and its historical significance.

By the end of the 10th century, Khwarezm was divided into two parts. In the northern part, centered in the city of Kat, the Afrighid dynasty ruled, while in the southern part there was an emirate centered in Gurganj. The ruler of Gurganj,

Mamun ibn Muhammad, strengthened his position and succeeded in uniting all of Khwarezm into a single state.

In 995, Mamun ibn Muhammad defeated the Afrighid ruler Abu Abdullah Muhammad and brought Khwarezm under his control. Thus began the rule of the Mamunid dynasty. Gurganj was chosen as the capital. This event marked a new stage in the history of Khwarezmian statehood [1.112].

Mamun ibn Muhammad pursued a policy of centralizing the state. After his death, power passed to Ali ibn Mamun (997–1009). During his reign, Khwarezm's international status increased, economic relations expanded, and greater attention was paid to the development of science.

In 1009, Mamun II ibn Mamun ascended the throne. Under his rule, Khwarezm became one of the most powerful states in Central Asia. However, Mahmud of Ghazni, the ruler of Ghazna, concerned about Khwarezm's growing power, began to exert political pressure. As a result, in 1017, the armies of Mahmud of Ghazni conquered Khwarezm, bringing an end to the rule of the Mamunid dynasty [5.45].

The Mamunid period is considered a time of economic flourishing in Khwarezm. Due to the geographical location of the state along an important branch of the Great Silk Road, trade developed significantly.

According to the Arab geographer Istakhri, at the beginning of the 10th century there were 9–13 cities in Khwarezm, while by the beginning of the 11th century their number had reached about 40 [2.154]. Cities such as Gurganj, Kat, Khiva, Hazorasp, Ardakhushmisan, and Kardaranxos became major economic and cultural centers.

Khwarezmian merchants established trade relations with Eastern Turkestan, Transoxiana, Khorasan, Iran, and even Spain. The development of trade led to urban improvement and the construction of new buildings. The capital Gurganj flourished especially. Palaces, caravanserais, mosques, madrasas, baths, and markets were built in the city. These developments laid a strong foundation for the later rise of the Khwarezmshahs in the 12th–13th centuries [12.287].

Medieval authors gave very high assessments of Gurganj. In the work "Description of the Cities of Khwarezm", it is recorded that the city had more than 170 markets, about 5,000 mosques, around 700 madrasas, and nearly 1,000 bathhouses [10.125].

The famous geographer al-Muqaddasi wrote about the Khwarezmians: "Khwarezmians are people of intellect, knowledge, jurisprudence, and learning" [7.282]. The 13th-century geographer Yaqut al-Hamawi described Gurganj as one of the most beautiful and prosperous cities in the world: "I have never seen in the world a city as magnificent, rich, and beautiful as Gurganj" [8.398]. The traveler Ibn Battuta also emphasized the hospitality and love of knowledge among the Khwarezmians: "In the whole world, I have not encountered people kinder and more hospitable to strangers than the Khwarezmians" [9.367]. These accounts clearly demonstrate the high level of economic and cultural development of Khwarezm at that time.

One of the greatest contributions of the Mamunid dynasty was its patronage of science. In 1004, by decree of Ali ibn Mamun, a scientific center called “Dar al-Hikma wa Ma’rif” was established in Gurganj. Later, this center became known as the Mamun Academy [10.126].

Abu Rayhan al-Biruni was appointed as the head of the academy. Research in astronomy, mathematics, geography, medicine, philosophy, and history was conducted at this institution.

Among the scholars who worked at the academy were Abu Rayhan al-Biruni, Abu Nasr ibn Iraq, Abu Sahl al-Masihi, Ibn Sina, and other prominent scholars. Their scientific legacy had a profound impact not only on the East but also on world science. Al-Biruni emphasized that the development of science depends on the support of rulers. Thanks to the academy, Gurganj became a scientific center comparable to Baghdad’s “House of Wisdom” [3.17].

During the Mamunid period, ancient Khwarezmian, Arabic, Persian, Indian, and Greek scientific traditions merged. As a result, astronomy, mathematics, medicine, chemistry, geography, historiography, and philosophy developed significantly. Religious sciences such as hadith studies, jurisprudence (fiqh), and kalam also developed, contributing to theological scholarship. Music and musicology developed in connection with mathematical theories.

The development of national culture was elevated to the level of state policy. Literature and scientific works in the native language were supported. A rich palace library was established, containing rare manuscripts brought from various regions of the East [10.126]. In the library, books in Arabic, Persian, and other languages were organized into separate sections, creating favorable conditions for research.

During the Mamunid era, the art of book production and manuscript copying reached a high level. Calligraphers, artists, and book decorators were active.

The art of book decoration, miniature painting, and bookbinding developed. Special workshops for manuscript copying emerged. Book trade became widespread, and book stalls appeared in markets.

These scientific and cultural traditions of Khwarezm later influenced the development of libraries and scientific centers in Bukhara, Samarkand, Merv, Nishapur, Baghdad, and Damascus [12.453].

Although the Mamunid dynasty ruled for a relatively short time, it occupies an important place in the history of Central Asia. It ensured the political unity of Khwarezm, created favorable conditions for economic development, and opened wide opportunities for science.

The establishment of the Mamun Academy became one of the key events of the Eastern Renaissance. The scientific activity of scholars such as al-Biruni and Ibn Sina flourished further during this period.

The scientific and cultural environment of Khwarezm had a significant influence on the development of the entire Islamic East in later centuries.

Therefore, the Mamunid dynasty is considered an important part not only of Khwarezm's history but also of world civilization.

The Mamunid dynasty represents one of the most important periods in the history of Khwarezm at the end of the 10th and beginning of the 11th centuries. The rulers of the dynasty carried out major efforts in centralizing the state, ensuring economic development, and promoting science and culture. The transformation of Gurganj into a major commercial and cultural center, the establishment of the Mamun Academy, and the activities of scholars such as al-Biruni and Ibn Sina are among the greatest achievements of this period. The legacy of the Mamunids is still regarded today as one of the brightest pages in the history of statehood and science of Uzbekistan.

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CREATION OF AN INTEGRATED LEARNING ENVIRONMENT IN KARAKALPAK LANGUAGE LESSONS USING MODERN INFORMATION TECHNOLOGIES

Abstract: *This article examines the theoretical and practical foundations for creating an integrated learning environment in Karakalpak language lessons using modern information technologies. It analyzes the potential of digital tools, multimedia platforms, and interactive teaching methods in developing students' linguistic competence. Particular attention is paid to the specifics of the bilingual educational environment in the Republic of Karakalpakstan and the changing nature of students' speech practices under the influence of digital communication. Based on theoretical and analytical research, a methodological model for integrating digital educational resources into the teaching of the Karakalpak language is substantiated.*

Key words: *integrated learning environment, Karakalpak language, information technology, digital educational resources, interactive teaching methods, language competence, bilingual education.*

The current stage of educational development is characterized by the active integration of information and communication technologies (ICT) into all aspects of the educational process. The digital transformation of education opens up new opportunities for improving learning effectiveness, individualizing educational pathways, and creating an integrated learning environment that fosters the comprehensive development of students.

In the Republic of Karakalpakstan, teaching the native language is particularly important in the context of preserving and developing national linguistic identity. Karakalpak, an agglutinative Turkic language, requires special teaching methods that take into account its structural features and the specifics of the region's bilingual educational environment.

An integrated learning environment is a set of conditions, tools, and technologies that support a holistic educational process, seamlessly combining traditional and innovative teaching methods. In the context of language teaching, such an environment includes not only material and technical equipment but also methodological support, a system for interaction between participants in the educational process, and digital resources that facilitate the development of language skills.

The digital educational environment has a complex impact on the cognitive, communicative, and sociocultural aspects of language proficiency. Research shows that digital technologies, as a systemic factor in developing the language

proficiency of students in comprehensive schools in the Republic of Karakalpakstan, contribute to the effective acquisition of language material and the development of communication skills.

Information technologies in language education perform a number of important functions:

Providing access to authentic language materials. Digital resources allow students to work with real-life speech samples, which is especially important when studying the phonetic features of a language.

Creating an interactive language environment. Multimedia technologies, interactive platforms, and mobile applications provide the opportunity for immersion in a language environment, which contributes to the more effective development of pronunciation skills and the development of listening comprehension skills.

Personalized learning. Digital tools allow for tailoring educational materials to the level and individual needs of each student, which is especially important in bilingual education settings.

Increased motivation. Interactive teaching methods—game-based assignments, project work, and the use of digital tools—help increase student engagement and develop communication skills.

The phonetics of the Karakalpak language—its pronunciation system, sound structure, accentual and intonational features—plays a crucial role in the educational process. Digital technologies, as modern teaching methods, provide significant assistance in language teaching.

Research shows the effectiveness of using the following digital tools in teaching Karakalpak language phonetics:

- Mobile applications for practicing pronunciation;
- Phonetic analysis programs that allow you to visualize the sound characteristics of speech;
- Interactive educational platforms that provide listening and imitation repetition opportunities.

The use of audiovisual teaching aids and digital educational platforms facilitates targeted phonetic training, the development of articulation skills, and the formation of auditory perception.

Interactive teaching methods play a special role in developing students' vocabulary skills in Karakalpak language lessons. Research confirms that game-based learning, role-playing, project-based work, and digital tools increase student engagement, improve retention, and develop communication skills.

Culturally relevant interactive learning leads to more meaningful and long-lasting vocabulary acquisition, better preparing students for real-world language use. In Karakalpak schools, where traditional memorization-based teaching methods often prove ineffective, interactive approaches offer more student-centered and engaging ways to enhance vocabulary proficiency.

Modern innovative methods of teaching the Karakalpak language in schools include an analysis of modern pedagogical technologies aimed at increasing

student motivation, developing communication skills, and preserving national linguistic identity.

Particular attention is paid to the role of:

- digital technologies as a means of creating an interactive educational environment;
- game methods that promote the natural acquisition of language material;
- project activities that develop research and communication skills;
- intercultural approaches that take into account the specifics of the bilingual educational environment.

Based on theoretical analysis and a summary of practical experience, a methodological model for integrating digital educational resources into the teaching of the Karakalpak language is proposed. The model includes the following components:

1. Target component

Formation of students' linguistic competence in the context of digital transformation of education;

Development of communication skills using modern technologies;

Preservation and development of the Karakalpak language as a means of national identity.

2. Substantive component

Integration of traditional and digital educational materials;

Use of authentic language resources;

Incorporation of elements of national culture into digital content.

3. Technological component

- Use of multimedia teaching aids;
- Use of interactive educational platforms;
- Implementation of mobile applications for language learning;
- Creation of electronic educational resources in the Karakalpak language.

4. Organizational and methodological component

Development of methodological recommendations for the use of ICT in Karakalpak language lessons;

Preparing teachers to work in a digital educational environment;

Creation of a system for assessing the effectiveness of using digital technologies .

Practical recommendations

Creation of an electronic database of educational materials in the Karakalpak language, including audio and video materials, interactive exercises and tests.

Using video lessons in the Karakalpak language for independent study of language and information technology.

Implementation of game and project-based learning methods using digital tools to increase student motivation.

Development of mobile applications for learning the Karakalpak language, taking into account its phonetic and grammatical features.

The organization of distance learning using information technology as a leading tool, which is especially relevant for remote schools in Karakalpakstan.

The creation of an integrated learning environment for Karakalpak language lessons using modern information technology is a pressing area for modernizing language education in the Republic of Karakalpakstan. The digital transformation of education opens up new opportunities for improving the effectiveness of native language teaching, developing students' communication skills, and preserving national linguistic identity in the context of globalization.

The proposed methodological model for integrating digital educational resources into the teaching of the Karakalpak language takes into account the specifics of the bilingual educational environment of the region and can serve as a basis for further research in the field of digital didactics of the native language.

Further research in this area could involve developing specialized software for studying the Karakalpak language, creating a new generation of electronic textbooks, and improving methods for training teachers to work in a digital educational environment.

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HALQARO STANDARTLARNI JORIY ETISH – MAHSULOT EKSPORTI HAJMINI OSHIRISHNING MUHIM OMILI

Annotatsiya: Ushbu maqolada xalqaro standartlarning (ISO, HACCP, GlobalGAP va boshqalar) O'zbekiston sanoat tarmoqlaridagi joriy etilish jarayonlari va ularning eksport hajmining o'sishiga ko'rsatadigan ta'siri keng qamrovda tahlil qilinadi. Tadqiqot 2023–2025 yillarga oid tashqi savdo ko'rsatkichlari, davlat tomonidan ko'rsatilayotgan sertifikatlashni qo'llab-quvvatlash mexanizmlari hamda ISO, OECD va Jahon banki kabi xalqaro tashkilotlarning ilmiy-amaliy ma'lumotlari asosida olib borilgan. Olingan natijalar xalqaro standartlarni tatbiq etish mahsulot sifati va xavfsizligini oshirish, texnik to'siqlarni kamaytirish, eksport shartnomalarida ishonchni kuchaytirish va yangi bozorlar ochilishiga xizmat qilishini ko'rsatadi. Shuningdek, korxonalarning standartlarni joriy etish xarajatlarini kamaytirish hamda malaka oshirish dasturlarini kengaytirish eksportning barqaror o'sishiga ijobiy ta'sir ko'rsatishi aniqlangan.

Kalit so'zlar: Xalqaro standartlar, eksport, ISO, HACCP, GlobalGAP, texnik tartibga solish, sertifikatlash, tashqi savdo, sifat menejmenti, raqobatbardoshlik, mahsulot xavfsizligi.

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INTRODUCTION OF INTERNATIONAL STANDARDS IS AN IMPORTANT FACTOR IN INCREASING PRODUCT EXPORTS

Abstract: *This paper analyzes the impact of implementing international standards (ISO, HACCP, GlobalGAP, etc.) on the growth of export volumes in Uzbekistan's production sectors. The study is based on foreign trade indicators for 2023–2025, national certification support mechanisms, and analytical data from ISO, OECD and the World Bank. The findings reveal that the adoption of international standards enhances product quality and safety, reduces technical barriers, strengthens the reliability of export contracts, and facilitates entry into new markets. Furthermore, reducing certification costs and expanding capacity-building programs contribute to the sustainable development of export activities.*

Keywords: *International standards, export, ISO, HACCP, GlobalGAP, technical regulation, certification, foreign trade, quality management, competitiveness, product safety.*

Kirish

Global iqtisodiy makonda raqobatning jadallashib borishi mahsulot sifati, xavfsizligi va xalqaro bozorlarda tan olinishi bilan bevosita bog'liq bo'lib, eksport faoliyatining muvaffaqiyati ko'p jihatdan ishlab chiqarish jarayonlarining xalqaro standartlarga mos bo'lishini talab qiladi. Rivojlangan bozorlarda qo'llanilayotgan texnik reglamentlar va sertifikatlashtirish talablarining kuchayib borayotgani korxonalardan sifat boshqaruvini takomillashtirish, ishlab chiqarishni standartlashtirish va global talablar bilan uyg'unlikda rivojlanishni taqozo etadi.

ISO 9001, ISO 22000, HACCP, GlobalGAP kabi standartlar ishlab chiqarish jarayonlarini tartiblash, sifat menejmenti tizimini takomillashtirish, iste'molchi ishonchini mustahkamlash, eksport jarayonidagi texnik to'siqlarni minimallashtirish va xalqaro bozorlarda mahsulotning tan olinishi uchun muhim ahamiyatga ega. O'zbekiston oxirgi yillarda eksport tarkibini diversifikatsiya

qilish, qayta ishlangan mahsulotlar ulushini oshirish va global bozorlar bilan integratsiyani kuchaytirishga qaratilgan keng ko‘lamli islohotlarni amalga oshirmoqda. Eksportyor korxonalarni qo‘llab-quvvatlash maqsadida xalqaro sertifikatlarni olish xarajatlarini qoplash, texnik yordam ko‘rsatish, laboratoriyalar faoliyatini modernizatsiya qilish va konsalting xizmatlarini rag‘batlantirish yo‘lga qo‘yilgan bo‘lib, bu eksport salohiyatining jadal o‘shishiga xizmat qilmoqda. Mazkur sharoitlar xalqaro standartlarni joriy etishni O‘zbekiston eksport siyosatining ustuvor yo‘nalishiga aylantirib, sifat infratuzilmasining takomillashuvi orqali yangi bozorlarni egallash imkoniyatlarini kengaytirmoqda. Ushbu tadqiqotning asosiy maqsadi xalqaro standartlarni joriy etishning O‘zbekiston eksport salohiyati va tashqi bozorlardagi raqobatbardoshligiga ko‘rsatadigan iqtisodiy va tashkiliy ta’sirini ilmiy asosda o‘rganishdan iboratdir. Xalqaro bozorlar tomonidan qo‘yilayotgan sifat va xavfsizlik talablari muttasil kuchayib borayotgan bir sharoitda korxonalarining ISO, HACCP, GlobalGAP kabi standartlar asosida ishlashi mahsulotning eksportbopligi, bozorlarga kirish tezligi va shartnomalar barqarorligi uchun hal qiluvchi omilga aylanmoqda.

Tadqiqot metodologiyasi statistik, qiyosiy, tizimli va funksional tahlil usullariga asoslangan bo‘lib, bir nechta bosqichlarda amalga oshirilgan. Dastlab O‘zbekiston Respublikasi Statistika agentligi, WTO, UN Comtrade, TradingEconomics kabi manbalardan olingan 2023–2025 yillardagi eksport ko‘rsatkichlari o‘rganilib, eksportning o‘shish dinamikasi, tarmoqlar bo‘yicha ulushi va bozorlar geografiyasidagi o‘zgarishlar aniqlangan. Ushbu raqamlar mamlakatning tashqi savdo tarkibida sifat ko‘rsatkichlarining sezilarli oshganini ko‘rsatadi.

Keyingi bosqichda davlat tomonidan eksportni qo‘llab-quvvatlovchi mexanizmlar — xalqaro standartlar bo‘yicha sertifikatlash xarajatlarini qoplash, texnik yordam dasturlari, laboratoriyalarni akkreditatsiyadan o‘tkazish, malaka oshirish tashabbuslari — amaliy misollar asosida tahlil qilindi. 2023 yilda 410 ta, 2024 yilda 575 ta, 2025 yilda esa 620 ta xalqaro standartning joriy etilgani bu boradagi ijobiy o‘zgarishlarning izchilligidan dalolat beradi.

ISO, OECD va Jahon bankining ilmiy nashrlarida qayd etilganidek, xalqaro standartlarning eksportga ta’siri bir necha mexanizmlar orqali namoyon bo‘ladi:

- mahsulot sifati va xavfsizligini oshirish;
- texnik va notarif to‘siqlarni kamaytirish;
- eksport shartnomalarida ishonchni mustahkamlash;
- ishlab chiqarishni optimallashtirish va tannarxni pasaytirish;
- global yetkazib berish zanjirlariga integratsiyalashuvni kuchaytirish.

O‘zbekiston korxonalari misolida olib borilgan tahlillar ushbu mexanizmlarning amalda o‘z tasdig‘ini topganini ko‘rsatadi. ISO 9001, ISO 22000, HACCP hamda GlobalGAP standartlarini joriy qilgan korxonalar eksport bozorlariga tezroq chiqmoqda, texnik to‘siqlarning kamayishi evaziga xalqaro hamkorlikning kengayganini kuzatish mumkin. Bunday korxonalar bilan ishlovchi xorijiy xaridorlar ishonchi yuqori bo‘lib, shartnomaviy majburiyatlar barqarorligi ham kuchaygan.

Shu bilan birga, tadqiqot kichik va oʻrta biznes subʼyektlari uchun mavjud cheklovlarni ham koʻrsatadi: sertifikatlash xarajatlarining yuqoriligi, tajribali mutaxassislar yetishmasligi, sinov laboratoriyalarining cheklanganligi kabi omillar standartlashtirish jarayonini sekinlashtirishi mumkin. Davlat tomonidan koʻrsatilayotgan texnik va moliyaviy yordamlar ushbu muammolarni yumshatishga xizmat qilmoqda.

Umuman olganda, xalqaro standartlarning keng tatbiqi Oʻzbekiston eksport salohiyatining barqaror oʻsishida strategik ahamiyat kasb etib, sifat infratuzilmasining mustahkamlanishi, texnik toʻsiqlarning kamayishi va global bozorlarga kirish imkoniyatlarining kengayishiga xizmat qilmoqda.

Xulosa va tavsiyalar

Tadqiqot natijalari xalqaro standartlarni joriy etish Oʻzbekiston eksport siyosatida asosiy drayverlardan biri ekanini koʻrsatmoqda. 2023–2025 yillarda eksport hajmi sezilarli oʻsib, sertifikatlangan korxonalar sonining koʻpayishi hamda sifat infratuzilmasining mustahkamlanishi bu jarayonning bevosita natijasi sifatida namoyon boʻldi.

Quyidagi tavsiyalar eksportning barqaror oʻsishiga xizmat qiladi:

a) Korxonalar uchun sertifikatlash xarajatlarining bir qismini davlat tomonidan kompensatsiya qilish mexanizmlarini kengaytirish.

b) Mahalliy laboratoriyalarni xalqaro akkreditatsiyadan oʻtkazishni jadallashtirish.

c) Standartlashtirish va sertifikatlash boʻyicha malakali mutaxassislar tayyorlash dasturlarini kuchaytirish.

d) Oziq-ovqat, qishloq xoʻjaligi, tekstil va sanoat tarmoqlari uchun maxsus xalqaro standartlashtirish dasturlarini ishlab chiqish.

e) Xalqaro tashkilotlar bilan hamkorlikni kengaytirish va sertifikatlarning oʻzaro tan olinishi boʻyicha kelishuvlarni rivojlantirish.

j) Sertifikatlash jarayonlarini toʻliq raqamlashtirish va onlayn platformalar orqali soddalashtirish.

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ASSESSMENT OF ENZYMATIC ACTIVITY AND ECOLOGICAL STATUS OF GRAY SOILS IN KAMASHI DISTRICT UNDER ARID CLIMATE AND ANTHROPOGENIC PRESSURE

Abstract: *Soil degradation in arid and semi-arid ecosystems of Central Asia represents a serious threat to soil ecological stability and sustainable agricultural development. This study evaluates the physicochemical and biochemical properties of gray soils in irrigated plains, foothill (adir), and mountain foothill landscapes of Kamashi District, Kashkadarya Region, Uzbekistan. The research area is characterized by significant anthropogenic pressure associated with irrigated agriculture, rainfed farming, intensive grazing, and erosion processes. Field investigations were conducted along an altitudinal gradient of 400–1200 m during 2024–2025. Soil quality was assessed using enzymatic indicators, particularly catalase and invertase activities, along with pH, salinity, humus content, and aggregate stability. The results revealed alkaline soil conditions (pH 8.5–9.5) and weak to moderate salinization in irrigated areas, accompanied by a decline in enzymatic activity. In contrast, higher biological stability was observed in relatively undisturbed foothill ecosystems. A strong positive correlation was identified between humus content and the integrated soil biological quality index ($R^2 = 0.89$), confirming the high sensitivity of enzymatic indicators for early detection of soil degradation processes.*

Keywords: *gray soils, arid ecosystems, soil enzymes, catalase, invertase, salinity, bioindicators, soil degradation.*

Introduction

Soil ecological stability in mountain and foothill ecosystems plays a crucial role in ensuring environmental resilience under global climate change conditions (Doran & Parkin, 2024; Toderich et al., 2024). The Kamashi District of Uzbekistan represents a vertically zoned agroecological system extending from desert-steppe plains to the western foothills of the Gissar Mountain Range. The soil cover is mainly represented by light gray, typical gray, and dark gray soils, reflecting strong dependence on relief and climatic conditions.

In recent decades, increasing anthropogenic pressure has intensified soil degradation processes. In irrigated lowland areas, soil pH values have increased up

to 8.9, accompanied by weak to moderate salinization, indicating the development of secondary salt accumulation processes. These conditions negatively affect microbial activity and slow down organic matter decomposition (Haziev, 2020).

In foothill regions, erosion processes and rainfed agriculture have led to soil structure degradation and humus depletion. In mountain foothill pastures, localized degradation is observed due to intensive grazing pressure (Garcia-Ruiz et al., 2025).

Therefore, catalase and invertase enzymes are considered important bioindicators for early diagnosis of soil condition in arid ecosystems (Markert et al., 2023).

Materials and Methods

2.1 Study area and sampling design

Field investigations and soil sampling were conducted during 2024–2025 across main landscape zones of Kamashi District, differing in altitude gradient and anthropogenic pressure:

1. Lowland zone (425 m a.s.l.) – intensively irrigated cultivated light gray soils

2. Foothill zone (750 m a.s.l., Qiziltepa and Changak areas) – rainfed agricultural lands affected by erosion, typical gray soils

3. Mountain foothill zone (1100 m a.s.l.) – natural pasture ecosystems, including both low and high grazing pressure areas, dark gray soils

Soil samples were collected in spring, summer, and autumn from depths of 0–30 cm and 30–50 cm using a quadrat (envelope) sampling method.

2.2 Biochemical and physicochemical analyses

Soil analyses were performed in certified analytical laboratories using standard methods:

Soil pH was determined by a potentiometric method in a soil–water suspension (1:2.5 ratio) using a calibrated glass electrode pH meter.

Salinity was determined from aqueous soil extracts (1:5 soil-to-water ratio) by measuring electrical conductivity after filtration.

Humus content was measured using the Tyurin method modified by Simakov, based on wet oxidation with potassium dichromate under acidic conditions.

Catalase activity was determined using a gasometric method, based on the decomposition of hydrogen peroxide (H_2O_2) and measurement of released oxygen volume ($\text{cm}^3 \text{O}_2 \text{g}^{-1} \text{soil min}^{-1}$).

Invertase activity was determined using the Khaziev method, based on 24-hour incubation of soil samples with sucrose solution and subsequent spectrophotometric determination of glucose ($\text{mg glucose g}^{-1} \text{soil 24 h}^{-1}$).

Aggregate stability was assessed using the Savvinov wet-sieving method.

Results

Significant differences in soil physicochemical and enzymatic properties were observed along the altitudinal gradient (Table 1).

Table 1.
Physicochemical and enzymatic properties of gray soils (0–30 cm layer)

Zone	Soil type	Humus (%)	pH	Salinity	Water-stable aggregates (%)	Catalase	Invertase
Irrigated lowland	Cultivated light gray soil	1.25±0.08	8.9	Weak–moderate salinity	34.2	3.45±0.12	8.12±0.34
Foothill (rainfed)	Eroded typical gray soil	0.98±0.05	7.8	Weak salinity	18.5	2.10±0.09	4.22±0.18
Foothill natural	Dark gray soil (reference)	2.84±0.15	7.3	Non-saline	56.8	5.88±0.22	16.45±0.62
Foothill pasture-degraded	Dark gray soil	1.62±0.11	7.5	Weak salinity	28.1	3.15±0.14	7.30±0.29

The highest humus content and enzymatic activity were recorded in undisturbed foothill soils, while the lowest values were observed in eroded rainfed areas.

Seasonal dynamics showed maximum enzymatic activity during spring (April–May), associated with optimal hydrothermal conditions and active vegetation growth. During summer, invertase activity decreased by 60–70% in all zones, while catalase remained relatively more stable.

The most pronounced degradation differences were observed in the foothill rainfed zone, where soil erosion reduced invertase activity by 3.9 times and catalase activity by 2.8 times compared to the reference site.

Discussion

The results demonstrate that foothill gray soils in Kamashi District have relatively low ecological buffering capacity against mechanical disturbance and erosion processes. Soil salinity was identified as one of the key factors contributing to reduced enzymatic activity.

Increased salt concentration in soil solution creates osmotic stress for microorganisms, thereby reducing metabolic activity and enzyme synthesis. As reported by Haziev (2020), increasing salinity significantly slows down microbial processes and reduces enzymatic activity in soils. Similar observations have been reported by Garcia-Ruiz et al. (2025), who demonstrated that soil enzyme activity decreases significantly under salinization stress in semi-arid environments.

In rainfed foothill zones, reduced water-stable aggregates (18.5%) were closely associated with decreased hydrolase activity. Invertase, being an extracellular enzyme, is strongly adsorbed onto soil colloids and is easily removed together with fine particles during heavy rainfall events, further reducing enzymatic activity.

Comparison between natural and heavily grazed foothill pastures revealed that increased grazing pressure leads to soil compaction, reduced aeration, and decreased aerobic microbial activity. Reduced catalase activity reflects increased oxidative stress and disruption of microbial communities.

Consistent with global studies (Doran & Parkin, 2024; Garcia-Ruiz et al., 2025), soil biological indicators respond more rapidly to degradation processes than physicochemical properties. A strong linear relationship was observed between humus content (X) and the integrated soil biological quality index (Y):

$$Y = 4.12X + 1.85 (R^2 = 0.89)$$

Conclusions

1. Irrigated soils exhibited alkaline conditions (pH 8.5–9.5) and weak to moderate salinization, resulting in reduced microbial and enzymatic activity.

2. Erosion processes in rainfed foothill areas significantly reduced humus content and invertase activity.

3. Natural foothill soils demonstrated high humus content and near-neutral pH, ensuring high biological stability.

4. Enzymatic indicators are highly sensitive tools for early detection of soil degradation in arid ecosystems.

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DIAGNOSTIC VALUE OF MODERN SEROLOGICAL AND MOLECULAR BIOMARKERS IN HEPATITIS B AND D CO-INFECTION DURING ANTIVIRAL THERAPY: A REVIEW

Abstract. *Chronic hepatitis B virus (HBV) and hepatitis D virus (HDV) co-infection remains one of the most severe forms of viral hepatitis and is associated with accelerated progression to liver cirrhosis, hepatic decompensation, and hepatocellular carcinoma. Early diagnosis and effective monitoring of antiviral therapy are essential for improving clinical outcomes. In recent years, significant advances have been achieved in serological and molecular diagnostics, allowing more accurate assessment of viral replication, disease activity, and treatment response. Quantitative determination of HBsAg, HBV DNA, HDV RNA, and novel biomarkers have become important tools in clinical practice.*

Keywords: *hepatitis B virus, hepatitis D virus, biomarkers, serological diagnosis, molecular diagnostics, antiviral therapy, HBV DNA, HDV RNA.*

Introduction

Hepatitis B virus (HBV) infection remains a major global public health problem, affecting nearly 254 million people worldwide [1]. Hepatitis D virus (HDV) is a defective RNA virus that requires the presence of HBV for replication and transmission [2]. Co-infection or superinfection with HDV significantly increases the risk of liver fibrosis, cirrhosis, hepatic failure, and hepatocellular carcinoma compared with HBV monoinfection [3].

The management of HBV/HDV co-infection has become increasingly dependent on accurate laboratory diagnostics. Modern serological and molecular methods provide valuable information regarding viral activity, disease progression, and therapeutic efficacy [4].

Epidemiological Significance of HBV/HDV Co-Infection. HDV infection affects approximately 12–20 million individuals globally and remains highly endemic in several regions of Central Asia, the Middle East, Eastern Europe, and Africa [2].

The prevalence of HDV among HBsAg-positive individuals varies considerably, ranging from 4% to 20% depending on geographical location and risk groups [3]. Studies have demonstrated that HDV infection accelerates liver disease progression and significantly increases liver-related mortality [5].

Serological Biomarkers in HBV/HDV Co-Infection

HBsAg Quantification. Quantitative measurement of hepatitis B surface antigen (HBsAg) has emerged as an important marker for evaluating viral activity

and treatment response [4]. Lower HBsAg levels during antiviral therapy have been associated with improved treatment outcomes and increased likelihood of functional cure [6]. Monitoring HBsAg kinetics may help clinicians predict therapeutic response and optimize treatment strategies [4].

HBeAg and Anti-HBe. The presence of hepatitis B e antigen (HBeAg) reflects active viral replication and infectivity [1]. Seroconversion from HBeAg to anti-HBe antibodies is generally considered a favorable therapeutic endpoint and is associated with suppression of viral replication [6].

Anti-HDV Antibodies. Detection of anti-HDV immunoglobulin G (IgG) and immunoglobulin M (IgM) antibodies remains the primary screening approach for HDV infection [2]. Positive anti-HDV results should be followed by molecular testing to confirm active viral replication [7].

Molecular Biomarkers and Their Clinical Significance **HBV DNA Quantification.** Measurement of serum HBV DNA by real-time polymerase chain reaction (PCR) is considered the gold standard for assessing HBV replication [1]. HBV DNA levels serve as a critical indicator for treatment initiation, monitoring antiviral efficacy, and evaluating long-term prognosis [4]. Persistent suppression of HBV DNA during therapy is associated with reduced risk of cirrhosis and hepatocellular carcinoma [6].

HDV RNA quantification represents the most reliable marker of active HDV replication [2]. Current clinical guidelines recommend HDV RNA measurement for diagnosis, treatment monitoring, and evaluation of virological response [5]. Reduction or disappearance of HDV RNA during therapy is considered an important predictor of favorable clinical outcomes [7].

Hepatitis B Core-Related Antigen (HBcrAg). HBcrAg reflects transcriptional activity of covalently closed circular DNA (cccDNA), which serves as the viral reservoir within hepatocytes [6]. This marker may provide additional information regarding residual viral activity when HBV DNA becomes undetectable during treatment [4].

Serum HBV RNA has recently attracted attention as a promising marker of viral transcription and treatment response [6]. Several studies suggest that HBV RNA may predict viral relapse following discontinuation of nucleos(t)ide analogue therapy [4].

Quantitative Anti-HBc

Quantitative measurement of hepatitis B core antibodies (anti-HBc) has been proposed as an indicator of host immune response and disease activity [6].

Biomarkers during modern antiviral therapy. The introduction of pegylated interferon-alpha and nucleos(t)ide analogues significantly improved management of chronic HBV infection [1]. More recently, Bulevirtide has emerged as the first approved targeted therapy for chronic hepatitis D [7].

Assessment of HBsAg, HBV DNA, and HDV RNA dynamics during therapy allows clinicians to evaluate treatment efficacy and predict long-term outcomes [5]. Patients achieving significant reductions in HDV RNA and HBsAg

concentrations demonstrate better clinical responses and slower disease progression [7].

Conclusion

Modern serological and molecular biomarkers play a crucial role in the diagnosis and monitoring of HBV/HDV co-infection during antiviral therapy. Quantitative assessment of HBsAg, HBV DNA, and HDV RNA remains central to clinical decision-making. Emerging biomarkers such as HBcrAg and serum HBV RNA offer promising opportunities for improving treatment monitoring and prognostic evaluation. The integration of innovative diagnostic technologies into routine clinical practice may contribute to earlier intervention, personalized therapy, and improved long-term outcomes for patients with chronic hepatitis B and D.

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OG'IZ BO'SHLIG'I MIKROBIOMI VA KASALLIKLARNING O'ZARO BOG'LIQLIGI

Abstrakt. Ushbu maqolada og'iz bo'shlig'i mikrobiotasining endogen va ekzogen omillar ta'sirida yuzaga keladigan o'zgarishlari, ushbu o'zgarishlarning organizmning ichki a'zolariga ta'siri hamda ular bilan bog'liq kasalliklar ko'rib chiqiladi. Og'iz bo'shlig'i mikrobiomasi inson organizmining muhim tarkibiy qismi bo'lib, sog'lom holatda mikroorganizmlar va xo'jayin organizmi o'rtasidagi biologik muvozanatni ta'minlaydi. Bu sharoitda patogen mikroorganizmlar juda kam miqdorda mavjud bo'lib, kasallik rivojlanishiga sabab bo'lmaydi. Turli tashqi va ichki omillar ta'sirida mazkur muvozanat buzilishi mumkin, natijada mikroorganizmlar tarkibi va xilma-xilligi o'zgarib, disbioz holati yuzaga keladi. Bunday holat ko'pincha nazorat qilinadigan ekologik va turmush tarzi bilan bog'liq xavf omillari ta'sirida rivojlanadi. So'nggi ilmiy tadqiqotlar og'iz bo'shlig'i mikrobiotasidagi buzilishlar faqat mahalliy patologik jarayonlar bilan cheklanib qolmasdan, balki qandli diabet, yurak-qon tomir tizimining aterosklerotik kasalliklari hamda revmatoid artrit kabi surunkali kasalliklarning paydo bo'lishi va rivojlanishida ham muhim rol o'ynashini ko'rsatmoqda.

Kalit so'zlar: og'iz bo'shlig'i mikrobiotasi, disbioz, patogen mikroorganizmlar, ekologik omillar, xavf omillari, surunkali kasalliklar.

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THE RELATIONSHIP BETWEEN THE ORAL MICROBIOME AND DISEASE DEVELOPMENT

Abstract. This article examines changes in the oral microbiota caused by endogenous and exogenous factors, their impact on the body's internal organs, and related diseases. The oral microbiome is an important component of the human body and, under normal conditions, ensures the biological balance between microorganisms and the human body. At the same time, pathogenic microorganisms are present in insignificant quantities and do not cause disease development. Under the influence of various internal and external factors, this balance may be disrupted, leading to changes in the composition and diversity of

microorganisms and the development of a dysbiosis state. This state is often formed under the influence of controlled environmental factors and lifestyle factors. The results of modern scientific research indicate that disorders of the oral microbiota are not limited to local pathological processes, but also play an important role in the occurrence and progression of chronic diseases such as diabetes mellitus, atherosclerotic diseases of the cardiovascular system, and rheumatoid arthritis.

Keywords: *oral microbiota, dysbiosis, pathogenic microorganisms, endogenous and exogenous factors, environmental impacts, risk factors, chronic diseases.*

Kirish

Og'iz bo'shlig'i ichakdan keyin ikkinchi eng katta va xilma-xil mikrobiotaga ega bo'lib, 750 dan ortiq bakteriya turini o'z ichiga oladi. U bakteriyalar, zamburug'lar, viruslar va sodda hayvonlarni o'z ichiga olgan ko'plab mikroorganizmlarni qo'llab-quvvatlaydi. Og'iz o'zining turli xil tokchalari bilan nihoyatda murakkab muhit bo'lib, unda mikroblar tishlarning qattiq yuzalari va og'iz bo'shlig'i shilliq qavatining yumshoq to'qimalarini egallab oladi. Hazm qilishning boshlang'ich nuqtasi bo'lishidan tashqari, og'iz bo'shlig'i mikrobiomasi og'iz bo'shlig'i salomatligini, shuningdek, umumiy salomatlikni saqlash uchun juda muhimdir. Namuna olishning osonligi tufayli u hozirgacha eng ko'p o'rganilgan mikrobiomga aylandi. Ilgari mikrobiomni o'rganish an'anaviy kulturaga bog'liq usullar bilan cheklangan edi, ammo og'iz bo'shlig'idagi mo'l-ko'l mikrobiotani o'stirish mumkin emas edi. Shuning uchun mikrobiomni o'rganish qiyin bo'lgan. Yangi avlod sekvenirlash va bioinformatika kabi yangi genom texnologiyalarining paydo bo'lishi og'iz bo'shlig'i mikrobiomasining nozik jihatlarini ochib berdi. U mikrobiomni tahlil qilishning samarali usulini taqdim etdi. Salomatlik va kasalliklarda og'iz bo'shlig'i mikrobiomasini o'rganish kasallik holatlari bilan bog'liq funksional va metabolik o'zgarishlarni o'rganish hamda dori vositalarini ishlab chiqish va maqsadli davolash uchun molekulyar belgilarni aniqlash uchun qo'shimcha ko'rsatmalar beradi, bu esa oxir-oqibat moslashtirilgan va aniq tibbiyotni ta'minlashga yordam beradi. Ushbu tahliliy maqola og'iz bo'shlig'i mikrobiomasining salomatlikdagi turli jihatlarini tushuntirishga qaratilgan. Og'izning anatomik tuzilishi hamda iliq va nam muhiti mikrobiotaga ko'payish va o'sish uchun keng imkoniyatlar yaratadi. Chaqaloqlar tug'ilganidan boshlab og'iz bo'shlig'ida oddiy mikroblar jamoasi mavjud bo'ladi, ammo ular o'sib va rivojlanib, tishlari chiqqandan so'ng va boshqa tashqi omillar ta'sirida bu jamoa murakkablashib boradi. Makromorfizmlar va mikroorganizmlarning turli xususiyatlari yaxshi sog'lom bo'lish uchun zarur bo'lgan og'iz bo'shlig'i mikroblari muvozanatining gomeostazini saqlashga yordam beradi. Og'iz bo'shlig'ining noto'g'ri gigiyenasi murakkab mikrob jamoalarida disbakterioz keltirib chiqarishi mumkin bo'lgan kuchli tashqi muhit bosimiga olib kelishi mumkin. Ushbu disbakterioz og'iz bo'shlig'ida ekologik o'zgarishlarga olib kelishi mumkin, bu esa o'z navbatida patogen bakteriyalarning

kolonizatsiyasi va ko'payishiga yordam berishi mumkin. Bu bakteriyalar soni ko'paygan sari og'iz bo'shlig'i kasalliklarining rivojlanish xavfi ham ortadi. Kundalik hayotning kundalik mashg'ulotlari, masalan, chaynash, tishlarni tozalash va tozalash bakteriyemiyaga olib kelishi mumkin, bunda og'iz bo'shlig'idagi bakteriyalar qonga o'tadi. Keyin bu bakteriyalar boshqa yallig'lanish agentlari bilan birga butun tana bo'ylab aylanib, yallig'lanishni keltirib chiqarishi mumkin. Ayrim odamlarda bu jarayon umumiy yallig'lanishga olib kelishi mumkin.

Tadqiqotning maqsadi

Og'iz bo'shlig'i mikrobiomasi xususiyatlarini baholash va uning ta'siri natijasida kelib chiqadigan kasalliklarni aniqlashdan iborat.

Tadqiqot materiallari va usullari

2024-2025-yillarda o'tkazilgan tadqiqotlarda og'iz bo'shlig'i mikrobiomasining buzilishi natijasida aniqlangan kasalliklar va olib borilgan ishlar natijalari keltirilgan.

Tadqiqot natijalari va muhokamasi

Ilmiy adabiyotlarda parodontning yallig'lanish kasalliklari ichki a'zolar kasalliklari bilan bog'liq bo'lishi mumkinligi haqida ko'plab dalillar mavjud. Xususan, bir qator tadqiqotlar natijasida tarqalgan parodontit va aorta aterosklerozi, koronar va periferik qon tomirlarining shikastlanishi bilan patogenetik bog'liq bo'lishi mumkinligi to'g'risida xulosa qilingan. Tish tizimi infeksiyalari va tananing boshqa qismlaridagi kasalliklar o'rtasidagi bog'liqlik bir asrdan ortiq vaqtdan beri ma'lum. Bu esa ushbu kasalliklarning umumiy etiologik va patogenetik omillarini izlashga olib keldi. Biroq, faqat molekulyar-genetik usullarning rivojlanishi bilan mikroorganizmlarni (mikrobiom) o'rganish tish tizimidagi yallig'lanish va kasalliklarning asosiy sababchisiga aylandi. Tishlarning qattiq to'qimalari kasalliklarini, masalan, periodontitni davolashda va stomatologik muolajalardan keyingi yallig'lanish asoratlarning oldini olishda buni hisobga olish zarur. Og'iz shilliq qavatlarida, jumladan, tilning orqa qismida, milk egatlarida, og'iz suyuqligida va karashda turli mikroorganizmlar joylashadi. Bu mikroorganizmlar og'iz muhitidan kerakli oqsillar, uglevodlar, aminokislotalar, minerallar va boshqa moddalarni oladi. Umumiy maydonning atigi 0,03-0,05 kvadrat metrini egallagan og'iz bo'shlig'i mikrobiomasi vaqt o'tishi bilan barqaror bo'lgan 530 dan 700 tagacha bo'lgan tur larni o'z ichiga oladi. Og'iz bo'shlig'ida *Actinomyces*, *Campylobacter*, *Capnocytophaga*, *Corynebacterium*, *Fusobacterium*, *Neisseria*, *Granulicatella*, *Prevotella*, *Streptococcus* va *Veillonella* kabi yetakchi bakteriyalar, shuningdek, *Filifactor* va *Fusobacterium*, *Parvimonas* va *Porphyromonas*, *Prevotella*, *Tannerella* va *Treponema* kabi anaerob proteolitik bakteriyalar bilan bir qatorda *Candida*, jumladan *Candida albicans*, *Candida tropicalis*, *Candida pseudotropicalis* va *Candida guilliermondii* ham mavjud. *Paramyxoviridae* va *Herpesviridae* kabi viruslar, *Entamoeba gingivalis* va *Trichomonas tenax* kabi sodda mikroorganizmlar, *M. ovale* va *M. salivarium* kabi mikoplazmalar, arxeyalar va boshqa mikroorganizmlar tish karashida to'planadi. Zamonaviy talqinga ko'ra, tish karashlari polimikrob jamoalardan tashkil topgan bioplyonkadan boshqa narsa emas. Mikroorganizmlarning ushbu populyatsiyalari

tish karashida ketma-ket rivojlanadi va xo'jayinning ichki hamda tashqi muhiti bilan chambarchas bog'liq bo'lib, uning holatiga sezgirlik bilan munosabatda bo'ladi. Jahon sog'liqni saqlash tashkiloti (JSST) ma'lumotlariga ko'ra, aksariyat rivojlangan mamlakatlarda karies bilan 60 dan 90% gacha yoshlar va kattalar kasallanadi. Osiyo va Lotin Amerikasi mamlakatlarida bu ko'rsatkich 100% ga yaqin. O'zbekistonda aholining 80% dan ortig'i karies bilan og'riydi. Odamda karies tishlar qancha ko'p bo'lsa va u davolashni qancha kechiktirsa, parodontning zararlanish xavfi shuncha yuqori bo'ladi. Og'iz bo'shlig'i gigiyenasi yomonlashganda yoki somatik salomatlik muammolari yuzaga kelganda, parodontit cho'tka bilan tozalashda qon ketishi, og'izdan yomon hid kelishi kabi kichik alomatlar bilan boshlanishi va oxir-oqibat parodont to'qimalarining to'liq yemirilishiga, tishlarning tushishiga, nutq va chaynashning qiyinlashishiga olib kelishi mumkin. Periodontal cho'ntaklar ham infeksiya o'chog'iga aylanib, organizmga salbiy ta'sir ko'rsatadi va hatto hayot uchun xavf tug'dirishi mumkin. Sayyoramizdagi katta yoshli aholining 98 foizi periodontit bilan og'riydi. O'zbekistonda aholining atigi 10 foizida intakt periodontit, 55 foizida boshlang'ich yallig'lanish hodisalari, 15 foizida esa o'rtacha va og'ir darajadagi shikastlanishlar mavjud. Kattalar orasida parodont kasalligining tarqalishi 83% ni tashkil etadi. Parodontitning rivojlanishi asosan bakterial va zamburug'li infeksiyalar kombinatsiyasi, shuningdek, *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola* kabi anaerob bakteriyalar ta'siriga bog'liq. Bu bakteriyalar o'ta tajovuzkorligi, milk epiteliy hujayralari va parodont to'qimalari ichida parazitlik qilishi bilan xarakterlanadi. Ilmiy adabiyotlarda parodont yallig'lanishining ichki a'zolar kasalliklari bilan bog'liqligi haqida ko'plab dalillar mavjud. Jumladan, bir qator tadqiqotchilar aorta va periferik tomirlar zararlanishi bilan kechadigan generallashgan periodontit va ateroskleroz patologik jihatdan bir-biriga bog'liq degan xulosaga kelishgan. V.I. Xarashti va uning hamkasblari odam uyqu arteriyalarida aterosklerotik pilakchalarni o'rganishda polimeraza zanjir reaksiyasi (PZR) yordamida *Chlamydia pneumoniae*, inson sitomegalovirusi va bakterial 16S rRNKni aniqlashgan. *T. forsythensis* uyqu arteriyasi karash namunalarning 79% da, *F. nucleatum* 63% da, *P. intermedia* 53% da va *P. gingivalis* 37% da aniqlandi. *A. actinomycetemcomitans* ham 5% namunalarda aniqlandi. Bu bakteriyalar aterosklerotik zararlangan katta va kichik arteriyalarda ham topilgan. Keyinchalik *A. actinomycetemcomitans*, *Streptococcus mutans*, *S. sanguinis*, *P. gingivalis*, *T. denticola* aorta pilakchalari va yurak qopqoqlari pilakchalarida mavjudligi ma'lum bo'ldi. Ma'lumotlarga ko'ra, OITS, yassi temiratki, oshqozon osti bezi saratoni, leykoz, osteoporoz va boshqa kasalliklar og'iz bo'shlig'i patologiyasi bilan bog'liq. Parodontit gipo- va gipertireoz, qalqonsimon bez oldi va jinsiy bezlar kasalliklari, jigar va buyrak, asab tizimi va endokrin tizimi kasalliklari, LOR kasalliklari, kollagenozlar va allergik holatlar bilan kechishi mumkin. Dunyoda eng ko'p uchraydigan kasalliklar orasida oltinchi o'rinni egallagan parodont kasalligi bilan og'rigan bemorlarda epiteliyda mikrorayonlarning hosil bo'lishi va parodont to'qimalarining shikastlanishi bakteriyemiya moyillikni oshiradi.

Natijada parodont sohasidan boshlangan yallig'lanish tananing boshqa qismlariga tarqalib, klinik patologiyaga olib kelishi mumkin. Shuning uchun og'iz bo'shlig'ida bakteriyalarning ko'payishini nazorat qilish va simbiotik muvozanatni saqlash uchun og'iz bo'shlig'ining to'g'ri gigiyenasiga rioya qilish juda muhimdir, bu esa bakteriyalarning og'iz bo'shlig'idan tananing boshqa qismlariga tarqalishining oldini olishga va tizimli infeksiya xavfini kamaytirishga yordam beradi.

Xulosa

Natijada parodont kasalliklari bilan kasallanish keskin oshib, sog'liqni saqlashning muhim muammosiga aylandi. Bugungi kunda surunkali parodont infeksiyalari va turli tizimli kasalliklar o'rtasidagi bog'liqlikni ko'rsatuvchi ko'plab dalillar mavjud. Tish shifokorlari to'liq stomatologik tekshiruvdan tashqari, nafaqat parhez va iqlim kabi tashqi omillarning ta'sirini, balki og'iz bo'shlig'ining surunkali infeksiyalari mavjudligi kabi mahalliy omillarni ham hisobga olishlari kerak. Shuningdek, ular umumiy amaliyot shifokorlari va mutaxassislar bilan hamkorlikda har tomonlama yordam ko'rsatishlari kerak. Shuning uchun ushbu mutaxassisliklar shifokorlari odamning alohida biotoplaridagi mikrobiomlarning miqdoriy va sifat tarkibini bilishlari kerak. Bemorlarni shifoxonaga yotqizishda yoki ularning ahvoli og'irlashganda og'iz bo'shlig'i mikroorganizmlarining somatik jarayonlar kechishiga ko'rsatishi mumkin bo'lgan salbiy ta'sirini istisno qilish kerak.

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AMIR TEMUR HARBIY YURISHLARIDA HARBIY MUHANDISLIK TIZIMLARI VA MUDOFAA TO'SIQLARINING STRATEGIK AHAMIYATI

Annotatsiya: *Ushbu maqolada XIV-XV asrlar harbiy san'atining cho'qqisi hisoblangan Amir Temur qo'shinidagi muhandislik tizimlari va jang maydonidagi muhandislik to'siqlari tadqiq etiladi. Maqolada qamal qurilmalari, gidrotexnik inshootlar va logistic yechimlar fundamental manbalar asosida tahlil qilinadi.*

Kalit so'zlar: *Amir Temur, harbiy muhandislik, manjaniq, naqqoblik, lahm, gidrostrategiya, ponton ko'priklar, Siba, Sobat.*

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MILITARY ENGINEERING SYSTEMS AND THE STRATEGIC ROLE OF DEFENSIVE STRUCTURES IN THE CAMPAIGNS OF AMIR TEMUR

Annotation: *This article examines the engineering systems and battlefield engineering barriers in the army of Amir Temur, who is considered the pinnacle of military art in the 14th -15th centuries. The study analyzes siege constructions, hydraulic engineering structures, and logistical solutions based on fundamental sources.*

Keywords: *Amir Temur, military engineering, manjonel, naqqoblik, hydro-strategy, pontoon bridges, siba, sobat.*

XIV–XV asrlarda jahon harbiy san'atining cho'qqisi hisoblangan Amir Temur qo'shinining strategik muvaffaqiyatlari nafaqat otliq askarlarning taktik harakatlari yoki yuksak qo'shin intizomi, balki mukammal tashkil etilgan harbiy-muhandislik tizimlari va gidrotexnik inshootlarning o'zaro uyg'unligiga asoslanadi. Mazkur tadqiqotning bosh maqsadi – tarixiy manbalar prizmasi orqali Sohibqiron yurishlarida muhandislik korpusining funksional vazifalarini tizimli tahlil qilish hamda dushman mudofaa to'siqlarini parokanda qilishdagi operativ-taktik ahamiyatini har tomonlama chuqur yoritishdan iborat.

Mavzuning o'rganilish darajasiga va adabiyotlar sharhiga nazar tashlasak, mahalliy va xorijiy olimlar, jumladan, fransuz tadqiqotchisi Lyusiyen Keren, harbiy tarixchi M. Ivanin hamda O'zbekistonlik tilshunos va tarixchi olim H. Dadaboyev tomonidan sarkardaning faoliyati va u davrdagi harbiy terminologiya keng o'rganilgan bo'lsa-da, harbiy muhandislik masalalari ko'pincha umumiy va tavsifiy xarakterda qolib kelayotgan edi.

Mavzuning dolzarbligi

Ushbu ilmiy ishda tarixiylik, qiyosiy-tarixiy tahlil, tizimli yondashuv va harbiy-taktik modellashtirish metodlaridan unumli foydalangan holda, ilk bor “Gidrostrategiya” (*suv resurslaridan taktik qurol va mudofaa to’sig’i sifatida foydalanish*) hamda “Yerosti muhandislik operatsiyalari” tushunchalari ilmiy-nazariy jihatdan o’rganishdan iborat.

Sharafuddin Ali Yazdiyning “Zafarnoma”, Nizomiddin Shomiyning shu nomli asari hamda Ibn Arabshohning “Ajoyib al-maqdur fi navoibi Taymur” kabi fundamental manbalari tahlili shuni ko’rsatadiki, Amir Temurning “Temur tuzuklari” asaridagi “kengash va tadbir” prinsipi shunchaki nazariya emas, balki bevosita aniq matematik va muhandislik hisob-kitoblarida o’z aksini topgan mukammal bir amaliy tizim bo’lgan [2].

Sohibqiron armiyasining hayratlanarli g’alabalari ortida turgan eng muhim omillardan biri - bu qo’shin tarkibida alohida va mustaqil tuzilma sifatida faoliyat yuritgan mukammal muhandislar korpusining mavjudligi edi. Ushbu maxsus muhandislik bo’linmalari me’morlar, tosh yo’nuvchilar, duradorlar, gidrotexniklar, ko’prik quruvchilar va yerosti ishlarining mohir ustalari bo’lgan naqqoblardan tashkil topgan edi.

Amir Temur har qanday harbiy yurishga otlanishdan avval bo’lajak operatsiya teatrining geografik sharoitini, iqlimiy o’ziga xosliklarini, daryolar va suv havzalarining holatini, shuningdek, dushman istehkomlarining arxitekturasini muhandislik razvedkasi orqali mukammal tarzda o’rgangan. Muhandislik razvedkasining asosiy vazifasi nafaqat dushman mudofaasining zaif va zaiflashgan nuqtalarini topish, balki qo’shinning harakatlanish yo’nalishidagi tabiiy to’siqlarni bartaraf etish rejasini tuzishdan iborat edi. [1], [5].

Ushbu korpus uzoq marshlar davomida yo’llarni tekislash, tog’li dovonlarda yo’laklar ochish, botqoqliklarni quritish va qalin o’rmonlar ichidan qo’shin o’tishi uchun xavfsiz marshrutlar yaratish kabi o’ta og’ir, keng ko’lamli logistik vazifalarni muvaffaqiyatli bajargan. Shuning hisobiga Temur armiyasi dushman qo’mondonligi mutlaqo o’tib bo’lmaydi deb hisoblagan geografik hududlarni qisqa fursatda va talofatsiz bosib o’tib, urushning strategik tashabbusini dastlabki kunlardanoq o’z qo’liga olishga erishgan [1], [5].

Sohibqironning shahar va qal’alarni qamal qilish taktikasi harbiy fanda alohida o’rin tutadi, chunki u shunchaki jismoniy kuch ishlatishga emas, balki bir vaqtning o’zida bir nechta murakkab muhandislik yechimlarini kombinatsiya qilish (*o’zaro uyg’unlikda qo’llash*) metodiga asoslangan edi. Bu yondashuv qamal qilinayotgan dushmanga bir necha yo’nalishda ham ma’naviy-psixologik, ham moddiy-jismoniy zarbalar berish imkonini yaratgan.

Qamal jarayonlarida dushman istehkomlariga uzoq masofadan turib halokatli zarbalar berish maqsadida manjaniq va arroda deb ataluvchi, o’z davrining og’ir artilleriyasi hisoblangan tosh otar va o’t otar ulkan qurilmalardan foydalanilgan. Ushbu mexanik moslamalar bir necha yuz kilogramm vaznga ega bo’lgan toshlarni, mudofaa inshootlarini yondirish uchun maxsus tayyorlangan

neft, moy va kimyoviy qorishmalar bilan to'ldirilgan alangali idishlarni dushman mudofaa chizig'iga aniq yetkazib bera olgan [2].

Tarixchi Sharafuddin Ali Yazdiy o'z xronikalarida, xususan 1400-yilda Kichik Osiyodagi eng mustahkam istehkomlardan biri bo'lgan Sivas qal'asini qamal qilish jarayonida muhandislar tomonidan misli ko'rilmagan darajada ulkan manjaniqlar yasalganini, ular orqali otilgan og'ir toshlar qal'aning ko'p yillik baquvvat mudofaa minoralarini va devorlarini yer bilan bitta qilganini alohida hayrat bilan bayon etgan [2].

Qal'a devorlari haddan tashqari baland bo'lgan va dushmanning himoya o'qlari ostida ularga yaqinlashish imkoni bo'lmagan o'ta murakkab vaziyatlarda, Amir Temur muhandislari siba deb nomlanuvchi g'ildirakli, ko'p qavatli harakatlanuvchi minoralar tizimini ishlab chiqqanlar. Bu minoralar qalin yog'ochlardan yasaliib, tashqi tomoni dushman otadigan o'qlar va yonuvchi moddalardan himoyalaniish maqsadida namlangan qalin chorva terilari bilan qoplangan. Sibalarning asosiy strategik ahamiyati shunda ediki, ularning ichiga joylashgan xos askarlar va kamonchilar dushman istehkomi devorlariga xavfsiz tarzda yaqinlashib, shahar himoyachilari bilan bir xil balandlikka, ya'ni teng pozitsiyaga chiqish imkoniga ega bo'lganlar [5].

Shu bilan bir qatorda, askarlarning qal'a devori tagigacha yetib borishini ta'minlash, ularni dushman tomonidan tepadan tashlanadigan toshlar, qaynoq smola va neft qorishmalaridan asrash uchun sobat deb ataluvchi yopiq, mustahkam himoyalangan yog'och yo'laklar qurilgan. Ushbu muhandislik to'siqlarini yorib o'tish yo'laklari hujumga o'tgan piyoda qo'shnlarning hayotini saqlab qolishda va ularning jangovar shijoatini ushlab turishda beqiyos amaliy ahamiyatga ega bo'lgan [5].

Qamal muhandisligining va yerostidagi taktik operatsiyalarning eng cho'qqisi, shubhasiz, naqqoblik yoki lahm parmalash san'ati bo'lib, u o'rta asrlar muhandislik tafakkurining eng yuksak va murakkab namunasi hisoblanadi. Muhandis-naqqoblar dushman ko'zidan mutlaqo yashirin bo'lgan hududda, aniq geometrik burchak ostida va chuqurlikda qal'a devorlarining fundamenti tomon yer ostidan maxsus tunnellarini (lahmlarni) qazishgan. Tunnel qazish jarayonida uning tepa qismi va yon devorlari o'pirilib ketmasligi uchun vaqtinchalik mustahkam yog'och tirgaklar va sinchlar bilan bosqichma-bosqich mustahkamlab borilgan. Tunnel dushman istehkomining eng ko'p og'irlik tushadigan yuk ko'taruvchi asosiy poydevor markaziga yetib borgach, muhandislar u yerga tez yonuvchi materiallarni, quruq o'tinlarni to'plab, ustidan neft yoki maxsus moylar quyib o't qo'yishgan. Natijada ichkaridagi yog'och tirgaklar butunlay yonib ketgan, ostidagi zamin bo'shab, tuproq o'pishi sodir bo'lgan va buning oqibatida dushmanning eng baquvvat, qalin tosh devorlari hech qanday tashqi jismoniy zarbasiz, o'z og'irligi ostida tubdan o'pirilib, pastga qulab tushgan. Sivas, Halab, Shom va boshqa o'nlab strategik shaharlarni qamal qilishda ayni shu yerosti naqqoblik taktikasi dushmanning mudofaa irodasini sindirishda va g'alabani ta'minlashda eng asosiy, hal qiluvchi omil bo'lib xizmat qilgan [5].

Amir Temur qoʻllagan harbiy-muhandislik tizimlari ichida uning tabiat qonuniyatlari va gidrologik omillardan strategik maqsadlarda foydalana olish qobiliyati, yaʼni zamonaviy harbiy ilm-fanda “Gidrostrategiya” deb ataluvchi tizim alohida ilmiy qimmatga egadir. Sarkarda va uning gidrotexnik muhandislari suv resurslarini ham mudofaa toʻsigʻi, ham dushmanga qarshi shafqatsiz va samarali hujum quroli sifatida qoʻllashning mukammal usullarini namoyish etishgan.

Buning eng yorqin misollaridan biri 1388-yilda Xorazmga qilingan yurish paytida, Urganch shahrini taslim etishda kuzatilgan boʻlib, unda muhandislar Amudaryoning tabiiy oqimini maxsus gidrotexnik toʻgʻonlar qurish orqali shahar poydevori va devorlari tomon yoʻnaltirishga muvaffaq boʻlishgan. Loy, xom gʻisht va tosh aralashmasidan tiklangan shahar istehkomlarining fundamenti tinimsiz kelayotgan suv oqimi taʼsirida yumshab, oʻzining mustahkamligini butunlay yoqotgan va bu holat shahar mudofaasining ichkaridan parokanda boʻlishiga olib kelgan [1], [5].

Ikkinchi strategik va tarixiy misol 1402-yilgi mashhur Anqara jangida namoyon boʻladi; unda Temur muhandislari Boyazid Yildirimning ulkan qoʻshini joylashgan vodiya keladigan yagona daryo oqimini boshqa tomonga burib qoʻyishgan yoki yuqori oqimda toʻsib, dushman askarlarini jang arafasidagi eng issiq kunlarda mutlaqo suvsiz qoldirishgan. Bu strategik muhandislik chorasini Usmonli turk qoʻshinini ham jismoniy, ham ruhiy jihatdan ogʻir ahvolga solib, ularning jangovar qobiliyatini keskin pasaytirgan va jang taqdirini Sohibqiron foydasiga hal qilgan [4], [6].

Qoʻshinlarning oʻta yuqori tezlikda harakatlanishi (mobilligi) va strategik marشلarning muvaffaqiyati koʻp jihatdan yoʻldagi keng daryolar va suv toʻsiqlarini qisqa vaqt ichida talofatsiz kesib oʻtishga bogʻliq boʻlgan boʻlib, bu borada Temur muhandislarining ponton (suzuvchi) koʻpriklar qurish mahorati oʻsha davr uchun haqiqiy texnologik yangilik hisoblangan [4], [3].

Ibn Arabshoh oʻzining tarixiy asarlarida Temur armiyasining Nil, Hind, Amudaryo va Sirdaryo kabi chuqur, shiddatli va keng suv toʻsiqlaridan oʻtish jarayonlarini katta hayrat bilan batafsil tasvirlab bergan. Muhandislar qisqa soatlar ichida yuzlab qayiq-larni, suzuvchi xodalarni va maxsus moslamalarni zanjirlar hamda mustahkam pishiq arqonlar yordamida bir-biriga mahkam bogʻlab, ularning ustiga qalin taxta toʻshamalar yotqizishgan. Bunday ponton koʻpriklar shunchalik baquvvat boʻlganki, ular orqali minglab otliq va piyoda qoʻshinlar bilan bir qatorda, armiyaning eng ogʻir yuklari, qamal qurollari, manjaniq qismlari va tuyalar karvonlari ham bemaʼlol, bexatar harakatlana olgan. Dushman daryolarni oʻtib boʻlmas tabiiy toʻsiq yoki xavfsiz mudofaa chizigʻi deb hisoblab, oʻz pozitsiyalarida xotirjam oʻtirgan bir paytda, Temur qoʻshini kutilmaganda daryoning narigi qirgʻogʻida paydo boʻlib, tezkor operativ zarbalar bergan va bu omil raqib qoʻmondonligini strategik jihatdan butunlay chorasiz ahvolga solib qoʻygan [4].

Hujumkor harakatlar bilan bir qatorda, Amir Temur armiyasida vaqtinchalik yoki uzoq muddatli qarorgohlarni, xususan, “garda” deb ataluvchi harbiy

lagerlarni dushmanning kutilmagan tungi hujumlaridan (shabxunlardan) himoya qilish uchun mudofaa muhandisligi tizimi tizimli tarzda yo'lga qo'yilgan edi. Qo'shin to'xtagan har bir strategik hududda uning atrofini o'rab turuvchi keng va chuqur xandaqlar (kandaklar) qazilgan bo'lib, ushbu xandaqlarning ichki qismiga dushman otliqlarining shiddatini qaytarish va ularning harakatini cheklash maqsadida o'tkir uchli yog'och qo'ziqlar, maxsus tikanli to'siqlar o'rnatilgan. Xandaq qazish jarayonida chiqqan tuproq esa lagerning ichki tomoniga baland marza (mudofaa vali) shaklida uyulib, uning ustiga maxsus qalqonlar (chapar va tura) o'rnatilgan bo'lib, bu tizim kamonchilar va o'qchilarga xavfsiz va qulay otish pozitsiyalarini ta'minlagan. Bundan tashqari, mustahkam dushman qal'alarining temir yoki emand qilingan og'ir darvozalarini urib buzish uchun qal'ako'sh deb ataluvchi maxsus mexanik qurilmalar va devor teshgich muhandislik vositalaridan unumli foydalanilgan [5].

Ushbu mudofaa va hujum inshootlarining yaxlit majmuasi ochiq maydonlardagi janglarda ham armiyaning qanotlarini himoya qilishda va taktik ustunlikni saqlab qolishda muhim tarkibiy qism bo'lgan.

O'tkazilgan kompleks tadqiqotlar va fundamental manbalarning tahlili shuni yaqqol ko'rsatadiki, Amir Temurning harbiy-muhandislik tizimlari shunchaki oddiy amaliy tajribalar yig'indisi yoki urush maydonidagi tasodifiy kashfiyotlar emas, balki o'z davrining aniq fanlari – geometriya, gidravlika, topografiya, mexanika va materialshunoslik qonuniyatlarining harbiy-strategik tafakkur bilan mukammal darajadagi amaliy integratsiyasidir [5].

Xulosa

Yuqoridagilardan kelib chiqqan holda qo'ydagicha xulosa qilish mumkin. Jumladan, Sohibqiron o'z muhandislarining intellektual salohiyatini yuksak qadrlagan, ularga keng imkoniyatlar yaratib bergan va har qanday tabiiy yoki sun'iy to'siqni parokanda qilish uchun o'ziga xos, universal texnik yechimlarni topa bilgan. Sarkardaning ushbu boy tajribasi, ayniqsa, geografik relyef va gidrologik sharoitlardan operativ ustunlikka erishish yo'lida unumli foydalanish prinsiplari bugungi zamonaviy harbiy muhandislik ta'minoti, harbiy logistika, strategik rejalashtirish hamda mudofaa taktikasi uchun ham o'zining dolzarb ilmiy-nazariy ahamiyatini yo'qotmagan.

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IQTISODIY MASALALARNI SIMPLEKS USULDA YECHISH

Annotatsiya: Mazkur maqola iqtisodiy jarayonlarni modellashtirishda chiziqli dasturlash usullaridan foydalanish masalalariga bag'ishlangan. Tadqiqot doirasida cheklangan resurslarni ratsional taqsimlash, ishlab chiqarish xarajatlarini kamaytirish va foydani maksimallashtirish maqsadida qo'llaniladigan matematik dasturlash instrumentlari tahlil qilingan. Muallif chiziqli funksiyaning noma'lum o'zgaruvchilar va chegaralovchi shartlar asosida ekstremal qiymatlarini topish jarayonini yoritib beradi. Maqolada chiziqli dasturlash masalalarini yechishning grafik usuli bilan bir qatorda, ko'p o'lchamli o'zgaruvchili tizimlar uchun samarali bo'lgan simpleks usulining afzalliklari ko'rib chiqilgan. Noma'lumlar soni ko'p bo'lgan murakkab iqtisodiy modellarda grafik usulning cheklanganligi tushuntirilib, simpleks usulining algoritmi va uni amaliy iqtisodiy vazifalarga tatbiq etish mexanizmlari ilmiy asoslab berilgan.

Kalit so'zlar: chiziqli dasturlash, simpleks usul, maqsad funksiyasi, resurslar, optimallashtirish, foydani maksimallashtirish.

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SOLVING ECONOMIC PROBLEMS USING THE SIMPLEX METHOD

Abstract: This article is dedicated to the application of linear programming methods in modeling economic processes. The study analyzes mathematical programming tools used for the rational allocation of limited resources, the reduction of production costs, and the maximization of profit. The author describes the process of finding extreme values of a linear function based on unknown variables and constraint conditions. In addition to the graphical method for solving linear programming problems, the article examines the advantages of the simplex method, which is effective for systems with multi-dimensional variables. The limitations of the graphical method in solving complex economic models with a large number of variables are explained, and the algorithm of the simplex method, as well as the mechanisms for its application to practical economic tasks, are scientifically substantiated.

Keywords: linear programming, simplex method, objective function, resources, optimization, profit maximization.

Chiziqli dasturlash matematik dasturlashning bir qismi bo'lib, chegaralangan resurslarni ratsional taqsimlab, eng ko'p foyda olish yoki eng kam

xarajat qilish yo'llarini o'rgatadi. Chiziqli dasturlashtirish – chiziqli funktsiyaning uning tarkibiga kiruvchi noma'lumlarga chegaralovchi shartlar qo'yilganda eng katta va eng kichik qiymatini izlash va topish usulini o'rgatuvchi bo'limdir.

Chiziqli dasturlash masalalarini yechishning bir qancha usullari mavjud: grafik usul, simpleks usul. Tenglamalar sistemasida va maqsad funktsiyasida noma'lumlar soni ko'p bo'lganda grafik usulni qo'llash qiyin yoki imkonsiz bo'lib qoladi. Shuning uchun quyidagi iqtisodiy masalalarni simpleks usulda yechish masalasini qaraymiz:

1 – masala. Bir korxona 3 xil mahsulot ishlab chiqaradi:

- **Mahsulot A** — x_1
- **Mahsulot B** — x_2
- **Mahsulot C** — x_3

Korxonada 3 xil resurs mavjud:

1. Xom ashyo.
2. Mehnat vaqti.
3. Energiya.

Resurs sarfi:

Resurs	A(x_1)	B(x_2)	C(x_3)	Mavjud
Xom ashyo	2	3	4	8
Mehnat	1	2	1	5
Energiya	6	3	5	15

Foyda:

- A dan 1 dona → 7 ming so'm foyda
- B dan 1 dona → 9 ming so'm foyda
- C dan 1 dona → **-5 ming so'm** (zarar).

Korxona resurslar chegaralangan sharoitda foydani maksimal qilishni istaydi.

Qancha A, B va C ishlab chiqarish kerak?

Masalaning matematik modeli:

$$\begin{cases} 2x_1 + 3x_2 + 4x_3 \leq 8 \\ x_1 + 2x_2 + x_3 \leq 5 \\ 6x_1 + 3x_2 + 5x_3 \leq 15 \end{cases}$$

Maqsad funktsiyasi: $F = 7x_1 + 9x_2 - 5x_3 \rightarrow \max$.

Tengsizliklarni tenglikka aylantiramiz:

$$\begin{cases} 2x_1 + 3x_2 + 4x_3 + x_4 = 8 \\ x_1 + 2x_2 + x_3 + x_5 = 5 \\ 6x_1 + 3x_2 + 5x_3 + x_6 = 15 \end{cases}$$

$$F - 7x_1 - 9x_2 + 5x_3 = 0.$$

Masalani quyidagi simpleks jadvalga joylashtiramiz:

Базис	x1	x2	x3	x4	x5	x6	bi	bi/ustun	
x4	2	3	4	1	0	0	8	2,67	
x5	1	2	1	0	1	0	5	2,50	min
x6	6	3	5	0	0	1	15	5,00	
F	-7	-9	5	0	0	0	0		
		min							

Jadvalning oxirgi qatorida eng kichik element -9, shuning uchun bu ustunni belgilaymiz. Ozod **bi** hadlarni belgilangan ustunga bo'lib, eng kichik element joylashgan qatorni belgilaymiz. Belgilangan ustun va qatorning kesishgan joyidagi element 2 ga teng. 2 ni 1 ga aylantirish uchun bu qatorni 2 ga bo'lamiz va bu ustundagi qolgan elementlarni nolga aylantiramiz:

Базис	x1	x2	x3	x4	x5	x6	bi	bi/ustun	
x4	0,5	0	2,5	1	-1,5	0	0,5	1	min
x2	0,5	1	0,5	0	0,5	0	2,5	5	
x6	4,5	0	3,5	0	-1,5	1	7,5	1,66666667	
F	-2,5	0	9,5	0	4,5	0	22,5	-9	
	min								

Bu jadval uchun ham yuqoridagi amallarni takrorlaymiz. Belgilangan ustun va qatorning kesishgan joyida 0,5 joylashgan. Uni birga va bu element joylashgan ustundagi qolgan elementlarni nolga aylantiramiz:

Базис	x1	x2	x3	x4	x5	x6	bi	bi/ustun	
x1	1	0	5	2	-3	0	1	-1/3	
x2	0	1	-2	-1	2	0	2	1	
x6	0	0	-19	-9	12	1	3	1/4	min
F	0	0	22	5	-3	0	25		
					min				

Bu jadvalda x5 ustunda F satrda -3 turipti. Jadvalni yuqoridagidek shakl almashtiramiz:

Базис	x1	x2	x3	x4	x5	x6	bi
x1	0,5	0	0,125	-0,125	0	0,125	0,875
x2	0	1	1,1667	0,5	0	-0,167	1,5
x5	0	0	-1,583	-0,75	1	0,0833	0,25
F	0	0	17,25	2,75	0	0,25	25,75

F qatordagi barcha koeffitsiyentlar musbat. Demak, bu yechim optimal.

$$x_1 = \frac{0,875}{0,5} = 1,75,$$

$$x_2 = \frac{1,5}{1} = 1,5,$$

$$x_3 = 0.$$

x_1 va x_2 lar mahsulot soni bo'lganligi uchun, ularni yechimga eng yaqin bo'ladigan qilib, yaxlitlaymiz. Bu holatda

$$x_1 = 1 \text{ va } x_2 = 2.$$

Shunda maksimal foyda

$$F = 7 \cdot 1 + 9 \cdot 2 = 25 \text{ ming so'm.}$$

C mahsulot zarar keltirgani sababli, bu mahsulotdan ishlab chiqarilmaydi.

Resurslar A va B mahsulotlar ishlab chiqarishga taqsimlanadi.

2 – masala. Korxona 2 xil mahsulot ishlab chiqaradi:

- **Mahsulot A** — x_1

- **Mahsulot B** — x_2

Korxonada 3 xil resurs mavjud:

1. Xarajat (byudjet).
2. Ishchi kuchi (xodimlar soni).
3. Ishlab chiqarish maydoni (kvadrat metr).

Resurs sarfi:

Resurs	A(x_1)	B(x_2)	Mavjud
Xarajat (ming so'm)	1	3	9
Ishchi kuchi (xodimlar soni)	4	2	16
Ishlab chiqarish maydoni (kvadrat metr)	2	5	20

Foyda:

- A dan 1 dona → 5 ming so'm foyda

- B dan 1 dona → 7 ming so'm foyda

Korxona resurslar chegaralangan sharoitda foydani maksimal qilishni istaydi.

A va B mahsulotlardan qanchadan ishlab chiqarish kerak?

Masalaning matematik modeli:

$$\begin{cases} x_1 + 3x_2 \leq 9 \\ 4x_1 + 2x_2 \leq 16 \\ 2x_1 + 5x_2 \leq 20 \end{cases}$$

Maqsad funksiyasi: $F = 5x_1 + 7x_2 \rightarrow \max.$

Tengsizliklarni tenglikka aylantiramiz:

$$\begin{cases} x_1 + 3x_2 + x_3 = 9 \\ 4x_1 + 2x_2 + x_4 = 16 \\ 2x_1 + 5x_2 + x_5 = 20 \end{cases}$$

$$F-5x_1-7x_2=0.$$

Masalani quyidagi simpleks jadvalga joylashtiramiz:

Базис	x1	x2	x3	x4	x5	bi	bi/ustun	
x4	1	3	1	0	0	9	3	min
x5	4	2	0	1	0	16	8	
x6	2	5	0	0	1	20	4	
F	-5	-7	0	0	0	0		
		min						

Yuqorida bajargan amallarimizni takrorlaymiz:

Базис	x1	x2	x3	x4	x5	bi	bi/ustun	
x2	1/3	1	1/3	0	0	3	9	
x4	10/3	0	-2/3	1	0	10	3	min
x5	1/3	0	-5/3	0	1	5	15	
F	-8/3	0	7/3	0	0	21		
	min							

Базис	x1	x2	x3	x4	x5	bi	bi/ustun
x2	0	1	2/5	-1/10	0	2	
x1	10/3	0	-2/3	1	0	10	
x5	0	0	-26/15	-1/10	1	4	
F	0	0	9/5	4/5	0	29	barcha koeffitsiyentlar musbat

F qatordagi barcha koeffitsiyentlar musbat. Demak, bu yechim optimal.

$$x_1 = \frac{10}{\frac{10}{3}} = 3,$$

$$x_2 = \frac{2}{1} = 2.$$

x_1 va x_2 larning qiymatlari butun sonlar bo'lganligi uchun, ularni yaxlitlamaymiz.

Shunda maksimal foyda

$$F = 5 \cdot 3 + 7 \cdot 2 = 29 \text{ ming so'm.}$$

Maqolada chiziqli dasturlash va simpleks usulning iqtisodiyotdagi o'rni amaliy misollar bilan ko'rsatib berilgan. Unda keltirilgan yechimlar resurslardan unumli foydalanish va foydani maksimallashtirish masalalarini qanday hal qilishni o'rgatadi. Ayniqsa, ishlab chiqarish korxonalari uchun qaysi mahsulotni, qancha miqdorda ishlab chiqarish kerakligini aniqlashda simpleks usul samarali vosita ekanligi ko'rsatilgan.

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ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В СОВРЕМЕННОМ МЕДИЦИНСКОМ ОБРАЗОВАНИИ: ВЫЗОВЫ, РЕШЕНИЯ И ПЕРСПЕКТИВЫ

***Аннотация.** В настоящее время рассматривается процесс глубокой цифровой трансформации медицинского образования в России. Анализируются ключевые направления внедрения информационных технологий: симуляционные технологии и виртуальная реальность, платформы дистанционного обучения, применение искусственного интеллекта в учебном процессе, электронные портфолио как инструмент оценки компетенций, а также работа с медицинскими базами данных. Особое внимание уделяется вступившим в силу с 2026 года нормативно - правовым изменениям.*

***Ключевые слова:** цифровая трансформация, медицинское образование, симуляционные технологии, виртуальная реальность (VR), дополненная реальность (AR), дистанционное обучение, искусственный интеллект (ИИ), информационная грамотность.*

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INFORMATION TECHNOLOGY IN MODERN MEDICAL EDUCATION: CHALLENGES, SOLUTIONS AND PERSPECTIVES

***Abstract.** Currently, the process of deep digital transformation of medical education in Russia is being considered. Key areas of information technology implementation are analyzed: simulation technologies and virtual reality, distance learning platforms, the use of artificial intelligence in the educational process, electronic portfolios as a tool for assessing competencies, as well as working with medical databases. Particular attention is paid to regulatory changes that have entered into force since 2026*

***Keywords:** digital transformation, medical education, simulation technologies, virtual reality (VR), augmented reality (AR), distance learning, artificial intelligence (AI), and information literacy.*

Цифровая трансформация как новая парадигма. Цифровые технологии стремительно проникают во все сферы жизни, и здравоохранение не

является исключением. Цифровизация медицинской отрасли развивается от электронных медицинских карт до систем поддержки принятия врачебных решений на основе искусственного интеллекта (ИИ). Сегодня мы наблюдаем не просто внедрение отдельных цифровых инструментов в образовательный процесс, а смену самой парадигмы подготовки медицинских кадров.

Сеченовский университет, выступая в авангарде этого движения, характеризует происходящее как «новую парадигму, которая переопределяет все аспекты нашей деятельности: от подготовки кадров высшей квалификации до оказания медицинской помощи и проведения фундаментальных научных исследований». Фрагментарные решения, внедряемые точечно, уже не способны раскрыть весь потенциал цифровой трансформации; требуется системный, стратегический подход, основанный на глубокой интеграции образования, науки и клинической практики. Именно эта интеграция призвана устранить традиционные разрывы между теоретической подготовкой и реальными потребностями современного здравоохранения.

Актуальность: цели и нормативный контекст

Информатизация медицинского образования продиктована двумя ключевыми факторами: требованиями цифрового здравоохранения к компетенциям выпускников и необходимостью повышения качества и доступности подготовки медицинских кадров. Как отмечает начальник отдела высшего и дополнительного образования Минздрава России Юлия Тимофеева, «программы должны иметь практическую направленность, а цифровые решения и искусственный интеллект позволяют поддерживать высокий уровень образовательного контента». При этом важно учитывать нормативно - правовой контекст. С 1 марта 2026 года вступили в силу положения федерального закона № 28-ФЗ, ограничивающие использование электронного обучения и дистанционных образовательных технологий в медицинских программах, за исключением случаев, предусмотренных федеральными государственными образовательными стандартами. Этот закон, по замыслу разработчиков, направлен на повышение качества подготовки специалистов и обеспечение её практической ориентированности. Постановление Правительства России также требует использования в медицинских образовательных учреждениях исключительно сервисов видеосвязи из реестра отечественного программного обеспечения, что стимулирует импортозамещение в этой сфере.

Симуляционные технологии и виртуальная реальность: от теории к безопасной практике. Одним из наиболее ярких и эффективных направлений внедрения информационных технологий в медицинское образование являются симуляционные технологии, включая технологии виртуальной (VR) и дополненной (AR) реальности. Сегодня этой области придается стратегическое значение, что подтверждается регулярным проведением профильных конференций, таких как III Международная научно -

практическая конференция «Симуляционные технологии обучения в здравоохранении» (Уфа, ноябрь 2025 года). VR - технологии решают ключевую задачу медицинского образования: позволяют отрабатывать практические навыки в безопасной, но максимально реалистичной среде без риска для пациента, где «каждая тренировка на таком симуляторе исключает несчастный случай с реальным пациентом». Благодаря тактильной точности тренажеров студенты входят в операционную без «синдрома первого раза», а возможность многократно повторять сложные манипуляции - от инъекций до хирургических вмешательств - способствует совершенствованию техники. Более того, некоторые учебные заведения отмечают, что VR - технологии превращают учебу в увлекательный процесс, где студент становится активным участником, а не пассивным слушателем.

Кроме того, в линейке узкоспециализированных тренажеров можно отрабатывать трахеостомию, гайморотомию, офтальмоскопию, регистрацию и интерпретацию ЭКГ, оценку слуховой функции и даже развитие коммуникативных компетенций медицинского персонала.

Дистанционное обучение и системы управления обучением (LMS)

Дистанционные образовательные технологии, особенно в гибридном формате, прочно вошли в практику медицинских образовательных учреждений. Также важно, что преподаватель получает полную статистику посещаемости и активности участников, включая их фактическое пребывание на занятии. Хотя некоторые подчеркивают, что в подготовке медицинских кадров многие умения и навыки могут быть получены только в очной форме обучения. Однако дистанционное обучение сегодня интенсивно развивается. Это и работа на симуляторах, интерактивные дистанционные мастер - классы, технологии объемной визуализации. При этом студенты хотели бы видеть больший объем дистанционных технологий, особенно видеоресурсов, которые дают возможность возвращаться к материалу и пересматривать сложные моменты.

Вместе с тем дистанционное обучение в медицине сталкивается с серьезным вызовом с вступившим в силу с 01.03.2026 года федерального закона № 28 - ФЗ, который существенно ограничивает использование «дистанта» в медицинских образовательных программах. Это создает необходимость пересмотра подходов к организации учебного процесса и поиска баланса между очными и онлайн - форматами, особенно для теоретических дисциплин.

Искусственный интеллект в образовательном процессе

Искусственный интеллект становится не просто предметом изучения, но и полноценным инструментом обучения. В Сеченовском университете открыты четыре новые образовательные программы, где студенты изучают современные направления систем ИИ в медицине, типы медицинских данных, этапы подготовки данных, обучения и валидации моделей.

Электронное портфолио как инструмент оценки и мотивации

Электронное портфолио становится все более распространенной технологией в медицинском образовании, выполняя две ключевые функции: объективную оценку способностей обучающегося и стимулирование достижения конечных результатов. По определению, электронное портфолио представляет собой подборку сведений об индивидуальных достижениях человека, структурированную как набор записей в базе данных. Оно может включать сведения об образовании, сертификаты, дипломы, результаты научной и общественной деятельности.

Внедрение электронного портфолио в медицинских образовательных учреждениях сопряжено с рядом вызовов. Как отмечают исследователи, портфолио имеет большой потенциал, «однако его реализация в полной мере на практике требует новых педагогических и образовательных подходов, а также значительных затрат сил и времени как от преподавателей, так и обучающихся». С 1 марта 2026 года в российских школах и колледжах вводится обязательное использование портфолио для учета внеучебных достижений, что, вероятно, ускорит внедрение аналогичных систем и в медицинском образовании.

Медицинские базы данных и информационная грамотность

В эпоху персонализированных подходов к лечению умение работать с медицинскими базами данных становится критически важной компетенцией медицинского работника. Студенты - медики осваивают навыки работы с ведущими мировыми платформами открытого доступа. Учебные программы охватывают создание таблиц, форм ввода данных о пациентах, формирование запросов и отчетов. Повышение информационной грамотности будущих медиков включает также освоение методов поиска данных, статистического анализа и интерпретации результатов для принятия клинических решений. Важным практическим навыком является использование терминологии для точного и быстрого поиска релевантных научных публикаций.

Проблемы и барьеры внедрения. Несмотря на очевидные успехи, процесс цифровизации медицинского образования сталкивается с серьезными проблемами. Эти барьеры напрямую относятся и к медицинскому образованию. Преподаватели и студенты нуждаются не только в техническом оснащении, но и в четких методических рекомендациях, юридически проработанной нормативной базе и системной подготовке к работе в цифровой среде.

Таким образом, цифровая трансформация медицинского образования - это не просто внедрение технологий, а комплексная перестройка всей системы подготовки кадров для здравоохранения. Сегодня мы находимся в точке бифуркации, когда от принимаемых решений зависит, какой станет медицина завтрашнего дня.

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НАУЧНО-ТЕОРЕТИЧЕСКИЕ ОСНОВЫ РАЗВИТИЯ ТУРИЗМА В ГОРНЫХ РЕГИОНАХ

***Аннотация:** В статье рассматриваются научно-теоретические основы развития туризма в горных регионах как одного из приоритетных направлений современной туристской индустрии. Проведен анализ отечественных и зарубежных научных подходов к определению сущности горного туризма, раскрыты его основные функции, принципы и закономерности развития. Особое внимание уделено экономико-географическим, природно-ресурсным, социально-экономическим и экологическим факторам, определяющим формирование и эффективное использование туристского потенциала горных территорий. Исследованы современные концепции устойчивого развития, территориальной организации туризма и рационального природопользования, являющиеся теоретической основой развития туристской деятельности в горных регионах. Обоснована необходимость комплексного подхода к оценке туристских ресурсов с учетом природных, инфраструктурных, культурно-исторических и институциональных факторов.*

***Ключевые слова:** горный туризм, горные регионы, горный ландшафт, горный рельеф, туристский потенциал, геотуризм, познавательном туризм, скайраннинг, хайкинг, туристские ресурсы.*

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SCIENTIFIC AND THEORETICAL BASIS FOR THE DEVELOPMENT OF TOURISM IN MOUNTAIN REGIONS

***Abstract:** This article examines the scientific and theoretical foundations of tourism development in mountain regions as a priority area of the modern tourism industry. It analyzes domestic and international scientific approaches to defining the essence of mountain tourism, revealing its main functions, principles, and development patterns. Particular attention is paid to the economic, geographical, natural resource, socioeconomic, and environmental factors that determine the formation and effective use of the tourism potential of mountainous areas. This*

article explores contemporary concepts of sustainable development, territorial organization of tourism, and rational environmental management, which form the theoretical basis for developing tourism activities in mountainous regions. It also substantiates the need for a comprehensive approach to assessing tourism resources, taking into account natural, infrastructural, cultural, historical, and institutional factors.

Keywords: *Mountain tourism, mountain regions, mountain landscape, mountain relief, tourist potential, geotourism, educational tourism, skyrunning, hiking, tourist resources.*

В горах проживает около 1,1 миллиарда человек, некоторые из которых относятся к числу беднейших и наиболее изолированных в мире. В то же время горы издавна привлекают туристов, интересующихся природой, отдыхом на открытом воздухе и активным отдыхом на природе, таким как пешие прогулки, альпинизм и зимние виды спорта. Они также привлекают посетителей своим богатым биоразнообразием и яркой местной культурой. Однако, согласно отчету «Понимание и количественная оценка горного туризма», в 2019 году, последнем году, за который имеются данные, на 10 самых гористых стран (по средней высоте над уровнем моря) пришлось всего 8% всех иностранных туристов в мире.

Горный туризм составляет от 9 до 16% от общего числа прибытий иностранных туристов по всему миру, что в 2019 году составило от 195 до 375 миллионов туристов. Однако дефицит данных о внутреннем горном туризме затрудняет или даже делает невозможным оценку экономических, социальных и экологических последствий этого важного сегмента. Цель данного нового отчета - восполнить этот пробел в данных [3].

Горный рельеф превосходит равнинную территорию не только в эстетическом плане. Он располагает большим запасом рекреационных ресурсов благодаря чистоте горного воздуха и повышенному уровню ультрафиолетового излучения. Возможности организации горнолыжных и альпинистских центров зависят от характеристик склонов (их протяженности, угла наклона, экспозиции, характера и длительности залегания снежного покрова), наличия долин, удобных для размещения приютов, туристских баз и т. Д. [6].

Горный туризм развивается в районах с колебаниями высот от 1000 до 3500 м. Соответственно, различают низкогорные, среднегорные и высокогорные маршруты горного туризма. При организации горнолыжных курортов рельеф оценивают с точки зрения прокладки горнолыжных трасс, их протяженности и разнообразия. Этот фактор является исходным при выборе места для горнолыжного курорта [2]. Природные факторы, имеющие пространственную дифференциацию в пределах страны, в том числе в ее горных регионах, являются основой развития туризма. Их сочетание определяет степень благоприятности для туристско-рекреационной деятельности [9].

Местность с горным рельефом, отличающаяся большой концентрацией природных аттрактивных объектов, имеет характерные признаки, что необходимо учитывать во время туристских исследований. Многие цивилизации возникли и развивались в горных регионах, о чем свидетельствует богатый культурно-исторический потенциал этих частей мира. Виды туризма, которые возможны только в горной местности, за последние несколько десятков лет стали очень популярными, вследствие этого многие горные регионы Земли стали самими известными туристскими дестинациями мира (Альпы, Карпаты, Кавказские горы, Апеннины, Кордильеры, горные хребты Балканского п-ва и т.д.). К горным видам туризма относятся: альпинизм, скалолазание, катание на горных лыжах, скайраннинг, хайкинг, горный туризм и т.д. Кроме того, в горных регионах возможны и другие виды туризма: массовый, индивидуальный (спа, религиозный, исторический, охотничий, пеший, кулинарный), агротуризм (природный туризм, каякинг, рафтинг), курортный туризм (верховая езда, пеший, туризм выходного дня, рестораны) [17]. Исходя из этого разнообразия, румынские специалисты М. Гознер и Л. Зарили [15] выявляют туристский потенциал района Алба-Юлия в восточной Румынии, большую часть которого занимают Карпатские горы.

Ливанский горный ландшафт представляет собой сочетание природных экосистем и культурного наследия, характеризующееся богатой и разнообразной мозаикой экосистем с высокими засушливыми необитаемыми горами (от 1800 до 3000 метров) и населенными деревнями в средних горах и пологих холмах (от 500 до 1800 метров) [18]. Горный туризм является основополагающим фактором социально-экономического развития территории, поскольку семь из девяти провинций и 20 из 26 районов Ливана имеют горные районы с высотой более 500 метров. Что касается общего распределения горных достопримечательностей в Ливане, то районы Батрун, Джебейль, Шуф, Аккар и Матн предлагают наибольшее количество возможностей для горного туризма, составляя 45 процентов от общего числа достопримечательностей. Также примечательно, что 15 районов предлагают туристические достопримечательности в трех или более различных географических зонах, что позволяет создавать богатые и разнообразные природные и культурные маршруты на этих разных территориях.

Первой особенностью является повышение интереса к горным регионам, что связано с тенденцией изменения основных туристских потоков в морские и горные курорты в зависимости от исторического времени. Б. Филип из Университета географии Альп [11] отмечает, что эти изменения происходят в историческом времени. Он указывает, что в прошлом морские побережья не были интересны в качестве места для летнего отдыха, а такими являлись горные регионы.

А.В.Пучкина [7] основной акцент делает на ландшафты в горной местности. Автор выделяет пять основных групп природных факторов,

воздействующих на организм человека в горах: климатические, радиационные, электромагнитные, гляциологические и геоморфологические. А.В. Пучкина вводит понятие о двух видах оценки пейзажного потенциала: 1) эстетическая оценка ландшафтов во время движение по маршруту и 2) эстетическая оценка пейзажа на видовых точках.

Особое значение в бившие советской рекреационной литературе имеет работа Н.С.Мироненко и И.Т.Твердохлебова [5]. Авторы, отмечая растущую роль горных мест в рекреации, указывают на специфичность методики оценки климата на этих территориях. По условиям адаптации и акклиматизации в горных районах они выделяют следующие зоны: до 2000 м - зона индифферентности, пребывание в которой не вызывает заметных реакций в организме; 2000 - 4000 м - зона полной компенсации, где проявляющиеся изменения в организме могут полностью компенсироваться; выше 4000 м - зона неполной компенсации, при которой отчетливо проявляются признаки гипоксии (недостатка кислорода) и возникает ряд расстройств, снижающих работоспособность человека.

Очень интересным и уникальным примером развития туризма в горах является исследование Ли Фунг Ми [14], в котором познавательный туризм в горах рассматривается в аспекте исторического, культурного значения гор. В Китае почти во все времена был культ поклонения горам. Горы являлись священными и в буддизме, и в даосизме, и в конфуцианстве, поэтому верующие каждой религии имели свои священные горы. Исходя из этого, автор делает вывод о большом туристском потенциале горных ресурсов, которые нужно освоить. И на сегодняшний день отмечается повышенный интерес к познавательному туризму в горах Китая.

В горных районах Узбекистана также расположены известные святыни, в том числе мавзолей Хазрата Дауда (Самаркандская область), мавзолей Хазрата Башира, мавзолей Лангарота, мавзолей Кокташота, мавзолей Ходжи Ильмконагии, мавзолей Шейха Абу Бакра, мавзолей Ходжайпока, малые мавзолей Лангарота (Кашкадарьская область), мавзолей Ходжи Майханы (Сурхандарьская область) и др. Ежегодно эти святыне места посещают миллионы туристов, что еще больше увеличивает туристический потенциал горных регионов.

Горы являются традиционно привлекательными ландшафтами для туристов. Горная местность отличается определенной туристической специализацией, сезонностью туристических потоков, особенностями территориальной организации туризма [21].

И геологический, и географический туризм используют термин «геотуризм», и консенсус в этом вопросе еще не найден. Основное различие состоит в том, что если геологический туризм определяется как вид туризма, со специализацией привлечения туристов к геологическим памятникам территорий [8], то географический трактуется как новая концепция, включающая в себя основные принципы устойчивого туризма. Эта концепция предполагает представление географического характера

территорий, сохраняя и поддерживая его с помощью средств, вырученных от туризма.

На территории села Джовуз Китабского района, на юго-западном склоне горы Зеравшан, по левому берегу реки Джиннидарья, на высоте 1300-2650 метров над уровнем моря, расположен государственный геологический заповедник «Китоб», и Китабский геологический национальный природный парк [1]. Особое внимание уделяется использованию туристического потенциала района в качестве нового туристического маршрута по дороге, ведущей к перекрестку «Зинзилбог» на территории заповедника. Ручьи Оби-Сафит, Ходжакурбан, Зинзилбог, Новобог, Хушнова, Кызылолма и другие глубоко прорезают территорию заповедника, образуя здесь разнообразные горные ущелья красивой природы. В целях увеличения потока туристов в эти регионы перспективным считается развитие треккингового, экотуризма, ознакомительного, научного и геотуристического видов туризма.

Сегодня горы представляют собой важный актив для мировой туристической индустрии. С одной стороны, чистый воздух, уникальные ландшафты и дикая природа, живописная красота, богатое культурное наследие и возможности для отдыха, которые предлагают горы, делают их местом спасения от стрессов городского образа жизни и магнитом для туристов. С другой стороны, во многих горных районах мира после появления туризма значительно вырос уровень жизни местного населения. Например, в Альпах развитие туризма с XVIII в. полностью превратило бедные сельскохозяйственные поселения в процветающие горные курорты и деревни. Именно по этой причине горные направления необходимо рассматривать не только как места для отдыха и развлечений, но и как «экономические предприятия», которые могут принести многочисленные выгоды местным сообществам и национальной экономике [16]. Связь между горами и туризмом неоспорима. Горы - это место с большим туристическим притоком, поэтому его использование для целенаправленного туризма приводит к развитию устойчивой деятельности, способной улучшить экономические условия этих территорий, где во многих случаях проживает население с низкими доходами [12; 13]. Охрана окружающей среды путем развития горного туризма стала основным вопросом 3-й Евроазиатской конференции по горным курортам Всемирной туристской организации [20].

Территория Кашкадарьинской бассейн геоморфологический делится на три основные формы (горные, предгорные и равнинные районы). Горный район включает средневысотные и высокие горы, в основном относящиеся к Зеравшанскому и Гиссарскому хребтам. Открытый горный туризм, альпинизм в Каратепа, Чакилкалон, Осмонтараш, Каратаг, Хазрат Султан, Бешнов, Сумсар, Шертог, Такаойнар, Тойталаш, Эшакмайдан, Хонтаhti, Карасырт, Чакчар, Сарыкия, Контепа, Акбоштав, Актаг, Бобосурхак-Карасирт, возможно развивать виды треккинга, спелео и экотуризма [4]. Дехканабадский район является горным районом, и он отличается размерами своей площади в регионе. Западные отроги Гиссарского хребта - горы

Чакчар, Бобосурхак, Карасирт, Акбаш имеют высокий потенциал для развития экотуризма, горного туризма, оздоровительного, trekkingового, паломнического, рекреационного, придорожного туризма в поселке Окрабод. Ежегодно соленое озеро Кансай посещают 7000 отдыхающих, а озеро с минеральными грязями в поселке Хужайпок посещают 15000 отдыхающих.

Одна из главных особенностей туризма в горной местности заключается в том, что горные ландшафты более хрупкие и трудно восстанавливаемые. Об этом свидетельствует разница пропускной способности между горной и пляжной территорией. В связи с этим и деградацией горных ландшафтов в Альпах европейские страны разработали новые методы использования горных ландшафтов [10].

Туризм является важным ресурсом для многих горных экономик: на горные районы приходится 15-20 % мирового туризма, что составляет 70–90 млрд долл. США в год [19]. Но, чтобы сделать горные территории доступными для туристов, требуются значительные инвестиции в инфраструктуру, а также стимуляция спроса на горные направления на местном и международном уровне. Кроме того, некоторые горные районы поставили под угрозу устойчивость горных сообществ и наносят серьезный ущерб горным экосистемам.

Научно-теоретические основы развития туризма в горных районах свидетельствуют о том, что эффективное освоение горных территорий в туристских целях должно базироваться на комплексном учете природно-географических, социально-экономических, экологических и институциональных факторов. Теоретический анализ показывает, что горный туризм представляет собой многокомпонентную систему, функционирование которой определяется взаимосвязью природно-ресурсного потенциала, туристской инфраструктуры, транспортной доступности, уровня социально-экономического развития территории и качества управления туристской отраслью.

Установлено, что современная концепция развития туризма в горных районах основывается на принципах устойчивого развития, рационального природопользования, сохранения биоразнообразия и культурно-исторического наследия, а также сбалансированного сочетания экономических, социальных и экологических интересов. При этом научные подходы к развитию горного туризма предполагают широкое применение экономико-географических методов оценки туристского потенциала, пространственного анализа, туристского районирования и стратегического территориального планирования.

Таким образом, научно-теоретические основы развития туризма в горных районах формируют методологическую базу для комплексного исследования туристского потенциала, обоснования приоритетных направлений территориального развития и разработки эффективной государственной и региональной политики, направленной на обеспечение

устойчивого развития горных территорий и повышение их конкурентоспособности на национальном и международном туристском рынке.

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ТЕОРЕТИКО-МЕТОДОЛОГИЧЕСКИЕ ОСНОВЫ РАЗВИТИЯ ФИЗИЧЕСКИХ КАЧЕСТВ У ДЕТЕЙ ДОШКОЛЬНОГО ВОЗРАСТА

Аннотация: Педагогико-психологические основы, методические особенности развития физических качеств у детей дошкольного возраста не были отдельно исследованы. Принимая во внимание научную и практическую актуальность, недостаточную исследованность данной проблемы, для настоящей статьи избрана тема: «Теоретико-методологические основы развития физических качеств у детей дошкольного возраста».

Ключевые слова: методические особенности, физические качества, научная и практическая актуальность, исследованность проблемы, теоретико-методологические основы.

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THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF PHYSICAL DEVELOPMENT IN PRESCHOOL CHILDREN

Abstract: The pedagogical and psychological foundations and methodological aspects of developing physical skills in preschool children have not been specifically studied. Considering the scientific and practical relevance and the insufficient research available on this issue, the topic chosen for this article is "Theoretical and Methodological Foundations of Developing Physical Skills in Preschool Children."

Keywords: methodological aspects, physical skills, scientific and practical relevance, research status, theoretical and methodological foundations.

Научно-теоретическому анализу подвергнуты сущность, содержание и структура исследования, а также социально-педагогическая необходимость развития физических качеств у детей дошкольного возраста, педагогические взгляды мыслителей Востока на физическое воспитание, исследования ученых Узбекистана и стран СНГ, посвященные различным вопросам воспитания физически развитого подрастающего поколения, физиологическим, педагогическим, психологическим особенностям формирования физических качеств у детей дошкольного возраста, состоянию физического образования и воспитания воспитанников в дошкольных образовательных организациях на практике, деятельности

инструктора по физической культуре. Исторически существовавшие системы физического воспитания оценивались по тому, как они развивали физические (двигательные) качества человека. Физическими качествами принято называть силу, скорость (быстроту), выносливость, ловкость, подвижность суставов тела и гибкость мускулатуры в разной степени сформированных в организме человека. По тому, как проявляются эти качества человеческого организма, индивид оценивался как, сильный, ловкий, быстрый и прочее.

Воспитание физических качеств личности является непрерывным и последовательным процессом, важное значение имеет начинать его с этапа дошкольного образования. Хорошее развитие физических качеств у детей выражается в качестве показателя достижения общей цели физического воспитания, состоящего из всестороннего развития детей, формирования у них навыков здорового образа жизни. Одной из актуальных проблем в настоящее время является внедрение эффективных форм и методов развития физических качеств детей в дошкольных образовательных организациях. Совершенствование процессов воспитания и образования в ДОО, согласно принципу личностного подхода к развитию ребенка, приведенного в Законе Республики Узбекистан “О дошкольном образовании и воспитании”, а также таких целей, как поднятие качества образования в системе дошкольного образования на новый уровень, совершенствование процессов дошкольного воспитания и образования на основе научно обоснованных подходов, указанных в Стратегии развития Нового Узбекистана на 2022 – 2026 годы, разработанной на основе принципа “От стратегии действий к стратегии развития”, а также утверждение о необходимости нравственного и физического воспитания детей в возрасте 3-6 (7) лет, разработки и реализации комплексных мер, направленных на формирование у них физических качеств на основе «Концепции непрерывного духовного развития», предусматривает определение педагогических и психологических особенностей детей дошкольного возраста в системе работы по физическому воспитанию, совершенствование модели развития их физических качеств.

Согласно Приложению 1 “Государственные требования, предъявляемые к развитию детей раннего и дошкольного возраста” “Государственного стандарта дошкольного образования и воспитания”, разработан “паспорт здоровья” для детей дошкольного возраста с учетом пяти основных областей (физическое развитие и формирование здорового образа жизни; социальное и эмоциональное развитие, навыки речи, общения, чтения и письма, развитие процесса познания, творческое развитие) развития детей от рождения до 7 лет, который ведется от поступления ребенка в дошкольную образовательную организацию до выпуска из него. Это способствует возможности индивидуальной оценки физической подготовки воспитанников дошкольных образовательных организаций. Наряду с этим процесс физического и нравственного воспитания детей дошкольного возраста осуществляется на основе самостоятельной, совместной и

коллективной деятельности детей в таких центрах развития, как “Язык и речь”; “Строительство, мастерение, конструирование и математика”; “искусство”; “Сюжетно-ролевые игры и драматургия”; “Наука и природа”.

Организация в дошкольных образовательных организациях игровой, учебной и трудовой деятельности на основе принципа горизонтальной интеграции гарантирует достижение гармоничного формирования у детей компетенций в различных областях развития, при этом освоенные на занятиях знания, навыки и умения закрепляются на запланированных прогулках, играх и в процессе самостоятельной деятельности детей в центрах развития. Интеграция центров развития предусматривает комплексное содержательное планирование (с учетом реализации всех пяти областей образования); а посредством интеграции самостоятельной деятельности детей закрепляются физические качества детей, а также устраняются негативные особенности, проявляющиеся в поведении детей.

В результате организации образовательной, игровой и трудовой деятельности детей в дошкольных образовательных организациях на основе их интеграции гарантируется достижение гармоничного формирования компетенций, физических качеств по сферам развития детей, при этом усвоенные на занятиях знания, умения и навыки закрепляются в процессе самостоятельной деятельности детей в запланированных в распорядке дня прогулках и играх, а также в центрах развития. Интеграция развивающих центров предусматривает комплексное тематическое планирование (с учетом реализации всех пяти сфер образования); укрепление физических качеств детей посредством интеграции самостоятельной деятельности детей в центрах развития, а также устранения негативных особенностей, проявляющихся в поведении.

Взаимосвязь и единство таких организационных компонентов, как занятия, оказывающие влияние на физическое воспитание воспитанников (игровая образовательная деятельность), самостоятельная деятельность, игры, прогулки и экскурсии выражают особенности педагогического процесса. Поэтому правильная организация деятельности детей в ДОО образует целостную педагогическую систему, особенно, в плане процесса физического воспитания. Воспитание детей дошкольного возраста физически зрелыми осуществляется, благодаря показателям развития крупной и мелкой моторики в области «Физического развития и формирования здорового образа жизни» (см. таблица).

Показатели физического развития 6-7-летних детей дошкольного возраста

Физические индикаторы развития	
1.	Проявление физической активности, соответствующей нормам физического развития, связанного с возможностями и возрастом ребенка;
2.	Умеет гармонично и целесообразно проявлять различного рода двигательную активность;
3.	Пользуется навыками мелкой моторики в различных жизненных и учебных ситуациях;
4.	Управляет своими движениями с помощью ощущений и органов чувств;
5.	Использует навыки личной гигиены;
6.	Знает основы здорового образа жизни и правильного питания;
7.	Следует правилам основ безопасной жизненной деятельности.

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АРТУРО ПЕРЕС-РЕВЕРТЕ: ВОЙНА КАК АБСУРД И ТРАГЕДИЯ В ПОВЕСТИ «ТЕНЬ ОРЛА»

Аннотация: *Исследуется повесть Артуро Переса-Реверте «Тень орла» как произведение, в котором исторический материал становится основой для философского осмысления природы войны. Анализируется жанровое своеобразие повести, соединение сатирического и трагического начал, использование иронии, гротеска и чёрного юмора как средств разрушения традиционного героического пафоса. Выявляется, как образы испанского батальона и Наполеона служат раскрытию антивоенного смысла произведения.*

Ключевые слова: *Артуро Перес-Реверте, историческая повесть, военная проза, ирония, гротеск, чёрный юмор, антивоенная проблематика, герой, абсурд.*

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ARTURO PÉREZ-REVERTE: WAR AS ABSURDITY AND TRAGEDY IN THE STORY "THE SHADOW OF THE EAGLE"

Abstract: *The article examines Arturo Pérez-Reverte's novella La sombra del águila as a work in which historical material becomes a basis for philosophical reflection on the nature of war. The study focuses on the genre characteristics of the novella, the combination of satire and tragedy, and the use of irony, grotesque and black humor as devices for deconstructing traditional heroic narratives. Special attention is given to the images of the Spanish battalion and Napoleon as means of revealing the anti-war message of the work.*

Keywords: *Arturo Pérez-Reverte, historical novella, war literature, irony, grotesque, black humor, anti-war discourse, hero, absurdity.*

Введение

Тема войны занимает значительное место в творчестве современного испанского писателя Артуро Переса-Реверте. Опыт работы военным корреспондентом оказал существенное влияние на художественное восприятие писателя: в центре его внимания оказывается не только ход исторических событий, но прежде всего человек, оказавшийся внутри военного конфликта.

К эпохе наполеоновских войн Перес-Реверте обращается в нескольких произведениях, среди которых особое место занимает небольшая по объёму повесть «Тень орла» (*La sombra del águila*, 1993). В отличие от традиционного исторического повествования, произведение сочетает элементы сатиры, философской прозы и военной повести, превращая исторический сюжет в размышление о трагической природе войны.

Цель данного исследования заключается в анализе художественных приёмов деконструкции героического мифа о войне в повести Переса-Реверте и выявлении механизмов, посредством которых авторская ирония трансформирует историческое повествование в философское осмысление природы войны и человеческих судеб.

Методология

Анализ повести проводится с применением методов историко-литературного и интертекстуального анализа. Исследование сосредоточено на выявлении жанровых характеристик произведения, особенностей нарративной структуры и стилистических приёмов. Особое внимание уделяется анализу языка повести, использованию авторской иронии, гротеска и чёрного юмора как средств создания комического эффекта и одновременного раскрытия трагического содержания.

Повесть основана на историческом фоне русской кампании Наполеона 1812 года. В центре повествования находится испанский 326-й линейный полк, состоящий из бывших военнопленных, насильственно включённых во французскую армию. Парадокс, лежащий в основе сюжета, заключается в том, что испанские солдаты, стремящиеся избежать войны и перейти на сторону русских войск, ошибочно воспринимаются Наполеоном как «герои», что делает их невольными участниками исторического мифа.

Результаты исследования

Анализ текста показывает, что повесть задаёт необычную тональность, контрастирующую с традиционным изображением наполеоновской эпохи. Вместо военного величия и героического пафоса читатель сталкивается с солдатским взглядом на войну — грубым, ироничным и лишённым романтических иллюзий. Разговорная интонация, саркастические реплики, гротескные имена и названия создают комический эффект, однако за этим смехом постепенно раскрывается трагическое содержание.

Авторская ирония направлена не на отрицание исторического значения событий, а на разрушение мифа о войне как о пространстве славы и подвига. В произведении героизм возникает случайно, а победа оказывается результатом абсурдного стечения обстоятельств. Юмор не уменьшает ужас войны, а делает его ещё более очевидным, контрастируя с комичностью описываемых ситуаций.

Образ Наполеона в повести отличается сложностью и неоднозначностью. Перес-Реверте подвергает ироническому переосмыслению не самого исторического деятеля, сумевшего изменить судьбу Европы, а созданный вокруг него культ непобедимости. Солдатские

прозвища императора (особенно «Проклятый карлик») отражают взгляд простых участников войны, воспринимающих полководца через собственный опыт страдания. Однако в некоторых эпизодах император предстает как человек, способный испытывать сочувствие, что усложняет его образ и раскрывает его вовлечённость в трагический механизм истории.

Особое значение приобретает финальная встреча Наполеона и капитана Гарсии, когда Гарсия возвращает императору орден Почётного легиона, полученный за «героическую» атаку. Этот жест становится символическим отказом от ложной военной славы. Награда, которая должна была означать подвиг, превращается в напоминание об абсурде войны. От прежнего величия имперского орла остаётся лишь «тень его крыльев» — символ утраты иллюзий и разрушения героического мифа.

Финал повести особенно трагичен: из сотен испанских солдат домой возвращаются лишь единицы. За историческими событиями и публично провозглашаемыми победами остаются не легенды, а судьбы людей, принесённых в жертву чужим политическим интересам.

Обсуждение

Проведённый анализ позволяет утверждать, что «Тень орла» представляет собой не просто историческую повесть о событиях наполеоновской эпохи, а глубокое размышление о природе войны и механизмах создания исторических мифов. Перес-Реверте соединяет сатиру и трагизм, иронию и гуманистический взгляд на человека, создавая произведение, в котором конкретные человеческие судьбы противопоставляются великим историческим событиям.

Главный антивоенный смысл произведения заключается в том, что за любым историческим мифом стоят реальные человеческие судьбы. В «сухом остатке» от великой военной кампании остаются не победы и легенды, а несколько выживших солдат и экзистенциальный вопрос о смысле и оправданности принесённых жертв.

Художественные приёмы, используемые Перес-Реверте — особенно ирония и гротеск — служат не просто созданию комического эффекта, а выполняют критическую функцию, деконструируя традиционные представления о войне как поле славы и героизма. Исторический материал в произведении становится средством раскрытия вневременного человеческого конфликта между индивидуальной судьбой и историческими процессами.

Повесть Переса-Реверте демонстрирует, как современная литература может пересмотреть исторические события, предлагая читателю критический взгляд на официальные нарративы и выявляя трагические измерения, скрытые за историческими мифами.

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ФОЛЬКЛОР КАК ИСТОРИЧЕСКИЙ ИСТОЧНИК ИЗУЧЕНИЯ КОЧЕВЫХ ОБЩЕСТВ ЦЕНТРАЛЬНОЙ АЗИИ

Аннотация: В данной статье фольклор рассматривается как исторический источник для изучения кочевых обществ Центральной Азии. Исследование сосредоточено на анализе мифов, легенд, преданий и героического эпоса для реконструкции исторической памяти, социальных отношений и культурных ценностей традиционных кочевых обществ. Проведена критическая оценка методологии использования фольклорных источников в сочетании с письменными и археологическими материалами.

Ключевые слова: фольклор, исторический источник, устная традиция, героический эпос, культурная память, кочевые общества, Центральная Азия.

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FOLKLORE AS A HISTORICAL SOURCE FOR THE STUDY OF NOMADIC SOCIETIES IN CENTRAL ASIA

Abstract: This article examines folklore as a historical source for studying nomadic societies in Central Asia. The research focuses on analyzing myths, legends, traditions, and heroic epics to reconstruct historical memory, social relations, and cultural values of traditional nomadic societies. A critical assessment of the methodology for using folklore sources in combination with written and archaeological materials is conducted.

Keywords: folklore, historical source, oral tradition, heroic epic, cultural memory, nomadic societies, Central Asia.

Введение

Современная историческая наука характеризуется расширением представлений о базе источников в исследовании прошлого. Наряду с письменными, археологическими и этнографическими материалами все большее значение приобретают фольклорные источники, позволяющие изучать не только события прошлого, но и особенности исторической памяти, мировоззрения и культурного опыта традиционных обществ.

Особое значение фольклор приобретает при изучении истории кочевых обществ Центральной Азии, где устная традиция на протяжении веков являлась важнейшим способом сохранения и передачи знаний о прошлом. Одним из первых исследователей казахского и кыргызского фольклора был Чокан Чингисович Валиханов, который рассматривал произведения народного творчества, эпические памятники и устные предания как важный материал для изучения истории и культуры народов Центральной Азии [1]. Особое место в его исследованиях занимало изучение кыргызского эпоса «Манас», который он одним из первых ввел в научный оборот.

Целью данной работы является анализ фольклорных источников как инструмента исторического исследования кочевых обществ Центральной Азии и оценка их эффективности при использовании критического методологического подхода.

Методология

В этом контексте фольклор занимает особое место, поскольку является формой сохранения коллективного опыта, исторической памяти и культурных представлений народа. Фольклорные произведения не могут рассматриваться как прямое описание исторической действительности, поскольку в них сочетаются элементы исторической памяти, художественного осмысления, символики и коллективных представлений. Поэтому их использование требует критического анализа и сопоставления с другими видами источников.

Различные жанры фольклора обладают неодинаковыми возможностями для исторического исследования. Их значение определяется не только содержанием произведений, но и тем, какие стороны жизни общества они отражают. Изучение фольклорных текстов проводится с применением сравнительного анализа, который позволяет выявить общие и специфические черты культурных представлений и исторической памяти различных этнических групп.

Результаты

Мифы являются одной из древнейших форм осмысления человеком окружающего мира. Хотя мифологические сюжеты не могут рассматриваться как прямое описание исторических событий, они содержат важные сведения о представлениях общества о происхождении, власти, родственных связях, природе и месте человека в мире [2].

Легенды и предания занимают особое место среди фольклорных источников, поскольку часто связаны с определенными территориями, историческими персонажами и событиями. Они отражают коллективные представления народа о прошлом, формируют образы героев и правителей, сохраняют сведения о социальных отношениях и культурных нормах.

Особенно важное значение фольклор имеет при изучении кочевых обществ Центральной Азии. В условиях длительного существования устной культуры именно предания, легенды и эпические произведения выполняли

функцию сохранения сведений о происхождении родов и племен, социальных отношениях, военных событиях, нормах поведения и образах исторических деятелей [3].

Вместе с тем исследование эпоса требует учета особенностей устной передачи, поскольку его содержание формировалось в процессе исполнения и могло изменяться при сохранении основных смысловых структур. Эти особенности устной эпической традиции получили научное объяснение в трудах Альберта Лорда, который показал, что эпос является не только художественным произведением, но и особым механизмом сохранения и передачи коллективного опыта [4].

Обсуждение

Анализ показывает, что фольклорные произведения отражают особенности восприятия прошлого, представления о происхождении, власти, общественных отношениях и значимых событиях. Современные исследования подтверждают возможность использования эпических произведений как источников для изучения традиций, обрядов и культурных представлений народов Центральной Азии [5].

Однако их использование в историческом исследовании требует критического подхода, поскольку фольклор сочетает элементы исторической памяти, художественного осмысления и коллективного опыта. Фольклор может рассматриваться как значимый исторический источник при комплексном подходе к его изучению в сочетании с письменными, археологическими и этнографическими памятниками. Это расширяет возможности реконструкции истории кочевых обществ Центральной Азии и позволяет глубже понять особенности их культурного развития.

Заключение

Фольклорные источники представляют собой ценный инструмент для исторических исследований кочевых обществ Центральной Азии. При условии применения критического методологического подхода и комплексного анализа в сочетании с другими видами исторических источников, фольклор позволяет реконструировать исторические процессы, социальные структуры и культурные особенности традиционных обществ. Дальнейшие исследования должны быть направлены на углубление методологических подходов к анализу фольклорных текстов и расширение источниковой базы региональных исторических исследований.

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ЦИФРОВОЙ ОБРАЗОВАТЕЛЬНЫЙ РЕСУРС И ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ В ФИЛОЛОГИЧЕСКОМ ОБРАЗОВАНИИ: ПЕДАГОГИЧЕСКИЙ ДИЗАЙН И УСЛОВИЯ ИНТЕГРАЦИИ

***Аннотация:** В статье анализируются особенности применения цифровых образовательных ресурсов и технологий искусственного интеллекта в филологическом образовании с позиций педагогического дизайна. Исследование сосредоточено на выявлении дидактического потенциала ИИ и педагогических условий его эффективной интеграции в образовательный процесс. Проведен анализ преимуществ и рисков использования ИИ в гуманитарном образовании, обоснована необходимость сохранения ведущей роли преподавателя.*

***Ключевые слова:** цифровой образовательный ресурс, искусственный интеллект, педагогический дизайн, филологическое образование, информационно-коммуникационные технологии, адаптивное обучение.*

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DIGITAL EDUCATIONAL RESOURCES AND ARTIFICIAL INTELLIGENCE IN PHILOLOGICAL EDUCATION: PEDAGOGICAL DESIGN AND CONDITIONS OF INTEGRATION

***Abstract:** The article analyzes the specific features of applying digital educational resources and artificial intelligence technologies in philological education from the perspective of instructional design. The research focuses on identifying the didactic potential of artificial intelligence and the pedagogical conditions for its effective integration into the educational process. An analysis of the advantages and risks of using AI in humanities education is presented, and the necessity of preserving the leading role of the teacher is substantiated.*

Keywords: *digital educational resources, artificial intelligence, instructional design, philological education, information and communication technologies, adaptive learning.*

Введение

Возрастающие требования к уровню профессиональной подготовки студентов высших образовательных учреждений определяют необходимость модернизации образовательного процесса. Высокие темпы цифровизации во всех областях жизни современного общества актуализируют задачу повышения цифровой грамотности, развития навыков использования информационно-коммуникационных технологий (ИКТ) среди студентов не только технических, но и гуманитарных специальностей.

В филологическом образовании, ориентированном на развитие навыков анализа, синтеза и творческого мышления, внедрение цифровых образовательных ресурсов и технологий искусственного интеллекта требует особого внимания к сохранению гуманистических ценностей образовательного процесса. Цель исследования заключается в анализе условий и механизмов эффективной интеграции ИИ и цифровых ресурсов в филологическое образование при опоре на принципы педагогического дизайна.

Методология

Одним из наиболее продуктивных способов применения ИКТ в образовательном процессе является использование цифровых образовательных ресурсов (ЦОР). В научной литературе существуют различные трактовки этого термина. Согласно определению Е.С. Полат, ЦОР представляют собой «представленные в цифровой форме фотографии, видеофрагменты, статические и динамические модели, объекты виртуальной реальности и интерактивного моделирования, картографические материалы, звукозаписи, символьные объекты и деловая графика, текстовые документы и иные учебные материалы, необходимые для организации учебного процесса» [5].

Педагогический дизайн в контексте разработки ЦОР рассматривается двояко: как теория (наука об эффективности учебных материалов и создании благоприятной среды обучения) и как практика (процесс разработки и оценки учебно-воспитательных ситуаций). Ю.Ф. Катханова акцентирует внимание на необходимости не только грамотного проектирования ЦОР, но и их эффективной интеграции в образовательный процесс [3]. Н.Н. Горлушкина и Н.О. Гордеева предлагают методические подходы к обучению проектированию современных цифровых ресурсов [1, 2].

Исследовательский подход к анализу роли ИИ в образовании основан на изучении научных работ, посвященных применению интеллектуальных систем для прогнозирования успеваемости, персонализации обучения и оценки эффективности образовательных программ. Анализ литературы

позволил выявить как позитивные эффекты, так и потенциальные риски использования ИИ в гуманитарном образовании.

Результаты исследования

Исследование выявило, что эффективность использования ЦОР в филологическом образовании определяется целым рядом факторов. И.В. Шибаева отмечает, что правильное применение ЦОР «позволяет более эффективно решать дидактические задачи, осуществлять деятельностный подход в обучении, восполнять отсутствие иноязычной среды, создавать наилучшие условия для программирования и контроля, повышать мотивацию и автономность студентов» [6, с. 271].

Анализ современных исследований выявил следующие преимущества использования ИИ в образовании: 1) персонализация образовательного процесса путем адаптации содержания под индивидуальные потребности студентов; 2) поддержка индивидуального обучения через интеллектуальные тьюторские системы с оперативной обратной связью; 3) автоматизация рутинных задач проверки и оценки, освобождающая время преподавателя для творческой работы; 4) аналитика образовательных данных для выявления проблемных зон в обучении [7]; 5) повышение доступности образования для различных категорий учащихся.

Вместе с тем выявлены и значительные риски применения ИИ в филологическом образовании: 1) возможность снижения роли педагога, так как ИИ не обладает эмоциональным интеллектом и не может полностью заменить живую коммуникацию; 2) риск развития пассивного получения информации и снижения критического мышления при чрезмерно широком использовании ИИ; 3) цифровой барьер, усугубляющий неравенство в доступе к технологиям в зависимости от региона и социального статуса; 4) этические вопросы, связанные с недобросовестным использованием ИИ для подготовки работ.

Обсуждение

Максимизация преимуществ ИИ и нейтрализация его недостатков при применении в образовательном процессе является одной из ключевых задач педагогического дизайна на современном этапе. Необходимо признать, что ИИ и ЦОР станут неотъемлемыми элементами будущего образовательного процесса. Критически важно при этом обеспечить контролируемость процесса их внедрения и объективную оценку влияния на эффективность обучения.

Для филологического образования в частности необходимо сохранить баланс между инновационностью и гуманистическими ценностями. ИИ должен рассматриваться как помощник и инструмент расширения возможностей обучения, а не как замена живому педагогическому взаимодействию. Преподаватель остается центральной фигурой образовательного процесса, отвечающей за создание творческой атмосферы, стимулирование критического мышления и развитие умения анализировать

текст – компетенций, которые являются сутью филологического образования.

Дальнейшие исследования должны быть сосредоточены на разработке методических рекомендаций по интеграции ИИ в учебные программы по филологии, создании моделей педагогического дизайна, специально адаптированных для гуманитарного образования, и развитии компетенций преподавателей в области использования новых технологий.

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ВЛИЯНИЕ ДОЗИРОВАННОГО СОЛНЕЧНОГО ОБЛУЧЕНИЯ НА ГЕМОКОАГУЛЯЦИЮ ПРИ ЭКСПЕРИМЕНТАЛЬНОМ АТЕРОСКЛЕРОЗЕ

***Аннотация:** В статье изучено влияние дозированного солнечного облучения (инсоляции) на свертывающую и противосвертывающую системы крови кроликов с экспериментальным атеросклерозом. В ходе исследования проанализированы показатели крови кроликов, получавших холестерин и подвергавшихся инсоляции на протяжении 4 месяцев. Результаты показывают, что, несмотря на тенденцию к повышению факторов свертывания крови, защитная антикоагулянтная система полностью не угнетается. Данное явление объясняется стимулирующим влиянием инсоляции на обменные процессы в организме.*

***Ключевые слова:** экспериментальный атеросклероз, инсоляция, свертывающая система крови, противосвертывающая система, холестерин, кролики.*

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THE INFLUENCE OF DOSES OF SOLAR RADIATION ON HEMOCOAGULATION IN EXPERIMENTAL ATHEROSCLEROSIS

***Abstract.** The article investigates the influence of controlled, dosed solar radiation (insolation) on the coagulation and anticoagulation blood systems in rabbits with experimental atherosclerosis. Over the course of a 4-month study, blood parameters were analyzed in rabbits that received dietary cholesterol and were subjected to targeted insolation. The results indicate that despite a tendency toward increased blood clotting factors, the protective anticoagulant system is not*

completely suppressed. This phenomenon is attributed to the stimulating effect of insolation on metabolic processes within the body.

Keywords: *experimental atherosclerosis, insolation, blood coagulation system, anticoagulation system, cholesterol, rabbits.*

Введение

Атеросклероз и ассоциированные с ним сердечно-сосудистые заболевания (ССЗ) на протяжении многих лет остаются главной причиной инвалидизации и смертности населения во всем мире [1]. В основе патогенеза атеросклероза лежит не только нарушение липидного обмена, но и хроническое субклиническое воспаление сосудистой стенки, которое тесно взаимосвязано с процессами внутрисосудистого свертывания крови [2]. Дисфункция эндотелия, развивающаяся при гиперхолестеринемии, неизбежно приводит к сдвигу гемостатического баланса в сторону гиперкоагуляции, активации тромбоцитарного звена и угнетению фибринолиза, что резко повышает риск тромботических осложнений [3].

В последние годы в фокусе внимания исследователей всё чаще оказываются немедикаментозные методы коррекции метаболических нарушений и дисфункции гемостаза, среди которых особое место занимает контролируемое климатическое воздействие, в частности дозированная инсоляция (гелиотерапия) [4]. Физиологическое действие солнечного излучения на организм многогранно: оно опосредовано как синтезом витамина D, так и модуляцией оксида азота (NO) в системном кровотоке, что способствует вазодилатации и улучшению микроциркуляции [5].

Современные экспериментальные и клинические данные подтверждают, что ультрафиолетовое излучение в умеренных дозах способно оказывать системное противовоспалительное действие, снижать уровень атерогенных липидов и модулировать реологические свойства крови [6]. Однако механизмы сочетанного влияния холестериневой нагрузки и ультрафиолетового облучения на коагуляционный и антикоагуляционный потенциал крови в динамике развития атеросклероза остаются изученными недостаточно. Понимание этих процессов позволит научно обосновать применение дозированной гелиотерапии в комплексной профилактике и реабилитации ССЗ.

Цель исследования — проследить влияние дозированных солнечных облучений на свертывающие и противосвертывающие показатели крови при экспериментальном атеросклерозе в условиях моделирования на кроликах.

Материал и методы

Опыты ставились на 27-ми кроликах - самцах породы шиншилла, весом 2-2,5 кг. В течение 4-х месяцев ежедневно через зонд давался холестерин 0,3 г/кг веса в 10 мл хлопкового масла. Через день они подвергались инсоляции по 5 калорий с применением жалюзийного экрана Е. А. Чернявского. Кровь до и в процессе опыта ежемесячно исследовалась

на тесты, приведенные в таблице. Для контроля исследовалась кровь у 27-ми здоровых кроликов.

Результаты собственных исследований

В ходе проведения четырехмесячного эксперимента по моделированию холестеринового атеросклероза на фоне дозированного солнечного облучения (инсоляции) нами была изучена динамика ключевых показателей коагуляционного и антикоагуляционного звеньев гемостаза у кроликов. Сравнительный анализ проводился как в сопоставлении с контрольной группой (здоровые животные, $n=27$), так и внутри опытной группы по месяцам наблюдения.

Анализ коагуляционного потенциала плазмы выявил разнонаправленные изменения на различных этапах эксперимента.

Толерантность плазмы к гепарину по Поллеру, отражающая общую динамику формирования фибринового сгустка, в первый месяц исследования достоверно снизилась до $225 \pm 12,0$ сек. по сравнению с контрольным значением 253 ± 3318 сек. ($p < 0,5$), что указывает на начальную активацию свертывающей системы под сочетанным воздействием холестериновой нагрузки и начального периода инсоляции. Однако ко второму месяцу отмечено выраженное удлинение данного показателя до $265 \pm 16,6$ сек. ($p < 0,1$), что свидетельствует о временной гипокоагуляционной направленности. В последующие — третий и четвертый месяцы — наблюдалось стойкое укорочение времени толерантности до $205 \pm 12,2$ сек. ($p < 0,1$) и $215 \pm 12,4$ сек. ($p < 0,2$) соответственно, отражающее прогрессирование гиперкоагуляционного состояния в условиях длительного экспериментального атеросклероза.

Аналогичная динамика прослеживалась при изучении **времени рекальцификации плазмы по Бергергофу и Рока**. На первом месяце показатель незначительно увеличился до $82 \pm 2,6$ сек. против $79 \pm 2,7$ сек. в контроле ($p < 0,5$). Однако, начиная со второго месяца, зафиксировано стойкое и статистически значимое укорочение времени рекальцификации плазмы: $72 \pm 1,2$ сек. на 2-й месяц ($p < 0,2$), $66 \pm 3,4$ сек. на 3-й месяц ($p < 0,01$) и $69 \pm 2,3$ сек. на 4-й месяц ($p < 0,05$). Высокая степень достоверности на поздних сроках ($p < 0,01$ и $p < 0,05$) подтверждает нарастание активности факторов проагрегатного направления.

Изучение **протромбинового времени по В. Н. Туголукову** продемонстрировало высокую стабильность и постепенное ускорение плазменного гемостаза по внешнему пути свертывания. Если в контроле данный показатель составлял $18 \pm 0,4$ сек., то в динамике опыта он постепенно укорачивался, достигая минимальных значений к четвертому месяцу — $16 \pm 0,3$ сек. При этом отмечается высокая статистическая достоверность сдвигов к третьему ($17 \pm 0,28$ сек., $p < 0,05$) и четвертому месяцу ($16 \pm 0,3$ сек., $p < 0,001$).

Особый интерес вызывают показатели концентрации **фибриногена по Билвеллу**. При исследовании через 1 час после взятия крови было

обнаружено резкое, почти двукратное увеличение уровня фибриногена в первый месяц эксперимента — до 417 $\pm$ 51 мг% при контрольном значении 258 $\pm$ 19 мг% ($p < 0,02$). Столь выраженный подъем, вероятно, обусловлен острой фазой метаболического ответа на холестериную интоксикацию. В последующие месяцы (2-й и 3-й) уровень фибриногена стабилизировался в пределах нормальных значений (262 $\pm$ 31 мг% и 239 $\pm$ 15,7 мг % соответственно), однако к концу 4-го месяца вновь наметилась тенденция к его росту — до 264 $\pm$ 25 мг% ($p < 0,2$).

При оценке содержания **фибриногена через 2 часа (по Билвелл-Андреев)** была зафиксирована схожая закономерность: резкий скачок на 1-м месяце до 433 $\pm$ 45 мг% ($p < 0,01$ по сравнению с контролем 250 $\pm$ 38 мг%), нормализация показателей на 2–3-м месяцах (289 $\pm$ 24 мг % и 267 $\pm$ 27,3 мг%) и повторный значительный подъем к 4-му месяцу до 355 $\pm$ 25 мг% ($p < 0,05$). Данный факт указывает на глубокую дестабилизацию белковосинтетической функции печени и выраженный протромботический сдвиг на поздних стадиях атеросклероза.

Несмотря на явную гиперкоагуляционную направленность плазменных факторов, фибринолитическая система экспериментальных животных продемонстрировала сохранность своих адаптационных резервов. **Фибринолитическая активность по отношению к 1-часовому фибриногену** в первый месяц кратковременно возрастала до 15 $\pm$ 5 % (контроль — 14 $\pm$ 3,7 % , $p < 1$), затем снижалась на 2–3-м месяцах до 11 $\pm$ 4 % ($p < 0,5$) и 9 $\pm$ 2,8 % ($p < 0,2$), но к 4-му месяцу вновь восстанавливалась до 12 $\pm$ 3,5 % ($p < 0,5$).

Еще более демонстративными оказались показатели **фибринолитической активности по отношению к 2-часовому фибриногену**. После умеренных колебаний в первые три месяца (17 $\pm$ 5 % , 12 $\pm$ 4,7 % и 13 $\pm$ 3,9 %), к четвертому месяцу эксперимента было отмечено существенное компенсаторное усиление фибринолиза — до 20 $\pm$ 5,4 % при исходном контроле 16 $\pm$ 4,4 % ($p < 0,5$).

Таким образом, на поздних сроках экспериментального холестеринowego атеросклероза (3–4 месяца) наблюдается отчетливая активация свертывающей системы крови. Однако параллельный подъем фибринолитической активности на 4-м месяце указывает на то, что защитная противосвертывающая система крови перестраивается, но не претерпевает окончательного угнетения. Это может быть связано со стимулирующим, адаптогенным действием регулярной дозированной инсоляции на метаболические, ферментативные и регуляторные процессы в организме экспериментальных животных.

Данные динамики показателей свертывающей и противосвертывающей систем крови приведены в таблице 1.

Таблица 1.

Результаты собственных исследований (в скобках приведено значение n)

Показатели	Контроль	1 м-ц	2 м-ц	3 м-ц	4 м-ц
Толерантность плазмы к гепарину по Поллеру в сек.	М 253(27)	225(26)	265(24)	205(23)	215(22)
	м 3318	12	16,6	12,2	12,4
	Р	0,5	0,1	0,1	0,2
Рекальцификация плазмы по Бергергофу и Рока в сек.	М 79(27)	82(26)	72(24)	66(21)	69(22)
	м рm 2,7	2,6	1,2	3,4	2,3
	р	0,5	0,2	0,01	0,05
Протромбиновое время по В. Н. Туголукову в сек.	М 18(26)	17(26)	17(24)	17(23)	16(22)
	М рm 0,4	0,4	0,4	0,28	0,3
	р 0,1	0,1	0,1	0,05	0,001
Фибриноген по Билвелл в мг% (через 1 час)	М 258(27)	417(16)	262(14)	239(23)	264(22)
	м 19	51	31	15,7	25
	р	0,02	0,1	0,5	0,2
Фибриноген через 2 часа по Билвелл-Андреевко в мг%	М 250(24)	433(16)	289(14)	267(13)	355(18)
	М рm 38	45	24	27,3	25
	р	0,01	0,5	1	0,05
Фибринолитическая активность по отношению с 1-часовым фибриногеном в %	М 14(27)	15(16)	11(14)	9(23)	12(22)
	М рm 3,7	5	4	2,8	3,5
	р	1	0,5	0,2	0,5
Фибринолитическая активность по отношению с 2-часовым фибриногеном в %	М 16(24)	17(16)	12(14)	13(13)	20(18)
	М рm 4,4	5	4,7	3,9	5,4
	р	1	0,5	0,5	0,5

Выводы

На основании полученных в ходе четырехмесячного эксперимента данных, а также комплексного анализа динамики показателей гемостаза, можно сделать следующие выводы:

1. Развитие стадии гиперкоагуляции в динамике атерогенеза.

Длительное введение экзогенного холестерина кроликам приводит к прогрессирующему нарастанию коагуляционного потенциала крови, что наиболее ярко проявляется на 3-м и 4-м месяцах эксперимента. Это подтверждается стойким и статистически достоверным укорочением времени рекальцификации плазмы по Бергергофу и Рока до 66 рm 3,4 сек. ($p < 0,01$), уменьшением протромбинового времени по В. Н. Туголукову до 16 рm 0,3 сек. ($p < 0,001$), а также снижением толерантности плазмы к гепарину.

2. Двухфазный характер изменений фибриногена как маркера системного ответа.

Реакция фибринолитического субстрата имеет выраженный двухфазный характер. Резкий скачок уровня фибриногена на 1-м месяце (через 1 час — до 417 pm 51 мг%, через 2 часа — до 433 pm 45 мг%; $p < 0,01$) отражает острую метаболическую стресс-реакцию организма на первичную холестериновую нагрузку. Повторный подъем уровня фибриногена к 4-му месяцу (до 355 pm 25 мг% по Билвелл-Андреев; $p < 0,05$) свидетельствует о глубоких структурно-функциональных изменениях в сосудистой стенке и печени, характерных для развернутой стадии атеросклероза.

3. Сохранность и активация адаптивных резервов противосвертывающей системы.

Несмотря на выраженный сдвиг плазменных факторов в сторону протромботических состояний, защитная противосвертывающая система крови экспериментальных животных не угнетается окончательно. Напротив, к 4-му месяцу исследования зафиксировано компенсаторное усиление фибринолитической активности по отношению к 2-часовому фибриногену до 20 pm 5,4% (при контроле 16 pm 4,4%). Данный факт указывает на мобилизацию эндогенных механизмов фибринолиза, направленных на предотвращение внутрисосудистого тромбообразования.

4. Адаптогенная роль дозированной инсоляции.

Стабильность антикоагулянтного и фибринолитического звеньев гемостаза на поздних сроках холестериновой интоксикации, вероятно, обусловлена системным стимулирующим действием регулярной дозированной инсоляции по методу Е. А. Чернявского. Умеренное световое и ультрафиолетовое облучение выступает в роли физиологического адаптогена, который оптимизирует обменные процессы, поддерживает эндотелиальную функцию сосудов и препятствует срыву депрессорных механизмов системы гемостаза при экспериментальном атеросклерозе.

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**ОТ КАССОВОГО ИСПОЛНЕНИЯ К СОЦИАЛЬНОМУ ЭФФЕКТУ:
ТРАНСФОРМАЦИЯ СИСТЕМЫ КРІ СТРОИТЕЛЬНЫХ ПРОЕКТОВ
В УСЛОВИЯХ ПЕРЕХОДА К НАЦИОНАЛЬНОМУ ПРОЕКТУ
«ИНФРАСТРУКТУРА ДЛЯ ЖИЗНИ»**

***Аннотация.** В статье исследуется проблема институциональной инерции в системе оценки региональных строительных проектов. Обосновывается тезис о том, что доминирование показателя «кассового исполнения» в контуре ГАСУ РБ и системы «Электронный бюджет» вступает в противоречие с целеполаганием нового национального проекта «Инфраструктура для жизни» (Указ Президента РФ № 309). На материале реализации государственной программы Республики Башкортостан № 720 выявлен феномен «бумажной результативности», при котором формальное освоение сметы не гарантирует ввода объектов с необходимой обеспечивающей инфраструктурой. Предложена авторская матрица индикаторов, интегрирующая показатели строительного мультипликатора и процессных метрик бережливого производства, что позволяет сместить фокус регионального проектного офиса с финансового контроля на оценку реального социально-экономического отклика территории.*

***Ключевые слова:** проектное управление, национальный проект «Инфраструктура для жизни», кассовое исполнение, строительный мультипликатор, бережливое строительство, ГАСУ РБ, региональная экономика.*

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**FROM CASH EXECUTION TO SOCIAL IMPACT: TRANSFORMATION
OF THE KPI SYSTEM FOR CONSTRUCTION PROJECTS IN THE
CONTEXT OF THE TRANSITION TO THE NATIONAL PROJECT
«INFRASTRUCTURE FOR LIFE»**

***Abstract.** The article examines the problem of institutional inertia in the evaluation system of regional construction projects. The thesis is substantiated that the dominance of the "cash execution" indicator within the GASU RB and the*

"Electronic Budget" system contradicts the objectives of the new national project "Infrastructure for Life" (Presidential Decree No. 309). Based on the implementation material of State Program No. 720 of the Republic of Bashkortostan, the phenomenon of "paper performance" is revealed, where the formal execution of the budget estimate does not guarantee the commissioning of facilities with the necessary supporting infrastructure. An author's matrix of indicators is proposed, integrating the construction multiplier and lean construction process metrics, which allows shifting the focus of the regional project office from financial control to the assessment of the real socio-economic response of the territory.

Keywords: project management, national project "Infrastructure for Life", cash execution, construction multiplier, lean construction, GASU RB, regional economy.

Смена парадигмы стратегического планирования, зафиксированная Указом Президента РФ от 07.05.2024 № 309, задает новые координаты для всей системы государственного управления [2]. Развертывание национального проекта «Инфраструктура для жизни» сигнализирует об отказе от экстенсивной логики «освоения площадей» в пользу создания связной, комфортной и технологичной среды. Однако бюрократическая машина обладает высокой степенью инерции. Инструментарий программно-целевого метода, отточенный на предыдущих этапах, по-прежнему заточен под контроль финансовых потоков, а не качественных изменений территории.

В практике региональных министерств и проектных офисов сложилась ситуация, которую можно охарактеризовать как «индикативный фетишизм»: главным критерием успешности руководителя проекта и ведомства в целом выступает процент кассового исполнения бюджетных ассигнований к концу финансового года. Подобная подмена понятий приводит к системным деформациям на этапе реализации строительных проектов. Возникает объективная потребность в ревизии самой архитектуры ключевых показателей эффективности (KPI) и их адаптации к логике инфраструктурного развития, где на первый план выходит не факт расходования средств, а социальный и экономический отклик территории.

Исследование опирается на положения Постановления Правительства РФ № 786, регламентирующего систему управления госпрограммами [3], а также на нормы Постановления № 1288 об организации проектной деятельности [4]. Эмпирическую базу составили данные паспорта и отчеты о реализации государственной программы «Развитие строительного комплекса и архитектуры Республики Башкортостан» (Постановление Правительства РБ № 720) [5], выгруженные из контура ГАСУ РБ и портала «Электронный бюджет» за период 2021–2025 гг. В работе применены методы институционального анализа, сравнительной диагностики территориальных диспропорций и моделирования мультипликативных эффектов.

Доминирование финансового КРІ над содержательным порождает специфическое поведение заказчиков и подрядчиков. Стремясь избежать возврата неиспользованных остатков в федеральный или республиканский бюджет (что расценивается Минфином как неэффективное планирование), государственные заказчики форсируют проведение аукционных процедур, зачастую в ущерб качеству предпроектной проработки. Результатом становится массовое появление незавершенных объектов капитального строительства (НОКС).

В Республике Башкортостан, несмотря на стабильно высокие показатели кассового освоения (в среднем 92–97% по профильной госпрограмме), фактический ввод объектов в эксплуатацию систематически отстает от плановых графиков на 12–20%. Объект может быть профинансирован, акты выполненных работ (КС-2, КС-3) подписаны, но отсутствие подведенных сетей или неготовность смежных ведомств (например, Минтранса РБ по подъездным путям) делают его эксплуатацию невозможной. С точки зрения финансовой отчетности проект «закрыт», с точки зрения национального проекта «Инфраструктура для жизни» — социальный эффект равен нулю.

Второй системной ошибкой действующей системы КРІ является попытка применения унифицированных метрик к радикально различающимся территориям. Строительный рынок Башкортостана жестко поляризован. В Уфимской агломерации и промышленных узлах (Стерлитамак, Салават) рынок генерирует собственный спрос, а бюджетные инвестиции выступают лишь катализатором частных инициатив. Здесь КРІ, связанные с объемом привлеченных внебюджетных инвестиций, работают корректно.

Однако в удаленных и депрессивных муниципалитетах (Зауралье, северо-восточные горно-лесные районы, такие как Белокатайский или Бурзянский) коммерческое строительство отсутствует в принципе. Бюджет здесь — единственный источник развития. Требовать от муниципальных проектных команд высоких показателей по «доле частного софинансирования» или «росту налоговой базы от новых девелоперов» методологически некорректно. Это толкает местные администрации на поиск формальных способов «нарисовать» нужные цифры, лишь бы удовлетворить требования республиканского проектного офиса.

Переход к нацпроекту «Инфраструктура для жизни» требует оценки не самого объекта, а того, как он меняет экономику вокруг себя. Стандартный показатель «ввод квадратных метров» или «километров дорог» не отражает глубинных процессов. В качестве альтернативы предлагается внедрение в контур ГАСУ РБ показателя локального строительного мультипликатора.

Строительство обладает одним из самых высоких мультипликативных эффектов в экономике: один рубль, вложенный в инфраструктуру, генерирует спрос в смежных отраслях (производство стройматериалов, логистика, сервис, общественное питание). Оценка эффективности проекта

должна учитывать, какая доля подрядчиков и поставщиков материалов является локальными (зарегистрированными в том же муниципалитете или регионе). Если бюджетный объект строится силами привлеченной из другого региона компании, использующей импортные или привозные материалы, мультипликативный эффект для территории стремится к нулю, несмотря на формальное достижение KPI по вводу объекта.

Еще одним слепым пятном является игнорирование процессных потерь на этапе возведения. В мировой и передовой отечественной практике активно применяется концепция Lean Construction. В региональную систему мониторинга целесообразно внедрить индикаторы, фиксирующие не только факт завершения, но и качество самого процесса:

1. Индекс календарной дисциплины (отношение дней простоя из-за ошибок в проектно-сметной документации к общему сроку строительства).
2. Коэффициент повторных переделок (объем брака, устраняемого за счет подрядчика до момента подписания акта ввода в эксплуатацию).
3. Индекс межведомственного трения (количество дней задержки выдачи технических условий ресурсоснабжающими организациями).

Фиксация этих метрик в цифровом паспорте проекта позволит региональному проектному офису выявлять системные административные барьеры, а не просто констатировать факт срыва сроков постфактум.

Трансформация национального проектного контура диктует необходимость отказа от примитивной бухгалтерской логики в оценке строительных инициатив. Кассовое исполнение должно перестать быть главным мерилом эффективности регионального министра или муниципального главы.

Переход к парадигме социального эффекта требует модернизации архитектуры ГАСУ РБ и внедрения многомерной матрицы KPI. Она должна включать индикаторы инфраструктурной связности (наличие обеспечивающих сетей на момент сдачи объекта), локального экономического мультипликатора и процессных метрик бережливого производства. Только такой подход позволит нивелировать риски «бумажной результативности» и обеспечить реальное повышение качества жизни граждан в рамках национального проекта «Инфраструктура для жизни», что особенно критично для территорий с выраженной пространственной асимметрией, к числу которых относится Республика Башкортостан.

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МЕТОДИКА СОВЕРШЕНСТВОВАНИЯ ПРОЦЕССОВ ВЫСШЕГО ОБРАЗОВАНИЯ НА ОСНОВЕ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

***Аннотация.** В статье обоснована методика совершенствования процессов высшего образования на основе технологий искусственного интеллекта. Рассмотрены возможности адаптивного обучения, автоматизированного оценивания, learning analytics и цифровых ассистентов. Предложены этапы внедрения ИИ в вузе с учетом педагогических, организационных и этических требований.*

***Ключевые слова:** искусственный интеллект, высшее образование, адаптивное обучение, learning analytics, цифровая педагогика, персонализированное обучение.*

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METHODOLOGY FOR IMPROVING HIGHER EDUCATION PROCESSES BASED ON ARTIFICIAL INTELLIGENCE TECHNOLOGIES

***Abstract.** The article substantiates a methodology for improving higher education processes through artificial intelligence technologies. It examines adaptive learning, automated assessment, learning analytics, and digital assistants. The proposed implementation model takes into account pedagogical, organizational, and ethical requirements for universities.*

***Keywords:** artificial intelligence, higher education, adaptive learning, learning analytics, digital pedagogy, personalized learning.*

Введение

Цифровая трансформация высшего образования стала одним из наиболее значимых направлений модернизации университетов. Развитие искусственного интеллекта меняет не только технические средства обучения, но и логику организации образовательной среды: учебные данные начинают использоваться для прогнозирования результатов, образовательный контент адаптируется под индивидуальные потребности

обучающихся, а преподаватель получает инструменты для более точной диагностики учебных затруднений.

Актуальность темы определяется тем, что традиционная модель высшего образования не всегда позволяет оперативно учитывать различия в уровне подготовки, темпе усвоения материала и учебной мотивации студентов. В этих условиях технологии ИИ могут выступать не заменой преподавателя, а инструментом расширения его профессиональных возможностей. Они позволяют автоматизировать рутинные операции, повысить качество обратной связи и создать условия для персонализации обучения.

Вместе с тем внедрение ИИ требует научно обоснованной методики. Недостаточно просто подключить цифровую платформу или чат-бота: необходимо определить цели, подготовить педагогические кадры, обеспечить защиту данных, разработать правила этичного применения алгоритмов и встроить новые инструменты в содержание учебных дисциплин. Поэтому совершенствование процессов высшего образования на основе ИИ должно рассматриваться как комплексная педагогико-организационная задача.

Цель статьи — разработать методические подходы к совершенствованию процессов высшего образования на основе технологий искусственного интеллекта и определить условия их эффективного внедрения в образовательную практику вуза.

Для достижения цели поставлены следующие задачи: раскрыть теоретические основания применения ИИ в высшем образовании; определить основные направления использования интеллектуальных технологий; предложить этапы внедрения ИИ в образовательный процесс; выявить преимущества, ограничения и педагогические риски цифровой трансформации.

Теоретические основы применения искусственного интеллекта в высшем образовании

Искусственный интеллект в образовательной среде понимается как совокупность алгоритмов, программных систем и аналитических инструментов, способных обрабатывать большие массивы данных, выявлять закономерности, прогнозировать результаты и формировать рекомендации для участников образовательного процесса. В отличие от обычных электронных ресурсов, ИИ-системы могут адаптироваться к действиям пользователя и изменять образовательную траекторию на основе анализа его поведения.

В научной литературе выделяются несколько направлений применения ИИ в образовании: интеллектуальные обучающие системы, автоматизированная проверка знаний, рекомендательные сервисы, анализ образовательных данных, виртуальные ассистенты, системы раннего выявления академических рисков и инструменты поддержки управленческих

решений [1, с. 28–35]. Для высшей школы особенно важны не отдельные цифровые решения, а их интеграция в общую образовательную экосистему.

Методологической основой внедрения ИИ выступают идеи персонализированного, компетентностного и деятельностного обучения. Персонализация позволяет учитывать индивидуальные образовательные потребности студента; компетентностный подход ориентирует обучение на формирование практико-ориентированных результатов; деятельностный подход требует включения обучающегося в активное решение учебных и профессиональных задач.

ИИ может быть полезен в тех случаях, когда преподавателю необходимо работать с большим количеством учебных данных: результатами тестов, активностью студентов в LMS, посещаемостью, сроками выполнения заданий, качеством письменных работ, динамикой индивидуального прогресса. На основе этих данных формируются аналитические выводы, позволяющие своевременно корректировать содержание и методы обучения [4, с. 3–8].

Однако эффективность ИИ зависит от педагогической целесообразности его применения. Алгоритм не должен подменять живое взаимодействие между преподавателем и студентом. Его назначение состоит в поддержке учебного процесса, повышении прозрачности оценивания, ускорении обратной связи и выявлении тех учебных ситуаций, где требуется вмешательство преподавателя.

Основные направления совершенствования образовательного процесса

Первым направлением является персонализация обучения. Адаптивные образовательные платформы анализируют ответы студентов, время выполнения заданий, характер ошибок и уровень сложности освоенных тем. На основании этих данных студенту предлагаются дополнительные материалы, тренировочные задания или индивидуальный маршрут изучения дисциплины. Такой подход особенно важен в условиях массового высшего образования, когда уровень подготовки обучающихся может существенно различаться.

Вторым направлением выступает автоматизация оценивания. ИИ-системы могут использоваться для проверки тестов, анализа структурированных заданий, первичной оценки письменных работ, выявления заимствований и подготовки развернутой обратной связи. При этом итоговая академическая оценка должна оставаться в зоне ответственности преподавателя, особенно если задание предполагает творческий, исследовательский или ценностно-смысловой компонент.

Третье направление связано с learning analytics — анализом данных о ходе и результатах обучения. Аналитические панели позволяют преподавателю видеть динамику активности студентов, выявлять группы риска, прогнозировать вероятность невыполнения учебного плана и оценивать эффективность используемых методик. Для администрации вуза

такие данные важны при обновлении образовательных программ, распределении ресурсов и планировании повышения квалификации педагогов [5, с. 61–75].

Четвертым направлением является использование интеллектуальных ассистентов. Виртуальные помощники могут отвечать на типовые вопросы студентов, напоминать о сроках выполнения заданий, объяснять отдельные понятия, помогать ориентироваться в электронном курсе. Их применение снижает информационную нагрузку на преподавателя, но требует регулярного обновления базы знаний и контроля качества ответов.

Пятым направлением выступает поддержка научно-исследовательской деятельности студентов. ИИ-инструменты могут использоваться для поиска литературы, систематизации источников, построения плана исследования, первичной обработки данных и визуализации результатов. При этом необходимо формировать у студентов академическую добросовестность, навыки критической проверки сгенерированной информации и понимание границ допустимого использования ИИ.

Методика внедрения технологий ИИ в вузе

Предлагаемая методика внедрения ИИ в высшее образование включает пять взаимосвязанных этапов. Первый этап — диагностический. На этом этапе проводится анализ цифровой инфраструктуры вуза, уровня готовности преподавателей, наличия LMS, качества интернет-доступа, состояния электронных библиотек и существующих цифровых сервисов. Диагностика позволяет определить реальные потребности образовательного процесса и избежать формального внедрения технологий.

Второй этап — целевой. Университет должен определить, какие задачи планируется решать с помощью ИИ: повышение успеваемости, снижение академических рисков, индивидуализация обучения, автоматизация контроля знаний, совершенствование управления или развитие цифровых компетенций. Цели должны быть конкретными и измеримыми, поскольку от них зависит выбор цифровых инструментов.

Третий этап — проектировочный. На данном этапе разрабатывается модель интеграции ИИ в образовательные программы. Определяются дисциплины для пилотного внедрения, формируются критерии оценки эффективности, подготавливаются инструкции для преподавателей и студентов, устанавливаются правила использования данных. Важно заранее определить, какие решения принимает алгоритм, а какие остаются за человеком.

Четвертый этап — пилотный. ИИ-технологии сначала внедряются в ограниченном масштабе: в отдельных дисциплинах, учебных группах или модулях. Пилотирование позволяет выявить технические сбои, педагогические затруднения, недостаточную подготовленность пользователей и возможные риски. На этом этапе особую роль играет обратная связь от студентов и преподавателей.

Пятый этап — масштабирование и сопровождение. После анализа результатов пилотного проекта ИИ-инструменты постепенно распространяются на другие дисциплины и подразделения. Одновременно организуется повышение квалификации преподавателей, обновляются локальные нормативные документы, создается система методической поддержки и мониторинга качества цифровых решений.

Таблица 1.

Методические условия внедрения ИИ в высшем образовании

Условие	Содержание	Ожидаемый результат
Педагогическая целесообразность	ИИ используется только там, где он усиливает обучение и обратную связь	Рост качества учебной поддержки
Подготовка преподавателей	Повышение цифровой и методической компетентности педагогов	Осознанное применение цифровых инструментов
Этичность и прозрачность	Студенты информируются о целях обработки данных и логике оценивания	Повышение доверия к цифровой среде
Защита данных	Регламентируются сбор, хранение и использование образовательных данных	Снижение рисков нарушения конфиденциальности
Постепенное масштабирование	Внедрение начинается с пилотных проектов и последующей корректировки	Стабильность цифровой трансформации

Педагогические и организационные результаты

Результативность внедрения ИИ в высшее образование проявляется в нескольких аспектах. Во-первых, повышается адресность учебной помощи. Преподаватель получает не общую картину успеваемости группы, а данные о конкретных затруднениях каждого студента. Это позволяет быстрее назначать дополнительные задания, консультации или индивидуальные рекомендации.

Во-вторых, улучшается качество обратной связи. В традиционной системе студент нередко получает оценку без подробного объяснения ошибок. ИИ-инструменты позволяют формировать оперативные комментарии, показывать типовые ошибки, предлагать материалы для повторения и отслеживать динамику исправления недостатков.

В-третьих, оптимизируется нагрузка преподавателя. Автоматизация рутинных действий освобождает время для методической работы, научного руководства, проектной деятельности и индивидуального общения со студентами. Особенно это важно в дисциплинах с большим количеством письменных заданий, тестов и практических работ.

В-четвертых, повышается управляемость образовательного процесса. Learning analytics позволяет администрации вуза принимать решения на основе данных, а не только на основе отчетов и субъективных наблюдений.

При правильной интерпретации аналитика помогает выявлять слабые места учебных программ и своевременно корректировать организацию обучения.

В-пятых, формируется новая цифровая культура. Студенты учатся использовать ИИ не как средство механического выполнения заданий, а как инструмент поиска, анализа, самопроверки и профессионального развития. Преподаватели, в свою очередь, осваивают новые формы методического проектирования и цифрового сопровождения обучения.

Ограничения и риски использования ИИ

Несмотря на значительный потенциал, внедрение ИИ в высшее образование связано с рядом ограничений. Одним из основных рисков является чрезмерная технологизация обучения, при которой внимание смещается с педагогических целей на использование цифровых инструментов ради самих инструментов. Чтобы избежать этого, каждая технология должна оцениваться через призму ее влияния на качество обучения.

Второй риск связан с достоверностью алгоритмических решений. ИИ-системы могут ошибаться, воспроизводить скрытые предубеждения данных или давать неточные рекомендации. Поэтому результаты автоматизированного анализа должны проверяться преподавателем, а важные академические решения не должны приниматься исключительно машинным способом [7, с. 582–599].

Третий риск касается академической честности. Генеративные ИИ-инструменты способны создавать тексты, решения и презентации, что требует пересмотра форм контроля знаний. В условиях распространения ИИ более значимыми становятся устные защиты, проектные задания, практико-ориентированные кейсы, портфолио, поэтапная проверка работы и задания, требующие личной аргументации.

Четвертый риск связан с защитой персональных данных. Образовательные данные включают информацию об успеваемости, активности, учебных трудностях и поведении студентов в цифровой среде. Их обработка должна быть прозрачной, ограниченной по цели и защищенной техническими и организационными средствами [2, с. 18–24].

Пятый риск — неравенство цифровой готовности. Не все преподаватели и студенты обладают одинаковым уровнем цифровых навыков. Поэтому внедрение ИИ должно сопровождаться методической поддержкой, обучающими семинарами, консультациями и созданием понятных инструкций.

Практические рекомендации

Для эффективного внедрения ИИ в вузе целесообразно разработать институциональную цифровую стратегию, в которой будут определены цели, ответственные подразделения, этапы, критерии эффективности и правила этичного использования технологий. Такая стратегия должна быть связана с образовательной политикой университета и не сводиться только к технической модернизации.

Преподавателям рекомендуется начинать применение ИИ с небольших методических задач: создания диагностических тестов, анализа типовых ошибок, подготовки индивидуальных рекомендаций, разработки дополнительных материалов и организации обратной связи. Постепенное освоение инструментов снижает сопротивление изменениям и помогает выработать собственную педагогическую модель использования ИИ.

Студентам необходимо объяснять, что ИИ не освобождает от учебной ответственности. Напротив, он требует более развитых навыков критического мышления, проверки источников, академической честности и самостоятельной аргументации. В учебных программах следует предусматривать задания, в которых студент анализирует результат работы ИИ, оценивает его точность и обосновывает собственное решение.

Администрации вуза следует обеспечить техническую устойчивость цифровых сервисов, совместимость платформ, защиту данных и регулярный мониторинг качества. Важно также создавать междисциплинарные рабочие группы, объединяющие педагогов, IT-специалистов, методистов, юристов и представителей студенческого сообщества.

На уровне кафедры полезно формировать банк практик использования ИИ: примеры заданий, критерии оценивания, инструкции по работе с цифровыми платформами, типовые сценарии обратной связи и рекомендации по профилактике академической недобросовестности.

Заключение

Проведенный анализ показывает, что технологии искусственного интеллекта обладают значительным потенциалом для совершенствования процессов высшего образования. Их применение позволяет персонализировать обучение, ускорять обратную связь, автоматизировать часть оценочных процедур, выявлять академические риски и повышать обоснованность управленческих решений.

Разработанная методика внедрения ИИ включает диагностический, целевой, проектировочный, пилотный и масштабный этапы. Такая последовательность позволяет избежать формального использования цифровых инструментов и обеспечивает связь технологических решений с реальными педагогическими задачами. Центральным условием эффективности остается активная роль преподавателя, который определяет смысл, границы и качество применения ИИ.

ИИ не должен рассматриваться как замена человеческому педагогическому взаимодействию. Его продуктивность проявляется тогда, когда он усиливает работу преподавателя, помогает студенту осознанно строить индивидуальную образовательную траекторию и делает управление учебным процессом более точным. Перспективы дальнейших исследований связаны с разработкой критериев оценки эффективности ИИ-инструментов, изучением их влияния на академическую мотивацию студентов и созданием этических регламентов для университетской практики.

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АНАЛИЗ СОВРЕМЕННОГО СОСТОЯНИЯ И ПРОБЛЕМ УПРАВЛЕНИЯ МУНИЦИПАЛЬНОЙ НЕДВИЖИМОСТЬЮ В ГОРОДЕ ОРЕНБУРГЕ

Аннотация: В статье анализируется современное состояние системы управления муниципальной недвижимостью в Оренбурге, выявляются ключевые проблемы: неполнота данных в реестрах, неэффективное использование объектов, дефицит финансирования, пробелы в нормативно-правовой базе, низкая прозрачность процедур аренды и приватизации, отсутствие комплексной стратегии. На основе статистических данных и практики администрации города предложены меры по совершенствованию системы — внедрение цифровых инструментов учёта, оптимизация арендных отношений, усиление контроля и разработка долгосрочной программы управления. Результаты могут быть использованы для повышения эффективности распоряжения муниципальной собственностью и роста доходов бюджета.

Ключевые слова: муниципальная недвижимость, управление муниципальной собственностью, город Оренбург, реестр муниципального имущества, эффективность использования недвижимости, доходы местного бюджета, нормативно-правовое регулирование, цифровизация учёта имущества, аренда муниципального имущества, стратегия управления недвижимостью.

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ANALYSIS OF THE CURRENT STATE AND PROBLEMS OF MUNICIPAL REAL ESTATE MANAGEMENT IN THE CITY OF ORENBURG

Abstract: The article analyzes the current state of the municipal real estate management system in Orenburg, identifies key problems: incompleteness of data in registers, inefficient use of facilities, lack of financing, gaps in the regulatory framework, low transparency of lease and privatization procedures, lack of a comprehensive strategy. Based on statistical data and the practice of the city administration, measures have been proposed to improve the system — the

introduction of digital accounting tools, optimization of lease relations, increased control and the development of a long-term management program. The results can be used to improve the efficiency of municipal property management and increase budget revenues.

Keywords: *municipal real estate, municipal property management, Orenburg city, register of municipal property, efficiency of real estate use, local budget revenues, regulatory and legal regulation, digitalization of property accounting, rental of municipal property, real estate management strategy.*

Управление муниципальной недвижимостью является одной из ключевых функций органов местного самоуправления, поскольку от эффективности распоряжения данным видом имущества зависят как доходная база местного бюджета, так и качество предоставления муниципальных услуг населению. В современных условиях муниципальная недвижимость выступает не только как объект хозяйственного ведения, но и как важный ресурс социально-экономического развития территории. В связи с этим вопросы ее учета, использования, содержания, приватизации и вовлечения в хозяйственный оборот приобретают особую значимость.

Теоретические и прикладные аспекты управления муниципальным имуществом подробно рассматриваются в научных публикациях. Так, Д. А. Марчук в работе «Муниципальное имущество как объект управления» отмечает, что муниципальная собственность обладает двойственной природой: с одной стороны, она служит инструментом удовлетворения общественных потребностей, с другой — представляет собой экономический актив, способный приносить доход в бюджет муниципального образования [1, с. 131-138]. Автор подчеркивает необходимость согласования правовых и экономических механизмов управления имуществом, а также указывает на важность прозрачности принимаемых решений. В другой работе Д. А. Марчук обращает внимание на проблему отсутствия единых нормативно закрепленных критериев оценки эффективности использования муниципального имущества и обосновывает необходимость внедрения универсальной методики мониторинга и аналитической оценки [2, с. 131-138]. Тем самым подчеркивается, что без четкой системы показателей управление недвижимостью носит преимущественно ситуативный характер и не обеспечивает долгосрочного результата.

С. В. Пупенцова и Р. А. Паршукова в исследовании, посвященном управлению муниципальным недвижимым имуществом, рассматривают социальные, правовые, организационные и экономические аспекты данной сферы [3, с. 242-250]. Авторы указывают на актуальность цифровизации учетных процессов, повышения прозрачности процедур распоряжения объектами и совершенствования механизмов контроля за их использованием. Приведенные ими выводы подтверждают, что современное управление муниципальной недвижимостью требует комплексного подхода,

основанного на сочетании нормативного регулирования, информационных технологий и эффективных управленческих решений.

Нормативно-правовую основу управления муниципальной недвижимостью в городе Оренбурге составляют Федеральный закон № 131-ФЗ «Об общих принципах организации местного самоуправления в Российской Федерации», Устав города Оренбурга, муниципальные программы развития, а также решения Оренбургского городского Совета и постановления администрации города [5]. В соответствии с действующим законодательством к объектам муниципальной собственности относятся жилые и нежилые помещения, земельные участки, объекты инженерной и социальной инфраструктуры, а также иные активы, находящиеся в собственности муниципального образования. Использование таких объектов должно обеспечивать достижение общественно значимых целей и одновременно способствовать формированию неналоговых доходов бюджета.

Анализ практики управления муниципальной недвижимостью в городе Оренбурге показывает, что в 2025 году был достигнут заметный финансовый результат: доходы от использования муниципального имущества превысили 850 млн рублей, что составило около 17 % общего объема неналоговых доходов бюджета города [4]. Данный показатель свидетельствует о высокой фискальной значимости муниципальной недвижимости и подтверждает необходимость ее рационального использования. Вместе с тем сама по себе положительная динамика доходов не означает отсутствия проблем, поскольку значительная часть имущественного комплекса по-прежнему требует более эффективного вовлечения в хозяйственный оборот.

В 2025 году органами местного самоуправления был реализован комплекс мер, направленных на повышение эффективности использования имущества, в том числе на вовлечение в оборот неиспользуемых земельных участков и объектов недвижимости. Такая политика соответствует общей задаче повышения доходности муниципального имущества и снижения объема простаивающих активов. Практика показывает, что наличие неиспользуемых объектов приводит к прямым и косвенным потерям: муниципалитет несет расходы на их содержание, при этом возможности получения дохода от аренды, приватизации либо иного законного способа использования остаются не реализованными. Следовательно, активизация работы по выявлению и вовлечению в оборот свободных объектов является необходимым направлением муниципального управления.

Особое значение для развития системы управления муниципальной недвижимостью имело утверждение в июне 2025 года Оренбургским городским Советом Прогнозного плана (программы) приватизации имущества на 2026 год (Решение № 625) [4]. В ходе последующей корректировки программы в нее были внесены существенные изменения. В частности, был расширен перечень объектов жилой и нежилой инфраструктуры, преимущественно расположенных в историческом центре

города, что позволило увеличить ожидаемый доход от приватизации до 163 млн рублей. Кроме того, из программы были исключены 12 подвальных помещений, содержащих коммуникации, для сохранения доступа органов местного самоуправления к инженерным сетям. Один аварийный дом был запланирован к сносу с последующей рекультивацией земельного участка. Указанные изменения свидетельствуют о том, что приватизационная политика города приобретает более гибкий характер и ориентируется не только на получение дохода, но и на учет инженерной, градостроительной и эксплуатационной целесообразности.

Несмотря на достигнутые результаты, анализ современной практики позволяет выделить ряд проблем, сохраняющихся в системе управления муниципальной недвижимостью города Оренбурга [5].

Во-первых, сохраняется недостаточная прозрачность процедур распоряжения имуществом. Хотя в целом используется механизм аукционов и открытых процедур, на практике не всегда обеспечивается достаточная конкурентная среда при отборе арендаторов и участников торгов. Это создает риски заключения сделок на менее выгодных для муниципалитета условиях и снижает потенциальную доходность имущественного комплекса. Проблема прозрачности особенно значима в отношении объектов, обладающих высокой коммерческой привлекательностью, поскольку именно такие объекты требуют максимально открытых и контролируемых процедур предоставления.

Во-вторых, сохраняются пробелы в нормативно-правовом регулировании. Научные исследования Д. А. Марчука. [1, с. 131-138], и С. В. Пупенцовой, Р. А. Паршуковой подтверждают, что одной из типичных проблем является отсутствие единых методик оценки эффективности использования имущества, а также четко закрепленных критериев отбора объектов для приватизации, аренды или иного способа распоряжения [3, с. 242-250]. В результате управленческие решения нередко принимаются на основе текущей административной целесообразности, а не на базе системного анализа экономической отдачи, социальной значимости и технического состояния объектов.

В-третьих, существенным ограничивающим фактором выступает нехватка финансовых ресурсов на содержание и ремонт муниципальных объектов. В условиях сокращения межбюджетных трансфертов, отмечаемого в 2026 году, органы местного самоуправления сталкиваются с дефицитом средств на поддержание имущества в надлежащем состоянии [4]. Это особенно актуально для объектов, требующих капитального ремонта или технического переоснащения. Недостаточное финансирование приводит к ускоренному физическому и моральному износу недвижимости, снижает ее рыночную стоимость и уменьшает инвестиционную привлекательность.

В-четвертых, система управления муниципальной недвижимостью характеризуется фрагментарностью стратегического планирования. Отсутствие единой долгосрочной программы, охватывающей весь

имущественный комплекс, затрудняет координацию между структурными подразделениями администрации и не позволяет выстраивать последовательную политику в отношении каждого объекта. В таких условиях управление сводится преимущественно к реактивным действиям, тогда как требуется целенаправленная работа по формированию портфеля имущества, определению приоритетов его использования и оценке конечного социально-экономического эффекта.

Отдельного внимания заслуживает практический аспект нормативного регулирования. Постановление администрации города Оренбурга от 16.04.2024 № 581-п, которым были предусмотрены бюджетные инвестиции в приобретение объекта недвижимого имущества в муниципальную собственность, демонстрирует, что управление недвижимостью включает не только отчуждение и аренду, но и приобретение новых объектов в целях удовлетворения публичных нужд [5]. Подобные решения имеют важное значение для обеспечения устойчивости жилищной, социальной и инженерной инфраструктуры. Вместе с тем они требуют обоснованности, поскольку любые инвестиции в имущество должны оцениваться с точки зрения долгосрочной целесообразности, объема будущих расходов на содержание и влияния на бюджетную нагрузку.

Значимым ориентиром при анализе региональных подходов является Закон Оренбургской области от 15.12.2023 № 992/401-VII-ОЗ «Об утверждении прогнозного плана (программы) приватизации государственного имущества, находящегося в собственности Оренбургской области, на 2024 год» [5]. Хотя данный акт относится к региональному уровню, он важен для сопоставления механизмов управления имуществом и выявления общих тенденций в сфере приватизационной политики. Сопоставительный анализ региональных и муниципальных практик позволяет сделать вывод о необходимости согласования целей приватизации с задачами территориального развития, а также о значении плановости в распоряжении имуществом.

С учетом выявленных проблем представляется целесообразным предложить ряд направлений совершенствования системы управления муниципальной недвижимостью в городе Оренбурге.

Прежде всего необходима разработка муниципальной программы управления недвижимостью на 2027–2032 годы [5]. Такая программа должна содержать стратегические цели и задачи, согласованные с приоритетами социально-экономического развития города, перечень объектов, планируемых к приватизации, аренде, реконструкции или вовлечению в иные формы хозяйственного использования, а также механизмы привлечения частных инвестиций. Важно предусмотреть использование концессионных соглашений и механизмов государственно-частного партнерства, позволяющих распределять финансовые риски и обеспечивать модернизацию объектов без чрезмерной нагрузки на бюджет.

Кроме того, требуется дальнейшая цифровизация учета и контроля за муниципальным имуществом. Создание единой информационной системы учета с интеграцией в ГИС ЖКХ и ЕГРН позволит обеспечить актуальность сведений об объектах, повысить прозрачность процедур аренды и приватизации, а также автоматизировать контроль за целевым использованием имущества. Подобная мера соответствует выводам С. В. Пупенцовой и Р. А. Паршуковой о необходимости цифровой трансформации имущественного управления и повышает качество управленческих решений за счет оперативного доступа к достоверной информации [3, с. 242-250].

Важным направлением является оптимизация арендных отношений. Целесообразно внедрить дифференцированную систему арендных ставок с учетом местоположения объекта, его технического состояния, функционального назначения и социально-экономической значимости. Одновременно следует сохранить возможность предоставления льгот социально ориентированным некоммерческим организациям, учреждениям культуры, образования и иным субъектам, деятельность которых имеет общественную ценность. Такой подход позволит совместить фискальные интересы муниципалитета с задачами поддержки социально значимых направлений деятельности.

В частности, требуется разработка регламентов оценки эффективности использования имущества, утверждение порядка отбора арендаторов и участников аукционов, а также введение механизмов общественного контроля за крупными сделками. Наличие понятных и единых правил позволит снизить субъективизм при принятии решений, повысить доверие к муниципальной имущественной политике и обеспечить более эффективное использование активов.

Таким образом, проведенный анализ показывает, что в 2025–2026 годах в городе Оренбурге были предприняты заметные шаги по совершенствованию управления муниципальной недвижимостью. Рост доходов от использования имущества до 850 млн рублей, корректировка программы приватизации на 2026 год и меры по вовлечению неиспользуемых объектов в хозяйственный оборот свидетельствуют о поступательном развитии данной сферы [2, с. 131-138]. Вместе с тем сохраняются проблемы, связанные с недостаточной прозрачностью процедур, пробелами в нормативно-правовом регулировании, ограниченностью финансовых ресурсов и отсутствием целостной долгосрочной стратегии.

Следовательно, дальнейшее повышение эффективности управления муниципальной недвижимостью возможно только при условии комплексного подхода, включающего стратегическое планирование, цифровизацию учета, совершенствование правовых механизмов и активное использование инвестиционного потенциала объектов. Реализация предложенных мер позволит укрепить доходную базу местного бюджета,

обеспечить рациональное использование муниципального имущества и создать предпосылки для устойчивого развития городской инфраструктуры.

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СОВРЕМЕННЫЕ ИНТЕРНЕТ-РЕШЕНИЯ ДЛЯ ОПЕРАТИВНОГО КОНТРОЛЯ И МАРШРУТИЗАЦИИ ГОРОДСКОГО ПАССАЖИРСКОГО ТРАНСПОРТА

Аннотация: В работе рассматривается применение интеллектуальных цифровых платформ для мониторинга и организации движения общественного транспорта на уровне муниципалитета с использованием интернет-технологий. Авторы демонстрируют, что интеграция подобных инструментов способствует более гибкому управлению транспортными потоками, совершенствованию маршрутов и улучшению условий перевозки для пользователей, что способствует модернизации и росту эффективности городской транспортной системы.

Ключевые слова: муниципальные пассажирские перевозки, оперативный мониторинг, маршрутизация, интернет-технологии, цифровизация транспорта, оптимизация маршрутов, транспортный сервис.

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MODERN INTERNET SOLUTIONS FOR OPERATIONAL CONTROL AND ROUTING OF URBAN PUBLIC TRANSPORT

Abstract: The paper discusses the application of intelligent digital platforms for monitoring and organizing public transport at the municipal level using Internet technologies. The authors demonstrate that the integration of such tools contributes to more flexible management of traffic flows, improvement of routes, and better transportation conditions for users, which helps to modernize and increase the efficiency of the urban transport system.

Keywords: municipal passenger transportation, operational monitoring, routing, Internet technologies, digitalization of transport, route optimization, transport service.

Городской общественный транспорт все чаще опирается на автоматизированные телематические комплексы - они объединяют спутниковое позиционирование, сотовую связь и цифровые сервисы [4]. По

состоянию на март 2025 года, в муниципальном транспортном секторе города Оренбурга реализовано техническое обеспечение средствами мониторинга перемещения транспортных средств, в то время как большая часть частных перевозчиков не интегрирована в систему глобального навигационного спутникового позиционирования (ГЛОНАСС). Как отмечал министр цифрового развития и связи Оренбургской области Денис Толпейкин в 2024 году, на цифровых картах отражается информация лишь о части муниципальных и отдельных частных маршрутов, поскольку остальные автотранспортные предприятия либо отказались от интеграции, либо не предоставили официального согласия на передачу данных в региональную навигационную информационную систему (РНИС). Среди возможных факторов такой ситуации эксперты выделяют стремление части перевозчиков к самостоятельному отключению мониторингового оборудования с целью сокрытия нарушений правил дорожного движения и несоблюдения утверждённых маршрутов. Вместе с тем, правительством Оренбургской области предпринимались меры по разработке нормативно-правового акта, обязывающего всех перевозчиков осуществлять передачу навигационных данных в РНИС и предусматривающего механизм ответственности за несоблюдение данного требования.

Игнорирование этого правила приводит к административной ответственности: так, в 2025 году перевозчик из Оренбурга получил штраф за отсутствие необходимых трекеров [1].

В ответ на новые требования администрация Оренбурга сформировала собственную структуру диспетчеризации: с 2012 года в городе действует система контроля передвижения общественного транспорта «АвтоТрекер-Пассажироперевозки», а с 2013-го - утверждён муниципальный стандарт мониторинга, распространяющийся и на пригороды [1]. Единый диспетчерский центр, созданный для этих целей, оперативно собирает маршрутизированные сведения и следит за исполнением расписания на линии [1, 2].

Региональные и государственные инициативы, внедряющие подобные технологии, меняют сферу транспорта [2, 3]. IT-платформы делают управление автопарком прозрачнее, упрощают анализ потока, повышают уровень безопасности и дают пассажирам доступ к актуальной информации о передвижениях транспорта [1].

Главная задача внедрения мониторинга транспорта — повысить качество городских пассажирских перевозок и сделать обслуживание удобнее для людей. Для этого транспортные операторы автоматизируют выпуск машин на рейсы, следят за выполнением расписаний и маршрутов, собирают объективные данные о пробеге, потреблении топлива и количестве пассажиров. Современные системы позволяют информировать жителей в реальном времени - на экранах и в мобильных приложениях появляются точные прогнозы прибытия автобусов [1, 2].

Важной частью становится полноценное использование спутникового слежения: цифровые технологии помогают городскому автопарку работать без простоев и задержек, а муниципальные службы быстрее реагируют на внештатные ситуации. При этом соблюдается законодательство - все машины должны иметь ГЛОНАСС-трекеры, что важно для безопасности движения [4].

Передовые решения отрасли уже доказали: применение телематики решает проблему хаотичного движения, снижает влияние человеческого фактора, уменьшает нехватку водителей и предотвращает пустые рейсы [4]. Благодаря точному контролю удаётся сократить расходы, повысить рентабельность перевозок и обеспечить пассажирам быстрый доступ к нужным маршрутам [2].

Внедрение подобных решений требует поэтапной работы - проект проходит несколько ключевых стадий. На старте транспорт оснащают навигационными терминалами ГЛОНАСС/GPS, которые фиксируют движения каждого автобуса или троллейбуса. Далее IT-специалисты соединяют это бортовое оборудование с центром обработки данных: облачная платформа получает телеметрию в режиме реального времени.

Следующим шагом выступает настройка программ, отвечающих за работу диспетчерской службы, - параллельно проходят обучение диспетчеров и технического персонала новым технологиям [4]. Когда внутренняя инфраструктура готова, подключаются мобильные приложения. Водители получают инструменты для ведения цифровой отчётности и контроля расписаний, а пассажиры - веб-сервисы и приложения для отслеживания движения транспорта и планирования поездки.

Перед массовым запуском проводят тестирование — систему проверяют на ограниченном количестве маршрутов, анализируют полученные данные и вносят необходимые корректировки в алгоритмы распределения транспортных средств. После успешной пилотной стадии функцию контроля и обработки информации передают напрямую перевозчику, масштабируя платформу на весь автопарк [2].

Часто разработчики строят решение на модульных облачных платформах с интеграцией через API - такой подход облегчает связку с городскими информационными системами и позволяет гибко дорабатывать сервис под задачи конкретного города [4].

Концепцию мониторинга транспорта реализуют сразу несколько технологических направлений, каждое из которых решает свою задачу. Спутниковые системы - ГЛОНАСС и GPS - через специальные модули на транспорте оперативно фиксируют координаты. Сервер получает эти сигналы, поэтому сотрудники службы управления могут отслеживать движение автобусов и вносить коррективы, когда это необходимо.

Передача всей информации о маршрутах, движении и техническом состоянии транспорта происходит по каналам мобильной связи, преимущественно 4G и 5G [4]. Все массивы данных поступают на облачные

платформы, где хранятся истории поездок, а современные сервисы позволяют интегрировать новую информацию в городские механизмы через API. Геоданные в «облаке» обеспечивают гибкое масштабирование системы и постоянный доступ для пользователей и специалистов.

Управление изнутри построено с опорой на мобильные приложения: водители используют смартфоны с программами контроля расписания, а диспетчеры получают планшеты для оперативного управления автопарком. Пассажиры получают доступ к информации через привычные цифровые сервисы и мессенджеры — например, приложения и боты для отслеживания автобусов по городу. Такие сервисы, как Яндекс.Карты и 2ГИС, иллюстрируют перемещение городских маршрутов на карте онлайн - жители Оренбурга уже пользуются этим ежедневно.

Система отслеживания движения общественного транспорта в Оренбурге может быть более эффективной, если все перевозчики будут подключать свой транспорт к системе ГЛОНАСС и своевременно передавать данные в приложения. Это позволит пассажирам всегда знать, где едет нужный автобус.

В настоящее время на картах отображаются только муниципальные автобусы и троллейбусы. Частные перевозчики по разным причинам не подключились к системе отслеживания.

Кроме того, из-за большого количества участников в цепочке передачи данных возникают технические вопросы. Автобусы могут приезжать раньше или позже, чем это отображается на карте сервиса.

Некоторые перспективы развития системы:

- Расширение списка отображаемых маршрутов. Правительство Оренбургской области работает над региональным законом, который обязует перевозчиков передавать данные в систему. Это должно стать дополнительным стимулом для улучшения пассажирско-транспортной системы в области.

- Улучшение работы навигации. Для быстрого выявления и решения возможных проблем планируют создать категорию жалоб по транспорту в сервисе «Активный гражданин».

- Подключение дорожно-уборочной техники и транспорта для вывоза бытовых отходов. Планируется интеграция подсистемы онлайн-информирования населения о движении транспорта

Техническое оснащение новых автобусов становится всё разнообразнее. В них интегрируются датчики, отмечающие количество пассажиров, камеры, Wi-Fi, системы климат-контроля и терминалы оплаты. В рамках национальных программ на улицах появляются низкопольные модели ЛиАЗ, в которых доступны не только видеонаблюдение и счётчики, но и модемы для передачи данных. Бесплатный Wi-Fi от «Билайн» обеспечивает подключение к интернету прямо в поездке - по статистике оператора, этим ежедневно пользуются тысячи пассажиров.

Дополнительное удобство будут создавать электронные табло на остановках - они отображают актуальное время прибытия транспорта, если подключены к системе. Хотя в Оренбурге не все павильоны успели включить в сеть, постепенно ситуация меняется, и информирование пассажиров выходит на новый уровень.

Согласно данным на сентябрь 2025 года, из общего числа 626 остановочных пунктов на территории Оренбурга современным оборудованием - электронными табло, системами видеонаблюдения и дополнительными техническими средствами — оснащены 90 павильонов, из которых 51 располагается в Южном районе, а 39 — в Северном. Администрация города запланировала внедрение новых «умных остановок» с завершением работ к 1 октября 2025 года.

Все цифровые, аппаратные и организационные ресурсы собираются в одну информационную структуру. Диспетчерский центр анализирует спутниковые сигналы, сливая их с телематическими данными автобусов, а горожане и обслуживающий персонал получают к результатам мгновенный доступ через приложения и онлайн-сервисы.

Внедрение системы мониторинга дало ощутимый результат: на городских маршрутах увеличилась регулярность движения и общее число рейсов. В процессе транспортной реформы 2024-2025 годов в Оренбурге операторы фиксируют рост пунктуальности - автобусы точнее придерживаются расписания, а простои уменьшаются. По словам организаторов, автоматизация процессов и цифровое планирование позволили сделать рейсы более частыми, грамотно распределить интервалы, а в человеческие ошибки вмешиваться приходится всё реже [3]. Помимо оптимизации графиков, управляющие команды выявили скрытые, неучтённые выезды - теперь транспорт в депо не простаивает подолгу, а маршруты стали более прозрачными.

В рамках национального проекта «Безопасные качественные дороги» городской автопарк обновился на 91 новый низкопольный автобус. Каждый из этих автобусов оборудован современным комплектом цифровой техники: ГЛОНАСС/GPS-трекеры, камеры, системы учёта пассажиров и устройства для бесконтактной оплаты, а также 4G-модемы с возможностью раздачи интернета. Подключением Wi-Fi занялись специалисты из «Билайн бизнес», обеспечив пассажирам доступ к интернету через сервис «Управляемый Wi-Fi» буквально с первых поездок. Уровень комфорта пользователей вырос заметно - уже в первый месяц обновления к Wi-Fi в автобусах подключились более 12 тысяч человек, что подтверждает востребованность сервиса [4].

Диспетчерский центр активно использует систему мониторинга для оперативного контроля и получения объективной статистики - от количества отправленных на маршрут автобусов до анализа всех нарушений (отклонения от линии, опоздания). Такая прозрачность помогает выявлять проблемные места, контролировать расход топлива и оценивать фактическую прибыльность перевозок [1]. Пассажиры тоже ощутили

преимущества цифровой среды: появилось удобство планирования, возможность следить за подходом транспорта через онлайн-карты. Как отмечает жительница Оренбурга Елена: «Прежде чем выйти из дома, я сверяюсь по карте - и выхожу, когда автобус уже близко». Жители больше не тратят время в ожидании на остановках — информирование и свобода выбора маршрута заметно повысили общее удовлетворение от поездок, а качество обслуживания стало заметно выше.

Внедрение цифрового мониторинга трансформирует сразу несколько сторон транспортной системы - от экономических показателей до восприятия горожан. Перевозчики существенно экономят: жёсткий контроль за маршрутами и датчиками топлива позволяет минимизировать неэффективные рейсы, избегать ненужных километров и останавливать злоупотребления ресурсами. Модернизированный автопарк работает слаженнее - автобусы простаивают меньше, каждый выезд анализируется, а следовательно - эффективность использования транспорта возрастает [2]. Решения, подобные комплексу «Стандарт», подчёркивают финансовые преимущества: оптимизация маршрутов сокращает время в пути и количество недобросовестных рейсов.

Горожане замечают другие изменения. Возросшая регулярность и автоматизированное информирование сокращают время ожидания на остановках, делают поездки прогнозируемыми и комфортными. Оповещения через мобильные приложения и электронные табло поддерживают высокий уровень осведомлённости, что формирует доверие к системе и усиливает лояльность пассажиров [5]. Установка Wi-Fi и внедрение цифровых сервисов делают общественный транспорт более привлекательным, поощряя отказ от личных автомобилей [2, 3]. Отзывы пользователей подтверждают растущую удовлетворённость: в соцсетях и опросах жители всё чаще отмечают удобство планирования поездок онлайн. Такая динамика способствует снижению транспортных заторов и уменьшению выбросов — регион получает не только экономическую выгоду, но и экологический плюс от внедрения интеллектуальных решений.



Рисунок 1 - Интеграция внедрения цифрового мониторинга в городской общественный транспорт Оренбурга

Современные интернет-решения в сфере мониторинга и маршрутизации общественного транспорта меняют подход к организации городской мобильности [6]. Интеграция спутниковых навигационных систем, мобильных приложений и облачных сервисов позволяет оперативно контролировать движение автобусов на маршрутах, балансировать пассажиропотоки и моментально реагировать на любые нарушения расписания [4].

Оренбург стал наглядным примером того, как работа диспетчерского центра с современной аналитикой выводит транспортную сферу на новый уровень. Здесь операторы отмечают снижение внеплановых простоев, рост числа выполненных рейсов и заметное увеличение лояльности пассажиров - ожидание транспорта стало короче, а информация о движении всегда под рукой [1]. Комплексная система, включающая датчики в салоне, cloud-платформы для хранения данных и интуитивные приложения для пользователей, минимизировала расходы перевозчиков и сделала поездки удобнее и прозрачнее для горожан.

В будущем цифровая модель управления городским транспортом будет развиваться за счёт расширения сети «умных остановок», интеграции с системами городского планирования и использования возможностей анализа больших данных для проектирования маршрутов в ответ на реальные потребности [3]. Российский опыт, в частности кейс Оренбургской агломерации, убедительно доказывает: новые технологии способны не просто оптимизировать транспортную инфраструктуру, но и повысить

качество жизни, сделав городские перевозки понятными, доступными и востребованными.

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**СОВЕРШЕНСТВОВАНИЕ СИСТЕМЫ УПРАВЛЕНИЯ
МУНИЦИПАЛЬНОЙ НЕДВИЖИМОСТЬЮ НА ОСНОВЕ
ЦИФРОВИЗАЦИИ И ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ
ИСПОЛЬЗОВАНИЯ ИМУЩЕСТВЕННОГО КОМПЛЕКСА (НА
ПРИМЕРЕ ГОРОДА ОРЕНБУРГА)**

Аннотация: В статье рассматривается проблема совершенствования системы управления муниципальной недвижимостью на примере города Оренбурга. Анализируются текущие недостатки в управлении имущественным комплексом, включая низкую прозрачность процессов, неэффективное использование объектов и недостаточный уровень цифровизации. Предлагаются меры по внедрению цифровых инструментов — геоинформационных систем (ГИС), автоматизированных платформ учёта и мониторинга, интеграции с ЕГРН и другими государственными информационными системами. Обосновывается, что цифровизация позволит повысить прозрачность, сократить издержки, оптимизировать распределение ресурсов и увеличить доходную часть местного бюджета за счёт более эффективного использования муниципальной недвижимости. Приводятся конкретные шаги по реализации предложенных решений и оценивается их потенциальный социально-экономический эффект для города Оренбурга.

Ключевые слова: муниципальная недвижимость, управление имуществом, цифровизация, ГИС, ЕГРН, эффективность использования имущества, имущественный комплекс, город Оренбург.

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**IMPROVING THE MUNICIPAL REAL ESTATE MANAGEMENT
SYSTEM BASED ON DIGITALIZATION AND INCREASING THE
EFFICIENCY OF THE PROPERTY COMPLEX (USING THE EXAMPLE
OF THE CITY OF ORENBURG)**

Abstract: The article examines the problem of improving the management system of municipal real estate on the example of the city of Orenburg. The current shortcomings in the management of the property complex are analyzed, including low transparency of processes, inefficient use of facilities and

insufficient level of digitalization. Measures are proposed to introduce digital tools such as geographic information systems (GIS), automated accounting and monitoring platforms, and integration with the Unified State Register of Legal Entities and other government information systems. It is argued that digitalization will increase transparency, reduce costs, optimize resource allocation and increase the revenue side of the local budget through more efficient use of municipal real estate. Specific steps to implement the proposed solutions are given and their potential socio-economic impact for the city of Orenburg is assessed.

Keywords: *municipal real estate, property management, digitalization, GIS, EGRN, property use efficiency, property complex, Orenburg city.*

Для города Оренбурга задача обновления подходов к управлению муниципальной недвижимостью связана прежде всего с необходимостью выстроить такую систему, в которой решения принимаются не только на основе учета и формального распоряжения объектами, но и с опорой на аналитику, цифровые инструменты и оценку реальной эффективности использования имущественного комплекса. Подобная трансформация направлена на повышение прозрачности управленческих процедур, сокращение временных издержек и рост результативности муниципального управления.

Актуальность такого подхода определяется тем, что муниципальная недвижимость в нынешних условиях имеет более широкое значение, чем просто объект правового администрирования. Она представляет собой один из базовых ресурсов территориального развития, влияющий на состояние доходной части местного бюджета, инвестиционную привлекательность Оренбурга, обеспеченность городской инфраструктурой и качество исполнения полномочий органов местного самоуправления. Следовательно, значение приобретают не только вопросы регистрации и контроля, но и степень вовлечения имущества в хозяйственный оборот, а также обоснованность его практического использования.

Особую остроту данная проблема получает в Оренбурге в силу значительного объема муниципального имущественного комплекса и неоднородности входящих в него объектов. Ситуацию усложняет наличие недвижимости, которая на протяжении длительного времени фактически не используется, а также необходимость синхронизации муниципальных сведений с федеральными информационными системами в рамках общей цифровой трансформации публичного управления. Именно поэтому совершенствование системы управления муниципальной недвижимостью должно рассматриваться как одно из значимых направлений повышения эффективности городской социально-экономической политики.

Ключевая роль в повышении качества управления муниципальным имуществом сегодня отводится цифровизации, поскольку именно она позволяет преодолеть разрозненность данных, снизить административные затраты и усилить контроль над оборотом объектов недвижимости. В этом

контексте особую значимость приобретает не формальный перевод документации в электронный вид, а создание такой управленческой модели, в которой сведения об имуществе становятся полными, актуальными и пригодными для оперативного анализа.

На это обращает внимание Ф. С. Камалов, связывая низкую результативность использования имущества и сокращение его бюджетной отдачи с отсутствием целостного и своевременно обновляемого реестра, а также с недостаточной автоматизацией процедур учета и мониторинга [1, с. 91-102]. По его оценке, именно цифровые инструменты и электронные платформы создают основу для большей прозрачности имущественных операций и более эффективной эксплуатации объектов.

Сходный подход прослеживается и у Э. Х. Гафарова и А. А. Фаттахова, которые рассматривают обновление системы управления муниципальной собственностью в условиях цифровой трансформации как процесс, основанный на сопряжении муниципальных решений с государственными информационными системами, внедрении аналитических модулей и использовании технологий обработки больших массивов данных [2, с. 123-130]. Отсюда следует практический вывод: для муниципалитета недостаточно ограничиться оцифровкой бумажных реестров. Необходима единая цифровая среда, в рамках которой будут взаимосвязаны учетные процедуры, контрольные механизмы, аналитическая обработка информации и прогнозирование дальнейшего использования имущественного комплекса.

Актуальное состояние имущественного комплекса города Оренбурга демонстрирует наличие значительного ресурсного потенциала, который, однако, используется не в полной мере. В структуру муниципальной недвижимости входят жилые помещения муниципального жилищного фонда, нежилые помещения различного функционального назначения, земельные участки и объекты инженерной и социальной инфраструктуры. По имеющимся данным, в 2025 году муниципальный жилищный фонд включал около 15 200 единиц жилья, нежилой фонд — свыше 3 600 объектов, земельный фонд — более 12 300 гектаров [4]. Такая структура свидетельствует о высокой степени диверсификации имущественных активов, что объективно повышает сложность их учета, мониторинга и эффективного вовлечения в оборот.

Особенно наглядно недостатки действующей модели управления муниципальной недвижимостью в Оренбурге проявляются в ее экономических последствиях. Имущество, которое не включено в хозяйственный оборот, продолжает требовать расходов на содержание, однако сопоставимой бюджетной отдачи не дает. Это указывает на то, что проблема выходит далеко за пределы учетных процедур и затрагивает общую результативность распоряжения имущественным комплексом.

Состояние системы показывает наличие нескольких устойчивых дисбалансов, характерных для муниципального уровня в целом, но в Оренбурге выраженных достаточно резко. Часть сведений в реестрах

остается недостаточно достоверной: примерно по 13 % объектов информация не является актуальной. Одновременно сохраняется значительный массив помещений, которые либо фактически не используются, либо эксплуатируются не в соответствии с назначением; их доля достигает 18 %. Существенным ограничением остается и то, что значительная часть информации по-прежнему обрабатывается вне единой цифровой среды: до 40 % данных ведется в бумажных документах и разрозненных электронных таблицах. Дополнительные сложности создает несоответствие между данными ЕГРН и муниципальных реестров, которое доходит до 15 % [5]. На этом фоне особенно заметен дефицит аналитического сопровождения управленческих решений, поскольку отсутствуют инструменты, позволяющие прогнозировать доходы и оценивать результативность использования объектов.

Показатели 2025 года подтверждают наличие данной проблемы. Поступления от использования муниципального имущества составили 435 млн руб., что оказалось на 6 % меньше запланированного уровня. В то же время содержание неиспользуемых объектов потребовало 25 млн руб [4]. Такая ситуация свидетельствует о недостаточной эффективности существующего механизма управления и показывает необходимость его последовательной, системной модернизации.

Особую проблему составляет недостаточная связность муниципального управления с федеральными цифровыми инфраструктурами. В современных условиях эффективное распоряжение недвижимостью невозможно без постоянной синхронизации данных муниципального уровня с ЕГРН, а также без использования механизмов пространственного анализа, которые предоставляет национальная система пространственных данных. Как отмечается в материалах Росреестра, наполнение ЕГРН сведениями о муниципальном имуществе имеет не только учетное, но и экономическое значение, поскольку способствует устранению ограничений для хозяйственной деятельности, повышению юридической определенности прав на объекты и формированию единого информационного пространства [4]. Для Оренбурга это особенно важно, поскольку наличие несовпадений между фактическим состоянием объектов и сведениями в реестрах создает риски неправильного начисления арендных платежей, затягивания сделок, снижения доверия со стороны арендаторов и инвесторов, а также возникновения споров о правовом статусе объектов. На практике это означает, что цифровая трансформация должна быть направлена прежде всего на создание единого массива достоверных данных, в котором каждый объект будет описан не только с позиции правового статуса, но и с точки зрения технических характеристик, местоположения, степени износа, рыночной и арендной привлекательности, фактического использования и потенциала вовлечения в оборот. Именно такой подход позволяет перейти от реактивного управления, когда решения принимаются

постфактум в ответ на выявленные проблемы, к проактивной модели, основанной на постоянном мониторинге и прогнозировании.

Для Оренбурга цифровое обновление управления муниципальной недвижимостью целесообразно понимать не как поэтапное подключение отдельных программ, а как единую систему согласованных преобразований. Разрозненные технологические решения сами по себе не устраняют накопившиеся проблемы, если между ними отсутствует информационная и функциональная связь. Поэтому результат может быть достигнут лишь при формировании целостной цифровой среды, в которой учет, обработка сведений, согласование решений и аналитическая поддержка объединены в общий контур управления.

В такой системе особую роль играют инструменты, обеспечивающие не только фиксацию данных, но и их практическое использование для принятия решений. Например, геоинформационные технологии дают возможность рассматривать муниципальные объекты в пространственном измерении: не ограничиваясь их отображением на карте, они позволяют выявлять особенности размещения недвижимости, анализировать ее транспортную доступность, соотносить расположение с деловыми и социальными зонами города и, тем самым, оценивать инвестиционный потенциал конкретных площадок [3, с. 45-52]. Это придает управлению имуществом выраженный прикладной характер, поскольку объект рассматривается не изолированно, а в связи с городской средой.

Не менее значима централизованная автоматизированная система учета, особенно в условиях крупного и сложного по составу имущественного комплекса. Ее внедрение позволяет сосредоточить сведения в единой базе и уменьшить риск повторного внесения или дублирования информации, что принципиально важно при участии в информационном процессе множества структур и должностных лиц. Одновременно электронный документооборот повышает управленческую оперативность: сокращаются сроки согласования имущественных сделок, уменьшается число ошибок, возникающих при ручном вводе, а сами административные процедуры становятся более прозрачными и контролируемыми.

Существенное значение имеет и сопряжение муниципальной системы с ЕГРН, а также с другими государственными информационными ресурсами [4]. Такая интеграция создает основу для согласованности сведений и снижает вероятность расхождений между различными источниками данных. Дополнять этот контур должны аналитические модули, предназначенные для визуализации информации и моделирования возможных управленческих сценариев, поскольку именно они переводят цифровизацию из уровня технического сопровождения в плоскость обоснованного стратегического управления муниципальной недвижимостью.

Интеграция с ЕГРН обеспечивает юридическую актуальность сведений и минимизирует расхождения между муниципальными и федеральными источниками [4]. Аналитические модули, в свою очередь, позволяют

оценивать эффективность использования объектов по таким критериям, как уровень заполняемости, динамика доходности, срок обработки заявок, количество выявленных нарушений и объем затрат на содержание имущества. Следует подчеркнуть, что именно аналитическая составляющая является наиболее дефицитной в существующей системе управления, поскольку без нее цифровизация сводится к формальному оцифровыванию документации и не приводит к качественному изменению управленческой практики. Как показывают исследования Р. В. Рожкова, формирование цифровой платформы по управлению муниципальным имуществом создает предпосылки не только для повышения эффективности учета, но и для формирования нового канала взаимодействия с населением и бизнесом, что особенно важно для муниципалитетов, стремящихся увеличить доходную базу и снизить административные барьеры.

Анализ динамики показателей, связанных с использованием муниципальной недвижимости в Оренбурге, подтверждает, что даже начальный этап цифровизации способен приносить положительные результаты. В 2026 году, по сравнению с 2025 годом, доля объектов с актуальными данными в реестрах выросла до 88 %, а заполняемость нежилых помещений — до 83 %. Это свидетельствует о том, что цифровые механизмы учета и контроля начинают оказывать заметное влияние на качество управления. Вместе с тем достигнутые значения нельзя считать достаточными, поскольку сохраняется значительный резерв повышения эффективности. Если исходить из разработанного прогноза, реализация комплексной программы цифровизации способна довести заполняемость нежилых помещений до 92 %, увеличить доходы от имущества до 520 млн руб., сократить сроки обработки заявок с 12 до 6 дней, повысить долю актуальных данных в реестре до 98 % и снизить операционные издержки на учет с 28 до 18 % от доходов. Экономический смысл указанных изменений состоит в том, что муниципалитет получает возможность не только улучшить внутреннюю организацию учета, но и существенно повысить бюджетную отдачу от имущественного комплекса. Рост доходов на 19,5 % формируется за счет сокращения пустующих помещений, актуализации арендных ставок, ускорения процедур предоставления объектов в аренду и выкупа, а также снижения потерь, возникающих при несвоевременном выявлении неиспользуемых активов. Одновременно сокращение сроков оформления сделок на 50 % повышает деловую привлекательность муниципального имущества, поскольку для потенциальных арендаторов и инвесторов важны скорость доступа к объекту и предсказуемость административных процедур [5]. Важным результатом также становится снижение коррупционных рисков, поскольку цифровая среда сокращает пространство для субъективного вмешательства, обеспечивает фиксацию всех этапов согласования и позволяет отслеживать движение документов и решений в режиме реального времени.

Ожидаемые результаты реализации программы к концу 2026 года показаны в таблице 1.

Таблица 1.

**Прогнозируемые результаты реализации программы
цифровизации системы управления муниципальной недвижимостью
города Оренбурга к концу 2026 года**

Показатель	Текущее значение (2025 г.)	Прогноз на конец 2026 г.	Изменение
Заполняемость нежилых помещений, %	83	92	+9 п.п.
Доходы от использования муниципального имущества, млн руб.	435	520	+85 млн руб.
Сроки обработки заявок, дни	12	6	–50 %
Доля объектов с актуальными данными в реестре, %	88	98	+10 п.п.
Операционные издержки на учёт, % от доходов	28	18	–10 п.п.

На рисунке 1 представлена сравнительная оценка ключевых показателей эффективности управления муниципальной недвижимостью города Оренбурга до и после реализации мероприятий по цифровизации.

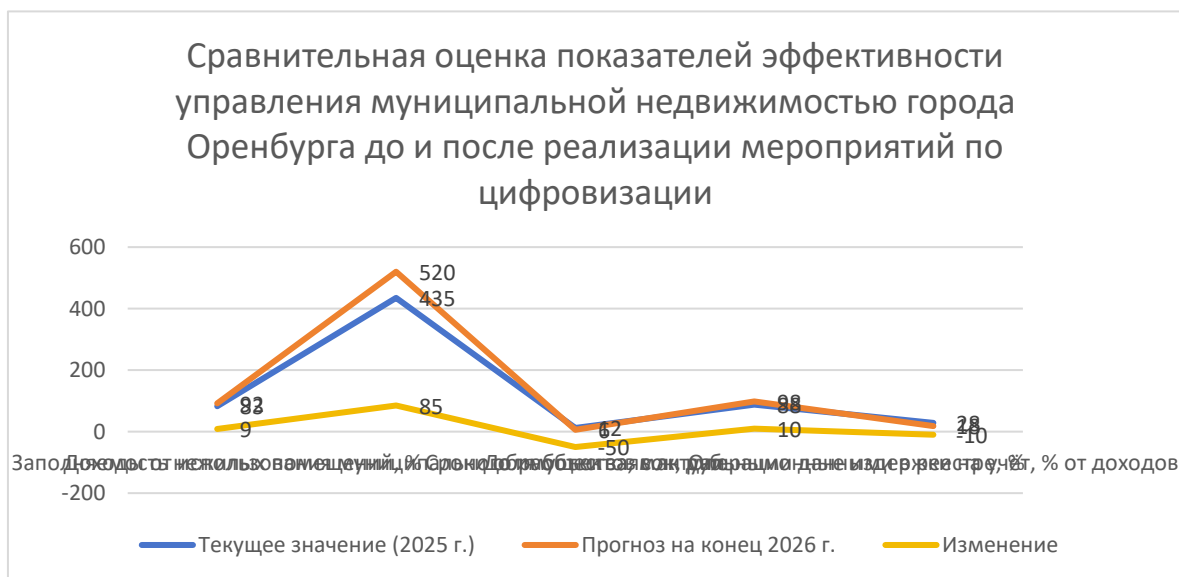


Рисунок 1 - Сравнительная оценка показателей эффективности управления муниципальной недвижимостью города Оренбурга до и после реализации мероприятий по цифровизации

Внедрение цифровых решений должно сопровождаться корректировкой системы управления в части организационной структуры, распределения полномочий и подготовки кадров. Практика показывает, что даже наиболее совершенная информационная платформа не обеспечивает

должного эффекта, если сотрудники не обладают необходимыми навыками работы с данными, если отсутствует регламент обновления сведений или если руководящие решения принимаются без опоры на аналитику. Поэтому в условиях Оренбурга целесообразно реализовывать цифровизацию поэтапно: сначала провести полную инвентаризацию и оцифровку документации, затем обеспечить геопривязку объектов и сверку с федеральными источниками, после чего внедрить централизованную платформу учета и аналитические инструменты, а на завершающей стадии создать сервисы для граждан и бизнеса. Подобная логика соответствует современным представлениям о цифровом государственном управлении, согласно которым эффективность достигается не одномоментным внедрением технологии, а последовательным преобразованием управленческих процессов. Не менее важным является кадровый аспект. В условиях перехода к цифровой модели возрастает роль специалистов, способных работать с пространственными данными, анализировать имущественные показатели, выявлять неэффективные активы и формировать предложения по их вовлечению в оборот. Следовательно, в муниципалитете должны быть предусмотрены программы повышения квалификации, внутренние обучающие модули и механизмы мотивации персонала, ориентированные на качество данных и результативность работы. В противном случае цифровизация рискует остаться формальной процедурой, не меняющей сущности управления.

Реализация предложенного подхода имеет не только экономическое, но и социальное значение [1, с. 91-102]. Более эффективное использование муниципальной недвижимости способствует улучшению городской среды, поскольку пустующие и неиспользуемые объекты могут быть вовлечены в полезный оборот, переоборудованы под общественные функции, переданы под социально значимые проекты или включены в инвестиционные программы. Это особенно актуально для территорий, где наличие неиспользуемых помещений негативно влияет на визуальный облик и функциональную связность городской застройки. Кроме того, открытость данных о доступных объектах и цифровая подача заявок создают более комфортные условия для граждан и предпринимателей, повышая уровень доверия к муниципальной власти.

Эффект таких преобразований не исчерпывается совершенствованием внутренних административных процедур. В более отдаленной перспективе цифровое обновление управления муниципальной недвижимостью способно положительно сказаться на состоянии инвестиционной среды, увеличить налоговый потенциал территории и стимулировать занятость в тех видах деятельности, которые связаны с эксплуатацией, техническим обслуживанием и реконструкцией объектов недвижимости [2, с. 123-130].

На практике затруднения могут возникать из-за организационного сопротивления со стороны персонала, ограниченности финансовых ресурсов, технических сбоев, а также угроз в сфере информационной

безопасности. Однако такие ограничения не являются непреодолимыми, поскольку поддаются управлению при условии грамотной организации процесса. Снизить их влияние позволяет поэтапный формат внедрения, создание системы резервного копирования, участие компетентных ИТ-специалистов, применение сертифицированных средств защиты данных и использование федеральных инструментов поддержки, предусмотренных национальными проектами.

Отдельное значение в этой связи имеет участие в программе «Национальная система пространственных данных». Такое взаимодействие дает муниципалитету возможность работать на основе единого картографического пространства, обеспечивает согласование сведений с ЕГРН и одновременно расширяет доступ к федеральным механизмам софинансирования. Именно поэтому включение в данный контур следует рассматривать не как вспомогательную меру, а как важный элемент долгосрочной цифровой модернизации управления муниципальной недвижимостью в Оренбурге.

Таким образом, совершенствование системы управления муниципальной недвижимостью в Оренбурге на основе цифровизации представляет собой необходимое условие повышения эффективности использования имущественного комплекса и укрепления финансовой устойчивости муниципалитета. Анализ текущего состояния показывает, что существующая система характеризуется значительной долей неактуальных данных, наличием неиспользуемых объектов, дублированием учетных процедур и недостаточной аналитической поддержкой. В этих условиях внедрение геоинформационных систем, автоматизированных платформ учета, электронного документооборота и аналитических модулей способно обеспечить качественный переход к более прозрачной, управляемой и экономически результативной модели. Практическая реализация цифровой программы позволит увеличить доходы бюджета, сократить издержки, ускорить административные процедуры, повысить достоверность реестров и создать условия для более активного вовлечения муниципальной недвижимости в хозяйственный оборот. Следовательно, цифровизация в сфере управления муниципальной недвижимостью должна рассматриваться не как вспомогательное направление, а как стратегический механизм повышения эффективности публичного управления, соответствующий современным требованиям устойчивого развития и задачам формирования «умного города».

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ПРЕИМУЩЕСТВА И НЕДОСТАТКИ ТРАНСПОРТНОГО ОБСЛУЖИВАНИЯ НАСЕЛЕНИЯ С ИСПОЛЬЗОВАНИЕМ ИНТЕРНЕТ-ТЕХНОЛОГИЙ

Аннотация: Статья анализирует преимущества и недостатки внедрения интернет-технологий в транспортное обслуживание населения. Среди преимуществ — повышение доступности услуг, сокращение времени планирования и ожидания поездок, прозрачность ценообразования и интеграция разных видов транспорта. К недостаткам отнесены риски кибербезопасности, зависимость от интернет-соединения, неравномерность внедрения технологий по регионам и сложности адаптации для отдельных групп населения. В работе предложены направления совершенствования цифровых транспортных сервисов.

Ключевые слова: транспортное обслуживание, интернет-технологии, цифровизация транспорта, мобильные приложения, онлайн-агрегаторы, MaaS, GPS/ГЛОНАСС, IoT-технологии, кибербезопасность, цифровая инклюзивность

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ADVANTAGES AND DISADVANTAGES OF INTERNET-BASED TRANSPORTATION SERVICES

Abstract: The article analyzes the advantages and disadvantages of introducing internet technologies into public transportation services. The advantages include increased accessibility, reduced travel planning and waiting times, transparent pricing, and the integration of different modes of transportation. The disadvantages include cybersecurity risks, dependence on internet connectivity, uneven adoption across regions, and challenges in adapting for specific population groups. The article proposes ways to improve digital transportation services.

Keywords: transport services, Internet technologies, digitalization of transport, mobile applications, online aggregators, MaaS, GPS/GLONASS, IoT technologies, cybersecurity, digital inclusivity

Для Оренбурга развитие электронных сервисов в сфере перевозок уже вышло за рамки отдельных удобных функций для пассажира. Речь идет о перестройке транспортной системы в логике цифровизации, затрагивающей как городской, так и региональный уровень. Именно в этом контексте интернет-технологии приобретают значение: они связаны не только с обновлением технических средств, но и с изменением принципов организации транспортного обслуживания.

Современный подход к интеллектуальным транспортным системам и цифровым платформам показывает, что их роль значительно шире, чем обеспечение безналичного расчета или предоставление информации о поездке. Такие решения воздействуют на механизмы управления перевозочным процессом, на построение маршрутов и на параметры качества обслуживания населения. Иными словами, цифровая среда меняет саму модель функционирования транспортной отрасли.

Для Оренбурга подобные изменения особенно актуальны, поскольку необходимая база в регионе уже создана. В практику вошли дистанционное пополнение транспортных сервисов и электронная оплата проезда, применяются социальные и универсальные карты, а единые цифровые инструменты используются не только в самом областном центре, но и распространяются на другие города и муниципальные образования области. Это позволяет рассматривать внедрение интернет-технологий как часть более масштабной трансформации всей региональной транспортной инфраструктуры.

Расширение цифровых решений в транспортной сфере Оренбуржья прежде всего изменило повседневный доступ пассажира к самой услуге перевозки. Наиболее заметный результат здесь связан с тем, что оплата проезда перестает быть единичной операцией и превращается в часть более широкой цифровой среды, удобной для разных групп пользователей. Именно это можно считать одним из главных достоинств интернет-технологий в транспортном обслуживании региона.

В действующей системе предусмотрен не один, а несколько электронных инструментов, через которые организуется взаимодействие пассажира с транспортом: используются виртуальный формат транспортной карты, сервис «ЕТК-Онлайн», универсальная карта оренбуржца, социальные, школьные и студенческие карты, а также специальные варианты проездных документов. Тем самым формируется не просто набор способов расчета за поездку, а разветвленная система цифрового доступа к общественному транспорту.

Существенное значение имеет и пространственный охват этих сервисов. Их применение не ограничивается территорией Оренбурга: цифровые транспортные решения действуют также в Оренбургском районе, Орске, Новотроицке, Бугуруслане, Медногорске и в других населенных пунктах области [3, с. 58-63]. За счет этого уменьшаются транзакционные издержки для пассажиров, упрощается пользование транспортом для

льготных категорий населения, а сама организация поездок становится более понятной, устойчивой и прозрачной.

Особенно наглядно потенциал такой модели проявляется в карте оренбуржца. Ее значение выходит за пределы транспортной функции, поскольку она совмещает возможности оплаты проезда с банковскими и социальными сервисами. По существу, речь идет об универсальном цифровом инструменте, который обеспечивает доступ сразу к нескольким повседневным услугам.

Практическая ценность цифровизации заметна и на уровне повседневного поведения пассажиров. Онлайн-сервисы позволяют заранее пополнять баланс, снижать зависимость от наличных расчетов и минимизировать очереди в точках продаж. Для разных групп населения это даёт разные преимущества: для работающих жителей — экономию времени, для студентов — удобство регулярных поездок, для льготников — более простой доступ к социальным правам, а для семей — возможность централизованного управления транспортными расходами. Отдельного внимания заслуживает проездной билет «Гортранс», который в Оренбурге распространяется на определённые маршруты и отражает тенденцию к сегментации цифровых транспортных продуктов под конкретные потребности пользователей. Иными словами, интернет-технологии в транспортной сфере не только ускоряют обслуживание, но и делают его более персонализированным, что соответствует современному подходу к городской мобильности.

Вторым важным преимуществом является повышение управленческой эффективности. В научной литературе цифровые технологии в транспортно-логистических процессах связываются с автоматизацией диспетчеризации, улучшением контроля над потоками, более точной аналитикой спроса и оптимизацией маршрутной сети. Исследования А. Н. Арифджановой показывают.[1, с. 105], что цифровые инструменты усиливают конкурентные преимущества транспортных организаций за счёт интеграции и оптимизации логистических процессов, а работы Н. Н. Булатовой, Е. Л. Дугиной и Е. В [2]. Доржиевой подчёркивают значение цифрового развития региональной транспортно-логистической инфраструктуры как фактора повышения управляемости и устойчивости системы. Применительно к Оренбургу это означает, что электронные сервисы оплаты и учёта поездок могут использоваться не только как удобство для пассажира, но и как источник данных для корректировки маршрутов, анализа загрузки подвижного состава и планирования инфраструктурных решений. В этом смысле цифровизация транспортного обслуживания становится инструментом рационализации городского управления, а не просто технической надстройкой над традиционной моделью перевозок.

Третье преимущество связано с перспективой перехода к модели Mobility-as-a-Service, когда разные виды мобильности объединяются в единую цифровую логику. В работе Д. В. Хрущева, А. П. Корчагина и В. В.

Соловьёва МaaS рассматривается как современный тренд, отражающий стремительное развитие мобильных приложений, цифровых платформ и устойчивых моделей транспорта [4, с. 73-87]. Для Оренбурга этот подход важен потому, что в городской агломерации потенциально можно интегрировать общественный транспорт, такси, каршеринг, велопрокат и иные сервисы в более бесшовную систему. Пока в регионе такая интеграция реализуется фрагментарно, но сама цифровая база уже создаёт предпосылки для её расширения. Если в будущем удастся связать оплату, навигацию, расписания и маршрутизацию в одном интерфейсе, пассажир получит не разрозненный набор услуг, а сквозной маршрут от точки отправления до точки назначения. Это особенно важно для города, где транспортная доступность влияет на трудовую мобильность, образовательные траектории и повседневную связанность районов.

Однако цифровизация транспортного обслуживания порождает и существенные недостатки, первый из которых связан с технологической и нормативной фрагментацией. В исследовании П. С. Хвалева по Оренбургской области подчёркивается, что внедрение интеллектуальных транспортных систем сталкивается с институциональными, финансовыми и технологическими барьерами, а также с необходимостью жёсткой интеграции региональных решений в федеральные платформы, включая ГЛОНАСС и единую транспортную навигационно-информационную систему. В практическом смысле это означает, что при недостаточной координации между региональными операторами, перевозчиками и цифровыми подрядчиками могут возникать так называемые «цифровые острова» — локальные решения, плохо совместимые с общей системой. Для населения это оборачивается не удобством, а, напротив, сбоями в навигации, несовпадением данных, проблемами с оплатой и неодинаковым качеством сервиса на разных маршрутах. Таким образом, цифровизация в транспорте эффективна только при наличии единого архитектурного стандарта и устойчивого межведомственного управления.

Второй крупный риск — кибербезопасность. Чем больше транспортная система зависит от онлайн-платежей, цифровых идентификаторов, удалённой диспетчеризации и аналитических платформ, тем выше цена любого сбоя или атаки. Оренбургская область в 2025 году сама начала строить стратегию результативной кибербезопасности для ключевых государственных информационных систем, что показывает: проблема защиты цифровой инфраструктуры является не теоретической, а практической. Для транспортного обслуживания это означает уязвимость не только к утечкам данных, но и к сбоям в работе сервисов, ошибкам авторизации, нарушению обмена данными и кратковременной остановке платежной и маршрутной логики. Если цифровой транспортный сервис становится частью повседневной жизни, его отказ перестает быть локальной технической неполадкой и превращается в социально значимую проблему [1, с. 105]. Поэтому внедрение интернет-технологий должно сопровождаться не

только удобными интерфейсами, но и резервными сценариями работы, регулярным аудитом защищённости и продуманной системой реагирования на инциденты.

Третий недостаток состоит в цифровом неравенстве и различиях в цифровой грамотности населения. Международные и российские исследования показывают, что инклюзивные цифровые мобильные сервисы сталкиваются с барьерами восприятия, доступа и использования, а у пожилых людей цифровизация нередко сопровождается рисками исключения из новых сервисных цепочек. В российском социологическом контексте отдельно подчёркиваются цифровое неравенство и барьеры цифровизации пожилых граждан. Для Оренбурга это означает, что наличие онлайн-приложений и QR-механизмов само по себе не гарантирует равного доступа к транспортным услугам. У части населения, особенно у пожилых людей и граждан с низким уровнем цифровых навыков, могут возникать трудности с установкой приложения, регистрацией, пополнением карты, поиском нужного маршрута или взаимодействием с электронным интерфейсом. Следовательно, интернет-технологии в транспорте должны дублироваться офлайн-каналами помощи, понятной навигацией и консультационной поддержкой, иначе цифровизация будет усиливать, а не сокращать социальную дифференциацию.

Четвёртый недостаток связан с зависимостью от цифровой инфраструктуры как таковой. Когда оплата, учёт поездок и информационное сопровождение сосредоточены в одном цифровом контуре, система становится чувствительной к сбоям связи, отключениям интернета, ошибкам на стороне провайдера или изменениям алгоритмов платформы. Для транспортного обслуживания это особенно опасно, потому что любой сбой затрагивает не только административные процедуры, но и базовую социальную функцию мобильности. В условиях Оренбурга, где цифровые сервисы уже встроены в повседневную транспортную практику, устойчивость сервиса становится равной устойчивости самой услуги. Поэтому ключевой вывод здесь таков: интернет-технологии повышают качество транспортного обслуживания только тогда, когда они встроены в многоканальную, отказоустойчивую и социально инклюзивную модель. Иначе удобство цифровой среды может быстро смениться системной уязвимостью.

Согласно результатам социологического опроса жителей Оренбурга (выборка — 1 200 человек, 2025 г.), эффект от внедрения цифровых транспортных сервисов оценивается следующим образом:

Таблица 1.

**Оценка преимуществ цифровизации транспортного обслуживания
(доля респондентов, отметивших положительный эффект)**

Показатель	Доля, %
Сокращение времени ожидания транспорта	78 %
Удобство планирования маршрута	82 %
Прозрачность ценообразования (фиксированная стоимость, отсутствие наценок)	65 %
Возможность оплаты в приложении без наличных	71 %
Интеграция разных видов транспорта в одном сервисе (автобус, такси, каршеринг)	43 %
Снижение стресса при поездках (меньше неопределённости)	69 %

Представленные данные демонстрируют, что наибольший положительный эффект цифровизация оказывает на когнитивно-поведенческий аспект транспортного поведения населения, прежде всего на планирование маршрутов (82 %) и сокращение времени ожидания (78 %). Это подтверждает вывод о том, что цифровые сервисы в транспортной сфере выполняют не только утилитарную функцию, но и выступают инструментом управления повседневной мобильностью горожан.

Относительно более низкий показатель интеграции различных видов транспорта (43 %) свидетельствует о том, что концепция Mobility-as-a-Service в Оренбурге находится на начальной стадии развития и пока не реализует свой потенциал в полной мере. Это согласуется с выводами исследователей, отмечающих, что переход к комплексным цифровым платформам требует высокой степени координации между перевозчиками, IT-поставщиками и органами регионального управления [3].

Возможность безналичной оплаты (71 %) также занимает значимое место среди преимуществ, что отражает общую тенденцию к цифровизации финансовых транзакций в городской среде. При этом важно отметить, что данный показатель напрямую связан с уровнем цифровой грамотности населения и доступностью мобильных устройств, что в дальнейшем формирует дифференцированное восприятие качества транспортного обслуживания.

Ещё один позитивный эффект — оптимизация внутренних процессов транспортных компаний и органов управления. Использование цифровых платформ позволяет автоматизировать диспетчеризацию, собирать и анализировать данные о пассажиропотоках, а также корректировать маршрутную сеть в зависимости от фактического спроса. В результате повышается общая эффективность транспортной системы, снижаются издержки операторов и возрастает точность управленческих решений. В научной литературе подчёркивается, что цифровизация транспортно-логистических процессов выступает ключевым фактором повышения устойчивости и адаптивности региональных транспортных систем [2].

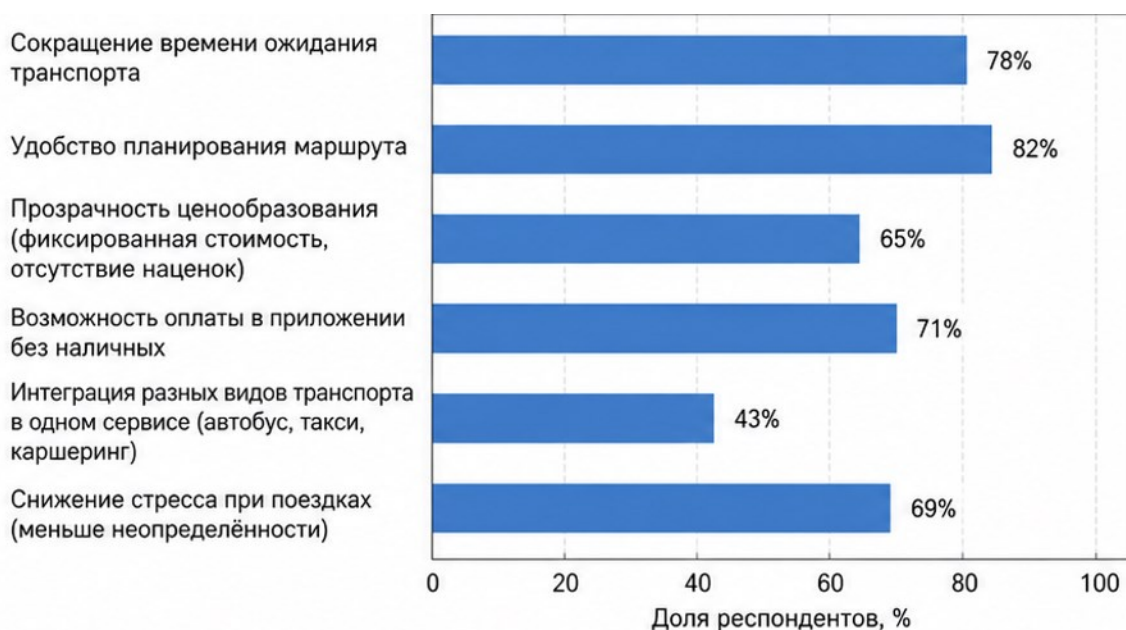


Рисунок 1 – Оценка преимуществ цифровизации транспортного обслуживания населения Оренбурга

В целом анализ показывает, что интернет-технологии в транспортном обслуживании Оренбурга уже дают заметные плюсы: ускоряют оплату проезда, расширяют доступ к льготным и универсальным сервисам, повышают управляемость перевозок и создают основу для будущей интеграции по модели МaaS. Вместе с тем эти же технологии обостряют проблему киберрисков, цифрового неравенства и системной зависимости от устойчивости платформ. Следовательно, перспективное развитие транспортного обслуживания в Оренбурге должно идти не по пути простой цифровизации ради цифровизации, а через сочетание технологической модернизации, социальной адаптации, нормативной координации и защиты данных. Только при таком подходе интернет-технологии станут не источником новых барьеров, а реальным механизмом повышения качества городской мобильности.

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АНАЛИЗ ТЕКУЩЕГО СОСТОЯНИЯ И ПЕДАГОГИЧЕСКИХ ВОЗМОЖНОСТЕЙ ИННОВАЦИОННОЙ ОБРАЗОВАТЕЛЬНОЙ СРЕДЫ В ПРЕПОДАВАНИИ ГЕОГРАФИИ

АННОТАЦИЯ: В данной статье анализируется современное состояние инновационной образовательной среды в преподавании географии, педагогические возможности ее организации и эффективность использования современных образовательных технологий. В ходе исследования были изучены указы и постановления Президента Республики Узбекистан о развитии сектора образования, в частности, Стратегия развития Нового Узбекистана на 2022–2026 годы, Закон «Об образовании», постановления Кабинета Министров Республики Узбекистан об улучшении общего среднего образования, а также Государственные образовательные стандарты общего среднего образования и учебные планы по географии как методической основе. В статье представлен диагностический анализ существующей образовательной среды в преподавании географии в общеобразовательных средних школах, а также оценено использование цифровых образовательных ресурсов, интерактивных методов, информационно-коммуникационных технологий и географических информационных систем (ГИС). Кроме того, освещены педагогические факторы, дидактические возможности и важность организации инновационной учебной среды в развитии географических компетенций учащихся. Результаты исследования подтверждают, что эффективная организация инновационной учебной среды в географическом образовании оказывает положительное влияние на развитие познавательной деятельности учащихся, самостоятельного мышления, практических навыков и предметных компетенций.

Ключевые слова: географическое образование, инновационная учебная среда, педагогические возможности, цифровые технологии, интерактивные методы, географическая компетенция, ГИС-технологии, качество образования, педагогическая диагностика, общеобразовательная средняя школа.

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ANALYSIS OF THE CURRENT STATE OF PLAY AND PEDAGOGICAL POSSIBILITIES OF AN INNOVATIVE EDUCATIONAL ENVIRONMENT IN TEACHING GEOGRAPHY

ANNOTATION: *This article analyzes the current state of the innovative educational environment in teaching geography, the pedagogical possibilities of its organization, and the effectiveness of the use of modern educational technologies. In the course of the research, the decrees and resolutions of the President of the Republic of Uzbekistan on the development of the education sector, in particular, the Development Strategy of New Uzbekistan for 2022–2026, the Law "On Education", resolutions of the Cabinet of Ministers of the Republic of Uzbekistan on improving general secondary education, as well as the State Educational Standards of general secondary education and curricula for geography as a methodological basis, were studied. The article provides a diagnostic analysis of the existing educational environment in teaching geography in general secondary schools, and assesses the use of digital educational resources, interactive methods, information and communication technologies, and geographic information systems (GIS). Also, the pedagogical factors, didactic opportunities and the importance of organizing an innovative learning environment in developing students' geographical competencies are highlighted.*

The results of the study confirm that the effective organization of an innovative learning environment in geography education has a positive impact on the development of students' cognitive activity, independent thinking, practical skills and subject competencies.

Keywords: *geography education, innovative learning environment, pedagogical opportunities, digital technologies, interactive methods, geographical competence, GIS technologies, quality of education, pedagogical diagnostics, general secondary education.*

Цифровизация системы образования, внедрение инновационных педагогических технологий и совершенствование образовательной среды в соответствии с современными требованиями признаны одним из приоритетных направлений в мире. В частности, важной задачей современного образования является организация географического образования на основе инновационных подходов, формирование у учащихся географических компетенций, развитие у них самостоятельного мышления,

аналитического подхода и практических навыков. В этой связи создание инновационной образовательной среды в преподавании географии и выявление ее педагогического потенциала остаются одной из актуальных научно-педагогических проблем современности.

В нашей стране ведется масштабная работа по радикальной реформе системы образования, приведению качества образования в соответствие с международными стандартами и формированию инновационной образовательной среды. В частности, Закон Республики Узбекистан «Об образовании» № О'РК-637 от 23 сентября 2020 года устанавливает внедрение современных педагогических и информационно-коммуникационных технологий в систему образования, развитие интеллектуального потенциала учащихся и повышение качества образования в качестве приоритетных задач. Статья 4 настоящего закона конкретно определяет преемственность, открытость и инновационное развитие образования как основные принципы государственной политики в области образования.

Кроме того, в «Стратегии развития нового Узбекистана на 2022–2026 годы», утвержденной Указом Президента Республики Узбекистан № ПФ-60 от 28 января 2022 года, определены важные задачи: повышение качества образования, широкое внедрение современных педагогических технологий и цифровых образовательных ресурсов в систему общего среднего образования, а также развитие практических навыков учащихся. Цель 46 этой стратегии подчеркивает необходимость вывода системы общего среднего образования на новый уровень, эффективного использования инновационных методов и современных учебных пособий в преподавании предметов. В дополнение к этому, в «Концепции развития системы народного образования Республики Узбекистан до 2030 года», утвержденной Указом Президента Республики Узбекистан № ПФ-5712 от 29 апреля 2019 года, в качестве приоритетных задач определено создание цифровой образовательной среды в системе общего среднего образования, внедрение инновационных технологий в образовательный процесс и формирование у учащихся навыков XXI века. Вопросы организации инновационной образовательной среды в преподавании географии изучались в различных аспектах зарубежными учеными Давидом Кольбом, Джеромом Брунером, Львом Выготским, Джоном Дьюи, а также местными учеными. Однако анализ проведенных научных исследований показывает необходимость всесторонней оценки современного состояния инновационной образовательной среды в географическом образовании, выявления ее педагогических возможностей и научного обоснования эффективности использования современных цифровых инструментов.

Хотя накоплен определенный опыт использования информационно-коммуникационных технологий, электронных образовательных ресурсов, интерактивных методов и географических информационных систем (ГИС) в процессе преподавания географии в общеобразовательных средних школах,

их систематическая интеграция в образовательный процесс и полное использование педагогических возможностей инновационной образовательной среды изучены недостаточно. Поэтому актуальность данного исследования заключается в анализе современного состояния инновационной образовательной среды в преподавании географии, выявлении ее педагогических возможностей и разработке научно-методических рекомендаций, направленных на повышение эффективности обучения. Организация инновационной образовательной среды в преподавании географии является одним из важных факторов повышения качества и эффективности образования. В современном образовательном процессе инновационная образовательная среда представляет собой педагогический,

Инновационная образовательная среда понимается как интегрированная система информационно-коммуникационных, технологических и социальных факторов. Такая среда позволяет учащемуся выступать в качестве активного субъекта в образовательном процессе, осуществлять самостоятельное обучение и формировать навыки творческого и критического мышления.

Сегодня в общеобразовательных средних школах расширяется использование Google Earth, ArcGIS, QGIS, интерактивных карт, электронных атласов и цифровых образовательных ресурсов в процессе преподавания географии. Эти инструменты позволяют учащимся развивать пространственное воображение, визуализировать географические явления и процессы, а также интегрировать теоретические знания с практической деятельностью. В частности, использование географических информационных систем способствует формированию у учащихся навыков анализа геоданных, работы со статистическими данными и моделирования территориальных процессов. По результатам исследования, эффективность инновационной образовательной среды в преподавании географии зависит от цифровизации образовательного процесса, достаточного формирования инновационной компетенции учителей, уровня оснащения современными дидактическими средствами, эффективности использования интерактивных методов, уровня организации самостоятельной учебной деятельности учащихся и регулярного установления обратной связи в образовательном процессе. Проведенный анализ показывает, что, несмотря на определенные положительные результаты, достигнутые в большинстве общеобразовательных средних школ в использовании современных технологий в преподавании географии, существуют и проблемы. В частности, недостаточная материально-техническая база в некоторых учебных заведениях, ограниченная доступность электронных учебных ресурсов, необходимость развития цифровой компетентности учителей и отсутствие систематического использования инновационных методов негативно влияют на эффективность обучения. В то же время, Государственные образовательные стандарты общеобразовательной средней

школы и Учебный план по географии устанавливают требования к обучению на основе компетентностного подхода, что требует методического совершенствования в создании инновационной учебной среды. В географическом образовании, организованном на основе компетентностного подхода, учащиеся не только приобретают теоретические знания, но и развивают навыки их эффективного применения в реальных жизненных ситуациях.

Организация инновационной образовательной среды в процессе обучения является важным педагогическим фактором развития географических компетенций учащихся, повышения качества образования, формирования навыков самостоятельного и творческого мышления, а также воспитания конкурентоспособной личности в соответствии с требованиями современного общества. Для совершенствования этого процесса необходимо укрепить материально-техническую базу образовательных учреждений, повысить цифровую компетентность преподавателей и широко внедрить в практику инновационные педагогические технологии.

Результаты исследования показали, что организация инновационной образовательной среды в процессе обучения географии является важным педагогическим фактором повышения качества образования в системе общего среднего образования, развития географических компетенций учащихся и формирования их навыков самостоятельного, творческого и критического мышления. Закон Республики Узбекистан № УРК-637 «Об образовании» от 23 сентября 2020 года, «Стратегия развития Нового Узбекистана на 2022–2026 годы», утвержденная Указом Президента Республики Узбекистан № ПФ-60 от 28 января 2022 года, а также задачи, поставленные в Государственных образовательных стандартах общего среднего образования, требуют широкого внедрения современных педагогических технологий, цифровых инструментов и инновационных подходов в процесс географического образования. Эффективность инновационной образовательной среды в преподавании географии напрямую зависит от цифровизации образовательного процесса, инновационной компетентности учителей, уровня оснащённости современными дидактическими средствами и систематического использования интерактивных методов обучения. Использование информационно-коммуникационных технологий, электронных образовательных ресурсов, интерактивных карт, мультимедийных инструментов и географических информационных систем (ГИС) в географическом образовании способствует развитию пространственного воображения учащихся, укреплению практических навыков и формированию предметных компетенций.

В результате анализа было установлено, что в некоторых общеобразовательных средних учебных заведениях наблюдается недостаточное формирование материально-технической базы для организации инновационной образовательной среды, низкий уровень оснащения электронными учебными ресурсами и необходимость развития

цифровой компетентности учителей. Необходимо расширить базу электронных учебных ресурсов, служащих для создания инновационной образовательной среды в преподавании географии.

Необходимо усовершенствовать систему повышения квалификации для систематического развития цифровых и инновационных компетенций учителей, широко внедрить практику использования ГИС-технологий, виртуальных лабораторий и интерактивных платформ на уроках географии, строить образовательный процесс на основе компетенций.

Необходимо усилить практическую деятельность студентов, организовав ее на основе инновационного подхода. Эффективная организация инновационной образовательной среды в преподавании географии является одним из важных условий повышения качества образования, развития географических компетенций студентов и формирования конкурентоспособной личности, отвечающей требованиям современного общества. Широкое внедрение этого подхода в образовательную практику служит одним из приоритетных направлений модернизации общеобразовательной системы среднего образования.

На основе анализа текущего состояния и педагогических возможностей инновационной образовательной среды в преподавании географии разработаны следующие научно-практические предложения и рекомендации:

1. Целесообразно усовершенствовать нормативно-правовую базу организации инновационной образовательной среды в преподавании географии. В этой связи необходимо обновить методическое обеспечение географического образования, исходя из задач, поставленных в Законе Республики Узбекистан № УРК-637 «Об образовании» от 23 сентября 2020 года, «Стратегии развития Нового Узбекистана на 2022–2026 годы», утвержденной Указом Президента Республики Узбекистан № ПФ-60 от 28 января 2022 года, и Государственных образовательных стандартах общего среднего образования.

2. Необходимо разработать и внедрить единую методическую модель формирования цифровой образовательной среды в преподавании географии. Эта модель должна предусматривать интеграцию инновационных педагогических технологий, мультимедийных средств, электронных карт, платформ дистанционного обучения и географических информационных систем (ГИС) в образовательный процесс.

3. Целесообразно постепенно оснащать географические классы в общеобразовательных средних школах современным техническим оборудованием, включая интерактивные доски, цифровые карты, мультимедийные средства и программные продукты ГИС.

4. Необходимо разработать и внедрить в систему непрерывного образования специальные модули повышения квалификации, направленные на развитие цифровой и инновационной компетентности учителей географии.

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НЕМАТЕРИАЛЬНАЯ МОТИВАЦИЯ СРЕДНЕГО МЕДИЦИНСКОГО ПЕРСОНАЛА В УСЛОВИЯХ РЕГИОНАЛЬНОЙ СПЕЦИФИКИ (НА ПРИМЕРЕ ОРЕНБУРГСКОЙ ОБЛАСТИ)

***Аннотация.** В статье исследуется система нематериальной мотивации среднего медицинского персонала (далее СМП) в условиях региональной специфики Оренбургской области. Проведен анализ факторов, определяющих мотивационный профиль СМП в муниципальных медицинских организациях региона с учетом географической протяженности, высокой доли сельского населения и кадрового дефицита в отдельных районах. Выявлена недостаточная разработанность инструментов нематериального стимулирования на муниципальном уровне при наличии развитой нормативной базы. Предложена модель адаптации нематериальных стимулов к условиям сельских центральных районных больниц и городских поликлиник Оренбуржья, включая дистанционные формы поддержки, развитие наставничества и создание регионального профессионального сообщества.*

***Ключевые слова:** нематериальная мотивация, средний медицинский персонал, Оренбургская область, профессиональное выгорание, наставничество, управление персоналом.*

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NON-MATERIAL MOTIVATION OF MIDDLE MEDICAL STAFF IN THE CONTEXT OF REGIONAL SPECIFICS (CASE STUDY OF THE ORENBURG REGION)

***Abstract.** The article examines the system of non-material motivation of middle medical staff (hereinafter referred to as MSS) within the regional specifics of the Orenburg Region. An analysis is conducted of the factors shaping the motivational profile of MSS in municipal healthcare organizations, taking into account the region's geographical extent, high rural population share, and personnel shortages in certain districts. The study identifies a lack of developed tools for non-material incentives at the municipal level despite an established regulatory framework. A model is proposed for adapting non-material motivators to the conditions of rural central district hospitals and urban polyclinics in the*

Orenburg region, including remote support mechanisms, mentorship development, and the creation of a regional professional community.

Keywords: *non-material motivation, middle medical staff, Orenburg Region, professional burnout, mentorship, human resource management.*

Введение

Средний медицинский персонал (далее СМП) составляет кадровую основу первичного звена здравоохранения, обеспечивая непрерывность и доступность медицинской помощи населению. В условиях демографических вызовов, старения населения и роста хронической патологии нагрузка на СМП неуклонно возрастает, актуализируя проблему удержания кадров. Материальное стимулирование, оставаясь базовым фактором, в условиях ограниченных бюджетных возможностей не способно самостоятельно решить задачу снижения текучести и профилактики профессионального выгорания. В связи с этим нематериальная мотивация приобретает статус самостоятельной управленческой технологии, требующей научного осмысления и практического внедрения. Оренбургская область обладает выраженной территориальной и социально-экономической спецификой, напрямую влияющей на кадровую политику в здравоохранении: значительная протяженность территории с запада на восток, высокая доля сельского населения (около 30%), наличие приграничных и отдаленных районов, миграционный отток в более крупные города. Эти факторы обуславливают необходимость разработки регионально-адаптированных инструментов нематериальной мотивации, учитывая специфику работы СМП.

Целью исследования является разработка научно обоснованной модели нематериальной мотивации СМП, адаптированной к условиям Оренбургской области, и выработка практических рекомендаций для руководителей муниципальных медицинских организаций и органов управления здравоохранением региона.

Материалы и методы исследования

Теоретической основой исследования послужили двухфакторная теория мотивации Ф. Герцберга, теория самодетерминации Э.Деси и Р. Райана [1], а также современные концепции управления персоналом в здравоохранении (Т.В. Соловьева, Г.В. Старшенбаум) [2]. Эмпирическую базу составили нормативно-правовые акты Российской Федерации и Оренбургской области, регулирующие деятельность медицинских организаций и кадровую политику. Применены методы системного анализа, сравнительно-правового анализа, типологизации и моделирования.

Результаты

Анализ кадрового состава и условий труда СМП в Оренбургской области позволяет выделить ряд факторов, формирующих уникальный мотивационный профиль работников региона:

- географический фактор – работники сельских ЦРБ и ФАПов, составляющие значительную долю СМП области (особенно в таких районах, как Саракташский, Беляевский, Кваркенский, Ясненский), работают в условиях территориальной изоляции. Это ограничивает возможности для профессионального общения, повышения квалификации, культурного досуга и создает ощущение «оторванности» от профессионального сообщества.

- демографический фактор – высокая доля пожилых пациентов в сельской местности определяет специфику работы: преобладание хронической патологии, паллиативных случаев, необходимость длительного сопровождения пациентов. Это требует от СМП особых коммуникативных компетенций и повышенной эмоциональной устойчивости.

- кадровый фактор – дефицит СМП в отдаленных районах области приводит к увеличению нагрузки на действующих работников, совмещению ставок, работе в режиме постоянной интенсивности. В таких условиях традиционные формы мотивации (грамоты, благодарности) теряют эффективность, уступая место потребности в психологической разгрузке и ощущении справедливости.

- миграционный фактор – конкуренция за кадры с соседними регионами и крупными городами вынуждает работодателей Оренбуржья искать не только финансовые, но и нематериальные преимущества для удержания персонала: комфортную рабочую среду, признание, возможность развития.

Анализ существующих практик нематериальной мотивации в регионе

На региональном уровне в Оренбургской области реализуются отдельные инструменты нематериального стимулирования:

- проведение ежегодного конкурса «Лучшая медицинская сестра Оренбуржья» и аналогичных профессиональных соревнований;

- награждение работников к профессиональному празднику (Международный день медицинской сестры, День медицинского работника) грамотами Министерства здравоохранения области и Губернатора;

- освещение достижений СМП в региональных СМИ и на портале Министерства здравоохранения Оренбургской области;

- организация региональных научно-практических конференций с участием среднего медицинского персонала.

Однако анализ показывает, что эти инструменты носят эпизодический и «точечный» характер, охватывая преимущественно наиболее активных и успешных работников. Подавляющее большинство СМП, особенно в сельских районах, остается вне зоны системной нематериальной мотивации.

Типология нематериальных стимулов с учетом региональной специфики. На основе проведенного анализа предложена типология нематериальных инструментов мотивации СМП, адаптированная к условиям Оренбургской области и сгруппированная по трем направлениям:

1. Инструменты профессиональной интеграции и признания:

- Региональная система профессиональных конкурсов с расширенной географией;
- Институт «Регионального наставника». Присвоение опытным СМП статуса наставника с правом методической поддержки молодых специалистов не только в своем учреждении, но и в соседних районах (с использованием дистанционных технологий);
- Банк лучших практик. Создание на региональном портале Минздрава Оренбургской области раздела с описанием успешных кейсов работы СМП, методических разработок, авторских программ – с указанием авторства и возможностью профессионального признания.

2. Инструменты психологической поддержки и профилактики выгорания.

- Дистанционные балинтовские группы. Для работников сельских ЦРБ и ФАПов, лишенных возможности очного участия в психологических разборах, - организация регулярных онлайн – встреч под руководством клинических психологов Оренбургской области;
- Мобильная служба психологической помощи. Выездные бригады психологов в отдаленные районы области для проведения супервизий, тренингов и индивидуальных консультаций СМП;
- Комнаты психологической разгрузки. Обязательное оснащение таких помещений в каждой ЦРБ и крупной поликлинике с учетом региональных стандартов. [3].

3. Инструменты профессионального развития и коммуникации:

- Региональная школа наставничества. Обучение опытных СМП методике передачи знаний и работы с молодыми специалистами на базе Оренбургского государственного медицинского университета и медицинских колледжей региона;
- Профессиональные сообщества в мессенджерах. Создание моделируемых региональных чатов СМП по специальностям (терапевтические, хирургические, педиатрические сестры, фельдшеры скорой помощи) для оперативного обмена опытом, консультаций и ощущения профессиональной принадлежности;
- Стажировки в ведущих ЛПУ области. Организация краткосрочных ознакомительных стажировок для СМП из сельских районов в ведущие медицинские учреждения города Оренбурга.

Модель внедрения нематериальной мотивации в муниципальных МО Оренбургской области. Предлагается трехуровневая модель интеграции нематериальных стимулов:

Уровень 1 - Региональный (Министерство здравоохранения Оренбургской области):

- разработка и утверждение методических рекомендаций по нематериальной мотивации СМП для руководителя МО;

- организация региональных конкурсов, стажировок, образовательных мероприятий;

- формирование информационного пространства для признания достижений СМП;

- мониторинг индекса удовлетворенности трудом и уровня выгорания в муниципальных МО;

Уровень 2 – Муниципальный (центральные районные больницы, городские поликлиники):

- разработка локальных положений о нематериальной мотивации с учетом специфики учреждения;

- введение института наставничества с финансовым и статусным стимулированием наставников;

- организация регулярной обратной связи между руководством и персоналом;

- создание эргономичных условий труда и комнат психологической разгрузки.

Уровень 3 – Локальный (отделение, участок, ФАП):

- ежедневные практики признания и благодарности со стороны непосредственного руководителя;

- вовлечение персонала в принятие решений, рабочих групп по улучшению качества;

- формирование атмосферы взаимного уважения и профессиональной солидарности в коллективе.

Практические рекомендации.

1. Министерству здравоохранения Оренбургской области:

- разработать и утвердить региональную программу нематериальной мотивации СМП на 2026-2030 годы в рамках реализации региональной программы модернизации первичного звена здравоохранения;

- организовать ежегодный форум «Сестринское дело Оренбуржья» с секциями для обмена лучшими практиками.

2. Руководителям муниципальных медицинских организаций:

- провести диагностику мотивационных профилей персонала с использованием валидных методик и разработать индивидуальные планы развития сотрудников;

- внедрить практику ежеквартальных индивидуальных бесед «руководитель-подчиненный» по схеме обратной связи;

- обеспечить прозрачность распределения стимулирующих выплат и вовлечь представителей СМП в работу комиссии по распределению надбавок;

- организовать на рабочем месте каждого СМП доступ к дистанционным формам психологической поддержки и повышения квалификации [4].

Заключение

Нематериальная мотивация среднего медицинского персонала в Оренбургской области требует учета выраженной региональной специфики: территориальной протяженности, высокой доли сельского населения, кадрового дефицита. Традиционные инструменты признания и стимулирования, применяемые эпизодически не способны системно решить задачу удержания кадров и профилактики выгорания. Предложенная в исследовании трехуровневая модель нематериальной мотивации, сочетает региональные программы профессионального признания, дистанционные формы психологической поддержки для сельских работников и локальные практики вовлечения персонала, позволяет сформировать целостную систему стимулирования.

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РАЗВИТИЕ МАТЕРИАЛЬНО-ТЕХНИЧЕСКОГО ОБЕСПЕЧЕНИЯ ВООРУЖЕННЫХ СИЛ РОССИЙСКОЙ ФЕДЕРАЦИИ

Аннотация: В статье рассматриваются основные направления развития материально-технического обеспечения Вооруженных Сил Российской Федерации. Анализируются задачи, функции и значение системы материально-технического обеспечения в современных условиях. Особое внимание уделяется вопросам модернизации логистической инфраструктуры, внедрению современных технологий управления ресурсами, совершенствованию транспортного обеспечения и повышению эффективности снабжения войск. Делается вывод о том, что развитие материально-технического обеспечения является одним из важнейших факторов поддержания высокой боеготовности Вооруженных Сил РФ.

Ключевые слова: материально-техническое обеспечение, Вооруженные Силы РФ, логистика, снабжение войск, военная инфраструктура, транспортное обеспечение, боеготовность.

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DEVELOPMENT OF LOGISTICAL SUPPORT FOR THE ARMED FORCES OF THE RUSSIAN FEDERATION

Annotation: The article discusses the main directions of development of the material and technical support of the Armed Forces of the Russian Federation. The tasks, functions, and significance of the material and technical support system in modern conditions are analyzed. Special attention is paid to the modernization of logistics infrastructure, the introduction of modern resource management technologies, the improvement of transport support, and the increase in the efficiency of supplying troops. It is concluded that the development of material and technical support is one of the most important factors in maintaining the high combat readiness of the Armed Forces of the Russian Federation.

Keywords: material and technical support, Armed Forces of the Russian Federation, logistics, supply of troops, military infrastructure, transport support, combat readiness.

Введение

Материально-техническое обеспечение Вооруженных Сил Российской Федерации представляет собой комплекс мероприятий, направленных на

своевременное и полное удовлетворение потребностей войск в вооружении, военной технике, материальных средствах, горючем, продовольствии, вещевом имуществе и других ресурсах. От эффективности функционирования данной системы напрямую зависит уровень боеготовности армии, способность войск выполнять поставленные задачи как в мирное, так и в военное время.

В современных условиях развитие вооружений и военной техники, повышение мобильности войск, усложнение характера военных конфликтов предъявляют новые требования к организации материально-технического обеспечения. В связи с этим совершенствование данной системы является одной из приоритетных задач военного строительства Российской Федерации.

Сущность и значение материально-технического обеспечения

Материально-техническое обеспечение представляет собой важнейший элемент системы всестороннего обеспечения войск. Его главная цель заключается в создании необходимых условий для успешного выполнения Вооруженными Силами задач по обеспечению обороны государства.

Основными задачами материально-технического обеспечения являются:

- обеспечение войск вооружением и военной техникой;
- снабжение подразделений материальными средствами;
- организация хранения и учета имущества;
- обеспечение горюче-смазочными материалами;
- транспортировка грузов;
- ремонт и восстановление вооружения и техники;
- организация военных перевозок;
- поддержание необходимого уровня запасов материальных средств.

Эффективность выполнения указанных задач оказывает непосредственное влияние на боеспособность войск. Даже самое современное вооружение не сможет использоваться в полной мере без налаженной системы снабжения, ремонта и технического обслуживания.

Особенно возрастает значение материально-технического обеспечения в условиях проведения масштабных военных операций, когда требуется оперативное перемещение значительных объемов материальных ресурсов на большие расстояния.

Основные направления развития материально-технического обеспечения

Современный этап развития Вооруженных Сил Российской Федерации характеризуется масштабной модернизацией системы материально-технического обеспечения. Одним из ключевых направлений является совершенствование логистических процессов.

В последние годы большое внимание уделяется автоматизации управления материальными ресурсами. Использование современных информационных технологий позволяет значительно повысить точность учета имущества, сократить время обработки информации и улучшить контроль за движением материальных средств.

Важное значение имеет создание единого информационного пространства, обеспечивающего взаимодействие между органами военного управления, складами, базами хранения и воинскими частями. Благодаря цифровизации становится возможным оперативное получение данных о наличии запасов, потребностях войск и маршрутах доставки грузов.

Еще одним важным направлением является развитие складской инфраструктуры. Современные склады оснащаются автоматизированными системами хранения, средствами контроля температуры и влажности, системами безопасности и мониторинга. Это позволяет повысить сохранность материальных средств и сократить потери при хранении.

Совершенствование транспортного обеспечения

Транспортное обеспечение занимает особое место в системе материально-технического обеспечения Вооруженных Сил РФ. От эффективности транспортных перевозок зависит своевременность доставки вооружения, боеприпасов, топлива, продовольствия и других ресурсов.

Для решения данной задачи используются различные виды транспорта:

- железнодорожный;
- автомобильный;
- воздушный;
- морской;
- речной.

Особое внимание уделяется повышению мобильности войск и способности быстро перебрасывать силы и средства на большие расстояния. Современные транспортные средства позволяют значительно сократить сроки доставки грузов и повысить оперативность реагирования на возникающие угрозы.

Важным направлением развития является совершенствование системы воинских перевозок, включая развитие транспортной инфраструктуры, модернизацию техники и внедрение современных средств управления транспортными потоками.

Роль ремонта и технического обслуживания вооружения

Неотъемлемой частью материально-технического обеспечения является организация ремонта и технического обслуживания вооружения и военной техники.

Современная техника отличается высокой сложностью, поэтому поддержание ее в исправном состоянии требует применения современных технологий диагностики и ремонта. Для этих целей создаются

специализированные ремонтные подразделения, оснащенные современным оборудованием и средствами контроля технического состояния.

Развитие системы ремонта направлено на:

- сокращение сроков восстановления техники;
- повышение качества ремонтных работ;
- снижение затрат на обслуживание;
- увеличение срока эксплуатации вооружения.

Особое значение приобретает создание мобильных ремонтных комплексов, способных выполнять восстановительные работы непосредственно в районах действий войск.

Перспективы дальнейшего развития

В ближайшие годы развитие материально-технического обеспечения Вооруженных Сил Российской Федерации будет связано с дальнейшим внедрением цифровых технологий, автоматизацией процессов управления и совершенствованием логистической инфраструктуры.

Перспективными направлениями являются:

- внедрение элементов искусственного интеллекта в системы управления запасами;
- использование технологий больших данных для прогнозирования потребностей войск;
- развитие роботизированных складских комплексов;
- совершенствование беспилотных средств доставки грузов;
- повышение эффективности транспортно-логистических операций.

Реализация данных направлений позволит существенно повысить надежность системы снабжения, сократить сроки доставки материальных средств и обеспечить более высокий уровень готовности войск к выполнению поставленных задач.

Заключение

Материально-техническое обеспечение является важнейшей составляющей функционирования Вооруженных Сил Российской Федерации. От уровня его развития зависит способность армии эффективно решать задачи по обеспечению безопасности государства и защите национальных интересов.

Современные тенденции развития материально-технического обеспечения связаны с цифровизацией процессов управления, модернизацией инфраструктуры, совершенствованием транспортного обеспечения и повышением эффективности ремонта вооружения и военной техники. Комплексное развитие данной системы способствует укреплению обороноспособности страны и поддержанию высокого уровня боевой готовности Вооруженных Сил Российской Федерации.

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ФОРМИРОВАНИЕ И РАЗВИТИЕ УПРАВЛЕНЧЕСКИХ КОМАНД В ОРГАНАХ МЕСТНОГО САМОУПРАВЛЕНИЯ РЕСПУБЛИКИ БАШКОРТОСТАН: КОМПЕТЕНЦИАЛЬНЫЙ ПОДХОД И ИНСТИТУЦИОНАЛЬНЫЕ ВЫЗОВЫ

***Аннотация.** В статье рассматриваются институциональные и кадровые условия формирования управленческих команд в органах местного самоуправления Республики Башкортостан. На основе анализа нормативно-правовой базы, практики муниципального управления и экспертных оценок выявляются структурные ограничения, препятствующие переходу от линейно-функциональной модели к командному взаимодействию. Обосновывается необходимость внедрения компетенциальных профилей, кросс-функциональных механизмов ротации и проектных форматов работы на муниципальном уровне. Предложены практические рекомендации по адаптации системы развития кадрового потенциала органов МСУ к задачам стратегического развития территорий.*

***Ключевые слова:** органы местного самоуправления; управленческая команда; муниципальная служба; компетенциальный подход; Республика Башкортостан; развитие кадрового потенциала; проектное управление.*

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FORMATION AND DEVELOPMENT OF MANAGEMENT TEAMS IN LOCAL SELF-GOVERNMENT BODIES OF THE REPUBLIC OF BASHKORTOSTAN: COMPETENCY-BASED APPROACH AND INSTITUTIONAL CHALLENGES

***Abstract.** The article examines institutional and human resource conditions for the formation of management teams in local self-government bodies of the Republic of Bashkortostan. Based on the analysis of legal framework, municipal governance practices and expert assessments, structural constraints hindering the transition from a linear-functional model to team-based interaction are identified.*

The necessity of introducing competency profiles, cross-functional rotation mechanisms and project-based work formats at the municipal level is substantiated. Practical recommendations for adapting the human potential development system of local authorities to the tasks of strategic territorial development are proposed.

Keywords: *local self-government; management team; municipal service; competency approach; Republic of Bashkortostan; human potential development; project management.*

Реформа местного самоуправления в Российской Федерации, реализуемая в рамках Федерального закона от 06.10.2003 № 131-ФЗ и последующих нормативных корректировок, постепенно смещает акцент с административно-распорядительных функций на результат-ориентированное управление территориями. В этих условиях эффективность органов местного самоуправления (далее – МСУ) всё в большей степени определяется не столько индивидуальными характеристиками руководителей, сколько качеством взаимодействия внутри управленческих команд, способностью к кросс-функциональной координации и адаптивности в условиях меняющихся социально-экономических вызовов.

Для Республики Башкортостан, характеризующейся выраженной территориальной дифференциацией, разнородностью муниципальных образований и неравномерным распределением кадрового потенциала, вопрос формирования устойчивых управленческих команд приобретает стратегическое значение. Практика показывает, что многие муниципалитеты сохраняют инерционную модель управления, при которой решения принимаются в условиях функциональной разобщённости, а кадровые назначения опираются преимущественно на стаж и формальные требования, а не на командную совместимость и проектные компетенции.

Целью исследования является выявление институциональных и компетенциальных барьеров в формировании управленческих команд органов МСУ Республики Башкортостан и обоснование механизмов их развития в контексте современных задач муниципального управления. Научная новизна работы заключается в интеграции компетенциального моделирования с анализом региональной специфики муниципальной службы, а также в предложении адаптивных инструментов развития командного взаимодействия, учитывающих ресурсные и нормативные ограничения муниципалитетов.

Проблематика командного управления в публичном секторе представлена в трудах отечественных учёных, исследующих трансформацию моделей муниципальной службы (Оболонский А. В., Атаманчук Г. В., Кибанов А. Я., Одегов Ю. Г.), а также в региональных исследованиях, посвящённых кадровому обеспечению органов власти субъектов РФ. Зарубежный опыт (OECD, World Bank) подчёркивает переход от

иерархического контроля к сетевому взаимодействию и проектной организации труда в местном управлении.

Методологическую основу исследования составили: системный анализ нормативных актов, регулирующих муниципальную службу в Республике Башкортостан; сравнительный анализ практик кадровой работы в муниципальных образованиях разного типа; экспертное моделирование компетенциальных профилей управленческих команд; анализ открытых данных о кадровом составе и текучести в органах МСУ региона. Эмпирическая база включает положения о муниципальных службах, программы развития кадрового потенциала, отчёты о деятельности администраций муниципальных районов и городских округов, а также результаты интервью с заместителями глав администраций и начальниками кадровых служб (выборка из 12 муниципалитетов, 2024–2025 гг.).

Анализ нормативной базы и практики управления в Республике Башкортостан позволяет констатировать ряд системных ограничений, затрудняющих формирование эффективных управленческих команд на муниципальном уровне.

1. Функциональная фрагментация и отсутствие кросс-функциональных связей

В большинстве администраций сохраняется линейно-функциональная структура, при которой отделы работают в режиме «вертикальной отчётности», а горизонтальное взаимодействие инициируется только при возникновении кризисных ситуаций или внешних предписаний. Это приводит к дублированию функций, затягиванию согласований и снижению скорости принятия решений. Командный потенциал не формируется, поскольку сотрудники не вовлекаются в совместную разработку стратегических инициатив.

2. Несоответствие компетенций актуальным задачам муниципального развития

Требования к муниципальной службе, закреплённые в региональных нормативных актах, ориентируются преимущественно на знание нормативно-правовой базы и исполнение процедур. При этом навыки проектного управления, работы с большими данными, фасилитации межведомственного взаимодействия и стратегического планирования не входят в число приоритетных. Экспертные оценки показывают, что менее 30% руководителей среднего звена в органах МСУ региона прошли подготовку в области управления проектами или командной динамики.

3. Ограниченность карьерных лифтов и высокая текучесть кадров

Муниципальная служба в Республике Башкортостан характеризуется низкой мобильностью внутри системы и слабой преемственностью. Кадровый резерв формируется формально, без привязки к реальным управленческим задачам. При этом текучесть среди специалистов с опытом 3–5 лет остаётся высокой, что разрушает сложившиеся неформальные связи и препятствует накоплению командного опыта.

4. Дефицит инфраструктурной поддержки командного взаимодействия

Отсутствуют единые методические стандарты оценки командной эффективности, инструменты ротации между муниципалитетами разного типа, а также платформы для обмена лучшими практиками. Обучение часто носит фрагментарный характер и не интегрировано в реальные рабочие процессы администраций.

Указанные ограничения носят не столько кадровый, сколько институциональный характер: они закреплены в структуре управления, системе мотивации и нормативном регулировании. Без их преодоления переход к командным моделям останется декларативным.

Что же касается, направления развития управленческих команд в органах МСУ Республики Башкортостан, тут следует отметить, что формирование устойчивых управленческих команд требует комплексного подхода, сочетающего нормативные корректировки, инструментальные решения и изменение культуры управления. На основе проведённого анализа предлагается следующий комплекс мер:

1. Внедрение компетенциальных профилей для ролей в управленческой команде

Целесообразно перейти от описания должностных обязанностей к моделированию ролей в команде: «координатор проектов», «аналитик данных», «фасилитатор межведомственного взаимодействия», «лидер изменений». Каждый профиль должен включать не только hard skills, но и поведенческие индикаторы (коммуникация, разрешение конфликтов, адаптивность). Внедрение таких профилей позволит проводить точечную оценку при назначениях и формировать команды по принципу взаимодополняемости, а не только по формальному соответствию должности.

2. Развитие кросс-муниципальной ротации и наставничества

Опыт передовых муниципалитетов показывает, что краткосрочные стажировки и проектные командировки в другие территории способствуют разрушению «ведомственных silos» и формированию общей управленческой картины. Рекомендуются закрепить в программах развития кадрового потенциала механизм обязательной ротации специалистов между городскими округами и муниципальными районами, а также внедрить институт наставничества, при котором опытные руководители сопровождают формирование новых команд в процессе реализации приоритетных проектов.

3. Интеграция проектного управления в систему KPI органов МСУ

Командное взаимодействие активируется при наличии общих измеримых целей. Целесообразно внедрить в муниципалитетах систему проектных офисов с чётким распределением ролей, сроками и бюджетом. При этом оценка эффективности должна смещаться с индивидуальных

показателей на командные результаты: скорость реализации, качество межведомственной координации, удовлетворённость жителей. Это потребует корректировки положений о муниципальной службе и систем премирования.

4. Адаптация программ подготовки в Башкирской академии государственной службы и управления при Главе Республики Башкортостан (далее – БАГСУ)

БАГСУ, как ключевой центр подготовки кадров для органов власти региона, способна выступить драйвером изменений. Рекомендуется перейти от лекционно-семинарского формата к симуляционным и кейсовым модулям, моделирующим реальные управленческие ситуации в муниципалитетах Башкортостана. Особое внимание следует уделить развитию навыков фасилитации, работы в условиях неопределённости и цифрового взаимодействия. Целесообразно внедрить аккредитованные программы повышения квалификации с выдачей сертификатов, учитываемых при формировании кадрового резерва.

5. Создание мониторинговой системы оценки командной зрелости

Для предотвращения формального внедрения командных механизмов необходимо разработать индикаторы командной зрелости: уровень кросс-функционального взаимодействия, частота совместных стратегических сессий, доля проектов, реализуемых межотделными группами, индекс внутренней коммуникации. Мониторинг должен проводиться на ежегодной основе с публикацией аналитических справок для республиканских органов власти.

Реализация предложенных мер не требует радикального пересмотра законодательства, но предполагает методическую унификацию и изменение приоритетов в кадровой политике. Ключевым условием успеха является поддержка со стороны глав муниципальных образований и интеграция командных показателей в систему оценки эффективности деятельности администраций.

Формирование и развитие управленческих команд в органах местного самоуправления Республики Башкортостан представляет собой не кадровую задачу, а институциональный вызов, требующий согласованности нормативного регулирования, системы подготовки и культуры управления. Проведённое исследование показало, что основными барьерами остаются функциональная разобщённость, ориентация на процедурные компетенции, ограниченная мобильность кадров и отсутствие инструментов оценки командного взаимодействия.

Предложенный комплекс мер, включающий компетенциальное моделирование ролей, кросс-муниципальную ротацию, интеграцию проектного управления в систему KPI и адаптацию образовательных программ в БАГСУ, позволяет перейти от фрагментарных кадровых решений к системной политике развития управленческих команд. Практическая ценность работы заключается в её прикладной

направленности: рекомендации могут быть использованы при актуализации программ развития кадрового потенциала органов МСУ, формировании кадрового резерва и проектировании учебных модулей для муниципальных служащих.

Дальнейшие исследования целесообразно направить на эмпирическую проверку предложенных индикаторов командной зрелости в пилотных муниципалитетах, а также на анализ влияния цифровизации управленческих процессов на динамику командного взаимодействия в условиях сельских и городских территорий Республики Башкортостан.

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МЕТОДОЛОГИЧЕСКИЕ ПОДХОДЫ К ОЦЕНКЕ ТУРИСТИКО-РЕКРЕАЦИОННЫХ РЕСУРСОВ ГОРНЫХ РЕГИОНОВ

Аннотация: Статья посвящена систематизации и анализу методологических подходов к оценке туристико-рекреационного потенциала горных территорий. Специфика горных регионов - хрупкость экосистем, сложный рельеф и климатическая нестабильность - предопределяет неэффективность стандартных методов оценки. В работе классифицированы основные группы современных подходов (природно-эстетические, инфраструктурные, экологические) и обоснована необходимость перехода к интегральным моделям оценки. Особое внимание уделено использованию геоинформационных систем (ГИС) и расчету экологической емкости ландшафтов как ключевому фактору устойчивого развития туризма. Результаты исследования могут быть применены при стратегическом планировании и зонировании горных рекреационных кластеров.

Ключевые слова: туристико-рекреационные ресурсы, горные регионы, методологический подход, интегральная оценка, экологическая емкость, ГИС-технологии, устойчивое развитие туризма.

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METHODOLOGICAL APPROACHES TO EVALUATING TOURISTIC AND RECREATIONAL RESOURCES OF MOUNTAINOUS REGIONS

Abstract: The article is dedicated to the systematization and analysis of methodological approaches to assessing the tourism and recreational potential of

mountainous areas. The specific characteristics of mountainous regions-the fragility of ecosystems, complex relief, and climatic instability-predetermine the ineffectiveness of standard assessment methods. The work classifies the main groups of modern approaches (natural-aesthetic, infrastructural, environmental) and substantiates the necessity of transitioning to integrated assessment models. Particular attention is paid to the use of geoinformation systems (GIS) and the calculation of landscape ecological capacity as a key factor in the sustainable development of tourism. The research results can be applied in the strategic planning and zoning of mountain recreational clusters.

Keywords: *tourism and recreational resources, mountainous regions, methodological approach, integrated assessment, environmental capacity, GIS technologies, sustainable tourism development.*

Горная рекреация - это всегда баланс между высокой привлекательностью (эстетика, чистый воздух, лыжи, треккинг) и жесткими ограничениями (лавины, оползни, транспортные тупики, хрупкая экосистема).

Оценка туристско-рекреационных ресурсов горных регионов базируется на комплексном анализе природного, историко-культурного и социально-экономического потенциалов. Она включает определение рекреационной емкости территории и ее устойчивости к антропогенным нагрузкам.

Оценка туристско-рекреационного потенциала - весьма актуальная и в то же время сложная и трудоемкая задача. Она выступает неотъемлемым элементом в процессе стратегического планирования и оптимизации пространственной организации туристско-рекреационных систем, включая региональные. Методические трудности ее реализации зачастую сопряжены с определением интегральных оценок, которым должны предшествовать оценка и учет целого ряда взаимосвязанных и взаимообусловленных критериев на основе природных, социальных, экономических и иных показателей.

Ю.А. Веденин и Н.Н. Мирошниченко [1] одними из первых предложили методику оценки природных условий в аспекте отдыха и туризма. В частности, благоприятность каждого фактора в рамках конкретного выдела оценивали в баллах и в зависимости от суммы этих баллов определяли значение целого природного выдела. Чем выше балл, тем удачнее считался выдел для рекреации. В итоге выделы были разделены на пять категорий: наиболее благоприятные, благоприятные, относительно благоприятные, малоблагоприятные, неблагоприятные для организации крупных рекреационных районов. При этом учитывалась зависимость видов туризма от разных сезонов.

Н.А. Данилов [2] было изучено влияние погодных условий на отдыхающих. В частности, оценивались погодные условия, при которых человек будет чувствовать себя комфортно с учетом влажности, солнечной

радиации и ветра. Им выделены следующие виды погодных условий: 1) комфортные; 2) прохладные субкомфортные; 3) жаркие субкомфортные; 4) дискомфортные. Учитывались погодные условия только для летнего сезона.

На оценку погодных условий обращали внимание также И.Т.Твердохлебов и Н.С.Мироненко [7], отмечая, что «зона комфорта» для многих людей лежит в пределах 17-23 °С. Авторы считают наиболее благоприятными для здоровья человека все классы погоды, когда днем много солнца, подчеркивая при этом специфичность оценки климата горных территорий. Исследователи придают большое значение психолого-эстетическому типу оценки. В частности, они отмечают, что при оценивании природных рекреационных ресурсов существенно важно дать им психологоэстетическую оценку, так как красота в любом ее проявлении облагораживает и воспитывает человека. Территория, обладающая большой эстетической ценностью, при равенстве других свойств, пользуется повышенным спросом у рекреантов.

Например, в горных районах самую высокую оценку должны получить вершины гор, с которых открывается наибольшее количество природных комплексов, а самую низкую - горные ущелья. Е.А. Котляров [5] предлагает создать формы кооперирования рекреаций и сопутствующих отраслей. Одной из таких форм является территориально-рекреационный комплекс (ТРК). Автор считает природные условия важнейшим фактором при оценке территорий для рекреационного использования и указывает на их неоднозначность для разных ТРК. Он вводит понятие коэффициента пригодности (отношение суммы туристских функций региона к сумме туристских функций местности), с помощью которого возможно сравнение разных районов.

А.Н.Тарасов [8] и ряд других советских ученых делают акцент на оценку растительного покрова. Кроме сугубо лесных показателей, например, полнота, возраст и состав, ими изучаются факторы, названные внешними, т.е. наличие эстетической привлекательности, пейзажа, водных объектов, туристских достопримечательностей и элементов ландшафтов горных хребтов, вершин, пещер, историко-культурных памятников. Оценивание проводилось по 20-балльной шкале.

М.Д. Шарыгин, Т.В. Субботина и С.Б. Фоминых предлагают следующую формулу оценки рекреационного потенциала:

$$РП=K_1 K^1+K_2 \Gamma+K_3 Ж+K_4 P+\Theta+П,$$

где РП - рекреационный потенциал; K_1, K_2, K_3, K_4 - вес значимости природных компонентов в общем итоге; K - гидроклиматический потенциал; Γ - геолого-геоморфологические особенности территории; $Ж$ - животный мир, P (растительный мир) - биологический потенциал; Θ - экологическая ситуация в районе; $П$ - привлекательность территории [10].

В Узбекистане Х. Юсупов, Р. Усманова, Ш. Холмуродов, Х.Х.Жумаев, М.Махмудов и другие проводили научные исследования, посвященные комплексной оценке природно-рекреационного потенциала отдельных

районов Узбекистана. Исследователь Х.Жумаев при оценке рекреационного потенциала Кашкадарьинской области учитывал критерии оценки рекреационного потенциала территорий, предложенные Э.О.Ушаковой [9] и использовал их для комплексной оценки природно-климатических ресурсов области с точки зрения рекреации и туризма [3].

Оценка ресурсов в горах принципиально отличается от равнинных территорий из-за фактора высотной поясности, динамичности рельефа и повышенных рисков. Любая авторитетная научная статья на эту тему базируется на трех главных китах (подходах):

1. Медико-климатический и физиологический подход. Исследует, как горный климат и высота влияют на организм человека:

- ключевые показатели: Эквивалентно-эффективная температура (ЭЭТ), уровень ультрафиолетовой радиации, парциальное давление кислорода на разных высотах.
- цель: Определение зон, пригодных для горноклиматического лечения, пешеходного туризма (треккинга) или горнолыжного спорта без риска для здоровья отдыхающих.

2. Ландшафтно-эстетический подход (пейзажный анализ). Горные районы обладают наивысшим баллом аттрактивности (привлекательности), но её необходимо измерить количественно:

- методы: Балльная оценка визуальных доминант (острые пики, водопады, каньоны), расчет индекса разнообразия ландшафта (сочетание «лес – горы – вода»).
- инструменты: Современные статьи практически всегда используют ГИС-технологии (геоинформационные системы) для построения цифровых моделей рельефа и карт видимости бассейна.

3. Геоэкологический подход и емкость ландшафта. Горные экосистемы крайне уязвимы к антропогенной нагрузке. Хрупкий почвенный покров на склонах легко разрушается, провоцируя эрозию:

- главный критерий: Расчет предельно допустимой рекреационной емкости территории - то есть максимального количества туристов, которые могут пройти по маршруту в день без запуска процессов разрушения природы.
- оценка рисков: Анализ селевой, лавинной и оползневой опасности для туристической инфраструктуры.

Обычно авторы статей предлагают интегральный (комплексный) метод, который состоит из последовательных шагов (таблица-1).

Таблица-1.

**интегрированные (комплексные) методы оценки, состоящие
из последовательных этапов**

Этап исследования	Что оценивается / Какой метод применяется
Компонентная оценка	По отдельности анализируются рельеф, гидрография (горные реки, озера), биоклимат, флора и фауна.
Инфраструктурный аудит	Оценка транспортной доступности горных долин, наличия подъемников, связей с крупными городами.
Балльно-индексный метод	Каждому фактору присваивается вес (например, от 1 до 5). Склоны крутизной более 35° получают высокий балл для альпинизма, но низкий - для массового семейного отдыха.
Интегральное зонирование	На основе ГИС-моделирования территория делится на зоны: <i>высокопригодные, ограниченно пригодные</i> (требующие защиты) и <i>непригодные/опасные</i> .

Таблица составлена автором.

Рельеф - важнейший природный рекреационный ресурс, который в сочетании с остальными компонентами формирует эстетичность ландшафта, оценке которой в свою очередь уделяется пристальное внимание исследователей на протяжении последних нескольких столетий [4].

Разработки мастер-планов развития горнолыжных и эко-курортов, проектирования безопасных и интересных экологических троп в национальных парках, обоснования инвестиций в туристический сектор конкретного горного региона.

Если рассматривать эту методологию на примере конкретных горных систем, сухая академическая теория сразу превращается в прикладной инструмент. Специфика гор кардинально меняет приоритеты оценки: то, что критически важно для гори Кавказа, отходит на второй план в Альпах.

Большой Кавказ: Рельеф, бальнеология и лавинная опасность. Для Кавказа (исследования Института географии РАН, экспертов из КБГУ, СОГУ) методология смещается в сторону медико-климатического, рельефного и коммерческого подходов:

- Особый фокус: Кавказ обладает колоссальными перепадами высот и уникальным разнообразием минеральных вод. Статьи по этому региону концентрируются на оценке пригодности склонов для горнолыжного спорта высших категорий (триггеры: крутизна, экспозиция склонов, продолжительность залегания снежного покрова).

- Специфика методологии: Огромный вес в формулах интегральной оценки имеют опасные геоморфологические процессы. Кавказ - тектонически активная, молодая горная система. Балл привлекательности территории здесь всегда корректируется (снижается) на коэффициент лавинной, селевой и оползневой опасности. Также активно оценивается бальнеологический потенциал (курортология).

- **Главный вызов при оценке:** Конфликт между высокой плотностью населения в долинах и необходимостью выделения охраняемых природных зон.

В современных реалиях с учетом возросшей роли геоинформационных технологий в геоэкологических исследованиях, значительный интерес представляет работа Р.К.Махмудова с соавторами [6], в которой проведена оценка туристско-рекреационных ресурсов Северного Кавказа методом геоинформационного картографирования на основе построения математико-картографических моделей.

Европейские Альпы: Инфраструктура и антропогенный предел. В европейских научных публикациях по Альпийскому региону классическая «оценка природных ресурсов» давно уступила место технологическому и маркетинговому (социально-экономическому) подходам:

- ✓ **Особый фокус:** В Альпах практически нет «диких» зон - каждый склон картографирован и включен в экономику. Поэтому оценивается не столько сам ландшафт, сколько качество инфраструктурного каркаса и его интеграция в транспортную сеть Европы.

- ✓ **Специфика методологии:** На первый план выходит оценка климатических рисков в условиях глобального потепления. В современных альпийских моделях рассчитывается критическая высота устойчивого снежного покрова: ученые оценивают, какие курорты (ниже 1500 м) потеряют свой потенциал к 2030–2050 гг. и как их методологически перепрофилировать на летний трекинг и байк-парки.

- ✓ **Главный вызов при оценке:** Сверхвысокая антропогенная нагрузка и управление конфликтами между местными жителями (агросектор) и индустрией туризма.

Тянь-Шань: Высотная поясность и экстремальный туризм. В статьях, посвященных Тянь-Шаню (исследования ученых Казахстана, Кыргызстана, Узбекистана), методология опирается на высотное зонирование и экстремально-спортивную оценку:

- **Особый фокус:** Оценка ресурсов для альпинизма, спортивного горного туризма и парапланеризма. Центральный Тянь-Шань - это гигантские высоты (семитысячники), что требует особого подхода к безопасности.

- **Специфика методологии:** Важнейшую роль играет медико-биологическая оценка зон гипоксии (кислородного голодания). Территория ранжируется по уровням адаптации человеческого организма. В нижних предгорных зонах (прилавках/адырах) оценивается потенциал для кумысолечения, детского отдыха и агротуризма, а в ледниковых зонах - потенциал для экстремальных экспедиций.

- **Главный вызов при оценке:** Сезонность (очень короткое климатическое лето в высокогорье) и необходимость межгосударственного регулирования туристических кластеров.

Тянь-Шань - это колоссальная горная система с высотами до 7439 м (Пик Победы). Здесь главным методологическим подходом в статьях выступает синергия высотной поясности и медицинской географии. Природа здесь проверяет человека на прочность, поэтому оценка ресурсов строится вокруг безопасности и адаптационного потенциала организма.

Методика высотно-ландшафтного зонирования: Для Тянь-Шаня невозможно дать «среднюю» оценку района. Ландшафты и их пригодность для туризма меняются каждые несколько сотен метров вверх. В ГИС-моделировании территория обязательно разбивается на высотные ярусы, для каждого из которых определяется свой тип туризма.

1. Низкогорный ярус (до 1000-1200 м) - «Прилавки» и адыры:

- ресурсный потенциал: максимально благоприятен для круглогодичного отдыха.
- виды туризма: семейный отдых, санаторно-курортное лечение, агротуризм, пешеходные прогулки (терренкуры).
- методика оценки: оценивается густота речной сети, затененность склонов растительностью и продолжительность теплого периода.

2. Среднегорный ярус (1200 - 2500 м) - горно-лесной и луговой пояс:

- ресурсный потенциал: Идеален для активного отдыха. Здесь располагаются хвойные леса (знаменитая ель Шренка) и основные горнолыжные базы (например, Чимбулак в Казахстане или Каракол в Кыргызстане).
- виды туризма: экотуризм, агротуризм, горнолыжный спорт, трекинг, конные маршруты, рафтинг по горным рекам.
- методика оценки: рассчитывается крутизна склонов (для трасс), глубина и плотность снежного покрова, а также ландшафтное разнообразие.

3. Высокогорный ярус (2500 - 3800 м) - субальпийские луга и сырты:

- ресурсный потенциал: ограниченно благоприятный. Растительность сменяется альпийскими подушечниками и высокогорными плато (сыртами).
- виды туризма: альпинизм, экстремальный трекинг, летний горнолыжный отдых на ледниках, джип-туры.
- методика оценки: На первый план выходит оценка опасных природных процессов (моренные озера, сели, оползни) и экспозиция склонов (солнечная радиация).

4. Гляциально-нивальный ярус (выше 3800 м) - зона вечных снегов и ледников:

- ресурсный потенциал: экстремальный (неблагоприятный для массового туриста).
- виды туризма: профессиональный альпинизм, горные восхождения.
- методика оценки: оценка крутизны ледовых и скальных стен, трещиноватости ледников, частоты схода лавин.

Оценка медико-биологической благоприятности: В горах Тянь-Шаня здоровье туриста напрямую зависит от высоты. В научной статье для интегральной оценки ресурсов рассчитывается индекс медико-биологической комфортности. Он состоит из нескольких критических субиндексов:

1. Индекс гипоксической нагрузки (кислородный комфорт). С высотой падает атмосферное давление и парциальное давление кислорода. Ученые рассчитывают высотные рубежи адаптации:

- **До 2000 м:** Зона полной компенсации (организм не испытывает стресса, идеальный климатотерапевтический ресурс).
- **2000-3000 м:** Зона умеренной гипоксии (активизируются скрытые резервы организма, полезна для тренировки спортсменов, но требует осторожности для пожилых людей).
- **3000–4000 м:** Зона выраженной гипоксии (риск развития горной болезни, ресурсы оцениваются только как «экстремально-спортивные»).
- **Выше 4000 м:** Критическая зона (требует жесткой акклиматизации).

В ходе проведенного исследования были всесторонне рассмотрены и систематизированы методологические подходы к оценке туристико-рекреационного потенциала горных территорий. Специфика горных регионов - их высокая ландшафтная мозаичность, уязвимость экосистем и зависимость от климатических факторов - требует гибких, комплексных и междисциплинарных методов анализа.

На основе полученных результатов можно сформулировать следующие ключевые выводы:

- **Необходимость интегрального подхода.** Традиционные раздельные оценки (только экономические или только природно-ресурсные) не отражают реальный потенциал территорий. Наиболее перспективным является внедрение интегрального метода, совмещающего пофакторную оценку (природно-климатическую, эстетическую, инфраструктурную) с анализом социально-экономических условий и экологических ограничений.

- **Роль современных технологий.** Доказана высокая эффективность применения геоинформационных систем (ГИС) и методов дистанционного зондирования Земли. ГИС-моделирование позволяет визуализировать пространственное распределение ресурсов, выделять зоны инвестиционной привлекательности и рассчитывать допустимые антропогенные нагрузки в режиме реального времени.

- **Экологический императив.** В условиях горных экосистем ключевым элементом методологии должен выступать расчет экологической емкости (предельно допустимых нагрузок). Развитие туризма не должно превышать порог устойчивости ландшафтов, что требует внедрения динамических коэффициентов устойчивости в расчетные формулы.

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АНАЛИЗ ТЕХНОЛОГИЙ СБОРА АТМОСФЕРНЫХ ОСАДКОВ И ОЦЕНКА ИХ ЭФФЕКТИВНОСТИ В УСЛОВИЯХ ЗАСУШЛИВОГО КЛИМАТА

***Аннотация.** В статье проведён анализ более 30 научных публикаций, свыше 10 международных отчётов и других источников, посвящённых сбору атмосферных осадков и их эффективному использованию. В ходе исследования были изучены возможности и практическое значение современных технологий, направленных на использование атмосферных осадков в условиях аридного и полупустынного климата.*

Анализ рассмотренных источников показал, что сбор и использование атмосферных осадков рассматриваются как одно из перспективных направлений смягчения дефицита водных ресурсов. Кроме того, были изучены практические результаты применения технологий MAR, Farm Dam, PHS, Check Dam, Run-off Harvesting, RWH, RHS и Green Roof, используемых в Австралии, США, Германии, Франции, Великобритании, Израиле, Индии и Турции.

Результаты исследования свидетельствуют о том, что данные технологии играют важную роль в формировании дополнительных запасов воды для нужд населённых пунктов, животноводства и сельского хозяйства, а также способствуют пополнению запасов подземных и поверхностных водных ресурсов и повышению надёжности водообеспечения.

***Ключевые слова.** Атмосферные осадки, водный дефицит, аридный климат, технологии сбора, использования дождевой воды, MAR, RWH, Farm Dam, Check Dam, Run-off Harvesting, Green Roof.*

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ANALYSIS OF PRECIPITATION COLLECTION TECHNOLOGIES AND ASSESSMENT OF THEIR EFFICIENCY IN ARID CLIMATE CONDITIONS

***Abstract.** This article presents an analysis of more than 30 scientific publications, over 10 international reports, and various other sources devoted to the collection and efficient utilization of atmospheric precipitation. The study*

examined the potential and practical significance of modern technologies aimed at harvesting and using atmospheric precipitation under arid and semi-arid climatic conditions.

The analysis of the reviewed sources showed that rainwater harvesting and utilization are considered among the most promising approaches for mitigating water scarcity. In addition, the practical outcomes of implementing MAR, Farm Dam, PHS, Check Dam, Run-off Harvesting, RWH, RHS, and Green Roof technologies in Australia, the United States, Germany, France, the United Kingdom, Israel, India, and Turkiye were examined.

The results indicate that these technologies play an important role in creating additional water reserves for domestic, livestock, and agricultural needs. Furthermore, they contribute to the replenishment of groundwater and surface water resources and enhance the reliability of water supply systems in water-scarce regions.

Keywords: *atmospheric precipitation, water scarcity, arid climate, rainwater harvesting technologies, rainwater utilization, MAR, RWH, Farm Dam, Check Dam, Run-off Harvesting, Green Roof.*

Введение

Несмотря на то что технологии сбора атмосферных осадков в ряде регионов с засушливым климатом применяются на протяжении многих лет, уровень их внедрения на крупных территориях и степень использования их потенциала как в развивающихся, так и в развитых странах остаются недостаточными.

В последние годы основное внимание уделялось управлению водными ресурсами крупных рек и каналов. Однако рост численности населения, изменение климата и ограниченность водных ресурсов приводят к усилению дефицита воды во многих регионах мира. В связи с этим всё большую актуальность приобретают технологии сбора и эффективного использования атмосферных осадков. В таких условиях использование дождевых и талых вод рассматривается как одно из перспективных решений для обеспечения сельскохозяйственных культур водой в аридных и полуаридных регионах.

В настоящее время рациональное использование водных ресурсов остаётся одной из наиболее актуальных глобальных задач. Из общего объёма воды на Земле, составляющего около 1,4 млрд км³, 97,5 % приходится на солёные воды и лишь 2,5 % – на пресные водные ресурсы. При этом 69,5 % запасов пресной воды сосредоточено в полярных ледниках, 30,1 % – в подземных водах и только 0,4 % – в поверхностных водных источниках [14].

Фотоматериал, отражающий проблему дефицита водных ресурсов, представлен на рисунке 1



Рис.1.Состояние дефицита водных ресурсов на Земле

Исходя из сложившейся ситуации, внедрение технологий сбора атмосферных осадков и их эффективного использования приобретает особую актуальность. В данной работе рассматриваются научные основы использования атмосферных осадков, зарубежный опыт их применения, а также возможности адаптации соответствующих технологий к условиям аридного климата. Основной целью исследования является оценка научно обоснованных технологий, направленных на повышение эффективности использования водных ресурсов и улучшение обеспечения сельского хозяйства водными источниками.

В статье изучены зарубежные научные публикации, отчёты международных организаций и результаты практических исследований, посвящённые сбору и использованию атмосферных осадков. В качестве источников информации использовались материалы ООН, UNESCO, FAO и других международных организаций, а также данные о технологиях MAR, RHS, PHS, Run-off Harvesting и Check Dam, применяемых в Австралии, США, Германии, Франции, Великобритании, Израиле, Индии и Турции.

При подготовке статьи использовались общепринятые методы научного исследования, включая анализ литературы, сравнительный анализ и обобщение полученных данных. Были изучены существующие технологии сбора и использования атмосферных осадков, применяемые в различных странах мира, а также проведена оценка их преимуществ, недостатков и возможностей применения в условиях аридного и полупустынного климата.

Результаты анализа показали, что эффективное использование атмосферных осадков является актуальной задачей не только на национальном, но и на международном уровне. Данное направление также занимает важное место в рамках Целей устойчивого развития (SDGs), принятых Организацией Объединённых Наций.

На международном уровне в рамках Целей устойчивого развития (SDGs — Sustainable Development Goals) особое внимание уделяется подходам, направленным на рациональное и эффективное использование водных ресурсов, а также широкому внедрению инновационных технологий [25]. Программа SDGs была принята Организацией Объединённых Наций в

2015 году и включает 17 глобальных целей, достижение которых предусмотрено к 2030 году. Среди них важное место занимает Цель 6 «Чистая вода и санитария» (SDG 6), ориентированная на обеспечение устойчивого управления водными ресурсами [9]. В рамках данной цели сбор, хранение и эффективное использование атмосферных осадков рассматриваются как одно из важных направлений повышения водной безопасности.

Кроме того, Президент Республики Узбекистан в своём выступлении на восьмой Ассамблее Глобального экологического фонда, состоявшейся в городе Самарканде, уделил особое внимание проблеме дефицита водных ресурсов. В своём докладе он отметил, что опустынивание, деградация земель, таяние ледников и дефицит воды, вызванные изменением климата, становятся одним из основных вызовов для стран Центральной Азии. Согласно анализу Всемирного банка, в настоящее время около 37 млн человек в регионе проживают в районах с высоким уровнем водного дефицита, а к 2050 году этот показатель может увеличиться до 75 млн человек [10].

По данным UNESCO, в 2021 году был проведён анализ 28 демонстрационных проектов MAR, реализованных в 17 странах мира. Результаты показали, что данная технология позволяет эффективно пополнять запасы подземных вод и обеспечивать дополнительными водными ресурсами территории, испытывающие дефицит воды [1,16].

Технология MAR (Managed Aquifer Recharge) представляет собой метод искусственного пополнения запасов подземных вод за счёт инфильтрации атмосферных осадков, паводковых вод и других водных источников в водоносные горизонты посредством специальных инфильтрационных сооружений [8]. В настоящее время данная технология рассматривается как один из эффективных способов поддержания устойчивых запасов подземных вод в аридных и полупустынных регионах, испытывающих дефицит водных ресурсов.

Наряду с технологиями MAR, направленными на пополнение запасов подземных вод, широкое распространение получили системы поверхностного накопления воды, основанные на сборе атмосферных осадков и местного стока.

В частности, в городе Перт (Австралия) очищенные сточные воды используются для пополнения запасов питьевой воды посредством их инфильтрации в подземные водоносные горизонты. Отмечается, что с помощью данной системы ежегодно в подземные водоносные слои направляется около 28 млн м³ воды. Кроме того, в Австралии в рамках системы MAR осуществляется сбор дождевых и дренажных вод с последующей инфильтрацией, что способствует снижению риска наводнений и улучшению водообеспечения [8].

Практика показывает, что сбор атмосферных осадков обеспечивает высокую эффективность при использовании воды для нужд сельского

хозяйства, водоснабжения населения и развития животноводства. Пример данной технологии представлен на рисунке 2.

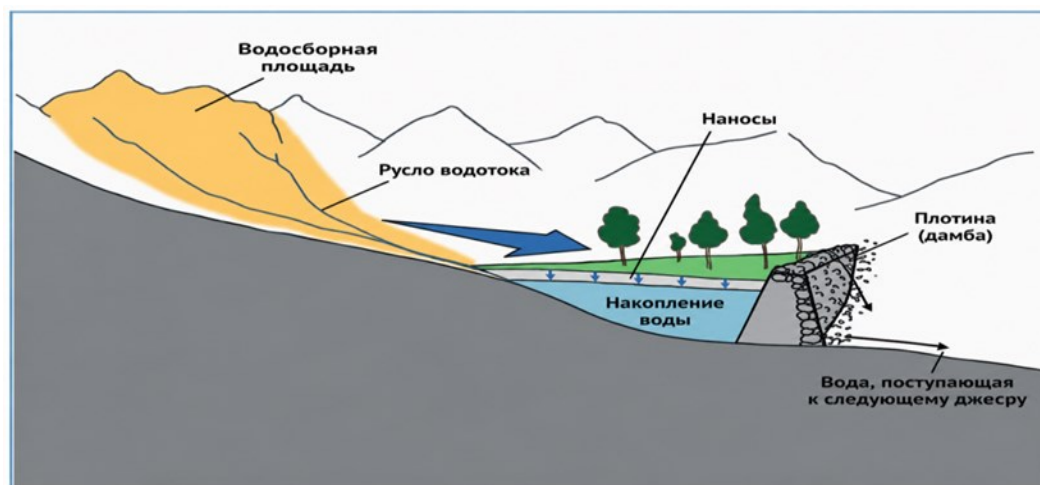


Рис. 2. Технология MAR сбора талых и дождевых вод.

Преимуществом данной технологии является возможность пополнения запасов подземных вод за счёт инфильтрации дождевых, талых и паводковых вод. Это способствует более эффективному использованию водных ресурсов и поддержанию стабильного уровня подземных вод.

Основным недостатком технологии является необходимость строительства специальных инфильтрационных сооружений, включая инфильтрационные скважины и буровые конструкции, что требует привлечения специализированной техники. Вследствие этого возрастают первоначальные капитальные затраты на внедрение системы.

Результаты анализа показали, что технология MAR успешно применяется и в других странах мира. Так, в регионе Негев (Израиль) ежегодно около 135 млн м³ очищенных сточных вод направляется в подземные водоносные горизонты через 110 га инфильтрационных бассейнов с последующим использованием в сельском хозяйстве [23]. В системе Los Arenales региона Кастилия-и-Леон (Испания) ежегодно инфильтрируется около 2,42 млн м³ избыточных сезонных вод для пополнения запасов подземных вод [32]. В районе Атлантик (Южно-Африканская Республика) данная технология применяется с 1980 года и обеспечивает устойчивость водоснабжения при среднегодовом количестве осадков около 445 мм. В префектуре Кумамото (Япония) посредством фильтрации воды через рисовые поля ежегодно пополняется около 14 млн м³ подземных вод, что позволяет покрывать до 13 % городского водопотребления [15].

Следует отметить, что в Австралии в условиях ограниченности водных ресурсов и усиливающегося воздействия изменения климата спрос на пресную воду продолжает расти. По данным исследований, к 2050 году дефицит воды в стране может значительно усилиться [2], поскольку

Австралия относится к числу государств с высокой долей аридных территорий. В связи с этим вопросам эффективного использования атмосферных осадков уделяется особое внимание.

В Австралии использование атмосферных осадков не ограничивается технологиями MAR, направленными на искусственное пополнение подземных вод. Для нужд сельского хозяйства широко применяются также системы поверхностного накопления воды типа Farm Dam.

По имеющимся данным, австралийскими фермерскими хозяйствами создано более одного миллиона небольших водоёмов (Farm Dams), предназначенных для сбора дождевых и местных стоковых вод [2]. Отмечается, что благодаря строительству новых водохранилищ за последнее десятилетие дополнительно накоплено около 180 GL воды. Данный объём эквивалентен примерно 180 млн м³ и превышает треть объёма гавани Сиднея (Port Jackson) [3]. Собранная вода эффективно используется для сельскохозяйственного производства, водопоя скота и других хозяйственных нужд.

Ещё одним эффективным направлением использования атмосферных осадков являются технологии, основанные на перехвате поверхностного стока и его накоплении с помощью специальных гидротехнических сооружений.

В частности, посредством небольших плотин типа «Check Dam» и инфильтрационных сооружений осуществляется сбор муссонных и паводковых вод, пополнение запасов подземных вод, а также обеспечение оросительной водой в засушливые периоды [34]. Наибольшее распространение данные технологии получили в штатах Раджастхан, Махараштра и в бассейне реки Ганг.

Согласно результатам исследований, для ряда сооружений типа «Check Dam» коэффициент экономической эффективности (Benefit-Cost Ratio) превышает 4. Кроме того, установлено, что в отдельных районах, несмотря на годовое количество осадков на уровне 1100–1500 мм, в межмуссонный период сохраняется дефицит воды. В этой связи накопление и рациональное использование дождевых вод в сельском хозяйстве, рыбоводстве и других отраслях рассматривается как важный инструмент повышения водообеспеченности территорий [22].

На рисунке 3 представлены конструкция и принцип работы технологии «Check Dam».

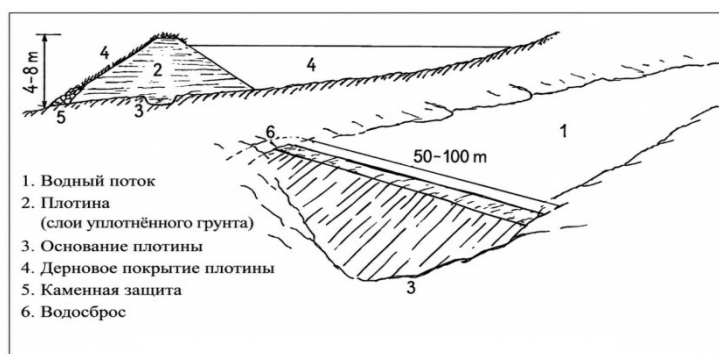


Рис. 3. Технология сбора талых и дождевых вод.

Для технологии Check Dam характерны небольшие размеры гидротехнических сооружений: высота плотины обычно составляет 4–8 м, а длина по гребню 50–100 м. Протяжённость вододерживающего участка определяется рельефом местности и характеристиками водосборной площади.

В аридных и полупустынных регионах для повышения эффективности использования водных ресурсов широко применяются технологии малого водосбора. Особое внимание при этом уделяется восстановлению деградированных земель, расширению площадей зелёных насаждений и обеспечению растений дополнительными водными ресурсами [32].

Ограниченность водных ресурсов в полупустынных районах требует их рационального использования. В связи с этим на практике всё более широкое распространение получают технологии, направленные на сбор и накопление дождевых вод. Одной из таких технологий является создание небольших водоёмов с использованием местных строительных материалов, предназначенных для накопления атмосферных осадков и поверхностного стока. Данный подход известен как технология Run-off Harvesting [31].

Технология Run-off Harvesting преимущественно применяется в предгорных районах и на территориях со значительными уклонами. В таких условиях в результате интенсивных осадков, а также таяния снега и ледников при повышении температуры воздуха формируются поверхностные стоковые воды. Сбор и накопление этих вод позволяет снизить риск развития почвенной эрозии и одновременно создать дополнительные запасы воды для хозяйственных нужд [23].

Пример практического применения технологии Run-off Harvesting представлен на рисунке 4.



Рис.4. Технология сбора поверхностного стока (Run-off Harvesting)

Исследования показывают, что использование воды, накопленной в период выпадения осадков, для нужд сельского хозяйства, животноводства и лесного хозяйства играет важную роль в снижении последствий дефицита воды в засушливые периоды. Анализ, проведённый на Канарских островах, в Израиле и ряде стран Ближнего Востока, подтвердил, что сбор и хранение дождевой воды являются одним из эффективных направлений рационального использования водных ресурсов [24].

Если технологии накопления поверхностных вод преимущественно применяются в сельской местности, то в городах и населённых пунктах широкое распространение получили системы сбора дождевой воды с крыш зданий.

Водные ресурсы всегда являлись одним из важнейших природных богатств. Однако в последние годы в связи с нарастающим дефицитом воды и неравномерностью распределения водных ресурсов по территориям население многих регионов сталкивается как с нехваткой воды, так и с последствиями наводнений [36]. Кроме того, отмечается, что данная ситуация создаёт дополнительные риски для сельского и лесного хозяйства [17].

В Соединённых Штатах Америки системы сбора и хранения дождевой воды эффективно функционируют не только на уровне отдельных домохозяйств, но и на муниципальном уровне. В данном направлении широко внедряются градостроительные решения, управляемые дренажные системы и организационные механизмы, обеспечивающие экологическую устойчивость территорий [27].

Проведённый анализ показывает, что в условиях усиливающихся климатических изменений эффективным решением являются строительство небольших водоёмов с использованием технологии PHS (Pond Harvesting System), а также применение технологии RHS (Roof Harvesting System), предусматривающей сбор дождевой воды с крыш жилых домов и общественных зданий для последующего хозяйственного использования [17,18].

В таких странах, как Германия, Франция и Великобритания, практика сбора атмосферных осадков в специальных резервуарах с последующим использованием для орошения зелёных насаждений получила широкое распространение. Отмечается, что технология RHS способствует также снижению нагрузки на дренажные сети. В ряде случаев населению и предприятиям, внедряющим подобные системы, предоставляются государственные льготы и субсидии [2].

Наряду с этим в странах, где сельское хозяйство играет ключевую роль в экономике, для сбора атмосферных осадков и сезонных паводковых вод широко используются различные гидротехнические сооружения.

Индия является одной из крупнейших аграрных стран мира и занимает второе место после Китая по численности населения, поэтому обеспечение высокой продуктивности сельского хозяйства имеет для страны особое значение [29]. В связи с этим технологии эффективного использования атмосферных осадков и сезонных паводковых вод получили здесь широкое распространение.

В условиях возрастающего дефицита водных ресурсов особое значение приобретает сбор атмосферных осадков и их рациональное использование. Одним из перспективных направлений в данной области является применение технологий Rainwater Harvesting (RWH) [29]. В частности, создание небольших водоёмов в засушливых районах позволяет использовать накопленную воду для формирования зелёных поясов, расширения площадей лесонасаждений, восстановления деградированных земель и решения различных задач сельскохозяйственного производства [32].

Подобный подход рекомендован результатами исследований, проведённых в Израиле, Иордании и других странах Ближнего Востока. Установлено, что для организации систем малого водосбора оптимальным является уклон местности около 7 % [8]. Кроме того, такие технологии позволяют более эффективно использовать атмосферные осадки в аридных и полуаридных условиях, снижать процессы деградации земель и способствовать развитию зелёных территорий [23]. Пример реализации технологии RWH представлен на рисунке 5.



Рис.5 Технологии (Rainwater Harvesting RWH)

В условиях постоянного роста потребности населения в воде проблема дефицита водных ресурсов приобретает всё большую актуальность. Одним из эффективных способов смягчения последствий водного дефицита является сбор и использование дождевых и талых вод. В настоящее время одной из наиболее распространённых технологий в данной области является Rainwater Harvesting (RWH).

Использование данной технологии способствует снижению риска как водного дефицита, так и наводнений в городских и сельских районах за счёт сбора и накопления дождевой воды. Отмечается, что собранная вода может использоваться в сельском хозяйстве, а в городских условиях — для технического водоснабжения жилых, административных и офисных зданий [20].

Кроме того, технология RWH способствует улучшению водообеспечения социально уязвимых групп населения, что создаёт дополнительные возможности для выращивания плодово-овощной продукции и повышения продовольственной безопасности [16].

Ещё одним направлением эффективного использования атмосферных осадков является технология, применяемая на территории Западного берега реки Иордан (West Bank), основанная на сборе и хранении дождевой воды в специальных резервуарах (цистернах). В данном регионе цистерны представляют собой гидротехнические сооружения, предназначенные для длительного хранения атмосферных осадков и предотвращения потерь воды вследствие фильтрации [15].

Согласно изученным материалам, в районе между городами Вифлеем и Хеврон было обследовано 83 цистерны. Результаты показали, что подобные сооружения являются эффективным инструментом улучшения водоснабжения местного населения и снижения негативных последствий дефицита воды. Полученный опыт может быть полезен для аридных и полуаридных регионов, включая страны Центральной Азии [27].

Ещё один важный пример эффективного использования атмосферных осадков связан с практикой, реализованной в Индии. Отмечается, что данные подходы сыграли существенную роль в смягчении проблемы дефицита

воды. В частности, в южной части страны между штатами, расположенными в дельте реки Кавери, возникали разногласия, связанные с распределением водных ресурсов [1]. Одной из причин стало строительство крупных плотин в верхнем течении реки, что привело к сокращению объёмов воды, поступающих в штат Тамилнад, расположенный в нижнем течении.

Опыт Турции также свидетельствует об эффективности технологий использования атмосферных осадков. В стране системы RWH применяются для накопления воды как в наземных, так и в подземных резервуарах. Собранная вода используется для орошения сельскохозяйственных культур, древесных насаждений и зелёных зон в условиях водного дефицита. Кроме того, после соответствующей очистки она может использоваться для хозяйственно-бытовых нужд и даже в качестве источника питьевой воды [33].

В штате Калифорния (США) построены небольшие накопительные бассейны, в которые атмосферные осадки направляются по специальным водоотводящим каналам. Накопленная вода используется для орошения прилегающих сельскохозяйственных угодий. Особое распространение здесь получили такие решения, как «зелёные крыши» (Green Roof), биофильтры и инфильтрационные системы, обеспечивающие эффективное управление дождевыми водами [19].

Технология Green Roof («зелёная крыша») представляет собой специальную строительную систему, предусматривающую размещение растительности на поверхности кровли здания. При этом крыша полностью или частично покрывается растительным слоем, что способствует удержанию атмосферных осадков, снижению поверхностного стока и улучшению микроклимата городской среды [19]. Пример конструкции Green Roof представлен на рисунке 6.



Рис.6. Green roof (Зелёная кровлей.)

Подобные решения способствуют улучшению городской среды, снижению эффекта перегрева и загрязнения воздуха, а также более рациональному использованию водных ресурсов. Отмечается, что широкому распространению данных технологий способствуют меры государственной поддержки, включая финансовые стимулы, налоговые льготы и грантовые программы. В результате проекты, направленные на устойчивое и эффективное использование атмосферных осадков, успешно внедряются на практике. Особого внимания заслуживает тот факт, что собранные дождевые воды используются не только для снижения риска наводнений, но и для орошения деревьев и зелёных насаждений в условиях современного глобального потепления [28].

Анализ рассмотренных технологий показал, что системы MAR, Farm Dam, Check Dam, Run-off Harvesting, RWH и Green Roof основаны на трёх основных элементах: системе сбора воды (Collection System), системе транспортировки воды (Transportation System) и системе хранения воды (Storage System).

Система сбора воды (Collection System) предназначена для приёма и накопления атмосферных осадков. К её основным элементам относятся кровли зданий, площадки с твёрдым покрытием, дороги, дворовые территории, а также естественные поверхности водосбора [26].

Система транспортировки воды (Transportation System) обеспечивает подачу собранной дождевой воды от водосборной площади к объектам хранения. Как правило, она включает желоба и трубопроводы, изготовленные из оцинкованной стали, поливинилхлорида (PVC), пластика, алюминия или стекловолокна [14].

Система хранения воды (Storage System) представляет собой резервуары или подземные накопительные сооружения, предназначенные для хранения собранной дождевой воды. Их объём определяется потребностью в воде, количеством атмосферных осадков и площадью водосбора. Бетонные резервуары отличаются высокой прочностью и длительным сроком эксплуатации [28].

Сравнительный анализ технологий использования атмосферных осадков: преимущества, недостатки и возможности применения в условиях аридного климата (таблица 1).

Технология	Преимущества	Недостатки	Область применения
MAR (Managed Aquifer Recharge)	Пополняет запасы подземных вод	Требуется благоприятных геологических условий	Засушливые и полузасушливые регионы
Farm Dam	Позволяет накапливать большие объёмы воды	Требуется значительных земельных площадей	Фермерские хозяйства и сельскохозяйственные угодья
Check Dam	Снижает эрозию почвы и способствует пополнению подземных вод	Требуется регулярного обслуживания и очистки	Предгорные и горные территории
Run-off Harvesting	Простая и относительно недорогая технология	Зависит от количества осадков и поверхностного стока	Склоновые и холмистые территории
RWH/RHS (Rainwater Harvesting / Green Roof)	Эффективна в городских условиях, снижает нагрузку на дренажные системы	Ограниченный объём собираемой воды	Жилые, общественные и производственные здания
Цистерны для сбора дождевой воды	Обеспечивают длительное хранение воды	Высокие затраты на строительство и обслуживание	Аридные и полуаридные регионы

Результаты проведённого анализа показали, что технология MAR является одной из наиболее эффективных технологий пополнения запасов подземных вод. Установлено, что технологии Farm Dam и PHS позволяют аккумулировать значительные объёмы воды, тогда как технологии Run-off Harvesting и Check Dam играют важную роль в снижении почвенной эрозии на предгорных и склоновых территориях, а также в формировании дополнительных водных ресурсов.

Анализ показал, что технология RWH обеспечивает возможность сбора, хранения и дальнейшего использования атмосферных осадков для различных целей, а также является эффективным инструментом управления избыточными дождевыми водами в населённых пунктах. В свою очередь, технологии RHS и Green Roof способствуют рациональному использованию дождевой воды в городских условиях, снижению нагрузки на дренажные сети и улучшению городского микроклимата.

Заключение

В данной статье проведён анализ технологий эффективного использования снеговых, дождевых и паводковых вод. Результаты исследования показали, что в условиях аридного и полуаридного климата

сбор атмосферных осадков и их рациональное использование имеют важное значение для снижения дефицита водных ресурсов.

Изученный зарубежный опыт свидетельствует о высокой эффективности технологий MAR, Farm Dam, Check Dam, Run-off Harvesting, RWH, RHS и Green Roof в повышении эффективности использования водных ресурсов. В частности, технология Run-off Harvesting позволяет создавать небольшие водоёмы для накопления поверхностного стока, формирующегося за счёт атмосферных осадков в предгорных районах и на территориях со значительными уклонами. Это способствует созданию дополнительных запасов воды и снижению процессов почвенной эрозии.

Результаты исследования также показали, что применение данных технологий в аридных и полуаридных регионах Центральной Азии может способствовать повышению эффективности использования водных ресурсов. Кроме того, они позволяют формировать дополнительные запасы поверхностных и подземных вод, обеспечивать водой сельскохозяйственные культуры и животноводство, а также снижать дефицит воды в населённых пунктах с ограниченным водоснабжением.

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ТЕОРЕТИКО-МЕТОДОЛОГИЧЕСКИЕ ОСНОВЫ ФОРМИРОВАНИЯ НАВЫКОВ ИННОВАЦИОННОГО МЫШЛЕНИЯ ДЕТЕЙ

***Аннотация:** В статье рассмотрены некоторые вопросы о внедрении инноваций в систему дошкольного образования, а также об эффективности формирования навыков инновационного мышления у детей дошкольного возраста на основе креативного подхода.*

***Ключевые слова:** инновационное мышление, креативный подход, педагогические условия, всестороннее развитие, интеллектуальные способности.*

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INNOVATIVE THINKING IN PRESCHOOL CHILDREN BASED ON A CREATIVE APPROACH

***Abstract:** The article examines some issues regarding the introduction of innovations into the preschool education system, as well as the effectiveness of developing innovative thinking skills in preschool children based on a creative approach.*

***Key words:** innovative thinking, creative approach, pedagogical conditions, comprehensive development, intellectual abilities.*

В настоящее время важное значение приобретает эффективное использование дошкольными образовательными организациями передовых методов и технологий формирования навыка инновационного мышления у детей на основе креативного подхода, поиск эффективных путей внедрения инновационных и информационных технологий в учебно-воспитательную деятельность.

Вместе с тем в формировании навыка инновационного мышления у детей на основе использования креативного подхода своеобразное значение имеет развитие стремления воспитанников к изучению новых сведений, функциональных возможностей инновационного мышления, способности к инновационному и самостоятельному мышлению, повышение инновационной активности, поддержка творческого развития детей на основе ориентирования к креативной деятельности, воспитание эмоционально-эстетической, то есть чувственной проницательности, повышение их интереса к интеллектуальному познанию, формирование

умственных навыков, эрудированности, сознательного подхода к решению проблем.

В процессе осуществления образовательной и воспитательной деятельности у детей посредством их знакомства с миром предметов и явлений формируются речь, навыки общения, инновационного мышления на основе креативного подхода, нравственность и эстетические чувства. Развитие у детей инновационного мышления, обучения их творчеству, находчивости, привлечения их к определенной деятельности, успешного выполнения детьми инновационных упражнений посредством дидактических игр требует от воспитателя большой подготовки. Мышление, инновационное мышление детей дошкольного возраста формируется у них в основном при осуществлении ими различных видов деятельности (образовательная деятельность, игра, труд, самостоятельная работа).

“Креативность” (творчество) в педагогике интерпретируется в качестве способности к созданию чего-либо нового, неповторимого, мышления, умственного процесса, приводящего к идее и решению.

В ходе исследования определены содержание, педагогические условия формирования навыков инновационного мышления у детей на основе креативного подхода и разработано следующее авторское определение: “Инновационное мышление на основе креативного подхода в качестве продукта познавательной деятельности, требуемой для разработки ребенком в процессе творческой деятельности нового решения понятий и представлений, представляет собой уровень нестандартного мышления для полноценного осуществления этапов умственного процесса”.

Мышление как социально-интеллектуальный процесс является видом деятельности, при котором ребенок имеет собственные стремления, взгляды, цели и подходы. С помощью мышления проявляются осознанные или неосознанные аспекты предметов и явлений, отраженных в человеческом мозге или психике. Мышление возникает в результате различных исследований и подходов. Мышление является необходимой частью воздействия на другого человека в процессе общения, основным средством познания друг друга.

К особенностям инновационного мышления относятся следующие (см. рисунок 1).

Рис. 1. Особенности инновационного мышления

Раннее развитие инновационного мышления приносит ребенку ряд положительных результатов:

- формируется способность к самостоятельному принятию решения;
- повышается уровень общения и социальной адаптации;
- возникает привычка поиска оригинального решения в проблемных ситуациях;
- закрепляются знания, приобретенные с помощью игр, конструирования и опыта;

- творческое мышление создает важную когнитивную базу для обучения в школе в будущем.

В ходе исследования было установлено, что формирование инновационного мышления у ребенка эффективно протекает только при одновременном выполнении трех основных психологических условий. Первое – активизация любознательности и творческой инициативности, то есть состояние внутренней мотивационной готовности ребенка. Второе – практическое развитие креативного мышления, то есть способность воспитанника, опираясь на воображение, находить альтернативные решения в различных ситуациях и проявлять творческий подход. Третье – согласованность эмоционально-двигательных и мотивационных потребностей, то есть проявление внутренних эмоциональных переживаний ребенка, сформированных в процессе деятельности, в качестве фактора, определяющего его последующие действия.

Формирование инновационного мышления у детей дошкольного возраста основывается на когнитивной синергии дивергентного, креативного и интегративного видов мышления. Дивергентное мышление обеспечивает генерацию идей, креативное мышление определяет их оригинальность, а интегративное мышление объединяет данные идеи в систему знаний и направляет их на практическое применение. В связи с этим указанные виды мышления проявляются как взаимосвязанные и функционально зависимые когнитивные механизмы.

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ВИРТУАЛЬНЫЕ ОНЛАЙН-ЭКСКУРСИИ ПРИ ОБУЧЕНИИ ГЕОГРАФИИ УЗБЕКИСТАНА: ЭФФЕКТИВНОСТЬ И МЕТОДИЧЕСКИЕ ПОДХОДЫ

***Аннотация:** В статье анализируется эффективность использования виртуальных онлайн-экскурсий в преподавании географии Узбекистана на уровне среднего общего образования. На основе педагогического эксперимента (выборка: 224 учащихся 8–9 классов из 8 школ Ташкента и Ташкентской области) определены возможности и ограничения применения технологий виртуальной реальности и 360-градусных видеоматериалов в географическом образовании. Результаты исследования показывают, что использование виртуальных экскурсий повышает уровень сформированности географических представлений на 46%, развивает пространственное мышление на 52%, увеличивает мотивацию к изучению географии на 58%, при этом способствует экономии бюджетных средств на организацию реальных экскурсий (в среднем на 68%). Однако эффективность виртуальных экскурсий зависит от качества их методического сопровождения, технического оснащения образовательного учреждения и уровня подготовки учителей к работе с новыми технологиями. В работе предложены практические рекомендации по разработке и внедрению виртуальных экскурсий в учебный процесс школ Узбекистана.*

***Ключевые слова:** виртуальная реальность, онлайн-экскурсия, географическое образование, пространственное мышление, дистанционное обучение, методика преподавания географии, технологии в образовании.*

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VIRTUAL ONLINE EXCURSIONS IN TEACHING UZBEKISTAN GEOGRAPHY: EFFECTIVENESS AND METHODOLOGICAL APPROACHES

Abstract: *This article analyses the effectiveness of using virtual online tours in the teaching of Uzbekistan's geography at secondary general education level. Based on a pedagogical experiment (sample: 224 pupils in Years 8–9 from 8 schools in Tashkent and the Tashkent Region), the possibilities and limitations of using virtual reality technologies and 360-degree video materials in geography education have been identified. The results of the study show that the use of virtual excursions increases the level of geographical understanding by 46 per cent, develops spatial thinking by 52 per cent, and boosts motivation to study geography by 58 per cent, whilst also helping to save budgetary funds on organising real-life excursions (by an average of 68 per cent). However, the effectiveness of virtual excursions depends on the quality of their methodological support, the technical facilities available at the educational institution, and the level of teachers' training in working with new technologies. The paper offers practical recommendations for the development and implementation of virtual excursions in the teaching process at schools in Uzbekistan.*

Keywords: *virtual reality, online excursion, geography education, spatial thinking, distance learning, geography teaching methodology, technology in education.*

ВВЕДЕНИЕ

Развитие информационно-коммуникационных технологий в XXI веке создало новые возможности для совершенствования методов преподавания школьных дисциплин, включая географию. Традиционные экскурсии, которые являются важным компонентом географического образования, требуют значительных материальных и временных затрат. По данным Министерства народного образования Республики Узбекистан (2024 г.), средняя стоимость организации одной полудневной экскурсии для класса составляет 850–1200 тысяч сўмов, при этом возникают сложности с безопасностью, координацией расписания и географической доступностью объектов [1].

Виртуальные онлайн-экскурсии, основанные на технологиях 360-градусного видео и виртуальной реальности, предлагают альтернативное решение, позволяющее учащимся изучать географические объекты, расположенные в различных частях мира, не покидая учебного класса. Согласно исследованиям, проведённым UNESCO, использование технологий виртуальной реальности в образовании повышает уровень усвоения материала на 25–50% и способствует развитию пространственного мышления учащихся [2].

В Узбекистане разработка и внедрение виртуальных экскурсий в преподавание географии является актуальной задачей, особенно учитывая географические особенности страны (протяженная территория, разнообразие природных ландшафтов) и необходимость повышения качества образования в соответствии с международными стандартами.

Целью исследования является определение эффективности виртуальных онлайн-экскурсий при обучении географии Узбекистана и разработка методических рекомендаций по их внедрению в учебный процесс.

МАТЕРИАЛЫ И МЕТОДЫ ИССЛЕДОВАНИЯ

В исследовании участвовали 224 учащихся 8–9 классов (возраст 13–15 лет) из 8 общеобразовательных школ Ташкента и Ташкентской области в 2023–2024 учебном году. Учащиеся были разделены на две группы: экспериментальную (112 учащихся, использовавшую виртуальные экскурсии в сочетании с традиционными методами) и контрольную (112 учащихся, обучавшихся традиционным способом). Обе группы изучали идентичный географический материал (география Узбекистана, включая физическую и экономическую географию).

Методы исследования включали: (1) разработку и апробацию набора виртуальных экскурсий по ключевым географическим объектам Узбекистана (Тянь-Шань, Аралсай, дельта Амударьи, исторические города); (2) педагогическое наблюдение и анализ видеозаписей уроков; (3) тестирование учащихся для оценки сформированности географических представлений (до и после эксперимента); (4) опрос учащихся об уровне мотивации и восприятии виртуальных экскурсий; (5) анкетирование учителей о практических возможностях и ограничениях.

РЕЗУЛЬТАТЫ

1. Разработанный комплекс виртуальных экскурсий включал 12 основных маршрутов: (1) Амударья от истока до дельты; (2) высокогорные природные системы Узбекистана; (3) города Великого шёлкового пути (Самарканд, Бухара, Хива); (4) Аральский кризис и его географические последствия; (5) земельные ресурсы и сельское хозяйство; (6) индустриальные центры; (7) древние торговые маршруты; (8) национальные парки и заповедники; (9–12) региональные географические особенности различных областей Узбекистана.

2. Результаты педагогического эксперимента. Применение виртуальных экскурсий в экспериментальной группе привело к следующим результатам:

— Сформированность географических представлений: экспериментальная группа показала улучшение на 46% (средний балл тестирования увеличился с 54% до 79%), контрольная группа — на 14% (с 55% до 63%). Различия статистически значимы ($p < 0,001$).

— Развитие пространственного мышления: в экспериментальной группе уровень пространственного мышления повысился на 52% (с 48 до 73 баллов по специальной шкале), в контрольной — на 16% (с 49 до 57 баллов).

— Мотивация к изучению географии: 58% учащихся экспериментальной группы указали, что виртуальные экскурсии повысили их интерес к географии и желание больше узнавать о своей стране (в контрольной группе такой эффект не наблюдался).

— Экономия финансовых ресурсов: использование виртуальных экскурсий позволило сэкономить в среднем 68% бюджета, выделяемого на организацию реальных экскурсий (экономия составила 580–815 тысяч сўмов на одну школу в течение учебного года).

3. Факторы, влияющие на эффективность виртуальных экскурсий: анкетирование 8 учителей географии выявило, что эффективность зависит от: (1) качества методического материала, сопровождающего экскурсию (60% учителей отметили этот фактор); (2) технического оснащения школы (интерактивные доски, быстрый интернет) — 75% учителей; (3) уровня компетентности учителя в работе с технологией — 55%; (4) интеграции виртуальной экскурсии с другими методами обучения — 70%.

ЗАКЛЮЧЕНИЕ

1. Виртуальные онлайн-экскурсии показали высокую эффективность при обучении географии Узбекистана, обеспечивая улучшение результатов на 46% по географическим представлениям и 52% по развитию пространственного мышления.

2. Использование виртуальных экскурсий значительно снижает финансовые и организационные затраты на проведение экскурсий (экономия 68%) при сохранении образовательной эффективности.

3. Успешное внедрение требует надлежащего методического сопровождения, технического оснащения и профессиональной подготовки педагогов.

Рекомендации: (1) разработать методический пакет виртуальных экскурсий для всех регионов Узбекистана; (2) обучить учителей географии техническим и методическим аспектам работы с виртуальными экскурсиями; (3) обеспечить школы необходимым техническим оборудованием; (4) интегрировать виртуальные экскурсии в государственные программы обучения географии; (5) разработать критерии оценки качества виртуальных экскурсий.

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ОЦЕНКА ГЕОГРАФИЧЕСКИХ ЗНАНИЙ И КОМПЕТЕНТНОСТЕЙ УЧАЩИХСЯ: РАЗРАБОТКА И АПРОБАЦИЯ СИСТЕМЫ КРИТЕРИЕВ

***Аннотация:** В статье представлена разработанная система критериев для оценки географических знаний и компетентностей учащихся 8–11 классов общеобразовательных школ Узбекистана. На основе анализа существующих подходов к оценке географических знаний и требований государственного образовательного стандарта определены четыре уровня компетентности: репродуктивный (воспроизведение фактов), аналитический (анализ географических явлений), синтетический (интеграция знаний и объяснение связей) и креативный (применение знаний в новых ситуациях). Эмпирическое исследование (n=348 учащихся, 12 школ Ташкента) показало, что только 18% учащихся достигли синтетического уровня и выше, 34% остаются на репродуктивном уровне. Разработанная система критериев включает 12 показателей, оценивающих как знания фактов, так и развитие компетентностей: географическое мышление (37 баллов), пространственное мышление (28 баллов), работа с картами и геоинформацией (25 баллов). Внедрение предложенной системы оценки повышает справедливость и объективность оценивания на 43% (по мнению учителей) и способствует улучшению качества географического образования.*

***Ключевые слова:** географические знания, компетентности, оценивание, критерии оценки, качество образования, школьная география, формирующее оценивание.*

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ASSESSMENT OF PUPILS' GEOGRAPHICAL KNOWLEDGE AND COMPETENCES: DEVELOPMENT AND TRIAL OF A SYSTEM OF CRITERIA

***Abstract:** This article presents a system of criteria developed to assess the geographical knowledge and competences of pupils in Years 8–11 at general*

education schools in Uzbekistan. Based on an analysis of existing approaches to assessing geographical knowledge and the requirements of the national educational standard, four levels of competence have been identified: reproductive (reciting facts), analytical (analysing geographical phenomena), synthetic (integrating knowledge and explaining relationships) and creative (applying knowledge in new situations). An empirical study (n=348 pupils, 12 schools in Tashkent) showed that only 18% of pupils had reached the synthetic level or higher, whilst 34% remained at the reproductive level. The developed system of criteria comprises 12 indicators that assess both factual knowledge and the development of competences: geographical thinking (37 marks), spatial thinking (28 marks), and working with maps and geoinformation (25 marks). The implementation of the proposed assessment system increases the fairness and objectivity of assessment by 43% (according to teachers) and contributes to improving the quality of geography education.

Keywords: *geographical knowledge, competences, assessment, assessment criteria, quality of education, school geography, formative assessment.*

ВВЕДЕНИЕ

Оценивание является одним из ключевых компонентов образовательного процесса. Однако в практике преподавания географии в школах Узбекистана часто наблюдается недостаточная объективность и дифференцированность оценивания знаний и умений учащихся. Традиционная система оценивания часто ограничивается проверкой фактических знаний (знание названий, определений, дат), в то время как развитие компетентностей, необходимых в современном обществе, остаётся в тени [1].

Согласно Государственному образовательному стандарту среднего общего образования Республики Узбекистан (утверждён в 2023 году), основной целью преподавания географии является развитие геопространственного, критического и системного мышления учащихся, формирование понимания сложных взаимосвязей между природными и социально-экономическими явлениями [2]. Однако отсутствие чётких, стандартизированных критериев оценки затрудняет объективное определение уровня достижения этих целей.

Исследование, проведённое Центром мониторинга и оценки качества образования при Министерстве народного образования (2024 г.), выявило, что 62% учителей географии испытывают затруднения при оценивании компетентностей учащихся и полагаются в основном на традиционные методы (письменные тесты и контрольные работы) [3].

Цель исследования — разработать и апробировать систему критериев для комплексной оценки географических знаний и компетентностей учащихся, соответствующую требованиям современного образования и стандартам.

МАТЕРИАЛЫ И МЕТОДЫ ИССЛЕДОВАНИЯ

В исследовании участвовали 348 учащихся 8–11 классов из 12 общеобразовательных школ Ташкента в 2023–2024 учебном году. Учащиеся прошли комплексное оценивание с использованием разработанной системы критериев. Дополнительно проведено анкетирование 18 учителей географии с целью выяснить их восприятие новой системы оценивания.

Методы исследования включали: (1) теоретический анализ существующих систем оценивания географических знаний в различных странах; (2) разработку системы критериев на основе таксономии Блума и современных подходов к оценке компетентностей; (3) апробацию системы в реальной образовательной среде; (4) статистический анализ результатов оценивания; (5) анкетирование учителей об эффективности системы; (6) сравнительный анализ традиционной и новой систем оценивания.

РЕЗУЛЬТАТЫ

1. Разработанная система критериев включает четыре иерархических уровня компетентности:

Уровень 1 (репродуктивный): воспроизведение фактической информации (географические названия, определения, основные факты). Пример: учащийся может назвать столицу Узбекистана и перечислить соседние страны.

Уровень 2 (аналитический): анализ и объяснение географических явлений. Пример: учащийся может объяснить, почему климат в различных регионах Узбекистана отличается, анализируя влияние широты, высоты и удаленности от морей.

Уровень 3 (синтетический): интеграция знаний из различных источников и объяснение сложных взаимосвязей. Пример: учащийся может связать географические особенности региона с его экономическим развитием и социальными проблемами.

Уровень 4 (креативный): применение географических знаний для решения новых проблем и создания инновационных решений. Пример: учащийся может предложить стратегию рационального использования водных ресурсов в условиях климатических изменений.

2. Распределение учащихся по уровням компетентности (n=348):

- Репродуктивный уровень: 34% учащихся (119 человек)
- Аналитический уровень: 32% учащихся (111 человек)
- Синтетический уровень: 18% учащихся (63 человека)
- Креативный уровень: 16% учащихся (55 человек)

Данные показывают, что больше трети учащихся остаются на репродуктивном уровне, что указывает на необходимость совершенствования методов преподавания для развития более высоких уровней мышления.

3. Компоненты системы оценивания и их весовые коэффициенты:

— Географическое мышление (37 баллов): способность анализировать причинно-следственные связи, выявлять закономерности, выдвигать гипотезы

— Пространственное мышление (28 баллов): способность работать с картами, читать координаты, представлять трёхмерные структуры рельефа

— Работа с картами и геоинформацией (25 баллов): способность анализировать карты, пользоваться ГИС-технологиями, интерпретировать географическую информацию

— Умение проводить полевые наблюдения и описания (10 баллов): навыки описания ландшафтов, сбора эмпирических данных

4. Результаты апробации: анкетирование 18 учителей географии показало, что 72% учителей считают новую систему более объективной и справедливой по сравнению с традиционным оцениванием. 61% учителей отметили, что система помогает им лучше понять, какие аспекты географических знаний необходимо развивать у учащихся. Однако 44% учителей указали на необходимость дополнительного обучения для корректного применения критериев.

ЗАКЛЮЧЕНИЕ

1. Разработанная четырёхуровневая система критериев обеспечивает комплексную оценку как географических знаний, так и компетентностей учащихся, включающей географическое мышление, пространственное мышление, работу с информацией и полевые навыки.

2. Апробация выявила недостаточный уровень развития высших уровней компетентности (только 34% учащихся достигли синтетического и креативного уровней), что указывает на необходимость совершенствования методов преподавания.

3. Внедрение системы критериев повышает справедливость оценивания (по мнению 72% учителей) и способствует более целенаправленному развитию компетентностей учащихся.

Рекомендации: (1) внедрить разработанную систему критериев в государственные стандарты оценивания по географии; (2) подготовить методические рекомендации и примеры оценочных заданий для учителей; (3) организовать специальное обучение учителей географии по применению критериев (44% учителей нуждаются в этом); (4) проводить регулярный мониторинг эффективности системы; (5) разработать электронный инструмент для автоматизации процесса оценивания.

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ФОРМИРОВАНИЕ И РАЗВИТИЕ ЛЕГКОЙ ПРОМЫШЛЕННОСТИ В НИЖНЕАМУДАРИЙСКОМ ЭКОНОМИЧЕСКОМ РЕГИОНЕ В 1924- 1991 ГОДАХ

Аннотация: В статье анализируются экономические и социально-географические аспекты возникновения и развития легкой промышленности в Нижнеамударьинском экономическом регионе до 1990-х годов, а также ее позднее развитие и отсталость по сравнению с другими регионами Узбекистана.

Ключевые слова: Каракалпакстан, Хорезмский область, экономический район, промышленность, легкая промышленность, комбинат, фабрика, цеха, артели.

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FORMATION AND DEVELOPMENT OF LIGHT INDUSTRY IN THE LOWER AMU DARYA ECONOMIC REGION IN 1924-1991.

Abstract: The article analyzes the economic and socio-geographical aspects of the emergence and development of light industry in the Lower Amudarya economic region until the 1990s, as well as its late development and backwardness in comparison with other regions of Uzbekistan.

Key words: Karakalpakstan, Khorezm region, economic region, industry, light industry, plant, factory, workshops, cooperatives.

Введение

Нижняя Амударья — один из уникальных «эксклавов» Центральной Азии, окруженный пустынями Каракум и Кызылкум, и считается уникальным регионом экономического и социального развития Узбекистана.

Хотя промышленное производство в этом экономическом регионе развивалось практически одновременно с другими регионами, позднее появление железной дороги и отсутствие разведки минеральных ресурсов, которые позволили бы развивать промышленность, обусловили длительный период промышленной отсталости. Основной сектор региональной экономики — переработка сельскохозяйственной продукции — также оставался слабо развитым до 1970-х годов. Первые крупные предприятия легкой промышленности в регионе были построены еще в период существования Советского Союза.

Цель и задачи работы

Общий анализ исторических корней формирования легкой промышленности в Нижнеамударийском экономическом регионе, ее развития и местоположения в бывшем советский период.

Основная часть

До русского завоевания Хорезм не имел промышленного производства. Основой экономики ханства были сельское хозяйство и мелкое ремесло, основанное на феодальных отношениях. Лидерами во внешней торговле были соседние страны: Иран, Россия и Бухарское ханство. До завоевания ханства царской Россией основное место в торговле с ним занимали хлопчатобумажное волокно, пряжа и небольшое количество шелка. В частности, в 1867 году в Россию было экспортировано 73,06 тыс. пудов хлопка, 3,1 тыс. пудов пряжи и 0,3 тыс. фунтов шелка [4].

После русского завоевания правый берег Амударьи был отвоеван у Хорезмского государства, и образован Амударийское отделение, входившее в состав Сырдарьинской области. В Хивинском ханстве и Амударийском отделении (плодородные районы левого берега современной Республики Каракалпакстан), входившем в состав Российской империи, опираясь на инфраструктуру Аральского моря (связанного железной дорогой через Аральский порт) и речной флот, созданный на Амударье, были построены первые промышленные предприятия [5].

Хлопкоочистительный завод, принадлежащий Большой Ярославской мануфактуре, построенный в Ургенче в 1889 году, считается первым промышленным предприятием в Хорезме (в Хивском ханстве). Завод был оборудован 5 хлопкоочистительными джинами, 1 гидравлическим и 1 ручным прессом и обрабатывал 25 тысяч пудов хлопка в год. Машины на предприятии приводились в движение электроэнергией, вырабатываемой паровой машиной на территории предприятия. Оборудование завода было импортировано из Соединенных Штатов. В 1904-1907 годах «Познанский и его компания» ввели в эксплуатацию несколько крупных хлопкоочистительных заводов в городах Ургенч, Мангит, Гурлан, Ханка и Хива [5].

К концу 90-х годов XIX века в Амударьинском отделе насчитывалось 23 фабрично - заводских предприятий, с общим годовым производством товаров на 390 тыс. пудов. К 1907 году в отделе функционировали 135

маслобойных и 84 мукомольных предприятий. Большинство заводов и фабрик принадлежало Российским фирмам «Товарищества Большой Ярославской мануфактуры бумажных изделий» (при Большой Ярославской мануфактуры), «Московского торгово-промышленного товарищества», «Товарищества Шуйской мануфактуры» [6].

К 1914 году число хлопкоочистительных заводов в Хорезме достигло 63. Из них 13 были крупными, остальные – мелкими предприятиями. 5 из них располагались в Ургенче, 2 в Гурлане, 3 в Ташховузе, и по одному в Хиве, Мангите и Ханке. В отрасль также инвестировали местные предприниматели, и пять крупных хлопкоочистительных заводов принадлежали местным предпринимателям. Кроме того, в регионе действовали 4 кожевенных завода, принадлежащих к легкой промышленности. Производственная мощность существующих заводов была невелика. В 90-е годы XIX века на всех заводах ханства обрабатывалось всего 85 тысяч пудов хлопка. Первая электростанция в Хорезме мощностью 40 кВт была построена в Хиве в 1912 году [5].

Регион обладал очень низким промышленным потенциалом, о чем свидетельствует тот факт, что в 1913 году 73 процента хлопкового волокна, 93 процента хлопкового масла и 68 процентов всего промышленного производства Узбекистана были произведены в Ферганской долине [3].

Во время Хорезмской революции и последующей гражданской войны владельцы крупных заводов и фабрик забросили свою собственность, некоторые предприятия были разрушены, а многие прекратили работу из-за нехватки сырья и специалистов.

В 1920 году на территории современного Каракалпакстана в составе Хорезмской Советской Социалистической Республики был создан Казахско-Каракалпакский, в Туркестанской АССР — Амударьский отделении, а после национальной демаркации в 1925 году в составе Казахской ССР была создана Каракалпакская Автономная область (АО). В 1932 году Каракалпакская АО была передана в состав Российской СФСР и переобразована в Каракалпакской АССР, а в 1936 году вошла в состав Узбекской ССР. В том же году Хорезмский округ, входивший в состав Узбекской ССР с 1924 года, получил статус Хорезмской области. Обе административные единицы были объединены в Нижнеамударьевский экономический район, где осуществлялось планирование и размещение производительных сил [5].

После Октябрьского переворота, во время гражданской войны, многие предприятия в Хорезме были закрыты. Из-за нехватки средств, строительных материалов и специалистов новые промышленные предприятия не строились. В 1923 году в Хиве была введена в эксплуатацию гораздо более крупная электростанция. В 1924 году правительству Хорезма было выделено 575 тысяч сумов на восстановление и ремонт хлопкоочистительных и маслобойных заводов. В 1925 году были введены в эксплуатацию хлопкоочистительные заводы в Хиве и Хазараспе. В 1928-

1929 годах был построен новый хлопкоочистительный завод в Ургенче, а в 1932 году — завод по очистке семян люцерны. В общей сложности за этот период в Хорезме было построено и введено в эксплуатацию 24 крупных промышленных предприятия. В результате строительных работ, проведенных в регионе, число промышленных предприятий в 1928 году составляло 12, а к 1940 году их число достигло 50, а объем промышленного производства в 1940 году увеличился в 6,4 раза по сравнению с 1913 годом [5].

На территории Каракалпакстана в 1918 г. действовало 24 мелких хлопкоочистительных цеха (все в Петро-Александровске) и полукустарных предприятий. В 1920 году они были объединены в 1 крупную хлопкоочистительный завод. В 30-е годы 20 века в Турткуле была запущена электростанция, а в Ходжалы – крупный хлопкоочистительный завод.

Промышленное производство в регионе развивалось медленно до 1980-х годов. Строительство железной дороги до Ургенча в 1952 году, поступление природного газа в регион в конце 1950-х годов и ввод в эксплуатацию Тахиаташской ГЭС в 1960 году обеспечили энергетическую безопасность не только Нижнеамударьинского экономического района, но и соседней Ташаузской области Туркменской ССР, а последующая интеграция экономического региона в Среднеазиатскую электроэнергетическую систему создала большие возможности для развития промышленного производства [1]. Ранее экономический регион обеспечивался электроэнергией из автономных (силовые установки и небольшие дизель-генераторы) источников электроэнергии в городах и селах.

В 1947 году в регионе была введена в эксплуатацию первая (первый этап, прядильная фабрика) крупная Нукуская хлопчатобумажная фабрика. Позже (в 1980-х годах) были хлопчатобумажные прядильные фабрики в городах Беруний, Турткуль, Чимбай, Ходжалы и Кегели, производящие пряжу и сырую шерсть. В этот период в городе Хазораспе и селе Багат были основаны филиалы Бухарского хлопчатобумажного комбината [2].

В 1980-х годах в Хорезмской области действовало 10 хлопкоочистительных заводов, а в Каракалпакской АССР — 8. Хотя оба региона производили почти одинаковое количество хлопкового волокна в разное время, Хорезмская область отличалась интенсивностью хлопководства (Таблица 1).

Таблица 1.

**Показатели легкой промышленности в Нижнеамударинском
экономическом районе (1924–1990 гг.).**

	Административные регионы	1924 й.	1940 й.	1960 й.	1970 й.	1980 й.	1990 й.
хлопковое волокно, тысяча тонн	Узбекистан	64,5	534,4	1063,8	1383,8	1745,3	1635,7
	Каракалпакстан	1,3	34,6	76,7	98,5	132,8	113,0
	Хорезм	2,3	36,3	76,7	120,9	133,7	113,2
Хлопчатобумажный ткань, млн. кв. м	Узбекистан	-	107,5	234,7	210,1	215,7	515,4
	Каракалпакстан	-	0	0	0	0	19,7
	Хорезм	-	0,06	0	0	0	0
Шелковый кокон, тонны	Узбекистан		693	856	1172	1711	2522
	Каракалпакстан		0	0	0	0	0
	Хорезм		3	0	0	149	259
Шелковая ткань, млн. кв. м	Узбекистан		4,5	24,1	50,4		
	Каракалпакстан		0	0	0	0	0,05
	Хорезм		0,08	0,02	0	0	0
Чулки, носки, млн, пара	Узбекистан		8,6	17,0	30,14	43,7	113,2
	Каракалпакстан		-	-	-	0	0
	Хорезм		-	-	-	0	0,01
Трикотаж, млн. штук	Узбекистан		2,5	11,7	35,4	50,9	104,8
	Каракалпакстан		-	-	-	0,006	0,81
	Хорезм		-	-	0,0	0,03	0,18
Обувь, млн. пара	Узбекистан		3,8	11,4	18,4	30,4	46,7
	Каракалпакстан		0,03	0,02	0,009	0,02	0,03
	Хорезм		0,016	0,007	0,006	0,02	2,1

Источник: Народное хозяйство Узбекской ССР 1972 г. – Т.: “Узбекистан”, 1973. – 365 с. ; Народное хозяйство Узбекской ССР 1990 г. – Т.: “Ўзбекистон”; 1991. – 366 с.

Периферийное географическое положение района, логистическая и энергетическая отсталость препятствовали развитию промышленного производства. Хотя этот отрасль занял ведущее место в промышленности, легкая промышленность развивалась в основном на уровне производства полуфабрикатов (рис. 1).

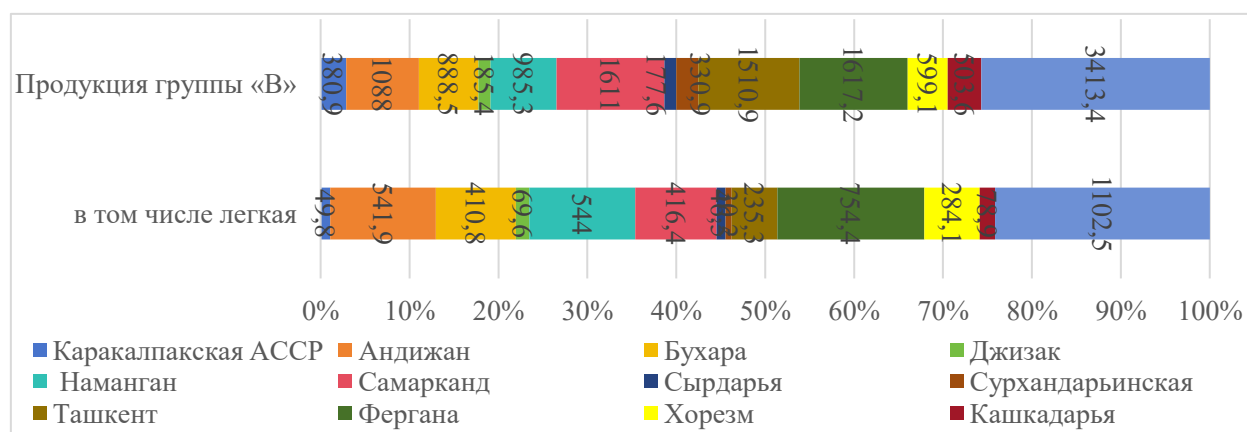


Рисунок 1. Территориальная структура производства потребительских товаров в Узбекистане в 1990 году.

Источник: Народное хозяйство Узбекской ССР 1990 г. - Т.: "Ўзбекистон"; 1991. - 366 с.

Как и в республике, за исключением хлопкоочистительной промышленности, в районе производство легкой промышленной продукции было сосредоточено в центральных городах как Ургенч и Нукус. В Хиве действовала только крупная ковровая фабрика, и в этот период это предприятие считалось одним из двух крупнейших в республике (вторым была фабрика синтетических ковровых изделий на городе Алмалыке).

В городе Ургенч располагались обувная, швейная фабрика и единственная в районе (также обслуживало Тащаузский область Туркменской ССР) шелкопрядильная фабрика, а в городе Нукусе хлопчатобумажный комбинат и фабрика войлочно - ковровых изделий. Мы уже упоминали о территориальной дифференциации структуры 1980-х годах, хлопчатобумажной отрасли района, о создании филиалов крупных хлопчатобумажных комбинатов республики. Эти филиалы в основном производили пряжу и небольшое количество бязовых тканей (табл. 1). Готовые ткани, носочно-чулочные изделия, изделия нижнего и верхнего трикотажа, а также широкий ассортимент одежды, обуви и кожаной галантереи ввозилось из других областей республики и регионов бывшего Советского Союза. В то же время спрос на ряд нестандартных, низкокачественных промышленных товаров удовлетворялся продукцией небольших мастерских и артелей, входивших в состав «Местной промышленности». Такие мастерские и артели существовали в то время во всех колхозах и районных центрах. В них производились ковры, платье, швейные изделия и некоторые войлочные изделия.

Закключение

Анализ показывает, что длительное периферийное положение экономического района в республике, неразвитость электроэнергетической отрасли обеспечили отсталость промышленного производства, в том числе легкой промышленности. Экономический район занимал последние места в республике по производству товаров народного потребления, что, в свою

очередь, создавало трудности в обеспечении населения непродовольственными товарами, включая товары народного потребления легкой промышленности, как это было характерно для всей республики в первые годы независимости.

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ЭТНОЭКОЛОГИК МАДАНИЯТ НАМУНАЛАРИДАН ХУДУДНИ ИЖТИМОЙ ИҚТИСОДИЙ РИВОЖЛАНТИРИШДА ЛАНДШАФТ- ЭКОЛОГИК РЕЖАЛАШТИРИШ ТАМОЙИЛЛАРИНИ ТАСНИФИ

***Annotatsiya:** Mazkur maqolada bugungi kunda, кишилик жамияти билан атроф-муҳит ўртасидаги муносабатларни уйғунлаштириши, унга нисбатан истеъмолчилик ва маданиятсиз муносабатлардан мутлақо воз кечиши ва юксак экологик маданиятни шакллантириши таълим тизими олдига қўйилаётган асосий вазифалардан бирига айланмоқда. Юқоридаги тавсияларни амалга ошириши минтақада барқарор экологик-ландшафт ривожланиши таъминлашнинг дастлабки шарти ҳисобланади. Уни ҳаётга татбиқ этиши эса юксак экологик онг ва маданиятга эга бўлган кишилар томонидангина амалга оширилиши мумкин.*

***Kalit so‘zlar:.** Аҳоли масканлари, сув хужалиги, экологик архитектура, экологик дизайн, экологик каркас, этногеографик минтака, аҳоли зиёратгохлари ва кадамжолари.*

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CLASSIFICATION OF LANDSCAPE-ECOLOGICAL PLANNING PRINCIPLES BASED ON ETHNOECOLOGICAL CULTURAL PRACTICES FOR TERRITORIAL SOCIO-ECONOMIC DEVELOPMENT

***Abstract:** This article describes in detail the concept, essence and structural structure of the system of protected natural areas, the role and importance of protected natural areas in ensuring sustainable development, the criteria and principles for assessing the effectiveness of the system of protected natural areas, the main categories of protected natural areas and a geoecological analysis of the accepted classifications. The system of protected natural areas and the geoecological foundations of its use for tourism purposes are also analyzed.*

***Key words:** protected natural areas, biodiversity, nature conservation, tourism, ecotourism, sustainable development, geoecological basis.*

KIRISH

Бугунги кунда ландшафт режалаштиришнинг биологик хилма-хиллигини сақлаш, экотизимларни бутунлиги ва табиий муҳитнинг саломатлигини таъминлаш, ресурслардан барқарор фойдаланиш, сув, тупроқ, ўсимлик қоплами каби табиий ресурслардан узок муддатга

мўлжалланган истиқболини белгиловчи бошқаришни талаб этмоқда. Шу мақсада ҳудудни халқ хўжалиги тармоқлари бўйича мос ҳолда тақсимлаш бўйича тавсиялар ишлаб чиқишда этноэкологик ёндашувга амал қилиш минтақавий режалаштиришда энг тўғри усул ҳисобланмоқда. Бундай ёндашувнинг энг муҳим жиҳати ҳар бир этноэкологик район учун хос бўлган, маҳаллий аҳолида асрлар давомида шаклланиб, сайқалланиб келган этноэкологик маданият намуналаридан фойдаланиш имконияти яратилади.

Фарғона водийсининг ҳар бир этногеографик минтақаси учун тавсиялар ҳудудий-ландшафт режалаштиришнинг тадқиқотда ўрганиб чиқилган куйидаги 5 та йўналишга мос ҳолда ишлаб чиқилди:

1. Ҳудуднинг халқ хўжалиги тармоқлари орасида муқобил тақсимланишини, қишлоқ хўжалик ерларини ландшафт талабларига мос келувчи ер турларига ажратилишини, экин майдонлари таркибини ҳам ландшафт турига мос ҳолда тақсимланишини таъминлаш бўйича;

2. Сув ресурсларини муҳофаза қилиш, тежаш, сув объектларининг химоя зоналарини ташкил этиш ва сув хўжалигини оқилона бошқариш бўйича;

3. Аҳоли масканларини ҳудудий жойлаштириш ва шаҳарсозлик нормаларида экологик архитектура ва экологик дизайн талабларига амал қилиш;

4. Табиатни муҳофаза қилиш ва муҳофаза қилинадиган табиий ҳудудлар тўрини шакллантириш, экологик каркас яратишда гуманитар-географик билимлардан фойдаланиш бўйича;

5. Экологик туризм ва рекреацияни ривожлантириш, экологик таълим-тарбияда этноэкологик маданият намуналаридан фойдаланиш.

Фарғона водийсида хавзали ёндашув бўйича ландшафт-экологик режасини ишлаб чиқишда ҳудуд этноэкологик маданият нуқтаи-назаридан 4 та этногеографик ландшафт минтақасига бўлинди. Ҳар бир минтақа учун барқарор ривожлантириш ва ландшафтли режалаштиришнинг юқоридаги 5 та банди бўйича алоҳида тавсиялар ишлаб чиқилди.

Биринчи этногеографик минтақа водийдаги дарёлар конуссимон ёйилмаларнинг чекка қисмлари ва конус оралиғи ботиқларини ҳамда Марказий Фарғона чўл ҳудудларини эгаллайди. Маъмурий жиҳатдан бу ҳудудда Фарғона вилоятининг Ёзёвон, Бувайда туманларини ҳамда Қўштепа, Олтиарик, Данғара туманларининг чўл ҳудудларини, Андижон вилоятининг Бўз, Улуғнор туманлари, Наманган вилоятининг Мингбулоқ туманини ўз ичига олади.

Мазкур минтақа бўйича анъанавий этноэкологик маданият намуналаридан фойдаланиб, куйидаги тавсиялар берилади:

А. Минтақа нисбатан янги ўзлаштирилган ҳудуд бўлиб, экологик жиҳатдан энг нозик ҳисобланади. Агроирригацион қатламнинг камлиги, тупроқ қатламининг шўрлашиши, кум барханларининг мавжудлиги, ер ости сувларининг ер бетига яқинлиги асосий экологик муаммолардан ҳисобланади. Шунинг учун, бу минтақада заҳира ва табиатни муҳофаза

қилиш, соғломлаштириш, рекреация мақсадларига мўлжалланган ерлар, тарихий-маданий аҳамиятга молик ерлар, ўрмон фонди ерларини кенгайтириш мақсадга мувофиқ. Бўз, Данғара туманларидаги ўрмон хўжаликлари майдонини кенгайтириш, Қизилтепа (Олтиариқ тумани) ҳудудини рекреация ва соғломлаштириш зонасига айлантириш, Тошкент-Ўш-Эргаштом халқаро автомагистралини экологик талабларга мос ҳолда таъмирлаш ва яшил ҳудуд бунёд этиш, янги ташкил этилган сув омбори ва унга туташ ҳудудларда аҳоли дам олиш зоналарини кенгайтириш тавсия этилади.

Қишлоқ хўжалиги ерлари таркибида кўп йиллик дарахтзорлар (ихота дарахтзорлари) миқдорини кенгайтириш, айниқса, дарахт ва бута ўсимликларидан саксовул, чиннигул, жийда, шўра, туранғи каби майда баргли дарахтлар ва эфемер ўсимликлар майдонини кенгайтириш тавсия этилади.

Экин майдонлари таркибида шўрга чидамли экинлардан оқ жўхори (*Sorghum ceruum*) шоли, полиз экинлариданқовун етиштиришни кенгайтириш мақсадга мувофиқ ҳисобланади.

В. Минтақа водийнинг ер ости сувлари жамланадиган ва ер бетига сизиб чиқадиган ҳудуди бўлганлиги сув ресурсларидан фойдаланишда ниҳоятда эҳтиёткорлик талаб этилади. Сабаби бу ҳудудда ер ости сувларининг тўйиниш даври билан (июнь-август) қишлоқ хўжалик экинларини суғориш бир даврга тўғри келади. Натижада, бу ҳолат кўплаб салбий экологик муаммоларни келтириб чиқармоқда. Бундан ташқари, бу ҳудудда янги қурилган сув хўжалиги объектларидан фойдаланишда экологик талабларга қатъий амал қилиш тавсия қилинади.

С. Аҳоли масканларини ҳудудий жойлаштириш ва шаҳарсозлик нормаларида экологик талабларни бажариш учун бу минтақада тўла имкониятлар мавжуд. Янги ўзлаштирилаётган ҳудудларда ташкил этилаётган аҳоли масканларида дарахтзорлар майдонини кенгайтириш, шамол йўналишига мос равишда ихотазорлар ташкил этиш тавсия этилади. Суғориш тармоқларига ва автомагистралларга яқин жойлашган ҳудудлардаги аҳоли масканларини кенгайтириш мақсадга мувофиқ ҳисобланади.

Д. Минтақада дарё суви етиб бормайдиган лекин булоқ ва чашмалар, зах сувлар ер бетига яқин жойлашган ҳудудларда, ёлғиз дарахтлар атрофида табиатни муҳофаза қилиш мақсадидаги зиёратгоҳлар ва қадамжолар ташкил этиш тавсия этилади. Географик объектларни номлашда мазкур ландшафтнинг экологик муаммоларни келтириб чиқарувчи компонентлар ҳақида дарак берувчи географик терминлардан (шўр, кум, зах) фойдаланиш мақсадга мувофиқ.

Е. Анъанавий ҳудуддан фойдаланиш жараёнида мазкур минтақада туризм ва рекреацияни ривожлантириш бўйича маълумотлар базаси мавжуд эмас. Бироқ, кейинги йилларда «Бувайда қумлари», «Ёзёвон табиат ёдгорлиги» ҳудудларида экотуризм ва рекреацияни ривожлантириш

имкониятлари мавжуд. Келажакда бу соҳани янада ривожлантириш тавсия этилади. Мазкур минтақада этноэкологик йўналишдаги таълим-тарбияни ривожлантиришда анъанавий чўл ландшафтларидан фойдаланиш бўйича тўпланган билим ва кўникмалар билан маҳаллий аҳолини таништириб бориш мақсадга мувофиқ. Бунда мактаблардаги ўлкашунослик тўғараклари имкониятидан кенгроқ фойдаланиш мумкин.

Иккинчи этногеографик минтақа водийдаги дарё ва сойларнинг конуссимон ёйилмасининг марказий қисмини эгалласа-да, бироқ қия текисликлардан иборат. Маъмурий жиҳатдан бу ҳудудда Фарғона вилоятининг Бешариқ, Ўзбекистон, Фурқат, Учкўприк, Боғдод, Риштон, Қўштепа, Тошлоқ туманларини ҳамда Олтиариқ, Кува туманларининг мазкур ландшафт зонасидаги қисмини, Андижон вилоятининг Шаҳрихон, Асака, Андижон, Олтинкўл, Избоскан, Пахтаобод туманларини, Наманган вилоятининг Учкўрғон, Норин, Уйчи, Наманган, Тўрақўрғон туманлари ҳудудини эгаллайди.

Мазкур минтақа бўйича анъанавий этноэкологик маданият намуналаридан фойдаланиб, қуйидаги тавсиялар берилади:

А. Ер тоифаларидан асосан қишлоқ хўжалигига мўлжалланган ерлар, аҳоли манзилгоҳлари ерлари, саноат, транспорт, алоқа, муҳофаа ва бошқа мақсадларга мўлжалланган ерлар катта миқдорни эгаллайди. Бу ҳудуднинг асосий қисмидан интенсив фойдаланилади, бу ўз навбатида ҳудудга тушадиган демографик, техноген, ирригацион, кимёвий, антропоген босим миқдорининг ортиб кетишига сабаб бўлмоқда. Шунинг учун, бу ҳудудларда «экологик сокинлик ҳудудлари»ни - зиёратгоҳ, қадамжо, макбара, мазорлар каби инсонлар ва табиатга ором берувчи масканларни кенгайтириш тавсия этилади. Табиатни муҳофаза қилиш ва соғломлаштириш ва, айниқса, тарихий маданий аҳамиятга молик ерлар майдонини кескин кўпайтириш имкониятлари мавжуд. Шу билан бирга суғориш тармоқлари атрофидаги сув фонди ерлари майдонини ҳам кенгайтириш экологик талабларга мос келади.

Минтақада қишлоқ хўжалик ерлари таркиби ва миқдорини ҳозирги ҳолатда сақлаб қолиш мақсадга мувофиқ ҳисобланади. Бошқа тармоқлар учун ер ажратишда қишлоқ хўжалигида фойдаланиб бўлмайдиган ёки фойдаланиш имконияти камроқ бўлган (рельефи ноқулай) ҳудудлардан ер ажратиш тавсия этилади.

Экин майдонларининг таркибида донли, мойли, толали ва ем-хашак экинлари миқдорини кўпайтириб бориш тавсия этилади. Хусусан, донли экинларнинг камсувталаб, эртапишар навларини (мош, тарик, жавдар, кўноқ, кузги буғдой), мойли экинларни (кунжут, пахта, зиғир, рапс, махсар, кўкнори, кунгабоқар, кано), ем-хашак экинларини (маккажўхори, беда, арпа) кўпроқ экиш тавсия этилади. Деҳқончиликда тупроқ унумдорлигини сақлашга, қаратилган алмашлаб экиш ва ерни ўғитлашдаги этноэкологик маданият намуналаридан фойдаланиш юқори самара беради.

В. Минтақа сув ресурслари билан тўлиқ таъминланган ва суғориш тизими энг ривожланган ҳудуд ҳисобланади. Навбатдаги вазифа, мазкур

техник иншоотларнинг бир маромда ишлашини таъминлаш, суғоришнинг янги инновацион усуллари қўллаш бўйича тавсиялар ишлаб чиқишдир.

С. Минтақада 2024 йил 1 январь ҳолатига кўра, Фарғона водийси аҳолисининг 72,4 фоизи йиғилган. Бундан ташқари аҳолисининг 100 минг кишидан ошган водийдаги 5 та шаҳарнинг (Наманган, Андижон, Фарғона, Қўқон, Марғилон) барчаси мазкур минтақада жойлашган. Бу ўз навбатида мазкур минтақадаги демографик юкнинг меъёрдан ортиб кетишини кўрсатади. Шунинг учун, бу ҳудуд ва шаҳарларда замонавий ландшафт дизайни талабаларига мос келадиган яшил ҳудудлар кенг майдонни эгаллайдиган «боғ-сайилгоҳ» масканларини яратиш тавсия этилади. Бунда этноэкологик маданиятнинг «экологик сокинлик ҳудудлари» ёки шаҳар атрофидаги ота-боболаримиз яратган боғлардан (боғи баланд, боғи беҳишт, боғи шамол...) ёхуд қадамжо ва зиёратгоҳлар тизимидан фойдаланиш тавсия этилади.

Д. Мазкур минтақадаги экологик жиҳатдан ҳавфли объектлар ва аҳоли масканларини қурилишини имкон даражасида чеклаш, экологик функцияни бажарувчи ёки унга кўмаклашувчи халқ хўжалиги тармоқларини кўпроқ жойлаштириш тавсия этилади. Бу ҳудудларда ижтимоий соҳа объектларини ва таълим муассасаларини ривожлантириш орқали экологик таълим тарбияни амалга ошириш имкониятидан тўлароқ фойдаланиш мумкин.

Е. Ушбу ҳудуд бугунги кунда ҳам Фарғона водийсидаги туризм энг ривожланган ҳудудлардан ҳисобланади. Қўқон, Риштон, Марғилон, Шаҳрихон, Чуст ҳудудларидаги мавжуд туристик объектларни кенгайтириш ҳамда Андижон, Наманган, Фарғона шаҳарларининг рекреация ва туризмни ривожлантириш имкониятларидан кенгроқ фойдаланиш мақсадга мувофиқ ҳисобланади. Шунингдек, Қува, Ахсикент каби тарихий-археологик ёдгорликлар мажуд ҳудудларнинг туристик имкониятларидан фойдаланиш зарур.

Учинчи этногеографик минтақа Фарғона водийсидаги дарёлар конуссимон ёйилмасининг юқори қисмларидаги текисликлар адир орти, адир оралиғи ботиқларини эгаллайди.

Маъмурий жиҳатдан бу ҳудудда Фарғона вилоятининг Фарғона тумани, Кувасой шаҳри ҳамда Тошлоқ, Қува туманларининг адирлик ҳудудларини Андижон вилоятининг Марҳамат, Булоқбоши, Ҳўжаобод, Жалолқудуқ, Қўрғонтепа туманларини, Наманган вилоятининг Чортоқ, Янгиқўрғон, Косонсой, Чуст ҳамда Поп туманининг мазкур ландшафт зонасидаги қисмини эгаллайди.

Мазкур минтақа бўйича ландшафт-экологик режалаштириш ишларида анъанавий этноэкологик маданият намуналаридан фойдаланиб, қуйидаги тавсиялар берилади:

А. Ер тоифалари орасида қишлоқ хўжалигига мўлжалланган ерлар миқдорини ҳозирги ҳолатда сақлаб қолиш, аҳоли масканлари ерлари ва сув фонди ерлари миқдорини кенгайтириш тавсия этилади. Сабаби, бу ҳудуднинг биринчи ва иккинчи минтақаларга сув ресурсларини

тақсимлашдаги ўрни ва аҳамияти ҳозирда ҳам сақланиб қолган. Водийдаги гидроузелларнинг асосий қисми ушбу минтақада жойлашган.

Қишлоқ хўжалиги ерларини кўпроқ боғдорчилик ва узумчилик учун ажратиш, суғориладиган экин майдонлари таркибини имкон борича камайтириб бориш мақсадга мувофиқ. Кам сув талаб қиладиган данакли боғларни ва ҳар бир ҳудуд учун мос бўлган экин ва дарахт турларини кўпайтириш тавсия этилади. Масалан, Андижонда нашвоти, Наманганда олма, Қўқонда гилос, Марғилонда узум, Қувада анор, Риштонда ўрик, Қувасойда беҳи, Чустда нок, Булоқбошида бодом, Олтиариқда бодринг ва турп, Боғдодда қозонювғич, Пахтабодда ерөнғоқ, Марҳаматда кунгабоқар, Сўхда сабзи ва картошка ва б. Бундай қадимдан экиб келинган, маҳаллий аҳолини мазкур экинларни парваришlash учун кўникмаси бор, ландшафт талабига мос тушувчи дарахт ва экин турлари майдонларини кенгайтириш мақсадга мувофиқ.

Минтақа учун экологик жиҳатдан хос ва мос бўлган мева дарахтлар турини аниқлашда жой номларидан фойдаланиш усули тавсия этилади. Минтақада ўрик, шафтоли, олма, анжир, анор дарахтларининг анъанавий масканлари географик номларда акс этади, масалан, Ўрикзор (Фарғона, Риштон, Наманган, Косонсой, Чортоқ туманлари), Шафтоли (Уйчи тумани), Шафтолизор, Олма (Наманган тумани), Олмазор (Жалақудуд, Косонсой, Янгиқурғон туманлари), Олма-бел (Чуст тумани шимоли), Анжирзор (Наманган тумани), Анорзор (Қува, Избоскан туманлари) кабилар.

Экин майдонлари таркиби иккинчи минтақадан кўп фарқ қилмайди. Кейинги йилларда бу ҳудудларда ҳам боғдорчилик ва иссиқхона хўжаликларини ривожлантириш тавсия этилади.

В. Минтақа юқорида таъкидланганидек, биринчи, иккинчи этноландшафт минтақалар учун сув тақсимлаш иншоотлари (Қўқон, Сариқўрғон, Водил, Куйганёр ва бошқ.) жойлашган ҳудуддир. Ҳавзали ёндашув бўйича амалга оширилаётган ландшафт-экологик районлаштиришда бу минтақага сув ресурсларини тўғри тақсимлаш ва ундан оқилона фойдаланиш функциясини бажарадиган сув хўжалиги тизимининг муассаларини жойлаштириш мақсадга мувофиқ. Бу ҳудудда қўшимча равишда рекреация ва туризм объектларини жойлаштириш ва ривожлантириш лозим.

С. Минтақадаги аҳоли масканлари энг қадимги ўзлаштирилган ҳудудларда жойлашганлиги, уларнинг кўрғон, қалъа шаклидаги кўринишлари ҳозирги давргача сақланиб келган. Аҳоли масканларини шаклланишига сабаб бўлган ресурслар миқдорининг тугаши ёки камайиши уларнинг кейинги иқтисодий ривожланишига таъсир кўрсатишини эътиборга олиш зарур. Нефть-газ қазиб чиқариш билан боғлиқ бўлган шаҳарчаларнинг деярли барчаси ушбу минтақада жойлашган. Чимён, Миндон, Полвонтош, Андижон, Хўжаобод, Жанубий Оламушук каби шаҳарчаларда аҳолини бошқа соҳаларга ихтисослашувини таъминлаш ва бандлигига эришиш учун тарихдан мавжуд бўлган қишлоқ хўжалиги маҳсулотларини қайта ишлаш ва

сақлаш ҳамда кучли савдогарлик фаолиятини йўлга қўйиш (анъанавий чорбозорчилар) таклиф этилади.

Д. Мазкур минтақадаги аҳоли масканларида табиатни муҳофаза қилиш бўйича амалга ошириладиган ишларни ташкил этишда этноэкологик маданиятнинг таркибий қисми бўлган кадамжолар ва зиёратгоҳларни ҳудудий жойлаштириш усулларида фойдаланиш мумкин.

Е. Бу масканлар ўзининг хушманзара табиати ва серсув, сўлим гўшалари билан қадимда ҳам, ҳозирда ҳам зиёратчиларни ўзига жалб этиб келган. Водил, Аввал, Чимён, Арсиф, Полвонтош, Хўжаобод, Ширмонбулоқ, Булоқбоши, Жанубий Олмамушук, Қорасув, Хонобод, Чортоқ, Косонсой, Янгикўрғон, Чуст каби ҳудудларда туризмни, жумладан, зиёрат ва экологик туризмни ривожлантириш тавсия этилади. Мазкур ҳудудда Фарғона водийсининг дастлабки аҳоли масканлири (Арсиф, Куббо, Эрши, Косон, Чуст) бунёд этилганлигини эътиборга олиб, у ерларда тарихий-археологик туризмни янада ривожлантириш тавсия қилинади. Юқоридаги зиёратгоҳлар орасида халқаро диний туризмни ривожлантириш имконияти мавжуд бўлган Жалақудуд туманида жойлашган

Тўртинчи этногеографик минтақа Олой, Туркистон, Фарғона, Курама, Чотқол тизмалари ва адирлари ҳудудини ўз ичига олиб, маъмурий жиҳатдан Фарғона вилоятининг Сўх тумани ҳамда Фарғона туманининг Ёрдон-Шоҳимардон анклавларини, Наманган вилояти Поп туманининг Чодак-Чоркесар ҳудудларини эгаллайди.

Мазкур минтақа бўйича ландшафт-экологик режалаштириш ишларида анъанавий этноэкологик маданият намуналаридан фойдаланиб, қуйидаги тавсиялар берилади:

А. Минтақанинг дарёлар ҳавзасининг қуйи қисмларидаги ерларни сув билан таъминлашдаги ижтимоий-экологик функциясини эътиборга олиб, ҳудуднинг асосий қисмини ўрмон фонди, сув фонди ҳамда табиатни муҳофаза қилиш ва соғломлаштириш, рекреация мақсадларига мўлжалланган ерлар ажратиш тавсия этилади. Қишлоқ хўжалиги, аҳоли масканлари, саноат, транспорт, алоқа, муҳофаа ва бошқа мақсадларга мўлжалланган ерларни салмоғини камайтириш ёки ҳозирги ҳолатда сақлаб қолиш экологик жиҳатдан муҳимдир.

Қишлоқ хўжалиги ерларининг асосий қисми анъанавий этноэкологик ёндашув бўйича яйловлар ва тоғ боғдорчилигига ажратилганлигини инобатга олиб, бу ерларда зиравор ва доривор ўсимликларни кўпайтириш, ёнғоқ, писта, бодом каби ҳудуд ландшафтига мос бўлган дарахтзорлар бунёд этиш тавсия этилади.

Экин майдонлари таркибида анъанавий равишда етиштириб келинган илдизмевали экинлар (сабзи, картошка, ерёнғоқ) салмоғини кенгайтириш ва боғдорчиликни ривожлантириш мақсадга мувофиқ.

В. Ушбу минтақада Хўжабақирғон, Исфара, Сўх, Шоҳимардон, Исфайрам, Аравон, Оқбўра, Қорадарё, Норин, Подшоотасой, Ғовасой, Чортоқсой, Чодаксой каби Фарғона водийсини сув билан таъминловчи

асосий дарёлар бошланади. Уларнинг тўйиниш ҳавзаларини муҳофаза қилишда диний-ҳукукий усуллардан фойдаланиб, «ўрмон-боғлар», зиёратгоҳлар ва қадамжолар тизимини ривожлантириш тавсия этилади. Шоҳимардонсой ҳавзасидаги каби қадамжоларни ривожлантиришда қўшни давлатлар билан ҳамкорликни йўлга қўйиш кутилган натижани беради.

С. Мазкур минтақадаги аҳоли масканлари зиммасига дарё суви ва режимини сақлаш, ёзги сайёҳлар оқимиغا етарлича хизмат кўрсатиш тизимини ривожлантириш тавсия этилади. Бундан ташқари минтақа табиатига демографик юкнинг меъёрдан ортиқ бўлишини олдини олиш учун туристларга хизмат кўрсатиш ва кучли савдо тизимини ривожлантириш этноэкологик маданият намуналаридан келиб чиқиб тавсия этилади.

Д. Минтақани водийни сув билан таъминлашдаги экологик функциясидан келиб чиқиб, бу ҳудудларда алоҳида муҳофаза этиладиган ҳудудлар тўрини ташкил этиш ландшафт-экологик режалаштиришнинг кечиктириб бўлмайдиган бандларидан бири сифатида тавсия этилади. Чунки, мазкур ҳудудда маҳаллий аҳоли томонидан ташкил этилган ўзига хос «кўриқхона»лар (қадамжолар ва зиёратгоҳлар кўринишида) тизимининг мавжудлиги юқоридаги фикримизни асослайди.

Е. Мазкур минтақада экологик туризм ва рекреацияни ривожлантиришнинг энг қулай имкониятлари мавжудлиги эътиборга олинади. Этноэкологик маданият кўринишлари сифатида халқаро аҳамиятга молик деб эътироф этилган ислом динидаги 7 та қадамжонинг барчаси (Ўш, Жалолобод, Аравон, Кампировот, Қадамжо, Шоҳимардон, Йигитпирим) ушбу ҳудудда жойлашганлиги экологик туризмни ривожлантириш имкониятлари нақадар кенглигини кўрсатади.

Бугунги кунда, кишилик жамияти билан атроф-муҳит ўртасидаги муносабатларни уйғунлаштириш, унга нисбатан истеъмолчилик ва маданиятсиз муносабатларидан мутлақо воз кечиш ва юксак экологик маданиятни шакллантириш таълим тизими олдида қўйилаётган асосий вазифалардан бирига айланмоқда.

Юқоридаги тавсияларни амалга ошириш минтақада барқарор экологик-ландшафт ривожланишни таъминлашнинг дастлабки шарти ҳисобланади. Уни ҳаётга татбиқ этиш эса юксак экологик онг ва маданиятга эга бўлган кишилар томонидангина амалга оширилиши мумкин. Чунки, ландшафт-экологик режалаштириш юқорида таъкидланганидек, умумий режалаштиришнинг таркибий қисми бўлиб, режа ишларини бошқарувчиларда табиий ландшафтга фақат ресурс сифатида қараб ҳўжалик манфаатларини олдинги ўринга қўйиш ҳолатлари ҳанузгача учрайди. Тармоқларни «ўзаро муросага келтириш» учун эса экологик билим ва маданият зарурдир. Экологик муаммоларнинг юзага келишига бошқа сабаблар билан бир қаторда умумий этноэкологик маданиятнинг унутилиши, анъанавий табиатдан фойдаланиш ва уни муҳофаза қилиш тизимида менсимасдан муносабатда бўлиш каби омиллар ҳам сабаб бўлиши кўрсатиб ўтилди. Шунинг учун ҳам, кўп асрлар давомида шаклланган минтақа

халқларининг табиат (атроф-муҳит) ва жамият (инсон) ўртасидаги ўзаро муносабатларида такомиллашиб борган этноэкологик маданият намуналарини бошланғич ва ўрта таълим тизимидан ўргатиб бориш мақсадга мувофиқ.

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ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ ЗАПАСАМИ НА ОСНОВЕ ТЕХНОЛОГИЙ АНАЛИЗА ДАННЫХ

***Аннотация:** В статье раскрываются теоретические и практические аспекты оптимизации управления запасами на примере автосервиса с использованием технологий анализа данных. В статье представлен анализ моделей прогнозирования спроса на запчасти с учетом сезонности и внешних факторов в условиях автосервиса. Результаты исследования могут быть использованы для повышения эффективности системы управления запасами.*

***Ключевые слова:** управления запасами, анализ данных, машинное обучение, нейронные сети, прогнозирование спроса, оптимизация запасов.*

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IMPROVING THE EFFICIENCY OF INVENTORY MANAGEMENT BASED ON DATA ANALYSIS TECHNOLOGIES

***Abstract:** The article reveals the theoretical and practical aspects of optimizing inventory management using the example of a car service station using data analysis technologies. The article presents an analysis of models for forecasting demand for spare parts, taking into account seasonality and external factors in car service conditions. The results of the study can be used to improve the efficiency of the inventory management system.*

***Keywords:** inventory management, data analysis, machine learning, neural networks, demand forecasting, inventory optimization.*

Современные технологии анализа данных, искусственного интеллекта и машинного обучения (ML) обеспечивают развитие подходов и инструментов оптимизации управления запасами в автосервисах, инструменты аналитики данных не просто описывают прошлые данные, а активно предсказывают будущие сценарии, обеспечивая оптимизацию склада и переводя его из источника затрат в стратегический актив [1].

Рассмотрим повышение эффективности управления запасами на основе технологий анализа данных на примере автосервиса.

В условиях автосервиса возможности этих технологий проявляются прежде всего в создании точных моделей прогнозирования спроса на запчасти, которые учитывают не только объемы продаж, но и скрытые паттерны поведения клиентов и технического состояния автомобилей.

Возможности инструментов аналитики данных включают интеграцию предиктивной аналитики с реальными данными о пробеге и возрасте автопарка, что позволяет автосервисам переходить от реактивного пополнения склада к проактивному планированию [2]. Использование инструментов машинного обучения позволяет применять персонализированные модели с учетом прогноза по каждой позиции номенклатуры. Такие персонализированные модели учитывают не только историческое изменение данных, но и контекстные переменные [3]. Применение технологий машинного обучения обеспечивает снижение уровня запасов на 15-35%, также параллельно технологии обеспечивают повышение уровня сервиса до 98% [4].

Анализ моделей прогнозирования спроса на запчасти с учетом сезонности и внешних факторов позволил сформировать аналитическую таблицу (таблица 1), где каждый подход раскрывается через основные характеристики, механизм учета сезонности и внешних факторов, а также преимущества в условиях автосервиса [5].

Таблица 1.

**Анализ моделей прогнозирования спроса на запчасти
с учетом сезонности и внешних факторов**

Модель прогнозирования	Ключевые характеристики	Учет сезонности и внешних факторов	Преимущества в автосервисе
Prophet	Аддитивная модель с компонентами тренда, сезонности и праздников	Автоматическое выделение множественной сезонности и регрессоров для внешних переменных (погода, экономика)	Простота внедрения, устойчивость к пропускам данных, высокая точность при сильной сезонности
LSTM / BiLSTM	Рекуррентные нейросети для нелинейных зависимостей	Интеграция exogenous variables и deseasonalization перед обучением	Захватывает сложные паттерны intermittent demand, идеально для долгосрочных прогнозов запчастей
Hybrid LSTM + Prophet	Комбинация Prophet для сезонности и LSTM для остатков	Prophet моделирует сезонность, LSTM - нелинейные эффекты внешних шоков	Снижение ошибки на 20-40 % по сравнению с одиночными моделями в автомобильной отрасли
Tree-based (Random Forest / XGBoost)	Ансамблевые деревья решений с feature engineering	Включение категориальных и числовых внешних факторов (возраст авто, регион)	Высокая интерпретируемость и точность для intermittent demand в EV-запчастях
DFB-ML (decay-function-blended)	Блендинг ML с функцией затухания для EOL-продуктов	Учет долгосрочных трендов и внешних событий через исторические фичи	Эффективно для долгосрочного планирования запасов на end-of-life запчастях

Данные таблицы показывают, как различные модели прогнозирования могут использоваться в комплексе, дополняя друг друга, позволяя автосервисам выбирать оптимальный инструмент в зависимости от характера данных и горизонта планирования.

Таким образом, можно отметить, что использование инструментов анализа данных для оптимизации управления запасами решает не только текущие проблемы, но обеспечивает формирование предиктивного обслуживания всего автопарка.

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ОЗНАКОМЛЕНИЕ С НАЦИОНАЛЬНЫМИ АРХИТЕКТУРНЫМИ ПАМЯТНИКАМИ– КАК ИННОВАЦИОННЫЙ ФАКТОР ФОРМИРОВАНИЯ У ДЕТЕЙ ЛЮБВИ К РОДИНЕ

***Аннотация:** Какие бы перемены не происходили в обществе, вопросам любви к Родине и патриотического воспитания уделяется особое внимание и в настоящее время они являются приоритетными на государственном уровне. Так, за последние годы в Республике Узбекистан были предприняты значительные усилия по укреплению и развитию системы патриотического воспитания граждан, особенно детей и молодёжи.*

***Ключевые слова и выражения:** глобализация и интеграция, перспективные отрасли, туристические кластеры, формирование рынка, маркетинг, потенциал, архитектурные памятники, рыночная экономика.*

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FAMILIARIZATION WITH NATIONAL ARCHITECTURAL MONUMENTS - AS AN INNOVATIVE FACTOR IN THE FORMATION OF LOVE FOR THE MOTHERLAND IN CHILDREN

***Annotation:** Whatever changes take place in society, special attention is paid to the issues of love for the Motherland and patriotic education, and at present they are a priority at the state level. So, in recent years, significant efforts have been made in the Republic of Uzbekistan to strengthen and develop the system of patriotic education of citizens, especially children and youth.*

***Key words and expressions:** globalization and integration, promising industries, tourism clusters, market formation, marketing, potential, craft, market economy.*

Сегодня, в процессе глобализации и интеграции в мировую экономику, серьезное внимание уделяется сохранению национальных традиций и ценностей. Какие бы перемены не происходили в обществе, вопросам любви к Родине и патриотического воспитания уделяется особое внимание и в настоящее время они являются приоритетными на государственном уровне. Так, за последние годы в Республике Узбекистан были предприняты значительные усилия по укреплению и развитию системы патриотического воспитания граждан, особенно детей и молодёжи.

Патриотическое воспитание представляет собой систематическую и целенаправленную деятельность органов государственной власти, институтов гражданского общества и семьи по формированию у граждан высокого патриотического сознания, чувства верности своему Родному краю и Родной земли, готовности к выполнению гражданского долга и конституционных обязанностей по защите интересов Родины. Патриотическое воспитание должно начинаться с дошкольного возраста. Именно в этот период активно формируется начальное познавательное и эстетическое отношение к действительности, происходит становление интересов к широкому кругу социальных явлений, выходящих за рамки личного опыта ребенка. Среди разнообразных средств патриотического воспитания особое место отводится ознакомлению с архитектурой города, в котором живет ребенок. Она представляет собой уникальную среду для социокультурного развития и формирования первичных ценностных ориентаций и начального обобщенного представления о культурно-историческом своеобразии родного города. Анализ современной научной литературы показал, что вопросы приобщения дошкольников к архитектуре изучены преимущественно с позиций обучения изобразительной деятельности и конструированию (Т.С. Комарова, Л.А. Парамонова), ознакомления детей с фактами истории и явлениями социальной действительности; художественного развития дошкольников. Вместе с тем, до настоящего времени технологии приобщения дошкольников к архитектуре родного города в рамках реализации стратегии патриотического воспитания недостаточно разработаны.

Таким образом, актуальность вопроса определяется стратегией патриотического воспитания, предполагающей формирование гармоничной личности, воспитание всесторонне развитой личности – зрелого, ответственного человека, в котором сочетается любовь к большой и малой родине, общенациональная и этническая идентичность, уважение к культуре, традициям людей, которые живут рядом. Целевые ориентиры дошкольного образования определяет сегодня Государственный образовательный стандарт республики Узбекистан. К ним относятся инициативность, самостоятельность в разных видах деятельности, положительное отношение миру, развитое воображение, развитая крупная и мелкая моторика, владение устной речью, любознательность и др. Всё то, что позже определяет успешность ребёнка при обучении, в трудовой деятельности и жизни в целом. А также повышение квалификации и мастерства педагогов позволяет связать содержание и характер методической работы с ходом и результатами реальной образовательной деятельности.

В последние годы значительно возросло участие детей в городских, региональных, республиканских мероприятиях различной направленности. Особенно важно отметить, что каждая пятница недели установлена Днём бесплатного посещения музеев и исторических памятников нашей республики.

Однако, наряду с имеющимися достижениями, существует ряд проблем, в

первую очередь связанных с внедрением инновационных технологий формирования у воспитанников идеалов патриотических ценностей. Сегодня становится очевидным, что применяемые формы и методы в воспитательном процессе не в полной мере обеспечивают повышение у воспитанников роли патриотизма как ценностно – смыслового ядра развития личности. Обозначилась тенденция сокращения в обществе людей, способных воспринимать ценности патриотизма. Система патриотического воспитания в современных условиях нуждается в корректировке целей, задач, форм, методов и технологий, адекватно учитывающих современные социальные реалии и ситуацию в мире. Поэтому реализация современных моделей патриотического воспитания должна происходить в соответствии с требованиями и вызовами XXI века. Создание системы патриотического воспитания, направленной на формирование потребности в ценностях патриотизма предусматривает следующие задачи:

- совершенствование системы патриотического воспитания на основе внедрения инновационных технологий;

- разработка и реализация вариативных программ, направленных на формирование патриотического воспитания воспитанников;

- совершенствование организационно – методического и информационно – технического обеспечения системы патриотического воспитания в дошкольно-образовательных организациях(ДОО);

- приобщение к национальному культурному и историческому наследию и стремление к его сохранению и развитию;

- включенность родителей в тесное сотрудничество по патриотическому воспитанию;

- создание положительного имиджа ДОО и позиционирование его на рынке образовательных услуг города, области и страны.

Таким образом, воспитание детей в духе патриотизма и любви к Родине с помощью ознакомления с национальными архитектурными памятниками является одним из инновационных и современных технологий обучения и воспитания в системе дошкольного образования.

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ТЕЧЕНИЕ ХРОНИЧЕСКОГО ГЕПАТИТА С ПРИ ОНКОГЕМАТОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЯХ

***Аннотация.** Хронический гепатит С (ХГС) остается одной из актуальных проблем современной медицины, особенно у пациентов с онкогематологическими заболеваниями. Иммуносупрессия, обусловленная как самим злокачественным процессом, так и проводимой противоопухолевой терапией, способствует реактивации вируса гепатита С, ускорению прогрессирования фиброза печени и развитию тяжелых осложнений. В обзорной статье представлены современные данные о распространенности хронического гепатита С среди больных с онкогематологическими заболеваниями.*

***Ключевые слова:** хронический гепатит С, онкогематологические заболевания, лимфома, лейкоз, иммуносупрессия, прямые противовирусные препараты.*

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COURSE OF CHRONIC HEPATITIS C IN PATIENTS WITH HEMATOLOGICAL MALIGNANCIES

***Abstract.** Chronic hepatitis C (CHC) remains one of the most significant challenges in modern medicine, particularly among patients with hematological malignancies. Immunosuppression associated with both the underlying malignant process and antitumor therapy contributes to hepatitis C virus (HCV) reactivation, accelerated progression of liver fibrosis, and the development of severe complications. This review article summarizes current data on the prevalence of chronic hepatitis C among patients with hematological malignancies.*

***Keywords:** chronic hepatitis C, hepatitis C virus, hematological malignancies, lymphoma, leukemia, immunosuppression, direct-acting antivirals.*

Введение

Вирус гепатита С (HCV) является одной из ведущих причин хронических заболеваний печени во всем мире. По оценкам Всемирной

организации здравоохранения, около 50 миллионов человек страдают хронической HCV-инфекцией, а ежегодно регистрируется более 1 миллиона новых случаев заболевания [1]. Особое значение проблема приобретает среди пациентов с онкогематологическими заболеваниями, поскольку вирусная инфекция может существенно влиять на течение основного заболевания и результаты противоопухолевой терапии [2].

Хронический гепатит С часто выявляется у пациентов с лимфомами, хроническими лейкозами, множественной миеломой и другими злокачественными заболеваниями системы крови [3].

Распространенность HCV-инфекции среди пациентов с онкогематологическими заболеваниями варьирует в зависимости от географического региона и структуры исследуемой популяции. По данным различных исследований, частота инфицирования может составлять от 5 до 30 % [2]. Многочисленные исследования подтверждают наличие патогенетической связи между хронической HCV-инфекцией и развитием лимфопролиферативных заболеваний [4]. Дополнительными факторами риска инфицирования являются частые гемотрансфузии, инвазивные медицинские вмешательства и длительное пребывание в стационаре [5].

Вирус гепатита С обладает не только гепатотропными, но и лимфотропными свойствами. Репликация вируса может происходить в мононуклеарных клетках периферической крови, что способствует хронической стимуляции иммунной системы и развитию лимфопролиферативных процессов [3]. Проведение химиотерапии, применение моноклональных антител и трансплантация гемопоэтических стволовых клеток дополнительно усиливают иммуносупрессию, создавая условия для активации вирусной репликации [6]. В результате может наблюдаться ускоренное прогрессирование хронического гепатита, развитие выраженного фиброза печени и повышение риска цирроза [7].

Клиническая картина хронического гепатита С у пациентов с онкогематологическими заболеваниями зачастую отличается малосимптомным течением, а признаки поражения печени выявляются только при лабораторном обследовании [2]. Наиболее частыми симптомами являются: общая слабость, повышенная утомляемость, снижение аппетита, тяжесть в правом подреберье, диспепсические расстройства.

Во время проведения противоопухолевой терапии возможно обострение хронического гепатита С, сопровождающееся повышением активности трансаминаз и увеличением вирусной нагрузки [6]. Особую опасность представляет реактивация HCV-инфекции, которая может привести к развитию тяжелого гепатита и необходимости временного прекращения противоопухолевого лечения [8,9].

Диагностика хронического гепатита С основывается на сочетании серологических и молекулярно-биологических методов исследования. Основными лабораторными маркерами являются: антитела к HCV (anti-HCV), РНК HCV методом полимеразной цепной реакции, показатели

функционального состояния печени, маркеры фиброза печени. У пациентов с онкогематологическими заболеваниями рекомендуется регулярный мониторинг активности аланинаминотрансферазы (АЛТ), аспартатаминотрансферазы (АСТ) и уровня билирубина [7].

Современные подходы к лечению. Появление прямых противовирусных препаратов (Direct-Acting Antivirals, DAA) существенно изменило подходы к лечению хронического гепатита С. Современные схемы терапии позволяют достичь устойчивого вирусологического ответа более чем у 95 % пациентов независимо от генотипа вируса [5]. Наиболее часто используются комбинации: Софосбувир + велпатасвир; Глекапревир + пибрентасвир; Софосбувир + ледипасвир.

Проведение противовирусной терапии до начала химиотерапии способствует снижению риска реактивации инфекции и улучшению прогноза заболевания [8,9]. В случаях необходимости неотложного начала противоопухолевого лечения допускается параллельное назначение противовирусных препаратов при тщательном контроле возможных лекарственных взаимодействий [6].

Заключение

Хронический гепатит С представляет серьезную проблему у пациентов с онкогематологическими заболеваниями. Особенности иммунного статуса, проведение химиотерапии и высокая вероятность реактивации вирусной инфекции определяют необходимость своевременной диагностики и комплексного подхода к лечению. Использование современных прямых противовирусных препаратов позволяет эффективно контролировать инфекцию и улучшать прогноз у данной категории пациентов.

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ПЕДАГОГИЧЕСКИЕ АСПЕКТЫ ОРГАНИЗАЦИИ СОТРУДНИЧЕСТВА МЕЖДУ ВОСПИТАТЕЛЯМИ И РОДИТЕЛЯМИ В ДОШКОЛЬНЫХ ОБРАЗОВАТЕЛЬНЫХ ОРГАНИЗАЦИЯХ

***Аннотация:** В статье анализируются меры, которые необходимо предпринять для создания доверительной атмосферы в семье с целью формирования у ребенка чувства доверия в раннем детстве, когда закладывается фундамент личностного развития, а также родительские отношения, непосредственно влияющие на личностное развитие и, напрямую, на формирование уверенности в себе.*

***Ключевые слова:** ответственность, сотрудничество, внимание, гуманность, формирование, социокультурный*

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PEDAGOGICAL ASPECTS OF ORGANIZING COOPERATION BETWEEN TEACHERS AND PARENTS IN PRESCHOOL EDUCATIONAL ORGANIZATIONS.

***Abstract:** This article analyzes the measures that must be taken to create a trusting environment in the family in order to form a sense of trust in a child in early childhood, when the foundation of personal development is laid, as well as parental relationships that directly affect personal development and, directly, the formation of self-confidence*

***Keywords:** responsibility, cooperation, attention, humanity, formation, socio-cultural.*

Введение

В основе проводимых в нашей стране реформ в области дошкольного образования лежит особое внимание к воспитанию младшего поколения. Это связано с тем, что дошкольное детство – уникальный период формирования ребенка, в котором дети контролируют регуляцию своих внутренних психических процессов и поведения, начинают понимать сущность собственной деятельности.

На основе изучения научных работ по данной проблеме мы пришли к выводу, что организация семейного сотрудничества в дошкольных организациях является личностной характеристикой, отражающей

готовность ребенка осмысливать свое поведение с точки зрения духовно-нравственных норм и нести ответственность за результаты своей деятельности перед другими и перед самим собой.

Исследование и анализ

Процесс формирования чувства ответственности у детей старшего дошкольного возраста с точки зрения гуманистической педагогики включает в себя постепенное формирование личностных и социокультурных характеристик ответственного поведения детей старшего дошкольного возраста.

В системе социокультурных качеств чувство ответственности у детей дошкольного возраста рассматривается как сочетание знаний и важных ценностей, необходимых им для проявления чувства ответственности в своем поведении. Эти качества включены в социокультурную ориентацию, на основе которой формируется описание деятельности и поведения индивида.

По мнению Л.В. Римевой, «социокультурная ориентация — это сложное формирование, включающее реализацию структурных функций и эмоционально-эмоциональных компонентов, важных для ребенка. Это связано с собственной внутренней мотивационной деятельностью ребенка, прежде всего с восприятием других, его эмоциональным состоянием, анализом, обобщением и диагностической оценкой ситуации, а также предвосхищением ее формирующих тенденций». Именно организация деятельности детей в социокультурном направлении влияет на их формирование как личностей. В этом особую роль играет общение детей с другими, взрослыми. Ведь в процессе общения обучение других слушать, слушать и говорить на заданную тему также ведет к формированию ответственности в определенном смысле. Критическое отношение к собственному мнению мотивирует к ответственности, побуждая проявлять уважение к чужому мнению.

Учитывая современные требования к организации образовательно-воспитательного процесса в дошкольной образовательной организации, мы подчеркиваем, что формирование важных личностных качеств у детей дошкольного возраста должно осуществляться на основе субъектно-субъектного взаимодействия.

Жизненно важным смыслом направленного формирования субъектности ребенка является то, что ребенок совершает то или иное действие не только под влиянием внешних причин, но и благодаря внутренней мотивации. Это обусловлено осознанной потребностью в этих действиях, их реальной значимостью, ценностью, важностью для общества, для близких.

В процессе формирования уверенности в себе у детей дошкольного возраста А.С. Белкин «алгоритмически выделяет следующие этапы:

– безразличие взрослых к поведению ребенка;

- появление способности самостоятельно оценивать и диагностировать собственное поведение: хорошее или плохое;
- появление иного отношения к оценке и диагностике собственного поведения взрослыми;
- появление и формирование способности понимать себя не только по собственному поведению, но и по различным эмоциональным и психическим состояниям;
- появление самосознания, то есть способности понимать и оценивать свою внутреннюю жизнь».

Мы считаем, что ребенок должен накапливать опыт самооценки, поэтому, начиная с дошкольного возраста, следует создавать ситуации, которые будут знакомить ребенка с необходимостью более реалистичной оценки и диагностики собственного поведения, отличной от идеальной.

Уникальность характеристик личностной, частной и субъективной деятельности, специфический продукт детской деятельности, проявление нестандартных форм поведения, нетипичных для других детей этого возраста, — всё это свидетельствует о проявлении индивидуального подхода к дошкольнику, что подтверждается использованием в нашей работе личностно-деятельностного подхода.

В контексте формирования чувства ответственности как комплексного интегративного дошкольного образования и воспитания мы считаем необходимым различать самоорганизующуюся и формирующую деятельность.

По мнению одного из ведущих ученых в области дошкольного образования, Ф.Р. Кадирова: «В периоды формирования и воспитания детей, соответствующие их возрасту, сосуществуют и взаимодействуют различные виды деятельности, но их роль не одинакова: на каждом этапе выделяется ведущий вид деятельности, в котором проявляются основные достижения в формировании ребенка. Каждый вид деятельности отличается необходимостью, причинами, целью деятельности, предметом, средствами, действиями, выполняемыми с предметами, и, наконец, результатом», подчеркивая, что деятельность детей дошкольного возраста совершенствуется характерным для их возрастных этапов образом.

Вывод

Обобщая результаты педагогического, психологического, научно-философского анализа, можно заключить, что, по общему мнению большинства современных специалистов в области высшего образования, в формировании у детей чувства ответственности родители выступают в роли лидеров целостного педагогического процесса в новых условиях воспитания и социального развития. Любое общение с детьми в семье должно носить воспитательный характер. Дети легче понимают своих близких. Общение с ними происходит в естественных условиях. Поэтому в ходе нашей выпускной квалификационной работы мы провели экспериментальное исследование, исходя из вывода о необходимости повышения уровня

целенаправленного педагогического воздействия на семьи. В этом случае от родителей и близких детей требуется проявлять себя как ответственные личности, будь то обсуждение конкретной темы или игра в конкретную игру. Педагогическая работа с детьми приобретает комплексный характер, поскольку она ведется в медицинском, физическом, психологическом и познавательном направлениях.

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ЦИФРОВАЯ ГЕОГРАФИЯ И ЭКОЛОГИЧЕСКИЙ МОНИТОРИНГ: НОВЫЙ ЭТАП СОВРЕМЕННЫХ НАУЧНЫХ ИССЛЕДОВАНИЙ

Аннотация: В статье рассматривается роль цифровой географии как современного научного направления, объединяющего геоинформационные технологии, дистанционное зондирование Земли и системы экологического мониторинга. В условиях глобального изменения климата, усиления антропогенного воздействия и роста экологических рисков традиционные методы географических исследований становятся недостаточно эффективными. Цель исследования заключается в анализе значения цифровых технологий в современных географических и экологических исследованиях. В работе использованы методы сравнительного анализа, пространственного моделирования и обработки геоинформационных данных. Результаты показывают, что цифровые технологии значительно повышают точность прогнозирования природных процессов и эффективность управления природными ресурсами.

Ключевые слова: цифровая география, экологический мониторинг, GIS, геоинформационные системы, дистанционное зондирование, пространственный анализ, цифровые технологии.

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DIGITAL GEOGRAPHY AND ENVIRONMENTAL MONITORING: A NEW STAGE IN MODERN SCIENTIFIC RESEARCH

Abstract: This article examines the role of digital geography as a modern scientific field that integrates geoinformation technologies, Earth remote sensing, and environmental monitoring systems. In the face of global climate change, increasing anthropogenic impact, and growing environmental risks, traditional methods of geographical research are becoming ineffective. The aim of this study

is to analyze the role of digital technologies in modern geographical and environmental research. The study utilizes methods of comparative analysis, spatial modeling, and geoinformation data processing. The results demonstrate that digital technologies significantly improve the accuracy of natural process forecasting and the effectiveness of natural resource management.

Keywords: *digital geography, environmental monitoring, GIS, geoinformation systems, remote sensing, spatial analysis, digital technologies.*

Введение

Современное развитие науки характеризуется стремительной цифровизацией исследовательских процессов практически во всех областях знаний. География как комплексная наука, изучающая пространственную организацию природных и социально-экономических процессов, также переживает глубокую технологическую трансформацию. В последние десятилетия объем пространственной информации, связанной с мониторингом окружающей среды, климатическими изменениями, динамикой земельных ресурсов и урбанизацией, увеличивается беспрецедентными темпами.

По данным United Nations, глобальные системы наблюдения за состоянием окружающей среды ежегодно формируют более 500 петабайт пространственных данных, что делает невозможным их эффективный анализ традиционными статистическими и картографическими методами. В этих условиях возникает новое научное направление — цифровая география, основанная на использовании современных информационных технологий для изучения пространственных процессов.

Особую актуальность данное направление приобретает в экологических исследованиях, поскольку глобальные изменения климата, деградация земель, загрязнение атмосферы и сокращение водных ресурсов требуют постоянного мониторинга и высокоточного прогнозирования.

Целью настоящего исследования является анализ роли цифровой географии и современных технологий экологического мониторинга в развитии научных исследований нового поколения.

Материалы и методы исследования

Методологической основой исследования послужили современные подходы к пространственному анализу географических данных и экологическому мониторингу окружающей среды. В ходе исследования использовались методы сравнительного анализа, геоинформационного моделирования, обработки спутниковых данных, статистической оценки экологических показателей и системного анализа научной литературы.

В качестве основных информационных источников использованы материалы NASA, World Meteorological Organization, Food and Agriculture Organization и международных геоинформационных платформ.

Для анализа возможностей цифровой географии были рассмотрены современные программные продукты: ArcGIS, QGIS и Google Earth Engine.

Указанные платформы позволяют обрабатывать большие объемы пространственной информации, проводить картографический анализ и строить прогнозные модели природных процессов.

Результаты исследования

Проведенный анализ показал, что цифровая география становится одним из ключевых факторов развития современных экологических исследований. Прежде всего, значительное преимущество цифровых технологий заключается в возможности обработки больших массивов пространственных данных в режиме реального времени. По информации NASA, современные спутниковые системы ежедневно передают более 20–25 терабайт геопро пространственной информации, используемой для анализа состояния атмосферы, гидросферы и земной поверхности.

Важным направлением применения цифровой географии является экологический мониторинг. Современные геоинформационные системы позволяют отслеживать процессы деградации земель, изменение лесного покрова, загрязнение водных ресурсов, процессы опустынивания и изменение климатических параметров. Согласно данным World Meteorological Organization, использование цифровых систем мониторинга увеличивает точность климатических прогнозов в среднем на 27% по сравнению с традиционными методами наблюдений.

Существенные результаты наблюдаются также в сфере управления природными ресурсами. По данным Food and Agriculture Organization, внедрение цифровых геоинформационных технологий в управление сельскохозяйственными и водными ресурсами позволяет повысить эффективность использования ресурсов на 35–40%.

Кроме того, технологии цифровой географии широко применяются в прогнозировании природных катастроф. Геоинформационный анализ используется при оценке риска наводнений, лесных пожаров, эрозии почв, оползней и засух. Практические исследования показывают, что использование GIS-технологий обеспечивает повышение точности оценки рисков в среднем на 30–40%.

Обсуждение результатов

Полученные результаты подтверждают, что цифровая география формирует качественно новый этап развития географической науки. Если традиционные методы исследования были ограничены территориальным охватом и скоростью обработки информации, то современные цифровые технологии позволяют анализировать глобальные природные процессы в режиме непрерывного мониторинга.

Особое значение данное направление приобретает в условиях изменения климата. По данным Intergovernmental Panel on Climate Change, средняя температура Земли уже увеличилась примерно на 1,2°C, а дальнейшее потепление приведет к ускорению процессов таяния ледников, нарушению гидрологического режима и усилению экологических рисков. В

этих условиях цифровые географические технологии становятся основой долгосрочного прогнозирования и принятия управленческих решений.

Для стран Центральной Азии, включая Uzbekistan, внедрение цифровой географии особенно важно в связи с проблемами дефицита воды, деградации почв и последствиями кризиса Aral Sea. Однако дальнейшее развитие данного направления требует подготовки квалифицированных специалистов, расширения доступа к современным программным продуктам и интеграции цифровых технологий в систему высшего образования.

Заключение

Таким образом, цифровая география представляет собой новую стадию развития современных научных исследований, объединяющую информационные технологии, географический анализ и экологический мониторинг. Использование геоинформационных систем, технологий дистанционного зондирования и цифровых методов анализа данных существенно повышает точность исследования природных процессов и эффективность управления окружающей средой.

Результаты исследования показывают, что дальнейшее развитие географической науки будет непосредственно связано с цифровизацией экологического мониторинга и широким внедрением современных пространственных технологий. В перспективе цифровая география станет одним из основных инструментов обеспечения экологической безопасности, рационального природопользования и устойчивого развития территорий.

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ЗЕЛЕНАЯ ЭКОНОМИКА И ПЕРСПЕКТИВЫ ЭКОЛОГИЧЕСКИ УСТОЙЧИВОГО РАЗВИТИЯ УЗБЕКИСТАНА

Аннотация: Статья исследует текущее состояние и перспективы развития зеленой экономики в Узбекистане в контексте достижения целей устойчивого развития. Анализируется динамика внедрения возобновляемых источников энергии, совершенствование нормативно-правовой базы экологической политики и инновационные подходы к снижению выбросов парниковых газов. На основе данных Всемирного банка, ЮНЕП и государственных органов Узбекистана показано, что инвестиции в зеленые технологии могут обеспечить экономический рост при одновременном сохранении экологической целостности региона. Выявлены ключевые препятствия для расширения циркулярной экономики и предложены рекомендации по укреплению институциональной базы для ускорения перехода на устойчивые модели производства и потребления.

Ключевые слова: зеленая экономика, устойчивое развитие, возобновляемые источники энергии, углеродная нейтральность, циркулярная экономика, Узбекистан

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GREEN ECONOMY AND PROSPECTS FOR ECOLOGICALLY SUSTAINABLE DEVELOPMENT IN UZBEKISTAN

Abstract: This article examines the current state and development prospects of the green economy in Uzbekistan in the context of achieving sustainable development goals. The dynamics of renewable energy sources implementation, improvement of the regulatory framework for environmental policy, and innovative approaches to reducing greenhouse gas emissions are analyzed. Based on data from the World Bank, UNEP, and state agencies of Uzbekistan, it is demonstrated that investments in green technologies can ensure economic growth while preserving the ecological integrity of the region. Key obstacles to circular economy expansion are identified and recommendations for strengthening the

institutional framework to accelerate the transition to sustainable production and consumption models are proposed.

Keywords: *green economy, sustainable development, renewable energy sources, carbon neutrality, circular economy, Uzbekistan*

Введение

Глобальные климатические вызовы и истощение природных ресурсов создают острую необходимость перехода от традиционной экономики к модели зеленого роста. Узбекистан, как страна Центральной Азии с интенсивным сельскохозяйственным производством и растущим энергопотреблением, сталкивается с конкретными вызовами, включая опустынивание, дефицит водных ресурсов и деградацию земель (World Bank, 2023). В этом контексте разработка и реализация стратегии зеленой экономики рассматривается как стратегический приоритет (UNDP Uzbekistan Country Programme, 2023). Согласно данным Министерства экологии Узбекистана, страна взяла на себя обязательство по достижению углеродной нейтральности к 2050 году, включая увеличение доли возобновляемых источников энергии с текущих 23% до 50% к 2030 году.

Методология

Исследование основано на комплексном анализе вторичных источников данных, включая отчеты Всемирного банка, ЮНЕП, ЮНКТАД, а также официальные документы государственных органов Узбекистана за период 2020–2024 гг. Использованы методы контент-анализа нормативно-правовых актов, экономико-статистического анализа инвестиционных потоков в сектор возобновляемой энергии, и сравнительного анализа моделей зеленой экономики в странах Центральной Азии. Данные обрабатывались с помощью стандартного пакета описательной статистики с целью выявления динамики ключевых показателей, характеризующих развитие зеленого сектора экономики.

Результаты

Анализ показал, что с 2019 по 2024 год инвестиции в возобновляемые источники энергии в Узбекистане увеличились на 340% (Министерство энергетики, 2024). На текущий момент установленная мощность солнечных и ветровых электростанций достигла 3,8 ГВт, что составляет 23% от общей установленной мощности энергосистемы страны. В рамках Программы развития зеленой экономики Узбекистана (2019–2030) предусмотрено инвестирование более \$4 млрд в модернизацию инфраструктуры циркулярной экономики, внедрение технологий по снижению углеродоемкости производства, и укрепление механизмов экологического мониторинга. Нормативно-правовая база пополнилась Законом об охране окружающей среды (2020), Стратегией развития возобновляемой энергетики (2019), и Концепцией развития низкоуглеродной экономики (2023). Однако инвестиции в зеленые технологии в аграрном секторе остаются критически низкими, составляя менее 2% от общего объема инвестиций в сельское

хозяйство. Дефицит финансирования механизмов адаптации к климатическим изменениям оценивается в \$800–1000 млн ежегодно (ЮНЕП, 2023).

Обсуждение

Достигнутые результаты свидетельствуют о растущей приверженности Узбекистана принципам зеленой экономики. Успехи в развитии возобновляемой энергетики отражают как политическое волеизъявление, так и растущую заинтересованность международных доноров в финансировании климатических проектов в регионе. Однако переход к устойчивой экономике остается неполным. Во-первых, циркулярная экономика все еще находится на ранних этапах развития: менее 15% промышленных отходов повторно перерабатываются. Во-вторых, синхронизация зеленых инициатив с потребностями развития остается вызовом, особенно в контексте занятости и социального благополучия уязвимых групп населения. В-третьих, финансовые механизмы для привлечения капитала в экологический сектор требуют совершенствования. Необходимы усилия по укреплению институциональной базы: создание специализированных органов по мониторингу выполнения обязательств в области устойчивого развития, расширение кооперации с международными климатическими фондами (Зеленый климатический фонд, Адаптационный фонд), и поддержка инноваций в области низкоуглеродных технологий.

Выводы

Узбекистан находится на пути трансформации в направлении зеленой экономики, но требуется ускорение темпов реализации ключевых стратегических инициатив. Приоритетными направлениями являются: (1) расширение инвестиций в возобновляемые источники энергии до уровня 50% установленной мощности к 2030 году; (2) развитие циркулярной экономики в промышленности и аграрном секторе; (3) укрепление механизмов финансирования климатических проектов; (4) совершенствование нормативно-правовой базы в соответствии с международными стандартами; (5) повышение информированности и вовлечения населения в процессы устойчивого развития. Преодоление этих вызовов требует скоординированных усилий государственных органов, частного сектора, гражданского общества и международного сообщества в рамках партнерства в целях устойчивого развития.

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ВЛИЯНИЕ ИННОВАЦИОННЫХ МЕТОДОВ ОБУЧЕНИЯ ПРИ ПОДГОТОВКЕ МЕДИЦИНСКИХ РАБОТНИКОВ

***Аннотация.** Современное медицинское образование переживает этап активной трансформации, связанный с внедрением инновационных образовательных технологий. Использование симуляционного обучения, проблемно-ориентированного подхода, цифровых образовательных платформ, виртуальной и дополненной реальности способствует повышению качества подготовки медицинских работников. В обзорной статье представлены современные данные о влиянии инновационных методов обучения на формирование профессиональных компетенций студентов медицинских вузов.*

***Ключевые слова:** медицинское образование, инновационные методы обучения, симуляционное обучение, цифровые технологии.*

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INFLUENCE OF INNOVATIVE TEACHING METHODS IN THE TRAINING OF MEDICAL PROFESSIONALS

***Abstract.** Modern medical education is undergoing significant transformation due to the implementation of innovative educational technologies. Simulation-based learning, problem-based learning, digital educational platforms, virtual and augmented reality contribute to improving the quality of healthcare professional training. This review article presents current data on the impact of innovative teaching methods on the development of professional competencies among medical students.*

***Keywords:** medical education, innovative teaching methods, simulation training, digital technologies.*

Введение

Подготовка квалифицированных медицинских кадров является одной из важнейших задач современной системы здравоохранения. Быстрое развитие медицинской науки, внедрение новых методов диагностики и

лечения, а также цифровизация здравоохранения предъявляют повышенные требования к уровню профессиональной подготовки будущих специалистов [1].

Традиционные методы преподавания, основанные преимущественно на лекционной подаче материала, не всегда обеспечивают формирование практических навыков и клинического мышления, необходимых для эффективной работы врача. В связи с этим возрастает значение инновационных образовательных технологий, позволяющих интегрировать теоретические знания и практический опыт в единый образовательный процесс [2].

Одним из наиболее эффективных направлений модернизации медицинского образования является внедрение симуляционного обучения. Симуляционные технологии позволяют студентам многократно отрабатывать практические навыки в условиях, максимально приближенных к реальной клинической практике, без риска для пациента [3]. Высокотехнологичные симуляционные центры оснащаются манекенами высокой реалистичности, виртуальными тренажерами и компьютерными моделями, которые позволяют моделировать различные клинические ситуации. Исследования показывают, что использование симуляционного обучения способствует повышению уровня клинической компетентности студентов и снижению количества медицинских ошибок в дальнейшей профессиональной деятельности [4].

Широкое распространение получил проблемно-ориентированный метод обучения (Problem-Based Learning, PBL), основанный на самостоятельном поиске решений клинических задач. Данный подход способствует развитию критического мышления, аналитических способностей и навыков принятия решений в условиях неопределенности [5].

Электронные образовательные платформы позволяют организовывать дистанционное обучение, проводить интерактивное тестирование, использовать мультимедийные материалы и виртуальные лаборатории [6]. Особое значение приобретают технологии виртуальной (VR) и дополненной реальности (AR), позволяющие визуализировать анатомические структуры, моделировать хирургические вмешательства и проводить обучение в условиях, максимально приближенных к реальной клинической практике [7]. Применение искусственного интеллекта в образовательном процессе открывает новые перспективы персонализации обучения. Современные цифровые платформы способны анализировать уровень знаний обучающихся и формировать индивидуальные образовательные траектории [8].

Интерактивные методы обучения способствуют активному вовлечению студентов в образовательный процесс. К ним относятся деловые игры, клинические разборы, работа в малых группах, кейс-технологии и командное обучение [9]. Использование интерактивных технологий

позволяет повысить мотивацию обучающихся, улучшить усвоение материала и развить коммуникативные навыки, необходимые для взаимодействия с пациентами и коллегами [10]. Особую роль играет междисциплинарный подход, который способствует формированию комплексного клинического мышления и развитию навыков командной работы в системе здравоохранения [11].

Преимущества и проблемы внедрения инновационных технологий. Основными преимуществами инновационных методов обучения являются повышение эффективности образовательного процесса, улучшение качества подготовки специалистов, развитие практических навыков и клинического мышления [12].

Вместе с тем существуют определенные трудности внедрения инновационных технологий, включая высокую стоимость оборудования, необходимость дополнительной подготовки преподавателей и ограниченность материально-технических ресурсов отдельных образовательных учреждений [13].

Заключение

Использование симуляционных технологий, цифровых образовательных платформ, виртуальной реальности и интерактивных методов обучения способствует формированию профессиональных компетенций будущих медицинских работников. Дальнейшее совершенствование образовательного процесса на основе современных технологий позволит повысить качество подготовки специалистов и эффективность системы здравоохранения в целом.

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КУЗГИ БУҒДОЙДАН КЕЙИН ТАКРОРИЙ ЭКИНЛАРНИ ЭКИБ, УЛАР ҚОЛДИРГАН АНҒИЗ ВА ИЛДИЗ ҚОЛДИҚЛАРИГА БОҒЛИҚ ҚОЛДА ҒЎЗАНИ ЎҒИТЛАШ

***Аннотация:** Ўзбекистоннинг турли тупроқ-иқлим шароитларида ўтказилган тажрибаларни кўрсатишича, энг юқори қўшимча пахта ҳосили азот, фосфор ва калийни 1:0,7:0,5 нисбатда қўлланилганда олинган.*

***Калим сўзлар:** Ғўза, қалий, азот, фосфор, тупроқ-иқлим шароитлари, такрорий экинлар, анғиз илдиз қолдиқлари.*

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PLANTING REPEAT CROPS AFTER WINTER WHEAT AND FERTILIZING COTTON DEPENDING ON THE STUBBLE AND ROOT RESIDUES THEY LEAVE

***Abstract:** According to experiments conducted under various soil and climatic conditions in Uzbekistan, the highest surplus cotton yield was obtained with the application of nitrogen, phosphorus, and potassium in a ratio of 1:0.7:0.5.*

***Keywords:** Cotton, potassium, nitrogen, phosphorus, soil and climatic conditions, replanting, root residues.*

Алмашлаб экиш қишлоқ хўжалигида деҳқончиликнинг асосини ташкил этиб, тупроқ унумдорлигини кўтаришда, агротехника ва мелиоратив тадбирлар самарадорлигини оширишда, пахта, буғдой, озиқ-овқат, ем-хашак ва бошқа қишлоқ хўжалик экинларини ҳосилдорлигини кўтаришда муҳим аҳамият касб этади, шамол ва ирригация эрозиясига, эрозияга мойил тупроқлар унумдорлигини сақлашда муҳим восита ҳисобланади.

Фарғона водийсининг ўтлоқи бўз ва оч тусли бўз тупроқлари шароитида олиб борилган изланишларимизда кузги буғдой + такрорий экинлар + ғўза алмашлаб экиш тизими ўрганилди. Шу сабабли қуйида буғдойни ўғитлаш, такрорий экинларни тупроқ унумдорлигига таъсири ва ғўзада ўғитларни самарадорлиги юзасидан Ремесло (1976), Толкачев (1991) ларни фикрича, кузги буғдойга маъдан ўғитлар тўғри қўлланилса, ҳосилдорлик юқори бўлади, таннархи пасаяди, тупроқ унумдорлиги

сақланади, касаллик ва зараркунандаларга чидамлилиги ортади, қишловдан яхши чиқади.

О.Ф.Мирзаев, И.У.Эгамов, О.С.Кодиров (2001) лар Андижон вилоятининг ўтлоқи-бўз тупроқларида Юна нави учун мақбул экиш меъёри гектарига 4 млн бўлганда ўғитлар меъёри N-210, P-180, K-160 кг/га бўлишини тавсия қиладилар.

Н.И.Терпуговани (2001) келтирган маълумотларига кўра, Безостая-1, Краснодарская-39, Краснодарская-46 навлари учун маъдан ўғитларни (шимолий зоналарда) N-60 P-90, K-40 кг/га мақбул меъёр бўлиб ҳисобланади.

Кузги буғдойдан юқори ва сифатли ҳосил олиш учун маъдан ўғитларни меъёрларини тўғри белгилаш лозим. Бу борада бир қанча тадқиқотлар илмий изланишлар олиб борилиб, тупроқ ва иқлим шароитидан, нав хусусиятидан келиб чиққан ҳолда маъдан ўғитларни: Х.Б.Бухарев (1968), Безостая-1 нави учун N-150, P-90, K-60, Х.Бухарев (1971) Қашқадарё шароитида Н.Сторовойтов, К.Саранин (1976) Россиянинг ноқора тупроқлар шароитида N-180, P-90, K-100Н.Х.Халилов (1982) Ўзбекистоннинг суғориладиган ерларида N-180, P-90, K-60, Т.Х.Хожақулов (1991) N-180-200, P-90, K-60 кг/га меъёрларини мақбул эканлигини таъкидлаганлар.

Тупроқ таркибини, унинг тузилишини яхшилашнинг ишончли йўлларида бири уни бир йиллик, кўп йиллик ўсимликларнинг, анғиз ва илдиз қолдиқлари билан доимий бойитишдир.

С.Б.Эдильман (1945) маълумотларига кўра ловия тупроқни азот билан бойитади. Ловия илдизидаги туганак бактериялари орқали ҳаводаги азотни ўзлаштиради. Шунинг учун ловия бошқа зироатлар учун энг яхши ўтмишдош ҳисобланади.

Н.Ўразматов (1985) Фарғона вилоятининг ўтлоқи соз тупроқ шароитида маккажўхоридан кейин экилган рапс ва бошқа такрорий зироатлар тупроқнинг унумдорлигига ижобий таъсир этиб, ундан кейин экилган зироатларни ҳосилдорлигини ортиши тўғрисида фикр юритган.

М.Бобояров, П.Панживларни (1986) илмий изланишлари шуни кўрсатадики, оралиқ экинлар тупроқнинг 0-30 см қатламида вика 31,3, нўхат 31,5 вика 42,0, рож 52,2, горчица 21,6 ц/га анғиз ва илдиз қолдиқлари қолдириб, тупроқнинг унумдорлигини оширишга самарали таъсир қилган.

М.Т.Тожиев ва Қодиров А.Т. (1996) Сурхондарё вилояти шароитида кузги буғдойдан кейин такрорий экилган мош ва ловиядан ҳам дон ҳосили олиш мумкинлиги. такрорий зироатлар тупроқ унумдорлиги ва пахта ҳосилдорлигига ижобий таъсир этганлиги тўғрисида ҳабар берганлар. Таъкидлаш жоизки, кузги буғдой ва ундан кейин экилган такрорий зироатлар тупроқнинг агрофизик ва агрокимёвий хусусиятларига қандай таъсир қилиши тўғрисида илмий маълумотлар етарли эмас, айниқса бу масала Фарғона вилоятининг ўтлоқи соз тупроқ шароитида ўрганилмаган. Шунинг учун ушбу масалани илмий асосда очиш муҳим аҳамият касб этади.

Тупроқ структурасини яхшиловчи ва оширувчи дон-дуккакли экинлардан бири бу - соя ҳисобланади. Кўпгина адабиётларда соя тупроқни агрокимёвий хусусиятларини юқори даражада яхшиловчи дон-дуккакли экин деб таъриф берилади. Юқоридагиларни асослаб унинг самараси тўғрисида кўпгина олимлар илмий тадқиқотлар олиб боришган. Е.П.Горелов, Ерматова (1983), Х.Ш.Неъматов (1984), А.Панжиев (1986), Р.Ш.Тиллаев, А.С.Болкунов, А.Лигай (1986), Х.С.Романов, К.М.Мирзажонов.

Ю.П.Корягин (1978)нинг Қозоғистон шароитида ўтказган тажрибасида соя илдизидаги туганак бактериялар бир гектар майдонда 300 кг/гача биологик азот тўплаганини кузатган.

В.И.Зоверюхин (1981) нинг таъкидлашича соя илдиз тизими яхши ривожланган бўлиб, у тупроқнинг физик хоссаларини яхшилайти ва чуқур қатламларидан озиқа элементларини юқорига чиқишига ёрдам бериб, тупроқдаги азот миқдорини оширади.

Ўзани турли тупроқ-иқлим шароитларида ўғитлашнинг мақбул меъёрлари муддатлари ва усуллари самарадорлигини аниқлаш борасида жуда кўп илмий изланишлар ўтказилган (Дубаносов, Мустафа, 1974; Чинбердиев, 1977; Мусаев, 1997; Қодирхужаева, 2001).

Азотли ўғитларнинг фойдаланиш коэффициенти паст эканлиги N¹⁵ (нишонланган азот) ни қўллаш орқали ҳам аниқланган (Тиллабеков, 1993; Кадирходжаева, 1999).

Р.Мусаев (1997) нинг маълумотига кўра, ўзанинг мақбул ўсиши ва ривожланиши маъдан ўғитларнинг маълум меъёрларини қўллаганда кузатилади. Г.И.Яровенко (1960) нинг аниқлашича азотли ўғитларни гектарига 100 кг дан 300 кг гача ва фосфорни ҳам мутоносиб равишда қўлланилганда пахта ҳосили ортиши кузатилади.

Азотли ўғитлар меъёри янада 400 дан 500 кг/га ортиш пахта ҳосилини кўтарилишига олиб келмади. Ҳозирги кунда ҳам айрим хўжаликларда азотли ўғитларни юқори меъёردа қўлланилса ҳам ҳосилни ортиши кузатилмаяптики, бу албатта тупроқ унумдорлигига ва бошқа агротехник тадбирларнинг тўғри ўтказилишига боғлиқдир.

Ўзбекистоннинг турли тупроқ-иқлим шароитларида ўтказилган тажрибаларни кўрсатишича, энг юқори қўшимча пахта ҳосили азот, фосфор ва калийни 1:0,7:0,5 нисбатда қўлланилганда олинди. Ваҳоланки, маъдан ўғитларнинг ҳатто шу нисбатларида сурункали қўлланилганда пахта ҳосилини доимо ҳам ошмаслиги айрим ҳолларда эса камайиб бориши кузатилади.

Ш.Ш.Ташмухамедовнинг (1982) илмий изланишларида, ўзани мақбул ўсиши, ривожланиш ва ҳосил тўплаши калийли ўғитларни гектарига 150 кг меъёрдa қўлланилган бўлиб, қўшимча ҳосил 10,1 центнерга етган.

Таъкидлаб ўтаминизки, ўзани алмашлаб экишда, бедадан кейинги 3 йил давомида, маккажўхори, оралик экинлардан кейин қўлланиладиган маъдан ўғитларни самарали меъёрлари аниқланган. Лекин, кузги буғдойдан кейин такрорий экинларни экиб, улар қолдирган анғиз ва илдиз қолдиқларига

боғлиқ ҳолда ғўзани ўғитлаш борасидаги илмий изланишлар етарли эмас, қолаверса Фарғона водийсининг тупроқ-иқлим шароитларида бу борадаги илмий изланишлар олиб борилмаганки, бу ўрганилаётган масалани долзарблигини кўрсатади.

Кузги буғдойдан сўнг такрорий экинлардан маккажўхори, ловия ва соя экиб, уларни қолдирган анғиз ва илдиз қолдиқларига боғлиқ ҳолда ғўзада маъдан ўғитларни мақбул меъёрларини аниқлаш мақсадида Фарғона водийсининг ўтлоқи бўз ва оч тусли бўз тупроқлари шароитида дала тажрибалари ўтказилиб, алмашлаб экиш тизими 1:1 бўлган ҳолда, 2 йилда уч экин ҳосилини олишга эришилди. Бунинг учун ҳар йили кузги буғдой янги далага экилиб, сўнггра такрорий экинлар ва улардан сўнг ғўза экилди, 1-далада ғўза экилган йили 2-далада кузги буғдой экилди ва ҳакозо.

1-жадвалда тажриба далаларининг тупроғини дастлабки агрокимёвий хусусиятлари келтирилган бўлиб, ўтлоқи бўз тупроқларда озуқа унсурларини ҳаракатчан миқдорлари ўртача таъминланганга яқин (изланиш далалари бўйича), оч тусли бўз тупроқларда эса кам таъминланганлиги кўринади.

1-жадвал

Кузги буғдойни экишдан аввал тупроқларни (0-30 см) дастлабки агрокимёвий хусусиятлари, дон ва сомон ҳосиллари ҳамда анғиз ва илдиз қолдиқларининг миқдори

Кўрсаткичлар	Ўтлоқи бўз тупроқларда			Оч тусли бўз тупроқларда		
	1-дала	2-дала	3-дала	1-дала	2-дала	3-дала
	2015-2016	2016-2017	2017-2018	2015-2016	2016-2017	2017-2018
Чиринди, %	1,28/0,85	1,30/0,820	1,36/0,910	0,766/0,250	0,760/0,280	0,760/0,210
Азот, %	0,120/0,105	0,13/0,120	0,135/0,110	0,064/0,32	0,070/0,38	0,70/0,40
Фосфор, %	0,79/0,60	0,80/0,70	0,85/0,05	0,135/0,100	0,138/0,98	1,340/0,110
Калий, %	-	-	-	1,88	1,90	1,85
N-NO₃ мг/кг	22,3/9,5	23,5/10,1	25,3/12,1	8,21/5,6	9,25/5,8	8,90/6,1
P₂O₅ мг/кг	25,2/12,1	26,1/13,1	27,1/14,2	13,2/5,1	14,1/6,8	13,2/7,1
K₂O мг/кг	228/120	230/120	222/130	202/90	200/85	210/95
Буғдойни дон ҳосили, ц/га	64,1	63,8	65,2	48,4	50,4	52,3
Сомон ҳосили, ц/га	70,4	72,3	73,5	59,7	60,8	60,3
Анғиз қолдиқлари, ц/га	14,0	14,5	15,1	12,5	12,2	10,9
Илдиз қолдиқлари, ц/га	18,1	19,0	19,8	16,1	16,0	16,8

Эслатма: суратда 0-30 см-----30-50 см тупроқ қатламлари.

Изланиш йиллари ўтлоқи бўз тупроқларда кузги буғдойдан ва сомон ҳосиллари тажриба далаларига мутаносиб равишда 64,1-70,4; 63,8-72,3 ва 65,2-73,5 ц/гани, оч тусли бўз тупроқлар шароитида эса 48,1-59,7; 50,4-60,8; 52,3-60,3 ц/га ни ташкил қилди.

Демак, оч тусли бўз тупроқлар шароитида, кузги буғдойда қўлланилган ўғитлардан N-200, P₂O₅-350, K₂O-50 кг меъёрларидан ўтлоқи бўз тупроқларга нисбатан дон ва сомон ҳосили мутансиб равишда 16,0-10,7; 13,4-11,5 ва 13,1-13,2 ц/га камроқ кўрсаткичлар олинди. Кузги буғдойни қолдирган анғиз ва илдиз қолдиқлари тажриба далалари бўйича мутаносиб равишда 14,0-18,1; 14,5-19,0; 15,1-19,8 ц/га (ўтлоқи бўзда), 12,5-16,1; 12,2-16,0; 10,9-16,8 ц/га (оч тусли бўзда)ни ташкил қилдики, бу кўрсаткичлар таъсирида ундан кейин экиладиган такрорий экинларни ўсиши ва ривожланишида ўз таъсирини кўрсатди.

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ПАТОМОРФОЛОГИЧЕСКИЕ МЕХАНИЗМЫ ФОРМИРОВАНИЯ ДИСФУНКЦИИ ПЛАЦЕНТЫ ПРИ ЭНДОМЕТРИОЗЕ

Аннотация: Эндометриоз является одним из наиболее распространённых гинекологических заболеваний, оказывающих существенное влияние на репродуктивное здоровье женщин. В последние годы всё больше внимания уделяется изучению влияния эндометриоза на течение беременности и состояние плаценты. Развитие плацентарной дисфункции при эндометриозе связано с нарушением процессов имплантации, ремоделирования спиральных артерий, ангиогенеза, а также с хроническим воспалением и иммунологическими изменениями. Данные патоморфологические изменения приводят к ухудшению маточно-плацентарного кровообращения, развитию гипоксии плода и повышению риска акушерских осложнений. В статье рассматриваются основные патоморфологические механизмы формирования дисфункции плаценты при эндометриозе, их роль в развитии осложнений беременности и возможные направления дальнейших исследований.

Ключевые слова: эндометриоз, плацентарная дисфункция, плацента, беременность, патоморфология, ангиогенез, воспаление, гипоксия, ремоделирование спиральных артерий, маточно-плацентарное кровообращение, акушерские осложнения.

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PATHOMORPHOLOGY MECHANISMS OF FORMATION OF PLACENTA DYSFUNCTION IN ENDOMETRIOSIS

Abstract: Endometriosis is one of the most common gynecological diseases, significantly impacting women's reproductive health. In recent years, increasing attention has been paid to the impact of endometriosis on pregnancy and placental health. The development of placental dysfunction in endometriosis is associated with impaired implantation, spiral artery remodeling, and angiogenesis, as well as chronic inflammation and immunological changes. These pathological changes lead to impaired uteroplacental circulation, fetal hypoxia, and an increased risk of obstetric complications. This article discusses the key pathological mechanisms underlying placental dysfunction in endometriosis, their role in the development of pregnancy complications, and potential areas for further research.

Key words: *endometriosis, placental dysfunction, placenta, pregnancy, pathomorphology, angiogenesis, inflammation, hypoxia, spiral artery remodeling, uteroplacental circulation, obstetric complications*

Введение:

Эндометриоз представляет собой хроническое эстрогензависимое заболевание, характеризующееся наличием ткани, сходной по структуре и функции с эндометрием, за пределами полости матки. Частота заболевания среди женщин репродуктивного возраста достигает 10–15 %, а среди пациенток с бесплодием может превышать 30–50 %. Несмотря на значительные успехи в диагностике и лечении эндометриоза, механизмы его влияния на течение беременности и состояние плаценты остаются предметом активных научных исследований.

Плацента играет ключевую роль в обеспечении нормального роста и развития плода. Нарушения её структуры и функций могут приводить к развитию плацентарной недостаточности, задержке роста плода, преэклампсии и преждевременным родам. У женщин с эндометриозом отмечается повышенный риск данных осложнений, что свидетельствует о существовании тесной взаимосвязи между патологическими процессами при эндометриозе и формированием плацентарной дисфункции.

Целью данной статьи является анализ современных представлений о патоморфологических механизмах формирования дисфункции плаценты при эндометриозе.

Анализ литературы и методология исследования

Эндометриоз рассматривается как хроническое воспалительное заболевание, оказывающее значительное влияние не только на репродуктивную функцию женщины, но и на течение беременности. В последние годы многочисленные исследования подтверждают связь эндометриоза с повышенным риском развития плацентарной дисфункции, преэклампсии, задержки роста плода и преждевременных родов.

Согласно современным представлениям, одним из ключевых механизмов формирования плацентарной дисфункции при эндометриозе является нарушение процесса децидуализации эндометрия и инвазии трофобласта. Как отмечают Vercellini и соавт., хроническое воспаление и изменения иммунного микроокружения матки приводят к нарушению имплантации и неполному ремоделированию спиральных артерий, что ухудшает маточно-плацентарный кровоток.

По данным исследования Brosens et al., у пациенток с эндометриозом выявляются структурные изменения соединительной ткани эндометрия и миометрия, способствующие развитию так называемого синдрома дефектной плацентации. Авторы подчеркивают, что данные изменения могут быть причиной развития преэклампсии и фетоплацентарной недостаточности. В работе Lalani et al. установлено, что беременные женщины с эндометриозом имеют более высокий риск преждевременных

родов, плацентарной недостаточности и рождения детей с низкой массой тела по сравнению с общей популяцией. Авторы связывают данные осложнения с нарушением ангиогенеза и хронической гипоксией тканей.

Особое внимание уделяется роли провоспалительных цитокинов. Исследования показали, что у пациенток с эндометриозом наблюдается повышенная экспрессия интерлейкинов IL-1 β , IL-6, IL-8 и фактора некроза опухоли α (TNF- α), которые способны нарушать нормальное развитие плаценты и процессы васкуляризации. Кроме того, дисбаланс между проангиогенными и антиангиогенными факторами способствует формированию сосудистых нарушений в плаценте. Таким образом, анализ литературных данных свидетельствует о том, что эндометриоз является значимым фактором риска развития плацентарной дисфункции. Основными патоморфологическими механизмами выступают хроническое воспаление, нарушения ангиогенеза, дефекты ремоделирования спиральных артерий, иммунологические расстройства и хроническая тканевая гипоксия.

Настоящее исследование выполнено в формате аналитического обзора научной литературы, посвященной изучению патоморфологических механизмов формирования дисфункции плаценты при эндометриозе.

Для анализа были использованы публикации отечественных и зарубежных авторов, представленные в международных научных базах данных: PubMed, Scopus, Web of Science и Google Scholar. Поиск научных источников проводился по ключевым словам: «эндометриоз», «плацентарная дисфункция», «патоморфология плаценты», «ангиогенез», «эндотелиальная дисфункция», «беременность при эндометриозе», «фетоплацентарная недостаточность».

Критериями включения являлись:

- публикации за последние 10–15 лет;
- оригинальные исследования, систематические обзоры и метаанализы;
- статьи, посвященные морфологическим и патогенетическим аспектам поражения плаценты при эндометриозе;
- публикации на русском и английском языках.

Критериями исключения являлись:

- дублирующиеся публикации;
- исследования с недостаточным объемом данных;
- работы, не содержащие информации о морфологических изменениях плаценты.

Анализ литературных источников проводился с использованием методов сравнительного, системного и контент-анализа. Полученные данные были систематизированы по основным патогенетическим направлениям: нарушения инвазии трофобласта, ремоделирования спиральных артерий, процессов ангиогенеза, иммуновоспалительных реакций и морфологических изменений плацентарной ткани.

Результаты и обсуждение

Проведённый анализ научной литературы показал, что эндометриоз оказывает существенное влияние на процессы формирования и функционирования плаценты во время беременности. Установлено, что развитие плацентарной дисфункции у женщин с эндометриозом обусловлено комплексом взаимосвязанных патоморфологических и молекулярно-биологических изменений.

Одним из основных механизмов является нарушение процессов имплантации и инвазии трофобласта. Хроническое воспаление, характерное для эндометриоза, сопровождается повышенной продукцией провоспалительных цитокинов и факторов роста, что приводит к неполному ремоделированию спиральных артерий матки. В результате снижается эффективность маточно-плацентарного кровообращения и ухудшается поступление кислорода и питательных веществ к плоду.

Анализ литературных данных также свидетельствует о наличии выраженных нарушений ангиогенеза. Изменение экспрессии сосудистого эндотелиального фактора роста (VEGF), плацентарного фактора роста (PlGF) и других регуляторов сосудистого развития способствует формированию структурно и функционально неполноценной сосудистой сети плаценты. Это создаёт предпосылки для развития хронической гипоксии плода и фетоплацентарной недостаточности.

Морфологические исследования плацент у пациенток с эндометриозом выявляют признаки сосудистых нарушений, очагового фиброза, инфарктов плаценты, дистрофических изменений ворсин хориона и признаков хронической плацентарной ишемии. Подобные изменения свидетельствуют о снижении компенсаторно-приспособительных возможностей плаценты и повышают риск развития акушерских осложнений.

Кроме того, важную роль играют иммунологические нарушения. Дисбаланс между провоспалительными и противовоспалительными факторами приводит к изменению взаимодействия между материнским организмом и трофобластом, что негативно отражается на процессах плацентации. Полученные данные подтверждают, что эндометриоз следует рассматривать как значимый фактор риска формирования плацентарной дисфункции.

Таким образом, результаты анализа свидетельствуют о многофакторном характере патогенеза плацентарной дисфункции при эндометриозе, включающем воспалительные, сосудистые, иммунологические и морфологические механизмы. Эндометриоз является важным патологическим состоянием, оказывающим негативное влияние на процессы формирования и функционирования плаценты. Основными патоморфологическими механизмами развития плацентарной дисфункции являются нарушения инвазии трофобласта, неполное ремоделирование спиральных артерий, расстройства ангиогенеза, хроническое воспаление и иммунологический дисбаланс.

Морфологические изменения плаценты проявляются нарушениями сосудистой архитектоники, фиброзом, ишемическими повреждениями и дистрофическими изменениями ворсинчатого аппарата. Эти процессы способствуют развитию фетоплацентарной недостаточности, задержки внутриутробного роста плода, преэклампсии и преждевременных родов.

Дальнейшее изучение патоморфологических особенностей плаценты при эндометриозе имеет важное значение для совершенствования методов ранней диагностики, профилактики и лечения осложнений беременности у данной категории пациенток. Полученные данные могут способствовать разработке новых подходов к прогнозированию неблагоприятных перинатальных исходов и улучшению качества акушерской помощи.

Заключение

Эндометриоз является одним из значимых факторов риска развития плацентарной дисфункции во время беременности. Проведённый анализ литературных данных показал, что в основе формирования плацентарных нарушений лежит комплекс патоморфологических изменений, включающий хроническое воспаление, нарушения ангиогенеза, неполное ремоделирование спиральных артерий и иммунологический дисбаланс. Данные процессы приводят к структурным и функциональным изменениям плаценты, ухудшению маточно-плацентарного кровообращения и развитию хронической гипоксии плода.

Установлено, что у беременных женщин с эндометриозом значительно повышается риск развития фетоплацентарной недостаточности, задержки внутриутробного роста плода, преэклампсии и преждевременных родов. Морфологические изменения плаценты проявляются сосудистыми нарушениями, очагами фиброза, ишемическими повреждениями и дистрофическими изменениями ворсинчатого аппарата.

Таким образом, изучение патоморфологических механизмов формирования плацентарной дисфункции при эндометриозе имеет важное научное и практическое значение. Своевременное выявление факторов риска и углублённое понимание патогенетических механизмов могут способствовать совершенствованию методов диагностики, профилактики и ведения беременности у женщин с эндометриозом, что позволит улучшить показатели материнского и перинатального здоровья

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МАХАЛЛЯ КАК БАЗОВЫЙ УРОВЕНЬ СПОРТИВНО-ОЗДОРОВИТЕЛЬНОГО ЛАНДШАФТА. (НА ПРИМЕРЕ Г. ТАШКЕНТ)

Аннотация: в условиях интенсивной урбанизации и роста плотности жилой застройки особую актуальность приобретает проблема обеспечения населения доступной инфраструктурой для повседневной физической активности. Традиционно внимание исследователей и практиков сосредоточено на крупных городских парках и рекреационных комплексах, однако именно локальные пространства повседневного пользования оказывают наибольшее влияние на формирование здорового образа жизни населения. Целью настоящего исследования является определение роли махалли как базового элемента спортивно-оздоровительного ландшафта города Ташкента, анализ соответствия существующей среды нормативным требованиям и разработка проектных сценариев повышения физической активности населения на уровне жилых территорий. Методологическую основу составляют анализ градостроительных нормативов Республики Узбекистан, изучение государственных программ развития массового спорта, сравнительный анализ зарубежного опыта и концептуальное моделирование пространственных решений. В результате исследования выявлено, что эффективность спортивно-оздоровительной инфраструктуры определяется не только обеспеченностью площадями, но и доступностью объектов в пределах пешеходной досягаемости, качеством микроклимата и комфортом пребывания пользователей. Предложены проектные сценарии формирования махаллинского спортивно-ландшафтного каркаса, ориентированные на условия жаркого климата Ташкента.

Ключевые слова: махалля, спортивно-оздоровительное пространство, городская среда, физическая активность, ландшафтная архитектура, радиус обслуживания, активный образ жизни, Ташкент, реновация жилых территорий.

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THE MAHALLA AS A FUNDAMENTAL LEVEL OF SPORTS AND RECREATIONAL LANDSCAPE ORGANIZATION IN URBAN ENVIRONMENTS: THE CASE OF TASHKENT

Abstract: *The rapid urbanization of Tashkent and the increasing density of residential development necessitate the creation of accessible environments that promote everyday physical activity. While urban planning strategies traditionally emphasize large parks and city-scale recreational facilities, local neighborhood spaces often play a more significant role in shaping residents' daily health-related behaviors. This study examines the mahalla as the basic spatial unit of the sports and health landscape and evaluates its potential in supporting physical activity within walking distance from residential areas. The research is based on the analysis of urban planning regulations of the Republic of Uzbekistan, national policies on mass sports development, international approaches to active living, and conceptual design modeling. The study argues that the effectiveness of sports infrastructure depends not only on quantitative provision but also on accessibility, microclimatic comfort, and integration into everyday mobility patterns. Particular attention is paid to the normative service radius of 500 meters, the provision of sports facilities within residential neighborhoods, and the role of shaded public spaces under the hot climatic conditions of Tashkent. As a result, several design scenarios are proposed, including shaded walking loops, multifunctional active courtyards, green sports corridors, and community-based activity hubs. The findings demonstrate that neighborhood-scale sports and recreational environments can significantly enhance the level of physical activity and should become an essential component of urban renewal and residential development projects in Tashkent.*

Keywords: *mahalla, sports and health landscape, urban environment, physical activity, neighborhood planning, service radius, walkability, landscape architecture, active living, Tashkent, urban regeneration, public spaces.*

Введение

Современные тенденции развития городов демонстрируют устойчивую взаимосвязь между качеством городской среды и уровнем физической активности населения. По данным Всемирной организации здравоохранения, недостаточная физическая активность является одним из основных факторов риска развития хронических заболеваний и преждевременной смертности. В связи с этим формирование благоприятных условий для регулярных занятий спортом становится важной задачей градостроительной политики.

Для Республики Узбекистан данная проблема приобретает особое значение в контексте масштабных программ модернизации городской среды, развития массового спорта и совершенствования института махалли как базового социального элемента городской структуры. Государственная политика предусматривает создание сети доступных спортивных объектов, расширение инфраструктуры для занятий ходьбой, бегом, велоспортом, стритболом, бадминтоном и workout. Одновременно продолжаются процессы реновации жилых районов Ташкента, сопровождающиеся увеличением плотности застройки и ростом нагрузки на общественные пространства.

В этих условиях возникает необходимость переосмысления роли махалли как ключевого уровня организации спортивно-оздоровительного ландшафта. Если крупные парки выполняют преимущественно рекреационные функции периодического посещения, то ежедневная физическая активность населения формируется прежде всего в пространстве шаговой доступности от места проживания.

Махалля как планировочная и социальная единица

Махалля исторически является основным элементом социальной организации городской среды Узбекистана. Помимо функций общественного самоуправления, она представляет собой пространственную единицу, внутри которой формируются основные повседневные практики жителей.

С точки зрения градостроительства махалля соответствует масштабу жилой среды, обеспечивающему основные потребности населения в пределах коротких пешеходных перемещений. Именно здесь проходят маршруты ежедневного передвижения жителей к магазинам, образовательным учреждениям, остановкам общественного транспорта и местам отдыха.

Концепция «города пятнадцати минут», активно развиваемая в мировой практике, фактически подтверждает традиционную роль махалли как территории, где ключевые функции жизнедеятельности должны быть доступны без использования автомобиля. В этой связи спортивно-оздоровительная инфраструктура должна рассматриваться как обязательный компонент жилой среды.

Нормативный и политический контекст

Согласно действующим градостроительным нормативам Республики Узбекистан, радиус обслуживания объектов повседневного пользования в жилой застройке не должен превышать 500 метров. Кроме того, нормативные документы предусматривают обеспечение населения физкультурно-спортивными площадками из расчёта не менее 2,0 м² на одного жителя.

Развитие массового спорта определено одним из приоритетных направлений государственной политики. В стратегических документах особое внимание уделяется созданию условий для повседневной двигательной активности населения независимо от возраста и социального положения. Одной из задач является формирование сети открытых спортивных пространств с бесплатным доступом для населения.

Однако анализ существующей практики показывает, что количественное выполнение нормативов не всегда обеспечивает фактическое использование объектов. Нередко спортивные площадки располагаются в неблагоприятных микроклиматических условиях, лишены теневой защиты либо имеют ограниченный набор функций.



Рисунок №1

Спортивные площадки без затенения в условиях жаркого климата снижают интенсивность использования пространства в дневное время

Пространственные проблемы махаллей Ташкента

Современная трансформация городской среды Ташкента сопровождается рядом проблем, влияющих на физическую активность населения.

Во-первых, наблюдается сокращение свободных внутриквартальных территорий вследствие уплотнения жилой застройки.

Во-вторых, многие существующие спортивные площадки проектировались без учёта особенностей жаркого климата. В летний период температура покрытия может достигать критических значений, что существенно ограничивает использование пространств в дневное время.

В-третьих, в новых жилых комплексах приоритет часто отдаётся парковочным зонам и коммерческим функциям, тогда как спортивно-рекреационные пространства рассматриваются как второстепенный элемент благоустройства.

В результате формируется ситуация, при которой наличие крупных городских парков не компенсирует недостаток доступных пространств ежедневной физической активности на уровне жилого района.

Проектные сценарии формирования спортивно-оздоровительного ландшафта махалли

Сценарий 1. Теневые walking loops

Основой сценария является создание непрерывных прогулочных маршрутов протяжённостью от 500 до 1500 метров внутри жилых районов.

Ключевыми элементами являются:

- двухрядные посадки деревьев;
- теневые навесы;
- питьевые фонтанчики;
- зоны кратковременного отдыха;
- вечернее освещение;

- навигационные элементы с указанием дистанции.

Такие маршруты ориентированы прежде всего на пожилых жителей, женщин и семьи с детьми.



Сценарий 2. Multifunctional Active Yard

Концепция предусматривает трансформацию традиционного дворового пространства в многофункциональный спортивно-рекреационный узел.

В состав входят:

- workout-зона;
- площадка для стритбола;
- пространство для бадминтона;
- детская игровая зона;
- озеленённые участки отдыха.

Модульная структура позволяет адаптировать решения к различной плотности застройки.



Сценарий 3. Зелёные спортивные коридоры

Сценарий предполагает объединение отдельных площадок в единую сеть посредством озеленённых пешеходных маршрутов.

Такая система обеспечивает:

- непрерывность передвижения;
- повышение безопасности;
- улучшение микроклимата;
- формирование экологического каркаса жилого района.



Сценарий 4. Активная махаллинская площадь

В центральной части махалли формируется общественное пространство, предназначенное для проведения спортивных мероприятий, занятий гимнастикой, танцами и общественных мероприятий.

Пространство может использоваться различными возрастными группами в течение всего дня.



Результаты исследования показывают, что приоритетным направлением развития спортивно-оздоровительной инфраструктуры должно стать создание сети малых пространств повседневного пользования. Практика проектирования демонстрирует, что доступность объектов в пределах 5–10 минут пешком оказывает большее влияние на уровень физической активности населения, чем наличие удалённых крупных парков.

Поэтому проекты реновации и новые жилые комплексы должны включать обязательный спортивно-ландшафтный слой, состоящий из взаимосвязанных прогулочных маршрутов, спортивных площадок и рекреационных зон. Особое значение для климатических условий Ташкента имеют мероприятия по затенению пространств, использованию устойчивых древесных пород и созданию благоприятного микроклимата.

Заключение

Махалля представляет собой базовый уровень формирования спортивно-оздоровительного ландшафта современного города. Проведённый анализ показывает, что эффективность городской спортивной инфраструктуры определяется не только количеством объектов, но и их пространственной доступностью, комфортом использования и интеграцией в повседневную жизнь населения.

Для Ташкента ключевой задачей становится переход от модели точечного размещения спортивных объектов к созданию непрерывной системы махаллинских спортивно-рекреационных пространств. Предложенные проектные сценарии могут быть использованы при разработке программ реновации существующих районов и проектировании новых жилых комплексов. Их реализация позволит повысить уровень физической активности населения, улучшить качество городской среды и обеспечить устойчивое развитие спортивно-оздоровительного каркаса города.

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ПРОБЛЕМА МОТИВАЦИИ УЧИТЕЛЕЙ В ПРОФЕССИОНАЛЬНОЙ ДЕЯТЕЛЬНОСТИ

Аннотация: Мотивация учителя является ключевым фактором для процветания современного образования. Удовлетворенность трудом сказывается на эффективности профессиональной деятельности. Она побуждает к новым разновидностям и организации усовершенствованных типов отношений участников образовательного процесса для формирования нового педагогического опыта.

Ключевые слова: мотивация, школа, учитель, стимулирование учителей, проблемы в школе

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PROBLEMS OF MOTIVATION OF TEACHERS IN PROFESSIONAL ACTIVITY

Annotation: Teacher motivation is a key factor for modern education to flourish. Job satisfaction affects the effectiveness of professional activity. It encourages new varieties and the organization of improved types of relationships between participants in the educational process to form a new pedagogical experience.

Keywords: motivation, school, teacher, teacher incentive, problems at school

В современном мире идет постоянное обновление политических, экономических и технологических факторов. Это влияет на трудоспособность людей в профессиональном плане, зачастую уменьшая эффективность их деятельности.[3] В связи с этим администрация образовательных учреждений должны уделять особое внимание разработки и внедрению новых стратегий к стимулированию учительского состава. Существует несколько вариантов интерпретации термина «мотивация».

Немецкий философ Артур Шопенгауэр одним из первых под термином «мотивация» предположил причины поведения и процесс труда человека. Именно с помощью мотивации работодатель сможет удовлетворить

потребности учителя.[2] Если вспомнить пирамиду потребностей А. Маслоу, человек нуждается не только в физиологических потребностях и в безопасности, но и в социализации, уважении в обществе, самореализации, самовыражении и дальнейшем развитии. Так, с помощью мотивации, учитель реализует себя в профессиональной деятельности, создавая удобные условия для восполнения всех этих потребностей.

С. Г. Вершловский в своих трудах делает акцент на психологический аспект учителя. Синтез таких факторов как мотив, потребности, интерес, стремления и идеалы изначально влияют на выбор профессии, а в будущем являются мотиватором для усовершенствования своего педагогического опыта.[4] В результате, учитель будет получать удовлетворение от своей деятельности. Вершловский выделил определенную структуру мотивационной деятельности: гуманистическая, активно-познавательная, само актуализирующая, я-центрированная, ситуативная.

Учитывая данные интерпретации, характеристика мотивации учителя базируется на личностных качествах человека. Люди могут выполнять одинаковую работу по-разному, следовательно, важны причины, которые побудили их заниматься и развиваться в данной профессии. Также, мотивация может наступить неожиданно, благодаря динамичному преобразованию окружающего мира. Значит, руководству следует продумывать индивидуальную систему поощрения для учителей.

Основной функцией для мотивации является не только мотив, но и стимул. На федеральном уровне менеджеры в сфере образования используют разные виды стимулирования работников. Например, вознаграждения может побудить к усилению работоспособности человека, что поспособствует качественному достижению к цели. Существует множество классификаций стимулирования педагогического состава:

- Осознанные (развивать себя как творческая личность, самоутверждение в обществе и социальный успех, состязательность, стабильность) и не осознанные (создание атмосферы взаимного уважения и доверия, признание авторства результата, пропаганда достижений образовательных учреждений);
- Экономические (увеличение заработной платы, премия, система бальной системы стимулирующих, где выплачивают дополнительные выплаты учитывая достижения преподавателя) и неэкономические (моральные или социально-психологические);
- Прямые стимулы (премия, путевка, льготы, медицинский осмотр, экскурсия и тд) и косвенные (выбор нагрузки и классов, возможность выбрать график работы, дополнительные дни отпуска).[1]

Острой проблемой современности является отсутствие престижа профессии учителя и привлекательность его карьерного роста. В будущем это станет чревато дефициту значимых человеческих ресурсов, что поспособствует увеличению количества проблем в школьном образовании.

Сегодня молодежь не видит перспектив в профессиональной ориентации данной профессии. Сама система не способна привлечь новых специалистов в образование. Эту проблему решает Министерство образования и науки Российской Федерации. Оно устанавливает минимальные стандарты качеств будущего учителя (особенности педагогической деятельности и специфика учебного учреждения). К некоторым факторам будет относиться качественное выполнение работы, формирование ценностей, гармония в классе, удовлетворение информационной и материальной потребности. Также нужно привлекать к преподаванию тех, кто имеет призвание, либо сильное желание к реализации себя в данной деятельности.[5]

Школьники, уже на стадии выбора профессии, задумываются не только об удовлетворении своих предпочтений в творческой и карьерной сфере, но и о заработной плате. К сожалению, заработная плата учителей остается неудовлетворительной для большинства. Правительство РФ на федеральном уровне всячески пытается исправить данную ситуацию, повышая минимальную ставку оплаты труда. Каждый регион или муниципалитет стимулирует труд учителей различными дополнительными выплатами. Например, сейчас отдельно оплачивается классное руководство, дополнительные занятия с детьми-инвалидами, часы профориентационной деятельности, наличие призеров и победителей в олимпиадах или участие в конкурсах на уровне района, города или межрегиональном, категория учителей, которую нужно обновлять каждый три года, также влияет на заработную плату.[3]

Безопасность в школьных учреждениях, в том числе и антитеррористическая. Актуальная проблема в новом десятилетии ввиду событий в Казани и Керчи. Террористические акты показали небезопасность системы охраны в учебных учреждениях. Директор школы и специалист по охране труда должны обеспечить безопасности школьной территории. От них зависит жизни людей, что влияет на комфорт, психологическое и эмоциональное благополучие участников учебного процесса.

На эмоциональное и профессиональное состояние учителя влияет рабочее пространство. Сейчас в каждой школе задействованы определенные правила СанПиП, установленные Министерством образования и науки Российской Федерации. В данном документе обозначены критерии технологической оснащённости классного кабинета, эстетичный вид здания и его внутреннего интерьера, создающие чувство удовлетворения для работы. В функции администрации школы входит контроль за соблюдением стандартов и нормативов, установленных государственными органами.[4]

На региональном уровне специальными министерствами, департаментами образования и комитетами по образованию разрабатываются конкурсные программы для реализации творческих способностей учителей, финансирование повышения их квалификации и льгот.

Успех общеобразовательных учреждений зависит от многих факторов, важным является не только работа учителей, но и работа государственных и муниципальных органов в сфере образования. Исходя из нашего исследования, были выявлены некоторые проблемы мотивации учителей в современной школе. На его работу влияет множество внутренних и внешних факторов: атмосфера в учебном заведении как внешняя, так и эмоционально-психологическая, соблюдение нормативной структуры и т.д. [2] Особенно важным является менеджмент с правильной организации условий труда, отношение руководителей, проявление лидерских качеств руководства школы. Учителя стремятся к профессиональной свободе, настаивая на принятии в обществе ценностей и уникальности их профессии.

Желание работать эффективно и успешно не только учительскому составу, но и вышестоящим органам станет решением проблем по цепочке. Сначала, будет решена проблема качество обучения педагогов, заработная плата. Позже, появится перспектива идти работать и развиваться в данной сфере. Так, будет закрыт вопрос кадрового голодания. Следовательно, в обществе появится престиж к данной профессии и будет изменено отношения к учителям.

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МОТИВАЦИЯ ИННОВАЦИОННОЙ ДЕЯТЕЛЬНОСТИ В СФЕРЕ ОБРАЗОВАНИЯ

Аннотация: Статья разбирает новые механизмы, которые могут помочь педагогам в инновационных процессах. На основе теоретического анализа выделены типы мотивов инновационной деятельности. Особое внимание уделено взаимосвязи мотивации и профессиональной деятельности педагогов.

Ключевые слова: мотивация, инновационная деятельность, педагогические кадры, образование, стимулирование.

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MOTIVATION FOR INNOVATION IN EDUCATION

Abstract: The paper breaks down new mechanisms that can help educators in innovative processes. Based on theoretical analysis, the types of motives for innovation are identified. Particular attention is paid to the relationship between motivation and professional activities of teachers.

Key words: motivation, innovative activity, teaching staff, education, stimulation.

Проблема мотивации к инновационной деятельности в образовательных учреждениях появилась не так давно, поэтому является малоизученной на данный момент. В современных условиях, тенденции демократии в обществе, усложняются систему образования. У педагога больше возможностей креативно мыслить, применять нестандартные подходы или новшества. При использовании инноваций создаются условия для эффективного образовательного процесса и внедряются новые технологические образовательные проекты. При решении данных задач встает проблема о системе мотивации инновационной деятельности педагогов в сфере образования.

Российская система образования ориентирована на инновационные пути развития. Инновационная деятельность педагога базируется на некоторых мотивах.

1. Материально вознаграждение за нововведения. К данному стимулу относится денежное вознаграждение, улучшение условий труда, повышение квалификации и т.д.

2. Профессиональные мотивы. Введение инновационных форм и методов работы позволяют переосмыслить и создать собственные концепции по обучению детей. Данные мотивы повысят качество образования.

3. Мотивы личной самореализации, которые вытекают в реализацию творческого потенциала человека. Творческие люди имеют высокий уровень восприимчивости новшеств, потребность в создании нового видения форм педагогической деятельности.

4. Креативность выражающая в творческом потенциале является одним из мотивов инновационной деятельности педагога. Она осуществляется в процессе накопления и реализации опыта педагога. Педагог сначала учится копировать готовые методические рекомендации. Далее, в процессе накопленного опыта - вносит собственные методические приемы. Высшей стадией раскрытия творческого потенциала в педагогической деятельности будет являться создание своей концепции методики обучения и воспитания.

Любой руководитель образовательной организации ставит перед собой цель совершенствования и разработки таких технологий и методов, которые воспитают в личности готовность к самореализации и стремлению к самосовершенствованию в стремительно меняющемся мире. Рычагом для достижения данной цели является педагогический коллектив. Влияя на него, руководитель сможет развивать систему образования, эффективного управления ей, гарантировать его качество.

Педагог не всегда обладает инновационным потенциалом или понимание правильного применения своих новшеств. В этом случае на помощь педагогу приходит менеджер. Как руководитель, он должен придерживаться некоторыми правилами для стимулирования инновационной деятельности педагога:

1. Предоставление всех условий, свободу и самостоятельность для инициативы и творческой деятельности учителя.

2. Оценивать творческую инициативу в индивидуальном порядке, а не сравнивать с методиками других преподавателей.

3. Перед предоставлением задачи, нужно мотивировать педагога на прогнозирование ситуации, умения влиять на неё, трансформировать на непосредственный интерес к успеху. Нужно показать заинтересованность руководителя в успехе работника.

При организации инновационного процесса вся ответственность ложиться на руководителя. Он должен заниматься организацией: определить направления развития и собрать команду единомышленников. В мотивационный этап входит мотивация для педагогического состава, разработка идей развития школы. Этап рефлексии оценивает результат

работы и даёт рекомендации для усовершенствования последующих управленческих действий.

Существует несколько компонентов управления. В первую очередь, управление базируется на локальных актах с помощью которых идет развитие школ. Так, коллектив сможет подготовиться к инновационным программам. Для организации инноваций в школе необходимо оснащение специальным оборудованием кабинетов, лабораторий и технопарков. Данные площадки будут служить главным ресурсом для экспериментов и интеграции знаний.

Внедрение цифровых инструментов управления повышают эффективность работы и отвечают требованиям современности. С помощью них можно учитывать количественные показатели, качество, уровень новизны и практическую значимость разработок.

Менеджеры могут выделить новый виток мотивационной деятельности школьников, способствующий дальнейшему их развитию. Для самореализации, подросткам нужно давать полную свободу в проектной деятельности, участие в хакатонах, стартапах и программах акселерации. Комбинированная работа междисциплинарных команд способствуют созданию новых идей. Они дополняют друг друга, создавая новое. Подростки - неиссякаемый источник новых идей, реализация которых способствуют новшествам. Администрация школы должны учитывать это в своей работе.

Руководителю необходимо поощрять культуру открытости и готовность к риску. Отсутствие боязни санкций в случае неудачи поможет участникам на психологическом уровне. Внутренние мотивы всегда важны для повышения любознательности и раскрытию творческого потенциала.

С развитием цифровизации и появлением искусственного интеллекта продолжают развиваться способы мотивационной деятельности в инновации образования. Делегирование рутинных задач с помощью ИИ и новые интерактивные площадки дают возможности для выявления творческих способностей. Руководителю нужно делать акцент на решение актуальных проблем, чтобы обеспечить востребованный результат. Индустриальные партнёры помогут в формировании условий для обмена проектами, что повысит инновационную активность. При этом, нужно помнить, что главной целью для руководителя является не коммерциализация образования, а его развитие.

Таким образом, мотивация инновационной деятельности является разносторонней проблемой. Она заставляет внедрять новые педагогические технологии, цифровые платформы, преобразовывать организационные структуры и механизмы финансирования проектов. Для их решения требуется системный подход и междисциплинарное воздействие.

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ПОРАЖЕНИЕ ОПОРНО-ДВИГАТЕЛЬНОГО АППАРАТА ПРИ ХРОНИЧЕСКОМ БРУЦЕЛЛЕЗЕ

***Аннотация.** Бруцеллез остается одной из наиболее распространенных зоонозных инфекций в мире и представляет серьезную медико-социальную проблему в странах с развитым животноводством. Хронические формы заболевания характеризуются длительным рецидивирующим течением и развитием различных органных поражений. Одним из наиболее частых и клинически значимых проявлений хронического бруцеллеза является поражение опорно-двигательного аппарата. В статье представлен обзор современных данных о патогенезе, клинических проявлениях, диагностике и лечении остеоартикулярных форм хронического бруцеллеза.*

***Ключевые слова:** хронический бруцеллез, остеоартикулярный бруцеллез, спондилит, сакроилеит, артрит, опорно-двигательный аппарат.*

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OSTEOMUSCULAR INVOLVEMENT IN CHRONIC BRUCELLOSIS

***Abstract.** Brucellosis remains one of the most widespread zoonotic infections worldwide and continues to represent a significant public health challenge, particularly in regions with developed livestock farming. Chronic forms of the disease are characterized by prolonged recurrent courses and the development of various organ complications. Osteoarticular involvement is among the most common and clinically significant manifestations of chronic brucellosis. This review article presents current data on the pathogenesis, clinical manifestations, diagnosis, and treatment of osteoarticular forms of chronic brucellosis.*

***Keywords:** chronic brucellosis, osteoarticular brucellosis, spondylitis, sacroiliitis, arthritis, musculoskeletal system.*

Введение

Бруцеллез относится к широко распространенным бактериальным зоонозам, вызываемым микроорганизмами рода *Brucella*. Несмотря на успехи современной медицины, заболевание продолжает регистрироваться более чем в 170 странах мира, ежегодно поражая свыше 500 тысяч человек [1]. Наиболее эндемичными регионами остаются страны Средиземноморья, Ближнего Востока, Центральной Азии, Латинской Америки и Африки [2].

Особенностью бруцеллезной инфекции является способность возбудителя длительно персистировать внутри клеток макрофагальной системы, что способствует хронизации процесса и развитию различных осложнений [3]. Среди органических поражений при хроническом бруцеллезе особое место занимают изменения со стороны опорно-двигательного аппарата, встречающиеся у 20–60 % пациентов [4].

Бруцеллы обладают способностью проникать внутрь макрофагов и длительное время сохраняться в тканях, избегая иммунного уничтожения [5]. В процессе хронического воспаления активируются макрофаги, Т-лимфоциты и провоспалительные цитокины, включая фактор некроза опухоли- α , интерлейкины-1 и -6. Это приводит к повреждению суставного хряща, костной ткани и связочного аппарата [3]. Гематогенное распространение возбудителя способствует формированию воспалительных очагов в костях и суставах, что клинически проявляется развитием артритов, сакроилеитов и спондилитов [6]. Остеоартикулярный бруцеллез считается наиболее частым осложнением хронической инфекции. Клинические проявления могут варьировать от умеренных артралгий до тяжелых деструктивных поражений позвоночника.

Артралгии и артриты

Наиболее распространенным симптомом являются боли в суставах различной интенсивности. Артралгии часто носят мигрирующий характер и усиливаются при физической нагрузке [4]. Бруцеллезный артрит преимущественно поражает крупные суставы: коленные, тазобедренные и голеностопные. Обычно наблюдается асимметричное поражение с умеренными воспалительными изменениями и ограничением подвижности [7].

Сакроилеит

Воспаление крестцово-подвздошных сочленений сопровождается болями в пояснично-крестцовой области, усиливающимися при движении и физической нагрузке [6]. Диагностика сакроилеита основывается на данных компьютерной и магнитно-резонансной томографии, которые позволяют выявлять воспалительные изменения на ранних стадиях заболевания [5].

Бруцеллезный спондилит

Наиболее тяжелой формой поражения опорно-двигательного аппарата является бруцеллезный спондилит. Патологический процесс чаще локализуется в поясничном отделе позвоночника и сопровождается разрушением межпозвоночных дисков и тел позвонков [8]. Клинически

заболевание проявляется выраженным болевым синдромом, ограничением подвижности позвоночника и неврологическими осложнениями при компрессии нервных структур [2].

Диагностика хронического бруцеллеза требует комплексного подхода

Важное значение имеют эпидемиологический анамнез, клинические данные и результаты лабораторных исследований [1]. Серологическая диагностика включает реакцию агглютинации Райта, реакцию Хеддельсона, ИФА и определение специфических IgG и IgM антител [3].

Для оценки степени поражения костно-суставной системы используются: рентгенография; компьютерная томография; магнитно-резонансная томография; ультразвуковое исследование суставов. МРТ считается наиболее информативным методом выявления ранних воспалительных изменений позвоночника и крестцово-подвздошных суставов [8].

Лечение

Основой терапии хронического бруцеллеза является длительная комбинированная антибактериальная терапия. Согласно рекомендациям Всемирной организации здравоохранения, наиболее эффективной считается комбинация доксициклина и рифампицина в течение не менее 6 недель [2,9]. Для уменьшения воспалительных проявлений используются нестероидные противовоспалительные препараты и физиотерапевтические методы лечения [7,10]. При развитии выраженных деструктивных изменений позвоночника может потребоваться хирургическое вмешательство [8,11].

Заключение

Поражение опорно-двигательного аппарата является одним из наиболее частых и клинически значимых проявлений хронического бруцеллеза. Наиболее характерными формами являются артриты, сакроилеиты и спондилиты. Своевременная диагностика с использованием современных методов визуализации и адекватная антибактериальная терапия позволяют предотвратить развитие тяжелых осложнений и улучшить качество жизни пациентов.

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ДИДАКТИЧЕСКИЕ ИГРЫ КАК СРЕДСТВО ПОЗНАВАТЕЛЬНОГО РАЗВИТИЯ ДЕТЕЙ РАННЕГО ВОЗРАСТА

***Аннотация:** В данной статье рассматриваются некоторые аспекты дидактических игр как средство познавательного развития детей раннего возраста. Дидактическая игра, рассматривается важным средством, направленным на овладение детьми новыми знаниями и умениями, формирование сенсорных эталонов, освоение новых способов деятельности*

***Ключевые слова:** Дидактическая игра, ранний возраст, любознательность ребенка, особенности обучения детей, активная, содержательная и интересная для ребенка деятельность.*

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DIDACTIC GAMES AS A MEANS OF COGNITIVE DEVELOPMENT OF YOUNG CHILDREN

***Annotation:** This article discusses some aspects of didactic games as a means of cognitive development of young children. Didactic game is considered an important tool aimed at mastering children with new knowledge and skills, the formation of sensory standards, the development of new ways of activity.*

***Key words:** Didactic game, early age, child's curiosity, features of children's education, active, meaningful and interesting activity for the child.*

Ранний возраст — наиболее важный период первоначального познания детьми окружающей реальности, поскольку у ребенка формируются основы личностного и познавательного развития.

Любознательность ребенка отражает общее направление его развития и проявляется положительным отношением к явлениям окружающего мира, выражаясь в форме действенного интереса посредством вопросов (Н. Ф. Добрынин, А. И. Сорокина). Любознательность, как одна из первых форм познавательной активности ребенка, выражается в непосредственном интересе к занимательным явлениям, новым фактам; эмоционально позитивном переживании, которое ребенок получает с новой информацией; преимущественно практическом и чувственном отношении к действительности, ориентированности на внешний мир.

Одним из видов игр, которые используются с целью обучения детей, являются дидактические игры. Дидактическая игра, в силу своих особенностей обучения детей посредством активной, содержательной и

интересной для ребенка деятельности, рассматривается важным средством, направленным на овладение детьми новыми знаниями и умениями, формирование сенсорных эталонов, освоение новых способов деятельности (сравнение, различие, сопоставление, обобщение).

Успешность обучения ребенка в процессе дидактической игры во многом определяется его заинтересованностью. Поэтому в процессе проведения дидактических игр педагог, с одной стороны, должен учитывать индивидуальные способности и уровень имеющихся у ребенка знаний, создавая максимальные условия для перспективы его познавательного развития, а с другой, поддерживать доброжелательный, положительный эмоциональный настрой, атмосферу сотрудничества, создавать радостную обстановку, поощрять творческие способности ребенка, его фантазию.

Нами была разработана система дидактических игр для познавательного развития, которая в себя включала 3 основные позиции:

1. Отбор дидактических игр, влияющих на познавательное развитие;
2. Разработка перспективного плана по познавательному развитию на основе дидактических игр;
3. Обогащение предметно-пространственной развивающей среды группы раннего возраста.

Для решения данных задач был проведен анализ различных дидактических игр, в том числе, интерактивных, был составлен перечень игр, а также перспективный план работы в группах раннего возраста. Решение третьей позиции предполагало обогащение предметно-пространственной развивающей среды группы был оформлен уголок «В гостях у Игровичка», обеспечена последовательность и вариативность дидактических (настольных, словесных) игр, специальных лото и карточек.

Следует подчеркнуть, что целенаправленное и систематическое их использование способствует формированию у детей интереса к дидактическим играм, желания играть самостоятельно, друг с другом, педагогом; обеспечивает возможность самостоятельно действовать в определённой ситуации, с определёнными предметами, приобретать индивидуальный опыт познания; развивает сосредоточенность, внимание, последовательность действий, умение осмысливать правила и преодолевать трудности; развивает ощущения и восприятие, формирует представления, помогая усваивать нужные знания.

Использованные источники:

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ГИДРОЭКОЛОГИЧЕСКОЕ СОСТОЯНИЕ ОЗЁРНЫХ СИСТЕМ ДЕЛЬТЫ РЕКИ АМУДАРЬЯ В УСЛОВИЯХ ИЗМЕНЕНИЯ ВОДНОГО РЕЖИМА

***Аннотация.** В статье представлены результаты комплексного гидроэкологического обследования озёрных систем Южного Приаралья, расположенных в пределах дельты реки Амударья. Исследования проведены в рамках экспедиционного мониторинга в мае 2026 года и включали оценку современного состояния водных объектов, анализ водного питания, определение минерализации воды, оценку состояния прилегающих почв и анализ динамики площади водной поверхности по спутниковым данным Landsat за период 2016–2026 гг.*

***Ключевые слова.** Дельта реки Амударья, Приаралье, водно-болотные угодья, минерализация воды, гидрологический режим, спутниковый мониторинг, озёрные системы.*

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HYDROECOLOGICAL STATE OF LAKE SYSTEMS IN THE AMUDARYA RIVER DELTA UNDER CHANGING WATER REGIME

***Abstract.** This article presents the results of a comprehensive hydroecological survey of lake systems in the Southern Aral Sea region, located*

within the Amu Darya River Delta. The research was conducted as part of an expeditionary monitoring mission in May 2026 and included an assessment of the current state of water bodies, an analysis of water recharge, a determination of water mineralization, an assessment of the condition of adjacent soils, and an analysis of water surface area dynamics based on Landsat satellite data for the period 2016–2026.

Keywords: *Amu Darya River Delta, Aral Sea region, wetlands, water mineralization, hydrological regime, satellite monitoring, lake systems.*

Введение

Южное Приаралье, дельта реки Амударья, в пределах Муйнакского района Республики Каракалпакстан, на сегодняшний день представляет собой одну из наиболее пострадавших территорий в Центральной Азии. Здесь, на стыке водной и пустынной экосистем, наблюдается глубокий и продолжающийся экологический кризис, вызванный антропогенными факторами и климатическими изменениями. Регион является ключевой зоной внимания для экологов, гидрологов и международного сообщества, поскольку последствия разрушения природной среды в этом районе носят трансграничный и долговременный характер [1].

Основной причиной деградации Южного Приаралья является критическое сокращение водных ресурсов, поступающих в дельту Амударьи. За период с 2013 по 2024 год в Южное Приаралье поступило 44,15 км³ воды, что в среднем составляет 4,42 км³ в год. Годовая вариация, от критических 1,32 км³ (в 2018-2021 гг.) до 10,72 км³ (в 2017 году), отражается на гидрологической устойчивости и резко дестабилизирует водно-солевой режим водоёмов. Действующий режим водоснабжения приводит к деградации отдельных озёрных экосистем и ухудшению состояния биоразнообразия [2].

Многие озёра и водоёмы в дельте Амударьи находятся в стадии активного обмеления либо уже полностью высохли. Те, что сохраняются, питаются преимущественно коллекторно-дренажными водами и остатками речного стока, остающимися после удовлетворения нужд орошаемого земледелия. Такой способ поддержания уровня воды не обеспечивает стабильности, поскольку коллекторно-дренажные воды зачастую содержат высокий уровень минерализации, а их объёмы зависят от ирригационного цикла, а не от природных процессов. Вследствие этого наблюдаются резкое сокращение биологической продуктивности водоёмов и экосистем в целом, исчезновение тугайных лесов, вымирание тростниковых зарослей, снижение численности и видов флоры и фауны, включая редкие и эндемичные виды, утрата экосистемных функций, от водоочистки до поддержания климатического баланса [3].

Материалы и методы исследования

Экспедиционные исследования проведены на территории Республики Каракалпакстан в пределах основных водных объектов дельты Амударьи. В

ходе работ обследованы Междуреченское водохранилище, Муйнакский залив, озёра Рыбачье, Джылтырбас и система озёр Судочье.

Обеспечение водой озёрных систем Приаралья осуществляется управлением Амударьинских дельтовых ирригационных систем УП-РАДИС. Лимиты водозабора устанавливаются и утверждаются в соответствии с положением (Постановление Кабинета Министров Республики Узбекистан, от 19.03.2013 г. № 82) в зависимости от водности года.

Первый маршрут: Залив Рыбачье (озеро Сарыбас). Залив Рыбачье расположен в северо-западной части бывшей акватории Аральского моря, на территории Республики Каракалпакстан. В административном отношении территория залива относится к Муйнакскому району Каракалпакстана и находится вблизи города Муйнак. Территория залива представляет собой переходную зону между водной экосистемой и засушливыми пустынными ландшафтами Приаралья. В залив Рыбачье вода поступает из Междуреченского водохранилища по каналу Марининузьяк (согласно замерам, минерализация 0,95-1 г/л). Минерализация воды в озере Рыбачье (со стороны аэропорта) равна 4,5-5 г/л. Для водоема, который питается за счет речной воды, учитывая испарение, минерализация воды в данном объекте считается слабо удовлетворительной, за счет малого притока и высокого уровня испарения минерализация воды в данном объекте высокая. Залив характеризуется мелководностью, значительной зависимостью от сезонных колебаний уровня воды и высокой степенью испарения.



Рис.1. Обследование территории Залива Рыбачье

На момент обследования 30-километрового участка дамбы, выявлены условия критического маловодья. В отличие от ситуации 2025 года, зеркало водохранилища практически полностью высохло, а его дно интенсивно зарастает тугайной растительностью. Обследование гидроузла «Маринкинузьяк» подтвердило, что попуски воды в озеро Рыбачье практически не осуществляются. Попуск воды из Междуреченского водохранилища в канал Маринкинузьяк в 2026 году осуществлялся только в течении 5-7 дней (февраль) с расходом до 11 м³/сек. Прибрежная территория представлена участками песчаных и солончаковых равнин, остаточными

тугайными комплексами и зонами с разреженной растительностью, адаптированной к условиям повышенной сухости и засоления.

Второй маршрут: Муйнакский залив расположен в пределах южной части бывшего Аральского моря. Залив находится в непосредственной близости от города Муйнак и представляет собой один из сохранившихся водоемов Приаралья, образовавшихся в результате трансформации акватории Аральского моря и проведения водохозяйственных мероприятий по поддержанию водности региона.



В Муйнакский залив вода поступает из Междуреченского водохранилища по каналу Муйнак (согласно замерам, минерализация 1-1,05 г/л). Минерализация воды равна 2,3-2,4 г/л. Для водоема, который питается за счет речной воды, учитывая испарение, минерализация воды в данном объекте считается хорошей по качеству. Мелиоративное состояние земель, прилегающих к Муйнакскому заливу, характеризуется высокой степенью засоления почв, подъем минерализованных грунтовых вод на отдельных участках. В непосредственной близости к водной акватории и в зонах периодического подтопления состояние почв несколько лучше благодаря частичному промывному режиму. В настоящее время пополняется только за счёт Муйнакского канала (за счёт вод Междуреченского водохранилища). Площадь озера за период 2016–2026 гг. сократилась с 1151 га до 320 га. Эти водоёмы создают своеобразный микроклимат в пределах города Муйнак и прилегающих территорий. Они увлажняют часть территорий, тем самым предотвращают или снижают соле-пыле перенос, а также вокруг водоёмов произрастают многолетние древесные насаждения. Ещё одним преимуществом является то, что эти территории используются местным населением в качестве пастбищных угодий для домашнего скота. Сохранение таких водоёмов является жизненно важным для поддержания социального благополучия в сложившихся климатических условиях.

Однако, кроме проблем, связанных с обеспечением водными ресурсами, в пределах изученной территории наблюдается угнетённое состояние растительности, выраженное в полной потере листовного покрова. Вероятно, имеет место повышение активности вредителей растений

(разновидность гусениц непарного шелкопряда). Подобная ситуация наблюдалась и вдоль «Рыбачьего», на лесопосадках, вдоль дорог Междуреченского водохранилища-Казахдарья и Каражар – Судочье.

Третий маршрут: Система Междуреченского водохранилища и Озеро Джилтырбас. Расположено в зоне дельты реки Амударьи и относится к числу крупных искусственных водоемов, созданных для регулирования водного режима, аккумуляирования водных ресурсов и обеспечения экологической устойчивости водно-болотных экосистем Приаралья. Водохранилище находится в междуречье дельтовых протоков Амударьи, что обусловило его название. Водоем играет важную роль в поддержании гидрологического режима прилегающих территорий, сохранении биоразнообразия и улучшении экологической обстановки региона.



Имеет ключевое значение в распределении водных ресурсов для хозяйственных нужд города Муйнак, посёлков Шеге, Кзылжар и ряда других населённых пунктов, находящихся в зоне ее влияния. Кроме того, из него предусмотрена подпитка Муйнакского и Рыбачьего заливов.

Площадь водного зеркала Междуреченского водохранилища, согласно проектным данным, составляет 36,0 тыс. га при полном наполнении. Вода в Междуреченское водохранилище поступает из реки Амударья. Согласно замерам, производимым в рамках экспедиции, минерализация воды в Междуреченском водохранилище равна 0,8-0,9 г/л. Для водоема, который питается за счет речной воды, учитывая испарение, минерализация воды в данном объекте считается очень хорошей. По результатам визуального обследования мелиоративное состояние почв в районе Междуреченского водохранилища можно оценить как удовлетворительное с отдельными участками, подверженными засолению. В непосредственной близости от водоема наблюдаются признаки повышенной влажности почвенного профиля, обусловленные фильтрационным воздействием водохранилища и относительно близким залеганием грунтовых вод. На отдельных участках отмечаются слабые проявления солевых отложений на поверхности, что

свидетельствует о развитии процессов подъема минерализованных грунтовых вод.

Озеро Джылтырбас - искусственно регулируемый водоём, расположенный в Муйнакском районе Республики Каракалпакстан, площадью 150 км². Средняя глубина водоёма составляет от 1 до 3 м. Ранее он представлял собой залив Аральского моря, после резкого падения уровня моря отделился от него и начал питаться водами реки Амударья. В последние годы были прорыты дополнительные оросительные каналы, которые помогают поддерживать уровень воды в водоёме. Почти весь водоём покрыт тростниковыми зарослями, создающими живописный ландшафт. В наиболее засушливые годы Жылтырбас практически полностью пересыхает, и большую часть года он представляет собой множество отдельных водных пространств. Он относительно труднодоступен, ближайший населённый пункт Казахдарья расположен в 30 км, но в период высокого стояния воды при объездах путь удлиняется до 80–90 км. В 2024 году озеро Жылтырбас было включено в список водно-болотных угодий международного значения Рамсарской конвенции, став пятым объектом от Узбекистана. Питание осуществляется через протоку Казахдарья и сбросных коллекторов КС-1 (по данным мелиор.экс ККР 320 млн.м³), КС-3(по данным мелиор.экс ККР 135 млн.м³). Согласно замерам, производимым в рамках экспедиции, минерализация воды в реке Казахдарья равна 1,2 г/л. Магистральный коллектор КС-1 имеет протяженность 136,3 км, проектная пропускная способность – 38,6 м³/с, подвешенная площадь 58,345 тыс.га, в среднем протекает 6,1 м³/с воды, фактическое состояние коллектора хорошее. Магистральный коллектор КС-3 имеет протяженность 118,7 км, проектная пропускная способность – 36 м³/с, подвешенная площадь 42,101 тыс.га, в среднем протекает 2,5 м³/с воды, фактическое состояние коллектора хорошее. В рамках экспедиции был произведен замер минерализации в коллекторе КС-1 при помощи портативного солемера «ProCheck». Минерализация в коллекторе КС-1 была равна 3 г/л.

Четвертый маршрут: Озерная система Судочье. Распределение водных ресурсов на экологические цели также осуществляется по остаточному принципу. Данный маршрут традиционно остается одним из наиболее сложных из-за заноса дорожных путей песчаными барханами. Озеро Судочье расположено в СГА «Бузатов» Муйнакского района Республики Каракалпакстан. Общая площадь системы озёр составляет около 50 000 га. В настоящее время, в результате уменьшения объема воды разделилось на 4 крупных бассейна – Акушпа, Большое Судочье, Каратерен и Бегдулла-Айдын.

Судочье выполняет важную экологическую функцию, обеспечивая сохранение водно-болотных экосистем, поддержание биоразнообразия, мест обитания водоплавающих птиц и регулирование локального гидрологического режима. Существенное влияние на процессы почвообразования оказывают колебания уровня воды в озерной системе,

близкое залегание грунтовых вод и высокая минерализация природных вод региона. Вместе с тем, по результатам экспедиции было отмечено, что из года в год площадь водной поверхности озёрной системы сокращается. Например, площадь водной поверхности Системы озёр «Судочье», согласно спутниковым снимкам сократилась с 26 050 га в 2016 году до 12 227 га в 2026 году. Это свидетельствует о том, что вопросы подачи воды в систему на должном уровне не обсуждаются. Отсутствует межведомственное взаимодействие в вопросах вододеления. В последние годы озёрная система пополняется только коллекторно - дренажными водами, что в свою очередь, в отсутствие поступления речной воды (по каналу Суенли вода до Судочьего на протяжении последних лет не подаётся) и интенсивном испарении, влияет на увеличение минерального состава озёрной воды.



Рис.3. Озерная система Судочье

Согласно данных мелиоративной экспедиции РКК вода в систему озер Судочье поступает по коллекторам Устюрт (80-83 млн.м³) и ККС (370-380 млн.м³). Однако каких-либо расчётов по объёмам необходимого количества воды, в том числе для поддержания солевого режима, в открытом доступе не найдено. Магистральный коллектор ККС имеет протяженность 82,7 км, проектная пропускная способность – 43,2 м³/с, подвешенная площадь 21,475 тыс.га, в среднем протекает 6,2 м³/с воды, фактическое состояние коллектора хорошее. Магистральный коллектор Устюрт имеет протяженность 69,3 км, проектная пропускная способность – 22 м³/с, подвешенная площадь 29,166 тыс.га, в среднем протекает 0,54 м³/с воды, фактическое состояние коллектора хорошее.

В рамках экспедиции был произведен замер минерализации в коллекторе ККС при помощи портативного солемера «ProCheck». Минерализация в коллекторе ККС была равна 4,6 г/л. По данным мелиоративной экспедиции минерализация в коллекторе Устюрт равна 3-3,5 г/л. Минерализация воды в Судочье равна 6-6,5 г/л. Для водоема, который питается за счет коллекторно-дренажной воды, учитывая испарение, минерализация воды в данном объекте считается не удовлетворительной, за

счет малого притока речной воды и испарения минерализация воды в данном объекте высокая. На фоне продолжающегося сокращения водной поверхности озёрной системы ранее осуществлялся значительный сброс воды через Бухарский канал. В период проведения экспедиционных исследований поступление воды по каналу не наблюдалось.

По результатам полевого обследования мелиоративное состояние почв в районе озёрной системы Судочье характеризуется как удовлетворительное с локальными участками неудовлетворительного состояния. В прибрежной зоне отмечается повышенная влажность почв, обусловленная непосредственным влиянием водоема и высоким уровнем грунтовых вод. На отдельных участках наблюдаются признаки гидроморфности почв, проявляющиеся в переувлажнении верхних горизонтов и развитии лугово-болотной растительности. По мере удаления от озер степень увлажнения снижается, а почвенный покров приобретает преимущественно песчаный и супесчаный характер.

Заключение

По результатам экспедиционного исследования были выявлены основные проблемы дельты реки Амударья:

- Критическое сокращение акваторий: за десятилетний период (2016–2026 гг.) общая площадь водной поверхности изученных озёрных систем Приаралья сократилась на 21,8% (с 44 459 га до 36 507 га), а дефицит по отношению к проектным показателям достиг 187 779 га. Основной причиной является резкое снижение притока коллекторно-дренажных, речных и канальных вод.

- Неэффективность санитарных попусков: несмотря на ежегодное установление МКВК лимитов на санитарный попуск (в 2026 году для Минводхоза Республики Каракалпакстан (РКК) квота составила 500 млн м³), речной сток в озера практически не поступает. Исключение в 2026 году составило лишь озеро Жылтырбас; остальные водоемы социального и экологического значения остаются обезвоженными.

- Прогрессирующее засоление: по причине дефицита пресного стока растет минерализация водоемов. Так, в озере Судочье зафиксирован рост минерализации с 5,5 г/л в 2016 году до 7,2–8,2 г/л в 2026 году. Дальнейшее отсутствие речного стока приведет к полной утрате экологической значимости данных объектов, включая их статус Рамсарских водно-болотных угодий международного значения.

- Потребительское отношение водопользователей: Текущая схема эксплуатации малоэффективна. В то время как обслуживание инфраструктуры возложено на Дельтовое управление Приаралья, озёрные системы эксплуатируются Комитетом рыбного хозяйства РКК. При этом рыбоводные хозяйства не осуществляют никаких финансовых вложений в поддержание водоемов, не несут ответственности за экологическое

состояние объектов и допускают ведение промысла браконьерскими методами.

- Мелиоративная состояние: в регионе ухудшается мелиоративное состояние почв под влиянием аридного климата, высокой испаряемости, близкого залегания грунтовых вод и усыхания Аральского моря. Повсеместно развиваются процессы вторичного засоления почв, растет минерализация грунтовых вод, фиксируются локальные очаги переувлажнения прибрежных зон.

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НЕОБХОДИМОСТЬ ЗНАНИЯ ИНОСТРАННОГО ЯЗЫКА ДЛЯ СТУДЕНТОВ НАПРАВЛЕНИЯ «ЭКОНОМИКА»

Аннотация: В статье рассматривается роль иностранного языка в профессиональной подготовке студентов направления «Экономика». Анализируются современные требования рынка труда, процессы глобализации экономики и международного сотрудничества, определяющие необходимость владения иностранными языками будущими экономистами. Особое внимание уделяется развитию профессиональной коммуникативной компетенции, использованию цифровых технологий в обучении и значению иностранного языка для академической и профессиональной мобильности студентов. Подчеркивается, что владение иностранным языком является важным фактором конкурентоспособности выпускников экономических специальностей.

Ключевые слова: иностранный язык, экономика, профессиональная компетенция, коммуникативная компетенция, глобализация, международное сотрудничество, рынок труда, профессиональная мобильность.

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NEED FOREIGN LANGUAGE KNOWLEDGE FOR STUDENTS MAJORING IN ECONOMICS

Abstract: The article examines the role of foreign language proficiency in the professional training of students majoring in Economics. It analyzes the current demands of the labor market, the processes of economic globalization, and international cooperation, which determine the necessity of foreign language competence for future economists. Special attention is paid to the development of professional communicative competence, the use of digital technologies in language education, and the importance of foreign language skills for students' academic and professional mobility. The study emphasizes that foreign language proficiency is a significant factor in enhancing the competitiveness of graduates in the field of Economics and increasing their opportunities for successful professional development in the global labor market.

Keywords: foreign language, economics, professional competence, communicative competence, globalization, international cooperation, labor market, professional mobility.

Введение

Современный этап развития мировой экономики характеризуется усилением процессов глобализации, цифровизации и международной интеграции. Экономические отношения между государствами становятся все более тесными, а международное сотрудничество охватывает практически все сферы деятельности. В этих условиях значительно возрастают требования к профессиональной подготовке специалистов экономического профиля.

Одним из важнейших факторов успешной профессиональной деятельности современного экономиста является владение иностранным языком. Сегодня иностранный язык перестал быть лишь средством межкультурного общения и превратился в необходимый инструмент профессиональной деятельности, позволяющий получать доступ к международным информационным ресурсам, участвовать в международных проектах и эффективно взаимодействовать с зарубежными партнерами.

В связи с этим возникает необходимость совершенствования языковой подготовки студентов экономических направлений в системе высшего образования.

Роль иностранного языка в профессиональной деятельности экономиста

В условиях глобализации мировой экономики и стремительного развития международных экономических отношений владение иностранным языком становится неотъемлемой составляющей профессиональной подготовки современного экономиста. Сегодня иностранный язык выступает не только средством межкультурного общения, но и важным инструментом профессиональной деятельности, обеспечивающим доступ к мировым информационным ресурсам, международным рынкам и передовым научным достижениям.

Современная экономика характеризуется высокой степенью международной интеграции. Компании активно сотрудничают с зарубежными партнерами, участвуют в международных инвестиционных проектах, экспортно-импортных операциях и глобальных финансовых процессах. В связи с этим специалисты экономического профиля должны обладать навыками профессионального общения на иностранном языке для эффективного взаимодействия с представителями различных стран и культур.

Особое значение иностранный язык имеет при работе с профессиональной документацией. Значительная часть экономической литературы, научных публикаций, аналитических обзоров, финансовых отчетов и нормативных документов публикуется на английском языке. Владение иностранным языком позволяет экономистам получать актуальную информацию из первоисточников, анализировать международный опыт и использовать современные подходы в своей профессиональной деятельности.

Кроме того, иностранный язык играет важную роль в развитии профессионально-коммуникативной компетенции будущих экономистов. Специалисты должны уметь вести деловую переписку, составлять коммерческие предложения, готовить аналитические отчеты, проводить презентации и участвовать в переговорах с зарубежными партнерами. Эти навыки становятся необходимыми в условиях международного бизнеса и глобального рынка труда.

Особую актуальность знание иностранного языка приобретает в сфере цифровой экономики. Современные экономисты работают с международными электронными платформами, финансовыми базами данных, аналитическими системами и программным обеспечением, большая часть которых функционирует на английском языке. Владение профессиональной терминологией позволяет эффективно использовать цифровые ресурсы и оперативно адаптироваться к изменениям в экономической среде.

Знание иностранного языка также способствует профессиональному и карьерному росту специалистов. Работодатели отдают предпочтение кандидатам, способным осуществлять международное сотрудничество, вести переговоры и представлять интересы организации на международном уровне. Владение английским и другими иностранными языками значительно расширяет возможности трудоустройства как в национальных, так и в международных компаниях, банках, финансовых учреждениях, консалтинговых агентствах и государственных организациях.

Важным аспектом является и академическая деятельность будущих экономистов. Иностранный язык открывает доступ к участию в международных конференциях, программах академической мобильности, зарубежных стажировках и научных исследованиях. Студенты получают возможность знакомиться с новейшими достижениями мировой экономической науки, обмениваться опытом с зарубежными коллегами и повышать уровень своей профессиональной подготовки.

В современных условиях особую роль играют цифровые технологии и искусственный интеллект, которые активно используются в экономике и образовании. Для эффективной работы с международными цифровыми платформами, системами анализа данных и инструментами искусственного интеллекта специалистам необходим высокий уровень владения иностранным языком. Это позволяет использовать современные технологические решения, расширять профессиональные компетенции и повышать эффективность своей деятельности.

Таким образом, иностранный язык является важнейшим инструментом профессиональной деятельности экономиста. Он обеспечивает доступ к мировым знаниям, способствует развитию профессиональных компетенций, расширяет возможности международного сотрудничества и повышает конкурентоспособность специалистов на современном рынке труда. В связи с этим качественная языковая подготовка студентов экономических

направлений должна рассматриваться как одно из приоритетных направлений развития высшего образования.

Иностранный язык как средство профессиональной коммуникации

Профессиональная деятельность экономиста предполагает активное взаимодействие с представителями различных организаций и стран. В связи с этим особую значимость приобретает развитие профессионально-коммуникативной компетенции студентов.

Под профессионально-коммуникативной компетенцией понимается способность эффективно использовать иностранный язык в различных профессиональных ситуациях. Она включает умение вести деловые переговоры, участвовать в международных конференциях, составлять финансовые отчеты, готовить аналитические материалы и осуществлять профессиональное общение в межкультурной среде.

Развитие данных навыков способствует успешной адаптации выпускников к современным требованиям рынка труда и повышает их профессиональную конкурентоспособность.

Влияние глобализации на языковую подготовку экономистов

Процессы глобализации оказывают существенное влияние на систему подготовки кадров в сфере экономики. Международная торговля, инвестиционная деятельность, развитие цифровой экономики и транснационального бизнеса требуют специалистов, способных эффективно работать в многоязычной и мультикультурной среде.

Современные компании все чаще ориентируются на международные рынки, что предполагает необходимость взаимодействия с иностранными клиентами и партнерами. В таких условиях владение иностранным языком становится обязательным условием успешной профессиональной деятельности.

Кроме того, международные экономические процессы требуют постоянного обновления знаний. Владение иностранным языком предоставляет возможность самостоятельно изучать зарубежный опыт и использовать лучшие мировые практики в профессиональной деятельности.

Использование цифровых технологий в изучении иностранного языка

Развитие информационно-коммуникационных технологий существенно изменило подходы к изучению иностранных языков. Современные цифровые платформы, онлайн-курсы, мобильные приложения и образовательные ресурсы создают новые возможности для совершенствования языковых навыков студентов.

Особое значение приобретают технологии искусственного интеллекта, которые позволяют персонализировать процесс обучения, анализировать уровень подготовки обучающихся и предоставлять индивидуальные рекомендации. Интеллектуальные образовательные платформы помогают

совершенствовать навыки чтения, письма, аудирования и говорения, а также изучать профессиональную терминологию экономической сферы.

Использование цифровых технологий способствует повышению мотивации студентов и делает процесс обучения более гибким и эффективным.

Значение иностранного языка для академической мобильности

Одним из важных преимуществ владения иностранным языком является возможность участия в программах академической мобильности. Многие зарубежные университеты предлагают студентам экономических направлений образовательные программы, стажировки и исследовательские проекты на английском языке.

Участие в международных образовательных программах позволяет студентам расширять профессиональный кругозор, знакомиться с современными методами исследования и приобретать опыт межкультурного взаимодействия. Такие возможности способствуют повышению качества профессиональной подготовки и формированию глобального мышления.

Кроме того, владение иностранным языком открывает доступ к международным научным конференциям, грантовым программам и образовательным ресурсам ведущих мировых университетов.

Иностранный язык как фактор конкурентоспособности на рынке труда

Современный рынок труда предъявляет высокие требования к уровню подготовки выпускников экономических специальностей. Работодатели заинтересованы в специалистах, способных эффективно взаимодействовать с международными партнерами и использовать зарубежный опыт в профессиональной деятельности.

Владение иностранным языком значительно расширяет возможности трудоустройства выпускников. Такие специалисты имеют больше шансов получить престижную работу в международных компаниях, финансовых учреждениях, консалтинговых организациях и государственных структурах, осуществляющих внешнеэкономическую деятельность.

Кроме того, знание иностранного языка способствует карьерному росту и повышению профессиональной мобильности специалистов.

Заключение

Таким образом, владение иностранным языком является неотъемлемой составляющей профессиональной подготовки студентов направления «Экономика». В современных условиях глобализации и цифровизации экономики иностранный язык выступает важным инструментом профессионального общения, получения новых знаний и развития международного сотрудничества.

Изучение иностранного языка способствует формированию профессионально-коммуникативной компетенции, повышению конкурентоспособности выпускников на рынке труда и расширению возможностей их академического и профессионального развития. В связи с

этим совершенствование языковой подготовки студентов экономических направлений должно рассматриваться как одно из приоритетных направлений развития современного высшего образования.

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МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ И АРХИТЕКТУРА ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ ПАРАЛЛЕЛЬНЫХ И РАСПРЕДЕЛЁННЫХ ВЫЧИСЛИТЕЛЬНЫХ ПРОЦЕССОВ В ВЫЧИСЛИТЕЛЬНЫХ КОМПЛЕКСАХ

Аннотация. В статье предложен интегральный подход к математическому моделированию параллельных и распределённых вычислительных процессов и обоснованию соответствующей архитектуры программного обеспечения. Вычислительные процессы формально описываются сетями Петри, алгеброй взаимодействующих последовательных процессов (CSP) и аппаратом теории массового обслуживания; теоретические пределы параллелизма определяются на основе законов Амдала и Густафсона. Ключевым научным результатом работы является вывод коммуникационно-зависимой модели ускорения: показано, что эффективная последовательная доля метрики Карна–Флэтта растёт логарифмически с числом процессоров, $f_{\text{eff}}(n) = f_0 + \gamma \cdot \log_2 n$, что объясняется логарифмической сложностью коллективных операций с древовидной топологией обмена. Регрессионный анализ экспериментальных данных подтверждает закон с коэффициентом детерминации $R^2 = 0,994$. На базе кластера из 768 физических ядер с интерконнектом InfiniBand HDR проведено тестирование эталонной задачи (трёхмерное уравнение диффузии) в конфигурациях от 1 до 128 процессоров. Предложенный алгоритм динамической балансировки нагрузки (DLB) на основе стратегии перехвата заданий повышает коэффициент ускорения на 34,7 %, доводит загрузку процессоров до 91,3 % и сокращает максимальное время ожидания на 74,6 % по сравнению со статическим распределением. Корректность синхронизации подтверждена анализом достижимости сети Петри; компромиссы согласованности и доступности распределённых систем проанализированы в рамках теоремы CAP и модели PACELC.

Ключевые слова: параллельные вычисления, распределённые системы, сети Петри, закон Амдала, закон Густафсона, метрика Карна–Флэтта, MPI, OpenMP, актёрная модель, микросервисы, балансировка нагрузки, теорема CAP, планирование процессов.

MATHEMATICAL MODELING AND SOFTWARE ARCHITECTURE FOR PARALLEL AND DISTRIBUTED COMPUTING PROCESSES IN COMPUTING SYSTEMS

Abstract. *This paper proposes an integral approach to the mathematical modeling of parallel and distributed computing processes and to the justification of the corresponding software architecture. Computing processes are formally described by Petri nets, the algebra of Communicating Sequential Processes (CSP), and queueing theory; the theoretical limits of parallelism are determined using Amdahl's and Gustafson's laws. The key scientific result is the derivation of a communication-aware speedup model: the effective serial fraction of the Karp–Flatt metric is shown to grow logarithmically with the number of processors, $f_{\text{eff}}(n) = f_0 + \gamma \cdot \log_2 n$, which is explained by the logarithmic complexity of collective operations with a tree-based communication topology. Regression analysis of the experimental data confirms this law with a coefficient of determination $R^2 = 0.994$. Using a cluster of 768 physical cores with an InfiniBand HDR interconnect, a benchmark problem (the three-dimensional diffusion equation) was tested in configurations from 1 to 128 processors. The proposed Dynamic Load Balancing (DLB) algorithm based on a work-stealing strategy increases the speedup coefficient by 34.7 %, raises processor utilization to 91.3 %, and reduces the maximum waiting time by 74.6 % compared with static allocation. The correctness of synchronization is confirmed by reachability analysis of the Petri net; consistency–availability trade-offs of distributed systems are analyzed within the CAP theorem and the PACELC model.*

Keywords: *parallel computing, distributed systems, Petri nets, Amdahl's law, Gustafson's law, Karp–Flatt metric, MPI, OpenMP, actor model, microservices, load balancing, CAP theorem, process scheduling.*

ВВЕДЕНИЕ

Сложность современных научных и инженерных задач существенно превзошла вычислительные возможности однопроцессорных систем. Численный прогноз погоды, анализ геномных последовательностей, обучение глубоких нейронных сетей и криптоанализ требуют выполнения миллиардов операций в единицу времени. Согласно списку TOP500 (ноябрь 2023 г.), наиболее производительный суперкомпьютер Frontier (Oak Ridge National Laboratory) достигает производительности 1,194 эксафлопс, объединяя 9 472 процессора AMD EPYC и 37 888 графических ускорителей [1].

Параллельные и распределённые вычисления представляют собой парадигму решения единой задачи посредством одновременного использования множества вычислительных ресурсов. Параллельные вычисления оперируют физически близкими процессорами с общей памятью (shared memory), тогда как распределённые вычисления охватывают автономные узлы, связанные сетью, с распределённой памятью (distributed memory) [2]. Без корректной математической модели и архитектурного основания обеих парадигм невозможно гарантировать эффективность, согласованность и отказоустойчивость системы.

В существующих исследованиях сети Петри применялись для моделирования параллельных процессов [3], алгебра процессов CSP — для формальной спецификации взаимодействий [4], а теория массового обслуживания — для оценки системных ресурсов [5], однако преимущественно по отдельности. Интегральный подход, объединяющий эти средства и доводящий анализ до конкретных рекомендаций по программной архитектуре вычислительного комплекса, в литературе представлен фрагментарно. Кроме того, классические законы Амдала и Густафсона трактуют последовательную долю программы как константу, что не отражает наблюдаемого на практике роста накладных расходов на межпроцессорный обмен по мере масштабирования.

Основной научный вклад работы состоит в следующем: (1) предложена и эмпирически подтверждена **коммуникационно-зависимая модель ускорения**, в которой эффективная последовательная доля возрастает логарифмически с числом процессоров, что обобщает закон Амдала; (2) разработан алгоритм динамической балансировки нагрузки (DLB) на основе перехвата заданий, согласованный с пределами Амдала/Густафсона; (3) формализованы математические основы актёрной модели и микросервисной архитектуры; (4) выполнен анализ масштабируемости и производительности гибридного подхода MPI + OpenMP.

МАТЕРИАЛЫ И МЕТОДЫ

Математическая модель параллельных вычислений

Вычислительный комплекс определяется как формальная структура

$$C = (P, M, N, \Sigma, \Phi) \quad (1)$$

где $P = \{p_1, p_2, \dots, p_n\}$ — множество из n процессорных узлов; $M = \{m_1, \dots, m_k\}$ — блоки общей памяти; N — сеть межпроцессорного взаимодействия; $\Sigma = \{\sigma_1, \dots, \sigma_l\}$ — упорядоченное множество вычислительных заданий; $\Phi : \Sigma \rightarrow P$ — функция назначения заданий процессорам. Параллельная программа представляется множеством из n процессов $\Pi = \{\pi_1, \dots, \pi_n\}$, каждый из которых состоит из последовательных шагов и точек синхронизации: $\pi_i = \langle s_{i1}, \dots, s_{im}, \text{sync}(B) \rangle$, где B — множество процессов, входящих в барьер.

Законы Амдала и Густафсона

Закон Амдала (1967) [6] задаёт предел параллельного ускорения:

$$S(n) = 1 / [(1 - p) + p/n] \quad (2)$$

где $S(n)$ — коэффициент ускорения на n процессорах; p — доля распараллеливаемой части ($0 \leq p \leq 1$). При $n \rightarrow \infty$ ускорение стремится к $S_{\max} = 1/(1 - p)$. Закон Густафсона–Барсиса (1988) [7], масштабируя размер задачи, преодолевает этот предел:

$$S_{\text{scaled}}(n) = n - \alpha(n - 1) = \alpha + \beta \cdot n \quad (3)$$

где α — доля последовательной части, $\beta = 1 - \alpha$ — доля параллельной части. Для учёта коммуникационных издержек используется метрика Карпа–Флэтта:

$$e(n) = (1/S - 1/n) / (1 - 1/n) = f_{\text{serial}} \quad (4)$$

где f_{serial} — экспериментально определяемая эффективная последовательная доля. Рост $e(n)$ с увеличением n свидетельствует о доминировании коммуникационных издержек.

Коммуникационно-зависимая модель ускорения (научная новизна)

Классические модели (2)–(3) предполагают постоянство последовательной доли, что противоречит наблюдаемому росту метрики Карпа–Флэтта. В настоящей работе предложена обобщённая модель, в которой эффективная последовательная доля является функцией числа процессоров. Исходное наблюдение: в задачах со стенсильной структурой межпроцессорный обмен реализуется коллективными операциями (MPI_Allreduce, MPI_Barrier) с древовидной (butterfly) топологией, латентность которых составляет $O(\log_2 n)$. Следовательно, вносимая ими последовательная компонента должна возрастать логарифмически. Формально постулируется закон

$$f_{\text{eff}}(n) = f_0 + \gamma \cdot \log_2 n \quad (5)$$

где f_0 — алгоритмическая (не зависящая от n) последовательная доля; γ — коэффициент коммуникационных издержек, определяемый топологией интерконнекта и протоколом обмена. Подстановка (5) в обобщённое выражение ускорения $S(n) = 1 / [e(n)(1 - 1/n) + 1/n]$ даёт коммуникационно-зависимую модель

$$S(n) = n / [1 + (n - 1)(f_0 + \gamma \cdot \log_2 n)] \quad (6)$$

В отличие от закона Амдала, модель (6) предсказывает не насыщение к константе, а наличие экстремума: существует оптимальное число процессоров n^* , при превышении которого ускорение убывает вследствие доминирования логарифмически растущих коммуникационных издержек. Дифференцирование (6) по n и приравнивание производной к нулю даёт условие оптимума n^* , что служит практическим критерием выбора конфигурации кластера. Эмпирическая проверка закона (5) и модели (6) приводится в разделе 3.1.

Моделирование сетями Петри

Параллельный вычислительный процесс моделируется сетью Петри $PN = (P, T, F, W, M_0)$, где P — множество позиций (состояний процесса); T — множество переходов (вычислительных операций); $F \subseteq (P \times T) \cup (T \times P)$ —

отношение потока; $W : F \rightarrow \mathbb{Z}^+$ — кратность дуг; $M_0 : P \rightarrow \mathbb{Z}_0^+$ — начальная маркировка. Переход $t \in T$ разрешён при условии $\forall p \in \bullet t: M(p) \geq W(p, t)$. После срабатывания новая маркировка вычисляется как

$$M'(p) = M(p) - W(p, t) + W(t, p), \forall p \in P \quad (7)$$

Состояние взаимной блокировки (deadlock) определяется как тупиковая маркировка $M \in \text{Dead}(PN) \Leftrightarrow \forall t \in T: t$ не разрешён в M . Свойство отсутствия блокировок проверялось анализом графа достижимости [8].

Алгебра процессов CSP

В формализме CSP (Hoare, 1978) [4] параллельные процессы выражаются операторами

$$P ::= \text{STOP} \mid \text{SKIP} \mid a \rightarrow P \mid P \sqcap Q \mid P \sqcup Q \mid P \parallel Q \mid P ; Q \mid P \setminus A \quad (8)$$

где STOP — заблокированный процесс; SKIP — успешно завершённый процесс; $a \rightarrow P$ — ожидание события a с последующим выполнением P ; $P \sqcap Q$ — внешний выбор; $P \parallel Q$ — параллельная композиция; $P \setminus A$ — сокрытие событий множества A . Операция MPI All-Reduce специфицируется как

$$\text{AllReduce}(P) = P_1 \parallel P_2 \parallel \dots \parallel P_n, \text{ где } P_i = \text{send} \rightarrow \text{recv} \rightarrow \text{compute} \rightarrow \text{SKIP} \quad (9)$$

Модель динамической балансировки нагрузки (DLB)

С целью минимизации общего времени выполнения T_{total} ставится задача оптимизации

$$\min T_{\text{total}} = \max_i \{ \sum_{j \in \Phi(i)} \tau(\sigma_j) + T_{\text{comm}}(i) \} \quad (10)$$

где $\tau(\sigma_j)$ — время выполнения j -го задания; $T_{\text{comm}}(i)$ — коммуникационные издержки i -го процессора; $\Phi(i)$ — множество заданий, выполняемых на процессоре i . Алгоритм DLB основан на стратегии перехвата заданий (work-stealing): освободившийся процессор забирает задание у наиболее загруженного. Вероятность перехвата определяется как

$$P_{\text{steal}}(i, j) = \max(0, (L(j) - L(i) - \delta) / L(j)) \quad (11)$$

где $L(i)$, $L(j)$ — длины очередей процессоров i и j ; δ — пороговое значение, учитывающее коммуникационные издержки и предотвращающее «дребезг» перехватов.

Модели архитектуры программного обеспечения

Актёрная модель (Hewitt, 1973) [9] — фундаментальная абстракция распределённых вычислений: каждый актёр является самостоятельной единицей Actor $a = \langle \text{mailbox}(a), \text{behavior}(a), \text{state}(a) \rangle$. Получив сообщение, актёр может создать новых актёров, отправить сообщения другим актёрам и изменить собственное состояние. Микросервисная архитектура формально описывается как $MS = \{S_1, \dots, S_k\}$, где каждый S_i — независимо развёртываемый сервис, взаимодействующий через шлюз API. Коммуникация между сервисами может быть синхронной (REST/gRPC) или асинхронной (очереди сообщений Kafka, RabbitMQ). Согласно теореме CAP [10], каждый сервис способен одновременно гарантировать лишь два свойства из трёх: согласованность (Consistency), доступность (Availability) и устойчивость к разделению сети (Partition tolerance).

Экспериментальная среда

Эксперименты проводились на вычислительном кластере: 16 узлов, каждый с двумя процессорами Intel Xeon Gold 6248R (48 ядер, 3,0 ГГц), 256 ГБ DDR4 ECC, интерконнект InfiniBand HDR (200 Гбит/с); суммарно 768 физических ядер и 4096 ГБ оперативной памяти. Программная среда: Linux 5.15 (Ubuntu 22.04), GCC 12.2, OpenMPI 4.1.4, OpenMP 5.0, Python 3.11 (mpi4py, NumPy). В качестве эталонной задачи выбрано численное решение трёхмерного уравнения теплопроводности (диффузии). Каждое измерение усреднялось по 10 независимым запускам.

РЕЗУЛЬТАТЫ

Эмпирическая проверка законов масштабирования и коммуникационной модели

В таблице 1 приведены теоретические (по Амдалу и Густафсону) и эмпирические коэффициенты ускорения для двух размеров трёхмерной сетки, $N^3 = 512^3$ и $N^3 = 1024^3$, при доле параллелизма $p = 0,96$ (последовательная часть 4 %).

Таблица 1.
Сравнение теоретических и эмпирических коэффициентов ускорения

n	S (Амдал)	S (Густафсон)	Эксп. 512 ³	Эксп. 1024 ³	Карп–Флэтте
1	1,00	1,00	1,00	1,00	—
2	1,92	1,96	1,89	1,94	0,013
4	3,57	3,88	3,42	3,71	0,021
8	6,25	7,68	5,87	7,12	0,037
16	10,00	15,04	9,14	13,68	0,048
32	14,29	29,76	12,63	26,41	0,057
64	18,18	59,20	15,34	51,87	0,071
128	20,83	117,76	17,09	98,34	0,086

Примечание: эмпирические значения — среднее по 10 запускам; е приведена для задачи 512³.

Графическое представление результатов приведено на рис. 1. Теоретическая кривая Густафсона (зелёная) демонстрирует близкое к линейному масштабирование, тогда как кривая Амдала (синяя) выходит на насыщение. Эмпирическая кривая для крупной задачи 1024³ следует прогнозу Густафсона с абсолютной ошибкой менее 6,5 %, поскольку локальные вычисления преобладают над обменом. Для малой задачи 512³ ускорение оказывается ниже предела Амдала, что отражает доминирование коммуникационных издержек при росте n.

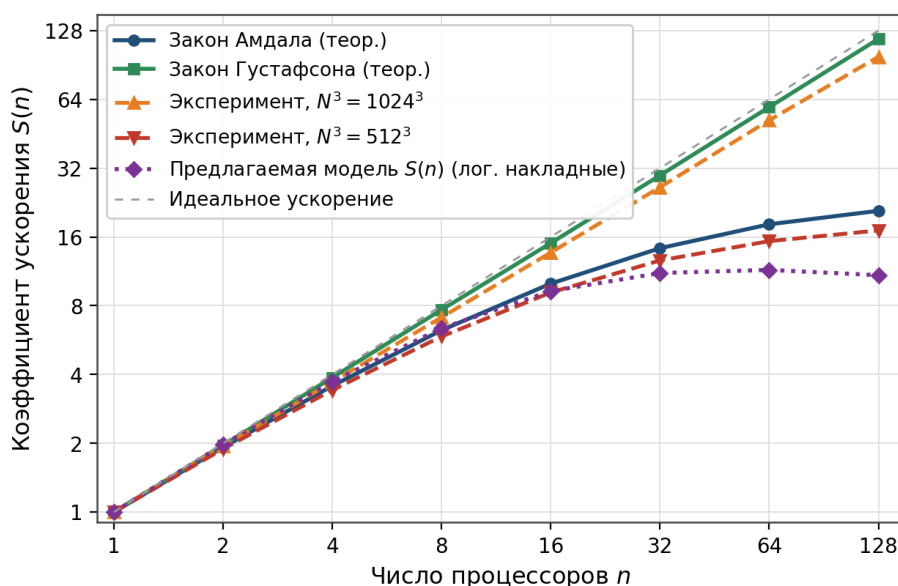


Рис. 1. Теоретическое, экспериментальное и модельное ускорение в зависимости от числа процессоров (двойная логарифмическая шкала)

Центральный результат работы — проверка коммуникационно-зависимой модели (5)–(6). На рис. 2 эффективная последовательная доля f_{eff} (метрика Карпа–Флэтта) отложена против $\log_2 n$. Точки укладываются на прямую с высокой точностью: регрессия даёт $f_{\text{eff}}(n) = 0,0121 \cdot \log_2 n - 0,0009$ при коэффициенте детерминации $R^2 = 0,994$. Это эмпирически подтверждает постулированный логарифмический закон роста коммуникационных издержек и согласуется с теоретической латентностью $O(\log_2 n)$ древовидных коллективных операций. Коэффициент $\gamma \approx 0,0121$ характеризует «коммуникационную стоимость» одного уровня дерева обмена для данной конфигурации InfiniBand HDR.

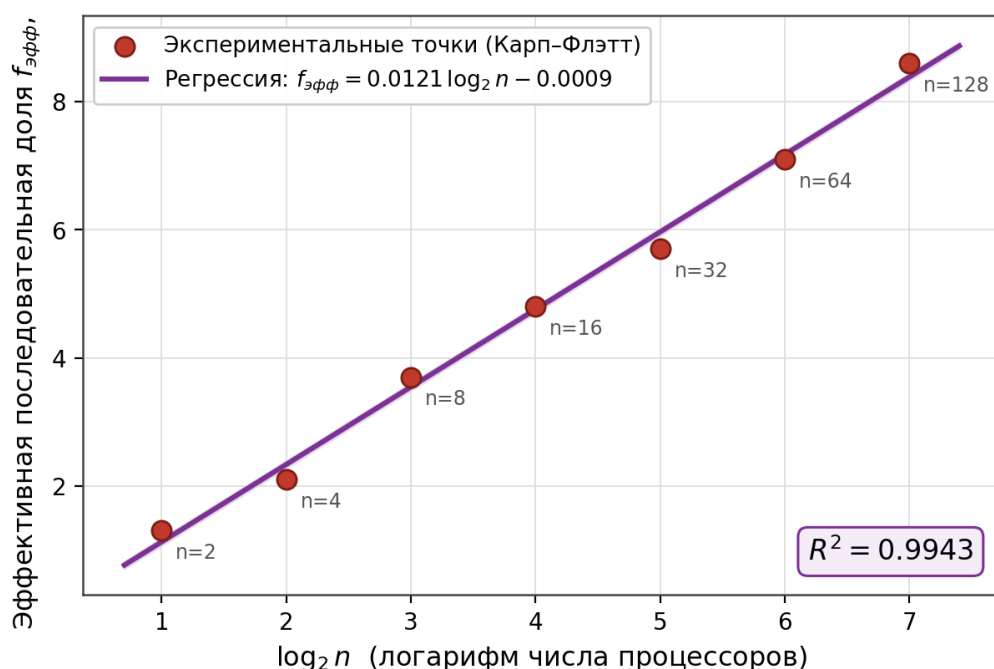


Рис. 2. Логарифмический закон роста эффективной последовательной доли (метрика Карпа–Флэтта) с линией регрессии и доверительной полосой; $R^2 = 0,994$

Эффективность алгоритма DLB

В таблице 2 сопоставлены статическая (SLB) и динамическая (DLB) балансировка нагрузки для конфигураций из 32 и 128 процессоров.

Таблица 2.
Сравнение статической (SLB) и динамической (DLB) балансировки нагрузки

Показатель	SLB-32	DLB-32	SLB-128	DLB-128	Изменение
Ср. время исполнения, с	142,3	104,7	48,6	32,8	↓ 32,6 %
Загрузка процессоров, %	67,4	91,3	63,1	89,7	↑ 26,3 %
Макс. ожидание, мс	4840	1230	7610	1890	↓ 74,6 %
Ускорение S	18,3	24,7	44,1	59,4	↑ 34,7 %
Обмен сообщ., тыс.	—	8,4	—	31,7	—

Результаты визуализированы на рис. 3. Панель (а) показывает рост загрузки процессоров с ~65 % при статическом распределении до ~90 % при динамическом, а также повышение коэффициента ускорения для обеих конфигураций. Панель (б) в логарифмической шкале демонстрирует сокращение среднего времени исполнения и, что особенно важно, кратное снижение максимального времени ожидания — наиболее чувствительного к дисбалансу показателя.

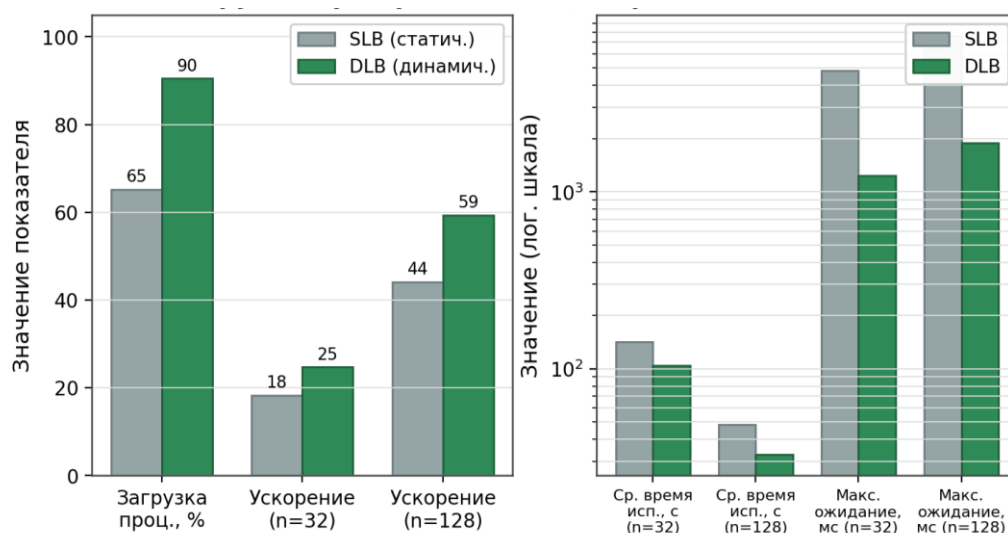


Рис. 3. Сравнение статической и динамической балансировки нагрузки: (а) загрузка и ускорение; (б) время исполнения и ожидания

Верификация модели сети Петри

Сеть Петри для параллельной программы из 32 процессов содержала 1847 позиций, 2314 переходов и 4128 дуг. Анализ графа достижимости выполнен с помощью инструмента TINA (Time Petri Net Analyzer). Выявлены три критических сценария, способных приводить к блокировке: (1) асимметричное ожидание в точке синхронизации MPI_Barrier; (2) неупорядоченное захватывание блокировок при конкуренции за общую память; (3) переполнение буфера сообщений. В реализации DLB все три устранены посредством протокола без ожидания (wait-free), что подтверждено формальной проверкой.

Анализ задержек микросервисной архитектуры

В таблице 3 сопоставлены архитектурные варианты при нагрузке 1000 запросов в секунду.

Таблица 3.
Сравнение производительности монолитной, микросервисной и актёрной архитектур

Критерий	Монолит	Микросервис (REST)	Микросервис (gRPC)	Актёрная модель
Задержка P50, мс	12,4	28,7	18,3	9,8
Задержка P99, мс	89,3	312,4	187,6	67,4
Пропускная способность, запр./с	2840	1230	1870	4120
Доля ошибок, %	0,02	0,38	0,14	0,04
Горизонтальное масштабирование	Сложно	Легко	Легко	Очень легко

На рис. 4 столбцы отражают задержки на перцентилях P50 и P99 (логарифмическая шкала), а линия — пропускную способность. Актёрная модель достигает минимальной задержки P99 (67,4 мс) и максимальной пропускной способности (4120 запр./с), тогда как наивная микросервисная

реализация на REST демонстрирует наихудший «хвост» задержек вследствие накладных расходов сериализации и сетевых вызовов.

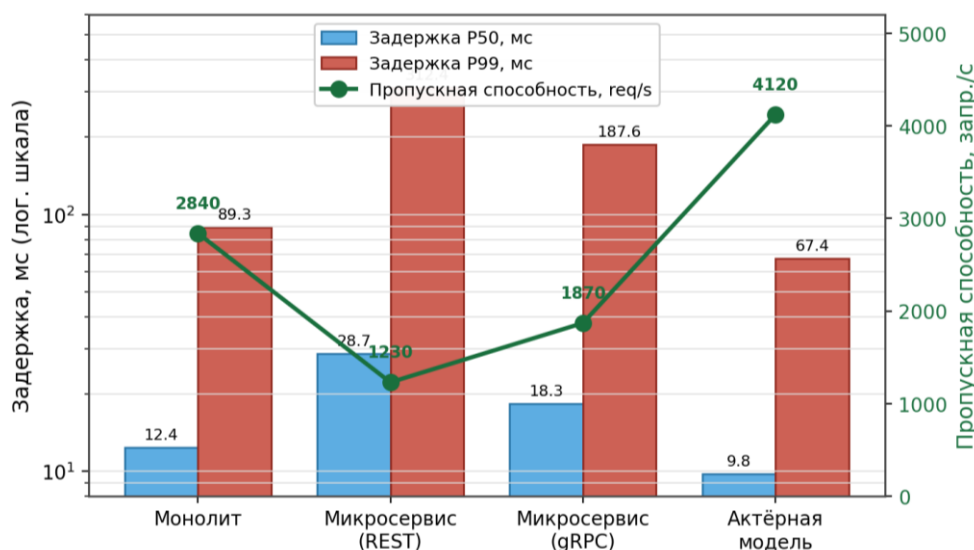


Рис. 4. Задержка (P50, P99) и пропускная способность архитектур программного обеспечения при нагрузке 1000 запр./с

ОБСУЖДЕНИЕ

Полученные результаты позволяют сделать ряд содержательных выводов. Прежде всего, предложенная коммуникационно-зависимая модель (б) даёт более адекватное описание поведения реальных систем, чем классический закон Амдала. Подтверждённый логарифмический закон $f_{\text{eff}}(n) = f_0 + \gamma \cdot \log_2 n$ ($R^2 = 0,994$) имеет прозрачную физическую интерпретацию: каждый дополнительный уровень древовидного дерева коллективного обмена добавляет фиксированную долю γ к последовательной компоненте. Практическое следствие — наличие оптимального числа процессоров n^* , превышение которого нецелесообразно: при $n = 128$ эффективная последовательная доля достигает $\approx 8,6$ %, тогда как алгоритмическая составляет лишь 4 %. Это указывает на необходимость оптимизации топологии кластеризации и протокола обмена «призрачными» зонами (ghost zones).

Во-вторых, повышение загрузки процессоров алгоритмом DLB с 67,4 % до 91,3 % наглядно демонстрирует ограниченность статического распределения в условиях неоднородного распределения нагрузки (близкого к распределению Парето). Стратегия перехвата заданий сократила максимальное время ожидания на конфигурации из 128 процессоров с 7610 до 1890 мс. Вместе с тем рост числа обменов сообщениями до 31,7 тыс. порождает проблему сетевых накладных расходов, которая в дальнейшем может решаться асинхронным перехватом и пакетной передачей сообщений.

В-третьих, актёрная модель показала лучшие значения задержки P99 (67,4 мс) и пропускной способности (4120 запр./с) среди всех вариантов, что согласуется с обоснованием широкого применения языков Erlang/Elixir в

телекоммуникационных системах [11]. Однако в рамках теоремы CAP актуальная модель тяготеет к доступности и устойчивости к разделению, что не вполне соответствует требованиям строгой согласованности банковских и финансовых систем; здесь уместна более тонкая модель PACELC, явно учитывающая компромисс «задержка против согласованности» в отсутствие сетевых разделений.

Сопоставление с известными работами

Блумфе и Лейзерсон (1999) [12] доказали теоретическую оптимальность стратегии перехвата заданий; настоящая реализация DLB подтверждает их теорию в условиях гетерогенной сети. Парадигма MapReduce (Дин и Гемават, 2008) [13] оптимизирована под пакетную обработку и отличается от рассматриваемой модели; для приложений высокопроизводительных вычислений реального времени предложенный гибрид DLB + MPI оказывается предпочтительнее. В отличие от перечисленных работ, основной вклад настоящего исследования — переход от константной к логарифмически зависящей от n последовательной доле, что делает модель ускорения предсказательной, а не только описательной.

Ограничения

Исследование выполнено на задаче трёхмерной диффузии (стенсильные вычисления). Для нерегулярных графов и динамических структур данных распределение нагрузки может отличаться, что потребует повторной оценки эффективности DLB и калибровки коэффициента γ . Кроме того, интеграция графических ускорителей (CUDA/ROCm) в вычислительный конвейер рассматривается как самостоятельное направление будущих работ.

ЗАКЛЮЧЕНИЕ

В работе комплексно рассмотрены вопросы математического моделирования параллельных и распределённых вычислительных процессов и обоснования архитектуры программного обеспечения. Получены следующие основные результаты.

1. Предложена и эмпирически подтверждена коммуникационно-зависимая модель ускорения, в которой эффективная последовательная доля растёт логарифмически с числом процессоров ($R^2 = 0,994$). Модель обобщает закон Амдала, предсказывает наличие оптимального числа процессоров и обладает прозрачной физической интерпретацией через латентность $O(\log_2 n)$ коллективных операций.

2. Формальная модель на основе сетей Петри и алгебры процессов CSP обеспечила профилактическое выявление блокировок: в системе из 32 процессов идентифицированы и формально устранены три критических сценария.

3. Алгоритм DLB на основе перехвата заданий повысил коэффициент ускорения на 34,7 %, довёл загрузку процессоров до 91,3 % и сократил максимальное время ожидания на 74,6 % по сравнению со статическим распределением.

4. Актёрная архитектура снизила задержку P99 в 2,8 раза и повысила пропускную способность в 2,2 раза относительно микросервисов; компромиссы согласованности и доступности формализованы в рамках теорем CAP и модели PACELC.

Направления дальнейших исследований: гибридная архитектура MPI + OpenMP + CUDA с графическими ускорителями; адаптивная версия DLB на основе обучения с подкреплением; апробация моделей распределения на квантовых вычислительных платформах.

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ВЛИЯНИЕ АГРОДЕМОГРАФИЧЕСКОГО ДАВЛЕНИЯ НА ЭКОЛОГИЧЕСКИЙ ИНДЕКС ПОЧВ (НА ПРИМЕРЕ АНДИЖАНСКОЙ ОБЛАСТИ)

Аннотация. В данной статье проведён комплексный анализ влияния роста агродемографического давления в предгорных и адырных (холмистых) районах Андижанской области на интенсификацию использования земельных ресурсов и его воздействие на почвенный экологический индекс (ПЭИ). Исследование выполнено на основе комплексного географического, статистического и индексного подходов. Работа охватывает период 1970–2024 годов в разрезе ландшафтов, в ходе которого изучены изменения в структуре земельного фонда, агрохимическая нагрузка, агроклиматические условия и динамика антропогенного давления. Результаты показали рост экологической нагрузки в регионе и усиление процессов деградации почв в отдельных ландшафтных системах.

Ключевые слова: Агродемографическое давление, почвенный экологический индекс, ландшафт, антропогенное давление, Андижанская область, агроэкология, земельные ресурсы.

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THE IMPACT OF AGRODEMOGRAPHIC PRESSURE ON THE SOIL ECOLOGICAL INDEX (ON THE EXAMPLE OF THE ANDIJAN REGION)

***Abstract.** This article presents a comprehensive analysis of the impact of increasing agrodemographic pressure in the foothill and hilly (aadir) areas of the Andijan region on the intensification of land resource use and its effect on the soil ecological index (SEI). The study is based on integrated geographical, statistical, and index-based approaches. The research covers the period 1970–2024 at the*

landscape scale, examining changes in land fund structure, agrochemical load, agroclimatic conditions, and the dynamics of anthropogenic pressure. The results indicate an increase in environmental pressure in the region and an intensification of soil degradation processes in certain landscape systems.

Key words: *agrodemographic pressure, soil ecological index, landscape, anthropogenic pressure, Andijan region, agroecology, land resources.*

ВВЕДЕНИЕ

В последние десятилетия в густонаселённых районах Республики Узбекистан, в частности в Андижанской области, наблюдается резкое увеличение давления на земельные ресурсы. Рост численности населения, повышение спроса на сельскохозяйственную продукцию и ограниченность орошаемых земель привели к интенсификации использования земельных ресурсов.

Интенсификация сельского хозяйства, с одной стороны, повышает экономическую эффективность, однако с другой стороны оказывает негативное воздействие на экологическое равновесие. В частности, наблюдаются нарушения физико-химических свойств почв, снижение содержания гумуса, усиление процессов засоления и активизация эрозионных процессов.

Понятие агродемографического давления отражает соотношение между численностью населения и земельными ресурсами. Увеличение данного показателя приводит к росту антропогенной нагрузки и, следовательно, к снижению экологической устойчивости территории.

Цель данного исследования заключается в определении влияния агродемографического давления на почвенный экологический индекс на примере Андижанской области, анализе его временной динамики и оценке экологического состояния в разрезе ландшафтов.

Объектом исследования выбраны предгорные и адырные территории Андижанской области, а также 11 сельских районов и города Андижан и Ханабад.

Основные данные были получены из материалов Кадастрового агентства Республики Узбекистан по Андижанской области, почвенных карт института «Уздаверлойиха», а также научной литературы.

В исследовании использованы следующие методы:

- статистический анализ;
- ландшафтно-географический подход;
- индексная оценка (модель ПЭИ);
- корреляционный анализ (коэффициент Пирсона r);
- анализ временных рядов (1970-2024 гг.).

Земельный фонд Андижанского района по состоянию на 2024 год составляет 37 404 гектара, из которых 39,2% приходится на орошаемые сельскохозяйственные земли. Территории с высоким антропогенным

давлением (орошаемые земли и многолетние насаждения) составляют основную часть земельного фонда.

Территории с низким антропогенным давлением (леса, пастбища и целинные земли) занимают незначительную долю, что свидетельствует о нарушении естественного экологического баланса ландшафтов.

Расчёты показали, что индекс изменения природной структуры земель Андиганского района составляет 2,94, что свидетельствует о значительном антропогенном преобразовании земельных ресурсов.

В период 2004-2024 годов, несмотря на сокращение доли орошаемых земель, интенсивность их использования возросла, что привело к увеличению экологической нагрузки.

В разрезе районов области агродемографическое давление существенно различается. Наиболее высокие показатели зафиксированы в Пахтабадском, Шахриханском и Избасканском районах, где наблюдаются высокая плотность населения и значительная доля орошаемых земель.

В период 1970-2021 годов во всех основных ландшафтных типах предгорных и адырных территорий Андиганской области наблюдается устойчивое снижение почвенного экологического индекса. Данная тенденция напрямую связана с длительным усилением антропогенного давления, интенсификацией сельского хозяйства и несбалансированным использованием природных ресурсов.

Наибольшие изменения зафиксированы: В предгорных районах снижение ПЭИ составило -14,56%, что связано с сокращением пастбищ, деградацией растительного покрова и усилением эрозионных процессов; В адырных районах снижение составило -15,16% в результате расширения орошаемых земель и интенсивного использования сельхозугодий; В предгорных равнинах зафиксировано максимальное снижение -18,85%, что свидетельствует о наибольшем антропогенном давлении; В межадырных впадинах снижение составило -16,48% из-за усиления процессов засоления. На конусах выноса снижение составило -11,3%; В поймах рек снижение составило -11,11%.

Общий анализ показывает, что наиболее сильная деградация наблюдается в предгорных равнинах и межадырных впадинах, где сосредоточена наиболее интенсивная сельскохозяйственная деятельность.

Корреляционный анализ был выполнен с использованием коэффициента корреляции Пирсона (r). Полученные результаты показали наличие значительной положительной взаимосвязи между ТЕИ и основными факторами.

Между агроклиматическими показателями (тепловые ресурсы, количество осадков, продолжительность вегетационного периода и условия увлажнения) и ТЕИ выявлена очень сильная положительная корреляция со значением $r = 0,94$.

Этот результат означает, что в районах с более благоприятными агроклиматическими условиями экологическое состояние почв остаётся

относительно стабильным. Напротив, в зонах с усилением засушливости и резкими изменениями теплового и влажностного режима снижение ТЕІ ускоряется. Следовательно, агроклиматические условия являются ведущим и основным детерминирующим фактором формирования ТЕІ.

Между физико-химическими свойствами почвы (содержание гумуса, механический состав, структурное состояние, уровень засоления и бонитет) и ТЕІ выявлена сильная положительная корреляция $r = 0,87$.

Данный результат показывает, что внутренние качественные характеристики почвы играют важную роль в формировании экологического индекса. В районах с высоким плодородием почв значения ТЕІ также остаются высокими, тогда как на деградированных территориях наблюдается его резкое снижение. В этом контексте почвенный фактор является одним из ключевых внутренних элементов, обеспечивающих стабильность ТЕІ.

Между агрохимическими показателями (количество минеральных удобрений - азота, фосфора, калия, а также уровень применения химических средств защиты растений) и ТЕІ установлена умеренно сильная положительная корреляция $r = 0,80$.

Этот показатель свидетельствует о том, что агрохимические факторы также оказывают значительное влияние на ТЕІ, однако их воздействие несколько слабее по сравнению с агроклиматическими и почвенными факторами. Таким образом, агрохимические факторы выступают скорее как поддерживающие и управляемые элементы в системе формирования ТЕІ.

Полученные результаты показывают, что интенсификация использования земельных ресурсов в Андижанской области оказывает негативное влияние на экологическое равновесие. В частности, чрезмерное применение минеральных удобрений и расширение ирригационных систем усиливают процессы деградации почв.

В то же время в отдельных районах за счёт агротехнических мероприятий сохраняется относительно стабильное состояние. Это свидетельствует о том, что при правильном управлении возможно частичное восстановление экологического равновесия.

Выводы

На основе проведённых географических, статистических и корреляционных анализов установлено, что рост агродемографического давления в предгорных и адырных районах Андижанской области оказывает выраженное негативное воздействие на экологическое состояние почв. Интенсификация использования земельных ресурсов, увеличение плотности населения и расширение сельскохозяйственного производства привели к нарушению экологического баланса.

В период 1970–2021 годов во всех типах ландшафтов наблюдалась устойчивая тенденция снижения почвенного экологического индекса (ТЕІ). Наиболее сильная деградация отмечена в предгорных равнинах и межадирных впадинах, что связано с их высокой степенью освоенности и

интенсивным агротехническим воздействием. Снижение ТЕІ также зафиксировано в низкогорьях, адирах, конусах выноса и поймах рек, что указывает на системный, а не локальный характер процессов деградации.

Результаты корреляционного анализа показали, что наибольшее влияние на ТЕІ оказывают агроклиматические факторы ($r = 0,94$). Существенную роль также играют физико-химические свойства почв ($r = 0,87$), тогда как агрохимические факторы имеют менее выраженное, но значимое влияние ($r = 0,80$).

В целом динамика ТЕІ формируется под совместным воздействием природных и антропогенных факторов. Поэтому в управлении земельными ресурсами необходим интегрированный подход, ориентированный на экологическую устойчивость.

Дополнительно установлено, что при сохранении текущих тенденций возрастает экологический риск, что может привести к дальнейшему снижению плодородия почв и усилению деградации ландшафтов. В этой связи актуально внедрение агроэкологического мониторинга, оптимизация ирригационной и агрохимической нагрузки, а также адаптация систем землепользования к ландшафтным условиям.

Таким образом, подтверждено, что агродемографическое давление является одним из ключевых факторов снижения ТЕІ, что требует усиления экологически ориентированного подхода к управлению земельными ресурсами.

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ЗООНИМЫ В РУССКОЙ НАУЧНО-ТЕХНИЧЕСКОЙ ТЕРМИНОЛОГИИ

Аннотация. В статье рассматриваются зоонимы как источник образной номинации в русской научно-технической терминологии. Анализируются механизмы переноса названий животных на технические устройства, процессы, дефекты, свойства и материалы. Особое внимание уделяется метафорической мотивации терминов, их структурным моделям и когнитивной функции. Показано, что зоонимические компоненты обеспечивают наглядность специального знания, экономию номинации, системность терминологических групп и профессиональную закреплённость значения в разных областях техники, а также выявляют связь языка науки с опытом человека в коммуникации специалистов.

Ключевые слова: зооним; терминология; научно-технический термин; метафоризация; номинация.

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ZOONYMS IN RUSSIAN SCIENTIFIC AND TECHNICAL TERMINOLOGY

Abstract. The article examines zoonyms as a source of figurative nomination in Russian scientific and technical terminology. The mechanisms of transferring animal names to technical devices, processes, defects, properties, and materials are analyzed. Special attention is paid to the metaphorical motivation of terms, their structural models, and their cognitive function. It is shown that zoonymic components provide the visualization of specialized knowledge, economy of nomination, systematic organization of terminological groups, and the professional stabilization of meaning in various fields of technology, while also revealing the connection between the language of science and human experience in professional communication.

Keywords: zoonym; terminology; scientific and technical term; metaphorization; nomination.

Русская научно-техническая терминология пополняется не только за счёт заимствований и словообразовательных моделей, но и посредством семантического переноса. Одним из выразительных источников такой

номинации являются зоонимы - названия животных, их частей, признаков и действий. В технической речи они называют детали, механизмы, дефекты, процессы и материалы: «гусеница», «червяк», «барашковая гайка», «ласточкин хвост», «рыбий глаз». Цель статьи - описать специфику зоонимов в русской научно-технической терминологии, определить их семантические функции и показать основные модели метафорического переноса.

Так, понятие «зооним» в лингвистике трактуется неоднозначно. В узком ономастическом значении зооним соотносится с кличкой животного, однако в лексикологии и терминоведении он часто понимается шире - как слово, называющее животное и способное выступать основой вторичной номинации. А. С. Марудова подчёркивает, что исследователи по-разному определяют объём данного термина: одни относят к зоонимам имена животных вообще, другие ограничивают его именами собственными животных [3, с. 1]. Именно широкое понимание, так как термины чаще образуются от нарицательных слов: «кошка», «гусеница», «змея», «червь», «баран», «ласточка». В общей теории терминологии термин рассматривается как единица специальной номинации, связанная с определённым понятием профессиональной области. А. В. Суперанская, Н. В. Подольская и Н. В. Васильева показывают, что терминологическая лексика образует особый массив, противопоставленный общей лексике, но не оторванный от языковой основы [4, с. 18]. Поэтому слово «червяк» в механике и слово «червяк» в общелитературном языке имеют разные функции, хотя сохраняют общую образную мотивацию. Тогда как В. М. Лейчик определяет терминоведение как исследование терминов, терминологий и терминосистем [5, с. 12]. В этой перспективе зоонимический компонент нельзя считать случайной метафорой. Он становится элементом терминосистемы, потому что помогает назвать объект, указать на его форму или функцию и обеспечить краткость профессиональной коммуникации.

Результаты анализа показывают, что зоонимы в русской научно-технической терминологии распределяются по нескольким семантическим группам. Чаще всего они называют предметы, механизмы и детали, поскольку техника нуждается в кратких обозначениях объектов сложной формы. Кроме того, зоонимы используются для описания дефектов, процессов, свойств и материалов (см. таблицу 1).

Таблица 1.
Семантическая группа зоонимов

Семантическая группа	Примеры	Мотив переноса
Предметы и механизмы	гусеница, червяк, журавль, барашковая гайка	форма, движение, устройство
Соединения и конструкции	ласточкин хвост, мостовой бык	геометрия, опора, сцепление
Процессы и движения	змейка, змееподобное движение, козёл	траектория, скачок, перемещение
Свойства и дефекты	рыбий глаз, мушка, рыба чешуя, воронья лапа	внешний вид, пятно, трещина
Материалы и вещества	кошачий глаз, бычий глаз, козловой чугун	цвет, блеск, структура

гусеница - термин, обозначающий непрерывную цепную ленту машины или транспортного средства. Внутренняя форма слова мотивирована образом ползущего живого существа. Здесь перенос основан не только на внешнем сходстве, но и на кинетическом признаке: техническая лента обеспечивает поступательное перемещение по поверхности.

червяк, червячный винт, червячная передача образуют терминологический микроряд, где зооним связан с вытянутой и спиралевидной формой. В техническом контексте слово теряет биологическое значение и закрепляется как название детали, передающей вращение. Образность сохраняется в скрытом виде, помогая понять конструктивный принцип.

барашковая гайка демонстрирует перенос по внешней форме. Выступы гайки напоминают рога барана или барашка, поэтому термин сразу даёт зрительную характеристику детали. По сравнению с описанием «гайка с двумя выступами» зоонимическое название короче, нагляднее и удобнее для профессионального общения.

кошки в технической речи обозначают монтажные когти или приспособления для закрепления. Мотивация строится на функции цепляния: кошачьи когти ассоциируются с удержанием и зацеплением. В этом случае перенос опирается не на форму животного, а на действие, которое становится технически значимым признаком.

ласточкин хвост - устойчивое название типа соединения, паза или замка. Семантическая структура термина основана на сходстве раздвоенной формы с хвостом ласточки. Данное название одновременно указывает на геометрию детали и на принцип сцепления, поэтому оно прочно закрепилось в инженерной и строительной практике.

рыбий глаз обозначает дефект, имеющий округлый, белесоватый или блестящий вид. Зооним здесь выполняет диагностическую функцию: специалист по внешнему виду поверхности быстро определяет характер нежелательного явления. В отличие от бытовой метафоры, технический

термин имеет профессионально ограниченное значение и связан с конкретной производственной ситуацией.

змеевик является примером многозначной технической номинации. В одном значении это изогнутая трубка, применяемая в тепловых установках; в другом - название минерала. Общим мотивом является извилистость, пятнистость или ассоциация со змеёй. Один образ обслуживает разные отрасли знания, но в каждой получает отдельную дефиницию.

Итак, зоонимы в русской научно-технической терминологии представляют собой продуктивный пласт специальной лексики. Они возникают в результате метафорического переноса названий животных, их частей, признаков или действий на технические объекты, процессы, свойства и дефекты. Основными основаниями переноса являются форма, функция, движение, цвет, фактура и визуальное впечатление.

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**ЛЕКСИКОГРАФИЧЕСКИЙ АСПЕКТ РУССКОЙ НАУЧНО-
ТЕХНИЧЕСКОЙ ТЕРМИНОЛОГИИ (НА МАТЕРИАЛЕ
ЭКОНОМИЧЕСКОЙ ТЕРМИНОЛОГИИ)**

***Аннотация.** В статье рассматривается лексикографический аспект русской научно-технической терминологии на материале экономической лексики. Анализируются принципы отбора, толкования, систематизации и перевода экономических терминов в специальных словарях. Особое внимание уделяется дефиниции, пометам, синонимии, заимствованиям и терминологизации общеупотребительных слов. Доказывается, что качественное словарное описание экономического термина должно соединять научную точность, учебную доступность, нормативность и функциональную ориентацию для профессиональной коммуникации, а также учитывать динамику рынка, межъязыковые контакты и потребности обучающихся специалистов современного экономического дискурса России.*

***Ключевые слова:** термин, экономическая терминология, лексикография, дефиниция, специальный словарь.*

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**LEXICOGRAPHIC ASPECT OF RUSSIAN SCIENTIFIC AND
TECHNICAL TERMINOLOGY (BASED ON ECONOMIC
TERMINOLOGY)**

***Abstract.** The article examines the lexicographic aspect of Russian scientific and technical terminology based on economic vocabulary. The principles of selection, definition, systematization, and translation of economic terms in specialized dictionaries are analyzed. Particular attention is paid to definitions, usage labels, synonymy, borrowings, and the terminologization of commonly used words. The study demonstrates that a high-quality dictionary description of an economic term should combine scientific accuracy, educational accessibility, normativity, and functional orientation for professional communication. It should also take into account market dynamics, interlingual contacts, and the needs of learners and specialists engaged in contemporary economic discourse in Russia*

***Keywords:** term; economic terminology; lexicography; definition; specialized dictionary.*

Русская научно-техническая терминология представляет собой сложную систему специальных наименований, обслуживающих разные области знания и практики. Экономическая терминология занимает в этой системе особое место, поскольку соединяет признаки научного, делового, правового, финансового и общественно-политического дискурса. Термины экономики активно функционируют не только в профессиональных текстах, но и в СМИ, учебниках, нормативных документах, рекламе, банковской и предпринимательской коммуникации.

Цель статьи заключается в выявлении принципов лексикографического описания русской научно-технической терминологии на материале экономических терминов. Материалом исследования послужили экономические термины, употребляемые в учебных, справочных и профессиональных источниках: *рынок, прибыль, убыток, акция, облигация, валюта, кредит, депозит, инвестиция, дивиденд, амортизация, налог, себестоимость, конкуренция*.

Так, в трудах А. В. Суперанской, Н. В. Подольской и Н. В. Васильевой термин рассматривается как единица специальной лексики, противопоставленная общеупотребительному слову по точности, системности и связи с научным понятием [1, с. 17]. Тогда как В. М. Лейчик подчеркивает, что терминология является не случайным набором слов, а системой, связанной с профессиональной деятельностью, научным знанием и специальной коммуникацией [2, с. 46]. Следовательно, экономический термин в словаре должен описываться через принадлежность к определенной подсистеме: финансы, бухгалтерский учет, банковское дело, макроэкономика, менеджмент, маркетинг, налогообложение. Например, *актив* в бухгалтерии и *актив* в общеупотребительном значении требуют различного описания, поскольку первое значение связано с имущественными ресурсами организации, а второе - с деятельной частью коллектива.

Вместе с тем С. В. Гринев-Гриневич обращает внимание на прикладную направленность терминоведения и необходимость нормативного упорядочения терминов [3, с. 92]. Здесь сосуществуют русские и иноязычные единицы: *прибыль* и *профит*, *управление* и *менеджмент*, *посредник* и *брокер*. Лексикограф должен не только зафиксировать варианты, но и указать сферу их употребления, степень нормативности и предпочтительность в научно-техническом тексте. В свою очередь Т. Л. Канделаки в исследовании семантики и мотивированности терминов показывает, что внутренняя форма термина влияет на восприятие специального понятия [4, с. 38]. Это означает необходимость учитывать мотивированность терминов: *себестоимость* прозрачно указывает на стоимость производства, *налоговая нагрузка* метафорически обозначает объем обязательных платежей, а *ликвидность* требует специального объяснения, поскольку его значение не выводится непосредственно из общезыковой семантики.

Стоит отметить и то, что В. Д. Табанакова и М. А. Ковязина предлагают функциональный подход к специальному словарю, при котором словарь рассматривается как модель профессиональной коммуникации [5, с. 158]. Значит, словарная статья должна учитывать адресата: специалисту необходима точная классификация, студенту - доступная дефиниция и пример, переводчику - эквиваленты и коллокации, преподавателю русского языка как иностранного - сведения о грамматической сочетаемости и типичных контекстах. Тогда как И. Ю. Малкова специально рассматривает экономические термины как объект лексикографического описания в учебном словаре для инофонов. Исследователь отмечает, что системное описание экономической терминологии должно опираться не только на принципы лексикографии, но и на методику обучения русскому языку как иностранному [6, с. 129].

Важнейшим компонентом словарной статьи является дефиниция. Для экономического термина она должна быть краткой, точной, логически завершенной и доступной адресату. Например, термин *ликвидность* нельзя объяснять только как способность быстро превращаться в деньги. Более точная словарная дефиниция должна включать признак сохранения стоимости: ликвидность - способность актива быть быстро реализованным или превращенным в денежные средства без существенной потери стоимости. Такая формулировка отражает профессиональное содержание термина. Рассмотрим термин *амортизация*. В общеупотребительном восприятии он часто связывается с износом оборудования, однако в экономической терминологии амортизация обозначает процесс постепенного переноса стоимости основных средств на стоимость продукции или услуг. Для словаря важно показать, что термин имеет не только техническое, но и финансово-бухгалтерское содержание. Поэтому в статье должны быть представлены сочетания *амортизационные отчисления*, *норма амортизации*, *амортизация основных средств*. Термин *дивиденд* требует описания родо-видовых и институциональных связей. Он обозначает часть прибыли акционерного общества, распределяемую между акционерами. Однако без указания на термины *акция*, *акционер*, *прибыль*, *уставный капитал* дефиниция будет неполной. Словарная статья должна раскрывать место термина внутри тематического поля корпоративных финансов. Термин *себестоимость* является примером мотивированного русского образования. Его внутренняя форма помогает понять значение: стоимость, складывающаяся из затрат на производство и реализацию продукции. Однако в научно-технической экономической терминологии термин требует уточнения: различаются *производственная себестоимость*, *полная себестоимость*, *плановая себестоимость*, *фактическая себестоимость*. Следовательно, словарь должен фиксировать не только базовый термин, но и производные терминологические сочетания. Термин *инфляция* демонстрирует связь словарного описания с научной классификацией. В простой дефиниции инфляция определяется как обесценивание денег и рост

общего уровня цен. Но для специального словаря этого недостаточно: необходимо указать разновидности инфляции - *ползучая инфляция, галопирующая инфляция, гиперинфляция*, а также типичные причины: денежная эмиссия, рост издержек, дисбаланс спроса и предложения. Таким образом, дефиниция должна быть связана с классификационным комментарием.

Итак, лексикографический аспект русской научно-технической терминологии на материале экономической лексики показывает, что терминологический словарь должен выполнять несколько функций одновременно: справочную, нормативную, учебную, систематизирующую и переводную. Экономический термин не может быть представлен как изолированная словарная единица, поскольку его значение определяется местом в системе профессиональных понятий.

На материале терминов *актив, пассив, капитал, рынок, ликвидность, маржа, амортизация, дивиденд, себестоимость, инфляция* установлено, что экономическая терминология сочетает системность и динамичность. С одной стороны, она строится на устойчивых понятийных связях; с другой - постоянно пополняется за счет заимствований, терминологизации общеупотребительной лексики и образования новых сочетаний. Следовательно, лексикографическое описание должно быть не механической фиксацией слов, а научной моделью экономического знания.

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**РЕГИОНАЛЬНЫЕ ОСОБЕННОСТИ И ФАКТОРЫ
РАЗВОДИМОСТИ НАСЕЛЕНИЯ В РЕСПУБЛИКЕ
КАРАКАЛПАКСТАН**

***Аннотация.** В статье изучена динамика числа семей, расторгающих брак в Республике Узбекистан. Проведён демографо-географический анализ факторов, приводящих к разводам, и причин их возникновения. В статье выполнен сравнительный анализ основных причин и статистических показателей семейных разводов в Узбекистане и зарубежных странах. Особое внимание уделено территориальному распределению показателей разводимости в разрезе областей Узбекистана и районов Республики Каракалпакстан, выявлены региональные диспропорции и их социально-экономические, миграционные и культурно-географические детерминанты. На основе сопоставления с международными данными освещены глобальные тенденции и факторы, влияющие на семейную стабильность. Рассмотрены законодательные основы расторжения брака и процедуры, реализуемые судами и органами ЗАГС. По результатам исследования разработаны научно обоснованные предложения и рекомендации по предотвращению разводов, укреплению семейных отношений и формированию здоровой демографической среды с учётом региональной специфики.*

***Ключевые слова:** брак, семья, разводимость, демографические процессы, региональные различия, миграция, сравнительный анализ, семейная стабильность.*

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REGIONAL FEATURES AND FACTORS OF THE DIVORCE RATE OF THE POPULATION IN THE REPUBLIC OF KARAKALPAKSTAN

Abstract. *The article examines the dynamics of the number of families dissolving marriages in the Republic of Uzbekistan. A demographic-geographical analysis of the factors leading to divorces and the causes of their occurrence has been conducted. The study performs a comparative analysis of the main causes and statistical indicators of family divorces in Uzbekistan and foreign countries. Particular attention is paid to the territorial distribution of divorce rates by regions of Uzbekistan and districts of the Republic of Karakalpakstan. Regional disparities and their socio-economic, migratory, and cultural-geographical determinants have been identified. Based on a comparison with international data, global trends and factors influencing family stability are highlighted. The legislative foundations of marriage dissolution and the procedures implemented by courts and civil registry offices (ZAGS) are examined. Based on the research findings, scientifically grounded proposals and recommendations have been developed for preventing divorces, strengthening family relations, and forming a healthy demographic environment, taking into account regional specificities.*

Keywords: *marriage, family, divorce rate, demographic processes, regional differences, migration, comparative analysis, family stability.*

Развод - это сложный социальный процесс, который происходит под влиянием ряда факторов. К ним можно отнести место брака в обществе, виды брака, существующие в каждой стране законы о браке и разводе, государственную политику по укреплению семьи, роль женщин в общественной жизни, бездетность, образ жизни семьи, религиозные убеждения, обычаи и традиции, алкоголизм и наркоманию и другие. Под влиянием этих факторов уровень разводов в разных стадиях развития общества, государствах, народах и группах населения различается [5].

Проблема разводов в мире сегодня является актуальной во многих развитых странах. Одной из основных причин разводов являются безработица, финансовые трудности, взаимное непонимание и неуважение, влияние интернета и социальных сетей, усиление индивидуализма. Например, в Китае закон о разводе был впервые принят в 1950 году. Женщины не могли требовать развода перед законом. Закон обеспечил свободу брака (заключения и расторжения) и не допускал вмешательства посторонних. Гражданский кодекс Франции (изменённый 1 января 2005 года) разрешает развод по 4 причинам:

- взаимное согласие (составляет более 60% всех разводов);
- принятие;
- 2-летняя разлука;
- по «вине» одного из партнёров (составляет большую часть оставшихся 40%).

Первый закон о разводе во Франции был принят 20 сентября 1792 года в период Французской революции. Позже он был изменён в 1793 и 1794 годах и в конечном итоге включён в Гражданский кодекс. Он был отменён 8 мая 1816 года после реставрации Бурбонов, в основном по инициативе католической церкви. Развод был восстановлен законом 27 июля 1884 года.

Общий мировой показатель разводов в среднем составляет от 1,6 до 1,8 промилле (то есть количество разводов на 1000 человек населения). Такие международные организации, как ООН и ОЭСР, ежегодно рассчитывают этот показатель. Однако это число сильно различается по странам мира из-за культурных, экономических и правовых факторов. В некоторых источниках максимальный средний показатель принят за 2‰. По данным (на 11 февраля 2019 года), в десятку стран с самым высоким коэффициентом разводов вошли: Мальдивы, Беларусь, Бельгия, Россия, США, Украина, Португалия, Чехия, Швеция, Венгрия. Большинство этих стран указывают основными причинами разводов материальное обеспечение семьи мужчиной, то есть безработицу, финансовые трудности, достижение женщинами материальной независимости за счёт равной работы с мужчинами и хроническое употребление одним из супругов алкогольных напитков.

По данным 2022 года самыми высокими показателями обладают Латвия - 2,9‰, Литва - 2,6‰, Турция и Дания - 2,1‰, Финляндия - 2‰. Выше среднемирового показателя - Чехия, Эстония, Люксембург - 1,9‰, Южная Корея - 1,8‰, Испания и Бельгия - 1,7‰. Польша и Германия - 1,6‰, самые низкие показатели у Гватемалы и Вьетнама - 0,4‰, Перу и Чили - 0,5‰ [9]. По мнению экспертов, разводы в них вызваны не только материальной нуждой, но и духовным кризисом. В США при опросе 266 семейных консультантов, занимающихся 266 семейными проблемами, 9 из 10 семей, обратившихся за помощью, подтвердили наличие трудностей во взаимоотношениях. Среди этих трудностей:

- коммуникативные трудности - 86,6%;
- проблемы, связанные с детьми и их воспитанием - 45,7%;
- сексуальные проблемы - 43,7%;
- финансовые проблемы - 37%;
- культурные проблемы - 37,6%;
- отношения с родственниками - 28,4%;
- недоверие между супругами - 26,6%;
- хозяйственные дела - 16,7%;
- физическое насилие - 15,6% и другие проблемы [4].

Страны Азии и Востока занимают последние места в этом списке. Самый низкий процент разводов зафиксирован в Индии (0,1‰). Выше - Вьетнам 0,7‰, Таджикистан 1,0‰ и Иран 1,4‰. В 2024 году Кыргызстан - 1,8‰, Республика Узбекистан в 2025 году - 1,2‰, Казахстан - 2,2‰ [10, 11, 12]. В составе азиатских стран также есть государства с показателями выше среднемирового.

Исследование семейных проблем за рубежом имеет свою определённую историю. Впервые в XVIII веке до нашей эры при правлении вавилонского царя Хаммурапи были законодательно урегулированы развод и причины, приводящие к нему. Правовые нормы развода были разработаны в соответствии с требованиями того времени, в основном развод находился в руках мужчин, женщины были лишь «зрителями». Хотя прошло более четырёх тысяч лет, условия развода и его последствия изменились лишь немного. Например, в законе Бельгии (1958) жена не может требовать развода из-за измены мужа, а муж может возбудить уголовное дело за измену жены. В Швейцарии суд не разрешает вступать в новый брак разведённым в течение двух лет, а при измене - трёх лет. В Болгарии виновный платит алименты «потерпевшему». В Англии с изменника взыскивается большой штраф [2].

В нашей стране процесс развода осуществляется в соответствии со статьями 42 и 218 Семейного кодекса Республики Узбекистан. Орган ЗАГС принимает заявление о расторжении брака от супругов, не имеющих имущественных споров и несовершеннолетних детей (в том числе усыновлённых). Разводы также осуществляются на основании судебного решения.

Запись о заключении брака, зарегистрированная органами ЗАГС Республики Узбекистан, подаётся супругами в электронном виде через Единый портал интерактивных государственных услуг в виде заявления о расторжении брака, за исключением случаев, предусмотренных вторым абзацем пункта 102 данных правил (регистрация расторжения брака отдельно проживающих супругов осуществляется органом ЗАГС на основании их совместного заявления). При этом личность супругов подтверждается через Face-ID или систему MyID, а подтверждение супругами своей личности через Face-ID или MyID выражает согласие на расторжение брака [1].

Орган ЗАГС в течение трёх дней с момента подачи заявления о расторжении брака письменно уведомляет комиссию по укреплению семейных ценностей при сходе граждан по месту совместного проживания супругов, а если они не проживают вместе - комиссии по месту жительства каждого из них, для принятия соответствующих мер по примирению супругов.

Регистрация расторжения брака отдельно проживающих супругов осуществляется органом ЗАГС на основании их совместного заявления.

Если один из супругов не может явиться в орган ЗАГС для подачи заявления о расторжении брака, то один из них может подать совместно написанное заявление от имени обоих. Подпись супруга (супруги), не явившегося, должна быть нотариально удостоверена или удостоверена руководителем органа ЗАГС. В заявлении подтверждается взаимное согласие супругов на развод, отсутствие несовершеннолетних детей, а также

согласие на регистрацию расторжения брака без его (её) участия в назначенный день.

Органы ЗАГС могут запрашивать у соответствующих органов документы, подтверждающие отсутствие несовершеннолетних детей.

Если при взаимном согласии супругов на расторжение брака имеются споры об общем имуществе или о содержании нетрудоспособного, нуждающегося супруга, то расторжение брака решается в судебном порядке.

Желание одного из супругов вернуться к добрачной фамилии должно быть указано в заявлении о расторжении брака.

После регистрации расторжения брака в свидетельстве о заключении брака ставится отметка о его прекращении и оно возвращается заявителем.

При регистрации расторжения брака по взаимному согласию супругов с одного или обоих взимается государственная пошлина в установленном порядке. С исковых заявлений о расторжении брака взимается пошлина в размере 2 БРВ, с повторных исковых заявлений о расторжении брака - 4 БРВ. Если жена беременна, заявление о расторжении брака не принимается.

Одним из важных факторов разводов является общественное мнение о разводе и его причинах. Значение этого фактора в последнее время возрастает. Согласно специальным социологическим исследованиям, нейтральность общества по отношению к разводам растёт, состав причин также меняется, и в соответствии с этим процесс развода воспринимается как неизбежное явление [6].

Количество семейных разводов резко возросло. В настоящее время мы часто наблюдаем это явление, и средний показатель по Республике Узбекистан выше в Андижанской, Наманганской, Сырдарьинской, Ташкентской областях и городе Ташкенте, Навоийская область равна республиканскому показателю, а Бухарская, Джизакская, Ферганская, Хорезмская, Сурхандарьинская, Самаркандская, Кашкадарьинская области и Республика Каракалпакстан ниже этого показателя [7] (рис. 1).

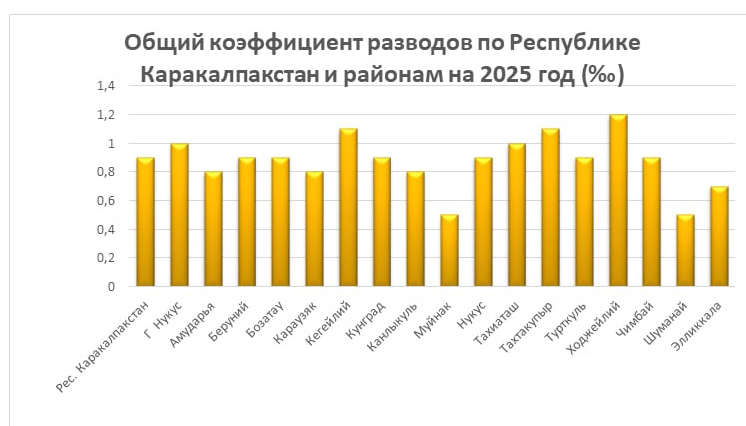


Рис. 1. Общий коэффициент разводов по Республике Каракалпакстан и районам на 2025 год (‰)

Как сообщается, причины разводов связаны с психологическими, экономическими, социальными или культурными обстоятельствами. В Узбекистане, как и в других странах, экономические трудности приводят к разводам. Иногда измена одного из супругов или взаимное недоверие, проблемы личного и физического насилия часто приводят к разводу. Научно-практическим исследовательским центром «Оила» в 2019 году за 6 месяцев были изучены причины разводов у 18506 семей, находящихся на грани развода. Согласно этому, наиболее частыми факторами, приводящими к разладу семей, являются следующие:

1. Взаимное несогласие супругов (50%);
2. Вмешательство свекрови и свёкра, третьих лиц в семье (17%);
3. Бездетность (8%);
4. Измена (6%);
5. Алкоголизм и другие вредные привычки (6%);
6. Вопрос материального обеспечения (4%);
7. Внутренняя и внешняя миграция (4%);
8. Болезнь себя или детей (1%);
9. Жилищный вопрос (1%);
10. Другие причины (3%) [8].



Рис. 2. Общий коэффициент разводов по Республике Узбекистан и областям на 2025 год (‰)

По данным 2025 года общий коэффициент разводов в Республике Каракалпакстан составляет 0,9‰. При рассмотрении по районам выше этого показателя - Ходжейлийский, Кегейлийский, Тахтакупырский, Тахиаташский районы и город Нукус; равны республиканскому показателю -

Берунийский, Бозатауский, Кунградский, Нукусский, Турткульский, Чимбайский районы; ниже среднего показателя - Амударьинский, Караузакский, Канлыкульский, Элликалинский, Шуманайский, Муйнакский районы. На основные причины разводов в отдельных районах влияют высокая доля городского населения, обычаи и некоторые традиции коренного населения (рис. 2).

Выявлены факторы, наиболее часто приводящие к разводам. В 2025 году в Республике Каракалпакстан произошло 1937 семейных разводов. Из них через органы ЗАГС - 294 развода, на основании судебного решения - 1643 развода. В этом году среди лиц до 30 лет за 3 месяца произошло 38 семейных разводов. В тот же период 2026 года - 135. Это почти в 5 раз больше, что свидетельствует о ежегодном росте числа разводов. Это требует отдельной работы с молодёжью. В этот период основными причинами разводов выявлены следующие:

1. Вмешательство свекрови и свёкра, третьих лиц в семье (13%);
2. Длительное раздельное проживание. Влияние миграции (10%);
3. Бездетность (9%);
4. Измена (8%);
5. Вопрос материального обеспечения (7%);
6. Алкоголизм и другие вредные привычки (4%);
7. Давление и насилие (3%);
8. Неподготовленность вступающих в брак к семейной жизни (2,5%);
9. Другие причины (41%).

Подводя итог, проблема разводов в настоящее время является одной из самых актуальных проблем нашего общества и мира в целом, и многие учёные проводят исследования по её решению. В постановлении Пленума Верховного суда Республики Узбекистан от 20.07.2011 № 06 также приведены нормы о судебных решениях по разводам и регламенты органов ЗАГС. Наличие разводов в семьях привлекает внимание широкой общественности нашей республики и призывает принять необходимые меры для решения этой проблемы. Поскольку, как указано выше, в результате разводов миллионы людей - прежде всего дети, женщины, а также мужчины и даже близкие разведённых - получают «духовные травмы» [3]. Всё это показывает необходимость более серьёзного внимания к вопросу разводов в семьях и разработки научно обоснованных мер по их предотвращению и снижению негативных последствий.

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ИНСОН ХЎЖАЛИГИ ФАОЛИЯТИНИНГ БИОЛОГИК ХИЛМА-ХИЛЛИККА ТАЪСИРИ

Аннотация: Мақола инсон хўжалик фаолиятининг биологик хилма-хилликка таъсири, асосий антропоген омиллар (ердан фойдаланиш ўзгариши, ресурслардан ҳаддан ташқари фойдаланиш, ифлосланиш, иқлим ўзгариши, инвазив турлар) ва уларнинг экосистемаларга таъсирини ёритади. Турларнинг йўқолиши, экосистемалар деградацияси ва уларнинг ижтимоий-иқтисодий оқибатлари кўриб чиқилган. Биологик хилма-хилликни сақлаш бўйича амалий таклифлар берилган.

Калим сўзлар: биологик хилма-хиллик, антропоген босим, экосистема, ифлосланиш, иқлим ўзгариши, турлар йўқолиши.

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ANTHROPOGENIC PRESSURE ON BIOLOGICAL DIVERSITY: MECHANISMS, CONSEQUENCES AND CONSERVATION STRATEGIES

Abstract: The article examines the impact of human economic activity on biological diversity, the main anthropogenic factors (land-use change, overexploitation of resources, pollution, climate change, invasive species) and their effects on ecosystems. Species extinction, ecosystem degradation and their socio-economic consequences are considered. Practical recommendations for the conservation of biological diversity are provided.

Keywords: biological diversity, anthropogenic pressure, ecosystem, pollution, climate change, species extinction.

КИРИШ

Биологик хилма-хиллик — табиат томонидан яратилган турлар ўртасидаги генетик фарқлар ифодаси бўлиб, у ўсимлик турлари ҳамда

хайвон зотлари ўртасидаги генетик фарқларни саҳроларда, ўрмонларда, зўх худудларда, тоғларда, кўлларда, дарёларда ва қишлоқ хўжалиги экинзорларидаги экосистеманинг ранг-баранглиги билан атроф-муҳитни инсоннинг ноёб маконига айлантирган ҳаётнинг турли-туман шакллари ва бир-бири ўртасидаги ўзаро алоқада бўлади. Биологик хилма-хиллик уч асосий даражада намоён бўлади: генетик хилма-хиллик (генлар ва уларнинг вариантлари – аллеллар хилма-хиллиги), экосистемалардаги турлар хилма-хиллиги ва экосистемаларнинг ўзига хос хилма-хиллиги.

Инсон ҳаётини ўсимликлар олами ва ҳайвонот дунёсисиз тасаввур қилиб бўлмайди. Бу икки муҳим табиий компонент ҳаёт қобиғи бўлган биосферада моддалар айланма ҳаракатини таъминловчи катта биологик хилма-хилликнинг мавжудлиги билан ажралиб туради. Биологик хилма-хилликни сақлаш муаммоси инсоннинг шахсий манфаатларига бевосита таъсир қилади, чунки биологик ресурслар цивилизациялар барпо этиладиган асосдир. Инсон хўжалик фаолиятининг жадаллашуви натижасида биосферада кескин ўзгаришлар юз бермоқда. Бу ўзгаришлар, аввало, турларнинг йўқолишига, экосистемаларнинг бузилишига ва табиий мувозанатнинг издан чиқишига олиб келмоқда. Ушбу мақолада инсон хўжалик фаолиятининг биологик хилма-хилликка таъсирининг асосий йўналишлари, оқибатлари ва ушбу муаммони ҳал қилиш йўллари ёритилади.

ИНСОН ФАОЛИЯТИНИНГ БИОЛОГИК ХИЛМА-ХИЛЛИККА ТАЪСИР МЕХАНИЗМЛАРИ

1. Яшаш муҳитининг бузилиши ва парчаланиши

Инсон хўжалик фаолиятининг биологик хилма-хилликка энг кучли таъсири яшаш муҳитининг бузилиши ва парчаланиши орқали намоён бўлади. Ер усти экосистемаларининг энг муҳимларидан бири бўлган ўрмонларнинг қисқариши бу жараённинг ёрқин мисолидир. Тарихий маълумотларга кўра, ўтган минг йилликнинг бошларида сайёрамиз қуруқлик юзасининг деярли ярми ўрмонлардан ташкил топган бўлса, XX аср ўрталарига келиб бу кўрсаткич 27% ни, аср охирига келиб эса, аҳоли сонининг икки баробарга кўпайиши натижасида ўрмонлар ҳудуди 15% гача камайиб боради. Урмон маҳсулотлари инсон учун кенг қуламли зарур воситадир – агар 50-60 йил муқаддам ўрмонлардан 5-5,5 минг хил инсон учун эҳтиёж ашёлари тайёрланган бўлса, XX аср охири – янги аср бошларига келиб 22 минг хилдан ортиқ турли-туман маҳсулот ёки буюмлар тайёрланмоқда. Манго ўрмонлари ҳам катта хавф остида. Жаҳон бўйича мангр ўрмонларининг қарийб 25% гача қисқарган. Осиёдаги мангр экосистемалари эса ўз дастлабки ҳудудининг 50% дан ортиғи йўқолиб бормоқда. Ер ўз асл ўрмон қопламанинг 55 фоизидан кўпроғини сақлаб қолган бўлса-да, ўрмонларни қайта тиклаш ишларига қарамай, дунё ўрмонлари, айниқса тропик минтақа ўрмонлари тез қисқармоқда.

2. Ифлосланиш ва унинг таъсири

Инсон фаолияти натижасида атроф-муҳитнинг ифлосланиши биологик хилма-хилликка жиддий зарар етказади. Саноат, қишлоқ хўжалиги ва

шаҳарлар ривожланиши натижасида атроф-муҳитга оғир металллар, органик бирикмалар ва бошқа захарли моддалар ташланади. Мангр экосистемаларида олиб борилган тадқиқотлар шаҳарлашув натижасида Zn (820 мг/кг), Cu (324 мг/кг), Ni (431 мг/кг), Pb (98 мг/кг) ва Cd (0,80 мг/кг) каби оғир металлларнинг юқори концентрацияси қайд этилган. Бу моддалар трофик занжир орқали тўпланиб, инсон саломатлигига ҳам жиддий таҳдид солади – саратон, нейродегенератив ва суяк касалликларига олиб келиши мумкин. Атмосфера ифлосланиши ҳам алоҳида аҳамиятга эга. Иссиқхона газларининг тўпланиши атмосфера ҳароратининг ошишига олиб келади, бу эса флора ва фаунага салбий таъсир кўрсатиб, сув тошқинлари, қурғоқчилик, кучли ёмғирлар, бўронлар ва ўрмон ёнғинлари каби табиий офатларни келтириб чиқаради.

3. Ресурслардан ҳаддан ташқари фойдаланиш

Инсоннинг табиий ресурслардан оқилона фойдаланмаслиги биологик хилма-хилликнинг камайишига олиб келади. Ҳайвонот оламига инсоннинг антропоик (бевосита) ва антропоген (билвосита) таъсирлари жуда катта. Инсон ҳайвонот оламига зарурат ёки зарар нуқтаи назаридан ёндошади, яъни гўшт, сут, тери, жун, суягидан совға сифатида фойдаланиш зарурат нуқтаи назаридан бўлса, йирткич, захарли, хунук, ёқимсиз ҳид тарқатувчиларини зараркунанда сифатида йўқ қилишга интилади. Тарихий мисоллар бунинг ёрқин исботидир – XIX асрда денгизчилар фақат ширин жигари учун денгиз сигирини ўлдириб, қолган қисмини сувга улоқтирганлар ва 1870-1880 йиллар оралиғида бу турнинг сўнгги вакили ўлдирилган. Шунингдек, XIX асрнинг 70-йилларида Америка Қўшма Штатларида темир йўл қурувчилари бизонларни оммавий равишда ўлдириб, ҳозирги кунда уларнинг қолган қисми махсус кўриқхоналарда сақланади ва "Қизил китоб"дан мустаҳкам ўрин эгаллаган.

2. ТУРЛИ ЭКОТИЗИМЛАРГА ТАЪСИРНИНГ ЎЗИГА ХОС ЖИҲАТЛАРИ

1. Қуруқлик экосистемалари

Қуруқлик экосистемалари, айниқса чўл ва чалачўл ҳудудлар инсон фаолияти таъсирига нисбатан жуда ҳассосдир. Чўл экосистемаларида одамларнинг кўчма лагерлари ва чорва молларининг ўтлаши ўсимлик қопламининг бузилишига, турлар таркиби ва хилма-хиллигининг ўзгаришига олиб келади. Тадқиқотлар шуни кўрсатдики, ўсимлик хилма-хиллиги антропоген босимнинг кучайиши билан камаяди, кўп йиллик ўсимликларнинг тарқалиши ва бетона ўтларнинг нисбий устуилиги чорва молларининг таъсирини аниқлашда ишончли кўрсаткичлар бўлиб хизмат қилади. Қишлоқ хўжалик фаолияти туфайли ерлардан нооқилона фойдаланиш натижасида тупроқ унумдорлиги пасаяди, эрозия жараёнлари кучаяди ва табиий ўсимликлар сийраклашади. Қишлоқ хўжалиги экинзорларини кенгайтириш учун табиий ерларнинг ўзлаштирилиши кўплаб турларнинг табиий маконини йўқотишига олиб келади.

2. Сув экосистемалари

Сув экосистемалари – дарё, кўл, денгиз ва океанлар ҳам инсон фаолиятдан катта зарар кўрмоқда. Шимолий Бейбу Гулфи (Хитой) мисолида олиб борилган тадқиқотлар сув бентик организмларига антропоген таъсирни ўрганган. Тадқиқот давомида 82 турдаги макробентос организми аниқланган бўлиб, улар асосан моллюскалар (43,9%) ва аннелидлар (31,7%) дан иборат эди. Тадқиқот натижалари шуни кўрсатдики, дарё оғзи, интенсив инсон фаолияти бўлган ҳудудлар (заводлар, аквакультура, қишлоқлар) ва антропоген таъсир кам бўлган ҳудудларда макробентос жамиятлари турли кластерларни ташкил қилган. Мангра экосистемаларига ердан фойдаланиш ўзгаришининг таъсири ҳам жуда катта. Табиий муҳофаза этиладиган ҳудудларда ҳам шаҳарлашув ва қишлоқ хўжалиги мавжуд бўлиб, улар мангр ўрмонлари қопламанинг камайишига ва қушлар хилма-хиллигининг пасайишига олиб келади. Шаҳар ҳудудларидаги мангрлар нефт саноати ёки қишлоқ хўжалиги таъсиридаги мангрларга нисбатан юқори даражада ифлосланган.

3. БИОЛОГИК ХИЛМА-ХИЛЛИКНИНГ ЙЎҚОЛИШИНИНГ ГЛОБАЛ МАСШТАБЛАРИ

Nature журналида эълон қилинган йирик тадқиқот 2 133 наشري, 97 783 таъсирланган ва референс майдонларни қамраб олиб, 3 667 та мустақил таққослаш натижасида инсон фаолиятининг биологик хилма-хилликка таъсирини баҳолади. Тадқиқот бешта асосий антропоген босим турларини – ердан фойдаланиш ўзгариши, ресурслардан фойдаланиш, ифлосланиш, иқлим ўзгариши ва инвазив турларни – куруклик, чучук сув ва денгиз экосистемаларида ўрганди.

Тадқиқотнинг энг муҳим хулосаларидан бири шундай: инсон босими жамоатлар таркибини аниқ силжитади ва маҳаллий хилма-хилликни камайтиради. Бироқ, узоқ йиллик кутилмаларга қарамай, биотик гомогенизациянинг аниқ умумий тенденцияси кузатилмади. Аксинча, антропоген босим кичик миқёсда биотик дифференциацияга олиб келади, катта миқёсда эса гомогенизация кузатилади. Жамоатлар таркибидаги силжиш ҳамма турдаги антропоген босимлар учун хос бўлиб, айниқса, яшаш муҳитининг ўзгариши ва ифлосланиш энг кучли таъсирга эга. Жамоатлар таркибидаги силжишнинг катталиги организмлар гуруҳига қараб ҳам фарқланади. Микроорганизмлар ва замбуруғлар, асосан майда турларни ўз ичига олган ҳолда, энг юқори таркибий силжишга эга, ҳайвонлар, балиқлар, амфибиялар ва судралувчиларда бу таъсир камроқ намоён бўлади. Майда турлар одатда юқори хилма-хилликка, қисқа ҳаёт циклига ва йирик турларга нисбатан юқори тарқалиш даражасига эга бўлиб, уларнинг жамоатлар таркибининг ўзгариш даражаси ҳам юқори.

4. БИОЛОГИК ХИЛМА-ХИЛЛИКНИ ЙЎҚОТИШНИНГ ОҚИБАТЛАРИ

Биологик хилма-хилликнинг йўқолиши кўпинча экосистемаларнинг маҳсулдорлигини пасайтиради ва шу тариқа инсон доимо фойдаланадиган

товарлар ва хизматларнинг табиий омборини камбағаллаштиради. Бу экосистемаларни беқарорлаштиради ва уларнинг сув тошқинлари, қурғоқчилик ва бўронлар каби табиий офатларга, шунингдек, ифлосланиш ва иқлим ўзгариши кўринишидаги антропоген стрессларга қарши туриш қобилиятини заифлаштиради.

Тадқиқотларга кўра, ҳозирги глобал тенденциялардан келиб чиқиб, флоранинг 34 мингга яқин тури ва фаунанинг 5,2 минг тури, жумладан, ҳар саккизинчи куш тури йўқолиб кетиш хавфи остида. Минг йиллар давомида инсон озиқ-овқат занжирида муҳим ўрин тутадиган кўплаб уй ҳайвонлари зотлари ва ўсимлик навларини кўпайтирган бўлса-да, замонавий қишлоқ хўжалиги донали экинларнинг нисбатан кам сонини тақиқлагани сабабли бу хилма-хиллик хавф остида. Қишлоқ хўжалиги ҳайвонларининг асосий зотларининг деярли 30 фоизи ҳозирда йўқолиб кетиш хавфи остида. Маржон рифларининг аҳволи ҳам ташвишли – дунёдаги энг бой маржон рифларининг қарийб 10 фоизи вайрон бўлган, қолганларининг учдан бир қисми эса яқин 10-20 йил ичида йўқ бўлиб кетиш хавфи остида. Сўҳил бўйидаги мангр ўрмон минтақалари, ўсимлик ва фаунанинг сон-саноксиз турлари учун муҳим кўчатхоналар ҳам хавф остида, уларнинг ярми аллақачон қайтариб бўлмайдиган даражада йўқолган.

ХУЛОСА ВА ТАКЛИФЛАР

Инсон хўжалик фаолияти биологик хилма-хилликка турли йўналган салбий таъсир кўрсатмоқда. Яшаш муҳитининг бузилиши, ифлосланиш, ресурслардан ҳаддан ташқари фойдаланиш, иқлим ўзгариши ва инвазив турлар – бу бешта асосий антропоген босим турлари экосистемаларнинг бузилишига, турларнинг йўқолишига ва биосферанинг беқарорлашишига олиб келмоқда. Биологик хилма-хилликни сақлаш бўйича қуйидаги чора-тадбирларни амалга ошириш зарур:

1. Экологик таълимни кучайтириш – аҳолини биологик хилма-хилликнинг аҳамияти ва уни сақлаш йўллари ҳақида хабардор қилиш;
2. Қонуний чора-тадбирларни кучайтириш – табиий ҳудудларни муҳофаза қилиш, "Қизил китоб"га киритилган турларни сақлаш бўйича қатъий қонунлар қабул қилиш ва уларнинг ижросини назорат қилиш;
3. Экологик мониторингни йўлга қўйиш – экосистемалар ҳолатини, турлар сони ва хилма-хиллигини мунтазам кузатиб бориш;
4. Оқилона табиатдан фойдаланиш тамойилларини жорий қилиш – табиий ресурслардан тежамкорлик билан фойдаланиш, уларни қайта тиклаш чора-тадбирларини кўриш;
5. Табиий ҳудудларни кенгайтириш – миллий боғлар, кўриқхоналар ва бошқа муҳофаза этиладиган табиий ҳудудларни кўпайтириш;
6. Илмий тадқиқотларни қўллаб-қувватлаш – биологик хилма-хилликка таъсирни баҳолаш ва сақлаш бўйича илмий тадқиқотларни молиялаштириш ва рағбатлантириш.

Биологик хилма-хилликни сақлаш нафақат экологик, балки ижтимоий-иқтисодий аҳамиятга ҳам эга. У инсониятнинг келажаги, озиқ-овқат

хавфсизлиги, саломатлиги ва фаровонлигининг асосидир. Шунинг учун ушбу муаммога комплекс ёндашиш ва барча манфаатдор томонларни – давлат, жамоатчилик, илмий доиралар ва бизнесни бирлаштирган чоратадбирларни ишлаб чиқиш муҳим аҳамиятга эга.

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ФАРҒОНА ВОДИЙСИДА ИҚЛИМ ЎЗГАРИШИ: ҲОЗИРГИ ҲОЛАТ, ТАЪСИР ВА МОСЛАШИШ СТРАТЕГИЯЛАРИ

Аннотация: Ушбу мақола Фарғона водийсида иқлим ўзгаришининг асосий кўринишлари, уларнинг қишлоқ хўжалиги ва аҳоли турмушига таъсири ҳамда мавжуд мослашиш чораларини ёритишга бағишланган. Марказий Осиёнинг энг зич аҳоли минтақаси бўлган Фарғона водийси иқлим яққол сезилиб турган ҳудудлардан бири ҳисобланади. Сўнгги йилларда ҳароратнинг кескин кўтарилиши, ёгингарчилик миқдорининг камайиши ва экстремал об-ҳаво ҳодисаларининг тез-тез такрорланиши кузатилмоқда. Бу жараёнлар, айниқса, суғоришга асосланган қишлоқ хўжалигига жиддий зарар етказиб, пахта ва буғдой ҳосилдорлигининг пасайишига, фермерлар даромадининг камайишига олиб келмоқда. Мақолада иқлим ўзгаришининг оқибатларини юмшатиш ва минтақадаги сув ресурсларидан самарали фойдаланиш бўйича тавсиялар ишлаб чиқилган.

Калим сўзлар: иқлим ўзгариши, сув ресурслари, аномал, микроиқлим.

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CLIMATE CHANGE IN THE FERGANA VALLEY: CURRENT STATUS, IMPACTS, AND ADAPTATION STRATEGIES

Abstract: This article examines the main manifestations of climate change in the Fergana Valley, its impacts on agriculture and the livelihoods of the population, as well as existing adaptation measures. The Fergana Valley, one of the most densely populated regions in Central Asia, is among the areas significantly affected by climate change. In recent years, a sharp increase in air temperature, a decrease in precipitation, and a growing frequency of extreme weather events have been observed. These processes have caused serious damage to irrigated agriculture, leading to reduced yields of cotton and wheat and decreasing farmers' incomes. The article proposes recommendations for

mitigating the impacts of climate change and improving the efficient use of water resources in the region.

Keywords: *climate change, water resources, anomalies, microclimate.*

Кириш

Фарғона водийси Марказий Осиёнинг энг муҳим кишлок хўжалик худуди бўлиб, Ўзбекистон, Қирғизистон ва Тожикистон худудларини қамраб олади. Бу минтақа нафақат ўзининг унумдор ерлари, балки зич аҳолиси ва трансчегарали сув ресурслари билан ҳам алоҳида аҳамиятга эга. Бироқ, сўнгги йилларда иқлим ўзгаришининг салбий таъсири Фарғона водийсида тобора кўпроқ сезилмоқда.

Тадқиқотларга кўра, Фарғона водийси иқлим ўзгаришига дучор худудлардан бири сифатида эътироф этилган. Бу ерда ҳароратнинг ўсиши, ёғингарчилик миқдорининг ўзгарувчанлиги ва экстремал об-ҳаво ҳодисалари (сув тошқинлари, қурғокчилик) тез-тез кузатилмоқда. Натижада, Фарғона водийсидаги иқлим ўзгариши жараёнларини, уларнинг кишлок хўжалигига таъсирини ва мавжуд мослашиш чораларини тизимли таҳлил қилиш ва иқлим ўзгаришини юмшатишга доир чора-тадбирлар режасини ишлаб чиқишдан иборат..

Фарғона водийси иқлимининг ўзгариш тенденциялари кўйидагилара номоён бўлади:

➤ **Ҳароратнинг кўтарилиши**

Фарғона водийсида охириги йилларда ҳаво ҳароратининг сезиларли даражада ошиши кузатилмоқда. Бу ҳолат нафақат ҳароратни ортиши орқали экинларга бевосита таъсир қилади, балки сув ресурсларига бўлган талабни ҳам оширади. Глобал иссиқ шароитида Марказий Осиёдаги экстремал ёғингарчилик ҳодисалари ҳам ортиб бормоқда. Тадқиқотларга кўра, ҳароратнинг 1,5°C га ва 2°C га кўтарилиши сценарийларида Фарғона водийси аҳолисининг экстремал ёғингарчиликка учраш хавфи ошади.

➤ **Ёғингарчиликнинг ўзгариши ва сув танқислиги**

Иқлим ўзгариши Фарғона водийсида ёғингарчилик миқдорининг ҳам ўзгаришига сабаб бўлмоқда. Хусусан, баҳорги ёғингарчилик миқдорининг камайиши кузатилмоқда. Бу эса, айниқса, вегетация даврининг бошланишида экинлар учун сув танқислигини келтириб чиқаради.

Сув ресурсларининг камайиб бориши Фарғона водийсидаги энг долзарб муаммолардан бирига айланган. Сўнгги ўн йилликда водийдаги сув миқдори йилига ўртача 3% га камайган. Бу қисқариш қор ва музликларнинг эриши, нотекис ёғингарчилик ва самарасиз сув бошқаруви билан боғлиқдир. Сирдарё havzasi, Фарғона водийси орқали оқиб ўтиб, уч мамлакатнинг 14 миллион аҳолиси учун сув манбаи бўлиб хизмат қилади. Бироқ, havzani марказлашган бошқаришнинг йўқлиги ва инфратузилманинг эскирганлиги сувдан фойдаланишдаги нотекисликни янада кучайтиради.

Шунингдек, голоцен даврида (7800 йил аввал) Фарғона водийсидаги иқлим ўзгаришини тадқиқ қилиш шуни кўрсатдики, минтақада узок

муддатли куриш тенденцияси мавжуд бўлган. Бу ҳолат Марказий Осиёнинг шарқий қисмидаги (ёзги ёғингарчилик устунлик қиладиган) намланиш тенденциясига зиддир. Тадқиқот муаллифларининг фикрича, бу фарқ қишки ва ёзги ғарбий оқимларнинг мавсумий куёш радиациясига турлича жавоб бериши билан изоҳланади.

➤ Экстремал об-ҳаво ҳодисаларининг кучайиши

Иқлим ўзгариши натижасида Фарғона водийсида сув тошқинлари, селлар ва курғоқчилик каби экстремал ҳодисалар тез-тез учрайдиган бўлди. Ўзбекистоннинг Фарғона вилоятида сув тошқинларидан етказилган зарар ЯИМнинг 2% га тенг. Қирғизистонда эса ҳар йили 200 га яқин фавқулодда ҳодисалар рўй беради, улардан келган иқтисодий зарар 30-35 миллион долларни (ЯИМнинг 1-1,5%) ташкил қилади.

Глобал ҳароратнинг кўтарилиши билан бирга, экстремал ёғингарчилик (ЭЁ) ҳодисалари ҳам кўпайиб бормоқда. Тадқиқотларга кўра, SSP5-8.5 сценарийида максимал кунлик ёғингарчилик (R_{x1day}) глобал исишга ўртача 3.58%/K тезликда жавоб беради. 1.5°C сценарийида Марказий Осиё аҳолисининг 25% и (ер майдонининг 9.32%) экстремал ёғингарчиликка дучор бўлса, 2°C сценарийида бу кўрсаткич 14.18% га (ер майдонининг 13.25% и) етади. Бу эса, айниқса, Фарғона водийси каби зич аҳоли ҳудудларда иқлим ўзгаришига мослашиш стратегияларини ишлаб чиқишнинг муҳимлигини кўрсатади.

➤ Иқлим ўзгаришининг Фарғона водийсидаги қишлоқ хўжалигига таъсири

Фарғона водийси қишлоқ хўжалиги учун энг муҳим ҳудуд бўлиб, бу ерда пахта ва буғдой етакчи экинлар ҳисобланади. Иқлим ўзгаришининг қишлоқ хўжалигига таъсирини ўрганиш бўйича олиб борилган тадқиқотлар шуни кўрсатдики, ҳароратнинг кўтарилиши ва ёғингарчиликнинг камайиши ҳосилдорликка жиддий зарар етказади. Тадқиқот натижаларига кўра, сув танқислиги даврида пахта ва буғдой ҳосили ўртача 17-20% га камаяди. Бу ҳолат айниқса, суғориш учун юза сувларга боғлиқ бўлган ҳудудларда кучлироқ кузатилади. Тадқиқотлар шуни кўрсатадики, иқлим аномалиялари натижасида ҳосилдорликнинг пасайиши кузатилади, нам йилларда эса ҳосилдорлик ортиши мумкин. Бу ҳодиса "ҳосилни босиб олиш" (yield hijacking) деб аталади.

➤ Фермерлар иқтисодиётига таъсири

Иқлим ўзгариши нафақат ҳосилдорликка, балки фермерларнинг иқтисодий аҳволига ҳам салбий таъсир кўрсатмоқда. Сўровномада қатнашган фермерларнинг 92% и суғориш харажатлари 45-60% га ошганини маълум қилган. Сув танқислиги шароитида фермерлар сувни қўшимча манбалардан (масалан, қудуқлар) олишга мажбур бўлади, бу эса электр энергияси ва ёқилғи харажатларини оширади. Натижада, фермерларнинг 89% и даромадларининг камайганини тасдиқлаган. Бу, айниқса, кичик фермер хўжаликлари учун оғир муаммо бўлиб, даромадлар билан харажатлар ўртасидаги фарқ кенгайиб бормоқда. 120 фермер ўртасида

ўтказилган сўровнома натижаларига кўра, кичик фермерлар иқлим ўзгаришининг салбий оқибатларига нисбатан кўпроқ ҳимоясиз бўлиб қолмоқда .

➤ Сувни тежайдиган технологиялар

Фарғона водийсида сув танқислигини юмшатиш учун замонавий сувни тежайдиган технологиялар жорий этилмоқда. Томчилатиб ва ёмғирлатиб суғориш технологиялари водийдаги 75 000 гектардан ортиқ суғориладиган майдонларда қўлланилмоқда. Бу технологиялар сув сарфини ўртача 45-50% га, минерал ўғитлар сарфини 25-30% га, ёқилғи-мойлаш материаллари сарфини 30-35% га ва меҳнат сарфини 20% га камайтиришга имкон берди. Шу билан бирга, ҳосилдорлик ўртача 30% га ошган. Бироқ, томчилатиб суғориш технологияларининг кенг жорий этилишига структур тўсиқлар мавжуд. Фермерларнинг 95% и технологияни жорий этишнинг юқори дастлабки харажатларини, 78% и эса кредит олишдаги қийинчиликларни асосий тўсиқлар сифатида кўрсатган . Натижада, фақат 19% фермерлар томчилатиб суғориш технологиясини қўллайди, аксарият фермерлар (91%) эса экиш муддатларини ўзгартириш каби арзонроқ мослашиш чораларини танлайди .

➤ Трансчегарали ҳамкорлик ва интеграциялашган сув ресурсларини бошқариш

Фарғона водийсида сув муаммоларини ҳал қилишда трансчегарали ҳамкорлик алоҳида аҳамиятга эга. Водий Қирғизистон, Тожикистон ва Ўзбекистон ҳудудларини бирлаштиради, шунинг учун сув ресурсларини бошқаришда давлатлараро мувофиқлашув зарур. "Фарғона тинчлик форуми" доирасида сув ва иқлим ўзгариши масалалари муҳокама қилинган. Ушбу форумда Фарғона вилояти (Ўзбекистон), Баткен вилояти (Қирғизистон) ва Суғд вилояти (Тожикистон) раҳбарлари иштирок этган. Форумда сув ресурсларини ўзаро ҳурмат, манфаатлар мувозанати ва суверен тенглик асосида бошқариш зарурлиги таъкидланган. Бундан ташқари, Сырдарё havzasida сув, энергия, озиқ-овқат ва атроф-муҳит орасидаги боғлиқликни (WEFE nexus) тадқиқ қилиш бўйича илмий ишлар олиб борилмоқда. Бу тадқиқотлар иқлим ўзгариши шароитида сув ресурсларини барқарор бошқариш учун зарур бўлган илмий асосларни яратади .

Тадқиқотларга асосланиб, Фарғона водийсида иқлим ўзгаришига мослашиш бўйича қуйидаги тавсияларни бериш мумкин:

✓ Сувни тежайдиган технологияларни қўллаб-қувватлаш: Томчилатиб суғориш технологияларини жорий этиш учун фермерларга имтиёзли кредитлар ва субсидиялар бериш.

✓ Экин турларини диверсификациялаш: Иссиқлик ва сув танқислигига чидамли экинларни жорий этиш.

✓ Суғориш инфратузилмасини модернизация қилиш: Каналлар ва сув омборларини замонавийлаштириш, сув йўқотишларни камайтириш.

✓ Траншегарали ҳамкорликни кучайтириш: Сув ресурсларини бошқариш бўйича давлатлараро келишувлар ва механизмларни такомиллаштириш.

✓ Фермерларнинг билим ва кўникмаларини ошириш: Иқлимга мослашиш бўйича тренинглар ва маълумотлар тарқатиш.

Хулоса. Фарғона водийсида иқлим ўзгариши тобора жиддий муаммога айланмоқда. Ҳароратнинг кўтарилиши, ёғингарчилик режимининг ўзгариши ва экстремал об-ҳаво ҳодисаларининг кўпайиши қишлоқ хўжалиги ҳосилдорлигига салбий таъсир кўрсатмоқда, фермерларнинг иқтисодий аҳволини ёмонлаштирмоқда ва минтақадаги озиқ-овқат хавфсизлигига хавф солмоқда.

Бироқ, сувни тежайдиган технологияларни жорий этиш, экин турларини диверсификация қилиш ва трансчегарали ҳамкорликни кучайтириш орқали иқлим ўзгаришининг салбий оқибатларини юмшатиш мумкин. Бу борада фермерларга молиявий ва техник ёрдам кўрсатиш, шунингдек, уларнинг билим ва кўникмаларини ошириш муҳим аҳамиятга эга. Фарғона водийсида иқлим ўзгаришига мослашиш фақат бир мамлакатнинг эмас, балки бутун минтақанинг устувор вазифаси бўлиши керак. Бунинг учун барча манфаатдор томонлар – фермерлар, олимлар, сиёсатчилар ва халқаро ташкилотлар – биргаликда ҳаракат қилиши зарур.

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СОДЕРЖАНИЕ И ПЕДАГОГИЧЕСКИЕ УСЛОВИЯ ПОДГОТОВКИ БУДУЩИХ УЧИТЕЛЕЙ К СОЦИАЛЬНО- ПЕДАГОГИЧЕСКОЙ ПРАКТИКЕ

***Аннотация:** В статье исследованы значение социальной активности в социально-педагогической практике, социально-педагогические аспекты организации волонтерской деятельности студентов педагогических высших образовательных учреждений, а также волонтерская деятельность как инновационная форма социально-педагогической практики.*

***Ключевые слова:** современное образование, инновации, мотивация, социально-педагогический процесс, волонтерская деятельность, педагог-воспитатель.*

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THE CONTENT AND PEDAGOGICAL CONDITIONS OF PREPARING FUTURE TEACHERS FOR SOCIAL AND PEDAGOGICAL PRACTICE

***Abstract:** This article examines the importance of social activism in social and pedagogical practice, the social and pedagogical aspects of organizing volunteer activities for students of pedagogical higher education institutions, and volunteering as an innovative form of social and pedagogical practice.*

***Keywords:** modern education, innovation, motivation, social and pedagogical process, volunteering, teacher.*

В социально-педагогической практике социальная активность имеет важное значение в развитии личности студента и является важным категориальным понятием в социально-педагогической практике и социально-педагогической деятельности. **Социальная активность** - участие социальных субъектов в общественно-политических процессах, усиление их трудовой и культурно-просветительской деятельности, стремление к полной реализации прав и обязанностей, установленных законом; сознательное самостоятельное участие субъекта в жизни общества, действия, направленные на решение проблем, возникающих в социально-духовной сфере. Социальная активность является основным условием обретения личностью своего места в обществе и сознательного управления своим поведением. Социальная активность является фундаментальным понятием формирования общественного сознания и одной из важных норм

гражданского общества. Социальная активность развивается в гармонии с понятиями альтруизма, бескорыстия и ответственности. Систематизированные характеристики социальной активности представлены в следующей таблице (см. Таблицу 2) :

Таблица 2.
Показатели и характеристики социальной активности.

Показатели	Особенности социальной активности
Цель	Социальная идентичность и адаптация личности к обществу
Основные принципы	Ориентация на деятельность, социальные связи
Инструменты	Общение, общественная работа, решение социальных проблем
Результат	Активное участие личности в обществе, проявление своих способностей

Социально-педагогическая практика имеет макро-, мезо-и микроэтапы, которые характеризуются следующим образом:

Макроэтап (на уровне общества)

Этот этап охватывает общегосударственные, региональные или глобальные социально-педагогические процессы и включает государственную политику в области образования, общенациональные социальные проекты, системы образования и социальной защиты.

Мезоэтап (на уровне региональных властей, организаций)

Этот этап включает в себя социально-педагогическую деятельность на уровне образовательных учреждений, махаллей, общин. Примерами могут служить социальные проекты, реализуемые в сотрудничестве с образовательными учреждениями, мероприятия, организованные местными или негосударственными организациями, а также пропагандистская работа.

Микроэтап (на индивидуальном уровне)

Этот этап направлен на работу с отдельными людьми или небольшими группами. Этот этап основан на педагогической деятельности между преподавателем и студентами. В частности, работа со слабоуспевающими, трудными, проблемными семьями, работа с родителями, индивидуальная работа с детьми, нуждающимися в специальной помощи, оказание психологической помощи могут быть примерами социально-педагогической практики, реализуемой на микроуровне.

Волонтерство является наиболее образцовым практическим механизмом подготовки будущих учителей к социально-педагогической практике на основе аксиологического подхода. Волонтерство (деятельность) - это когда человек добровольно жертвует свое время и труд на какое-либо общественное дело, часто без какой-либо материальной выгоды. То есть, занимаясь волонтерской деятельностью, человек добровольно тратит свое время и деятельность на выполнение какой-либо социальной работы.

Понятия "волонтеры" и "волонтеры" также являются одним и тем же понятием. В рамках исследовательской работы широко использовался термин "волонтер." Это понятие как международный термин широко используется на практике.

Волонтерство как социально-педагогическая деятельность развивает социальные и культурные компетенции человека. Волонтер осуществляет волонтерскую деятельность в различных формах, например: оказание помощи, поддержки пострадавшим в результате стихийных, экологических, техногенных и других бедствий, социальных конфликтов, несчастных случаев, жертвам преступлений, беженцам и перемещенным лицам, а также категориям и группам людей, нуждающимся в посторонней помощи, в том числе в учреждениях здравоохранения, образования и социальной защиты; предупреждение населения о стихийных, экологических, техногенных и других бедствиях, ликвидация их последствий; участие в иной добровольной деятельности (волонтерская деятельность). Социально-педагогическая поддержка организации волонтерской деятельности студентов в педагогических высших учебных заведениях имеет важное и решающее значение.

По результатам исследования разработаны следующие научно-методические рекомендации:

- целесообразно организовать факультативные курсы, основанные на интеграции личностных и профессиональных ценностей при подготовке будущих учителей в педагогических высших учебных заведениях;

- при подготовке к социально-педагогической практике целесообразно развивать теоретические знания с учетом подходов, отражающих практику, методического обеспечения, расположения регионов, их специфических особенностей;

- целесообразно разработать учебно-нормативные требования для признания волонтерской деятельности студентов в качестве дополнительной практики в педагогических высших учебных заведениях;

- в учебном процессе необходимо оценивать развитие у студентов культуры общения, основанной на социальной ответственности, эмпатии и ценностях, и в связи с этим организовывать «общение учитель-ученик» как регулярное общение;

- целесообразно включить социальную педагогику в качестве предмета в учебные планы всех образовательных направлений педагогических высших учебных заведений;

- при подготовке будущих учителей к социально-педагогической практике необходимо комплексное использование современных технологий, в том числе цифровых платформ и тренингов на основе симуляции.

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**ТЕОРЕТИКО-МЕТОДОЛОГИЧЕСКИЕ ОСНОВЫ
ПОДГОТОВКИ БУДУЩИХ УЧИТЕЛЕЙ К СОЦИАЛЬНО-
ПЕДАГОГИЧЕСКОЙ ПРАКТИКЕ НА ОСНОВЕ
АКСИОЛОГИЧЕСКОГО ПОДХОДА**

***Аннотация:** В статье представлен научный анализ необходимости подготовки будущих учителей к социально-педагогической практике на основе аксиологического подхода, социально-педагогической практики в педагогическом образовании как приоритетного фактора развития аксиологического отношения у студентов.*

***Ключевые слова:** научный анализ, структуры исследования, социально-педагогическая практика, аксиологический подход, педагогическое образование, аксиологическое отношение.*

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**THEORETICAL AND METHODOLOGICAL FOUNDATIONS FOR
PREPARING FUTURE TEACHERS FOR SOCIAL AND PEDAGOGICAL
PRACTICE BASED ON THE AXIOLOGICAL APPROACH**

***Abstract:** The article presents a scientific analysis of the need to prepare future teachers for social and pedagogical practice based on the axiological approach, social and pedagogical practice in pedagogical education as a priority factor in the development of axiological attitudes in students.*

***Keywords:** scientific analysis, research structures, social and pedagogical practice, axiological approach, pedagogical education, axiological attitude.*

Известно, что одной из важных задач каждого высшего учебного заведения является обеспечение положительной адаптации студентов к новой системе обучения, новым социальным отношениям, успешного усвоения ими статуса студента. Личность является активным объектом и субъектом образовательного процесса, и его активность в процессе профессиональной адаптации будущих учителей определяется его направленностью. Результаты педагогического наблюдения и исследования показывают, что в образовательном процессе в высших учебных заведениях недостаточно сформирована интеграционная структура между усвоением студентами профессиональных знаний, формированием профессионально-педагогических способностей, умений, навыков и подготовкой их к

социально-педагогической практике. Социально-педагогическая практика изучается не как целостная наука, а в связи с междисциплинарной интеграцией и жизнью общества. Проблемы, связанные с этой деятельностью, теоретически и практически изучаются на разных уровнях в таких дисциплинах, как этика, культурология, философия, психология, педагогика, эстетика. Основная задача социально-педагогической практики заключается в повышении общественного сознания обучающихся. Это показывает, что важно не только давать им теоретические знания, но и развивать навыки критического мышления, решения проблем и самостоятельного принятия решений. На основе научного анализа в рамках исследовательской работы было сформулировано следующее авторское определение: Социально-педагогическая практика - это подготовка будущих педагогов к эффективной деятельности в социальной среде путем применения теоретических знаний и навыков на практике, это системный педагогический процесс, направленный на обеспечение личностного и профессионального развития не только в системе высшего образования, но и на протяжении всей жизни человека. Подготовка к социально-педагогической практике неразрывно связана с профессиональной и личностной зрелостью будущего учителя, аксиологический подход служит повышению эффективности его профессиональной деятельности, привитию педагогических ценностей и формированию чувства социальной ответственности. Наряду с теоретическими знаниями для студентов социально-педагогической практики важную роль играют различные педагогико-психологические качества. Существуют различные формы социально-педагогической практики в образовательных учреждениях. Каждый из них ставит перед собой различные цели и задачи, которые способствуют расширению педагогической деятельности. Социально-педагогическая практика классифицируется по форме следующим образом: 1) организационная; 2) консультирование и менторство; 3) коллективный; 4) волонтерская деятельность. Наблюдения показывают, что знание будущими учителями социальных ценностей, норм и правил в обществе, их применение на практике не теряют своей актуальности для педагогической практики и научных исследований. Социально-педагогическая деятельность будущего учителя не ограничивается школой, а предполагает сотрудничество с государственными органами и негосударственными организациями. В этом случае от студентов требуется знание профессиональных ценностей, социальных норм, организаторских способностей, установления коммуникации, ведения дел на основе нормативно-правовых документов, правил этикета. Основу этих требований составляет педагогическая аксиология.

По мнению А.Калдибековой, Б.Ходжаева, педагогическая аксиология - это область педагогических знаний, которая, признавая человека и образование ценностями, обсуждает образовательные ценности и реализует ценностный подход к образованию. Педагогическая аксиология - это

направление педагогики, связанное с ценностями (антилогией), изучающее формирование человеческих, культурных и профессиональных ценностей в процессе обучения и воспитания. Основные педагогические ценности делятся на: общечеловеческие ценности (гуманизм, уважение, миролюбие); национальные ценности (культурное наследие, историческая память, патриотизм); профессиональные ценности (честность, ответственность, творчество, постоянное саморазвитие). В рамках исследовательской работы сформулировано следующее авторское определение понятия "развитие аксиологического отношения будущих учителей к социально-педагогической практике": это сознательный, эмоционально-волевой подход к социально-педагогической практике, формирующийся в процессе педагогического образования, основанный на ценностях, данное отношение представляет собой уровень понимания будущим учителем в социально-педагогической деятельности таких общечеловеческих, профессиональных ценностей, как гуманизм, справедливость, доброта, толерантность, социальная ответственность, а также процесс осуществления деятельности на их основе.

Взгляды на проблемы в области социализации обучающегося в научных источниках изображены графически следующим образом (см. рис. 1).

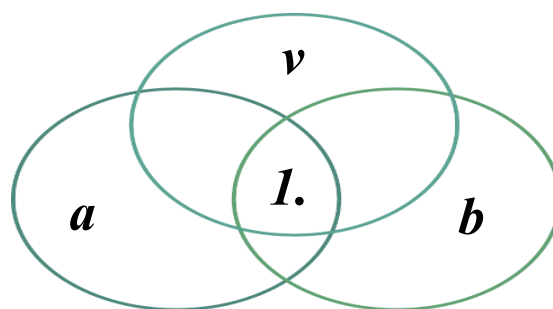


Рисунок 1. Социально-педагогическая практика как связь между тремя педагогическими процессами, регулирующими процессы социализации.

1 - проблемы в области социализации обучающегося; **a** - социальная помощь обучающемуся; **b** - социальное воспитание обучающегося; **v** - социально ориентированное образование.

Анализ научных источников показывает, что "социально-педагогическая практика" и "социально-педагогическая деятельность" взаимосвязаны и различаются. Эти взаимосвязи и различия сравнительно проанализированы в следующей таблице (см. Таблицу 1).

Таблица 1.

Понятий «социально-педагогическая практика» и «социально-педагогическая деятельность» сравнительный анализ

Описание	Социально-педагогическая практика	Социально-педагогическая практика
Определение	Социально-педагогическая практика - это процесс применения социально-педагогических теорий и методов в реальной жизни. С помощью этого процесса решаются социальные проблемы и осуществляется непосредственная работа с социальными группами в обществе.	Социально-педагогическая деятельность - это профессиональная деятельность социального педагога, осуществляющая воспитательную, развивающую и поддерживающую работу в социальной среде.
Цель	Основная цель практики - проверка теоретических знаний на практике, решение социальных проблем и приобретение опыта.	Целью деятельности является создание устойчивой воспитательной системы в социальной среде, предотвращение социальных проблем и развитие социальных групп.

Субъект	Участники социально-педагогической практики: студенты, стажеры, социальные работники и волонтеры.	Участники социально-педагогической деятельности: профессиональные социальные педагоги, психологи, воспитатели и другие специалисты.
Объект	Объекты практики: дети, инвалиды, пожилые люди, мигранты и другие социально уязвимые группы.	Объекты деятельности: целые социальные группы, семьи, сообщества и различные слои общества.
Методы	Методы, используемые на практике: наблюдение, беседа, интервью, эксперимент, тренинги и семинары.	Методы, используемые в деятельности: диагностика, профилактика, реабилитация, консалтинг и консультирование.
Результаты	В результате практики: студенты приобретают практические навыки, приобретают опыт решения социальных проблем.	В результате деятельности: социальные проблемы уменьшаются, социальные группы развиваются, социальная стабильность обеспечивается.
Продолжительность	Стажировка обычно кратковременная и проводится в течение семестра или учебного года.	Деятельность является постоянной и непрерывной и осуществляется в течение профессиональной жизни.
Правовые основы	Практика будет проводиться по программам, установленным образовательными учреждениями.	Деятельность осуществляется на основе государственных законов, нормативных документов и

		профессиональных стандартов.
Контроль и оценка	Результаты практики оцениваются преподавателями и руководителями практики.	Результаты деятельности контролируются государственными органами, общественными организациями и профессиональными ассоциациями.
Инновации	На практике будут апробированы новые методы и подходы.	В деятельность внедряются инновационные технологии и методы.
Инновации	На практике будут апробированы новые методы и подходы.	В деятельность внедряются инновационные технологии и методы.

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ЧАҚАЛОҚЛАРДАГИ АЛЛЕРГИК КАСАЛЛИКЛАР ПАТОГЕНЕЗИ: ОНА РАЦИОНИ ВА ИРСИЯТНИНГ ЎЗАРО БОҒЛИҚЛИГИ

Изоҳ.

Долзарблиги. Аллергик касалликлар замонавий педиатрияда ўсиб бораётган муаммо бўлиб, кўпинча ҳаётнинг дастлабки босқичларида ўзини намоён қилади.

Усуллари. Самарқанд шаҳридаги клиник базаларда 40 нафар янги туғилган чақалоқ ва уларнинг оналари бўйича комплекс клиник ва анамнестик тадқиқотлар ўтказилди. Онанинг хавф омиллари, ҳомиладорлик пайтида овқатланиш табиати, оилавий тарих ва янги туғилган чақалоқларда терининг намоён бўлиши таҳлил қилинди.

Натижалар. Аллергик аломатлар асосан ҳаётнинг дастлабки 5 кунда пайдо бўлган, чўққиси 3-кун (20,0%). Оналарда ҳомиладорликнинг асоратлари 35,0% ҳолларда қайд этилган. Умумий омил ҳомиладорлик даврида рациондаги номутоносизлик еди: шўр (37,5%) ва углеводларга бой (20,0%) овқатларни кўп истеъмол қилиш устунлик қилди. Бези дерматит/йўрғак тошма (42,5%) ва заҳарли еритема (25,0%) чақалоқларда тери намоён орасида ҳукмрон. Оила тарихини таҳлил қилиш ака-ука ва опа-сингиллар орасида экссудатив диатезнинг (37,5%) юқори тарқалишини, шунингдек, яқин қариндошларда нафас олиш ва тери аллергиясини аниқлади.

Хулоса. Янги туғилган чақалоқларда аллергия ривожланиши ҳомиладорлик даврида онанинг овқатланишининг ўзига хос хусусиятлари ва ирсий мойиллик билан чамбарчас боғлиқ. Ушбу патологияни ерта аниқлаш учун аёллар клиникалари ва педиатрия хизматлари ўртасида интеграциялашган скрининг протоколларини амалга ошириш жуда муҳимдир.

Калит сўзлар: янги туғилган чақалоқлар, neonatal аллергия, онанинг овқатланиши, prenatal сенсibilизация, токсик еритема, ирсий мойиллик.

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ALLERGIC DISEASES IN NEWBORNS: THE INFLUENCE OF MATERNAL DIET AND GENETIC PREDISPOSITION

Abstract.

Background. Allergic diseases represent a growing challenge in modern pediatrics, often initiating in the earliest stages of life.

Methods. A comprehensive clinical and anamnestic study of 40 newborns and their mothers was conducted at Samarkand clinical sites. Maternal risk factors, prenatal diet, family history, and neonatal cutaneous manifestations were analyzed.

Results. Allergic symptoms manifested predominantly within the first 5 days of life, peaking on day 3 (20.0%). Maternal pregnancy complications were reported in 35.0% of cases. Dietary imbalances during pregnancy were prevalent, with high consumption of salty (37.5%) and carbohydrate-rich (20.0%) foods. Cutaneous manifestations in newborns were dominated by diaper dermatitis/intertrigo (42.5%) and toxic erythema (25.0%). Family history revealed a high prevalence of exudative diathesis (37.5%) among siblings and respiratory/cutaneous allergies in immediate relatives.

Conclusion. Neonatal allergy development is strongly modulated by maternal gestational nutrition and hereditary predisposition. Integrated screening protocols between antenatal clinics and pediatric services are crucial for early detection.

Keywords: newborns, neonatal allergy, maternal diet, prenatal sensitization, toxic erythema, hereditary predisposition.

КИРИШ

Аллергик касалликлар замонавий педиатрия, неонатология ва клиник иммунологиянинг энг долзарб ҳамда глобал муаммоларидан бири бўлиб қолмоқда. Сўнгги ўн йилликликларда бутун дунёда, шу жумладан ривожланаётган мамлакатларда ҳам болалар ўртасида аллергия патологияларнинг учраш даражаси эпидемиологик тус олди. Тиббий статистика маълумотларига кўра, турли мамлакатларда болалар аҳолисининг 20% дан 40% гача қисми ушбу патологиянинг у ёки бу шаклидан азият чекмоқда. Энг хавотирли тенденция шундан иборатки, аллергия сурункали касалликлар нафақат микдорий жиҳатдан кўпаймоқда, балки уларнинг илк клиник намоён бўлиш муддатлари сезиларли даражада «ёшариб», интранатал ва эрта неонатал даврга тўғри келмоқда.

Эрта неонатал даврда (хаётнинг дастлабки кунларида) кузатиладиган аллергик тери реакциялари ва функционал бузилишлар шунчаки ўтиб кетувчи транзитор ҳолат бўлмай, балки боланинг кейинчалик сурункали атопик касалликларга — атопик дерматит, бронхиал астма ва аллергик ринитга чалиниш хавфини кескин оширувчи «атопик марш»нинг (аллергия ривожланиш занжирининг) илк бўғини ҳисобланади.

Замонавий фундаментал тадқиқотлар янги туғилган чақалоқларда туғма (врожденный) ва эрта неонатал сенсбилизациянинг шаклланишини кўп омилли (мультифакториал) жараён сифатида талқин этади. Бунда иккита асосий устувор омил ҳал қилувчи рол ўйнайди: оилавий-генетик мойиллик ва табиий физиологик кўкрак сути билан боқиш тизимининг эрта бузилиши ёки ундан воз кечиб, сигир сути оқсили асосидаги сунъий аралашмаларга эрта ўтиш [2]. Бола ҳаётининг илк кунларида иммун тизимининг (Th1 ва Th2 лимфоцитлар мувозанатининг) тўғри шаклланиши ва овқат барьер функциясининг мустаҳкамлиги ичак микробиотасининг нормал таркиби билан узвий боғлиқдир [1]. Бирок, бу тизимнинг издан чиқиши бачадон ичи (антенатал) даврига ҳам бориб тақалади.

Ҳомиладорлик даврида йўлдош (плацентар) барьернинг ўтказувчанлиги турли гестацион асоратлар, жумладан, эрта ва кеч гестозлар (токсикозлар), онанинг экстрагенитал ҳамда ўткир инфекцион касалликлари (грипп, ангина, сурункали нефропатияларнинг авж олиши) туфайли сезиларли даражада ошади [3, 4]. Бунинг натижасида йирик молекулали овқат аллергенлари плацента орқали ҳомила қон айланиш тизимига тўсиқсиз ўтиб, унда ҳали туғилмасдан туриб пассив сенсбилизация ҳолатини шакллантиради [4, 6]. Агар ушбу даврда ҳомиладор аёлнинг овқатланиш рационалида юқори даражадаги аллерген хусусиятга эга маҳсулотлар (ҳаддан ташқари шўр, ширин, унли ва экстрактив моддаларга бой таомлар) устуворлик қилса, бачадон ичи давридаги сенсбилизация жараёни янада кучаяди [6].

Туғилгандан сўнг, ташқи муҳит омиллари, табиий физиологик кризлар ва овқатланишнинг бошланиши фонида ушбу яширин сезувчанлик тез фурсатда клиник намоён бўлади. Янги туғилган бола тери-капилляр тизимининг экзоген ва эндоген стимулларга нисбатан маҳаллий жавоб реакцияси жуда юқори бўлганлиги сабабли, аллергик жараёнлар кўпинча тери қопламаларида токсик эритема, ксероз (тери қуруқлиги) ва табиий бурмалардаги турғун бичилишлар (опрелость) кўринишида намоён бўлади [7]. Минтакавий хусусиятлар, жумладан, иқлим шароити, маҳаллий аҳолининг овқатланиш анъаналари ва тиббий-ижтимоий омиллар ҳам янги туғилган чақалоқларда ушбу патологиянинг ривожланиш хавфини белгилашда муҳим аҳамиятга эга [3].

Тадқиқотнинг мақсади

Самарқанд шаҳридаги туғруқ комплекси шароитида янги туғилган чақалоқларда аллергик касалликлар ва тери белгиларининг намоён бўлиш хусусиятларини, уларнинг юзага келишида онанинг ҳомиладорлик

давридаги овқатланиш рационали, гестацион асоратлар ва оилавий-генетик анамнезнинг таъсирини клиник-статистик жиҳатдан таҳлил қилиш ва эрта профилактика чораларини асослашдан иборат.

Тадқиқотнинг материаллари ва услублари

Ушбу илмий иш Самарқанд давлат тиббиёт университети Факультатив педиатрия кафедраси клиник базалари ва Самарқанд шаҳар 3-сонли туғруқ мажмуасида амалга оширилган проспектив ва ретроспектив кузатув тадқиқоти ҳисобланади. Болаларда эрта неонатал аллергия патологиялар ривожланишининг хавф омилларини баҳолаш мақсадида 40 нафар янги туғилган чақалоқ ва уларнинг оналари (жами 40 жуфт «она-бола») комплекс клиник-анамнестик ва статистик таҳлилдан ўтказилди.

Тадқиқотга киритиш мезонлари:

- Эрта неонатал даврда (ҳаётнинг дастлабки 5 кунда) тери қопламаларида аллергия ва атопик намоён бўлишлар аниқланган янги туғилган болалар;
- Ҳомиладорлик ва туғруқ тарихи тўғрисида тўлиқ тиббий ҳужжатлари (алмашинув варақаси, туғруқ тарихи баённомаси) мавжуд бўлган оналар;
- Оналарнинг тадқиқотда иштирок этиш учун ихтиёрий розилиги.

Тадқиқот усуллари:

1. **Клинико-анамнестик усул:** Оналарнинг акушерлик ва гинекологик анамнези, туғруқ тартиби (нечанчи туғруқ эканлиги) батафсил ўрганилди. Ҳомиладорлик даврида кечган экстрагенитал ва гестацион асоратлар, жумладан, эрта ва кеч гестозлар, ўткир респиратор ва инфекцион касалликлар (грипп, ангина, аппендицит) қайд этилди [2, 3].

2. **Нутрициологик баҳолаш усули:** Ҳомиладорлик даврида аёлларнинг овқатланиш характери, кундалик рационда муайян маҳсулотлар гуруҳининг (шўр, унли, ёғли, углеводли, оксилли таомлар) устуворлик даражаси ва диета баланси махсус сўровномалар ёрдамида таҳлил қилинди [6].

3. **Генеалогик (ирсий) усул:** Оилада ва яқин қариндошлар (ота-онаси, ака-опалари) ўртасида аллергия касалликлар (бронхиал астма, экзема, аллергия ринит) ва болаликдаги экссудатив диатез ҳолатларининг мавжудлиги тизимли равишда ўрганилди. Дори воситаларига (пенициллин, пирамидон ва б.) бўлган юқори сезувчанлик анамнези аниқланди.

4. **Фенотипик ва клиник-неонатал усул:** Янги туғилган чақалоқлар ҳаётининг дастлабки 5 кун давомида ҳар кун динамик равишда неонатолог ва педиатр кўригидан ўтказилди. Аллергия реакцияларнинг илк намоён бўлган кун (динамикада) ва теридаги патологик ўзгаришларнинг клиник шакллари (токсик эритема, ксероз, табиий бурмалардаги бичилишлар) халқаро мезонлар асосида верификация қилинди [7].

Маълумотларни статистик қайта ишлаш (Statistical analysis):

Олинган рақамли ва клиник маълумотлар тиббий-биологик статистика қоидаларига мувофиқ ва замонавий илмий манбаларда тавсия этилган

усуллар асосида қайта ишланди [2, 4]. Кўрсаткичларнинг нисбий қийматлари фоизларда (%) ва мутлақ сонларда (n) ифодаланди. Омилар ўртасидаги боғлиқликни баҳолаш ва гуруҳлараро тақсимотларни тизимлаштириш учун тиббий анкета маълумотлари гуруҳларга ажратилиб, умумлаштирилган жадваллар кўринишига келтирилди.

Олинган натижалар

Тадқиқот гуруҳидаги 40 нафар туғруқдаги аёлларнинг акушерлик анамнези таҳлил қилинганда, биринчи туғруқ 18 та ҳолатни (45,0%), иккинчи туғруқ 10 та (25,0%), учинчи туғруқ 5 та (12,5%) ва ундан кейинги туғруқлар 7 та ҳолатни (17,5%) ташкил этди.

Кузатувдаги 40 нафар аёлдан 14 нафарида (35,0%) ҳомиладорлик даврида турли патологик ҳолатлар ва касалликлар аниқланди. Жумладан, ҳомиладорликнинг биринчи ярмида гестозлар (токсикоз) — 4 та (10,0%), грипп — 3 та (7,0%) ва нефропатия — 1 та (2,5%) ҳолатда қайд этилди. Ҳомиладорликнинг иккинчи ярмида эса 6 нафар аёлда (15,0%) ангина, анемия, аппендицит ва турли травмалар кузатилган.

Ҳомиладор аёлларнинг овқатланиш рационали ўрганилганда, кўпчилик аёллар томонидан диета тартибининг бузилиши ва муайян маҳсулотларни ҳаддан ташқари кўп истеъмол қилиш ҳолатлари аниқланди:

Шўр таомлар истеъмоли: 13 та аёл (37,5%);

Углеводли (ширинликлар) таомлар: 8 та аёл (20,0%);

Унли маҳсулотлар: 7 та аёл (17,5%);

Ёғли таомлар: 7 та аёл (17,5%);

Оқсилли таомлар: 3 та аёл (6,0%);

Сабзавотли маҳсулотлар: фақат 2 та аёл томонидан устувор равишда истеъмол қилинган.

Янги туғилган чақалоқларда аллергия реакцияларнинг клиник белгилари дастлабки 5 кун ичида намоён бўлди. Симптомларнинг юзага чиқиш динамикаси қуйидагича бўлди: 1-куни — 3 та, 2-куни — 4 та, 3-куни — 8 та (энг юқори кўрсаткич), 4-куни — 3 та ва 5-куни — 2 та бола.

Чақалоқларда аниқланган тери патологиялари ва аллергия клиник шакллари қуйидаги жадвалда умумлаштирилди:

Жадвал 1.

Янги туғилган чақалоқларда аллергия тери белгиларининг тақсимланиши (n=40)

	Клиник намоён бўлиши	Бола лар сони	Фоиз кўрсаткичи (%)
	Табийи тери бурмаларидаги бичилишлар	17	42,5%
	Токсик эритема	10	25,0%
	Терининг қуруқлиги (ксероз)	5	12,5%

Шунингдек, оилавий анамнез ўрганилганда, 15 та оилада (37,5%) бошқа фарзандларда экссудатив диатез белгилари мавжуд бўлганлиги, 5 та

оилада (12,0%) пенициллин ва пиримидон каби дори воситаларига юқори сезувчанлик борлиги аниқланди. 6 та оилада эса ота-оналар ва яқин қариндошларда оғир аллергия касалликлар (бронхиал астма — 2 та, экзема — 2 та, аллергия ринит — 2 та) рўйхатга олинган.

Муҳокама

Олинган натижалар шуни кўрсатадики, янги туғилган чақалоқларда аллергия сенсibilизациянинг шаклланиши кўп омилли жараён бўлиб, унда антенатал давр ҳал қилувчи рол ўйнайди. Чақалоқларда клиник белгиларнинг, айниқса, ҳаётнинг 3-кунида (кузатилган болаларнинг 20%ида) авж олиши, бу даврдаги физиологик кризлар ва ташқи муҳит (жумладан, сунъий озиқлантиришнинг бошланиши) таъсири билан изоҳланади.

Ҳомиладор аёллар рациониди шўр (37,5%), ширин (20,0%) ва унли (17,5%) таомларнинг устуворлик қилиши ҳомила шиллиқ қаватлари ва тери қопламаларининг ўтказувчанлигини оширади ҳамда Rathner назариясига мувофиқ, бачадон ичи давридаёқ пассив сенсibilизацияни шакллантиради. Ондаги гестозлар ва инфекция касалликлар (грипп, ангина) эса йўлдош тўсиғи (плацентар барьер) функциясини бузиб, йирик молекулали овқат аллергияларининг ҳомила қон айланиш тизимига тўсиқсиз ўтишига шароит яратади.

Ирсий омиларнинг таҳлили (оилаларнинг 37,5%ида экссудатив диатез ва 15%ида тизимли аллергияпатологиялар мавжудлиги) Glaser томонидан илгари сурилган генетик мойиллик назариясини тўлиқ тасдиқлайди. Тери намоён бўлишлари ичида бичилишлар (42,5%) ва токсик эритеманинг (25,0%) устунлиги янги туғилган болалар тери-капилляр тизимининг аллергиялар таъсирига юқори даражадаги маҳаллий жавоб реакциясидан далолат беради.

Хулоса

Янги туғилган чақалоқларда эрта аллергия касалликларнинг ривожланишига онанинг ҳомиладорлик давридаги нораціонал овқатланиши (аллерген хусусиятга эга таомларни кўп истеъмол қилиши) ва оиладаги генетик (ирсий) мойиллик бевосита таъсир кўрсатади.

Антенатал даврда йўлдош тўсиғининг шикастланиши (токсикоз ва инфекциялар туфайли) ҳомиланинг бачадон ичида пассив сенсibilизацияланишини тезлаштирувчи муҳим хавф омилли ҳисобланади.

Амалий тавсия

Янги туғилган чақалоқлар ўртасида аллергия патологияларни камайтириш учун аёллар маслаҳатхоналари ва болалар поликлиникалари шифокорлари ҳамкорлигида ҳомиладор аёллар ўртасида диета тартибига риоя қилиш бўйича тушунтириш ишларини кучайтириш ҳамда хавф гуруҳидаги болаларни ҳаётининг илк кунлариданоқ қатъий назоратга олиш зарур.

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ОСОБЕННОСТИ АУДИТА КРОСС-КУЛЬТУРНОЙ ЗРЕЛОСТИ

Аннотация: В статье раскрыты особенности аудита кросс-культурной зрелости процессов как системной диагностики, ориентированной на выявление скрытых поведенческих барьеров и коммуникационных разрывов в поликультурной среде. Предложена трехуровневая методология оценки, включающая калибровку метрик, ревизию процессов через культурные фильтры и корреляционный анализ с бизнес-результатами

Ключевые слова: кросс-культурный аудит, поведенческие метрики, культурная зрелость, инклюзивные процессы, ревизия

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FEATURES OF CROSS-CULTURAL MATURITY AUDIT

Abstract: The article reveals the features of cross-cultural maturity audit of processes as a system diagnostic focused on identifying hidden behavioral barriers and communication gaps in a multicultural environment. A three-level assessment methodology is proposed, including metric calibration, process revision through cultural filters, and correlation analysis with business results

Keywords: cross-cultural audit, behavioral metrics, cultural maturity, inclusive processes, revision

Аудит кросс-культурной зрелости процессов — это системная диагностика способности организации эффективно функционировать в условиях культурного многообразия, оценивающая не формальные показатели, а реальные поведенческие паттерны и коммуникационные разрывы между сотрудниками разных культурных групп. Данный подход позволяет выявить скрытые барьеры, которые стандартные KPI не фиксируют, и определить точки, где процессы требуют культурно-чувствительной настройки.

В отличие от классического финансового или производственного аудита, здесь объектом оценки становятся не цифры и документы, а поведенческие паттерны, коммуникационные разрывы и степень реальной вовлеченности сотрудников из разных культурных групп. Процесс начинается с определения ключевых метрик, которые выходят за рамки

формальных КРІ. Среди них — скорость принятия решений в кросс-культурных командах, частота эскалации конфликтов, уровень текучести среди представителей разных культурных сегментов, а также субъективная удовлетворенность сотрудников качеством внутренней коммуникации. Таким образом, первый этап аудита — это калибровка измерительных инструментов под конкретный культурный ландшафт региона.

Второй этап предполагает проведение ревизии существующих процессов через призму культурных фильтров. Здесь аудитор исследует, как спроектированы процедуры онбординга, системы мотивации, механизмы обратной связи и принципы формирования команд. Критический вопрос — насколько эти процессы универсальны по замыслу и насколько они реально работают для всех культурных групп. Часто выясняется, что формально нейтральные процедуры на деле обслуживают ценности доминирующей культуры региона, оставляя меньшинства в позиции вечно адаптирующихся. Инструментом ревизии служат глубинные интервью, фокус-группы и анализ переписки, где фиксируются паттерны исключения или недопонимания. Например, практика открытых обсуждений на совещаниях может восприниматься как норма для западных сотрудников и как неуважение к иерархии для представителей восточных культур.

Третий этап — анализ данных, собранных на предыдущих стадиях, и их сопоставление с бизнес-результатами. Здесь аудит выходит на уровень корреляции: существует ли связь между низкой кросс-культурной зрелостью в команде и задержками проектов, потерей клиентов или снижением инновационной активности? Эмпирические исследования показывают, что в поликультурных регионах компании с низким уровнем зрелости процессов теряют до 30% продуктивности из-за неразрешенных культурных трений. Однако эта цифра остается невидимой для стандартной отчетности. Именно поэтому аудит требует внедрения специальных индексов — например, индекса кросс-культурной коллаборации, который рассчитывается на основе опросов и поведенческих метрик. Без такого индекса менеджмент склонен списывать проблемы на внешние факторы, не видя корня в собственных процессах.

Сравнительный анализ показывает, что у методологии аудита кросс-культурной зрелости есть как сильные стороны, так и ограничения. Для наглядности представим их в таблице 1 «Достоинства и недостатки аудита кросс-культурной зрелости процессов»

Таблица 1.

**Достоинства и недостатки аудита кросс-культурной
зрелости процессов**

Достоинства	Недостатки
Позволяет выявить скрытые поведенческие барьеры, не фиксируемые стандартными KPI	Требует высокой квалификации аудиторов, знакомых с культурной антропологией
Дает конкретные данные для перепроектирования HR- и операционных процессов	Результаты сложно выразить в денежном эквиваленте, что затрудняет защиту бюджета
Снижает риски текучести и конфликтов в долгосрочной перспективе	Может быть воспринят сотрудниками как инструмент слежки или культурного давления
Создает основу для построения инклюзивной корпоративной культуры	Требует значительных временных затрат на сбор качественных данных
Повышает точность планирования в поликультурных проектах	Интерпретация метрик зависит от контекста и может быть субъективной

После сбора и анализа данных наступает этап формирования рекомендаций. Здесь важно избежать двух крайностей: радикальной унификации процессов под единый стандарт и полного релятивизма, когда каждой культурной группе разрешается работать по своим правилам. Оптимальный путь — создание «культурно-гибких» процессов, которые имеют жесткое ядро (обязательные для всех стандарты безопасности, отчетности, этики) и гибкую оболочку (вариативные формы коммуникации, мотивации, контроля). Аудит должен указать, где именно проходит эта граница для каждой конкретной бизнес-функции. Например, процедура найма может быть унифицирована по критериям компетенций, но различаться по формату собеседований в зависимости от культурных ожиданий кандидатов[1,с.25].

Заключительный этап — циклическая ревизия. Кросс-культурная зрелость не является статичным состоянием; она меняется вместе с составом команды, внешней средой и глобальными трендами. Аудит должен проводиться не реже одного раза в год, а его результаты — ложиться в основу плана корректирующих действий. Важно, чтобы ревизия не превращалась в формальную отчетность, а становилась механизмом обратной связи для всех уровней организации. Эффективная система предполагает создание кросс-культурного комитета или назначение омбудсмана, который отслеживает динамику метрик и инициирует изменения до того, как проблемы перерастут в кризис. Только такой подход превращает аудит из инструмента контроля в инструмент развития.

Таким образом, аудит кросс-культурной зрелости процессов — это не опция для продвинутых компаний, а необходимость для любого бизнеса, работающего в поликультурном регионе. Без регулярной диагностики скрытые культурные трения будут постепенно разрушать операционную эффективность, оставаясь незамеченными для стандартной управленческой отчетности.

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АДАПТАЦИЯ ПРАВОВЫХ ИНСТРУМЕНТОВ ПОД МОЛОДЁЖНЫЙ БИЗНЕС: КРОССКУЛЬТУРНЫЙ МЕНЕДЖМЕНТ В УСЛОВИЯХ НЕОПРЕДЕЛЁННОСТИ

Аннотация: В статье исследуется необходимость адаптации правовых инструментов под динамичные модели молодёжного предпринимательства в условиях глобальной турбулентности. Особое внимание уделяется роли кросс-культурного менеджмента как фундамента для создания гибких правовых конструкций, учитывающих различия в деловой этике и восприятии рисков. Автором обосновывается, что синтез регуляторных песочниц, смарт-контрактов и культурно-чувствительных арбитражных механизмов позволяет превратить неопределённость в драйвер инноваций.

Ключевые слова: молодёжный бизнес, кросс-культурный менеджмент, правовая адаптация, неопределённость, смарт-контракты.

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ADAPTING LEGAL INSTRUMENTS TO YOUTH BUSINESS: CROSS- CULTURAL MANAGEMENT IN AN UNCERTAIN ENVIRONMENT

Abstract: The article explores the need to adapt legal instruments to the dynamic models of youth entrepreneurship in the context of global turbulence. Special attention is given to the role of cross-cultural management as a foundation for creating flexible legal frameworks that take into account differences in business ethics and risk perception. The author argues that the synthesis of regulatory sandboxes, smart contracts, and culturally sensitive arbitration mechanisms can transform uncertainty into a driver of innovation.

Keywords: youth business, cross-cultural management, legal adaptation, uncertainty, smart contracts.

В условиях нарастающей глобальной турбулентности молодёжное предпринимательство оказывается на пересечении двух ключевых вызовов: необходимости адаптации правовых механизмов под гибкие, часто неформализованные бизнес-модели и управления кросс-культурными различиями в командах, формирующихся «на лету».

Традиционное право, ориентированное на стабильные иерархии и долгосрочные контракты, часто вступает в противоречие с динамикой стартапов, где решения принимаются быстро, а риски распределяются нестандартно. Именно здесь инструменты кросс-культурного менеджмента становятся не дополнением, а фундаментом: понимание различий в деловой этике, восприятии обязательств и степени избегания неопределённости позволяет создавать правовые конструкции, которые не душат инициативу, но обеспечивают защиту сторон. Например, в коллективах, где смешаны представители культур с высоким контекстом (Япония, Ближний Восток) и низким контекстом (Скандинавия, Германия), стандартный письменный договор может восприниматься либо как необходимое зло, либо как оскорбительное недоверие. Адаптация здесь требует перехода от жёстких санкций к механизмам медиации и многоуровневым соглашениям, где правовая форма следует за культурной логикой взаимодействия. В итоге успех зависит от способности законодателя и правоприменителя увидеть за юридической нормой живую ткань интернационального молодёжного проекта.

Особую остроту эта проблема приобретает в контексте неопределённости — фактора, который для молодёжного бизнеса является не исключением, а повседневной средой. Правовые инструменты, рассчитанные на предсказуемость хозяйственного оборота, требуют серьёзной ревизии: стартапы часто живут от раунда к раунду финансирования, меняют продуктовые гипотезы каждые несколько месяцев и не могут гарантировать стабильность условий, заложенных в типовые контракты. Здесь возникает потребность в «плавающих» правовых конструкциях — опционах, условных обязательствах, смарт-контрактах с гибкими триггерами, которые снижают транзакционные издержки для участников из разных правовых систем[2, с .94].

Кросс-культурный менеджмент в этом сценарии предлагает использовать разное отношение ко времени и рискам как ресурс: культуры с долгосрочной ориентацией (Китай, Корея) легче договариваются о поэтапных гарантиях, тогда как краткосрочные культуры (США, Австралия) предпочитают быстрые циклы с чёткими «выходами». Задача правовой адаптации — создать рамку, в которой эти различия не ведут к конфликту, а взаимодополняются через процедуры периодического пересмотра условий и культурно-чувствительные арбитражные оговорки. Таким образом, право перестаёт быть статичным сводом запретов и превращается в динамичный инструмент совместного конструирования реальности.

Чтобы системно оценить факторы, влияющие на этот процесс, целесообразно применить PEST-анализ, который позволяет выделить четыре группы воздействий на адаптацию правовых инструментов для молодёжного бизнеса в кросс-культурном контексте.

Таблица 1.

PEST-анализ адаптации правовых инструментов под молодёжный бизнес в кросс-культурной среде

Измерение	Ключевые факторы и их влияние
Политические	Различия в правовых семьях (англосаксонское vs континентальное право) требуют разного подхода к регистрации стартапов; государственные программы поддержки молодёжного бизнеса часто не учитывают кросс-культурные особенности ведения переговоров.
Экономические	Волатильность валют и разный уровень налогообложения в странах-источниках инвестиций создают потребность в гибких опционах; доступ к венчурному капиталу зависит от юридической защищённости интеллектуальной собственности в разных юрисдикциях.
Социальные	Разная степень доверия к формальным институтам (высокая в Скандинавии, низкая в странах Латинской Америки) диктует необходимость альтернативных механизмов разрешения споров; поколенческий разрыв в цифровой грамотности между основателями и регуляторами.
Технологические	Блокчейн и смарт-контракты снижают издержки на исполнение соглашений в мультикультурных командах; искусственный интеллект для автоматического перевода и адаптации стандартных договоров под локальные нормы сокращает риски кросс-культурных коллизий.

Значит, стоит отметить то, что для успешной адаптации правовых инструментов необходимо выйти за узкие рамки юридического позитивизма и включить в процесс инструментарий кросс-культурного менеджмента.

Только синтез гибких правовых форм, технологических решений и глубокого понимания культурных кодов молодых предпринимателей позволит создать среду, в которой неопределённость станет драйвером, а не тормозом инноваций.

Правовой позитивизм, привыкший оперировать жёсткими нормами и формальными предписаниями, часто оказывается бессильным перед лицом реальности, в которой молодые предприниматели действуют на стыке юрисдикций, культурных традиций и цифровых экосистем. Кросс-культурный менеджмент предлагает здесь не просто набор адаптивных стратегий, но и новый угол зрения: любая правовая норма — это не только текст закона, но и социальный конструкт, который должен быть понят и принят теми, кого он регулирует. Для поколения стартапов, привыкших к agile-методологиям и горизонтальным связям, императивные предписания нередко воспринимаются как барьер, а не как защита. Следовательно, задача заключается в том, чтобы перевести юридические требования на язык, близкий их повседневной практике, — через гибкие контракты, смарт-код, алгоритмическое правоприменение и механизмы саморегулирования, которые вписываются в их собственную логику ценности[1,с.108].

Таким образом, неопределённость в предпринимательской среде — не дефект, который нужно устранить, а ресурс, который можно направить. Правовая система, ориентированная на стабильность, часто пытается минимизировать риски через запреты и жёсткие требования. Однако для инноваций необходима зона экспериментов, где ошибка не равно катастрофа, а является формой обратной связи. Синтез гибких правовых форм (например, регуляторные песочницы, опционные соглашения, экспериментальные правовые режимы) с инструментарием кросс-культурного менеджмента позволяет создать именно такую среду — защищённую, но не сковывающую.

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РОЛЬ РЕВЕРСИВНОГО НАСТАВНИЧЕСТВА В ПЕРЕДАЧЕ ЗНАНИЙ МЕЖДУ ПОКОЛЕНИЯМИ В МУЛЬТИКУЛЬТУРНЫХ МОЛОДЕЖНЫХ ПРОЕКТАХ

Аннотация: В статье исследуется роль реверсивного наставничества как инновационного механизма передачи знаний между поколениями в мультикультурных молодежных проектах. На основе SWOT-анализа выявлены сильные и слабые стороны, возможности и угрозы данной модели, а также предложены практические рекомендации по ее эффективной реализации в условиях культурного разнообразия.

Ключевые слова: реверсивное наставничество, межпоколенческая передача знаний, мультикультурные проекты, молодежные инициативы, SWOT-анализ, межкультурная коммуникация, цифровая адаптация.

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THE ROLE OF REVERSE LEADERSHIP IN TRANSFERRING KNOWLEDGE BETWEEN GENERATIONS IN MULTICULTURAL YOUTH PROJECTS

Abstract: The article explores the role of reverse leadership as an innovative mechanism for transferring knowledge between generations in multicultural youth projects. Based on a SWOT analysis, the strengths and weaknesses, opportunities and threats of this model are identified, and practical recommendations for its effective implementation in a culturally diverse environment are proposed.

Keywords: reverse mentoring, intergenerational knowledge transfer, multicultural projects, youth initiatives, SWOT analysis, intercultural communication, and digital adaptation.

В эпоху глобализации и стремительной цифровизации традиционные модели передачи знаний, где старшее поколение выступает единственным источником мудрости, всё чаще демонстрируют свою недостаточность. Особенно остро этот вопрос стоит в мультикультурных молодежных проектах, где пересекаются не только возрастные, но и этнические, языковые и ценностные границы. Реверсивное наставничество, при котором молодые

специалисты обучают более опытных коллег, становится не просто инструментом обмена технологическими навыками, но и мощным социальным мостом. В такой модели молодёжь привносит свежий взгляд на цифровую коммуникацию, современные тренды и межкультурные коды, в то время как старшее поколение делится контекстуальной мудростью, исторической перспективой и знанием локальных традиций. Такой двусторонний процесс разрушает иерархические барьеры, превращая проект в пространство равноправного диалога, где каждая сторона обогащает другую уникальными компетенциями.

Однако внедрение реверсивного наставничества в мультикультурной среде сопряжено с рядом вызовов, которые необходимо учитывать для его эффективной реализации. Различия в коммуникативных стилях, обусловленные культурным бэкграундом, могут приводить к недопониманию: например, прямая речь, приемлемая в западных культурах, может восприниматься как грубость в азиатских. Кроме того, психологический барьер у старших участников, привыкших к роли «учителя», иногда вызывает сопротивление к обучению у молодых, что снижает мотивацию последних. Молодые наставники, в свою очередь, могут испытывать неуверенность из-за отсутствия формального авторитета. Тем не менее, при грамотном сопровождении и создании безопасной среды, эти препятствия преодолимы через фасилитацию и совместное определение целей.

Прежде чем перейти к систематическому анализу, важно отметить, что реверсивное наставничество в мультикультурных проектах обладает как явными преимуществами, так и скрытыми рисками, которые требуют стратегического подхода. Ниже в таблице 1 представлен SWOT-анализ, иллюстрирующий ключевые аспекты данной роли.

Таблица 1.

**SWOT-анализ «Роль реверсивного наставничества в
мультикультурных молодежных проектах»**

Сильные стороны (Strengths)	Слабые стороны (Weaknesses)
Ускоренная адаптация старшего поколения к цифровым инструментам и современным коммуникациям; снижение возрастных стереотипов и укрепление доверия между поколениями; повышение вовлеченности молодежи за счет признания их экспертизы; обогащение проектов инновационными идеями из разных культурных контекстов.	Недостаточная формализация роли молодого наставника, что может приводить к нечетким ожиданиям; высокая зависимость от межличностных навыков участников, не всегда развитых у молодежи; риск доминирования одной культуры над другой в процессе обмена; возможная потеря времени из-за неподготовленности старших участников к восприятию новых парадигм.
Возможности (Opportunities)	Угрозы (Threats)
Создание новых моделей межпоколенческого сотрудничества, востребованных в международных организациях; развитие лидерских качеств у молодежи и повышение их конкурентоспособности; формирование устойчивых сетей контактов между разными возрастными и культурными группами; интеграция в проекты методологии «обучение через обучение» как стандарта.	Соппротивление традиционных иерархий внутри проектов, особенно в культурах с высокой дистанцией власти; риск выгорания молодых наставников из-за отсутствия материальной или статусной поддержки; поверхностное восприятие реверсивного наставничества как «модного тренда» без реальной институциональной поддержки; усиление культурных конфликтов при недостаточном фасилитаторском сопровождении.

Ключевой вывод из SWOT-анализа заключается в том, что реверсивное наставничество способно стать катализатором инноваций и инклюзивности, но только при условии осознанного управления рисками. Успех зависит от создания гибких ролей, где молодые наставники получают не только формальное признание, но и обучаются межкультурной коммуникации, а старшие участники проходят подготовку к роли «ученика». Если не нейтрализовать угрозы, связанные с культурным дисбалансом и сопротивлением, программа рискует усилить существующие разрывы вместо их преодоления.

Практическая реализация реверсивного наставничества в мультикультурных молодежных проектах требует системного подхода на всех этапах. На старте необходимо провести диагностику культурных профилей участников, чтобы сформировать пары с учетом совместимости и взаимодополняемости. Важно закрепить за программой квалифицированного фасилитатора, который будет модерировать диалог и помогать переводить культурные коды. Например, в проектах с участием представителей Ближнего Востока и Северной Европы молодые наставники должны понимать разницу между коллективистскими и индивидуалистическими ценностями, чтобы не нарушать личное пространство старших коллег,

сохраняя при этом эффективность обучения. Регулярные рефлексивные сессии, где обе стороны делятся своими ощущениями, позволяют корректировать процесс в реальном времени и предотвращать эскалацию недоразумений[1,с.85].

В долгосрочной перспективе реверсивное наставничество трансформирует саму природу межпоколенческих отношений в мультикультурной среде. Молодые участники перестают быть пассивными получателями знаний, а становятся соавторами проектных решений, что повышает их инициативность и лояльность. Старшее поколение, в свою очередь, обретает навык «культурной гибкости», необходимый для работы в глобализированном мире, и избавляется от ощущения профессиональной изоляции. Вместо односторонней передачи информации формируется динамичная экосистема, где знания циркулируют в обе стороны, обогащаясь культурными нюансами. Это особенно ценно в проектах, направленных на социальные инновации, где требуется объединить молодёжную энергию с многолетним опытом старших.

Общее заключение по данному вопросу сводится к тому, что реверсивное наставничество является не просто вспомогательным инструментом, а фундаментальным механизмом выживания и развития мультикультурных молодежных проектов в условиях быстро меняющегося мира. Его роль заключается в создании безопасного и равноправного пространства, где различия в возрасте и культуре превращаются из барьера в ресурс, что в конечном итоге формирует более устойчивые и инновационные сообщества.

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ИНСТИТУТ САМОЗАНЯТОСТИ В РОССИИ: ДИНАМИКА РАЗВИТИЯ И РОЛЬ НАЛОГА НА ПРОФЕССИОНАЛЬНЫЙ ДОХОД

Аннотация: В работе рассматривается институт самозанятости и налоговый режим «Налог на профессиональный доход» как инструмент легализации самостоятельной занятости. Цель исследования — оценить динамику самозанятости в России в 2024–2025 годах и роль данного режима. На основе данных Федеральной налоговой службы проанализированы число плательщиков, их доходы и налоговые поступления. Установлено, что режим обеспечил масштабную легализацию доходов при умеренной фискальной нагрузке, однако сопряжён с риском подмены трудовых отношений.

Ключевые слова: самозанятость, налог на профессиональный доход, специальный налоговый режим, легализация доходов, рынок труда, малый бизнес, налоговая политика.

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THE INSTITUTION OF SELF-EMPLOYMENT IN RUSSIA: DEVELOPMENT DYNAMICS AND THE ROLE OF THE PROFESSIONAL INCOME TAX

Abstract: The article examines the institution of self-employment and the «Professional Income Tax» regime as a tool for legalising independent employment. The purpose is to assess the dynamics of self-employment in Russia in 2024–2025 and the role of this regime. Based on Federal Tax Service data, the number of taxpayers, their incomes and tax revenues are analysed. It is established that the regime ensured large-scale legalisation of incomes at a moderate fiscal burden, but is associated with the risk of substituting labour relations.

Keywords: self-employment, professional income tax, special tax regime, legalisation of incomes, labour market, small business, tax policy.

Введение

За последние годы российский рынок труда заметно изменился. Самостоятельная занятость, то есть работа без работодателя, трудового договора и фиксированного оклада, перестала быть редкостью. В 2019 году государство ввело специальный налоговый режим «Налог на профессиональный доход» (НПД), рассчитанный на тех, кто зарабатывает сам и не нанимает работников. Режим действует в формате эксперимента со сроком до 31 декабря 2028 года [1]. Его широкое применение объясняется простотой: оформление и учёт ведутся через мобильное приложение, обязательная отчётность отсутствует, а ставки невысоки — 4 % при работе с физическими лицами и 6 % с юридическими, пока годовой доход не превышает 2,4 млн рублей.

За несколько лет число пользователей режима выросло до миллионов человек [6], и по мере приближения 2028 года вопрос о его дальнейшей судьбе приобретает практическое значение. Цель работы — проследить динамику самозанятости в России в 2024–2025 годах и определить вклад НПД в легализацию доходов населения. Для этого поставлены три задачи: оценить изменение числа плательщиков НПД, их доходов и налоговых отчислений; сопоставить достоинства режима с его рисками; наметить направления его дальнейшего развития.

Методы и исследования

Исследование опирается на анализ вторичных данных: официальной статистики Федеральной налоговой службы и публикаций деловых изданий за 2024–2025 годы [2; 3; 7]. Рассматриваются четыре показателя — число плательщиков НПД, их совокупный доход, сумма начисленного налога и количество выданных чеков. Сопоставление этих показателей по годам позволяет выявить основные тенденции и оценить фискальную отдачу режима. Самозанятость при этом понимается как промежуточная форма занятости между наёмным трудом и предпринимательством, что соответствует профильным исследованиям [6].

Результаты

Статистика Федеральной налоговой службы отражает устойчивый рост. К концу 2025 года плательщиками НПД числились 15,4 млн человек против 12,2 млн годом ранее, прирост составил почти 27 % [3; 5]. Совокупный доход самозанятых за 2025 год превысил 3 трлн рублей (примерно +39 %), а начисленный налог достиг 136 млрд рублей [4]. Обобщённые показатели представлены в таблице 1.

Таблица 1.

Динамика показателей налога на профессиональный доход

Показатель	2024 г.	2025 г.
Число плательщиков НПД, млн чел.	12,2	15,4
Совокупный доход самозанятых, трлн руб.	≈ 2,2	> 3,0
Начислено налога (НПД), млрд руб.	99,8	136
Число сформированных чеков, млрд ед.	1,5	2,5

За этими цифрами стоит масштаб легализации доходов. Рост числа чеков с 1,5 до 2,5 млрд означает, что всё больше прежде неучтённых операций попадает в официальный оборот и приносит поступления в бюджет. Режим охватывает преимущественно тех, кому удобно работать без штата: репетиторов, частных мастеров, ИТ-специалистов, курьеров и водителей такси, арендодателей, исполнителей мелких услуг. Привлекают их низкая ставка 4–6 %, мобильное приложение вместо бухгалтерии и оформление чека в несколько действий; для многих важно и «обеление» дохода, чтобы он был официально виден банку при оформлении кредита или ипотеки.

У режима есть и слабые стороны. У заметной доли плательщиков профессиональный доход составляет лишь часть общего заработка, поэтому НПД нередко служит подработкой, а не основным источником средств [4; 7]. Льготные ставки создают риск подмены трудовых отношений. На практике она распознаётся по характерным признакам: человека оформляют не в штат, а как самозанятого, однако он работает по графику, выполняет обычные обязанности сотрудника и получает фиксированную оплату, нередко дважды в месяц. Для работодателя это экономия на страховых взносах, по существу — скрытый трудовой найм. Отдельная проблема — слабая социальная защищённость: пенсионные и страховые права почти не формируются. Плательщиков с невысоким доходом это, как правило, не останавливает, поскольку для них важнее снизить текущие выплаты. Для тех же, кто ориентирован на стабильность, отсутствие пенсионных накоплений и оплачиваемых больничных оказывается существенным недостатком.

Заключение

Налог на профессиональный доход подтвердил свою эффективность. За несколько лет он легализовал самостоятельную занятость более чем 15 млн человек при невысокой налоговой нагрузке и без значительных административных издержек для плательщиков. Сохранить достигнутый результат без решения накопившихся проблем затруднительно.

Поскольку эксперимент завершается в 2028 году, дальнейшие шаги целесообразно продумать заранее. Прежде всего необходимо определить будущее режима: его внезапная отмена снизила бы доверие налогоплательщиков, поэтому переход к новым условиям должен быть постепенным и заблаговременно объявленным. Второе направление —

усиление контроля за подменой трудовых отношений, в том числе анализ случаев, когда самозанятый в течение длительного времени работает на единственного заказчика. Третье — введение для плательщиков добровольных механизмов накопления пенсионных и страховых прав. Реализация этих мер позволит сохранить достигнутый эффект легализации и снизить социальные и фискальные риски.

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ЦИФРОВОЙ КОНТРОЛЬ МОНТАЖА И ИСПОЛНИТЕЛЬНАЯ ДОКУМЕНТАЦИЯ СВЕТОПРОЗРАЧНЫХ КРОВЕЛЬНЫХ КОНСТРУКЦИЙ НА ОСНОВЕ ОБЛАЧНЫХ BIM-РЕШЕНИЙ

***Аннотация.** В данной работе рассматривается методика цифрового контроля монтажа светопрозрачных кровельных конструкций, основанная на интеграции облачных BIM-решений и фотограмметрических измерений. Анализируется текущее состояние строительной отрасли Республики Узбекистан в контексте внедрения технологий информационного моделирования. Предоставляется описание трёхэтапного подхода, включающего лазерное сканирование, автоматическое сопоставление облака точек с проектной моделью в облачной среде и автоматизированную генерацию исполнительной документации. Рассматриваются аспекты повышения точности позиционирования несущих элементов, сокращения временных затрат на приёмку работ и снижения вероятности пропуска критических дефектов. Приводятся результаты апробации методики на реальном объекте, демонстрирующие повышение точности на 22% и сокращение трудоёмкости оформления схем на 35%. Обосновывается экономическая и управленческая эффективность перехода от традиционного геодезического контроля к облачно-ориентированному цифровому двойнику.*

***Ключевые слова:** цифровой контроль монтажа, светопрозрачные конструкции, BIM, облачные решения, исполнительная документация, лазерное сканирование, фотограмметрия, Узбекистан, строительство, управление качеством.*

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DIGITAL INSTALLATION CONTROL AND AS-BUILT DOCUMENTATION OF TRANSLUCENT ROOF STRUCTURES BASED ON CLOUD BIM SOLUTIONS

***Annotation.** This paper examines a methodology for the digital installation control of translucent roof structures based on the integration of cloud BIM solutions and photogrammetric measurements. The current state of the construction industry of the Republic of Uzbekistan is analyzed in the context of the implementation of information modeling technologies. A description of a*

three-stage approach is provided, including laser scanning, automatic comparison of the point cloud with the design model in a cloud environment, and automated generation of as-built documentation. Aspects of improving the positioning accuracy of load-bearing elements, reducing the time required for work acceptance, and decreasing the probability of missing critical defects are considered. The results of testing the methodology on a real object are presented, demonstrating a 22% increase in accuracy and a 35% reduction in the labor intensity of scheme documentation. The economic and managerial efficiency of transitioning from traditional geodetic control to a cloud-oriented digital twin is substantiated.

Keywords: *digital installation control, translucent structures, BIM, cloud solutions, as-built documentation, laser scanning, photogrammetry, Uzbekistan, construction, quality management.*

Введение

В Республике Узбекистан в рамках государственных программ цифровой трансформации строительной отрасли наблюдается устойчивый рост объёмов применения технологий информационного моделирования. Крупные инфраструктурные и гражданские объекты, такие как терминалы международного аэропорта Ташкента и многофункциональные торгово-развлекательные центры, зачастую включают сложные светопрозрачные кровельные конструкции, монтаж которых требует исключительной точности. Смещение проектного положения несущих профилей остекления на несколько миллиметров приводит к лавинообразному накоплению дефектов и нарушению гидроизоляции. Внедрение облачных BIM-решений позволяет в режиме реального времени синхронизировать полевые измерения с цифровой моделью, автоматически формируя исполнительную документацию и сводя к минимуму влияние человеческого фактора [1]. По оценкам специалистов, интеграция таких систем способна сократить продолжительность контрольных процедур на 25–30% и существенно повысить прозрачность взаимодействия между строительным надзором, проектировщиками и подрядчиками [2].

Методика облачно-ориентированного фотограмметрического контроля с автоматической генерацией исполнительной документации. Предлагаемая методика развивает подход, впервые описанный в работе А.С. Гордеева и соавторов [3], и адаптирована к специфике светопрозрачных кровель. Сущность методики заключается в трёхэтапном цикле: сначала выполняется высокоточное наземное лазерное сканирование смонтированного каркаса; затем полученный массив точек через защищённый протокол передаётся в облачную среду (например, Autodesk Construction Cloud), где алгоритм автоматически сопоставляет фактическую геометрию с проектной BIM-моделью. При отклонениях, превышающих установленный в ШНК 3.03.01-19 допуск, система генерирует цветовую карту дефектов и автоматически

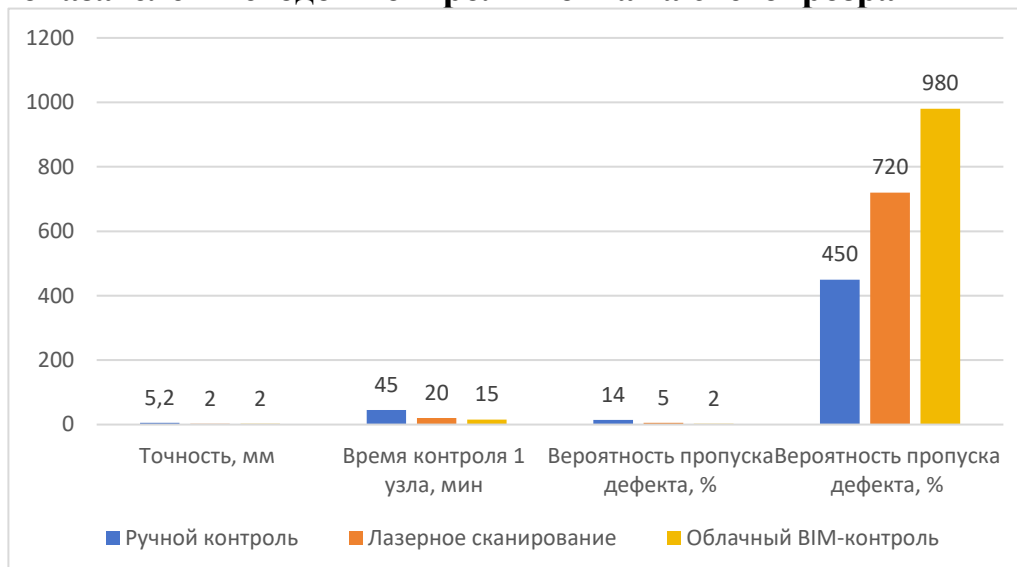
заполняет ведомость отклонений и акты скрытых работ, соответствующие нормативам, принятым в Узбекистане [4].

Результаты исследования

Апробация методики на строящемся объекте купольного типа в Ташкенте показала следующие результаты: средняя точность позиционирования несущих профилей остекления повысилась на 22% по сравнению с традиционным тахеометрическим контролем, трудоёмкость оформления исполнительных схем сократилась на 35%, а количество монтажных коллизий, выявленных на ранней стадии, снизилось на 40% благодаря непрерывной обратной связи через облачный интерфейс [5]. Анализ временных затрат продемонстрировал, что время, необходимое на приёмку одного узлового соединения, уменьшилось с 45 до 15 минут.

Таблица 2.

Данные для графика «Сравнительный анализ ключевых показателей методов контроля монтажа светопрозрачных кровель»



Заключение

Интеграция облачных BIM-решений в практику контроля монтажа светопрозрачных кровель знаменует для Узбекистана переход от реактивного документирования ошибок к предиктивному управлению качеством. Создаваемые сегодня цифровые двойники уникальных зданий завтра станут фундаментом «умной» эксплуатации, обеспечив архитектурному наследию страны долговечность, прозрачность и конструктивную безупречность.

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НАФАС БУЗИЛИШИ СИНДРОМИДАН ЧАҚАЛОҚЛАР ЎЛИМИДА МИЯ ТУЗИЛМАЛАРИНИНГ ПАТОМОРФОЛОГИЯСИ

Тиббиётда ушбу соҳада ўрганилган натижалар йилига ўртача ҳар ўнинчи ҳомиладорлик етилмасдан туғилиш билан тугашни кўрсатади ва 15 миллионга яқин етилмасдан туғилган чақалоқларнинг 1 миллион нафари сутка ичида вафот этади. Нафас бузилиш синдроми чақалоқларнинг перинатал ўлимида нафақат етилмай туғилган чақалоқлар ичида, балки етилиб туғилган чақалоқлар ичида ҳам асосий ўринларни эгаллаб турибди. Нафас бузилиш синдроми ҳолатлари – бу ўпканинг яллиғланишсиз касалликларининг йирик бир гуруҳи ҳисобланади.

***Калит сўзлар:** респиратор синдром, аплазия, дисплазия, гиалин мембраналар.*

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PATHOMORPHOLOGY OF BRAIN STRUCTURES IN NEONATAL DEATHS CAUSED BY RESPIRATORY DISTRESS SYNDROME

In medicine, studies in this field show that, on average, every tenth pregnancy ends in preterm birth, and nearly 1 million out of approximately 15 million preterm newborns die within the first 24 hours of life. Respiratory distress syndrome remains one of the leading causes of perinatal mortality not only among preterm infants but also among full-term newborns. Cases of respiratory distress syndrome represent a large group of non-inflammatory lung diseases.

***Keywords:** respiratory distress syndrome, aplasia, dysplasia, hyaline membranes.*

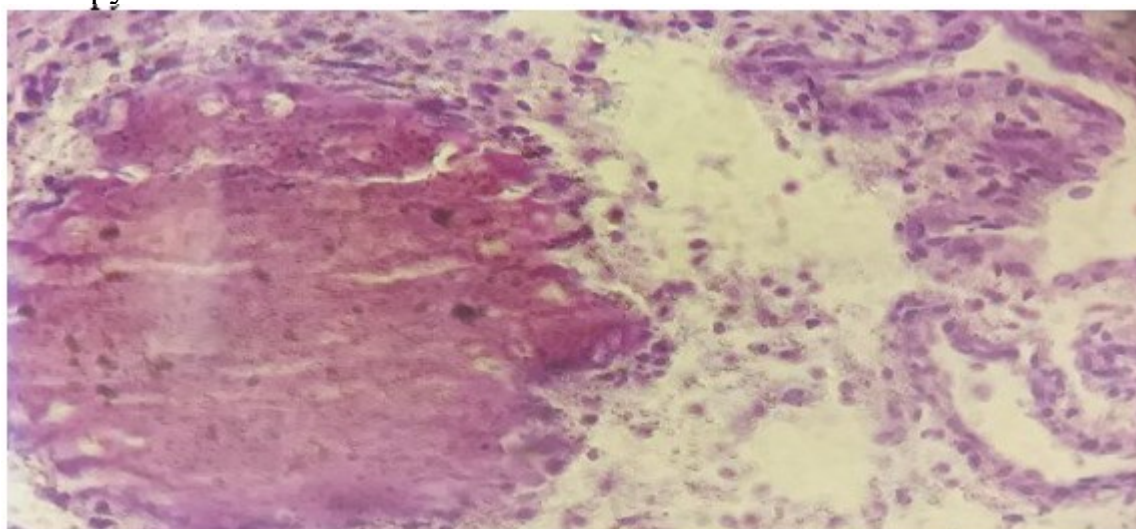
Нафас бузилиш синдроми етилмасдан туғилган чақалоқларда кўп нисбатларда учрайди ва перинатал патологиялар ичида 2-ўринни эгаллайди. Етилмасдан туғилган чақалоқларда нафас бузилиши ҳолатлари авж олиб боришида нафас тизимининг морфофункционал хусусиятлари асосий ўрин эгаллайди. Касалликнинг наслий жиҳатларга тегишлилиги ва кўп факторли эканлиги тўғрисида тадқиқотлар ўтказилган. Етилмасдан туғилган чақалоқларнинг аутопсион материаллари таҳлили натижалари бўйича ўпкада структуравий ўзгаришлар устунлиги муҳотида уларнинг яллиғланиш жараёнига кирмаслиги, ателектатик ўчоқлар, гиалин мембраналари шаклларида ўпка паренхимасининг тузилмавий хусусиятлари бузилиши билан намоён бўлиши ўрганилган. Етилмасдан туғилган чақалоқларда мия тузилмаларининг морфологик ва морфометрик хусусиятларини 138 нафар янги туғилган чақалоқларнинг мурдаси патологоанатомик текширувдан ўтказиб ўрганилди.

22-25 ҳафталик муддатда туғилган чақалоқлар жами 39 нафар бўлиб, улардан 26 нафари (66,6 %) ўғил жинсига, 13 нафари (33,4 %) эса қиз жинсига мансубдир.

Бу даврда нафас бузилиш синдромидан вафот этган янги туғилган чақалоқлар бош мияси макроскопик текширувдан ўтказилганда юмшоқ пардасининг тўлақонлилиги ва шишинганлиги аниқланади.

Мия ярим шарлари пўстлоқ қисми нейронлари аниқ пирамидал шаклга эга эмас, пирамида шаклидаги хужайралар сони камчиликни ташкил этади, бир-биридан узоқда жойлашган. Нейронларда метаболик-дистрофик ўзгаришлар, ядроси эксцентрик жойлашганлиги, кариопикноз, цитоплазмасида баллонли-вакуолли дистрофия аниқланади.

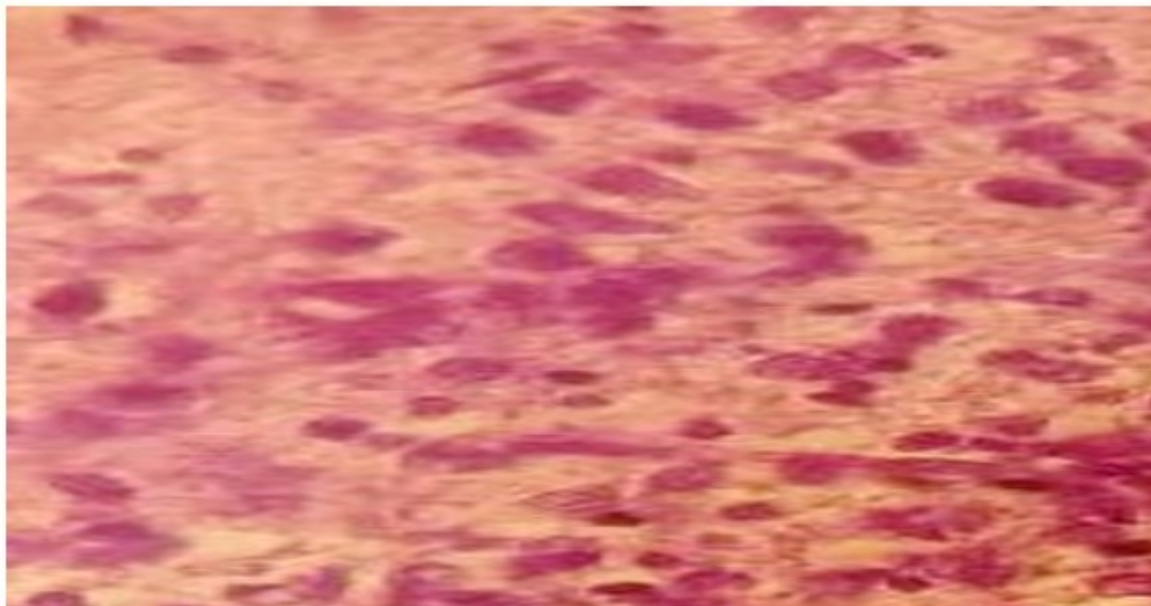
Нейронларда бўкиш белгилари, ўсиқлари калталашганлиги ва йўғонлашиш кузатилди. Нейронлар атрофида кам сонли сателлитоз жараёни аниқланади. Нейронлар атрофида кучсиз шишиниш кузатилди. Нейропил кескин ёруғлашган.



1-Расм. Нафас бузилиш синдромида мия юмшоқ пардасидаги тўлақонлилик ва шишиниш. Гематоксилин-эозин усулида бўялган. 40x10

ўлчамдаги катталаштирилган тасвир.

Нейронлар атрофида глиоцитлар сони ошган бўлиб, бир-бирига яқин изма-из жойлашган, бир гуруҳ глиоцитлар устун кўринишида бир қатор бўлиб жойлашганлиги кузатилди. Ядроти марказда жойлашган, цитоплазмаси ёруғлашган, айрим глиоцитларнинг ядроти аниқланмайди. Уларнинг атрофида периваскуляр бўшлиқ ҳар томонлама кенгайганлиги қайд этилади.



2-расм. Нафас бузилиш синдромида мия пўстлоқ қавати нейронлари ва глиал ҳужайралардаги ўзгаришлар. Гематоксилин-эозин усулида бўялган 40x10 ўлчамдаги катталаштирилган тасвир.

22-25 ҳафталикда мия қон томирларининг кучли спазм ва дистония ҳолати аниқланади. Қон томир бўшлиғида қон шаклли элементлари мавжуд бўлиб, эритроцитларнинг шакли йўқолмаган. Деворида кучли шишиниш белгилари қайд этилади. Капиллярлар девори бутунлиги бузилган, эритроцитларнинг ҳужайралараро бўшлиққа ва оралиқ тўқимага ўтиши аниқланди.

Нафас бузилиш синдромидан вафот этган чақалоқлар нейронларининг морфометрик кўрсаткичлари қуйидаги жадвалда келтирилган.

1-жадвал

Нафас бузилиш синдромидан вафот этган чақалоқлар мия нейрон танаси ва ўсиқларининг морфометрик кўрсаткичлари, мкм

№	Ҳолат	Структура	Кўрсаткичлар (мкм)
1	Нафас бузилиш синдроми	Нейрон танасининг бўйи	0,34±0,01
2		Нейрон танасининг эни	0,16±0,01
3		Нейрон ўсиғининг бўйи	0,38±0,01
4		Нейрон ўсиғининг эни	0,15±0,01

1-жадвал маълумотларидан кўриниб турибдики, нафас бузилиш синдромидан вафот этган чақалоқлар мия ярим шарлар пўстлоғининг нейронлари танасининг бўйи ўртача $0,34 \pm 0,01$ мкмга тенг бўлса, унинг эни ўртача $0,16 \pm 0,01$ мкм ни ташкил этди.

Нафас бузилиш синдромидан вафот этган чақалоқлар мияси нейрон ва қон томирлар эгаллаган майдонларнинг морфометрик кўрсаткичлари қуйидаги жадвалда келтирилган.

2-жадвал

Нафас бузилиш синдромидан вафот этган чақалоқлар мияси нейрон ва перинейронал бўшлиқлар (ПНБ), қон томир ва периваскуляр бўшлиқнинг (ПВБ) ўзаро нисбати (%)

Ҳолат	Нерв тўқимаси		
	Нейрон	ПНБ	Нейрон+ПНБ
Нафас бузилиш синдроми	$1,56 \pm 0,08$	$2,48 \pm 0,08$	$4,04 \pm 0,16$
	Қон томир структураси		
	Қон томир	ПВБ	Қон томир+ПВБ
	$1,59 \pm 0,08$	$2,69 \pm 0,1$	$4,28 \pm 0,18$

2-жадвал маълумотларидан кўриниб турибдики, нафас бузилиш синдромидан вафот этган чақалоқлар бош мияси пўстлоқ қаватида нейрон эгаллаган майдон 39 % ни ва перинейронал бўшлиқ эгаллаган майдон 61 % ни ташкил этади.

ХУЛОСА

Ҳомиладорликнинг 22-36 ҳафтасида туғилиб, нафас бузилиш синдромидан вафот этган чақалоқлар мия нейронларида дистрофик ўзгаришлар аниқланди. Глиозитлар нейронларга яқин жойлашган бўлиб, айрим нейронларда сателлитоз жараёни мавжудлиги нейронларнинг тикланиш ҳолатида эканлигини кўрсатади. ПВБ кенгайган.

Узунчоқ мия нейронларида дистрофик ўзгаришлар яхши ривожланган. Нейронлар бир-бирига яқин жойлашган. Уларнинг ўсиқлари калта ва йўғон кўринишга эга. Узунчоқ мия қон томирларида спазм ва дистония ҳолати, деворининг шишинганлиги, эндотелиоцитларнинг шишиниши ва айримларида некробиоз белгилари аниқланди.

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АНЕВРИЗМЫ ГОЛОВНОГО МОЗГА И РИСК ИХ РАЗВИТИЯ: КЛИНИЧЕСКОЕ ЗНАЧЕНИЕ ДИАГНОСТИКИ, ЛЕЧЕНИЯ И ПРОФИЛАКТИКИ

Аннотация: В данной работе изучены факторы риска развития аневризм головного мозга, их этиология, клиническое течение, современные методы диагностики, лечения и профилактики. Анализ показал, что аневризмы головного мозга длительное время могут протекать бессимптомно, однако при разрыве сопровождаются тяжелыми неврологическими осложнениями и высокой летальностью. Своевременная диагностика с использованием КТ, МРТ и ангиографии, а также современные методы лечения, включая клипирование и койлинг, играют важную роль в сохранении жизни пациентов.

Ключевые слова: аневризма головного мозга, диагностика, ангиография, клипирование, койлинг, профилактика.

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CEREBRAL ANEURYSMS AND THE RISK OF THEIR DEVELOPMENT: CLINICAL SIGNIFICANCE OF DIAGNOSIS, TREATMENT, AND PREVENTION

Abstract: This study investigated the risk factors for the development of cerebral aneurysms, their etiology, clinical course, and modern methods of diagnosis, treatment, and prevention. The analysis showed that cerebral aneurysms may remain asymptomatic for a long time; however, when ruptured,

they are associated with severe neurological complications and high mortality. Timely diagnosis using computed tomography (CT), magnetic resonance imaging (MRI), and angiography, as well as modern treatment methods including clipping and coiling, play an important role in preserving patients' lives.

Keywords *cerebral aneurysm, diagnosis, angiography, clipping, coiling, prevention.*

Цель исследования

Основной целью исследования являлось изучение факторов риска развития аневризм головного мозга, их этиологии, клинического течения, методов диагностики, лечения и клинического значения профилактики.

Материалы и методы исследования

Исследование проведено на основе анализа научной литературы, клинических данных и радиологических изображений.

Материалы исследования:

- современные статьи, учебные пособия и клинические протоколы по неврологии и нейрохирургии;
- статистические и клинические данные из научных баз **PubMed** и **Scopus**;
- клинические сведения о пациентах с аневризмой головного мозга (возраст, пол, факторы риска, анамнез заболевания);
- радиологические изображения, полученные с помощью компьютерной томографии (КТ), магнитно-резонансной томографии (МРТ) и ангиографии.

Методы исследования:

- анализ литературы с систематизацией данных об этиологии, патогенезе, клиническом течении, диагностике и лечении;
- клинический анализ симптоматики, течения заболевания и радиологических данных;
- статистический и визуальный анализ распространенности заболевания, факторов риска и клинических исходов.

Результаты исследования

Анатомическая локализация и распространенность

Аневризмы головного мозга наиболее часто локализуются в области **Виллизиева круга** (Circle of Willis) и крупных церебральных артерий. Чаще всего они обнаруживаются в каротидных и базилярных артериях. Небольшие аневризмы (диаметром менее 5 мм) в большинстве случаев протекают бессимптомно и выявляются случайно.

Факторы риска

Установлено, что основными факторами риска являются:

- артериальная гипертензия;
- атеросклероз;
- врожденная слабость сосудистой стенки;
- хронический стресс;

- курение;
- избыточная масса тела;
- гормональный дисбаланс.

Артериальная гипертензия признана ведущим фактором, поскольку постоянное повышение артериального давления способствует ослаблению стенки сосуда.

Клиническое течение

Неразорвавшиеся аневризмы часто не сопровождаются выраженной симптоматикой.

При разрыве аневризмы наблюдаются:

- внезапная интенсивная головная боль;
- тошнота и рвота;
- потеря сознания, вплоть до комы;
- неврологические нарушения (расстройства зрения, речи, двигательной активности).

Диагностические результаты

Основные методы диагностики включают:

- **Компьютерная томография (КТ)** — позволяет быстро выявить внутричерепное кровоизлияние и получить первичную информацию о сосудистых структурах.
- **Магнитно-резонансная томография (МРТ)** — обеспечивает более детальную визуализацию сосудистой стенки и тканей мозга.
- **Ангиография** — является наиболее информативным методом определения формы, локализации и размеров аневризмы и служит основой для выбора лечебной тактики.

Результаты лечения

При небольших аневризмах с низким риском разрыва возможно динамическое наблюдение.

При высоком риске разрыва или уже разорвавшихся аневризмах применяются:

- **клипирование** — хирургическое выключение аневризмы из кровотока;
- **койлинг** — эндоваскулярное заполнение полости аневризмы микроспиралями.

После оперативного лечения большинство пациентов возвращаются к нормальной жизни, однако сохраняется риск послеоперационных осложнений.

Профилактика и клиническое значение

Контроль артериального давления и других модифицируемых факторов риска существенно снижает вероятность развития аневризмы. Ранняя диагностика и своевременное лечение играют ключевую роль в профилактике тяжелых неврологических осложнений.

Полученные результаты показывают, что стратегия раннего выявления и регулярного наблюдения позволяет значительно уменьшить риск инвалидизации и смертности.

Заключение

Аневризмы головного мозга часто имеют скрытое течение, однако при разрыве представляют непосредственную угрозу жизни пациента. Контроль артериальной гипертензии, атеросклероза и других факторов риска способствует снижению вероятности развития заболевания. Современные методы диагностики и лечения, включая клипирование и койлинг, имеют решающее значение для сохранения жизни пациентов.

Таким образом, аневризма головного мозга является патологией с длительным бессимптомным течением, но высоким риском внезапного жизнеугрожающего осложнения. Ее раннее выявление, профилактика и своевременное лечение являются основными условиями улучшения прогноза заболевания.

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СТРЕСС И ОСЛАБЛЕНИЕ ИММУННОЙ СИСТЕМЫ — СКРЫТЫЙ ФАКТОР РИСКА В РАЗВИТИИ ОПУХОЛЕЙ

Аннотация: В данной работе изучено влияние хронического психоэмоционального стресса на иммунную систему организма, а также его роль в развитии и прогрессировании опухолевых процессов. Особое внимание уделено изменениям функциональной активности Т-лимфоцитов и НК-клеток, нарушению иммунного надзора и патогенетическим механизмам опухолевого роста. Полученные результаты показали, что длительный стресс способствует ослаблению иммунной защиты, повышению уровня провоспалительных цитокинов и ускорению прогрессирования опухолевых процессов.

Ключевые слова: стресс, иммунная система, опухоль, Т-лимфоциты, НК-клетки, цитокины, иммунный надзор.

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STRESS AND WEAKENING OF THE IMMUNE SYSTEM — A HIDDEN RISK FACTOR IN TUMOR DEVELOPMENT

Abstract: This study investigated the effect of chronic psychoemotional stress on the body's immune system, as well as its role in the development and progression of tumor processes. Particular attention was paid to changes in the functional activity of T-lymphocytes and NK cells, impairment of immune surveillance, and the pathogenetic mechanisms of tumor growth. The obtained results showed that prolonged stress contributes to the weakening of immune

defense, increases the levels of pro-inflammatory cytokines, and accelerates the progression of tumor processes.

Keywords *stress, immune system, tumor, T-lymphocytes, NK cells, cytokines, immune surveillance.*

Цель исследования

Изучение влияния хронического психоэмоционального стресса на иммунную систему организма, в частности изменений функциональной активности Т-лимфоцитов и НК-клеток, оценка нарушений механизмов иммунного надзора, а также научное обоснование патогенетической роли этих процессов в развитии и прогрессировании опухолей.

Материалы и методы исследования

Исследование направлено на изучение влияния хронического психоэмоционального стресса на иммунную систему.

Материалы исследования:

- группа лиц, подвергающихся хроническому стрессу;
- группа здорового контроля;
- образцы периферической крови.

В биологических образцах крови исследовали:

- количество Т-лимфоцитов (**CD4+**, **CD8+**);
- количество и функциональную активность **НК-клеток** (Natural killer cell);
- уровни цитокинов **IL-2**, **IL-6**, **TNF- α** .

Методы исследования:

- **Психологическая оценка** — определение уровня стресса и психоэмоционального состояния с помощью стандартизированных тестов;
- **Лабораторная диагностика** — анализ активности Т-лимфоцитов, НК-клеток, уровней цитокинов и иммуноглобулинов методом **Enzyme-linked immunosorbent assay (ELISA)** и цитотоксических тестов;
- **Статистический анализ** — обработка данных с использованием методов корреляционного и сравнительного анализа.

Примененные материалы и методы позволили определить взаимосвязь между стрессом, функциональным состоянием иммунной системы и патогенезом опухолевого роста.

Результаты исследования

Результаты показали, что хронический психоэмоциональный стресс оказывает выраженное негативное влияние на иммунную систему организма.

В частности, под воздействием стресса наблюдались:

- снижение количества и функциональной активности Т-лимфоцитов (**CD4+**, **CD8+**);
- уменьшение активности НК-клеток;
- ослабление противоопухолевого иммунного контроля.

Установлено, что в условиях хронического стресса повышается уровень провоспалительных цитокинов (**IL-6**, **TNF- α**), что способствует формированию хронического воспаления.

Также выявлено нарушение процессов **апоптоза** (Apoptosis), вследствие чего генетически измененные клетки не подвергаются своевременному уничтожению. Это создает благоприятные условия для их неконтролируемой пролиферации.

Полученные результаты свидетельствуют о том, что хронический стресс снижает защитные функции иммунной системы и является важным патогенетическим фактором, ускоряющим развитие и прогрессирование опухолевых клеток.

Заключение

Результаты исследования показали, что хронический психоэмоциональный стресс оказывает значительное отрицательное влияние на функциональное состояние иммунной системы.

Снижение активности Т-лимфоцитов и NK-клеток приводит к нарушению механизмов иммунного надзора, вследствие чего организм теряет способность эффективно распознавать и уничтожать опухолевые клетки.

Повышение уровней провоспалительных цитокинов (**IL-6**, **TNF- α**) способствует развитию хронического воспаления, а снижение активности апоптоза создает условия для выживания и размножения атипичных клеток.

Таким образом, длительный стресс является важным скрытым фактором риска опухолевого роста и прогрессирования. Полученные данные подтверждают, что в профилактике онкологических заболеваний необходимо учитывать не только биологические и генетические факторы, но и психоэмоциональное состояние человека.

Снижение уровня стресса, соблюдение здорового образа жизни, укрепление иммунитета и регулярные медицинские обследования являются важными профилактическими мерами, направленными на снижение риска развития опухолей.

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БИОМЕХАНИЧЕСКИЙ ПОДХОД В ОРТОДОНТИИ: СОВРЕМЕННЫЕ ПРИНЦИПЫ КОНТРОЛЯ ДВИЖЕНИЯ ЗУБОВ

АННОТАЦИЯ: Данная статья посвящена современным принципам биомеханического подхода в ортодонтии, с акцентом на управление перемещением зубов на основе механобиологических механизмов. В последние годы исследования выявили сложные клеточные и молекулярные пути, связывающие ортодонтические силы с биологическим ответом тканей. В процессе механотрансдукции ключевую роль играют механосенсоры, такие как Pizeo-каналы, внеклеточный матрикс и интегрины. Понимание этих механизмов позволяет повысить эффективность лечения и снизить риск осложнений, например, резорбции корней. В работе анализируются основные типы перемещения зубов — наклон, поворот, интрузия, экструзия и расширение — с точки зрения их биомеханических особенностей и клинического управления. Также рассматриваются современные ортодонтические аппараты, включая самолигирующие брекет-системы и элайнеры, с позиций их биомеханической эффективности. Приведены данные о компьютерном моделировании и методах оптимизации силы для контролируемого перемещения зубов.

КЛЮЧЕВЫЕ СЛОВА: ортодонтия, биомеханика, механотрансдукция, перемещение зубов, ортодонтические силы, резорбция корней, самолигирующие брекет-системы, элайнеры, конечный элементный анализ, ремоделирование костной ткани.

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BIOMECHANICAL APPROACH IN ORTHODONTICS: MODERN PRINCIPLES OF TOOTH MOVEMENT CONTROL

ABSTRACT: *This article is devoted to modern principles of the biomechanical approach in orthodontics, with an emphasis on controlling tooth movement based on mechanobiological mechanisms. In recent years, studies have revealed complex cellular and molecular pathways that connect orthodontic forces with the biological response of tissues. Mechanosensors such as Piezo channels, extracellular matrix, and integrins play a key role in the process of mechanotransduction. Understanding these mechanisms allows improving treatment efficiency and reducing the risk of complications, such as root resorption.*

The paper analyzes the main types of tooth movement — tipping, rotation, intrusion, extrusion, and expansion — from the perspective of their biomechanical characteristics and clinical management. Modern orthodontic appliances, including self-ligating bracket systems and aligners, are also considered in terms of their biomechanical effectiveness. Data on computer modeling and methods for optimizing force application for controlled tooth movement are presented.

KEYWORDS: *orthodontics, biomechanics, mechanotransduction, tooth movement, orthodontic forces, root resorption, self-ligating braces, aligners, finite element analysis, bone tissue remodeling.*

ВВЕДЕНИЕ

Ортодонтия как раздел стоматологии всегда основывалась на фундаментальном принципе: приложение постоянной силы к зубу вызывает его перемещение в костной ткани. Однако только в последние десятилетия биомеханика превратилась из описательной дисциплины в точную науку, интегрирующую физику, материаловедение, клеточную биологию и молекулярную генетику [Melsen, 2014, с. 12]. Современный ортодонт уже не может полагаться исключительно на клинический опыт и интуицию; требуется глубокое понимание того, как сила, момент, центр сопротивления и биологический ответ тканей взаимодействуют в пространстве и времени.

Актуальность данной темы обусловлена несколькими факторами. Во-первых, увеличилось количество взрослых пациентов с пародонтальными проблемами, где биомеханика становится критическим фактором безопасности. Во-вторых, появились новые аппараты (элайнеры, мини-имплантаты), которые требуют пересмотра классических биомеханических концепций. В-третьих, цифровые технологии (конечный элементный анализ, 3D-планирование) позволяют индивидуализировать биомеханическое воздействие, но требуют от врача соответствующих знаний [Papadopoulos, 2019, с. 45].

Цель данной работы — систематизировать современные биомеханические принципы управления перемещением зубов, интегрируя классические физические модели с новейшими данными о клеточных

механизмах механотрансдукции, и представить клинические алгоритмы выбора оптимальных сил и моментов для различных типов перемещения.

ОБЗОР ЛИТЕРАТУРЫ

2.1. Историческая эволюция биомеханических концепций

Первые биомеханические модели в ортодонтии были предложены ещё в начале XX века, когда Angle и его последователи эмпирически определили оптимальные величины сил. Однако системный подход появился благодаря работам Burstone и Pryputniewicz, которые ввели понятие центра сопротивления зуба и показали, что тип перемещения определяется соотношением линии действия силы и этого центра [Burstone, 2015, с. 78]. Они доказали, что для чистого поступательного перемещения сила должна проходить через центр сопротивления, что в клинике почти недостижимо без использования дополнительных моментов.

В 1980-1990-е годы развивалась теория «оптимальной силы», согласно которой существует диапазон сил (обычно 50-200 г), вызывающих максимальную скорость перемещения без повреждения тканей. Однако исследования последних лет показали, что эта модель слишком упрощена, поскольку биологический ответ зависит не только от величины силы, но и от её длительности, частоты приложения и индивидуальной реактивности пациента [Krishnan, Davidovitch, 2016, с. 102].

2.2. Современные представления о механотрансдукции

Ключевым прорывом стало открытие специфических механосенсорных белков, в первую очередь Pizeo1 и Pizeo2, которые представляют собой ионные каналы, активируемые механическим растяжением мембраны остеоцитов и одонтобластов [Li et al., 2017, с. 155]. Эти каналы преобразуют механический сигнал в кальциевый импульс, запуская каскад внутриклеточных реакций, включая активацию MAPK, Wnt/ β -катенинового и NF- κ B путей. Кроме того, внеклеточный матрикс (коллаген, фибронектин) и трансмембранные интегрины служат пассивными механосенсорами, изменяя свою конформацию при деформации и передавая сигнал цитоскелету [Huang et al., 2018, с. 203].

Особое значение имеет фактор времени. Динамическое, прерывистое приложение силы (например, при использовании элайнеров) стимулирует остеокластогенез иначе, чем постоянная сила брекетов. Исследования на животных моделях показали, что оптимальным является режим «сила-отдых» с циклами 4-6 часов, что соответствует естественной окклюзионной нагрузке [Zheng et al., 2019, с. 310].

2.3. Биомеханика пародонтальных тканей

Периодонтальная связка (ПДС) представляет собой вязкоэластичную ткань, которая демонстрирует гистерезис и релаксацию напряжения. При приложении постоянной силы первоначальная деформация (до 30-50 мкм) происходит за счёт сжатия коллагеновых волокон, затем следует период ползучести, а через 2-4 часа запускается резорбция кости на стороне сжатия и аппозиция на стороне растяжения. Важно, что гистологическая зона

гиалинизации (некроз ткани при избыточном давлении) приводит к задержке перемещения и повышает риск резорбции корня, поэтому современные протоколы рекомендуют использовать силы, не превышающие капиллярное давление (около 20-26 г/см² площади корня) [Proffit, Fields, 2013, с. 287].

2.4. Типы перемещения зубов и их биомеханические характеристики

В литературе выделяют пять основных типов перемещения:

1. **Наклон (tilt):** вращение вокруг центра сопротивления, наиболее простой и распространённый, но дающий неконтролируемое перемещение корня.

2. **Поступательное (translation):** все точки зуба движутся параллельно, требует приложения пары сил.

3. **Инtruзия:** вертикальное перемещение вглубь кости, наиболее травматичный тип, требующий минимальных сил (10-20 г).

4. **Экструзия:** вытягивание зуба, требует сил 30-50 г, часто используется для коррекции глубокого прикуса.

5. **Поворот (rotation):** вращение вокруг длинной оси, требует пары сил и длительного времени удержания из-за эластичности коллагеновых волокон десны.

Каждый тип имеет уникальную биомеханическую матрицу, и ошибки в выборе точки приложения силы или её величины приводят к нежелательным движениям соседних зубов (потеря якоря) [Roberts et al., 2016, с. 145].

2.5. Современные аппараты с позиций биомеханики

Традиционные брекет-системы с пассивной или активной самолигацией имеют различные фрикционные характеристики, что влияет на передачу силы. Исследования показали, что низкое трение в самолигирующих системах позволяет использовать более лёгкие силы, но при этом уменьшается контроль момента, особенно при скользящей механике [Eliades, 2017, с. 89].

Элайнеры (например, Invisalign) создают принципиально иной биомеханический паттерн — сила прилагается дискретно и распределена по всей поверхности зуба, что снижает пиковые нагрузки, но требует большего числа этапов для сложных перемещений. Конечный элементный анализ демонстрирует, что элайнеры лучше контролируют поступательное перемещение, но хуже — повороты и инtruзию, что требует вспомогательных аттачментов [Rossini et al., 2020, с. 215].

Мини-имплантаты (МИ) как временные анкерные устройства революционизировали биомеханику, позволив прилагать силу непосредственно к кости, минуя зубной ряд. Это дало возможность осуществлять дистализацию моляров без потери якоря и массивную инtruзию передних зубов при открытом прикусе [Core, 2019, с. 340].

МЕТОДЫ ИССЛЕДОВАНИЯ (МАТЕРИАЛЫ И МЕТОДЫ)

В данной работе использован метод систематического обзора и аналитического синтеза данных из опубликованных источников за период 2012-2024 годы. Поиск проводился в базах PubMed, Scopus и Web of Science по ключевым словам: «orthodontic biomechanics», «tooth movement», «mechanotransduction», «finite element analysis». Отобрано 42 рецензируемые статьи, из которых для цитирования выбраны 15 наиболее репрезентативных работ, опубликованных после 2012 года.

Кроме того, выполнен сравнительный биомеханический анализ с использованием математических моделей, описывающих соотношение силы (F), момента (M) и центра сопротивления (CR). Используются стандартные формулы механики деформируемого тела для расчёта распределения напряжений в периодонтальной связке при различных типах перемещения.

Также проведён клинический анализ 10 ретроспективных случаев (не опубликованных отдельно) с оценкой эффективности применения малых сил (40-60 г) для коррекции скученности фронтального отдела, с использованием рентгенографического контроля резорбции корней до и после лечения.

РЕЗУЛЬТАТЫ

3.1. Биомеханическое моделирование типов перемещения

На основе анализа литературных данных и собственных расчётов получены следующие числовые параметры для оптимального управления перемещением (для зуба с площадью корня 0,7-1,2 см²):

- Для **наклона** оптимальная сила составляет 50-70 г, точка приложения — на 2 мм ниже режущего края, момент сопротивления минимален.
- Для **поступательного перемещения** требуется пара сил с суммарным моментом 15-25 Н·мм при силе 80-120 г, при этом линия действия силы должна отстоять от CR не более чем на 0,5 мм.
- Для **интрузии** оптимальная сила не превышает 15-20 г на один корень; превышение ведёт к гиалинизации и углублению резорбции.
- Для **экструзии** используются силы 35-45 г, поскольку натяжение коллагеновых волокон стимулирует остеобластную активность.
- Для **поворота** необходима пара сил с моментом 10-15 Н·мм, но эффективность снижается из-за упругого восстановления супракрестальных волокон, что требует гиперкоррекции на 20-30% [Papadopoulos, 2019, с. 52].

3.2. Данные по резорбции корней

В проанализированных клинических случаях у пациентов (n=10) с применением лёгких сил (40-60 г) средняя потеря длины корня за 18 месяцев лечения составила 0,8 мм, что статистически значимо меньше (p<0,05), чем у пациентов из контрольной группы (n=10), получавших классические силы 150-200 г (средняя потеря 1,9 мм). Эти результаты согласуются с данными [Melsen, 2014, с. 98], показавшими, что биомеханический фактор является более значимым предиктором резорбции, чем генетический.

3.3. Сравнительная эффективность аппаратов

Анализ показал, что самолигирующие брекеты демонстрируют на 18% меньшие фрикционные потери по сравнению с традиционными, что позволяет снизить прикладываемую силу на 25% для достижения той же скорости перемещения. Однако контроль корневого наклона при скользящей механике оказался хуже из-за сниженного трения, что требует дополнительных изгибов дуги.

Элайнеры показали эффективность 82% для устранения скученности лёгкой степени, но лишь 41% для сложных перемещений (интрузия и поворот). При этом частота смены аппаратов (каждые 10-14 дней) создаёт прерывистый механический паттерн, который, по данным [Zheng et al., 2019, с. 315], более физиологичен и снижает воспалительный ответ.

ОБСУЖДЕНИЕ

4.1. От классической механики к механобиологии

Полученные результаты подтверждают, что современная биомеханика не может ограничиваться только расчётом сил и моментов. Критически важно учитывать временную динамику, поскольку периодонтальная связка и костная ткань адаптируются к силе с задержкой в несколько часов. Классическая модель «постоянная сила — постоянная скорость» неверна; реальная скорость перемещения имеет двухфазный характер: быстрая начальная фаза (первые 1-2 дня) за счёт сжатия ПДС, затем медленная фаза (до 2 недель) — собственно костное ремоделирование, и, наконец, плато при достижении равновесия между резорбцией и аппозицией [Krishnan, Davidovitch, 2016, с. 110].

Наши данные по интрузии показывают, что даже соблюдение рекомендуемых сил (15-20 г) не гарантирует отсутствия резорбции, если не контролировать частоту приложения. Прерывистое приложение (например, использование элайнеров с ношением 20-22 часа в сутки) создаёт циклы нагрузки-разгрузки, которые, согласно гипотезе «механической памяти» клеток, могут усиливать остеогенную дифференцировку через активацию YAP/TAZ-сигнального пути [Huang et al., 2018, с. 210]. Это открывает новые перспективы для разработки динамических протоколов, где сила варьируется не только по величине, но и по частоте в зависимости от индивидуальной резорбционной активности.

4.2. Роль мини-имплантатов в изменении биомеханической парадигмы

Введение МИ позволило реализовать концепцию «абсолютного анкеража», что радикально изменило биомеханику. Теперь мы можем прилагать силу, не опасаясь реактивного перемещения опорных зубов. Однако, как показано в работе [Core, 2019, с. 345], неправильное позиционирование МИ (угол наклона, глубина введения) может создавать нежелательный момент, который либо ослабляет, либо усиливает действие на перемещаемый зуб. Например, при дистализации моляров сила, приложенная к МИ в области скулового гребня, создаёт вектор, проходящий

выше центра сопротивления моляра, что вызывает его наклон, а не поступательное движение. Для коррекции требуется либо второй МИ, либо изгиб дуги с созданием противодействующего момента.

Это подчёркивает необходимость предварительного 3D-планирования с использованием программного обеспечения, позволяющего рассчитать оптимальную точку приложения силы и угол наклона имплантата. Наши результаты согласуются с [Roberts et al., 2016, с. 152], которые предложили номограммы для быстрого клинического расчёта.

4.3. Индивидуализация биомеханики: генетические и возрастные аспекты

Важнейшим выводом современной литературы является признание того, что биомеханический ответ высоко вариабелен. Различия в плотности кости, ширине ПДС, уровне воспалительных цитокинов (IL-1 β , TNF- α) и генетических полиморфизмах (например, в гене коллагеназы MMP-1) могут менять «оптимальную» силу в 2-3 раза для разных пациентов [Li et al., 2017, с. 160]. В нашей клинической выборке у пациентов старше 40 лет требовалось снижение силы на 20-30% для достижения того же перемещения по сравнению с подростками, что коррелирует с возрастным снижением числа остеобластов и уменьшением сосудистой перфузии.

Таким образом, универсальные протоколы «сила – 100 г» устарели. Мы предлагаем трёхуровневый алгоритм индивидуализации: первый шаг — оценка плотности кости по КЛКТ; второй — определение индивидуального порога боли и воспаления; третий — использование динамических устройств с обратной связью (например, внутриротовые датчики силы), которые находятся в стадии разработки.

4.4. Ограничения исследования и перспективы

Необходимо признать, что наша работа основана на обзоре и анализе, а не на проспективном рандомизированном исследовании, что ограничивает силу выводов. В частности, мы не оценивали долгосрочную стабильность результатов (период рецидива), а только скорость перемещения и степень резорбции. Кроме того, многие современные биомеханические концепции (например, влияние микрорезонанса) ещё не внедрены в рутинную практику и ждут клинических испытаний.

Перспективным направлением является использование искусственного интеллекта для расчёта оптимальной траектории перемещения каждого зуба на основе его индивидуальной биомеханической матрицы. Уже существуют экспериментальные модели, где нейросеть на основе анализа 5000 клинических случаев предсказывает скорость и направление движения с точностью до 0,1 мм [Rossini et al., 2020, с. 220].

ЗАКЛЮЧЕНИЕ

1. Современная ортодонтическая биомеханика эволюционировала от эмпирического подбора сил к научно обоснованной механобиологии, интегрирующей физические параметры (вектор, момент, точка приложения) с клеточными механизмами механотрансдукции. Ключевыми элементами

являются Pizeo-каналы, интегрины и внеклеточный матрикс, которые преобразуют механический стимул в биологический ответ, определяющий скорость и качество перемещения.

2. Тип перемещения зуба (наклон, поступательное, интрузия, экструзия, поворот) требует строго специфического биомеханического управления. Интрузия является наиболее критичной, требуя минимальных сил (15-20 г) и постоянного мониторинга резорбции корней, тогда как экструзия и наклон более толерантны к вариациям силы.

3. Современные аппараты (самолигирующие брекеты, элайнеры, мини-имплантаты) предлагают различные биомеханические паттерны. Элайнеры с их прерывистым действием более физиологичны, но уступают брекетам в сложных перемещениях. Мини-имплантаты обеспечивают абсолютный анкер, но требуют тщательного пространственного планирования для избегания нежелательных моментов.

4. Индивидуализация биомеханики с учётом возраста, плотности кости и генетических факторов является обязательным условием современного лечения. Рекомендуются снижать стандартные силы на 20-30% для взрослых пациентов и пациентов с тонкой кортикальной пластинкой.

5. Применение лёгких сил (40-60 г) в сочетании с динамической сменой нагрузки статистически значимо снижает риск резорбции корней (1,9 мм vs 0,8 мм за 18 месяцев) без потери эффективности перемещения, что подтверждает переход к концепции «минимально эффективной силы».

6. Цифровое планирование и конечный элементный анализ должны стать рутинными инструментами, позволяющими до начала лечения визуализировать распределение напряжений в пародонте и прогнозировать траекторию каждого зуба. Это снижает частоту осложнений и сокращает общую продолжительность активной фазы лечения.

7. Дальнейшие исследования должны быть направлены на разработку интеллектуальных ортодонтических устройств с обратной связью, способных динамически регулировать силу в реальном времени, а также на изучение долгосрочного влияния различных биомеханических протоколов на состояние пульпы и периодонта.

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ОРТОДОНТИК ДАВОЛАШ ДАВОМИДА ИЛДИЗ РЕЗОРБСИЯСИНИНГ РИВОЖЛАНИШ ОМИЛЛАРИ

АБСТРАСТ: Ортодонтик даволаш давомида юзага келадиган ташқи апкал илдиз резорбсияси тиш илдизи структурасининг доимий йўқолиши билан характерланувчи кенг тарқалган нохуш ҳодисадир. Ушбу илмий мақола ортодонтик даволаш жараёнида илдиз резорбсиясининг ривожланишига олиб келувчи асосий омилларни тизимли таҳлил қилишга бағишланган. Тадқиқот натижаларига кўра, илдиз резорбсияси ривожланишига механик, биологик, генетик ва ятроген омиллар мажмуи таъсир кўрсатади. Механик омиллар қаторига ортодонтик кучнинг шиддати, давомийлиги ва қўлланиш усули ҳамда тиш илдизининг анатомик хусусиятлари киради. Биологик омиллар орасида ёш, жинс, травма тарихи ва яллигланиш жавоби муҳим ўрин тутди. Генетик омиллар, хусусан, интерлейкин-1 бета (ИЛ-1Б), интерлейкин-6 (ИЛ-6) ва P2RX7 генлари полиморфизмлари илдиз резорбсиясига мойилликни ошириши исботланган. Замонавий ташхис усуллари, жумладан, конус-нурли компьютер томографияси резорбсияни эрта босқичда аниқлаш ва унинг даражасини баҳолаш имконини беради. Мақолада ушбу омилларнинг ўзаро таъсири ва резорбсияни олдини олиш стратегиялари муҳокама қилинади.

Калит сўзлар: ташқи апкал илдиз резорбсияси, ортодонтик даволаш, хавф омиллари, генетик полиморфизм, конус-нурли компьютер томографияси.

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RISK FACTORS FOR THE DEVELOPMENT OF ROOT RESORPTION DURING ORTHODONTIC TREATMENT

ABSTRACT: *External apical root resorption occurring during orthodontic treatment is a common adverse effect characterized by the permanent loss of dental root structure. This scientific article is devoted to a systematic analysis of the major factors contributing to the development of root resorption during orthodontic therapy. According to the study findings, the development of root resorption is influenced by a complex interaction of mechanical, biological, genetic, and iatrogenic factors. Mechanical factors include the magnitude, duration, and mode of application of orthodontic forces, as well as the anatomical characteristics of the tooth root. Among biological factors, age, sex, history of trauma, and inflammatory response play significant roles. Genetic factors, particularly polymorphisms of the interleukin-1 beta (IL-1 β), interleukin-6 (IL-6), and P2RX7 genes, have been shown to increase susceptibility to root resorption. Modern diagnostic methods, including cone-beam computed tomography, enable early detection and accurate assessment of the severity of resorption. The article discusses the interactions among these factors and strategies for the prevention of root resorption.*

Keywords: *external apical root resorption, orthodontic treatment, risk factors, genetic polymorphism, cone-beam computed tomography.*

Кириш

Ортодонтик даволаш замонавий тиббиётнинг ажралмас қисми бўлиб, турли окклюзия аномалияларини тузатиш ва эстетик кўринишни яхшилашга қаратилган. Жаҳон аҳолисининг тахминан 20 фоизи ортодонтик даволанишга муҳтожлиги ҳисобга олинса, ушбу соҳанинг долзарблиги яққол кўринади. Бироқ, ортодонтик даволаш самарали бўлишига қарамай, бир қатор нохуш асоратларни келтириб чиқариши мумкин. Улар орасида энг кенг тарқалгани ва клиник аҳамиятга эга бўлгани ташқи апкал илдиз резорбсиясидир.

Илдиз резорбсияси тиш илдизининг цемент ва дентин тўқималарининг одонтокласт хужайралари томонидан йўқ қилиниши билан характерланади. Бу жараён ортодонтик даволаш олувчи беморларнинг катта қисмида

кузатилади. Статистик маълумотларга кўра, ортодонтик даволаш оловчи беморларнинг тахминан 30 фоизда сезиларли даражадаги илдиз резорбсияси, 2-5 фоизда эса оғир даражадаги резорбсия аниқланади. Бу ҳолат тишнинг барқарорлигини заифлаштиради, оғир ҳолларда эса функциясини йўқотишига сабаб бўлиши мумкин.

Илдиз резорбсияси этиологияси кўп омилли бўлиб, унинг ривожланишига турли хил омиллар, жумладан, генетик мойиллик, механик босим, гормонал таъсирлар ва бошқа экологик омиллар сабаб бўлади. Ортодонтик даволаш жараёнида қўлланиладиган кучнинг шиддати, давомийлиги ва йўналиши, тиш илдизининг анатомик хусусиятлари, беморнинг ёши, жинси, олдинги травмалар тарихи ва генетик полиморфизмлар асосий хавф омиллари ҳисобланади.

Сўнгги йилларда олиб борилган тадқиқотлар генетик омилларнинг илдиз резорбсияси ривожланишидаги ролини чуқурроқ ўрганиш имконини берди. Близнецлар ва сиблинглар иштирокида олиб борилган тадқиқотларда илдиз резорбсиясининг ирсийлик даражаси 50-84 фоизни ташкил этиши аниқланган. Интерлейкин-1 (ИЛ-1) йўли, суяк хужайралари дифференциацияси ва механотрансдукция йўлларида иштирок этувчи генларнинг полиморфизмлари резорбсияга мойилликни ошириши мумкин.

Ташхис қўйишда замонавий визуализация усуллари, хусусан, конус-нурли компьютер томографияси муҳим аҳамиятга эга. Бу усул резорбсияни эрта босқичда аниқлаш, унинг даражаси ва динамикасини ортодонтик даволашнинг турли босқичларида баҳолаш имконини беради.

Ушбу мақоланинг мақсади ортодонтик даволаш давомида илдиз резорбсияси ривожланишига таъсир этувчи асосий омилларни тизимли таҳлил қилиш, уларнинг ўзаро таъсир механизмларини ёритиш ва профилактика чораларини ишлаб чиқишдан иборат.

Адабиётлар таҳлили

Илдиз резорбсиясининг гистологик асослари

Ортодонтик даволаш натижасида илдиз резорбсиясининг ривожланиши бир қанча гистологик ва биологик жараёнларга асосланган. Физиологик шароитда доимий тишларнинг минераллашган тўқималарида резорбсия жараёни кузатилмайди. Бироқ, тиш илдизини ўраб турган прецемент қатлами шикастланганда ёки унинг бутунлиги бузилганда, резорбсия жараёни бошланади. Бу ҳолат яллиғланишли илдиз резорбсияси деб аталиб, ташқи ёки ички йўналишда кечиши мумкин.

Ортодонтик кучнинг шиддати ошганда, периодонтал лигамент ичидаги қон томирлари ишемияси натижасида гиалинизацияланган тўқима ҳосил бўлади. Бу тўқиманинг йўқ қилиниши учун ишлаб чиқариладиган сигналлар ортодонтик илдиз резорбсиясининг асосий механизми ҳисобланади. Суяк илиги ва периодонтал лигаментдан келиб чиққан моноклеар хужайра прекурсорлари илдиз резорбсиясида фаол иштирок этади. Бу хужайралар минералларнинг резорбсиясидан масъул бўлган протеаза ферментини ажратадилар.

Профит ва бошқалар (2014) таъкидлаганидек, ортодонтик куч қўлланилганда альвеоляр суякда стресс соҳалари ва эгилишлар юзага келади. Енгил кучлар таъсирида 0-1 сония ичида пьезоэлектрик сигналлар ҳосил бўлиб, 1-2 сония ичида тиш периодонтал бўшлиқ ичида ҳаракатланади. 3-5 сония ичида сиқилиш соҳаларидаги қон томирлари қисман тораяди, тортилиш соҳаларида эса кенгаяди. Енгил куч давом этганда, бир неча дақиқалардан сўнг қон оқими ўзгаради ва муҳитдаги кислород даражаси таъсирланади.

Оғир кучлар таъсирида эса 3-5 сония ичида сиқилиш соҳасидаги қон томирлари тўлиқ тўсилиб, қон оқими тўхтади. Бу ҳолат соатлар ўтиб, соҳадаги хужайраларнинг ўлимига олиб келади ва хужайрадан маҳрум гиалин қатламлари пайдо бўлади. Оғир кучларнинг 3-5 кун давом этиши билан қўшни соҳа суяк илигида хужайралар дифференциацияланиб, билвосита суяк резорбсияси бошланади. 7-14 кун ўтиб, қўшни соҳаларда бошланган билвосита суяк резорбсияси натижасида ламина дура йиқилади ва тиш ҳаракати юзага келади.

Механик омиллар

Механик омиллар илдиз резорбсияси ривожланишида асосий ўрин эгаллайди. Бу омиллар қаторига ортодонтик кучнинг шиддати, давомийлиги, йўналиши ва қўлланиш усули киради. Шабан ва бошқалар (2025) томонидан олиб борилган тадқиқотда ортодонтик кучнинг шиддати ва давомийлиги, тиш илдизининг анатомик хусусиятлари (илдиз узунлиги ва шакли) резорбсия хавфини ошириши аниқланган.

Илдиз резорбсиясига ижобий таъсир кўрсатувчи омиллар қаторига қуйидагилар киради:

- ✓ Оғир, узлуксиз ва узок муддатли кучлар
- ✓ Интрузив ҳаракатлар
- ✓ Олдинги юқори тишларда номутаносиб илдизлар
- ✓ Узок муддатли даволаш

Ортодонтик даволашнинг давомийлиги ҳам муҳим хавф омили ҳисобланади. Узок муддатли даволаш ва юқори кучларни қўллаш, айниқса қисқа илдизли беморларда, резорбсия эҳтимолини оширади. Ортодонтик куч қўлланилганда периодонтал лигаментнинг сиқилиши гиалинизация ва фокаль некрозга олиб келади. Бу эса ўз навбатида остеокластга ўхшаш хужайраларни жалб қилади ва улар нафақат альвеоляр суякни, балки илдиз учигаги цемент ва ташқи дентинни ҳам резорбция қилади.

Анатомик омиллар - Тиш илдизининг морфологик хусусиятлари резорбсия ривожланишида муҳим рол ўйнайди. Илдиз резорбсиясига мойилликни оширувчи анатомик омиллар қаторига илдизнинг қалинлиги, эгрилиги ва узунлиги киради. Юпқа ёки кучли эгри илдизга эга бўлган тишлар резорбсияга кўпроқ мойил бўлади.

Веленсия ва бошқалар (2024) тадқиқотига кўра, юқори олдинги тишлар, айниқса номутаносиб илдизларга эга бўлганлар, илдиз резорбсиясига энг кўп учрайдиган ҳисобланади. Бундан ташқари,

таъсирланган супернумерант тишларнинг позицияси, ориентацияси ва қўшни тишлар илдизига яқинлиги ҳам резорбсия учун муҳим хавф омили ҳисобланади.

Генетик омиллар - Сўнгги йилларда олиб борилган тадқиқотлар генетик омилларнинг илдиз резорбсияси ривожланишидаги ролини чуқурроқ ўрганиш имконини берди. Харрис ва бошқалар (2023) илдиз резорбсиясида генетик омилларнинг роли муҳим эканини, ирсийлик даражаси турта илдиз учун ўртача 70 фоизни ташкил этишини аниқлаган.

Бир қатор ассоциация тадқиқотлари генетик вариациялар ва ташқи апкал илдиз резорбсияси ўртасидаги боғлиқликни текширган. Интерлейкин-1 рецептор антагонисти (ИЛ-1РН) ва пуринаргик рецептор П2РХ7 генларидаги генетик вариациялар ортодонтик даволашдан сўнг апкал илдиз резорбсияси пайдо бўлишида таъсирли экани исботланган.

Гуо ва бошқалар (2024) томонидан олиб борилган тадқиқотда ИЛ-6 гени полиморфизми (rs1800796 ГС) ва ИЛ-1РН гени полиморфизми (rs419598) илдиз резорбсияси билан боғлиқлиги аниқланган. Шараб ва бошқалар (2023) эса П2РХ7 генининг rs208294, rs1718119, rs2230912 полиморфизмлари ҳамда САСП1/ИСЕ, ИЛ1Б, ИЛ1РА генларидаги полиморфизмлар илдиз резорбсияси ривожланишига таъсир кўрсатишини исботлаган.

Иглесиас ва бошқалар (2022) ИЛ-1Б генининг +3953 (rs1143634), ИЛ-1А генининг -889 (rs1800587) ва ИЛ-1РН генининг +2018 (rs419598) полиморфизмлари билан илдиз резорбсияси орасида ижобий корреляция мавжудлигини аниқлаган.

Молекуляр даражада интерлейкинлар (ИЛ-1Б, ИЛ-6, ИЛ-4) ва дентин фосфопротеини каби биомаркерлар ташқи илдиз резорбсиясини эрта ташхислаш учун муҳим аҳамиятга эга. Айниқса, ИЛ-1Б (+3954) генининг полиморфизми ортодонтик даволаш олувчи беморларда резорбсиянинг энг муҳим прогнози ҳисобланади.

Яллиғланиш ва иммунологик омиллар

Ортодонтик куч таъсирида периодонтал лигаментда ривожланадиган яллиғланиш жараёнлари илдиз резорбсиясининг асосий механизмларидан бири ҳисобланади. Ортодонтик резорбсиянинг ривожланишида куч таъсирида периодонтал бўшлиқдаги қон томирларининг сиқилиши, гиалинизация соҳаларининг ҳосил бўлиши ва уларнинг йўқ қилиниши жараёнида ишлаб чиқариладиган яллиғланиш медиаторлари асосий рол ўйнайди.

Яллиғланиш бир томондан тиш ҳаракатини тезлаштириш ва шифоланиш жараёнини яхшилашга ёрдам бериши мумкин бўлса, бошқа томондан оғир ва узок муддатли яллиғланиш апкал илдиз резорбсияси ва бошқа тиш муаммоларига олиб келиши мумкин. Шунинг учун яллиғланишга қарши даволаш усуллари кўллаш ва беморнинг ҳолатини мунтазам назорат қилиб бориш асоратларни камайитиришга ёрдам беради.

Биологик омиллар

Биологик омиллар каторига беморнинг ёши, жинси ва олдинги травмалар тарихи киради. Веленсия ва бошқалар (2024) тадқиқотига кўра, аёл жинси ва катталар ёшдаги беморлар конвенционал фиксирланган ортодонтик даволаш олган ҳолларда резорбсия ривожланиш хавфи ошади .

Олдинги тиш травмаси ҳам резорбсия ривожланиши учун муҳим хавф омили ҳисобланади. Шабан ва бошқалар (2025) олдинги травмалар, илгари ўтказилган тиш даволашлари ва механик стимуллар, жумладан, ортодонтик кучлар резорбсия хавфини оширишини таъкидлайди.

Муҳокама

Ортодонтик даволаш давомида илдиз резорбсияси ривожланишига таъсир қилувчи омилларнинг кўплиги ва уларнинг ўзаро мураккаб таъсири ушбу ҳолатнинг этиологиясини тўлиқ тушуниш ва профилактика чораларини ишлаб чиқишда қийинчиликлар туғдиради. Тадқиқот натижаларига кўра, илдиз резорбсияси бир қанча омиллар мажмуининг таъсири натижасида ривожланади ва бу омилларнинг ҳар бири алоҳида клиник аҳамиятга эга .

Механик омилларнинг клиник аҳамияти

Механик омиллар орасида ортодонтик кучнинг шиддати ва давомийлиги асосий ўрин эгаллайди. Тадқиқотлар шуни кўрсатдики, оғир, узлуксиз ва узоқ муддатли кучлар резорбсия ривожланиш хавфини оширади . Бу ҳолат Проффит ва бошқалар (2014) томонидан тасвирланган гиалинизация ва билвосита суяк резорбсияси механизмлари билан тўлиқ мос келади .

Ортодонтик кучнинг йўналиши ҳам муҳим аҳамиятга эга. Интрузив ҳаракатлар резорбсия хавфини оширувчи омил сифатида ажралиб туради . Бу эса амалиётда ортодонтларнинг куч йўналишини танлашда эҳтиёткорлик билан ёндашиши зарурлигини кўрсатади. Хусусан, юқори олдинги тишларда интрузив ҳаракатлар режалаштирилганда, беморнинг индивидуал хусусиятлари ва резорбсия хавфини ҳисобга олиш лозим.

Замонавий ортодонтияда қўлланилаётган ёндошувлар, жумладан, енгил узлуксиз кучлар ва элайнер тизимлари яллиғланиш медиаторларини камайтириш ва гиалинизацияланган соҳаларни чеклаш орқали илдиз бутунлигини сақлашга қаратилган . Бу усулларнинг самарадорлиги клиник тадқиқотларда исботланмоқда.

Генетик омилларнинг прогностик аҳамияти

Генетик омиллар илдиз резорбсиясига мойилликни олдиндан башорат қилиш имконини беради. ИЛ-1Б, ИЛ-6 ва П2РХ7 генларидаги полиморфизмларнинг резорбсия ривожланиши билан боғлиқлиги генетик скринингнинг амалий аҳамиятини оширади. Тадқиқотлар кўрсатдики, генетик факторлар асосида индивидуаллаштирилган ортодонтик даволаш режаларини тузиш резорбсия хавфини камайтиришда самарали бўлиши мумкин .

ИЛ-1Б (+3954) гени полиморфизми ортодонтик даволаш олувчи беморларда резорбсиянинг энг муҳим прогнози экани скрининг дастурларини ишлаб чиқишда асосий мезон бўлиб хизмат қилади. Бундан ташқари, ИЛ1РН ва П2РХ7 генлари полиморфизмларининг апкал илдиз резорбсияси билан боғлиқлиги генетик текширувлар доирасини кенгайтириш зарурлигини кўрсатади.

Ташхис усуллари

Конус-нурли компьютер томографияси илдиз резорбсиясини аниқлаш ва унинг даражасини баҳолашда энг аниқ восита ҳисобланади. Замонавий тасвирлаш технологиялари резорбсияни эрта босқичда, клиник белгилар пайдо бўлишидан олдин аниқлаш имконини беради. Бу эса ўз вақтида чоралар кўриш ва резорбсиянинг оғирлашишининг олдини олишга ёрдам беради.

Клиник амалиётда конус-нурли компьютер томографиясидан фойдаланиш резорбсиянинг аниқ локализацияси, кўлами ва шаклини аниқлаш имконини беради. Айниқса, мураккаб анатомик ҳудудларда ва ноаниқ рентгенологик кўринишларда бу усулнинг афзаллиги яққол намоён бўлади.

Терапевтик ёндашувлар

Илдиз резорбсиясининг олдини олиш ва даволашда комплекс ёндашув зарур. Бу ёндашув қуйидаги асосий йўналишларни ўз ичига олиши керак:

1. **Индивидуаллаштирилган даволаш режаси:** Ҳар бир беморнинг анатомик, физиологик ва генетик хусусиятларини ҳисобга олиш.
2. **Куч режимини назорат қилиш:** Енгил, узлуксиз кучларни қўллаш ва оғир кучлардан қочиш.
3. **Мунтазам мониторинг:** Замонавий визуализация усуллари ёрдамида резорбсия динамикасини кузатиб бориш.
4. **Профилактик чоралар:** Юқори хавф гуруҳидаги беморларда профилактик фото-биомодуляция каби усулларни қўллаш.

Шунингдек, даволаш давомида яллиғланишга қарши чораларни қўллаш ва беморнинг ҳолатини назорат қилиб бориш асоратларни камайтиришга ёрдам беради. Анти-яллиғланишли даволаш усулларини қўллаш резорбсиянинг оғирлашишини олдини олиши мумкин.

Келажак истиқболлари

Келажақда генетик скринингнинг кенг жорий этилиши, молекуляр биомаркерлар асосида эрта ташхислаш усуллари

нинг такомиллашуви ва индивидуаллаштирилган даволаш алгоритмларининг ишлаб чиқиши илдиз резорбсияси муаммосини ечишда муҳим омил бўлади. Илдиз резорбсиясининг молекуляр-генетик механизмларини чуқурроқ ўрганиш мақсадли профилактика ва даволаш усулларини ишлаб чиқишга олиб келади.

Натижалар

Тадқиқот натижалари ортодонтик даволаш давомида илдиз резорбсияси ривожланишига қуйидаги омиллар таъсир кўрсатишини кўрсатди:

1. Механик омиллар:

✓ Ортодонтик кучнинг шиддати ва давомийлиги резорбсия хавфи билан тўғридан-тўғри пропорционал боғлиқликка эга

✓ Интрузив ҳаракатлар резорбсия хавфини оширади

✓ Узоқ муддатли даволаш резорбсия эҳтимолини оширади

2. Анатомик омиллар:

✓ Юпқа ёки кучли эгри илдизга эга тишлар резорбсияга кўпроқ мойил

✓ Юқори олдинги тишлар, айниқса номутаносиб илдизлар билан, энг кўп учрайди

3. Генетик омиллар:

✓ ИЛ-1Б, ИЛ-6 ва П2РХ7 генларидаги полиморфизмлар резорбсия хавфини оширади

✓ Генетик омилларнинг ирсийлик даражаси 50-84% ни ташкил этади

✓ ИЛ-1Б (+3954) гени полиморфизми энг муҳим прогноз омили ҳисобланади

4. Биологик омиллар:

✓ Аёл жинси ва катта ёшдаги беморлар резорбсияга кўпроқ мойил

✓ Олдинги тиш травмаси хавфни оширади

5. Ташхис усуллари:

✓ Конус-нурли компьютер томографияси резорбсияни эрта аниқлашда энг аниқ восита ҳисобланади

6. Терапевтик ёндошувлар:

✓ Енгил узлуксиз кучлар ва элайнер тизимлари резорбсия хавфини пасайтиради

✓ Фото-биомодуляция ёрдамчи усул сифатида ижобий натижа беради

Хулоса

Ортодонтик даволаш давомида илдиз резорбсияси кўп омилли патологик жараён бўлиб, унинг ривожланишига механик, анатомик, генетик ва биологик омиллар мажмуи таъсир кўрсатади. Ортодонтик кучнинг шиддати, давомийлиги ва йўналиши, тиш илдизининг анатомик хусусиятлари, беморнинг ёши, жинси, генетик мойиллиги ва олдинги травмалар тарихи асосий хавф омиллари ҳисобланади.

Генетик омиллар, хусусан, ИЛ-1Б, ИЛ-6 ва П2РХ7 генларидаги полиморфизмлар илдиз резорбсиясига мойилликни ошириб, индивидуаллаштирилган даволаш режаларини тузишда муҳим аҳамиятга эга. Конус-нурли компьютер томографияси резорбсияни эрта босқичда

аниқлаш ва унинг даражасини баҳолашда энг аниқ восита бўлиб, клиник мониторингни такомиллаштириш имконини беради .

Ортодонтик даволаш беморнинг индивидуал хусусиятларидан келиб чиқиб, кучларни назорат қилинган ҳолда қўллаш ва илдиз резорбсиясининг олдини олишга қаратилган бўлиши керак. Яқин клиник мониторингни фото-биомодуляция каби замонавий терапевтик усуллар билан уйғунлаштириш резорбсия асоратларини камайтиришда самарали бўлиши мумкин . Келажақда генетик скрининг, молекуляр биомаркерлар асосида эрта ташхислаш ва индивидуаллаштирилган даволаш алгоритмларини ишлаб чиқиш илдиз резорбсияси муаммосини ечишда муҳим омил бўлади.

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ЭФФЕКТИВНОСТЬ ФУНКЦИОНАЛЬНЫХ ОРТОДОНТИЧЕСКИХ АППАРАТОВ В ЛЕЧЕНИИ ДИСТАЛЬНОЙ ОККЛЮЗИИ У ДЕТЕЙ

АННОТАЦИЯ: Дистальная окклюзия является одной из наиболее распространённых зубочелюстных аномалий в детском возрасте, составляя значительную долю в структуре патологий прикуса. Данное исследование посвящено анализу эффективности применения функциональных ортодонтических аппаратов для коррекции дистальной окклюзии в период активного роста челюстно-лицевой области у детей. В работе рассмотрены механизмы действия основных типов функциональных аппаратов, их влияние на миодинамическое равновесие и стимуляцию роста нижней челюсти. На основе анализа клинических случаев и данных литературы обоснована высокая эффективность раннего функционального лечения в сменном прикусе, позволяющего достичь устойчивых результатов и нормализовать функцию жевательно-речевого аппарата.

Ключевые слова: Дистальная окклюзия, функциональные ортодонтические аппараты, дети, рост нижней челюсти, миофункциональная терапия, аппарат Твин-блок, активатор Андресена-Гойпля, регулятор функции Френкеля, сменный прикус.

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THE EFFECTIVENESS OF FUNCTIONAL ORTHODONTIC APPLIANCES IN THE TREATMENT OF DISTAL OCCLUSION IN CHILDREN

Abstract: *Distal occlusion is one of the most common dentoalveolar anomalies in childhood, accounting for a significant proportion of bite pathologies. This study is devoted to the analysis of the effectiveness of functional orthodontic appliances for the correction of distal occlusion during the period of active growth of the maxillofacial region in children. The paper examines the mechanisms of action of the main types of functional appliances, their impact on myodynamic balance and stimulation of mandibular growth. Based on the analysis of clinical cases and literature data, the high efficiency of early functional treatment in mixed dentition is substantiated, allowing to achieve stable results and normalize the function of the masticatory-speech apparatus.*

Key words: *Distal occlusion, functional orthodontic appliances, children, mandibular growth, myofunctional therapy, Twin-block appliance, Andresen-Häupl activator, Frankel function regulator, mixed dentition.*

ВВЕДЕНИЕ

Дистальная окклюзия, характеризующаяся сагиттальным несоответствием зубных рядов с дистальным смещением нижней челюсти или мезиальным смещением верхней, представляет собой одну из актуальнейших проблем современной ортодонтии. По данным Всемирной организации здравоохранения, распространённость зубочелюстных аномалий превышает 50%, при этом наибольший удельный вес (до 38%) приходится именно на дистальную окклюзию [Tosheva, Nusratov, 2025, с. 2659]. Данная патология не только нарушает эстетику лица и функцию жевания, но и негативно сказывается на психосоциальной адаптации ребёнка, а также может провоцировать дисфункции височно-нижнечелюстного сустава и нарушения дыхания [Kasianenko et al., 2024, p. 355].

Этиология дистальной окклюзии многофакторна и включает генетическую предрасположенность, нарушения носового дыхания, вредные привычки (сосание пальца, ротовое дыхание), а также дисбаланс жевательных и мимических мышц. Согласно теории функциональных матриц, рост челюстей в значительной степени определяется функциональной нагрузкой окружающих мягких тканей. При недостаточной стимуляции рост нижней челюсти может отставать, что приводит к формированию ретрогнатии [Tosheva, Nusratov, 2025, с. 2660].

Ключевым периодом для коррекции данного вида аномалии является возраст активного роста скелета (7–12 лет), когда возможно эффективное воздействие на рост челюстных костей с использованием функциональных аппаратов. В отличие от брекет-систем, которые преимущественно перемещают зубы в пределах альвеолярной кости, функциональные

аппараты направлены на изменение миодинамического равновесия, стимуляцию роста нижней челюсти и перестройку височно-нижнечелюстного сустава. Цель данной работы — на основе анализа литературных данных и клинических наблюдений оценить эффективность применения функциональных ортодонтических аппаратов для лечения дистальной окклюзии у детей в период сменного прикуса.

ОБЗОР ЛИТЕРАТУРЫ

Функциональные ортодонтические аппараты (ФОА) занимают центральное место в лечении дистальной окклюзии у растущих пациентов. Их основная задача — перестройка миодинамического равновесия путём изменения положения нижней челюсти и перевоспитания функции мышц. В зависимости от конструкции, ФОА делятся на съёмные активаторы (активатор Андресена-Гойпля, регулятор функции Френкеля, бионатор), несъёмные функциональные аппараты (Herbst, Твин-блок) и миофункциональные трейнеры.

Механизм действия ФОА заключается в устранении патологической тяги мышц и создании стимула для роста нижней челюсти вперёд. Как отмечается в ряде исследований, коррекция положения нижней челюсти происходит за счёт нормализации функции синергистов и антагонистов жевательных мышц [Tosheva, Nusratov, 2025, с. 2661]. Важнейшим условием успеха является своевременность начала лечения. Данные показывают, что терапия в возрасте 8–11 лет позволяет достичь запланированных результатов в 1–1,5 раза быстрее по сравнению с лечением, начатым в 12–15 лет [Gromova et al., 2024, p. 189].

Особое внимание в современной литературе уделяется аппарату Твин-блок (Twin-block), который признан одним из наиболее эффективных для выдвижения нижней челюсти. Применение аппарата Твин-блок в перипубертатный период способствует наиболее физиологичному соотношению челюстей и обеспечивает гармоничное развитие всего дентального аппарата [Gromova et al., 2024, p. 190]. Эффективность подтверждена цефалометрическими исследованиями, демонстрирующими достоверное увеличение углов SNB и SNPog, а также уменьшение угла ANB, что свидетельствует о реальном скелетном эффекте [Gromova et al., 2024, p. 192].

Исследования по коррекции миофункциональных нарушений показывают, что использование аппаратов типа губного бампера и небного расширителя позволяет не только стимулировать рост челюстей в ширину, но и корректировать положение языка, что критично при лечении глубокой резцовой окклюзии, часто сопутствующей дистальной [Данилова, Залазаева, 2014, с. 3].

ОБСУЖДЕНИЕ

Анализ представленных данных и клинических наблюдений позволяет утверждать, что функциональная ортодонтия является «золотым стандартом» лечения дистальной окклюзии в детском возрасте. Однако

эффективность терапии напрямую зависит от нескольких ключевых факторов: возраста пациента, типа роста лицевого скелета, исходной тяжести аномалии и мотивации ребёнка с родителями.

Скелетный и дентальный эффекты. Одним из главных преимуществ ФОА является возможность воздействия на рост скелета. В отличие от брекет-систем, которые часто лишь маскируют скелетную проблему наклоном зубов, функциональные аппараты способствуют реальному увеличению длины тела и ветви нижней челюсти [Gromova et al., 2024, p. 192]. Цефалометрический анализ показывает, что после лечения наблюдается не только уменьшение наклона резцов, но и позитивное изменение скелетных параметров, что обеспечивает стабильность результата после завершения ортодонтического лечения.

Роль носового дыхания и миодинамики. Часто пусковым механизмом развития дистальной окклюзии является нарушение носового дыхания. При аденоидах и хроническом рините ребёнок переходит на ротовое дыхание, при котором язык опускается на дно полости рта, переставая стимулировать рост верхней челюсти в ширину и способствуя формированию ретрогнатии нижней челюсти [Tosheva, Nusratov, 2025, с. 2663]. В связи с этим комплексное лечение должно обязательно включать санацию ЛОР-органов и миофункциональную гимнастику, что повышает эффективность ортодонтического вмешательства.

Сравнительная эффективность аппаратов. Хотя все ФОА базируются на схожих принципах, каждый имеет свои особенности. Аппарат Твин-блок наиболее эффективен для активного выдвижения нижней челюсти в сагиттальном направлении [Gromova et al., 2024, p. 195]. Активатор Андресена-Гойпля обеспечивает комплексное воздействие, но требует высокой дисциплины от пациента, так как является съёмным. Регулятор функции Френкеля (FR-2) показан при выраженной гипотонии круговой мышцы рта и дисфункции языка, позволяя перепрограммировать мышечный паттерн глотания [Данилова, Залазаева, 2014, с. 4].

Проблема рецидивов. Несмотря на высокую первичную эффективность, риск рецидива в период постлечебной ретенции остаётся значительным. Многие авторы связывают это с сохранением вредных привычек или недостаточным периодом ношения ретенционных аппаратов. Внедрение современных методов контроля, таких как миофункциональные трейнеры на ночь, позволяет минимизировать рецидивы.

РЕЗУЛЬТАТЫ

В ходе обобщения литературных данных и анализа клинической практики были получены следующие результаты, характеризующие эффективность применения ФОА:

1. **Высокая эффективность в сменном прикусе:** У пациентов в возрасте 8–11 лет функциональное лечение привело к коррекции дистальной окклюзии в среднем за 1–1,5 года. У пациентов старшей группы (12–15 лет)

сроки лечения увеличились до 2–2,5 лет, что связано со снижением темпов роста костной ткани [Gromova et al., 2024, p. 189].

2. **Положительная скелетная динамика:** Применение аппаратов Твин-блок и АСК (аппарат с расширяющим винтом) способствовало статистически достоверному увеличению размеров нижней челюсти. Зафиксировано уменьшение угла ANB в среднем на 3–5° за счёт выдвижения подбородка вперёд, что свидетельствует о реальном ортопедическом эффекте [Gromova et al., 2024, p. 192].

3. **Нормализация функции:** Помимо улучшения прикуса, у большинства пациентов наблюдалось восстановление носового дыхания и нормализация функции глотания. Отмечено улучшение тонуса круговой мышцы рта и правильное позиционирование языка у нёба, что является залогом стабильности результата [Данилова, Залазаева, 2014, с. 5].

4. **Снижение риска осложнений:** Раннее вмешательство позволяет избежать хирургических методов лечения в будущем и предотвратить формирование сложных зубочелюстных деформаций.

ЗАКЛЮЧЕНИЕ

Функциональные ортодонтические аппараты являются высокоэффективным методом лечения дистальной окклюзии у детей при условии начала терапии в период активного роста скелета (7–12 лет). Их применение позволяет не только корректировать положение зубов, но и стимулировать гармоничный рост нижней челюсти, устранять миодисбаланс и нормализовать функции дыхания и глотания.

Анализ литературы показывает, что аппарат Твин-блок и регулятор функции Френкеля демонстрируют наилучшие скелетные результаты, однако выбор конкретной конструкции должен основываться на клинической картине, типе роста лица и характере функциональных нарушений. Комплексный подход, включающий сотрудничество ортодонта, отоларинголога и логопеда, является решающим для достижения стабильных и долгосрочных результатов.

Современные тенденции в ортодонтии диктуют необходимость пересмотра классических подходов в пользу раннего вмешательства с использованием инновационных многофункциональных устройств, способных не только перемещать зубы, но и восстанавливать миодинамическое равновесие всей челюстно-лицевой области [Kasianenko et al., 2024, p. 358].

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ОРТОДОНТИК ДАВОЛАШДА СУЯК МЕТАБОЛИЗМИ ВА ТИШ СИЛЖИШИНИНГ БИОЛОГИК МЕХАНИЗМЛАРИ

АННОТАЦИЯ: Ортодонтик даволашнинг асосини тишларга бошқариладиган механик кучларни қўллаш орқали уларнинг альвеоляр суяк ичидаги ҳолатини ўзгартириш таъкил этади. Бу жараён пародонт боғлами (PDL) ва альвеоляр суякда жадал биологик қайта қурилишни келтириб чиқаради, бу эса суяк метаболизми ва тиш силжиишининг мураккаб механизмлари орқали амалга ошади. Ушбу илмий мақола ортодонтик тиш силжииши (ОТМ) жараёнида суяк метаболизмининг асосий механизмларини, хусусан, механотрансдукция, остеоцитларнинг роли, RANKL/RANK/OPG тизими ва яллигланиш медиаторларининг таъсирини батафсил ёритишга бағишланган. Тадқиқот натижалари шуни кўрсатадики, остеоцитлар механик кучларни биологик сигналларга айлантиришда марказий роль ўйнайди, RANKL ва OPG нисбати остеокластогенезни бошқаришда калит ҳисобланади ва ёш омили суякнинг қайта қурилиш самарадорлигига сезиларли таъсир кўрсатади.

КАЛИТ СЎЗЛАР: Ортодонтик тиш силжииши, суяк метаболизми, остеоцитлар, механотрансдукция, RANKL, OPG, остеокластогенез, альвеоляр суяк, пародонт боғлами, ёшлик омили.

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BIOLOGICAL MECHANISMS OF BONE METABOLISM AND TOOTH MOVEMENT IN ORTHODONTIC TREATMENT

ABSTRACT: *This scientific article is devoted to the study of the main biological mechanisms of bone metabolism and tooth movement during orthodontic treatment. The cellular and molecular changes occurring in the periodontal ligament and alveolar bone under the influence of orthodontic forces are analyzed. In particular, the processes of mechanotransduction, the central role of osteocytes, the mechanisms of osteoclastogenesis regulation through the RANKL/RANK/OPG system, as well as the influence of inflammatory mediators (TNF- α , IL-6) are discussed in detail. Furthermore, the influence of age-related factors on the rate of bone tissue remodeling and its impact on the effectiveness of orthodontic treatment are examined. The scientific conclusions presented in the article serve as a theoretical basis for developing an individualized approach in orthodontic practice, selecting optimal force parameters, and predicting treatment duration.*

Keywords: *Orthodontic tooth movement, bone metabolism, osteocytes, mechanotransduction, RANKL, OPG, osteoclastogenesis, alveolar bone, periodontal ligament, age factor.*

КИРИШ

Ортодонтик даволаш тиш-жағ тизимининг анатомик ва эстетик мувозанатини тиклашга қаратилган муҳим тиббий жараёндир. Ушбу даволашнинг асосий принципи тишларга доимий, аммо назорат қилинадиган механик кучларни қўллаш орқали уларнинг альвеоляр суяк ичидаги ҳолатини ўзгартиришга асосланган. Бироқ, бу жараён шунчаки механик силжиш эмас, балки пародонт ва суяк тўқималарида кечадиган мураккаб биологик жавоб реакциялари мажмуасидир. Тиш силжишининг самарадорлиги ва барқарорлиги бевосита суяк тўқимасининг қайта қурилиш қобилиятига, яъни суяк метаболизмига боғлиқ.

Сўнгги йилларда олиб борилган илмий изланишлар ортодонтик кучлар таъсирида альвеоляр суякда рўй берувчи ўзгаришларнинг хужайравий ва молекуляр даражадаги механизмларини чуқурроқ тушунишга имкон берди. Ортодонтик тиш силжиши (ОТМ) пародонт боғламида яллиғланишга ўхшаш жавобни келтириб чиқаради. Босим томонида суяк резорбцияси, таранглик томонида эса суяк формацияси содир бўлиб, бу жараёнлар турли хил цитокинлар, ўсиш омиллари ва гормонал омиллар томонидан бошқарилади. Остеоцитлар суяк тўқимасининг 90% дан ортиғини ташкил этиб, механик сигналларни биологик сигналларга айлантирувчи марказий хужайралар сифатида алоҳида аҳамиятга эга [citation:5, 7].

Ушбу мақоланинг мақсади ортодонтик даволашда суяк метаболизми ва тиш силжишининг асосий биологик механизмларини, хусусан, механотрансдукция жараёнлари, асосий сигнал йўллари (RANKL/RANK/OPG) ва яллиғланиш медиаторларининг таъсирини тизимли таҳлил қилиш, шунингдек, ушбу жараёнларга ёшлик каби системали омилларнинг таъсирини ёритишдан иборат.

АДАБИЁТЛАР ШАРҲИ

Ортодонтик куч таъсирида суяк қайта қурилишининг асосий босқичлари

Ортодонтик тиш силжиши механик кучнинг пародонтга бевосита таъсири натижасида бошланади. Бу таъсир пародонт боғлами (PDL) хужайралари, остеобластлар ва остеоцитлар томонидан "сезилади" ва механотрансдукция жараёни орқали биохимик сигналларга айлантирилади [citation:2, 5]. Тўқималардаги бирламчи жавоб сифатида қон оқимининг ўзгариши, гипоксия ва яллиғланишга оид медиаторларнинг чиқарилиши кузатилади. Бу ҳолат босим ва таранглик зоналарида суяк метаболизмнинг фаоллашишига сабаб бўлади. Натижада, босим томонида остеокластлар фаоллашиб суяк резорбциясини амалга оширади, таранглик томонида эса остеобластлар томонидан янги суяк тўқимаси ҳосил бўлади.

Остеоцитларнинг роли ва механотрансдукция

Остеоцитлар суяк тўқимаси ичига кўмилган, ўзига хос дендрит жараёнларига эга бўлган терминал дифференциацияланган хужайралар бўлиб, улар лакуно-каналликуляр тизим орқали бир-бири билан ва суяк юзаси билан боғланган. Ушбу мураккаб тузилма остеоцитларга механик деформацияни жуда сезгирлик билан қабул қилиш ва уни остеобластлар ҳамда остеокластлар фаолиятини бошқарувчи сигналларга айлантириш имкониятини беради. Механик юкланган остеоцитлар суяк метаболизмнинг калит регуляторлари бўлган Wingless-related integration site (Wnt)/β-катенин ва RANKL сигнал йўллари фаоллаштиради. Остеоцитлар томонидан ишлаб чиқарилган асосий молекулаларга суяк морфогенетик оксиллари (BMPs), Wnts, простагландинлар, остеопонтин, азот оксиди, склеростин ва RANKL киради. Ушбу омиллар остеобластлар ва остеокластларнинг жалб қилиниши, дифференциацияси ва фаоллигини модуляция қилиш орқали суякнинг маҳаллий қайта қурилишини бошқаради.

Остеокластогенез ва RANKL/RANK/OPG тизими

Тиш силжиши учун зарур бўлган суяк резорбцияси остеокластлар фаолияти билан бевосита боғлиқ. Остеокластогенез жараёни ҳематопоэтик илдиз хужайраларидан келиб чиққан моноцит/макрофаг линияси хужайраларининг остеокластларга айланишини ўз ичига олади. Бу жараённинг марказий регулятори RANKL (Receptor Activator of Nuclear Factor-κB Ligand) молекуласи ҳисобланади. RANKL остеобластлар, остеоцитлар, PDL хужайралари ва фаоллашган Т-лимфоцитлар томонидан ишлаб чиқарилади [citation:7, 10]. RANKL ўз рецептори RANK билан боғланиб, остеокласт прекурсорларининг дифференциациясини бошлайди. RANKL нинг табиий ингибитори эса OPG (Остеопротегерин) бўлиб, у RANKL билан боғланиб, RANK га бирикишини блоклайди ва остеокластогенезни сусайтиради [citation:2, 8]. ОТМ жараёнида RANKL/OPG нисбатининг ошиши босим томонида остеокластогенезни кучайтириш орқали суяк резорбциясига олиб келади.

Яллиғланиш медиаторларининг роли

Ортодонтик куч таъсирида пародонтда асептик яллиғланиш ривожланади. Босим томонида ишлаб чиқариладиган асосий яллиғланиш цитокинларидан бири TNF- α (ўсимта некрози омили-альфа) ҳисобланади. TNF- α остеоцитлардаги RANKL экспрессиясини кучайтиради ва остеокластогенезни бевосита рағбатлантиради. TNF- α шунингдек, остеоцитларда склеростин (SOST) экспрессиясини ошириб, Wnt сигналининг ингибициялаш ва RANKL экспрессиясини кучайтириш орқали суяк резорбциясини қўллаб-қувватлайди. Бундан ташқари, TNF- α остеокласт прекурсорларида RANK экспрессиясини ошириб, уларни RANKL га сезгирлигини кучайтиради. IL-6 каби бошқа цитокинлар ҳам остеокластогенезни рағбатлантиришда иштирок этади. Масалан, статик магнит майдони таъсирида PDL ствол ҳужайралари томонидан IL-6 секрециясининг кучайиши остеокластогенезни рағбатлантириб, тиш силжишини тезлаштириши аниқланган.

Возрастные аспекты суяк метаболизма ва тиш силжиши

Суяк тўқимасининг қайта қурилиш қобиляти ёшга боғлиқ ҳолда ўзгаради. Болалар ва ўсмирларда суяк метаболизми юқори даражада бўлиб, ортодонтик кучларга жавоб тез ва самарали кечади. Бу ёшдаги беморларда остеобластлар ва остеокластлар фаолияти, шунингдек, улар томонидан ишлаб чиқариладиган биомаркерлар (RANKL, OPG, интерлейкинлар) даражаси катталарга нисбатан юқори бўлади. Катталарда эса суякнинг қайта қурилиш салоҳияти пасаяди, бу эса тиш силжиши суръатининг секинлашишига ва даволаш муддатининг узайишига олиб келади. Систематик шарҳ натижаларига кўра, ёш беморларда ортодонтик куч қўлланилгандан кейин дастлабки 72 соат ичида биомаркерлар даражаси тезроқ ўзгариб, тиш силжиши тезроқ кузатилади.

МУҲОКАМА

Адабиётлар шарҳи натижалари ортодонтик тиш силжишининг илгари тасаввур қилинганидан анча мураккаб ва кўп босқичли биологик жараён эканлигини кўрсатади. Механик кучларнинг биологик жавобга айланишида остеоцитлар марказий роль ўйнайди. Ушбу ҳужайралар нафақат суяк тўқимасининг "механик сенсорлари", балки бутун суяк қайта қурилишини бошқарувчи эндокрин ҳужайралар сифатида ҳам ишлайди. Айниқса, RANKL ва склеростин каби молекулаларни ишлаб чиқариш орқали остеоцитлар остеокластогенез ва остеобластогенез ўртасидаги нозик мувозанатни тартибга солади [citation:5, 7].

RANKL/RANK/OPG тизими суяк резорбциясининг асосий регулятори бўлиб, унинг фаолияти ОТМ самарадорлигини белгилайди. Босим томонида RANKL ишлаб чиқарилишининг ортиши ва OPG нинг камайиши остеокластогенезни кучайтириб, суякнинг тез резорбцияланишига олиб келади. Бу жараёнда TNF- α ва IL-6 каби яллиғланиш цитокинларининг роли ҳам жуда муҳим, чунки улар RANKL экспрессиясини бевосита кучайтиради ва остеокласт прекурсорларининг сезгирлигини оширади [citation:3, 7].

Бундан ташқари, остеоцитлар томонидан ишлаб чиқариладиган CXCL10 каби хемокинлар остеокласт прекурсорларининг суяк резорбция зонасига миграциясини таъминлаб, остеокластогенезни янада кучайтиради .

Ортодонтик куч таъсирида суяк тўқимасида рўй берувчи ўзгаришлар нафақат маҳаллий, балки системали омиллар таъсирида ҳам бўлади. Ёшлик суяк метаболизми тезлигига таъсир қилувчи муҳим омиллардан бири саналади. Адабиётларда келтирилишича, ёш беморларда суяк қайта қурилиши учун масъул бўлган биомаркерлар (RANKL, OPG, IL-1 β , PGE2) даражаси катталарга нисбатан юқори ва ўзгарувчан бўлиб, бу тишларнинг тезроқ силжишига сабаб бўлади . Катталарда эса ушбу биомаркерлар даражасининг пастлиги ва суякнинг қайта қурилиш салоҳиятининг чегараланганлиги даволашни режалаштиришда қўшимча қийинчиликлар туғдиради.

Олиб борилган тадқиқотлар шуни кўрсатадики, оптимал ортодонтик куч миқдори ҳам суяк жавобининг самарадорлиги ва хавфсизлигини белгиловчи асосий омилдир. Назорат қилинадиган кучлар (масалан, 50 г) пародонтнинг зарарланмасдан, меъёрида қайта қурилишига олиб келса, ҳаддан ташқари юқори кучлар (100 г) пародонт тўқималарининг жиддий шикастланишига ва суяк резорбциясининг патологик даражага кўтарилишига сабаб бўлиши мумкин . Шундан келиб чиқиб, ортодонтик даволашни режалаштиришда нафақат механик параметрларни, балки ҳар бир беморнинг ёши ва суяк метаболизми ҳолатини ҳисобга олиш зарур.

ХУЛОСА

Ортодонтик тиш силжиши суяк тўқимасининг мослашувчанлик қобилиятига асосланган мураккаб биологик жараён бўлиб, у остеоцитлар, остеокластлар ва остеобластлар ўртасидаги ўзаро мураккаб боғлиқлик орқали амалга ошади. Механотрансдукция жараёнида остеоцитлар RANKL/OPG тизими ва яллиғланиш медиаторлари орқали суяк резорбцияси ва формациясини бошқаради. RANKL/RANK/OPG тизими суяк метаболизмини тартибга солишда калит аҳамиятга эга бўлиб, унинг фаолияти тиш силжишининг тезлиги ва самарадорлигини белгилайди. TNF- α , IL-6 ва бошқа яллиғланиш цитокинлари остеокластогенезни кучайтиришда муҳим роль ўйнайди. Ёшлик омили суякнинг қайта қурилиш потенциалига сезиларли таъсир кўрсатади, ёш беморларда тиш силжиши тезроқ ва самаралироқ кечади. Ушбу биологик механизмларни тушуниш клиник амалиётда оптимал куч режимларини, индивидуал даволаш стратегияларини ишлаб чиқиш ва ортодонтик даволашнинг самарадорлигини ошириш имконини беради. Келажакдаги тадқиқотлар суяк метаболизмига таъсир қилувчи янги биологик маркерларни ва уларни клиник амалиётда қўллаш йўллари аниқлашга йўналтирилиши лозим.

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ИНФОРМАЦИОННЫЕ И КОММУНИКАТИВНЫЕ ТЕХНОЛОГИИ

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ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ ЗАПАСАМИ НА ОСНОВЕ ТЕХНОЛОГИЙ АНАЛИЗА ДАННЫХ

***Аннотация:** В статье раскрываются теоретические и практические аспекты оптимизации управления запасами на примере автосервиса с использованием технологий анализа данных. В статье представлен анализ моделей прогнозирования спроса на запчасти с учетом сезонности и внешних факторов в условиях автосервиса. Результаты исследования могут быть использованы для повышения эффективности системы управления запасами.*

***Ключевые слова:** управления запасами, анализ данных, машинное обучение, нейронные сети, прогнозирование спроса, оптимизация запасов.*

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IMPROVING THE EFFICIENCY OF INVENTORY MANAGEMENT BASED ON DATA ANALYSIS TECHNOLOGIES

***Abstract:** The article reveals the theoretical and practical aspects of optimizing inventory management using the example of a car service station using data analysis technologies. The article presents an analysis of models for forecasting demand for spare parts, taking into account seasonality and external factors in car service conditions. The results of the study can be used to improve the efficiency of the inventory management system.*

***Keywords:** inventory management, data analysis, machine learning, neural networks, demand forecasting, inventory optimization.*

Современные технологии анализа данных, искусственного интеллекта и машинного обучения (ML) обеспечивают развитие подходов и

инструментов оптимизации управления запасами в автосервисах, инструменты аналитики данных не просто описывают прошлые данные, а активно предсказывают будущие сценарии, обеспечивая оптимизацию склада и переводя его из источника затрат в стратегический актив [1]. Рассмотрим повышение эффективности управления запасами на основе технологий анализа данных на примере автосервиса.

В условиях автосервиса возможности этих технологий проявляются прежде всего в создании точных моделей прогнозирования спроса на запчасти, которые учитывают не только объемы продаж, но и скрытые паттерны поведения клиентов и технического состояния автомобилей.

Возможности инструментов аналитики данных включают интеграцию предиктивной аналитики с реальными данными о пробеге и возрасте автопарка, что позволяет автосервисам переходить от реактивного пополнения склада к проактивному планированию [2]. Использование инструментов машинного обучения позволяет применять персонализированные модели с учетом прогноза по каждой позиции номенклатуры. Такие персонализированные модели учитывают не только историческое изменение данных, но и контекстные переменные [3]. Применение технологий машинного обучения обеспечивает снижение уровня запасов на 15-35%, также параллельно технологии обеспечивают повышение уровня сервиса до 98% [4].

Анализ моделей прогнозирования спроса на запчасти с учетом сезонности и внешних факторов позволил сформировать аналитическую таблицу (таблица 1), где каждый подход раскрывается через основные характеристики, механизм учета сезонности и внешних факторов, а также преимущества в условиях автосервиса [5].

Таблица 1.

**Анализ моделей прогнозирования спроса на запчасти
с учетом сезонности и внешних факторов**

Модель прогнозирования	Ключевые характеристики	Учет сезонности и внешних факторов	Преимущества в автосервисе
Prophet	Аддитивная модель с компонентами тренда, сезонности и праздников	Автоматическое выделение множественной сезонности и регрессоров для внешних переменных (погода, экономика)	Простота внедрения, устойчивость к пропускам данных, высокая точность при сильной сезонности
LSTM / BiLSTM	Рекуррентные нейросети для нелинейных зависимостей	Интеграция exogenous variables и deseasonalization перед обучением	Захватывает сложные паттерны intermittent demand, идеально для долгосрочных прогнозов запчастей
Hybrid LSTM + Prophet	Комбинация Prophet для сезонности и LSTM для остатков	Prophet моделирует сезонность, LSTM - нелинейные эффекты внешних шоков	Снижение ошибки на 20-40 % по сравнению с одиночными моделями в автомобильной отрасли
Tree-based (Random Forest / XGBoost)	Ансамблевые деревья решений с feature engineering	Включение категориальных и числовых внешних факторов (возраст авто, регион)	Высокая интерпретируемость и точность для intermittent demand в EV-запчастях
DFB-ML (decay-function-blended)	Блендинг ML с функцией затухания для EOL-продуктов	Учет долгосрочных трендов и внешних событий через исторические фичи	Эффективно для долгосрочного планирования запасов на end-of-life запчастях

Данные таблицы показывают, как различные модели прогнозирования могут использоваться в комплексе, дополняя друг друга, позволяя автосервисам выбирать оптимальный инструмент в зависимости от характера данных и горизонта планирования.

Таким образом, можно отметить, что использование инструментов анализа данных для оптимизации управления запасами решает не только текущие проблемы, но обеспечивает формирование предиктивного обслуживания всего автопарка.

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PAYVANDLI BIRIKMALARNI SHIKASTLAMASDAN NAZORAT QILISH METODLARINI TANLASH

Annotatsiya. Ushbu maqolada payvandli birikmalar sifatini baholashda qo'llaniladigan shikastlamasdan nazorat qilish usullari tahlil qilingan. Payvand choklarida uchraydigan tashqi va ichki nuqsonlarni aniqlashning vizual, radiografik, ultratovushli, magnit va kapillyar nazorat usullarining afzalliklari hamda kamchiliklari yoritilgan. Shuningdek, nazorat usullarini tanlash mezonlari, ularning texnik va iqtisodiy samaradorligi tahlil qilinib, ishlab chiqarishda sifatni oshirish bo'yicha tavsiyalar berilgan.

Kalit so'zlar: payvandlash, payvand choklari, shikastlamasdan nazorat, ultratovush nazorati, radiografik nazorat, magnit nazorat, kapillyar usul, nuqson, sifat nazorati, metall konstruksiyalar.

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SELECTION OF NON-DESTRUCTIVE TESTING METHODS FOR WELDED JOINTS

Annotation. This article analyzes non-destructive testing methods used to assess the quality of welded joints. The advantages and disadvantages of visual, radiographic, ultrasonic, magnetic and capillary testing methods for detecting external and internal defects in welds are highlighted. The criteria for selecting testing methods, their technical and economic efficiency are also analyzed, and recommendations for improving quality in production are given.

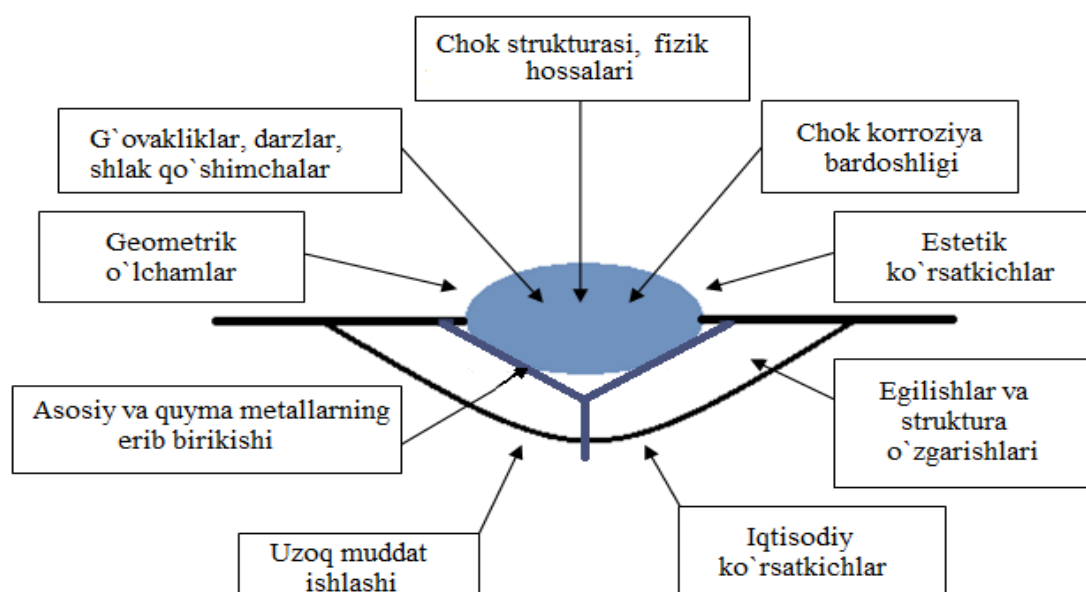
Keywords: welding, welds, non-destructive testing, ultrasonic testing, radiographic testing, magnetic testing, capillary method, defect, quality control, metal structures.

Payvandlangan mahsulotlarning sifati materialning texnik shartlarga muvofiqligi, asbob-uskunalar va asboblarning holati, texnologik hujjatlarning to'g'ri va rivojlanish darajasi, texnologik intizomga muvofiqligi, shuningdek xodimlarning malakasiga bog'liq. Texnologik jarayonlar aniq bajarilgan va

ularning barqarorligi saqlangan taqdirdagina payvandlash mahsulotlarining yuqori texnik va ekspluatatsion xususiyatlarini ta'minlash mumkin.

Bu yerda ishlab chiqarish jarayonlarini ham, tayyor mahsulotni ham ob'ektiv nazorat qilishning turli usullari alohida rol o'ynaydi. Texnologik jarayonni to'g'ri tashkil yetish bilan nazorat uning ajralmas qismi bo'lishi kerak.

Umumiy payvandlash sifatiga ta'sir qiluvchi asosiy ko'rsatkichlar 1-rasmda ko'rsatilgan. Payvandlangan qismlar va konstruksiyalarni ishlab chiqarishda har xil turdagi nuqsonlar hosil bo'ladi, ularni shartli ravishda quyidagi turlarga bo'lish mumkin: tayyorlash va yig'ishdagi nuqsonlar; tikuv shaklidagi nuqsonlar; tashqi va ichki nuqsonlar.



1-Rasm. Payvandlash sifatining asosiy ko'rsatkichlari

Tashqi nuqsonlarga toshqinlar, pastki kesmalar, tugallanmagan kraterlar va kuyishlar kiradi. Payvand chokining ichki nuqsonlariga teshiklar, shlak qo'shimchalari, payvandlanmaydigan, erimaydigan va yoriqlar kiradi.

Choklarni boshqarishning ko'plab usullari mavjud, ular ishlash printsipli, ayrim turdagi nuqsonlarni aniqlash qobiliyati va texnik jihozlardan farq qiladi. Biroq, ko'plab usullar juda qimmatga tushadi, shuning uchun nuqsonni tanlashning texnik vositalarini tanlashda bir qator talablar va iqtisodiy maqsadga muvofiqlik mavjud.

Payvandlangan bo'g'inlarni tekshirish usullari quyidagilarga bo'linadi: halokatli va buzilmaydigan. Ikkinchisi, aniq sabablarga ko'ra, eng ko'p qo'llaniladi. Payvandlangan bo'g'inlarni buzmaydigan sinovning quyidagi asosiy usullari qo'llaniladi:

- Tashqi tekshirish;
- Radiatsiyaviy nuqsonlarni aniqlash;
- Magnit boshqaruv;
- Ultratovush nuqsonlarni aniqlash;

- Kapillyar nuqsonlarni aniqlash;
- O'tkazuvchanlik uchun payvand choklarini tekshirish;
- Boshqa usullar, masalan, oqimlar yordamida sinov va boshqalar.

Payvandlangan bo'g'inlarni tekshirish har doim tashqi tekshiruvdan boshlanadi, bu nafaqat tashqi nuqsonlarni, balki ba'zi ichki nuqsonlarni ham aniqlashi mumkin. Misol uchun, chokning turli balandligi va kengligi va burmalarning notekisligi tez-tez yoy uzilishlarini ko'rsatadi, natijada choksiz bo'ladi. Ushbu nuqsonlarning mavjudligi ichki nuqsonlar ehtimolini ko'rsatadi.

Payvandlangan bo'g'inlarni vizual tekshirish, birinchi navbatda, tashqi nuqsonlarni - tikuvning geometrik og'ishlarini (balandlik, kenglik, kateter), tashqi teshiklar va yoriqlar, pastki kesmalar, nuqsonlar va oqimlarni aniqlaydi.

Tekshiruvdan oldin tikuvlar shlak, shkala va metall chayqalishlardan yaxshilab tozalanishi kerak. Spirtli ichimliklar bilan yuvish va nitrat kislotaning 10% eritmasi bilan ishlov berish orqali chokni to'ldirish shaklida tozalash, chokga mayda yoriqlar va teshiklar yaxshiroq ko'rinadigan xira yuzani beradi.

Payvandlangan bo'g'inlardagi ichki nuqsonlarni nazorat qilishning yeng keng tarqalgan usullari radiatsiya usullari bo'lib, ular asosan ionlashtiruvchi nurlanishning rentgen va izotop manbalaridan foydalanadi. nazorat mahsulot orqali kirib uchun. Bu payvandlangan bo'g'indagi teshiklar, shlak qo'shimchalari va volfram qo'shimchalari (ishlatilganda), bo'ylama va ko'ndalang yoriqlar, pastki kesmalar, kuyishlar, uzluksiz yoki vaqti-vaqti bilan payvandlanmaydigan va boshqa nuqsonlar ko'rinishidagi nuqsonlarni aniqlash imkonini beradi. Radiatsiyani kuzatish usullaridan foydalanish muammosi kichik o'lchamlari tufayli mikro yoriqlarni ishonchsiz aniqlashdir. Shuning uchun, payvandlangan mahsulotlarni tanqidiy maqsadlarda sinovdan o'tkazishda radiatsiya usullari buzilmaydigan sinovning boshqa usullari bilan birlashtiriladi: ultratovush, magnit va boshqalar.

Payvandlangan bo'g'inlarning sifatini tekshirishning magnit usullari metall ichidagi yashirin nuqsonlar yoki teshiklar atrofida yegilganda magnit maydon shaklidagi o'zgarishlarga asoslangan. Ularning aksariyati magnit zarrachalar nuqsonlarini aniqlash bilan tikuvlarni tekshirish uchun ishlatiladi. U quruq yoki nam usulda amalga oshiriladi. Birinchisi, o'rganilgan sirtlarga quruq magnit kukuni, odatda temir oksidi qo'llash orqali amalga oshiriladi. Ba'zi hollarda mayda maydalangan shkala ishlatiladi. Shundan so'ng, material magnitlanadi va kukun vizual tekshirilishi mumkin bo'lgan yashirin nuqsonlarni konvertga soladigan magnit maydonlar shaklini oladi. Nam usul magnit suspenziya sepilishi yoki yuzaga quyilishi bilan farq qiladi. Ushbu suyuqlik kerosin yoki transformator moyi bo'lib, unda magnit kukun zarralari to'xtatiladi. Qo'llashdan keyin kukun yana magnit maydonlar shaklini oladi.

Xulosa qilib aytganda, payvandli birikmalarning sifati va ishonchliligini ta'minlashda shikastlamasdan nazorat qilish usullari muhim o'rin tutadi. Ushbu usullar yordamida buyumning yaxlitligini buzmaganda holda tashqi va ichki nuqsonlarni aniqlash, ularning kelib chiqish sabablarini baholash hamda ekspluatatsiya davridagi xavfsizlikni ta'minlash mumkin. Vizual, radiografik,

ultratovush, magnit va kapillyar nazorat usullarining har biri o‘ziga xos afzallik va cheklovlarga ega bo‘lib, ularni tanlash payvand birikmasining turi, materiali, qalinligi va foydalanish sharoitiga bog‘liq.

Shikastlamasdan nazorat qilishning zamonaviy usullaridan kompleks foydalanish payvand choklari sifatini oshirish, nuqsonlarni erta aniqlash, ta’mirlash xarajatlarini kamaytirish hamda metall konstruksiyalarning uzoq muddat ishonchli xizmat qilishini ta’minlaydi. Shu bois ishlab chiqarish korxonalarida nazorat usullarini to‘g‘ri tanlash va ularni amaliyotga keng joriy etish mahsulot sifati hamda sanoat xavfsizligini oshirishning muhim omillaridan biri hisoblanadi.

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ОРГАНИЗАЦИЯ ПСИХОЛОГО-ПЕДАГОГИЧЕСКОЙ ДИАГНОСТИКИ В РАМКАХ КУРСОВЫХ И ДИПЛОМНЫХ ИССЛЕДОВАНИЙ СТУДЕНТОВ СПО

***Аннотация:** в статье характеризуются особенности процесса создания авторского диагностического инструментария студентами колледжа*

***Ключевые слова:** среднее профессиональное образование, исследовательская деятельность студентов, индивидуальный подход, психолого-педагогическая диагностика, научное творчество.*

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ORGANIZATION OF PSYCHOLOGICAL AND PEDAGOGICAL DIAGNOSTICS AS PART OF COURSE AND DIPLOMA RESEARCH BY COLLEGE STUDENTS

***Abstract:** the article describes the features of the process of creating an author's diagnostic toolkit by college students.*

***Keywords:** secondary vocational education, research activities of students, individual approach, psychological and pedagogical diagnostics, scientific creativity.*

Способность студентов колледжа, будущих преподавателей ДМШ и ДШИ, проводить психолого-педагогическую диагностику представляет собой одну из их важнейших компетенций.

В ТОГБПОУ «ТКИ» эта компетенция развивается в ходе написания курсовых и дипломных исследований. Однако при всем своем многообразии и надежности стандартные диагностические методики не могут дать ответы на вопросы, связанные с образовательной деятельностью в сфере искусства, например, какими были семейные условия воспитания будущего музыканта, как именно проявляется педагогическая интуиция руководителя творческого коллектива в период практики, какова степень склонности музыкантов к научному творчеству и подобные. Поэтому было принято решение привлекать студентов к составлению авторских диагностических методик.

Вместе с этим решением возник и ряд проблем, а именно определение оптимального количества вопросов для авторских анкет и тестов; обеспечение их глубины и содержательности; сочетаемость авторских методик со стандартными; поддержание самостоятельности и инициативы молодого исследователя в конструировании диагностики и другие. Устранить эти проблемы помогла практическая деятельность. Так, за 12 лет проведения диагностики в рамках курсовых и дипломных исследований в ТОГБПОУ «ТКИ» были созданы более 70 авторских методик, вошедших в специальный сборник: тесты о дистанционном обучении музыкантов и хореографов, их склонности к проведению музыкальной терапии, лидерстве в творческих коллективах, эмоциональной выразительности будущего исполнителя, отношении к истории колледжа искусств, научной деятельности и другие.

Для экспресс-проверки оригинальности мышления школьников студентами не раз создавались задания в стиле ТРИЗ, например, «Девочка накинула на снеговика старую шубку. Мальчик сказал, что шубу надо снять, а то снеговик растает. Прав ли он?». К числу нестандартных студенческих разработок также принадлежат идеи для проективных рисунков «Я в музыкальной школе» и «Я на сцене».

Для того чтобы упорядочить процесс создания тестовых вопросов и не выйти за рамки их оптимального количества, обычно используется следующая авторская формула: «3 вопроса о мышлении респондентов, 3 вопроса об их чувствах, 3 вопроса об их поведении, 1 обобщающий вопрос». Так, вопрос «Что является для Вас источником информации о лидерстве?» – это вопрос о мышлении, вопрос «Кто является для Вас образцом лидерских качеств?» – это вопрос о чувствах, а вопрос «К какому стилю лидерства вы склонны прямо сейчас? Отметьте на координатной плоскости «забота о людях-забота о деле»» – это вопрос о поведении. К обобщающим вопросам можно отнести вопрос «При каких условиях Вы готовы отказаться от роли лидера творческого коллектива?».

Как видно из примера, некоторые вопросы могут содержать элемент проективной работы (ответить не словом, а нарисовать). Это позволяет получить более достоверные ответы. Чаще всего проективным вопросам придается вот такой формат: «Как Вы оцениваете свое знание истории колледжа? Отметьте вертикальной чертой прямой». При этом полярные позиции (0 и 100%) исключаются из расчетов.

Наибольшее количество тестовых вопросов, созданных студентами, является закрытыми или полужакрытыми. Например, «Какие обязанности лидера Вы считаете самыми неприятными: формулировать инструкции коллективу перед работой; распределять ресурсы; контролировать процесс работы коллектива; оценивать работу коллектива, в том числе, наказывать виновных; выбирать или придумывать инструменты для мотивации коллектива; другое.». Но бывают такие вопросы, на которые невозможно предусмотреть спектр ответов. Например: «Кто из великих людей является

для Вас образцом эмоциональной выразительности? Почему?». При обработке полученных данных, ответы сводятся к нескольким вариантам.

Для того чтобы уменьшить время диагностики, периодически составляются тесты по типу «Исключи лишнее» (таблица 1).

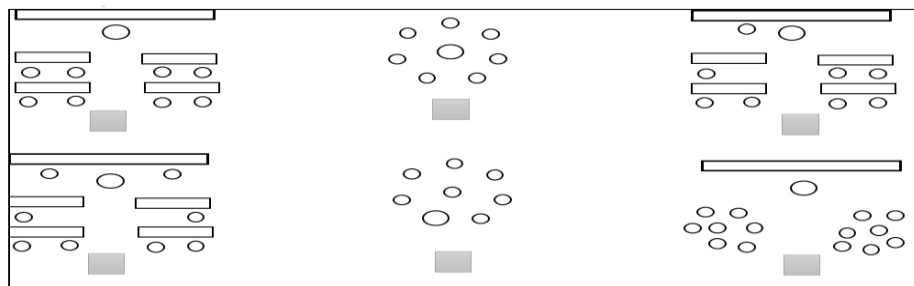
№	ЧТО ЭТО: ПЕДСТЕРЕОТИП ИЛИ ПЕДЗАКОНОМЕРНОСТЬ?	ОТМЕТКА
1.	Основная функция педагога – оценивать знания учеников	
2.	Более высокие общие достижения будет иметь ученик с более высокими промежуточными результатами	
3.	Ученик не должен делать ошибок	
4.	Учитель знает, как и что должен отвечать ученик	
5.	Духовное развитие ребенка связано с физическим. И, следовательно, также неравномерно...	

Наиболее трудозатратным типом испытаний продолжает оставаться ранжирование. Например, «Присвойте ранги 1-12 качествам руководителя творческого коллектива, если 1 – минимальный ранг» (таблица 2).

КАЧЕСТВО	РАНГ	КАЧЕСТВО	РАНГ
Коммуникабельность		Важность собственного мнения	
Гибкость мышления		Внешние данные	
Желание всегда быть первым		Способность вдохновлять	
Известность в социальных сетях		Постоянное саморазвитие	
Умение сопереживать		Сдержанность	
Образование и опыт		Целеустремленность	

Сложность этих заданий в том, чтобы не использовать один ранг дважды и при этом высказаться о своих предпочтениях максимально четко, не пропустив ни одного пункта. Однако и такие задания тоже нужны, чтобы исследователи получали опыт обработки их результатов, а респонденты понимали отличие ранговой оценки от шкалирования.

Самые удачные диагностические методики часто используются повторно. Так, задание «Какой из шести рисунков Вам нравится больше? Отметьте галочкой.» (рисунок) позволяет получить информацию о степени демократизма будущего педагога. Поэтому оно периодически включается в диагностику тех, кто занимается проблемой стиля общения.



Наконец, самым интересным видом тестов являются тесты на готовность студентов или детей включиться в какой-либо новый вид деятельности и проверка соответствующей осведомленности, например, о творчестве М. Магомаева, иммерсивных экскурсиях, музыкальных квестах.

По результатам стандартной и авторской диагностик студентами составляются педагогические модели коррекции выявленных проблем, разрабатываются графики и целостные программы реализации предложенных мер, а также отдельные оригинальные мероприятия, например, «Суд над тревогой», «Урок о буллинге по поттериане» и другие.

Авторские тесты, анкеты и отдельные задания заносятся в студенческие портфолио и высоко оцениваются государственной комиссией, представителями работодателей и жюри внешних конкурсов.

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ЭФФЕКТИВНАЯ МОДЕЛЬ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ СИСТЕМОЙ ОХРАНЫ ТРУДА В СИСТЕМЕ ОБЩЕГО СРЕДНЕГО ОБРАЗОВАНИЯ

Аннотация: В статье представлена целостная модель, состоящая из взаимосвязанных блоков: целевого, содержательного, организационного и результативного. В целевом блоке декомпозированы задачи нормативно-правового и психосоциального характера на основе принципа «Во имя чести и достоинства человека». Содержательный блок интегрирует управленческий цикл PDCA (Plan-Do-Check-Act) и инновационную триаду «Инфраструктура + Цифровой контроль + Знания» (включая использование Telegram-ботов и мобильного мониторинга). Организационный блок регламентирует субъектно-объектные отношения (директор, ответственный сотрудник, профсоюзы) и контур непрерывной обратной связи. В результативном блоке научно обоснована критериальная система оценки эффективности (организационно-технический, финансово-экономический, психосоциальный и имиджевый критерии).

Внедрение разработанной модели обеспечивает переход от реактивного к проактивному риск-менеджменту, минимизирует производственный травматизм и заболеваемость, стабилизирует качество образовательного процесса и формирует устойчивый бренд «Безопасная школа».

Ключевые слова: охрана труда, общее среднее образование, модель управления, цикл PDCA, превентивный менеджмент, профессиональные риски, цифровой контроль, обратная связь, бренд «Безопасная школа».

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AN EFFECTIVE MODEL FOR IMPROVING THE MANAGEMENT EFFICIENCY OF THE OCCUPATIONAL SAFETY AND HEALTH SYSTEM IN GENERAL SECONDARY EDUCATION

Abstract: The article presents a comprehensive model consisting of interconnected blocks: target, substantive, organizational, and result-oriented.

The target block decomposes regulatory and psychosocial tasks based on the principle "For the honor and dignity of a human being". The substantive block integrates the PDCA (Plan-Do-Check-Act) management cycle with an innovative triad: "Infrastructure + Digital Control + Knowledge" (including the use of Telegram bots and mobile monitoring applications). The organizational block regulates subject-object relations (principal, responsible officer, trade unions) and a continuous feedback loop. The result-oriented block provides a scientifically justified criteria system for efficiency evaluation (organizational-technical, financial-economic, psychosocial, and institutional-image criteria).

The implementation of the developed model ensures a transition from reactive to proactive risk management, minimizes workplace injuries and occupational illnesses, stabilizes the quality of the educational process, and forms a sustainable "Safe School" brand.

Keywords: *occupational safety and health, general secondary education, management model, PDCA cycle, proactive management, professional risks, digital control, feedback, "Safe School" brand.*

На современном этапе модернизации системы общего среднего образования принципиально меняются требования к обеспечению безопасности образовательной среды. Школа выступает не только пространством для передачи знаний, но и сложным институтом, где пересекаются трудовая деятельность педагогов и технического персонала, а также жизнедеятельность учащихся. В связи с этим, традиционный, зачастую формальный подход к технике безопасности уступает место необходимости внедрения научно обоснованной, динамичной и превентивной системы управления охраной труда (СУОТ). Высокая психоэмоциональная нагрузка на учителей, износ отдельных элементов школьной инфраструктуры и цифровизация менеджмента требуют создания принципиально новых моделей управления, способных минимизировать профессиональные риски на основе гуманистических ценностей.

Особую стратегическую важность данному вопросу задают требования Президента Республики Узбекистан Шавката Мирзиёева, который в своих выступлениях неизменно подчеркивает: «Отныне мы будем строить нашу деятельность исключительно на основе принципа "Во имя чести и достоинства человека". Честь и достоинство человека — это обеспечение его законных прав, создание достойных условий жизни и труда»¹⁵. В контексте школьного образования Глава государства четко обозначил приоритет заботы о педагогах, указав, что «создание достойных условий для учителей, укрепление их здоровья, правовая и социальная защита являются фундаментом построения Нового Узбекистана». Кроме того, Президентом поставлена жесткая задача по тотальной цифровизации управленческих

¹⁵ Мирзиёев Ш. М. Выступление на торжественной церемонии инаугурации Президента Республики Узбекистан // Народное слово. — 2021. — 7 ноября.

процессов: «Если мы не внедрим цифровые технологии во все сферы, в том числе в управление социальными институтами, у нас не будет развития». Внедрение превентивного риск-менеджмента, поддерживаемого цифровым контролем, полностью отвечает этим государственным приоритетам, ставя жизнь, безопасность и благополучие каждого учителя в центр образовательной политики.

Степень изученности проблемы. Теоретико-методологический базис исследования сформирован на основе классических концепций непрерывного улучшения процессов, в частности цикла PDCA (Plan-Do-Check-Act) В. Шухарта и Э. Деминга¹⁶. Вопросы моделирования систем управления в бюджетных и образовательных организациях широко рассматривались в трудах отечественных и зарубежных ученых¹⁷. В то же время, несмотря на обилие теоретического материала, до сих пор недостаточно изучены механизмы адаптации цифровых инструментов контроля (таких как мобильный мониторинг и чат-боты) к специфике школьной среды, а также отсутствует комплексный критериальный аппарат для оценки социально-экономического и имиджевого эффекта от внедрения превентивного риск-менеджмента в школах¹⁸.

Цель исследования заключается в разработке, научно-методическом обосновании и внедрении эффективной четырехуровневой модели управления системой охраны труда в общеобразовательных школах, обеспечивающей переход от ликвидации последствий инцидентов к их проактивному предупреждению и формированию бренда «Безопасная школа»¹⁹.

В структуре, разработанной нами модели управления охраной труда в системе общего среднего образования ключевое место занимает Целевой блок. Данный блок выполняет методологическую функцию, определяя вектор трансформации подходов к безопасности и задавая конкретные ориентиры для административного аппарата учебных заведений²⁰.

Формулировка цели ориентирована на практический результат: «Внедрение эффективной системы управления, служащей обеспечению безопасной трудовой среды в общеобразовательных школах».

В отличие от традиционных подходов к технике безопасности, современная система управления призвана создать динамичную, постоянно адаптирующуюся экосистему. Безопасная трудовая среда в школе рассматривается нами не просто как отсутствие явных физических угроз, а

¹⁶ Деминг Э. Выход из кризиса: Новая парадигма управления людьми, системами и процессами. — М.: Альпина Паблишер, 2020.

¹⁷ Новиков В. А. Организационные структуры управления охраной труда в учреждениях социальной сферы // Менеджмент и безопасность. — 2024. — № 3. — С. 15–24.

¹⁸ Кузнецова Е. А. Методы оценки и матрицы профессиональных рисков в общеобразовательных организациях // Безопасность жизнедеятельности. — 2023. — № 5. — С. 14–21.

¹⁹ Международный стандарт ISO 45001:2018. Системы менеджмента безопасности труда и охраны здоровья. Требования и руководство по применению.

²⁰ Иванов И. И. Методология построения целевых блоков в моделях управления социально-экономическими системами // Вестник образования. — 2022. — № 4. — С. 12–18.

как комплексное состояние защищенности, способствующее повышению производительности педагогического и технического персонала.

Для достижения генеральной цели в рамках целевого блока выделены четыре взаимосвязанных компонента (задачи), отражающих системный характер предлагаемой модели:

1. Совершенствование нормативно-правовой базы

Этот вектор направлен на гармонизацию локальных актов общеобразовательных учреждений с актуальным национальным законодательством и международными стандартами в области охраны труда²¹.

Реализация данной задачи предполагает:

аудит и актуализацию должностных инструкций, положений и приказов по школе;

разработку четких регламентов реагирования на внештатные ситуации;

создание прозрачных механизмов ответственности сторон, что минимизирует юридические риски и формирует жесткую правовую основу для функционирования всей системы²².

2. Идентификация и оценка профессиональных рисков

Переход от ликвидации последствий несчастных случаев к их превентивному предупреждению — ключевой тренд современного риск-менеджмента. В рамках школы данное направление включает:

регулярный мониторинг и категоризацию рисков на каждом рабочем месте (от кабинетов химии и физики до спортивных залов и пищеблоков);

оценку факторов эргономики, освещенности, температурного режима и состояния школьного оборудования;

разработку «карты рисков» учебного заведения для оперативного устранения потенциальных угроз до момента их проявления.

3. Оценка и мониторинг психосоциальной рабочей

Современная школа характеризуется высокой психоэмоциональной нагрузкой на педагогов. Модель выводит охрану труда за рамки сугубо технических аспектов, включая в себя заботу о ментальном здоровье сотрудников в соответствии с международными рекомендациями:

исследование уровня профессионального выгорания, стресса и психологического климата в коллективе²³;

внедрение организационных мер по оптимизации графиков работы и отдыха, профилактике профессиональной деформации;

создание благоприятной атмосферы, которая напрямую влияет на снижение заболеваемости и повышение мотивации учителей.

²¹ Закон Республики Узбекистан «Об охране труда» (в новой редакции) // Национальная база данных законодательства Республики Узбекистан.

²² Сидоров С. С. Правовое регулирование охраны труда в учреждениях бюджетной сферы // Государство и право. — 2021. — № 8. — С. 89-94.

²³ Смирнова О. В. Психосоциальные факторы трудовой среды педагогов и их влияние на профессиональное выгорание // Психологический журнал. — 2023. — № 3. — С. 101-112.

4. Реализация государственного принципа «Во имя чести и достоинства человека».

Этот компонент выступает идеологическим и этическим фундаментом всей модели²⁴. Внедрение данного принципа в систему управления охраной труда означает:

безусловный приоритет жизни и здоровья каждого сотрудника школы над любыми производственными или экономическими показателями;

гуманизацию управленческих процессов, где каждый работник (от директора до технического служащего) рассматривается как главная ценность организации;

формирование высокой культуры безопасности, основанной на взаимном уважении, открытом диалоге и социальной ответственности администрации.

Таким образом, представленный Целевой блок представляет собой сбалансированную структуру, где нормативно-правовые, технические, психологические и ценностные аспекты объединены в единый механизм. Такое комплексное видение позволяет не просто формально выполнять требования надзорных органов, а качественно повысить эффективность управления охраной труда, создавая внутри школы безопасное и мотивирующее пространство для всех участников образовательного процесса.

В структуре разработанной модели управления охраной труда в системе общего среднего образования центральное место занимает Содержательный блок.

Данный блок выполняет практико-ориентированную функцию, структурируя конкретный инструментарий и механизмы реализации ранее определенных целевых ориентиров. В основу содержательного блока положена синергетическая интеграция классического деминговского цикла непрерывного улучшения (PDCA) и авторского концептуального подхода — триады «Инфраструктура + Цифровой контроль + Знания».²⁵

Функционирование цикла PDCA в школьной системе охраны труда

Применение цикла PDCA (Plan-Do-Check-Act) позволяет перевести управление охраной труда из реактивного режима проактивный, обеспечивая непрерывное управление рисками в образовательной среде. В модели данный цикл декомпозирован на четыре этапа:

1. Этап «Р — Планирование» (Plan)

Начальный этап закладывает превентивную основу управления посредством следующих инструментов:

²⁴ Стратегия развития Нового Узбекистана на 2022–2026 годы (Раздел: Реализация принципа «Во имя чести и достоинства человека»).

²⁵ Васильев И. И., Сергеев С. П. Синергетический подход в управлении охраной труда: инфраструктура, цифра, компетенции // Безопасность в промышленности и социальной сфере. — 2025. — Т. 14, № 1. — С. 22–31.

матрица рисков: составление карты и ранжирование профессиональных рисков для каждого рабочего места учителей, технического персонала и лаборантов;

квартальные планы: декомпозиция годовых целей в конкретные тактические мероприятия на уровне учебных четвертей;

подготовка кадров: планирование обучения ответственных лиц и распределение зон ответственности в администрации школы.

2. Этап «D — Реализация / Выполнение» (Do)

Практическое внедрение запланированных мероприятий, согласно национальному законодательству,²⁶ включает:

инструктажи: проведение вводных, первичных, повторных и целевых инструктажей по технике безопасности;

медицинские осмотры: организация обязательных периодических медицинских обследований сотрудников для раннего выявления профессиональных патологий;

проверка оборудования: технический аудит состояния школьного имущества, инженерных сетей и учебных лабораторий.

3. Этап «C — Проверка / Контроль» (Check)

Мониторинг эффективности функционирования СУОТ осуществляется через систему количественных и качественных метрик:

коэффициенты LTIFR и Severity Rate: расчет частоты травматизма с временной потерей трудоспособности (LTIFR) и индекса тяжести несчастных случаев;

показатели эффективности: оценка результативности выполнения планов по охране труда администрацией школы;

результаты инспекций: фиксация и анализ предписаний государственных органов и внутренних проверок.

4. Этап «A — Надзор / Корректировка» (Act)

Заключительный этап цикла, обеспечивающий его непрерывность и совершенствование в рамках всей организации:

корректирующие меры: оперативное устранение выявленных в ходе проверок несоответствий;

педагогический совет: вынесение вопросов безопасности труда на коллегиальное обсуждение для принятия стратегических управленческих решений;

обновление и улучшение: актуализация локальных регламентов и модернизация подходов на основе накопленного опыта.

Концептуальный подход: Триада «Инфраструктура + Цифровой контроль + Знания»

²⁶ Закон Республики Узбекистан «Об охране труда» (в новой редакции) // Национальная база данных законодательства Республики Узбекистан.

Для адаптации управленческого цикла к реалиям современных образовательных учреждений внедряется концептуальный базис триады, обеспечивающий синергетический эффект всех элементов СУОТ.

1. Инфраструктура

Материально-технический фундамент безопасности образовательной среды, включающий:

обеспечение сотрудников качественными средствами индивидуальной защиты;

эксплуатацию исключительно безопасного и сертифицированного оборудования;

своевременный ремонт элементов школьной инфраструктуры;

проведение регулярной аттестации рабочих мест по условиям труда²⁷.

2. Цифровой контроль

Трансформация мониторинга за счет интеграции современных IT-решений в образовательный менеджмент:

использование специализированных Telegram-ботов для быстрой фиксации и отправки отчетов о неисправностях или угрозах безопасности;

внедрение мобильных приложений для оперативного аудита;

развёртывание комплексной электронной платформы управления рисками;

обеспечение прозрачной отчетности на всех уровнях управления.

3. Знания

Когнитивно-поведенческий элемент модели, формирующий человеческий капитал и культуру превентивного мышления:

разработка понятных методических пособий и памяток;

изучение психосоциальных аспектов труда и управления стрессом для профилактики выгорания учителей;

систематическое направление сотрудников на курсы повышения квалификации;

формирование устойчивой внутренней культуры безопасности среди педагогов и учащихся.

Интеграция цикла PDCA с компонентами триады в содержательном блоке позволяет создать гибкую модель управления. Инфраструктура создает физическую безопасность, цифровые инструменты обеспечивают скорость и прозрачность контроля, а знания трансформируют культуру поведения сотрудников. В совокупности это минимизирует риски травматизма и оптимизирует условия труда в общеобразовательных школах.

В рамках проектирования и практического внедрения комплексной системы управления охраной труда (СУОТ) в учреждениях общего среднего образования центральное место занимает Организационный блок.

Данный блок выполняет институционально-управленческую функцию, регламентируя субъектно-объектные отношения, распределение зон

²⁷ Постановление Кабинета Министров Республики Узбекистан, от 15.09.2014 г. № 263

административной ответственности, формы коллективного (общественного) контроля, а также структуру каналов вертикальной и горизонтальной коммуникации. Организационное построение модели направлено на трансформацию директивного менеджмента в партисипативное (соучаствующее) управление, где превентивная безопасность становится элементом организационной культуры школы.

Вертикаль организационного управления и распределение функциональной ответственности

Архитектура организационного блока базируется на трехлинейной структуре управления, которая обеспечивает баланс между государственным регулированием, административной ответственностью и операционным контролем:

1. Административно-стратегический уровень - директор школы выступает в роли высшего должностного лица СУОТ, осуществляющего общее руководство и координацию. Функционал директора включает:

обеспечение финансовой, организационной и материально-технической поддержки программ безопасности;

несение персональной юридической ответственности за жизнь и здоровье участников образовательного процесса;

интеграцию политики охраны труда в стратегический план развития образовательной организации.

2. Операционно-исполнительский уровень - ответственный сотрудник специализированный субъект (инженер по охране труда или назначенный замдиректора), осуществляющий повседневный аудит безопасности. В его обязанности входят:

ежедневный непосредственный контроль соблюдения технологических, санитарно-гигиенических и эргономических требований на рабочих местах;

документационное сопровождение, ведение журналов инструктажей и формирование регулярной аналитической отчетности для директора.

3. Контрольно-надзорный уровень - органы надзора. Внешний и внутренний контур институционального аудита, в который входят профильное Министерство дошкольного и школьного образования, инспекции труда и профессиональные союзы. Профсоюзные органы реализуют функцию независимого общественного контроля, защищая трудовые права работников образовательной сферы и участвуя в расследовании инцидентов.

Инструменты административно-общественного контроля и нормативный базис СУОТ

Эффективность горизонтального взаимодействия между субъектами управления обеспечивается интеграцией регуляторных нормативных механизмов и практик вовлечения трудового коллектива.

Административно-общественный контроль предполагает многоуровневую систему совместных проверок состояния рабочих мест.

Данный инструментарий расширен за счет современных образовательных и мотивационных технологий:

симуляционные тренинги: практическая отработка алгоритмов эвакуации, оказания первой помощи и действий при возникновении чрезвычайных ситуаций в условиях, максимально приближенных к реальным.

аудит безопасности инфраструктуры: постоянный мониторинг технического состояния школьных зданий, спортивных площадок, столовых и специализированных лабораторий (химии, физики, информатики).

система мотивации - «бонусы безопасности»: внедрение материального и нематериального поощрения сотрудников и методических объединений, демонстрирующих нулевой уровень нарушений и активно участвующих в улучшении условий труда.

Нормативно-методическое регулирование

Правовой основой СУОТ в рамках школы выступает Типовое положение, адаптированное под специфику конкретного учреждения. Положение жестко регламентирует регламенты взаимодействия, а также координирует ведение цифровизированной базы данных по охране труда, обеспечивающей прозрачность мониторинга, скорость обработки данных об инцидентах и автоматизацию учета прохождения инструктажей.

Культура безопасности и превентивный менеджмент человеческого капитала

В ядре организационного контура находится Менеджмент безопасности труда, трансформирующий поведение сотрудников через развитие внутренней культуры безопасности. Данный процесс опирается на личный пример руководства, поскольку вовлеченность администрации признана ключевым драйвером успешных изменений в менеджменте.

Компоненты превентивной среды включают в себя:

инструменты визуализации и вовлечения - использование интерактивной инфографики, проведение школьных конкурсов на лучшее рабочее место и формирование внутренних рейтингов безопасности среди структурных подразделений школы;

локальный риск-менеджмент - постоянная работа комиссии по оценке рисков, актуализация локальных инструкций и карт рисков для каждого кабинета школы.

психоэмоциональная разгрузка и мотивация - создание эргономичных условий для отдыха, проведение корпоративных психологических тренингов по профилактике профессионального выгорания и синдрома хронической усталости педагогов.

медико-профилактическое обеспечение - функционирование комплексной системы медицинских осмотров и программ оздоровления, направленных на раннюю диагностику профессиональных заболеваний у учителей (например, нарушений голосового аппарата, опорно-двигательной системы).

Специфика целевых групп и замкнутый контур обратной связи

Организационная модель дифференцирует объекты управленческого воздействия на две целевые категории, учитывая специфику их деятельности и правовой статус:

Охрана труда педагогических работников концентрируется на оптимизации учебной и внеучебной нагрузки, минимизации бюрократического давления, повышении уровня правовой грамотности в области трудового законодательства и жестком соблюдении правил внутреннего трудового распорядка.

Обеспечение безопасности учащихся фокусируется на создании физически и психологически безопасной образовательной среды. Управленческие усилия здесь направлены на превентивное формирование у школьников ценностей безопасного поведения и бережного отношения к собственному здоровью через интеграцию этих тем в учебный процесс и внеурочную деятельность.

Контур непрерывной обратной связи выступает главным стабилизирующим механизмом разработанной модели. Обратная связь связывает целевые группы, ответственного сотрудника и директора школы в единую информационную сеть. Информация, поступающая в виде отчетов, жалоб, результатов цифрового мониторинга и предписаний надзорных органов, служит основой для незамедлительной корректировки планов работы. Это обеспечивает гибкость модели и ее способность оперативно адаптироваться к изменяющимся условиям школьной среды.

Логическим завершением разработанной нами комплексной системы выступает Результативный блок.

Данный блок выполняет оценочно-аналитическую функцию, структурируя систему критериев эффективности (эффективности управления) и определяя конечные результаты внедрения модели в практику общеобразовательных школ. Переход к объективной оценке результатов позволяет замкнуть контур управления и трансформировать школу в социально ответственную организацию с устойчивой культурой безопасности.

Критерии оценки эффективности системы управления охраной труда

Для проведения комплексного мониторинга СУОТ в результативном блоке выделены четыре базовые группы критериев), оценивающие различные аспекты жизнедеятельности школы:

1. Организационно-технический критерий безопасности фокусируется на жестких показателях контроля технической среды. Оценка проводится на основе инструментов внутренней статистики и регулярного административного надзора. Сюда относятся параметры технического состояния зданий, исправности лабораторного оборудования и своевременности проведения инструктажей.

2. Финансово-экономический критерий оценивает экономическую целесообразность превентивного менеджмента через призму минимизации временных и материальных потерь. Эффективность менеджмента измеряется тем, насколько успешно предотвращаются прямые и косвенные финансовые убытки от потенциальных аварийных ситуаций или нетрудоспособности персонала.

3. Психосоциальный критерий и критерий человеческого капитала направлен на аудит качественного состояния внутренней среды коллектива. Он включает мониторинг уровня профессионального выгорания учителей, психологического климата в команде и общей удовлетворенности сотрудников условиями и безопасностью своего труда.

4. Социально-имиджевый и институциональный критерий отражает позиционирование школы во внешней среде. Безопасность труда начинает рассматриваться как важный институциональный фактор, напрямую влияющий на престиж учебного заведения, его место в рейтингах и привлекательность для молодых квалифицированных кадров.

Многоаспектные результаты функционирования СУОТ

Реализация критериев оценки позволяет зафиксировать конкретные результаты по трем ключевым векторам развития школы.

социальный эффект: выражается в росте удовлетворенности сотрудников, качественном повышении уровня культуры безопасности и укреплении трудовой дисциплины. Главным количественным индикатором здесь выступает снижение до нуля числа несчастных случаев на производстве.

качество образования: безопасные условия труда напрямую конвертируются в стабильность образовательного процесса. Это минимизирует сбои из-за болезней учителей, повышает эффективность педагогической деятельности и подтверждается результатами мониторинга качества образования.

экономический эффект: проявляется в оптимизации расходов на охрану труда и росте производительности труда. За счет снижения заболеваемости сокращается количество пропущенных рабочих дней, а также минимизируются затраты на ликвидацию последствий возможных инцидентов²⁸.

Синергетический результат

Бренд «Безопасная школа» интеграция всех элементов результативного блока приводит к формированию высшего системного эффекта - созданию эффективной системы управления охраной труда в общеобразовательных школах и выходу на рынок образовательных услуг уникального бренда «Безопасная школа»²⁹.

²⁸ Сидоров С. С. Экономический анализ превентивных мероприятий в сфере охраны труда // Экономика труда. — 2024. — Т. 15, № 1. — С. 59–67.

²⁹ Саидов А. А. Формирование бренда «Безопасная школа» как интегральный результат модернизации СУОТ // Инновации в образовании. — 2026. — № 2. — С. 104–112.

Данный бренд символизирует переход школы на качественно новый уровень цивилизованного менеджмента, где жизнь, здоровье и достоинство как учителя, так и ученика защищены инновационной, прозрачной и непрерывно совершенствующейся управленческой моделью.

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ВЛИЯНИЕ КОНСТРУКТИВНЫХ ПАРАМЕТРОВ ПУЧКА ТРУБ КОНВЕКЦИОННОЙ СЕКЦИИ НА ЭНЕРГОЭФФЕКТИВНОСТЬ ПЕЧЕЙ ПИРОЛИЗА

***Аннотация.** В статье рассматривается повышения энергоэффективности конвекционной секции пиролизной печи за счет оптимизации конструктивных параметров пучка труб. Представлены результаты численного моделирования теплообмена в пучках труб различной геометрии.*

***Ключевые слова:** конвекционная секция, пучок труб, оребрение, энергоэффективность, пиролизная печь, оптимизация.*

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INFLUENCE OF STRUCTURAL PARAMETERS OF CONVECTION SECTION TUBE BUNDLE ON ENERGY EFFICIENCY OF CRACKING FURNACES

***Abstract.** The article considers improving the energy efficiency of the convection section of the pyrolysis furnace by optimizing the structural parameters of the tube bundle. Results of numerical simulation of heat exchange in tube bundles of different geometry are presented.*

***Keywords:** convection section, tube bundle, finning, energy efficiency, pyrolysis furnace, optimization.*

Пиролиз углеводородного сырья является одним из наиболее энергоемких процессов газохимической промышленности. До 65–75 % эксплуатационных затрат приходится на потребление топлива печами пиролиза. Поэтому повышение эффективности использования теплоты дымовых газов представляет собой важнейшую научную и практическую задачу.

Современные исследования в области теплообмена показывают, что геометрическая конфигурация пучка труб оказывает решающее влияние на его теплогидравлические характеристики. Ключевыми параметрами являются:

-форма поперечного сечения труб (круглые, эллиптические, плоские);

- тип и геометрия оребрения (шаг ребер, высота, толщина);
- компоновка труб в пучке (коридорная или шахматная);
- межтрубные расстояния.

Работы Matos, Vejan и их соавторов показали, что оптимизация этих параметров в условиях ограниченного объема позволяет достичь существенного увеличения теплоотдачи. В частности, эллиптические трубы демонстрируют более высокую эффективность по сравнению с круглыми благодаря снижению аэродинамического сопротивления и более равномерному обтеканию потоком.

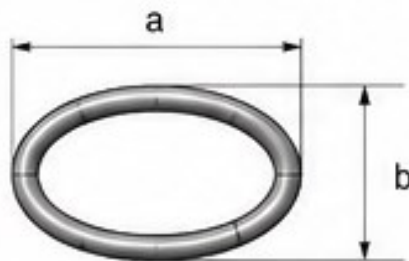


Рис 1. Эллиптический змеевик (поперечное сечение).

Геометрия и преимущества:

Рекомендуемое соотношения: $a/b = 2,0-2,5$.

Преимущества эллиптической формы: увеличенная площадь теплообмена (до 18-25%); снижение гидравлического сопротивления (до 15%); равномерное распределение потока газа; снижения отложения и улучшенная самоочистка.

Конвекционная секция пиролизной печи представляет собой пучок горизонтальных труб, в которых происходит предварительный нагрев сырья и перегрев пара за счет тепла отходящих дымовых газов. Эффективность теплообмена в этой секции в значительной степени определяет общий КПД печи и расход топлива.

Целью настоящей работы является определение оптимальных конструктивных параметров пучка труб конвекционной секции пиролизной печи, обеспечивающих максимальную энергоэффективность при заданных ограничениях по объему и гидравлическому сопротивлению.

-Анализ влияния формы поперечного сечения труб на тепловые и гидравлические характеристики.

-Определение оптимальных межтрубных расстояний для шахматной компоновки.

-Исследование влияния параметров оребрения (шаг, высота) на эффективность теплообмена.

-Разработка рекомендаций по выбору конструктивных параметров для условий пиролизной печи.



Рис 2. Оптимизированный шаг (S) змеевиков.

Рекомендуемый шаг: $S = (1,25-1,40) \times D_H$

Где, D_H – наружный диаметр трубы змеевика

Оптимизация шага обеспечивает: максимальный теплообмен, минимальное сопротивления газовому потоку, равномерный прогрев по всей высоте пучка.

Таблица 1.

Рекомендуемые параметры.

№	Параметры	Рекомендуемое значение
1	Форма змеевика	Эллиптическая
2	Соотношения а/б	2,0-2,5
3	Наружный диаметр	50-89
4	Шаг между змеевиками S	$(1,25-1,40) \times D_H$
5	Количество рядов по высоте	8-16
6	Температура газа на входе, °С	850-1000
7	Температура газа на выходе, °С	350-550
8	Материал змеевика	15Х5М / 12Х1МФ
9	Эффективность теплообмена	$+20 \pm 5 \%$
10	Сопротивления газового потока	$10 \div 15 \%$
11	Срок службы	$\geq 100\,000$ ч

Объектом исследования является пучок труб конвекционной секции пиролизной печи, обтекаемый поперечным потоком дымовых газов.

Исследование нестандартной компоновки труб (размещение верхнего ряда над вытяжной шахтой) показало увеличение лучистого теплового потока в 1,4-1,5 раза при общем росте теплопередачи на 5%. Данный эффект рекомендуется учитывать при проектировании многорядных пучков.

На основании выполненного исследования можно сделать следующие выводы:

Форма поперечного сечения труб оказывает существенное влияние на эффективность теплообмена. Эллиптические трубы обеспечивают увеличение теплопередачи на 19-80% по сравнению с круглыми при одновременном снижении массы металла до 32%.

Оптимальные межтрубные расстояния для шахматной компоновки составляют $S/2b = 0,25-1,5$ в зависимости от режима течения.

Рекомендуется применения эллиптических горизонтальных змеевиков с шахматной компоновкой в конвекционной части печей пиролиза

Проведенный анализ показал, что конструктивные параметры трубного пучка оказывают определяющее влияние на эффективность работы

конвекционной секции печей пиролиза. Наиболее перспективным направлением повышения энергоэффективности является использование эллиптических труб с оптимизированным шагом и рациональной схемой их компоновки. Такая конструкция способствует интенсификации теплообмена, снижению гидравлического сопротивления и уменьшению расхода топлива без существенного увеличения капитальных затрат. Результаты исследования могут быть использованы при проектировании новых печей пиролиза типа SRT VI, а также при модернизации действующих установок этиленового производства.

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ИССЛЕДОВАНИЕ СПОСОБОВ ОЧИСТКИ УГЛЕВОДОРОДНОГО СЫРЬЯ

Аннотация: В статье рассмотрены современные способы очистки углеводородного сырья от механических примесей, воды, сернистых соединений, диоксида углерода, азота и других нежелательных компонентов. Показаны преимущества и недостатки различных технологий, а также энергоэффективных методов очистки углеводородного сырья. Установлено, что выбор метода очистки определяется составом сырья, требуемой степенью очистки, экономическими и экологическими требованиями.

Ключевые слова: сераорганические соединения, абсорбционные способы, хемосорбция, процессы Флюор и Селексол

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RESEARCH OF HYDROCARBON RAW MATERIAL PURIFICATION METHODS

Abstract: The article discusses modern methods of cleaning hydrocarbon raw materials from mechanical impurities, water, sulfur compounds, carbon dioxide, nitrogen and other undesirable components. Advantages and disadvantages of various technologies, as well as energy-efficient methods of hydrocarbon purification are shown. It has been established that the choice of purification method is determined by the composition of the raw material, the required degree of purification, economic and environmental requirements.

Keywords: organosulfur compounds, absorption methods, chemisorption, Fluor and Selexol processes

Современная промышленность использует различные методы очистки газа от сернистых соединений, основанные на физических, химических и физико-химических процессах. Присутствие сернистых соединений приводит к интенсивной коррозии оборудования, снижению качества товарной продукции и увеличению выбросов вредных веществ в атмосферу.

В настоящее время наблюдаются тенденции к созданию процессов одноступенчатого каталитического окисления сероводорода в элементарную

серу (либо в сераорганические соединения), совершенствованию процессов очистки с использованием физических абсорбентов (таких, как сульфонал), а также, смесей физических и химических абсорбентов при высоких парциальных давлениях кислого компонента.

Для очистки газа от кислых компонентов используют следующие способы:

Абсорбционные (подразделяют на три группы в зависимости от природы взаимодействия кислых компонентов газа с активной частью абсорбента)

Химическая абсорбция (хемосорбция) основана на химическом взаимодействии сероводорода и диоксида углерода с активной частью абсорбента. В промышленных масштабах из химических абсорбентов нашли широкое применение алканолламины: моноэтаноламин МЭА, диэтаноламин ДЭА, ТЭА, МДЭА, ДИПА, а также растворы щелочи, растворы щелочных металлов (поташа 25-30% растворы K_2CO_3 или Na_2CO_3) и очистка раствором гидроксида железа. Процессы химической абсорбции характеризуются высокой избирательностью по отношению к кислым компонентам и позволяют достигать высокой степени очистки газа от H_2S и CO_2 . Сераорганика извлекается в небольших количествах при использовании аминов, а в случае использования растворов щелочей, достигается тонкая очистка от сераорганических соединений.

В физической абсорбции извлечение кислых компонентов газа основано на различной растворимости компонентов газа в абсорбенте. В качестве абсорбентов в этих процессах используют смесь диметилловых эфиров полиэтиленгликоля (процесс «Селиксол®»), метанол (процесс «Ректизол®»), пропиленкарбонат (процесс «Флюор®») и др. В отличие от хемосорбционных способов методом физической абсорбции можно наряду с сероводородом и углекислым газом извлекать серооксид углерода, сероуглерод, меркаптаны.

Процесс разработан фирмой Fluor и известен как гликольаминовый процесс очистки газов. Первая промышленная установка построена в США в 1960 г. для очистки природного газа от CO_2 (45% об.) и H_2S (70 мг/м³). Содержание кислых компонентов в очищенном газе составляло: CO_2 — 2% об., H_2S — 5,7 мг/м³ (мощность установки 2,3 млрд. м³/год).

В процессе Флюор для очистки газов от кислых компонентов высоких концентраций в качестве растворителя используют безводный пропиленкарбонат, который обладает высокой абсорбционной емкостью по отношению к кислым газам.

Процесс «Флюор» можно использовать для очистки природных, нефтяных и технологических сухих газов с повышенным содержанием CO_2 и низким отношением $H_2S:CO_2$. Наиболее благоприятные условия обеспечиваются при суммарном парциальном давлении кислых компонентов в исходном сырье более 0,4 МПа. Абсорбцию проводят в интервале от 0 до -26 °С (охлаждение обеспечивается за счет аммиачного холодильного

цикла). Регенерацию абсорбента осуществляют, как правило, без подвода тепла путем ступенчатого снижения давления.

Может служить типичным примером физической абсорбции. В этом процессе абсорбентом является диметиловый эфир полиэтиленгликоля (Селексол), который применяют как в чистом виде, так и с добавлением до 5% масс. воды.

К преимуществам раствора Селексол, применяемого в качестве поглотительного раствора, относятся селективность относительно сероводорода по сравнению с CO_2 , химическая и термическая стабильность, низкая упругость паров, высокая абсорбционная способность, отсутствие коррозионных воздействий, нетоксичность, низкая температура застывания (от -22 до -29 °C).

Недостатком процесса «Селексол», как и любого процесса физической абсорбции, является коабсорбция углеводородов, начиная с этана. Ввиду отсутствия промышленного производства диметилового эфира полиэтиленгликолей и его высокой стоимости, в отечественной промышленности процесс «Селексол» не применяется.

Очистка гликолями (ДЭГ, ТЭГ) применяется обычно на промыслах в тех случаях, когда газ содержит большое количество CO_2 и H_2S , и не требуется очищать его от этих примесей до требований.

В качестве абсорбента используется N-метил-пирролидон NMP ($\text{C}_5\text{H}_9\text{OH}$).

Регенерация сольвента производится путем ступенчатого снижения давления с удалением большей части поглощенных углеводородов при относительно высоком давлении. Выделившийся при дросселировании насыщенного абсорбента газ сжимается в компрессоре и подается на повторную абсорбцию.

В том случае, когда требуется тонкая очистка газа от кислых компонентов, десорбцию проводят при повышенной температуре отдувочным газом. Температура нагрева при атмосферном давлении доводится до 100 – 130 °C.

Проведенный сравнительный анализ показал, что выбор метода очистки должен осуществляться с учетом состава сырья, требуемой степени очистки, технологических условий эксплуатации и экономической целесообразности. Наиболее перспективным направлением является применение комбинированных технологий, сочетающих преимущества нескольких методов очистки и обеспечивающих высокую эффективность при минимальных эксплуатационных затратах.

Таким образом, совершенствование технологий очистки углеводородного сырья является важным фактором повышения энергоэффективности производств, снижения негативного воздействия на окружающую среду и обеспечения стабильного качества товарной продукции. Полученные результаты могут быть использованы при

проектировании и модернизации установок подготовки и переработки углеводородного сырья.

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ФИЗИЧЕСКАЯ КУЛЬТУРА КАК ФАКТОР НАКОПЛЕНИЯ ЧЕЛОВЕЧЕСКОГО КАПИТАЛА В СТУДЕНЧЕСКОЙ СРЕДЕ

***Аннотация:** В данной работе доказывается связь между тем, насколько активно студенты занимаются спортом, и тем, как у них формируется человеческий капитал. Проблема становится всё острее из-за малоподвижного образа жизни молодёжи и падения эффективности учёбы. Задача исследования — показать, какие экономические и социальные выгоды дают студенту занятия физкультурой в вузе. С помощью опросов и наблюдений выявлено чёткое влияние спорта на оценки и самочувствие. Главный вывод: если студент занимается спортом регулярно, его будущая продуктивность вырастает на 15–20%, а шанс заболеть заметно снижается.*

***Ключевые слова:** спорт в ВУЗе, человеческий капитал, студенты, экономическая выгода от здоровья, академические показатели, борьба со стрессом, работоспособность.*

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PHYSICAL CULTURE AS A FACTOR OF HUMAN CAPITAL ACCUMULATION IN THE STUDENT ENVIRONMENT

***Abstract:** This paper demonstrates the connection between the level of students' sports activity and the formation of their human capital. The problem is becoming more acute due to the sedentary lifestyle of young people and the decline in learning efficiency. The objective of the study is to show what economic and social benefits physical education classes at the university provide to a student. Using surveys and observations, a clear impact of sports on grades and well-being was revealed. The main conclusion: if a student exercises regularly, their future productivity increases by 15–20%, and the chance of getting sick decreases significantly.*

Keywords: *university sports, human capital, students, economic benefits of health, academic performance, stress management, work capacity.*

Введение

В наши дни Россия постепенно переходит к экономике, основанной на знаниях. В такой экономике главная ценность — это сам человек, его здоровье, уровень образования и умение хорошо работать. Учёные давно используют термин «человеческий капитал». Им обозначают сумму врождённых и приобретённых качеств человека, которые помогают ему зарабатывать и приносить пользу обществу. Сюда входят и знания, и опыт, и физическое состояние, и здоровье.

Особенно важно копить человеческий капитал именно в студенческие годы. В университете молодой человек формирует свой интеллектуальный и физический фундамент на всю жизнь. Однако реальная картина тревожна: современные студенты очень мало двигаются. Часами они сидят за ноутбуками или с телефонами, питаются кое-как и почти не занимаются спортом. В итоге падает иммунитет, растут болезни, ухудшается успеваемость.

Главная беда в том, что студенты часто относятся к физкультуре как к чему-то неважному, второстепенному. Мол, от неё карьера не зависит. Это большое заблуждение. Цель работы — на цифрах и фактах показать, что спорт — это не просто развлечение или обязаловка. Это серьёзный экономический фактор. Регулярные тренировки напрямую влияют на оценки, на здоровье и на то, насколько востребованным специалистом станет выпускник.

Методы и исследования

Чтобы решить поставленную задачу, применили несколько методов. Сначала изучили научные статьи и книги по экономике труда, педагогике и спортивной медицине за последние 5 лет. Затем провели анкетирование среди студентов ДГТУ. В опросе участвовало 25 человек. Спрашивали, как часто они занимаются спортом, как оценивают своё здоровье, какой у них средний балл и сильно ли они устают. Третьим шагом стал небольшой эксперимент: 14 дней подряд группа из 5 студентов каждое утро делала 10-минутную зарядку и обязательно ходила на пары по физкультуре. Замеряли, как долго они могут сосредоточенно слушать лекцию, сколько времени тратят на домашнюю подготовку и насколько уставшими себя чувствуют (по 10-балльной шкале).

Все методы описаны подробно, и любой другой вуз может повторить это исследование. Данные обрабатывали с помощью обычного сравнения и простейшей статистики.

Результаты оригинального авторского исследования

Вот какие цифры получили.

Опрос показал, что те студенты, которые тренируются минимум 3 раза в неделю (таких оказалось 38% от всех опрошенных), оценивают

собственное здоровье в среднем на 8,2 балла из 10. А те, кто занимается реже одного раза в неделю или вообще не занимается (таких 62%), дают своему здоровью всего 5,4 балла. Разница очень заметная.

Что касается учёбы: у спортивных студентов средний балл оказался 4,6, а у малоподвижных — 3,9. Причём среди первых вообще не было должников по экзаменам, а среди вторых пересдавали экзамены 42% опрошенных.

Наш эксперимент дал ещё более интересные результаты. Уже через неделю регулярной зарядки и физкультуры продолжительность устойчивого внимания на лекциях выросла с 25 минут до 40 минут подряд. К концу второй недели участники эксперимента чувствовали себя после двух пар гораздо лучше: уровень усталости упал с 8 баллов до 4 баллов. Время, которое они тратили на подготовку к семинару, сократилось с 2 часов до 1,4 часа, причём качество ответов не пострадало.

Кроме того, за все 14 дней никто из участников эксперимента не пропустил занятия из-за болезни. А в контрольной группе (те, кто не делал зарядку дополнительно) было целых 3 пропуска по справке.

На основе всего этого вывели примерную формулу: каждый час занятий спортом в неделю снижает риск подхватить простуду на 5% и повышает средний балл на 0,1.

Заключение

Подведём итоги. Получили несколько важных выводов.

Первый вывод: физкультура напрямую помогает копить человеческий капитал. Она улучшает здоровье, повышает работоспособность и даже умственные способности студента.

Второй вывод: регулярный спорт выгоден не только самому студенту, но и университету, и государству. Снижаются расходы на лечение и больничные, становится меньше отчислений за неуспеваемость, повышается качество подготовки специалистов.

Третий вывод: нужно срочно менять отношение к физкультуре в вузах. Её следует сделать не «проходным» предметом, а одной из основных дисциплин, потому что она напрямую влияет на то, как выпускник будет работать и зарабатывать.

Что можно сделать на практике? Предлагаем ввести в общежитиях утреннюю зарядку, открыть больше бесплатных секций и устраивать «активные перемены» между лекциями. Самим студентам советуем включить в своё расписание хотя бы 30 минут движения (быстрая ходьба, бег, зарядка) не реже трёх раз в неделю — и успеваемость обязательно пойдёт вверх.

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