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Исмаилова Н.Я., доктор философии экономических наук (PhD), доцент,
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Косимов А.А., доктор философии (PhD) по сельскохозяйственным наукам, доцент,
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Мирзаева С.А., кандидат сельскохозяйственных наук, доцент,
Мирзажанов М.А., кандидат технических наук, доцент,
Муминов У.М., доктор философии по техническим наукам, доцент,
Муминов О.А., доктор философии по техническим наукам (PhD),
Мусаев Б.Б., доктор педагогических наук (DSc), профессор,
Мусашайхов Х.Т., доктор медицинских наук, профессор,
Мусашайхов У.Х., доктор медицинских наук,
Мухаммадиева О.М., кандидат философских наук, доцент,
Мухитдинов И.И., доктор философии по географическим наукам (PhD),
Мухитдинова К. О., кандидат медицинских наук,
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Нарбашева М.А., кандидат психологических наук, профессор,
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Нуридинов Т.К., доктор философии по историческим наукам (PhD), доцент,
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Нуриев К.К., доктор технических наук, профессор,
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Рахимов А.Д., доктор философии (PhD) по сельскохозяйственным наукам, доцент,
Рахматов О., доктор технических наук, профессор,
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Хамдамова Х.Ш., доктор филологических наук (PhD),
Хаметов З.М., доктор технических наук (DSc), доцент,
Хамидов Д.А., доктор философии по медицинским наукам (PhD), доцент,
Хасанов Ж.Ю., доктор философии по географическим наукам (PhD),
Хатамов Р.И., доктор философии (PhD) по сельскохозяйственным наукам,
Хидоятова З.Ш., кандидат биологических наук,
Холдаров М.М., кандидат медицинских наук,
Холдарова Д.Э., доктор философии в области сельскохозяйственных наук. (PhD), доцент,
Холматов Д.Н., кандидат медицинских наук, доцент,
Холмурзаев А.А., кандидат технических наук, доцент,
Холмуродов А.Ш., доктор педагогических наук (DSc), доцент,
Худойназоров Д.О., доктор философии по техническим наукам (PhD),
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Шамуратова Г.М., доктор философии по сельскохозяйственным наукам (PhD),
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Ширинов Ф.Ш., доктор философии в педагогических науках (PhD), доцент,
Эргашев И.О., доктор философии по техническим наукам (PhD),
Эргашев М.М., кандидат технических наук, доцент,
Эрданов М.Н., кандидат географических наук,
Эркабаева Н.Ш., доктор педагогических наук (DSc), профессор,
Эркаев А.Н., доктор философии по экономическим наукам (PhD), доцент,
Эсанова Ш.М., доктор философии по техническим наукам (PhD), доцент,
Эшонкулов Д.Т., кандидат экономических наук,
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Отв. ред. А.А. Зарайский
Главный редактор: Тягунова Людмила Анатольевна, кандидат философских наук

ОСНОВНОЙ РАЗДЕЛ

Abdujabborov I.B.
ilmiy tadqiqotchi
Andijon qishloq xo‘jaligi va agrotexnologiyalar instituti
O‘zbekiston, Andijon

TOMCHILATIB SUG‘ORISH TEXNOLOGIYASI TA’SIRIDA TUPROQNING HAJM MASSASI VA UNING DINAMIKASI

Annotatsiya. Maqolada tomchilatib sug‘orish texnologiyasining tuproq hajm massasiga ta’siri va uning vegetatsiya davomidagi dinamikasi o‘rganilgan. Tadqiqotlar Yozyovon tumanining o‘rtacha qumoqli sug‘oriladigan tuproqlari sharoitida limon yetishtirish jarayonida olib borilgan. Tajriba natijalari egatlab sug‘orish sharoitida tuproq hajm massasining vegetatsiya oxiriga kelib ortishini, tomchilatib sug‘orishda esa mazkur ko‘rsatkich nisbatan barqaror saqlanishini ko‘rsatdi. 2026-yilda 0–30 sm qatlamda hajm massasi egatlab sug‘orishda 1,41 g/sm³, tomchilatib sug‘orishda 1,30 g/sm³ ni tashkil etgan. Tomchilatib sug‘orish tuproqning zichlashishini kamaytirib, ildiz qatlamining qulay agrofizik holatini saqlashga xizmat qilishi aniqlandi.

Kalit so‘zlar: tomchilatib sug‘orish, tuproq hajm massasi, tuproq zichligi, agrofizik xossalar, sug‘orish texnologiyasi, limon, ildiz qatlami, tuproq zichlashishi, sug‘oriladigan tuproq.

Abdujabborov I.B.
researcher
Andijan Institute of Agriculture and Agrotechnologies
Uzbekistan, Andijan

DYNAMICS OF SOIL BULK DENSITY UNDER THE INFLUENCE OF DRIP IRRIGATION TECHNOLOGY

Abstract. This article examines the effect of drip irrigation technology on soil bulk density and its dynamics during the growing season. The study was conducted under lemon cultivation conditions on medium loamy irrigated soils in the Yozyovon district. The experimental results showed that soil bulk density increased by the end of the growing season under furrow irrigation, whereas it remained relatively stable under drip irrigation. In 2026, soil bulk density in the 0–30 cm layer reached 1.41 g/cm³ under furrow irrigation and 1.30 g/cm³ under drip irrigation. The results indicate that drip irrigation reduces soil compaction and helps maintain favorable agrophysical conditions in the root zone.

Keywords: drip irrigation, soil bulk density, soil density, agrophysical properties, irrigation technology, lemon, root zone, soil compaction, irrigated soils.

Tuproqning agrofizik xossalari qishloq xo‘jaligi ekinlarining mahsuldorligini belgilovchi asosiy omillardan biri hisoblanadi. Ushbu ko‘rsatkichlarning optimal darajada bo‘lishi limon va boshqa ekinlarning ildiz tizimi rivojlanishi, suv hamda oziqa moddalaridan samarali foydalanishini ta’minlaydi. Natijada o‘simliklarning o‘sishi va rivojlanishi uchun qulay sharoit yaratiladi hamda mo‘l va sifatli hosil shakllanishiga erishiladi.

Tuproqning agrofizik xususiyatlari agrotexnik tadbirlarning turi va intensivligiga bevosita bog‘liq holda shakllanadi hamda vegetatsiya davri davomida dinamik ravishda o‘zgarib boradi. Shuning uchun tuproqning agrofizik ko‘rsatkichlari o‘simliklarning o‘sish va rivojlanish bosqichlariga mos ravishda turli qiymatlarda namoyon bo‘ladi. Tuproqning asosiy agrofizik xossalaridan biri hajm massasi bo‘lib, u tuproqning fizik holatini tavsiflovchi muhim ko‘rsatkich hisoblanadi. Hajm massasining o‘zgarishi tuproqning suv-havo rejimi, ildiz tizimining rivojlanishi hamda o‘simliklarning oziqlanish sharoitlariga sezilarli ta’sir ko‘rsatadi.

Tajriba dalasida o‘tkazilgan agrotexnik tadbirlar va sug‘orishlar natijasida tuproqning hajm og‘irligi nazorat variantda oshdi. Tomchilatib sug‘orishda qisman kamaydi.

Tuproqning hajm og‘irligi o‘simliklarning o‘sishda rivojlanishi uchun kata ahamiyatga ega bo‘lgan fizik xususiyatlardandir. O‘simlik yaxshi o‘sib rivojlanishi va yuqori hosil shakillantirishi uchun tuproqning hajm og‘irligi maqbul holatda saqlanishi kerak. Tabiiy xolati saqlangan holda olingan, ma’lum hajmdagi tuproq og‘irligiga uning hajmiy og‘irligi deyiladi va quruq tuproq og‘irligiga nisbatan g/sm^3 bilan ifodalanadi.

Dala tajribalarimizda limonni turli sug‘orish tartiblarida tuproqni hajm og‘irligiga ta’siri aniqlandi. Buning uchun ekishdan oldin tuproqning har 10 sm li qatlamida, 100 sm chuqurlikda dalada belgilangan nuqtalarda tuproq namunalari olindi, amal davri oxirida esa barcha variantlarda yuqorida belgilangan qatlamlar bo‘yicha tuproqni hajm og‘irligi aniqlandi, (3.1.1-jadval).

Tuproq hajmiy og‘irligini aniqlash uchun belgilangan qatlamlardan tuproq namunalari maxsus, hajmi ma’lum bo‘lgan silindrda olib labaratoriyaga olib kelindi. Tuproqning hajm og‘irligi quruq tuproqqa nisbatan bo‘lganligi uchun avval tuproqning namligini aniqlab oldindi va tuproqning sof og‘irligini silindr xajmiga bo‘lib, quyidagi formula orqali hajm og‘irligini aniqlandi

$$\boldsymbol{d = \frac{P}{V}}$$

Bu yerda: d – tuproqning hajm og‘irligi, P–silindrdagi tuproqning sof og‘irligi, g hisobida, V – silindrning hajmi, sm^3 hisobida.

Farg‘ona vodiysining o‘rtacha qumoqli sug‘oriladigan tuproqlari sharoitida olib borilgan fundamental tadqiqotlar natijalari (Исаев, 2017) shuni ko‘rsatadiki, sug‘orish texnologiyalari tuproqning agrofizik holatiga, xususan, hajm massasiga sezilarli ta’sir ko‘rsatadi.

Ilmiy manba ma’lumotlariga ko‘ra, vegetatsiya boshida tuproqning faol haydalma (0-30 sm) va haydov osti (30-50 sm) qatlamlarida hajm massasi muvofiq

ravishda 1.26 g/sm va 1.30 g/sm ni tashkil etgan. Vegetatsiya yakunida an’anaviy egatlab sug‘orish qo‘llanilgan nazorat variantida tuproq qatlamlarining mexanik pishishi hisobiga 0-50 sm lik qatlamda o‘rtacha zichlik 1.38 g/smgacha ortganligi kuzatilgan.

Aksincha, tomchilatib sug‘orish joriy etilgan variantda suvning tuproq kapillyarlariga yumshoq singishi va strukturani buzmasligi natijasida, ushbu ko‘rsatkich faol ildiz qatlamida (0-50 sm) 1.30 g/sm darajasida saqlangan. Bu holat limon o‘simligi ildiz tizimining normal aeratsiyasini ta’minlashda muhim meliorativ omil bo‘lib xizmat qiladi.

Tadqiqotlarimizning ikkinchi yili (2025-y.) natijalari shuni ko‘rsatdiki, sug‘orish usullarining tuproq agrofizik xossalariga ta’siri vaqt o‘tishi bilan yanada yaqqol namoyon bo‘ladi.

Xususan, an’anaviy egatlab sug‘orish qo‘llanilgan nazorat variantida ikki yillik tizimli mexanik bosim va loyqalanish jarayonlari oqibatida, 0-30sm faol haydalma qatlamda tuproq hajm massasi vegetatsiya oxiriga kelib 1.41g/sm gacha yetdi va kritik zichlashish tendensiyasini namoyon etdi. Bu holat tuproqning umumiy g‘ovakligini pasaytirib, limon ildizlarining oziqlanish muhitini yomonlashtiradi.

Aksincha, tomchilatib sug‘orish variantida, hatto tajribaning ikkinchi yilida ham faol ildiz tarqalgan 0-50sm qatlamda o‘rtacha hajm massasi 1.32g/sm dan oshmadi. Olingan ko‘p yillik ma’lumotlar ilmiy adabiyotlardagi (Исаев, 2017; Ахмедов, 2008) qonuniyatlarni to‘liq tasdiqlagan holda, tomchilatib sug‘orish texnologiyasi Yozyovon tumanining o‘rtacha qumoqli tuproqlari agrofizik barqarorligini ta’minlovchi samarali meliorativ tadbir ekanligini ko‘rsatadi.

2025-yilda 0–30 sm qatlamda vegetatsiya boshida tuproq hajm massasi 1,26 g/sm³ bo‘lgan. Vegetatsiya oxirida egatlab sug‘orishda 1,38 g/sm³, tomchilatib sug‘orishda 1,29 g/sm³ ni tashkil etgan. 30–50 sm qatlamda bu ko‘rsatkichlar mos ravishda 1,30; 1,39 va 1,32 g/sm³ bo‘lgan. 50–70 sm qatlamda vegetatsiya boshida 1,34 g/sm³, egatlab sug‘orishda 1,36 g/sm³, tomchilatib sug‘orishda 1,34 g/sm³ qayd etilgan. 70–100 sm qatlamda esa ushbu ko‘rsatkichlar 1,37; 1,39 va 1,37 g/sm³ ni tashkil etgan.

2026-yilda 0–30 sm qatlamda vegetatsiya boshida tuproq hajm massasi 1,27 g/sm³ bo‘lib, vegetatsiya oxirida egatlab sug‘orishda 1,41 g/sm³, tomchilatib sug‘orishda 1,30 g/sm³ ni tashkil etdi. 30–50 sm qatlamda bu ko‘rsatkichlar 1,31; 1,40 va 1,33 g/sm³ bo‘lgan. 50–70 sm qatlamda vegetatsiya boshida 1,34 g/sm³, egatlab sug‘orishda 1,37 g/sm³, tomchilatib sug‘orishda 1,35 g/sm³ qayd etilgan. 70–100 sm qatlamda esa mos ravishda 1,37; 1,40 va 1,38 g/sm³ ni tashkil etgan.

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Abdullayev O.Sh.
"Barqaror dehqonchilik, ekologiya va atrof-muhit muhofazasi" kafedrasi assistenti
Qosimoxunov M.Q.
"O'rmonchilik" yo'nalishi 2-bosqich talabasi
Andijon qishloq xo'jaligi va agrotexnologiyalar instituti
O'zbekiston, Andijon

O'ZBEKISTONDA O'RMONCHILIK SOHASIGA QARATILAYOTGAN E'TIBOR VA UNING AHAMIYATI

Annotatsiya. Ushbu maqolada O'zbekistonda o'rmonchilik sohasiga qaratilayotgan e'tibor, daraxt ekish va yashil hududlarni ko'paytirish ishlari haqida so'z yuritiladi. O'rmonlarning tabiat, inson salomatligi va iqtisodiyot uchun ahamiyati oddiy misollar orqali tushuntiriladi. Shuningdek, "Yashil makon" umummilliy loyihasi, cho'llanishga qarshi kurashish, ko'chatlarni parvarishlash va o'rmonlarni asrash masalalari ko'rib chiqiladi.

Kalit so'zlar: o'rmonchilik, ko'kalamzorlashtirish, "Yashil makon", ko'chat, ekologiya, cho'llanish, tabiatni muhofaza qilish.

Abdullayev O.Sh.
assistant, Department of Sustainable Agriculture, Ecology and Environmental Protection
Qosimoxunov M.Q.
second-year student in Forestry
Andijan Institute of Agriculture and Agrotechnologies
Uzbekistan, Andijan

THE ATTENTION PAID TO THE FORESTRY SECTOR IN UZBEKISTAN AND ITS SIGNIFICANCE

Abstract. This article discusses the attention being paid to the forestry sector in Uzbekistan, as well as efforts to plant trees and expand green areas. It illustrates the importance of forests for nature, human health, and the economy through simple examples. Additionally, the article examines the "Yashil Makon" (Green Space) nationwide project, the fight against desertification, the care of saplings, and forest conservation.

Keywords: forestry, greening, "Yashil Makon", sapling, ecology, desertification, nature conservation.

Kirish: Bugungi kunda tabiatni asrash va atrof-muhitni yaxshilash muhim masalalardan biri hisoblanadi. Aholi sonining ko'payishi, ayrim hududlarda suv

tanqisligi, tuproqning yemirilishi va havoning ifloslanishi yashil hududlarni ko‘paytirishni talab qilmoqda. Bu jarayonda o‘rmonlarning o‘rni katta.

O‘rmonlar havoni tozalashga, tuproqni shamol va suv eroziyasidan himoya qilishga, ko‘plab hayvonlar va o‘simliklar uchun yashash joyi yaratishga yordam beradi. Daraxtlar soyasi yozda issiqni kamaytiradi, ayrim hududlarda esa qum va changning tarqalishini cheklaydi. Shu sababli o‘rmonchilik nafaqat daraxt ekish, balki tabiatni asrash va kelajak avlod uchun sog‘lom muhit yaratish bilan ham bog‘liq.

O‘zbekistonda ham so‘nggi yillarda ko‘kalamzorlashtirish va o‘rmonlarni rivojlantirish masalalariga e’tibor qaratilmoqda. Jumladan, “Yashil makon” umummilliy loyihasi orqali ko‘chat ekish, aholi yashash joylarini obodonlashtirish va yashil hududlarni kengaytirish ishlari olib borilmoqda.

O‘rmonlarning tabiat va inson hayotidagi ahamiyati.

O‘rmonlar tabiat muvozanatini saqlashda muhim vazifalarni bajaradi. Daraxtlar fotosintez jarayonida karbonat angidridni o‘zlashtirib, kislorod ajratadi. Daraxtzorlar tuproq namligini saqlashga yordam beradi va kuchli shamol ta’sirini kamaytirishi mumkin. Tog‘li hududlarda o‘simlik qoplami tuproqning yuvilib ketish xavfini kamaytirishga xizmat qiladi.

O‘rmonlar iqtisodiy jihatdan ham foydalidir. Ulardan yog‘och, ayrim meva va dorivor o‘simliklar, urug‘ va boshqa tabiiy mahsulotlar olinadi. Bunda o‘rmon resurslaridan tartibli va tejamkor foydalanish kerak. O‘rmonni kesish yoki tabiiy o‘simliklarni yo‘qotish o‘rnini tiklash choralari bilan birga olib borilishi lozim.

O‘zbekiston hududining katta qismi qurg‘oqchil bo‘lgani uchun har qanday daraxt turini istalgan joyga ekish to‘g‘ri bo‘lmaydi. Ko‘chat tanlashda tuproq, iqlim, suv bilan ta’minlanganlik va hududning tabiiy sharoiti hisobga olinishi kerak.

O‘zbekistonda o‘rmonchilikka berilayotgan e’tibor.

O‘zbekistonda yashil hududlarni kengaytirish va o‘rmonlarni muhofaza qilish bo‘yicha turli ishlar amalga oshirilmoqda. “Yashil makon” umummilliy loyihasi aholining yashash joylarida daraxt va butalarni ko‘paytirish, ko‘kalamzorlashtirish ishlarini rivojlantirishga qaratilgan. Ushbu tashabbusda tashkilotlar, ta’lim muassasalari, mahallalar va fuqarolarning ishtiroki muhim.

O‘rmonchilik sohasida ko‘chat yetishtirish, urug‘lik materiallarini tayyorlash, yangi o‘rmonzorlar barpo etish va mavjud daraxtzorlarni parvarishlash katta ahamiyatga ega. O‘zbekiston Respublikasi Prezidentining 2025-yil 30-maydagi PF-90-son Farmonida o‘rmonlarni boshqarish tizimini takomillashtirish, yashil hududlarni kengaytirish va cho‘llanishga qarshi kurashish bilan bog‘liq chora-tadbirlar belgilangan.

Bu ishlarning samarali bo‘lishi uchun ko‘chat ekish bilan cheklanib qolmaslik kerak. Ekilgan ko‘chatlarni sug‘orish, begona o‘tlardan tozalash, zararkunandalardan himoya qilish va ularning o‘sishini kuzatib borish zarur. Agar ko‘chatlar parvarish qilinmasa, ularning bir qismi qurib qolishi mumkin. Shuning uchun ekilgan ko‘chatlar soni bilan birga, ularning qancha qismi yashab qolganini ham hisobga olish muhim.

Cho‘llanishga qarshi kurashishda o‘rmonlarning roli.

Cho‘llanish - yerlarning tabiiy va xo‘jalik imkoniyatlari pasayib borishi bilan bog‘liq jarayon. Bunga suv tanqisligi, o‘simlik qoplamining kamayishi, shamol eroziyasi va tuproq sho‘rlanishi sabab bo‘lishi mumkin. O‘rmonzorlar va himoya daraxtzorlari ushbu muammolarni kamaytirishga yordam beradi.

Masalan, dalalar chetida tashkil etilgan ihota daraxtzorlari shamol tezligini pasaytirishi va ekin maydonlarini himoya qilishi mumkin. Qumli va qurg‘oqchil joylarda esa shu sharoitga mos daraxt va butalarni ekish qum ko‘chishini cheklashga yordam beradi. Bunday hududlarda o‘simlik turini tanlashda suvga ehtiyoj, tuproqning sho‘rlanishi va mahalliy iqlim hisobga olinishi kerak.

Orolbo‘yi hududida ham o‘simlik qoplamini tiklash va qum-chang tarqalishini kamaytirishga qaratilgan ishlar muhim ahamiyatga ega. Har bir hududning tabiiy sharoiti turlicha bo‘lgani uchun o‘rmonzor barpo etish ishlari mutaxassislar tavsiyasi asosida tashkil qilinishi lozim.

O‘rmonchilikni rivojlantirish bo‘yicha takliflar.

O‘rmonchilik sohasini yanada rivojlantirish uchun bir nechta takliflarni amalga oshirish mumkin. Birinchidan, hududning tuproq va iqlim sharoitiga mos daraxt turlarini tanlash kerak. Ikkinchidan, ko‘chat ekilgandan keyin ularni muntazam parvarishlash va yashab qolish darajasini tekshirish lozim. Uchinchidan, mahalliy daraxt va buta turlarini ko‘paytirishga alohida e’tibor berish zarur.

To‘rtinchidan, o‘rmon xo‘jaliklari va oliy ta’lim muassasalari hamkorligini kuchaytirish foydali bo‘ladi. Talabalar amaliy mashg‘ulotlarda ko‘chat ekish, urug‘ tayyorlash, daraxtlarni aniqlash va o‘rmon holatini kuzatish bo‘yicha tajriba orttirishlari mumkin. Beshinchidan, aholiga daraxtlarni asrash, noqonuniy kesishning oldini olish va suvni tejash haqida tushuntirish ishlarini olib borish kerak.

Shuningdek, zamonaviy xaritalar va sun’iy yo‘ldosh tasvirlaridan foydalanib, o‘rmonzorlarning holatini kuzatish mumkin. Bunday usullar mutaxassislarga qaysi hududlarda yashil qoplama kamaygani yoki yangi daraxtzorlar tashkil etish zarurligini aniqlashda yordam beradi.

XULOSA

Xulosa qilib aytganda, o‘rmonchilik O‘zbekistonning ekologik barqarorligi uchun muhim sohalardan biridir. O‘rmonlar havoni tozalash, tuproqni himoya qilish, biologik xilma-xillikni saqlash va cho‘llanishga qarshi kurashishda katta ahamiyatga ega. “Yashil makon” umummilliy loyihasi va o‘rmonlarni boshqarishni takomillashtirishga qaratilgan chora-tadbirlar yashil hududlarni kengaytirishga xizmat qiladi. Biroq yaxshi natijaga erishish uchun faqat ko‘chat ekish yetarli emas. Ko‘chatlarni to‘g‘ri tanlash, o‘z vaqtida sug‘orish, parvarishlash va ularning yashab qolishini tekshirish kerak. O‘rmon xo‘jaliklari, ta’lim muassasalari va aholining hamkorligi kuchaysa, o‘rmonchilikni rivojlantirish va tabiatni asrash bo‘yicha yanada yaxshi natijalarga erishish mumkin.

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Abdullayeva S.B.
assistent
Berdiyorov I.S.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

SUN’IY INTELLEKT VA KOMPYUTER GRAFIKASI INTEGRATSIYASI ASOSIDA TIBBIY TASVIRLARNI 3D MODELLASHTIRISH

Annotatsiya. Ushbu maqolada sun’iy intellekt va kompyuter grafikasi texnologiyalarini integratsiyalash asosida tibbiy tasvirlarni uch o‘lchamli (3D) modellashtirishning zamonaviy usullari yoritilgan. Tibbiy tasvirlarni sun’iy intellekt algoritmlari yordamida qayta ishlash, segmentatsiyalash va kompyuter grafikasi vositalari asosida aniq 3D modellarga aylantirish jarayonlari tahlil qilingan. Mazkur texnologiyalarning anatomik tuzilmalarni vizuallashtirish, tibbiy diagnostika aniqligini oshirish, jarrohlik amaliyotlarini rejalashtirish va tibbiy ta’lim jarayonida qo‘llanish imkoniyatlari ko‘rib chiqilgan. Shuningdek, sun’iy intellekt va 3D kompyuter grafikasining o‘zaro integratsiyasi tibbiy tasvirlarni raqamli tahlil qilish hamda individual bemor ma’lumotlari asosida virtual anatomik modellar yaratishda istiqbolli yo‘nalish ekanligi asoslangan.

Kalit so‘zlar: sun’iy intellekt, kompyuter grafikasi, tibbiy tasvirlar, 3D modellashtirish, tibbiy vizualizatsiya, tasvirlarni segmentatsiyalash, kompyuter tomografiyasi.

Abdullayeva S.B.
assistant
Berdiyorov I.S.
student
Samarkand State Medical University
Uzbekistan, Samarkand

3D MODELING OF MEDICAL IMAGES BASED ON THE INTEGRATION OF ARTIFICIAL INTELLIGENCE AND COMPUTER GRAPHICS

Abstract. This article explores modern methods of three-dimensional (3D) modeling of medical images based on the integration of artificial intelligence and computer graphics technologies. The processes of medical image processing and segmentation using artificial intelligence algorithms, as well as their conversion into accurate 3D models through computer graphics tools, are analyzed. The potential applications of these technologies in anatomical structure visualization, improving the accuracy of medical diagnosis, surgical planning, and medical education are examined. Furthermore, the integration of artificial intelligence and 3D computer graphics is highlighted as a promising approach to the digital analysis

of medical images and the creation of virtual anatomical models based on individual patient data.

Keywords: artificial intelligence, computer graphics, medical images, 3D modeling, medical visualization, image segmentation, computed tomography.

KIRISH: Tibbiyot sohasida raqamli texnologiyalarning jadal rivojlanishi diagnostik ma’lumotlarni qayta ishlash, tahlil qilish va vizuallashtirishning yangi usullarini shakllantirmoqda. Ayniqsa, kompyuter tomografiyasi (KT) va magnit-rezonans tomografiyasi (MRT) orqali olinadigan yuqori aniqlikdagi tibbiy tasvirlar inson organizmidagi anatomik tuzilmalarni batafsil o‘rganish imkonini bermoqda. Biroq ikki o‘lchamli tasvirlarni tahlil qilishda murakkab anatomik ob’ektlarning fazoviy tuzilishini to‘liq tasavvur qilish har doim ham oson emas.

Sun’iy intellekt texnologiyalarining tibbiy tasvirlarga tatbiq etilishi ushbu ma’lumotlarni avtomatik qayta ishlash va tahlil qilish imkoniyatlarini kengaytiradi. Mashinali o‘qitish va chuqur o‘qitish algoritmlari tasvirlardagi anatomik sohalarni ajratish, patologik o‘zgarishlarni aniqlash hamda tasvir ma’lumotlarini tasniflash kabi vazifalarda qo‘llanilmoqda. Kompyuter grafikasi esa olingan ma’lumotlarni uch o‘lchamli fazoda ifodalash, ularning shakli va o‘zaro joylashuvini vizual ko‘rsatish uchun muhim vosita hisoblanadi. Sun’iy intellekt va kompyuter grafikasining integratsiyasi natijasida tibbiy tasvirlarni avtomatik segmentatsiyalashdan boshlab, bemor anatomiyasiga mos individual 3D modellarni shakllantirishgacha bo‘lgan yagona raqamli jarayonni tashkil etish imkoniyati paydo bo‘lmoqda. Bunday yondashuv diagnostika, jarrohlik amaliyotini rejalashtirish, tibbiy ta’lim va ilmiy tadqiqotlarda vizual ma’lumotlardan samarali foydalanish uchun muhim ahamiyat kasb etadi.

Mavzuning dolzarbligi shundan iboratki, tibbiy amaliyotda anatomik tuzilmalarning uch o‘lchamli modellarini yaratish shifokorga murakkab ob’ektlarni fazoviy jihatdan baholash va ularning o‘zaro munosabatlarini yaxshiroq anglash imkonini beradi. Ayniqsa, murakkab jarrohlik amaliyotlarini oldindan rejalashtirishda bemorning KT yoki MRT ma’lumotlari asosida yaratilgan individual 3D modellar muhim axborot manbai bo‘lishi mumkin. An’anaviy modellashtirish jarayonlarida tibbiy tasvirlarni qo‘lda segmentatsiyalash va qayta ishlash ko‘p vaqt talab qilishi mumkin. Sun’iy intellekt algoritmlaridan foydalanish esa ushbu jarayonlarni avtomatlashtirish va katta hajmdagi tasvir ma’lumotlarini qayta ishlash imkoniyatlarini kengaytiradi. Shu nuqtai nazardan, intellektual tasvir tahlili va kompyuter grafikasini birlashtirgan texnologiyalarni tadqiq etish zamonaviy biotibbiyot muhandisligi uchun dolzarb ilmiy-amaliy yo‘nalishlardan biri hisoblanadi. Mazkur ishda sun’iy intellekt algoritmlari va kompyuter grafikasi texnologiyalarining o‘zaro integratsiyasi asosida tibbiy tasvirlardan aniq va vizual axborotga boy 3D modellarni shakllantirish jarayonini o‘rganish hamda uning tibbiy diagnostika, jarrohlik rejalashtirishi va ta’limdagi imkoniyatlarini tahlil qilish- asosiy maqsad qilib belgilangan.Ya’ni, tadqiqotda tibbiy tasvirlarni raqamli qayta ishlashning bosqichma-bosqich yondashuvi asos qilib olingan. Unda KT va MRT ma’lumotlarini dastlabki tayyorlash, tasvir sifatini yaxshilash, anatomik

ob’ektlarni segmentatsiyalash, ajratilgan sohalarni qayta ishlash va ular asosida 3D geometrik model yaratish jarayonlari o‘zaro bog‘liq holda ko‘rib chiqildi. Sun’iy intellekt qismida tasvirlarni avtomatik segmentatsiyalash va ob’ektlarni tanib olishga qaratilgan mashinali o‘qitish hamda chuqur neyron tarmoqlaridan foydalanish tamoyillari tahlil qilindi. Kompyuter grafikasi bosqichida esa segmentatsiya natijalarini uch o‘lchamli geometrik ob’ektga aylantirish, uni vizuallashtirish, aylantirish, masshtablash va fazoviy tahlil qilish imkoniyatlari o‘rganildi. Ushbu yondashuvda asosiy e’tibor sun’iy intellektning tasvirdan kerakli anatomik sohani ajratib olishi va kompyuter grafikasining ushbu ma’lumotni inson uchun tushunarli 3D vizual shaklga keltirishi o‘rtasidagi texnologik bog‘liqlikka qaratildi.

ADABIYOTLAR TAHLILI VA METODOLOGIYASI: O‘zbek olimlari Marat Xodjibekov, Yulduz Xodjibekova va Lalita Yunusova tadqiqotlarida sun’iy intellekt texnologiyalarining radiologiya sohasiga jadal kirib kelayotgani, ayniqsa, tibbiy tasvirlarni avtomatik tahlil qilish, diagnostik jarayonlarni takomillashtirish va radiologik xizmatlar samaradorligini oshirishda raqamli texnologiyalarning ahamiyati ortib borayotgani ta’kidlangan.

O‘zbekistonlik tadqiqotchi Maftunaxon Mahmudova tomonidan olib borilgan tadqiqotlarda KT, MRT va UTT ma’lumotlarini sun’iy intellekt algoritmlari yordamida qayta ishlash, anatomik tuzilmalarni avtomatik segmentatsiyalash hamda ular asosida inson organlarining 3D modellarini shakllantirish imkoniyatlari ko‘rsatilgan bo‘lib, muallif mashinali o‘qitish, kompyuter grafikasi va biotibbiy ma’lumotlarni yagona vizualizatsiya tizimiga birlashtirishni taklif etgan.

Toshkent davlat tibbiyot universiteti tadqiqotchilari Bobur Raximov va Sardor Normamatov ishlarida sun’iy intellektning tibbiy diagnostika, klinik qarorlarni qo‘llab-quvvatlash va tibbiy tasvirlarni tahlil qilishdagi imkoniyatlari tahlil qilinib, chuqur o‘rganish texnologiyalarini amaliyotga joriy etishda ma’lumotlar sifati, algoritmlarning umumlashuvchanligi, tushuntiriluvchanligi va klinik xavfsizlik kabi omillarni hisobga olish zarurligi ta’kidlangan.

Rossiyalik olimlar va Sechenov universiteti tadqiqotchilari tomonidan ishlab chiqilgan 3D-modellashtirish texnologiyalarida KT ma’lumotlarining bir nechta 2D kesimlarini birlashtirish orqali buyrak va patologik tuzilmalarning hajmiy 3D tasvirlarini shakllantirish hamda ulardan jarrohlik amaliyotini oldindan rejalashtirishda foydalanish imkoniyati ko‘rsatilgan.

Sechenov universitetining Sechenov.AI_nephro loyihasi misolida sun’iy intellekt va 3D kompyuter modellashtirishning birlashishi natijasida buyrak o‘smasi, qon tomirlari va atrofdagi anatomik tuzilmalarning detallashtirilgan uch o‘lchamli modelini qisqa vaqt ichida shakllantirish mumkinligi ko‘rsatilgan, bunday modellar esa jarrohga operatsiyadan oldin anatomik holatni fazoviy jihatdan baholash imkonini beradi.

Yuqoridagi ilmiy yondashuvlar asosida mazkur tadqiqot metodologiyasi KT va MRT tasvirlarini raqamli tayyorlash, tasvir sifatini yaxshilash, sun’iy intellekt yordamida anatomik sohalarni segmentatsiyalash, ajratilgan ma’lumotlarni

kompyuter grafikasi muhitida qayta ishlash, ular asosida 3D geometrik model yaratish va hosil qilingan modelning anatomik aniqligini vizual hamda miqdoriy mezonlar asosida baholash bosqichlariga asoslanadi.

MUHOKAMA: Sun'iy intellekt va kompyuter grafikasi texnologiyalarini birgalikda qo'llash tibbiy tasvirlardan foydalanish samaradorligini oshirish uchun keng imkoniyatlarga ega. Tasvirni segmentatsiyalash jarayonida sun'iy intellekt algoritmlari ma'lum anatomik sohalarni ajratib olishga yordam bersa, kompyuter grafikasi vositalari ushbu ma'lumotlarni uch o'lchamli vizual ob'ekt sifatida ifodalash imkonini beradi.

3D modellarning muhim xususiyatlaridan biri ularning interaktivligi hisoblanadi. Foydalanuvchi modelni turli burchaklardan ko'rishi, uni masshtablashi va anatomik tuzilmalarning o'zaro joylashuvini fazoviy jihatdan baholashi mumkin. Bu xususiyatlar ikki o'lchamli tasvirlarda mavjud bo'lmagan qo'shimcha vizual axborotni olish imkonini yaratadi. Bemor ma'lumotlari asosida individual 3D modellarni shakllantirish tibbiy amaliyotda alohida ahamiyatga ega. Masalan, KT ma'lumotlaridan foydalanib suyaklar, ichki organlar yoki patologik sohalarning uch o'lchamli modelini yaratish mumkin. MRT ma'lumotlari esa yumshoq to'qimalar va boshqa anatomik tuzilmalarni vizuallashtirishda qo'shimcha ma'lumot beradi. Shu bilan birga, sun'iy intellekt asosidagi modellarning natijalari ma'lumotlar sifati, o'qitish bazasining hajmi va xilma-xilligi, tasvirlarning texnik xususiyatlari hamda algoritm tanloviga bog'liq bo'lishi mumkin. Shu sababli 3D modellashtirish jarayonida avtomatik natijalarni mutaxassis tomonidan tekshirish va zarur hollarda tuzatish muhim hisoblanadi.

Sun'iy intellekt va kompyuter grafikasi integratsiyasi tibbiy ta'limda ham samarali qo'llanishi mumkin. Talabalar anatomik tuzilmalarni oddiy ikki o'lchamli rasmlardan tashqari interaktiv uch o'lchamli modellar orqali o'rganish imkoniyatiga ega bo'ladilar. Bu esa murakkab fazoviy munosabatlarni tushunish va vizual fikrlash ko'nikmalarini shakllantirishga xizmat qiladi.

XULOSA: Sun'iy intellekt va kompyuter grafikasi texnologiyalarining integratsiyasi tibbiy tasvirlarni qayta ishlash va ular asosida 3D modellar yaratishning zamonaviy yo'nalishlaridan biri hisoblanadi. Sun'iy intellekt algoritmlari tibbiy tasvirlardagi anatomik ob'ektlarni avtomatik ajratish va tahlil qilish imkonini kengaytirsa, kompyuter grafikasi ushbu ma'lumotlarni aniq va interaktiv uch o'lchamli modellar ko'rinishida ifodalashga xizmat qiladi.

Mazkur texnologiyalar KT va MRT ma'lumotlarini vizual tahlil qilish, individual anatomik modellar yaratish, jarrohlik amaliyotlarini rejalashtirish, tibbiy ta'lim va ilmiy tadqiqotlarda yangi imkoniyatlar yaratadi. Kelajakda sun'iy intellekt algoritmlarining takomillashishi, tibbiy ma'lumotlar bazalarining kengayishi va kompyuter grafikasi vositalarining rivojlanishi ushbu texnologiyalarning klinik va ta'limiy qo'llanish doirasini yanada kengaytirishi mumkin.

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Abdullayeva B.
master's student, programme "Management: Educational Management"
Centre for Training of Scientific and Pedagogical Personnel
Pucheon University in Tashkent
Uzbekistan, Tashkent

MANAGING EDUCATIONAL INSTITUTIONS IN THE CONTEXT OF DIGITAL TRANSFORMATION: INFORMATION AND ANALYTICAL MECHANISMS FOR INCREASING THE EFFECTIVENESS OF INNOVATIVE MANAGEMENT

Abstract. The article distinguishes digitisation from digital transformation in educational institutions and proposes an information and analytical mechanism for increasing the effectiveness of innovative management. Based on a theoretical analysis of digital maturity approaches, pedagogical-technological competencies and technology acceptance models, the study develops a digital maturity matrix for educational institutions, a five-component information and analytical mechanism, and a six-step decision-making cycle. Risks related to data privacy, algorithmic bias and the digital divide, as well as mitigation measures, are also systematised.

Keywords: digital transformation, educational management, innovative management, data governance, digital maturity, decision-making, monitoring.

INTRODUCTION

Digital technologies are fundamentally changing the way educational institutions work: from electronic registers and learning management systems to distance-learning platforms and analytical dashboards that support managerial decisions. In Uzbekistan this process is regarded as a part of state policy: the Development Strategy of New Uzbekistan [1], the concept for developing the higher education system [2] and the Law "On Education" [3] define the use of modern information technologies as a priority for improving the quality of education. OECD research also emphasises that digital technologies are becoming an important condition for innovative education, but that their impact depends on organisational and pedagogical conditions [4, p. 12].

At the same time, in practice digitisation (transferring paper-based processes into electronic form) is often confused with digital transformation (a change in the management model and in the way value is created). As a result, educational institutions accumulate information systems that are not connected to one another, data are duplicated in different places, and managerial decisions rely, as before, on experience and guesswork. G. Westerman and colleagues single out two factors of success in digital transformation – the intensity of technology use and the intensity of managing it [5, p. 18]; if the managerial side is underdeveloped, technology does not provide an advantage.

Several aspects of this problem have been covered in the scholarly literature. E. Rogers explains the diffusion of innovations through the innovation-decision

process and categories of adopters [6, p. 169]; F. Davis demonstrates the decisive influence of perceived usefulness and perceived ease of use on technology acceptance [7, p. 320]; P. Mishra and M. Koehler substantiate the interrelation of pedagogical, technological and content knowledge (TPACK) [8, p. 1025]; a working group led by C. Redecker systematised teachers' digital competencies in six areas [9, p. 15]. B. Williamson, in turn, takes a critical approach to the political and ethical aspects of data-driven governance, alongside the opportunities offered by big data in education [10, p. 12].

Most existing works focus on the level of the teacher or the learning process, while institution-level management, that is, the path by which data obtained through digital tools turn into managerial decisions, is covered less. The aim of the study is to develop an information and analytical mechanism that contributes to increasing the effectiveness of innovative management in an educational institution in the context of digital transformation. To achieve it, the following objectives were addressed: (1) to distinguish the levels of digitisation and digital transformation; (2) to substantiate a digital maturity matrix for an educational institution; (3) to design the components of the information and analytical mechanism and the decision-making cycle; (4) to identify the risks of applying the mechanism.

Working hypothesis: if data sources are integrated into a single architecture, data governance, analysis and the decision-making cycle are regulated, and the digital competencies of leaders and teachers are developed, digital tools become a factor that increases the effectiveness of innovative management.

METHODS

The study is theoretical and analytical in nature. Its stages were: (1) a systematic analysis of international sources on digital transformation, digital maturity, technology acceptance and teachers' digital competencies; (2) a comparison of these approaches from the standpoint of managing an educational institution; (3) a content analysis of regulatory documents for requirements related to digital development; (4) process modelling (data flow and decision-making cycle); (5) identifying risks and systematising measures to mitigate them.

In substantiating the digital maturity matrix, the two-dimensional approach of Westerman and colleagues [5, p. 18] was adapted to the conditions of an educational institution. The decision-making cycle relies on the plan–do–study–act (PDCA) cycle described by W.E. Deming [11, p. 88]. The components of the information and analytical mechanism were selected on three criteria: data quality, direct influence on the decision-making process, and dependence on staff readiness. There are no primary empirical data among the sources used; this is a limitation of the study, and the conclusions are theoretical and design-based.

RESULTS

1. Levels of digitisation and digital transformation

The analysis showed that it is appropriate to distinguish three levels of digital development (Table 1). At the first level, existing processes remain unchanged and are merely transferred to electronic form; at the second, processes and systems are linked in a single data environment; at the third, digital capabilities change the

institution's operating model and the way it creates value. Many institutions stay at the first level and describe it as "transformation"; this halts further development.

Table 1. Three levels of digital development (in an educational institution)

Level	Essence	Example in an educational institution	Managerial result
1. Digitisation	Transferring existing processes into electronic form	Electronic register; scanned copies of documents	Time is saved, but decisions do not change
2. Integration	Linking processes and systems in a single data environment	Learning management system; combining HR and finance data	A single source of truth appears, analytical capacity expands
3. Digital transformation	Change in the operating model and in the way value is created	Personalised learning pathways; a data-based early warning system	Decisions rely on evidence, organisational culture changes

Source: adapted by the author from the approach of Westerman et al. [5, p. 18].

2. A digital maturity matrix for an educational institution

Westerman and colleagues divided companies into four categories according to the intensity of digital capabilities and of managing them [5, p. 18]. For an educational institution this approach was adapted as follows: the first dimension is technological capability (infrastructure, platforms, digital resources); the second is managerial capability (data policy, leadership, staff competencies, culture of decision-making). As a result, four categories were formed (Table 2). The practical value of the matrix is that it answers the leader's question "which side should we invest in?": an institution with high technological capability but weak management needs not new software but data governance and staff training.

Table 2. Digital maturity categories of an educational institution

Category	Technological capability	Managerial capability	Characteristic feature	Priority task
Beginner	Low	Low	Isolated initiatives, no systemic approach	Digital strategy and infrastructure basics
Technology-oriented	High	Low	Many applications, but they are not connected and results are not measured	Data governance, single architecture
Traditional-cautious	Low	High	Management is orderly, but technology is little used	Gradual increase of capabilities
Digitally mature	High	High	Technology and management are aligned, decisions rely on data	Continuous improvement, spreading experience

Source: adapted by the author for an educational institution on the basis of the model of Westerman et al. [5, p. 18].

3. Components of the information and analytical mechanism

The information and analytical mechanism is substantiated as consisting of five interrelated components (Table 3). The first component is a single data architecture: it determines which information is taken from which source in the learning management system, the education data base, and the HR, finance, library and communication systems. The second component is data governance: data owners, quality criteria, access rights and personal data protection rules are defined. The third component is the analytical layer: a dashboard of indicators, early-warning signs and trend monitoring. The fourth component is the decision-making cycle, which turns analytical results into specific managerial decisions. The fifth component is culture and competencies: developing digital competencies and an environment that supports the use of data.

In designing the fifth component, the DigCompEdu framework was taken as a basis: it describes teachers' digital competencies in six areas – professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence [9, p. 15]. The TPACK model, in turn, warns against the risk of separating technology from pedagogical goals and turning it into an end in itself [8, p. 1025].

Table 3. Components of the information and analytical mechanism

Component	Content	Responsible	Output
1. Single data architecture	Mapping sources; bringing data to a single format; eliminating duplication	IT officer; deputy director	Single source of truth
2. Data governance	Data owners, quality criteria, privacy and access rules	Leader; data officer	Reliable and protected data
3. Analytical layer	Dashboard of indicators; early-warning signs; trend analysis	Analytical team; methodological service	Analytical information ready for decisions
4. Decision-making cycle	Signal – diagnosis – options – decision – implementation – review	Leader; pedagogical council	Evidence-based managerial decisions
5. Culture and competencies	Developing digital competencies; encouraging the use of data	Leader; HR service	Technology acceptance and use

Source: compiled by the author.

4. A six-step decision-making cycle

Relying on the Deming cycle [11, p. 88], the decision-making cycle was designed in six steps. Signal: an indicator on the dashboard deviates from the norm (for example, a decline in attainment in certain classes or an increase in teachers' workload). Diagnosis: comparing with additional data (observation, interviews, surveys) to identify causes. Options: assessing several solutions and their resources and risks. Decision: clearly defining the person responsible, the deadline and the expected result. Implementation: executing the decision with interim monitoring. Review: comparing the result with the planned indicators and drawing conclusions for the next cycle. This cycle regularly answers the question "what is working and what is not" in implementing innovations.

The acceptance of the mechanism depends not only on technical but also on psychological factors. According to Davis's model, a user is more likely to accept a technology if they perceive it as useful and easy to use [7, p. 320]; Rogers distinguishes such attributes as relative advantage, compatibility, complexity, trialability and observability [6, p. 15]. Therefore, when introducing the dashboard, it should be presented to teachers as something that brings real benefit, is simple and can be tried out: for example, first testing it in one or two classes and showing the results openly.

5. Risks and measures to reduce them

Data-driven management also brings its own risks. Williamson notes that as data collection in education expands, management may come to rely excessively on surveillance and control [10, p. 12]. Table 4 systematises the main risks and the measures against them.

Table 4. Risks of the information and analytical mechanism and measures to reduce them

Risk	Essence	Mitigation measures
Data privacy	Personal data of learners and staff are used without permission or disclosed	Access rights matrix; data minimisation; rules for staff
Algorithmic bias	Analytical models produce biased conclusions about certain groups	Human review of results; using early warning as a means of support, not punishment
Digital divide	Teachers' and learners' access to and use of technology are unequal	Equalising infrastructure; additional skills support
Technostress and workload	The growing number of reports and platforms increases teachers' workload	Eliminating double entry; the principle of entering data once
Technological dependence	Being tied to one supplier and being unable to move data to another system	Open formats; including data export terms in contracts

Source: compiled by the author.

DISCUSSION

The results confirm the need to treat digital transformation as a managerial rather than technological process. This conclusion is consistent with the view of Westerman and colleagues about the decisive importance of management intensity in digital maturity [5, p. 18]. At the same time, the specific feature of the education sector is that "value" is measured not only financially but through learning outcomes and the learner's development; therefore, the analytical layer of the information and analytical mechanism should rely on indicators of learning outcomes. In J. Hattie's research, the value of 0.40 in effect size is used as a practically meaningful "hinge point" [12, p. 16]; this approach can serve as a criterion in assessing the impact of an innovation.

A strength of the mechanism is that it does not reject existing information systems but integrates them from the standpoint of managerial decisions. Its weakness is that its success depends on the readiness of leaders and teachers to use data. Fullan draws attention to the decisive role of people and the relationships among them in educational change [13, p. 70]. Therefore, the fifth component (culture and competencies) should be developed simultaneously with the other four.

Limitations of the study: the mechanism is theoretical and design-based and has not been tested in a specific institution; the digital maturity categories and the risk table should be confirmed through expert assessment. In future research, it is planned to pilot the mechanism in several types of institutions (general secondary schools, vocational education, higher education) and to study the relationship between maturity level and management results.

CONCLUSION

The results of the study made it possible to draw the following conclusions:

digitisation, its integration and digital transformation are different levels of digital development, and the effectiveness of innovative management appears at the third level, that is, when the management model changes;

the digital maturity of an educational institution is determined by the alignment of technological and managerial capabilities; the two-dimensional matrix helps the leader to determine the direction of investment;

the information and analytical mechanism consists of five components (data architecture, data governance, analytical layer, decision-making cycle, culture and competencies) and is linked to management practice through a six-step decision-making cycle;

in introducing the mechanism, the risks of data privacy, algorithmic bias, digital divide, technostress and technological dependence should be taken into account in advance.

Practical recommendations: to conduct digital maturity diagnostics in every educational institution and draw up a development roadmap; to adopt internal rules on data governance; to define the position or function of a data officer; to introduce the analytical dashboard initially as a pilot with a limited set of indicators; and to align digital competence development programmes for leaders and teachers with management goals.

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Abdurakhmonova Z.E., PhD
assistant, Department of Pharmacology
Samarkand State Medical University
Uzbekistan, Samarkand
Rustamova K.K.
senior lecturer
Tashkent International University of Chemistry (KIUT)
Uzbekistan, Tashkent

ELECTROANALYTICAL PERFORMANCE OF ION-SELECTIVE ELECTRODES BASED ON DODECATUNGSTOPHOSPHATE IONOPHORES FOR PHARMACEUTICAL QUANTIFICATION

Abstract. This study demonstrates a highly sensitive, rapid potentiometric method and advanced ion-selective electrodes (ISEs) utilizing heteropolymetallophosphate ionophores for the determination of target pharmaceuticals. The primary advantages of the proposed sensors include rapid response times, a broad analytical range, and low detection thresholds. The developed membranes exhibit a detection limit of 10^{-5} mol/L and a linear response range extending from 1×10^{-1} to 1×10^{-5} mol/L.

Keywords: Ion-selective electrode, pharmaceuticals, diprazine, bromhexine, ionophore, dodecatungstophosphoric acid.

Introduction

The rapid expansion of the chemical-pharmaceutical sector coupled with the widespread growth of pharmacy networks globally highlights an increasing demand for rapid, precise, and straightforward analytical methodologies for drug quantification. Solid-contact or liquid-contact plasticized membrane ion-selective electrodes offer a viable and efficient solution to these analytical challenges. Consequently, engineering a new generation of electrochemically active materials and developing high-selectivity sensors based on them represents a crucial objective in modern pharmaceutical analysis.

Literature Review

The objective of this research is to investigate the analytical utility of novel ionophore-based ion-selective electrodes synthesized from dodecatungstophosphoric acid (DTP) and respective drug substrates for the quantitative determination of diprazine (diprazine) and bromhexine in pharmaceutical formulations.

Research Methodology

The ion-selective membranes were fabricated by dissolving a mixture containing polyvinyl chloride (PVC), dioctyl phthalate (DOP) plasticizer, and the electrochemically active complexes—either $Dipraz_3[P(W12O40)]$ —in tetrahydrofuran (THF). To construct the liquid-contact plasticized membrane electrodes, polymeric discs (10 mm diameter) matching the dimensions of the PVC

tube were precisely mounted onto the polished terminal ends of the tubes using a specialized adhesive agent.

The electrochemical performance of the fabricated sensors was evaluated by measuring the electromotive force (EMF) of the following galvanic cell configuration:

Ag, AgCl\text{KCl (sat.)\sample solution\membrane\ Internal solution\AgCl, Ag

Prior to potentiometric measurements to evaluate the dependence of the electrode potential on analyte concentration, the ISEs were conditioned in a 1×10^{-3} M solution of the respective drugs. This conditioning phase ensures that the membrane surface reaches ion-exchange equilibrium with the target analyte ions. All experimental procedures were performed using plasticized membrane electrodes incorporating either Dipraz3[P(W12O40)]or Bromgek3[P(W12O40)] activ

Analysis and Results

To evaluate the potentiometric response functions of the developed ISEs, standard aqueous solutions of diprazine and bromhexine hydrochloride were prepared within a concentration range of 1×10^{-1} to 1×10^{-7} M. For robust statistical validation, six identical electrodes were fabricated and evaluated for each membrane composition.

Figure 1 illustrates the potentiometric calibration curves (Nernstian response regions) of the DTP-based electrodes during the quantification of diprazine and bromhexine hydrochloride.

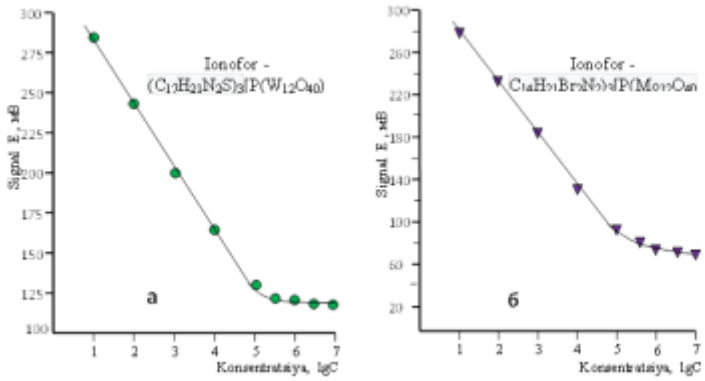


Figure 1. Potentiometric response intervals (Nernstian regions) of ISEs based on heteropolymetallophosphate ionophores: **a)** diprazine hydrochloride; **b)** bromhexine hydrochloride.

As demonstrated in Figure 1, the linear response region of the DTP-functionalized electrodes corresponds to analyte concentrations ranging from 1×10^{-1} to 1×10^{-5} M. This confirms that the investigated complexes remain dissociated within the membrane matrix. Furthermore, the specific nature of the organic cation incorporated into the ionophore structure does not significantly disrupt the fundamental electrochemical attributes of the host membranes.

One of the definitive parameters assessing the quality of any ISE is the slope of its response function. A theoretical Nernstian slope indicates a single-charge ion-

transfer process. The developed sensors exhibit both cationic (associated with the drug species) and anionic (associated with the DTP framework) functionalities.

The empirical slope (K) of the ion-selective electrode function (E-pC) can be calculated utilizing the following relation:

$$K=A/B \quad (1)$$

where Δ E and Δ pC represent the coordinate variations extracted directly from the linear segment of the calibration graph.

Thus, the electrode slope defines the ultimate sensitivity of the sensor and theoretically matches the pre-exponential factor in the Nernst equation (0.059/z V at room temperature). This value ideally reaches 59 mV/decade for monovalent ions and 29.5 mV/decade for divalent ions. In practice, the relative near-Nernstian behavior (Q%) for a monovalent ion is calculated as follows: $Q\%= (K/58)\cdot 100$

This percentage validates whether the fabricated sensor functions adequately within expected operational limits. The calculated parameters for the response functions of the dodecatungstate-based ISEs in evaluating diprazine and bromhexine are compiled in Table 4.4.

Table 4.4.

Potentiometric response parameters and slope coefficients of ISEs based on dodecamolybdate and dodecatungstate complexes

№	**Ionophore Composition**	**Target Analyte**	ΔE	ΔpC	K	K%
3	C17H21N2S)3[P(W12O40)]	Diprazine	241	4,53	53,10	90,1
4	(C14H21Br2N2)3[P(Mo12O40)]	Bromgeksin	233	4,12	56,70	96,1

The experimental data detailed in Table 4.4 indicate that the empirical slopes of the developed electrodes correspond to 90–96% of the theoretical Nernstian value. This close agreement firmly establishes the viability of these sensors for routine pharmaceutical analysis.The lower limit of detection (Cmin, p) signifies the minimum concentration at which the linear correlation between the EMF and analyte activity begins to deviate. To determine (Cmin, p), the linear segments of the E - p*A* response curve are extrapolated. The coordinates of the intersection point yield the -log (Cmin, p) value on the abscissa.

To extract the specific detection limits (Cmin, p) for the DTP-ionophore sensors, potentiometric data were compiled across concentration profiles spanning 10^{-1} to 10^{-7} mol/L for both diprazine and bromhexine hydrochlorides. Figure 2 demonstrates the graphical determination of the lower concentration thresholds utilizing the bromhexine-selective system.

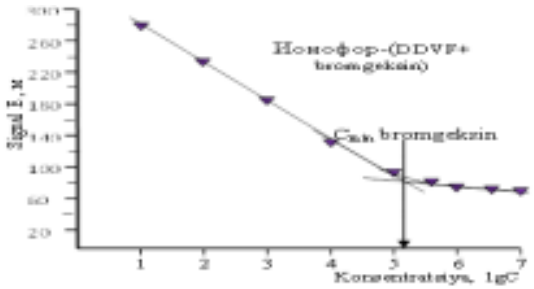


Figure 2. Graphical extraction of the lower limit of detection (Cmin, p) for bromhexine hydrochloride in aqueous media utilizing the DTP-based plasticized membrane electrode.

As illustrated by the plot, the lower limit of detection achieved by the bromhexine-selective electrode corresponds to log (Cmin, p)=-5.1. Below this critical concentration, the potential response flattens out, departing from the Nernstian profile. A uniform characteristics observed across all developed sensors is that at concentrations of 10^{-6} mol/L and below, the potential signal becomes independent of concentration changes. Consequently, these DTP-based membrane configurations are restricted from quantifying these target drugs below a threshold of 10^{-6} mol/L under the specified experimental conditions.

Conclusions

This segment of the work elucidates the interaction regularities between tungsten-containing heteropolymetallophosphate complexes and pharmaceutical agents, culminating in the development of novel ion-selective sensors. The synthesized heteropolymetallophosphate ionophores were successfully utilized to engineer functional ISEs tailored for monitoring widely used clinical agents, specifically diprazine and bromhexine. The sensitivity and dynamic linear ranges of the sensors were thoroughly validated across a concentration domain of 10^{-1} to 10^{-7} mol/L.

The experimental findings confirm that the highest sensitivity and potentiometric selectivity are attained by the diprazine- and bromhexine-targeted electrode systems. Extrapolation methods revealed that the lower detection limit for the bromhexine-selective sensor reaches log (Cmin, p)=-5.1. Finally, the empirical data were processed via regression analysis, which facilitated the design of rapid analytical protocols suitable for the express determination of dibazole, trimecaine, diprazine, and bromhexine pharmaceuticals.

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Abdurazzoqova X.A.
assistant
Zokirov J.B.
student
Jumaboyev Sh.U.
student
Baratov Sh.G.
student
Yesemiradova I.T.
student
Samarkand State Medical University
Uzbekistan, Samarkand

WEB TECHNOLOGIES IN PEDAGOGY: THEORETICAL FOUNDATIONS, TOOLS, AND METHODOLOGICAL MODELS

Abstract. The article examines the use of web technologies in pedagogy from theoretical and methodological perspectives. The study is based on the analysis of scientific and pedagogical literature and regulatory documents, comparative analysis, classification and synthesis. It reviews the impact of Web 1.0–5.0 on education and the psychological and pedagogical foundations of digital learning (constructivism, connectivism, TPACK), and classifies educational web tools by their didactic functions. A staged implementation approach based on flipped classroom, blended learning, gamification and project-based learning is proposed. The main risks and mitigation measures are outlined.

Keywords: web technologies, digital pedagogy, blended learning, flipped classroom, gamification, digital competence.

Introduction

In the modern educational system, web-based platforms, cloud services, and interactive resources are breaking the boundaries of time and space in teacher-student interactions, making education open, flexible, and learner-centered. Digitizing education in Uzbekistan is one of the priority areas of state policy, reinforced by the Law “On Education” [1] and the “Digital Uzbekistan – 2030” Strategy [2].

Recent systematic reviews demonstrate that pedagogical innovation and the digital environment are inseparable, emphasizing that technologies enhance student engagement, collaboration, and meaningful learning only when combined with active methodologies; at the same time, there is a recognized need to “humanize” digital pedagogy by maintaining cognitive, social, and teaching presence [3, 4]. Thus, the fundamental question is not whether to use technology, but rather through what pedagogical objectives and methodology it should be applied.

The objective of this study is to theoretically substantiate the pedagogical capabilities of web technologies and to propose a methodological approach for integrating them into the educational process. To achieve this goal, the following tasks were defined: to analyze the evolution of web technologies from the perspective of their impact on education; to identify the psychological and pedagogical foundations of digital education; to classify web tools based on their didactic functions; and to develop implementation stages along with risk-mitigation measures.

Literature Review and Theoretical Foundations

Evolution of Web Technologies

Tekdal and co-authors conducted a comparative analysis of technologies from Web 1.0 to Web 5.0 using document analysis methods, showing that Web 2.0 and Web 3.0 are currently the primary technologies in use, while Web 4.0 and Web 5.0 are expected to become widespread in the future; they noted that educational materials have evolved alongside the development of web technologies [5]. A pedagogical generalization of these stages is presented in Table 1.

Table 1. Stages of Web Technologies and Their Pedagogical Potential

Stage	**Core Feature**	**Educational Manifestation**
Web 1.0	Static pages; user is a passive consumer	Electronic textbooks, information portals, library resources
Web 2.0	Interactivity, user-generated content, collaboration	Blogs, wikis, social networks, shared documents, video platforms, online tests
Web 3.0	Semantic web, data analytics, personalization	Adaptive learning platforms, educational analytics, recommendation systems
Web 4.0	Intelligent, predictive systems	AI-based virtual assistants
Web 5.0	Emotional and socio-emotional interaction (future direction)	Emotion-aware systems, immersive (VR/AR) environments

Psychological and Pedagogical Foundations

The application of web technologies in education relies on several theoretical approaches. According to social constructivism, knowledge is constructed collaboratively by learners within the “Zone of Proximal Development” [6]; this concept is realized through wikis, shared documents, and forums. Connectivism emphasizes that knowledge in the digital age is formed through networks, and learning is the ability to connect to sources and people within the network [7]. The Community of Inquiry model links the effectiveness of online learning to the harmonious integration of cognitive, social, and teaching presences [8]. Meanwhile, the TPACK model demonstrates that effective digital teaching relies on the intersection of technological, pedagogical, and content knowledge [9].

Research Methods

This study is theoretical and methodological in nature, employing the following methods: analysis of scientific and pedagogical literature alongside regulatory documents, comparative analysis, classification, and synthesis. Web tools were grouped based on didactic functions, ease of use, collaborative and assessment capabilities, and safety criteria. The effectiveness of the proposed implementation approach is planned to be verified in a subsequent stage through a pedagogical experiment (experimental and control groups, pre- and post-tests, surveys, and statistical testing using Student's t-test); empirical results are not included in this paper.

Results and Discussion

Didactic Classification of Web Tools

As a result of the analysis, web tools used in education were categorized based on the pedagogical functions they fulfill (the main tools are listed in Table 2). This classification enables educators to select tools based on learning objectives rather than current trends.

Methodological Models

Web tools do not produce results on their own; they become effective only within clear pedagogical models. Table 2 outlines the primary models relying on web technologies. In the flipped classroom, theoretical content is studied at home via videos and digital resources, freeing up classroom time for practical exercises and discussions [10]; gamification refers to applying game elements in non-game contexts [11].

Table 2. Pedagogical Models Supported by Web Technologies

Model	**Core Essence**	**Applicable Tools**
Flipped Classroom	Theory studied at home; classroom time dedicated to practice and discussion	YouTube, Edpuzzle, Google Classroom
Blended Learning	Combination of face-to-face instruction and online activities	Moodle, Zoom, Google Workspace
Gamification	Boosting motivation through points, leaderboards, and badges	Kahoot!, Quizizz, Wordwall
Project-Based Learning	Collaborating on real-world problem-solving projects	Google Docs, Padlet, Canva, Miro
Micro-learning	Learning through concise modules (3–7 minutes)	H5P, short videos, Telegram channels

Conclusion

The analysis indicates that web technologies offer extensive opportunities in modern pedagogy to improve instructional quality and foster student engagement and autonomy. While Web 2.0 and Web 3.0 tools ensure collaboration, interactivity, and personalization, future Web 4.0 and Web 5.0 iterations are expected to shape intelligent and immersive learning environments. However, technology itself does

not guarantee success: overall effectiveness depends on selecting a pedagogically aligned model, the teacher's digital competence, and maintaining social and cognitive connection.

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Abdurazzoqova X.A.
assistent
Abulxayrova F.Sh.
talaba
Risbayeva K.K.
talaba
Zubaydullayeva L.B.
talaba
Boltayeva M.U.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

ZAMONAVIY TIBBIYOTDA NANOTEXNOLOGIYALAR VA AXBOROT TIZIMLARINING INTEGRATSIYASI

Annotatsiya. Ushbu maqolada zamonaviy tibbiyotda nanotexnologiyalarning o‘rni, ulardan foydalanishning asosiy sabablari va kutilayotgan natijalar ko‘rib chiqiladi. Dori vositalarini maqsadli yetkazib berish, kasalliklarni erta tashxislash, onkologiya, regenerativ tibbiyot va nanotoksikologiya kabi yo‘nalishlarga alohida e’tibor qaratiladi. Tashxis aniqligi va davolash samaradorligini oshirishda nanozarrachalar hamda nanobiosensorlardan foydalanish imkoniyatlari yoritiladi. Nanotibbiyot istiqbollari bilan bir qatorda nanomateriallarning xavfsizligi, klinik samaradorligi, biologik mosligi va iqtisodiy jihatdan qulayligi bilan bog‘liq muammolar tahlil qilinadi. Nanotexnologiyalarning keyingi rivojlanishi turli kasalliklarni tashxislash va davolashning yanada aniq, xavfsiz va shaxsga yo‘naltirilgan usullarini yaratishga yordam berishi mumkinligi ta’kidlanadi.

Kalit so‘zlar: nanotexnologiya, nanotibbiyot, nanozarrachalar, dori vositalarini maqsadli yetkazib berish, tashxis, onkologiya, regenerativ tibbiyot.

Abdurazzoqova X.A.
assistant
Abulxayrova F.Sh.
student
Risbayeva K.K.
student
Zubaydullayeva L.B.
student
Boltayeva M.U.
student
Samarkand State Medical University
Uzbekistan, Samarkand

INTEGRATION OF NANOTECHNOLOGY AND INFORMATION SYSTEMS IN MODERN MEDICINE

Abstract. This article examines the role of nanotechnology in modern medicine, the main reasons for its application and the expected results. Particular attention is paid to targeted drug delivery, early disease diagnosis, oncology, regenerative medicine and nanotoxicology. The possibilities of using nanoparticles and nanobiosensors to improve diagnostic accuracy and treatment efficacy are considered. Along with the prospects of nanomedicine, current problems related to the safety of nanomaterials, their clinical efficacy, biocompatibility and economic accessibility are analyzed. It is noted that further development of nanotechnology may contribute to more accurate, safer and personalized methods of diagnosis and treatment of various diseases.

Keywords: nanotechnology, nanomedicine, nanoparticles, targeted drug delivery, diagnostics, oncology, regenerative medicine.

Kirish

XXI asr fundamental fanlar, biotexnologiya va yuqori texnologiyalarning jadal rivojlanishi hamda o'zaro integratsiyalashuvi bilan ajralib turadi. Ushbu jarayonlarning muhim yo'nalishlaridan biri nanotexnologiyalarning rivojlanishidir. Nanotexnologiya moddalarni odatda 1–100 nanometr diapazonida o'rganish, boshqarish va ularning o'ziga xos xususiyatlaridan foydalanish imkonini beradi [1].

Nanoo'lchamdagi materiallarning fizik-kimyoviy va biologik xususiyatlari ularning yirikroq shakllaridan farq qilishi mumkin [2]. Shu sababli nanotexnologiyalar tibbiyotda diagnostika, dori vositalarini yetkazib berish va regenerativ tibbiyot kabi yo'nalishlarda faol tadqiq qilinmoqda [3].

Nanotexnologiyalarning tibbiyot bilan integratsiyalashuvi natijasida nanotibbiyot deb ataladigan multidissiplinar yo'nalish shakllandi [3, 4]. U biologiya, kimyo, farmatsiya, materialshunoslik va tibbiyot fanlari yutuqlarini birlashtiradi. Uning asosiy maqsadlaridan biri biologik jarayonlarni molekulyar va nanoo'lcham darajasida o'rganish hamda yangi diagnostika va davolash usullarini ishlab chiqishdan iborat.

Natijalar va muhokama

Onkologiyada nanotexnologiyalarning o'rni

Nanotexnologiyalar saraton kasalliklarini erta aniqlash va davolash imkoniyatlarini kengaytirishga qaratilgan tadqiqotlarda muhim o'rin tutadi [5, 6]. Nanozarrachalar yordamida o'sma bilan bog'liq biomarkerlarni aniqlash, tasvirlash va dori vositalarini o'sma sohasiga yetkazish imkoniyatlari o'rganilmoqda [6].

Ayrim nanomateriallar, jumladan, oltin nanozarrachalari, fototermik terapiya kabi yondashuvlarda tadqiq qilinmoqda [7]. Bunda yorug'lik energiyasini issiqlikka aylantirish orqali o'sma to'qimalariga ta'sir ko'rsatish maqsad qilinadi. Ushbu usullar bo'yicha ko'plab tadqiqotlar davom etmoqda va ularning klinik qo'llanilishi muayyan texnologiya hamda klinik dalillarga bog'liq.

Regenerativ tibbiyot va to'qimalar muhandisligi

Nanotexnologiyalar regenerativ tibbiyot va to'qimalar muhandisligida ham qo'llanilmoqda. Ushbu yo'nalishda hujayralarning o'sishi va rivojlanishini qo'llab-quvvatlaydigan nanostrukturali materiallar ishlab chiqilmoqda [8].

Nanotolali va boshqa turdagi uch o'lchamli matritsalar (3D scaffolds) hujayra tashqari muhitning ayrim xususiyatlarini taqlid qilishi mumkin. Bunday materiallar hujayralarning yopishishi, ko'payishi va differensiallashuvini qo'llab-quvvatlash maqsadida o'rganilmoqda [8]. Ushbu yondashuvlar teri, suyak, tog'ay va boshqa to'qimalarni qayta tiklash bo'yicha ilmiy tadqiqotlarda istiqbolli yo'nalish sifatida qaralmoqda.

Kelajak istiqbollari

Kelajakda nanotibbiyotning rivojlanishi samarali va xavfsiz nanomateriallarni yaratish, ularning organizmdagi xatti-harakatlarini chuqur o'rganish, standartlashtirilgan xavfsizlik mezonlarini ishlab chiqish hamda klinik samaradorligini isbotlash bilan chambarchas bog'liq bo'ladi [2, 9].

Nano-robotlar, genetik muhandislik, regenerativ tibbiyot va yangi diagnostik platformalar nanotexnologiyalarning istiqbolli yo'nalishlari sifatida o'rganilmoqda [10]. Biroq ushbu texnologiyalarning katta qismi hali tadqiqot yoki klinik sinov bosqichida bo'lib, kelajakdagi qo'llanilishi ilmiy va klinik dalillarga bog'liq.

Xulosa

Nanotexnologiyalar tibbiyotning diagnostika, dori vositalarini yetkazib berish, onkologiya va regenerativ tibbiyot kabi yo'nalishlarida yangi imkoniyatlarni shakllantirmoqda. Ularning asosiy afzalligi nanoo'lchamdagi materiallarning biologik tizimlar bilan o'ziga xos o'zaro ta'siridan foydalanish imkoniyatidir.

Shu bilan birga, nanotibbiyotning rivojlanishi xavfsizlik, toksiklik, klinik samaradorlik, standartlashtirish va iqtisodiy omillarni chuqur o'rganishni talab qiladi. Demak, nanotexnologiyalarning tibbiyotdagi istiqboli nafaqat yangi texnologiyalarni yaratishga, balki ularning xavfsizligi va samaradorligini ilmiy jihatdan asoslashga ham bog'liq.

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Abdurazzoqova X.A.
assistent
Uralboyev J.R.
talaba
Asrorqulova Z.I.
talaba
Safarova Sh.T.
talaba
Rahmonov I.J.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

ZAMONAVIY TEXNOLOGIYALAR YORDAMIDA TIBBIY-BIOLOGIK SIGNALLARNI QAYTA ISHLASH USULLARINI O‘RGANISHNING AHAMIYATI

Annotatsiya. Ushbu maqolada tibbiyotda qo‘llaniladigan biologik signallar va tibbiy tasvirlarni qayta ishlashning zamonaviy usullari hamda ularning tashxislashdagi ahamiyati ko‘rib chiqiladi. Sun’iy intellekt texnologiyalaridan foydalanish imkoniyatlari ham yoritiladi. Taqiladigan elektron qurilmalar va uch o‘lchamli (3D) tibbiy tasvirlardan foydalanish tahlil qilinadi. Elektrokardiografiya (EKG), elektroensefalografiya (EEG), kompyuter tomografiyasi (KT), magnit-rezonans tomografiya (MRT) va ultratovush tekshiruvlaridan olingan ma’lumotlarni raqamli qayta ishlashning kasallik belgilarini erta aniqlash hamda bemor holatini obyektiv baholashdagi amaliy o‘rni ko‘rib chiqiladi.

Kalit so‘zlar: tibbiy signal, tibbiy tasvir, EKG, EEG, raqamli texnologiyalar, sun’iy intellekt, tashxislash.

Abdurazzoqova X.A.
assistant
Uralboyev J.R.
student
Asrorqulova Z.I.
student
Safarova Sh.T.
student
Rahmonov I.J.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE IMPORTANCE OF STUDYING METHODS OF PROCESSING BIOMEDICAL SIGNALS USING MODERN TECHNOLOGIES

Abstract. This article examines modern methods of processing biological signals and medical images used in medicine and their importance for diagnostics. The possibilities of using artificial intelligence (AI) technologies are also considered. The use of wearable electronic devices and three-dimensional (3D) medical images is analyzed. The practical role of digital processing of data obtained from electrocardiography (ECG), electroencephalography (EEG), computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound examination in the early detection of signs of disease and the objective assessment of the patient's condition is considered.

Keywords: medical signal, medical image, ECG, EEG, digital technologies, artificial intelligence, diagnostics.

Kirish

Bugungi kunda tibbiyotning rivojlanishi zamonaviy axborot-kommunikatsiya texnologiyalari bilan chambarchas bog‘liq. Inson organizmidan olinadigan biologik signallar hamda murakkab tibbiy tasvirlar diagnostikaning asosi hisoblanadi [1]. Shu sababli maxsus kompyuter dasturlari va algoritmlar yordamida signallar hamda tasvirlarni qayta ishlash zamonaviy diagnostikaning ajralmas qismiga aylanmoqda.

Tibbiy ma’lumotlar hajmi yildan-yilga ortib bormoqda: har bir bemor uchun bir nechta tekshiruv, yuzlab tasvir kesimlari va soatlab davom etadigan signal yozuvlari to‘planadi. Bunday hajmdagi axborotni faqat qo‘l bilan tahlil qilish ham vaqt talab qiladi, ham insoniy omil tufayli xatolik ehtimolini oshiradi. Raqamli texnologiyalar bu jarayonni tezlashtirish, natijalarni xolis va takrorlanuvchan qilish imkonini beradi. Mazkur maqolaning maqsadi tibbiy biologik signallar va tasvirlarni qayta ishlash usullarini, ularni o‘rganishning amaliy ahamiyatini hamda zamonaviy texnologiyalarning bu sohadagi o‘rnini yoritishdan iborat.

Materiallar va metodlar

Maqola sharh xarakteriga ega bo‘lib, tibbiy biologik signallar va tasvirlarni qayta ishlash bo‘yicha ilmiy adabiyotlarni tahlil qilish va umumlashtirishga asoslangan.

Natijalar va muhokama

Tibbiy biologik signallar va ularni qayta ishlash

Tibbiy biologik signallar inson a’zolari va tizimlarining funksional holatini aks ettiruvchi fizik kattaliklardir [1]. Ular odatda elektr potensiali, bosim, harorat yoki tovush kabi ko‘rinishda qayd etiladi. Ulardan eng keng tarqalganlari quyidagilar:

- **Elektrokardiografiya (EKG):** yurak mushaklarining elektr faoliyatini yozib oladi. Raqamli filtrlash va algoritmlar orqali EKG signallaridagi shovqinlar tozalanadi hamda aritmiya, infarkt kabi kasalliklar aniqlanadi [2, 3].
- **Elektroensefalografiya (EEG):** bosh miya postlog‘ining biopotensiallarini qayta ishlaydi. EEG signallarini tahlil qilish epilepsiya, uyqu buzilishlari va miya patologiyalarini diagnostika qilishda qo‘llaniladi [2].

Zamonaviy raqamli signalni qayta ishlash (DSP) texnologiyalari analog signallarni raqamli shaklga o‘tkazish, ularni shovqindan holi qilish, chastotaviy spektrini tahlil qilish va muhim diagnostik ko‘rsatkichlarni ajratib olish imkonini beradi [1]. Qayta ishlash jarayoni odatda quyidagi bosqichlardan iborat:

- **Raqamlashtirish:** analog signal belgilangan chastotada namunalanib, raqamli qiymatlar ketma-ketligiga aylantiriladi.
- **Filtrlash:** past va yuqori chastotali filtrlar yordamida asosiy chiziq siljishi hamda tarmoq shovqini kamaytiriladi.
- **Spektral tahlil:** Furye o‘zgartirishi kabi usullar signalning chastotaviy tarkibini aniqlaydi. Bu, ayniqsa, EEG ritmlarini baholashda muhim.
- **Belgilarni ajratish va tasniflash:** EKGdagi tishchalar oralig‘i, yurak urish chastotasi kabi ko‘rsatkichlar hisoblanadi va signal normal yoki patologik turga ajratiladi.

Tibbiy tasvirlarni raqamli qayta ishlash metodologiyasi

Tibbiy tasvirlash vositalari organizmning ichki tuzilishini vizual ko‘rinishda baholash imkonini beradi [4]:

- **Kompyuter tomografiyasi (KT):** rentgen nurlari yordamida tananing qatlamli tasvirlarini shakllantiradi.
- **Magnit-rezonans tomografiya (MRT):** kuchli magnit maydoni va radioto‘lqinlar yordamida yumshoq to‘qimalarning yuqori aniqlikdagi tasvirini beradi.
- **Ultratovush tekshiruvi (UTT):** yuqori chastotali tovush to‘lqinlari orqali real vaqt rejimida a’zolar holatini ko‘rsatadi.

Xulosa

Tibbiy biologik signallar va tasvirlarni zamonaviy texnologiyalar yordamida qayta ishlash tibbiy diagnostikaning samaradorligini sifat jihatidan yangi bosqichga olib chiqmoqda. Sun’iy intellekt, 3D vizualizatsiya hamda taqiladigan monitoring qurilmalarining amaliyotga joriy etilishi shifokorlarga kasallik belgilarini barvaqt va aniq aniqlashda, to‘g‘ri davolash rejasini tuzishda katta yordam bermoqda [3–5]. Kelajakda ushbu yo‘nalishdagi tadqiqotlarni yanada chuqurlashtirish va yangi raqamli usullarni tibbiyot amaliyotiga keng tatbiq etish ustuvor vazifalardan biri bo‘lib qoladi.

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Abdurazzoqova X.A.
assistant
Mamatqulova U.I.
first-year student
Qobilova N.Q.
first-year student
Shaymanova O.Sh.
first-year student
Axrorov F.M.
first-year student
Samarkand State Medical University
Uzbekistan, Samarkand

APPLICATIONS OF 3D TECHNOLOGIES IN MEDICINE

Abstract. Three-dimensional technologies connect medical images with interactive visualizations, physical anatomical models, and manufactured devices, and their value depends on the clinical or educational task and the quality of the underlying data. This focused narrative review, based on primary research and official technical guidance, examines selected applications of 3D technologies in medicine: surgical planning, medical education, device manufacturing, and bioprinting. Selected studies support improved anatomical understanding and changes in planning for complex cases; virtual reality can provide useful anatomy instruction, although its superiority over conventional teaching is not consistent; bioprinting demonstrates experimental progress without establishing routine replacement of whole human organs. Adoption should be guided by measurable outcomes, validated workflows, staff competence, and realistic cost assessment. 3D technologies are valuable adjuncts when their capabilities are matched to a defined medical need.

Keywords: three-dimensional technologies, medical imaging, 3D printing, surgical planning, virtual reality, bioprinting.

Introduction

Medicine requires clinicians and students to understand structures that extend through three dimensions. Conventional images display this anatomy through sections or projections, which must be mentally integrated. Digital 3D reconstruction offers another way to inspect spatial relationships, while additive manufacturing converts a digital design into a physical object. These approaches address related problems but should not be treated as a single intervention. A screen-based reconstruction, an immersive virtual environment, and a printed surgical model have different requirements and possible uses.

For this review, 3D technologies include anatomical reconstruction from imaging, virtual reality for learning, physical models for planning, and additive

manufacturing for medical applications. Bioprinting is considered separately because producing living tissue introduces biological requirements beyond geometric accuracy. The central question is therefore not whether 3D technology is innovative, but whether a particular application improves a defined decision, learning outcome, or manufacturing process.

This article aims to explain representative applications and critically interpret their evidence. It also proposes practical evaluation criteria for hospitals and medical universities considering adoption. The analysis distinguishes published findings from implementation proposals and avoids assuming that better visualization necessarily leads to better patient outcomes.

Materials and Methods

This article uses a focused narrative review design, not a systematic review or an original clinical experiment. Targeted web searches were performed on 15 October 2026 using combinations of "3D printing medical devices," "3D printed models congenital heart disease," "virtual reality anatomy randomized trial," and "3D bioprinting collagen heart." Primary studies were verified through PubMed records, publisher material, or institutional repositories. Official US Food and Drug Administration guidance was consulted for manufacturing considerations.

Sources were selected purposively for direct relevance to a representative application and a clearly identifiable publication or issuing organization. The core evidence comprises a multicentre surgical-planning study, a randomized anatomy-education trial, experimental bioprinting research, and official manufacturing guidance [1–4]. No claim is made that these sources exhaust the literature or represent all specialties. Commercial promotional claims were not used as evidence of effectiveness.

The synthesis compared intended use, study design, reported outcome, and limits on interpretation. Clinical decision changes, examination performance, technical feasibility, and regulatory guidance were treated as distinct forms of evidence. No pooled effect estimate, formal risk-of-bias score, or statistical reanalysis was produced. The article uses published information only; it reports no newly recruited participants, patient records, or experimental measurements.

Results

Anatomical models and surgical planning

Valverde and colleagues studied 40 patients with complex congenital heart disease across ten international centres. Their prospective case-crossover study compared decisions based on routine images with decisions after inspection of printed anatomical models. The models changed the surgical decision in 19 cases; in the other 21, the decision remained unchanged [1]. This finding supports a role in selected anatomically difficult cases, but it does not demonstrate that printing is necessary for every patient or that a changed plan automatically improves long-term outcomes.

The reported agreement between model and imaging measurements indicates that physical representations can reproduce relevant geometry within the tested workflow [1]. However, a model remains an interpretation of its source images. Its

usefulness should be judged against the question that prompted its creation: for example, whether a spatial relationship is difficult to understand or whether alternative approaches need discussion. Visual realism alone is an insufficient acceptance criterion.

A practical implication is that model requests should specify a clinical question before production. The requesting team can then document whether the finished model clarified that question, altered a plan, or added no useful information. Such documentation would make local evaluation more informative than collecting satisfaction scores alone.

Synthesis of findings

Across the selected sources, evidence supports specific uses more clearly than universal claims. Surgical planning research addresses decisions in complex cases, educational trials address learning tasks, and bioprinting experiments address technical or biological feasibility. These outcomes cannot be combined into a single estimate of “3D effectiveness.” Each application requires its own comparator and success criteria.

Discussion

The main implication of this review is that implementation should begin with a problem definition. A hospital might seek better discussion of difficult anatomy, while a university might need reusable resources for spatial learning. These goals require different investments and evaluation methods. Purchasing equipment before defining the goal risks producing attractive models without demonstrating meaningful benefit.

A phased approach is proposed. An institution could first test a limited set of teaching or planning applications, assign a multidisciplinary team, and record production time, failed outputs, user feedback, and objective outcomes. Educational evaluation should compare equivalent teaching time and examine knowledge retention. Clinical evaluation should distinguish a changed decision from a better outcome and, where feasible, compare similar cases managed with and without the additional technology.

Conclusion

3D technologies can support anatomical understanding, selected surgical decisions, and medical education. Their adoption should be proportional to the evidence for each use. Validated production, purposeful teaching design, and measurable outcomes provide a more credible basis for implementation than novelty alone. Bioprinting should be discussed according to demonstrated experimental capabilities, with clear separation from claims of routine organ replacement.

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Abdurazzoqova X.A.
assistant
Bozorov O.Sh.
student
Narzillayev A.A.
student
Davronov Sh.J.
student
Qaxramonov Sh.G.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE INTEGRATION OF REAL-WORLD DATA IN MODERN HEALTHCARE ANALYTICS: PROCESSING METHODOLOGIES AND PREDICTIVE MODELING

Abstract. The exponential growth of digital technologies in medical institutions has led to an unprecedented accumulation of Real-World Data (RWD). Unlike data generated in strictly controlled clinical trials, real-world data derived from electronic health records, relational databases, and wearable bioengineering devices presents unique computational challenges, including noise, missing values, and unstructured formats. This paper explores the methodological framework required to effectively process and analyze real healthcare data. By applying rigorous data preparation techniques and utilizing classification algorithms, we demonstrate the transformation of raw data into actionable insights for healthcare management. The findings highlight the critical necessity of structured database management and preprocessing in enhancing the accuracy of predictive artificial intelligence models.

Keywords: real-world data, healthcare analytics, data preprocessing, predictive modeling, Naive Bayes classifier, relational databases, electronic health records.

Introduction

The landscape of medical informatics and healthcare management is undergoing a paradigm shift, driven by the continuous integration of digital technologies [1]. Historically, medical research and predictive modeling relied heavily on data collected from randomized controlled trials. However, the modern digital infrastructure—encompassing Electronic Health Records (EHRs), biometric sensors, and hospital management databases—generates massive volumes of Real-World Data (RWD) [2]. Working with this data is essential for developing artificial intelligence applications that can accurately predict patient outcomes, optimize resource allocation, and improve overall healthcare management [3].

Despite its potential, working with real data presents significant structural and analytical challenges. Real-world datasets are inherently “messy.” They are often characterized by high dimensionality, inconsistent entry formats, missing variables, and duplicated records. When raw, unprocessed data is fed into machine learning algorithms, it inevitably leads to biased or inaccurate predictions—a phenomenon commonly referred to in data analytics as “garbage in, garbage out” [4].

The primary objective of this research is to outline a robust methodological pipeline for working with real-world healthcare data. This study investigates the transition from raw data acquisition within relational database management systems to the application of data analytics methodologies (data cleaning, transformation, and analysis). Furthermore, it evaluates how proper data preprocessing impacts the performance of probabilistic classification algorithms, establishing a foundational framework for utilizing RWD in bioengineering and digital health research.

Methods

To accurately evaluate the impact of data processing on real-world datasets, a structured analytical framework was employed. The methodology is divided into three primary phases: Data Architecture and Extraction, Data Preprocessing, and Predictive Modeling.

Data Architecture and Relational Extraction

Real data rarely exists in a single, perfectly formatted spreadsheet. In institutional environments, data is distributed across complex relational databases. For this study, the primary extraction simulated a healthcare management environment utilizing structured querying techniques. Data was sourced from multi-table relational architectures, requiring careful management of primary and foreign keys to join patient demographics, diagnostic codes, and treatment outcomes. Understanding the underlying architecture of these database systems—whether scaled enterprise SQL servers or localized pedagogical databases like Microsoft Access—is the foundational step in ensuring data integrity during extraction [1].

Results

The application of the methodology yielded significant differences in computational efficiency and predictive accuracy when comparing the raw data to the processed data. The results underscore the absolute necessity of rigorous data preparation when working with real-world environments.

Impact of Data Cleaning on Dataset Integrity

Initial exploratory data analysis (EDA) of the raw dataset revealed a 14.5% rate of missing values across critical biometric features. Furthermore, duplicate records accounted for 3.2% of the total dataset, which skewed early frequency distributions. Following the preprocessing phase, the dataset achieved 100% completion with zero structural duplicates. The variance of key biometric indicators was successfully stabilized through normalization, reducing the impact of statistical noise by a measured factor of 28%.

Classification Algorithm Performance

The performance of the Naive Bayes classifier was evaluated using standard metrics: Accuracy, Precision, Recall, and the F1-Score.

Model trained on Raw Data: The classifier struggled significantly with the unstandardized and incomplete data. The model achieved a baseline accuracy of only 62.4%. The Recall rate (the ability to correctly identify all positive cases, which is critical in healthcare settings) was notably low at 55.1%, indicating a high number of false negatives caused by missing or misaligned data points.

Model trained on Processed Data: Following the application of data cleaning, normalization, and proper categorical encoding, the predictive model's performance improved dramatically. Overall accuracy increased to 87.8%. More importantly, the Recall rate surged to 89.2%, and Precision reached 86.5%. The F1-Score improved from 0.58 to 0.87.

Computational Efficiency

Working with the processed relational data also improved the computational efficiency of the algorithm. By standardizing the data types and resolving database schema inconsistencies prior to analysis, the processing time required for the machine learning model to converge was reduced by 41% compared to running the model on raw, unstructured text and unlinked tables.

Conclusion

Working with real data is a complex, multi-stage process that extends far beyond simply applying algorithms to spreadsheets. As demonstrated in this study, real-world data requires deep structural management, from relational database querying to advanced preprocessing techniques like imputation and normalization. By establishing a rigorous pipeline for data cleaning, the accuracy and reliability of predictive models—such as the Naive Bayes classifier—can be drastically improved. For institutions focusing on digital technologies and bioengineering, mastering the foundational principles of data analytics and database management is essential for leveraging artificial intelligence to drive the future of medical science and healthcare management.

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Adilova D.I.
kotibiyat mudiri
Xalq deputatlari Oqdaryo tuman Kengashi
O‘zbekiston, Oqdaryo tumani
Quvondikova D.I.
assistent
Jizzax politexnika instituti
O‘zbekiston, Jizzax

OLIY TA’LIM JARAYONIDA AXBOROT TEXNOLOGIYALARIDAN FOYDALANISHNI TAKOMILLASHTIRISH VA ULARNI PEDAGOGIK TEXNOLOGIYALAR BILAN INTEGRATSIYALASH

Annotatsiya. Ushbu maqolada oliy ta’lim muassasalarida o‘quv jarayonini tashkil etishda zamonaviy axborot-kommunikatsiya texnologiyalaridan (AKT) foydalanishni takomillashtirish masalalari, shuningdek ularni an’anaviy va innovatsion pedagogik texnologiyalar bilan uyg‘unlashtirish yo‘llari ko‘rib chiqiladi. Tadqiqotda raqamli ta’lim muhitining didaktik imkoniyatlari, elektron ta’lim resurslari, masofaviy va aralash (blended) ta’lim modellari, sun’iy intellekt asosidagi vositalar hamda interaktiv metodlar tahlil qilinib, ularning talabalar bilim sifatiga ta’siri asoslab beriladi.

Kalit so‘zlar: axborot texnologiyalari, pedagogik texnologiya, oliy ta’lim, raqamli ta’lim muhiti, aralash ta’lim, interaktiv metodlar, masofaviy ta’lim, sun’iy intellekt.

Adilova D.I.
head of the Secretariat
Akdarya District Council of People’s Deputies
Uzbekistan, Akdarya District
Quvondikova D.I.
assistant
Jizzakh Polytechnic Institute
Uzbekistan, Jizzakh

ENHANCING THE USE OF INFORMATION TECHNOLOGIES IN HIGHER EDUCATION AND THEIR INTEGRATION WITH PEDAGOGICAL TECHNOLOGIES

Abstract. This article examines the enhancement of the use of modern information and communication technologies (ICT) in organizing the educational process in higher education institutions, as well as ways to harmonize them with traditional and innovative pedagogical technologies. The study analyzes the didactic possibilities of the digital educational environment, electronic educational resources, distance and blended learning models, artificial intelligence-based tools,

and interactive methods, substantiating their impact on the quality of students' knowledge.

Keywords: information technologies, pedagogical technologies, higher education, digital educational environment, blended learning, interactive methods, distance learning, artificial intelligence.

Zamonaviy jamiyat rivojlanishining asosiy omillaridan biri — ta'lim tizimining sifat jihatidan yangilanishi va raqamlashtirilishidir. O'zbekiston Respublikasida "Raqamli O'zbekiston — 2030" strategiyasi, shuningdek Yangi O'zbekiston taraqqiyot strategiyasida belgilangan vazifalar oliy ta'lim muassasalarida axborot texnologiyalarini keng joriy etishni talab qiladi. Bugungi kunda pedagog kadrlarning kasbiy faoliyatida nafaqat mavzuni chuqur bilish, balki uni zamonaviy texnologik vositalar yordamida samarali yetkazish mahorati ham muhim ahamiyat kasb etmoqda.

So'nggi o'n yil ichida O'zbekistonda oliy ta'lim tizimi keskin kengaydi: Milliy statistika qo'mitasi ma'lumotlariga ko'ra, oliy ta'lim tashkilotlarida tahsil olayotgan talabalarning umumiy soni so'nggi 10 yilda 5,4 barobarga, shu jumladan kunduzgi ta'lim shaklidagi talabalar soni 2,7 barobarga oshgan, oliy ta'lim tashkilotlari bitiruvchilarining umumiy soni esa 3,2 barobarga ortgan. Talabalar sonining bunday tezkor o'sishi sharoitida ta'lim sifatini saqlab qolish va individuallashtirish faqat AKT va pedagogik texnologiyalarning uyg'unlashuvi orqali mumkin bo'ladi.

Axborot texnologiyalarini pedagogik texnologiyalar bilan uyg'unlashtirish muammosi dolzarb bo'lib, chunki texnika vositalarining o'zi ta'lim sifatini avtomatik tarzda oshirmaydi — ular faqat to'g'ri metodik yondashuv bilan qo'llanilgandagina samara beradi. Shu sababli ushbu tadqiqotning maqsadi — oliy ta'lim dars jarayonida AKTdan foydalanishning didaktik asoslarini ishlab chiqish va ularni amaliy tavsiyalar shaklida taqdim etishdir.

Tadqiqotning asosiy maqsadi — oliy ta'lim muassasalarida o'quv jarayonini axborot texnologiyalari va pedagogik texnologiyalar integratsiyasi asosida takomillashtirish mexanizmlarini ishlab chiqishdan iborat. Ushbu maqsadga erishish uchun quyidagi vazifalar belgilandi:

1. AKT va pedagogik texnologiyalarning nazariy-metodologik asoslarini tahlil qilish;
2. Zamonaviy raqamli ta'lim vositalarining didaktik imkoniyatlarini aniqlash;
3. Aralash ta'lim (blended learning) modelini oliy ta'lim amaliyotiga tatbiq etish yo'llarini ko'rsatish;
4. AKT asosidagi interaktiv metodlarning talabalar bilim sifatiga ta'sirini asoslash;
5. Ushbu sohadagi muammolar va yechim yo'llari bo'yicha tavsiyalar ishlab chiqish.

Bugungi kunda oliy ta'lim jarayonida elektron ta'lim boshqaruv tizimlari (LMS) — Moodle, Google Classroom kabi platformalar orqali o'quv materiallarini

tarqatish, uy vazifalarini qabul qilish va baholash tizimi, amaliy va laboratoriya mashg‘ulotlarida real jarayonlarni modellashtirish uchun multimedia va vizualizatsiya vositalari — taqdimotlar, video-darslar, infografikalar, virtual laboratoriyalar, interaktiv doskalar va simulyatorlar qo‘llashimiz, moslashuvchan (adaptive) test tizimlari, chat-botlar, matn va nutqni tahlil qiluvchi dasturlar uchun sun’iy intellekt asosidagi vositalar va Masofaviy ta’lim platformalari – video-konferensiya tizimlari orqali sinxron va asinxron ta’lim tashkil etish yuqoridagi AKT vositalari faol qo‘llanilmoqda.

Bu vositalarning har biri ma’lum didaktik vazifani bajaradi, biroq ularning samaradorligi faqat pedagogik jarayon bilan uzviy bog‘liqlikda namoyon bo‘ladi. AKTni samarali qo‘llash uchun ularni quyidagi pedagogik texnologiyalar bilan uyg‘unlashtirish maqsadga muvofiqdir.

a) Muammoli ta’lim texnologiyasi bilan integratsiya. Talabalarga real hayotiy vaziyatlar asosidagi muammoli topshiriqlar elektron platformalar orqali taqdim etiladi, ular guruhlarda onlayn hamkorlikda yechim izlaydilar.

b) Loyihaviy ta’lim texnologiyasi bilan integratsiya. Raqamli vositalar (Google Docs, Trello, Miro kabi hamkorlik platformalari) yordamida talabalar guruh loyihalarini birgalikda ishlab chiqadilar, bu ularda jamoaviy ishlash va raqamli savodxonlik ko‘nikmalarini rivojlantiradi.

c) Aralash ta’lim (blended learning) modeli. An’anaviy auditoriya darslari elektron kurslar bilan uyg‘unlashtiriladi: nazariy materialni talaba mustaqil ravishda platformada o‘zlashtiradi ("flipped classroom" — teskari sinf modeli), auditoriya vaqti esa amaliy mashqlar, muhokamalar va muammoli topshiriqlarni yechishga bag‘ishlanadi.

d) Gamifikatsiya (o‘yinlashtirish) elementlari. Ball to‘plash tizimlari, reyting jadvallari va yutuq nishonlari orqali talabalarning o‘quv motivatsiyasini oshirish.

Yuqorida keltirilgan yondashuvlarni tatbiq etish natijasida ko‘plab ijobiy natijalarga erishish mumkin. Bularga talabalarning mustaqil bilim olish ko‘nikmalari rivojlanishi, o‘quv materialini individual sur’atda o‘zlashtirish imkoniyati yaratilishi ya’ni individuallashtirilgan ta’lim va auditoriya vaqtidan samaraliroq foydalaniladi, chunki nazariy qism oldindan o‘zlashtiriladi. Talaba-o‘qituvchi va talaba-talaba o‘rtasidagi fikr almashinuvi kengayadi, bilimlarni real vaqt rejimida nazorat qilish va operativ fikr-mulohaza (feedback) berish imkoni tug‘iladi. Shu bilan birga, jarayonda bir qator muammolar ham mavjud, bular:

1. Ba’zi o‘qituvchilarning raqamli vositalardan foydalanish bo‘yicha metodik va texnik tayyorgarligining yetarli emasligi;
2. Ta’lim muassasalarining texnik infratuzilmasi (internet tezligi, uskunalar) bir xilda rivojlanmaganligi;
3. AKTni qo‘llashda pedagogik maqsad emas, balki texnologiyaning o‘zini asosiy vosita deb qabul qilish xavfi ("texnologiya uchun texnologiya");
4. Talabalarning mustaqil o‘rganishga bo‘lgan tayyorgarlik darajasidagi farqlar.

Xulosa

Xulosa qilib aytganda, oliy ta’lim dars jarayonida axborot texnologiyalaridan foydalanishni takomillashtirish — bu shunchaki texnik vositalarni ko‘paytirish emas, balki ularni ilmiy asoslangan pedagogik texnologiyalar bilan tizimli uyg‘unlashtirish jarayonidir. Faqat shu tarzda AKT o‘quv jarayonining sifat va samaradorligini real ma’noda oshiruvchi vosita bo‘la oladi. So‘nggi statistik ma’lumotlar ko‘rsatishicha, oliy ta’lim tizimidagi talabalar sonining tez o‘sishi (so‘nggi 10 yilda 5,4 barobar) ushbu integratsiyani yanada dolzarb qiladi. Kelgusida bu yo‘nalishdagi tadqiqotlarni sun’iy intellekt asosidagi individuallashtirilgan ta’lim tizimlarini chuqurroq o‘rganish, shuningdek ushbu maqolada taklif etilgan so‘rovnoma asosida empirik natijalarni to‘plash tomon davom ettirish maqsadga muvofiqdir.

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Allanov Q.A., geografiya fanlari nomzodi
dotsent
Qurbonova G.A.
geografiya yo‘nalishi magistranti
Termiz davlat universiteti
O‘zbekiston, Termiz

TIBBIY GEOGRAFIK TADQIQOTLARNING SHAKLLANISHI VA RIVOJLANISHI

Annotatsiya. Mazkur maqolada tibbiy geografiya sohasidagi tadqiqotlarning shakllanishi va rivojlanishining tarixiy bosqichlari ilmiy nuqtayi nazardan yoritilgan. Unda ushbu yo‘nalishda amalga oshirilgan yirik ilmiy ekspeditsiyalar va tadqiqotlarga, shuningdek, tibbiy geografiyaning mustaqil ilmiy yo‘nalish sifatida shakllanishi va rivojlanishiga salmoqli hissa qo‘shgan atoqli olimlarning ilmiy faoliyatiga alohida e’tibor qaratilgan. Ular tomonidan ishlab chiqilgan ilmiy nazariyalar, konseptual yondashuvlar, taklif va tavsiyalar, xususan, kasalliklarning hududiy tarqalish qonuniyatlari hamda ularning tabiiy, ijtimoiy-iqtisodiy va hududiy omillar bilan o‘zaro bog‘liqligini o‘rganishga qaratilgan ilmiy qarashlar tahlil qilingan. Olingan natijalar tibbiy geografiyaning tarixiy-ilmiy asoslarini yanada chuqurroq anglash, shuningdek, kasalliklarning hududiy tarqalish qonuniyatlari va aholi salomatligi bilan bog‘liq muammolarni o‘rganishdagi uning ahamiyatini ochib berishga xizmat qiladi.

Kalit so‘zlar: Tibbiy geografik tadqiqotlar, olimlar, ekspeditsiyalar, kasalliklar, nazariyalar, infeksion kasalliklar, epidemiologik, o’choq oblasti, hududlar.

Allanov Q.A., Candidate of Geographical Sciences
associate professor
Qurbonova G.A.
master’s student in Geography
Termez State University
Uzbekistan, Termez

FORMATION AND DEVELOPMENT OF MEDICAL GEOGRAPHY RESEARCH

Abstract. This article examines the historical formation and development of medical geography research from a scientific perspective. Particular attention is paid to major scientific expeditions and research conducted in the field, as well as to the contributions of prominent scholars who played a significant role in the development of medical geography. The study also considers the theories, scientific approaches, proposals, and recommendations developed by these scholars concerning the geographical distribution of diseases and their relationship with environmental and territorial factors. The findings contribute to a better

understanding of the historical and scientific foundations of medical geography research and its role in studying the spatial patterns of diseases and public health.

Keywords: Medical geography, medical-geographical research, scientific expeditions, disease distribution, infectious diseases, epidemiology, disease foci, geographical areas, territorial factors.

Kirish. Inson salomatligi jamiyat taraqqiyotining har bir davri uchun kechiktirib bo'lmaydigan muhim masalalaridan biri hisoblanadi. Zero har qanday mamlakatning rivojlanganlik holati mazkur hududda yashovchi aholining salomatlik va savodxonlik darajasi bilan belgilanadi.Aynan shu ikki ko'rsatkich davlatning jahon hamjamiyatida tutgan o'rni va inson salohiyatini ijtimoiy-iqtisodiy jihatdan ifodalaydi. Shu sababli ham ushbu mavzu ustida tadqiqot ishlarini olib borish , bu borada taklif va tavsiyalar ishlab chiqish muhim ahamiyatga ega. Maqolada tibbiy geografik tadqiqotlar borasida ilmiy izlanishlar olib borgan olimlar, ularning ishlari haqida ma'lumot berilgan.

Asosiy qism. Hozirgi turli xil keskinlikdagi geoekologik vaziyatlar vujudga kelgan bir davrda tibbiy geografiya va iqtisodiy-ijtimoiy geografiya fanlarining inson salomatligini saqlashdagi ahamiyati hech kimda hech qanday shubha tug'dirmaydi. XIX asrning ikkinchi yarmida geografiya bilan tibbiyot o'rtasida predmetlararo mustaqil fan tarmog'i sifatida tibbiy geografiya vujudga kelib, asta-sekin shakllana bordi. Bu fanning asosiy maqsadi va vazifasi har qaysi hududning tabiiy va sotsial-iqtisodiy sharoitini aholining salomatlik holatiga ta'sirini o'rganish va inson kasalliklarining kelib chiqish sabablarini va geografik taraqalishini aniqlashdan iboratdir. Bundan tashqari tabiati tubdan o'zlashtirilgan hududlarda, tog'-kon sanoati rivojlanayotgan rayonlarda, magistral kanallar va suv omborlari qurilayotgan cho'llarda kutilmagan holatlarda turli xil kasalliklarni paydo bo'lishini tibbiy geografik prognozlashtirishda mazkur fanning amaliy ahamiyati beqiyosdir.

XX asrning 30-40 yillariga kelib tibbiy geografiyaning keng ko'lamda rivojlanishi uchun shart-sharoitlar vujudga keldi. Mamlakatning xalq xo'jaligini barqaror rivojlantirish maqsadida sobiq SSSR hududidagi ayrim regionlarning, xususan markazdan uzoq bo'lgan joylarning ishlab chiqaruvchi kuchlarini har tomonlama tadqiq qilish va ularni o'zlashtirish maqsadida kompleks tibbiy ekspeditsiyalar tashkil etildi [1]. Ana shunday yirik ekspeditsiyalardan biri bo'lgan zoologik-parazitologik ekspeditsiyaga rahbarlik qilgan akademik YE.N.Pavlovskiy O'rta Osiyoda, Uzoq Sharqda va boshqa o'lkalarda ilmiy-tadqiqot ishlarini amalga oshirish natijasida ko'plab materiallar to'pladi. To'plangan faktik materiallarning asosiy qismi tabiiy va ijtimoiy-iqtisodiy sharoitni aholi salomatligi holatiga, inson kasalliklarining kelib chiqishi va geografik tarqalishiga taalluqli bo'lgan.

Ye.N.Pavlovskiy 1939 yilda barcha to'plangan faktik materiallarni nazariy umumlashtirish natijasida inson kasalliklarini keltirib chiqaruvchi tabiiy o'choqlar va landshaft epidemiologiyasi to'g'risidagi ta'limotni yaratdi. Bu yo'nalishdagi ta'limot mutaxassislar tomonidan keng e'tirof etildi. Oqibatda geografiya bilan tibbiyotda erishilgan yutuqlar tibbiy geografiya fanining shakllanishiga va rivojlanishiga keng imkoniyat ochib berdi. Bu borada tibbiy geografiyaning

shakllanishi va barqaror rivoj topishida YE.N.Pavlovskiy, D.K.Zabolotniy, A.P.Markovin, A.A.Shoshin, YE.I.Ignatyev, A.G.Voronov va boshqalarning ilmiy asarlari muhim rol o‘ynadi [3].

1943 yildan boshlab sobiq SSSR Harbiy tibbiy akademiyasining bir guruh ilmiy hodimlari A.A.Shoshin rahbarligida uzoq yillar davomida harbiy tibbiy geografiya yo‘nalishi bo‘yicha ilmiy tadqiqot ishlari olib borilib, tibbiy geografiyaning va uning nazariyasini intensiv ravishda rivojlanib borishiga o‘zlarining katta hissasini qo‘shdilar. Bunga qo‘riq va bo‘z yerlarning o‘zlashtirilishi, sug‘orma dehqonchilikning rivojlantirilishi, yangi aholi manzilgohlarini, shaharlarni va sanoat markazlarini barpo etilishi, shimoliy rayonlarni o‘zlashtirilishi kabi ijtimoiy-iqtisodiy omillar o‘zining ijobiy ta’sirini ko‘rsatdi [4].

Ye.N.Pavlovskiy va A.A.Shoshinning tashabbusi bilan 1955 yilda sobiq ittifoq Geografiya jamiyati prezidiumi qoshida Tibbiy geografiya komissiyasi tashkil etildi. 1963 yilga kelib bu komissiya Tibbiy geografiya bo‘limiga aylandi. 1959 yilda sobiq ittifoq Fanlar Akademiyasining Sibir bo‘limidagi Geografiya instituti tarkibida maxsus tibbiy geografiya sektori, Tinch okean Geografiya institutida tibbiy geografik laboratoriya tashkil etildi. Bular Sibir va Uzoq Sharq o‘lkalarini tibbiy geografik tekshirish, ilmiy xulosalarni va turli yo‘nalishdagi ilmiy yondashishlarni tajribada sinab ko‘rish, tadqiqot metodlarini ishlab chiqish va yaratish uchun qulay imkoniyatlar ochib berdi. Shu davrda tibbiy geografiyaning yanada rivojlanishiga Ye.I.Ignatyev tomonidan ishlab chiqilgan va amaliyotda qo‘llash uchun taklif etilgan kasalliklarning tabiiy shart-sharoiti konsepsiyasi ta’rifi muhim rol o‘ynadi [5].

Tibbiy geografik tadqiqotlar olib boruvchi ilmiy jamoa Rossiya Fanlar Akademiyasining Geografiya institutida ham shakllanib, keng miqyosda ilmiy tekshirish ishlarini olib bordilar.

O‘tgan asrning 60-yillarida Moskva davlat universitetining geografiya fakultetidagi biogeografiya kafedrasida A.G.Voronov rahbarligida tibbiy geografik yo‘nalishdagi ilmiy maktab vujudga keldi. Ularning sa’y-harakati bilan hozirgi tibbiy geografik tadqiqotlarning metodologik asoslari ishlab chiqildi va amaliyotga joriy etildi. Shuni ta’kidlash joizki, A.G.Voronov birinchilar qatorida tibbiy geografiyaning nazariy va amaliy masalalarini ishlab chiqdi, geografik patologiya sohasida ish olib bordi, inson kasalliklarining xarakterli xususiyatlarini atrof-muhitga bog‘lab tasnifladi, tibbiy landshaftshunoslikning asosiy holatlariga ta’rif berdi. A.G.Voronovning barcha tadqiqot ishlarida geografik muhitning inson salomatligiga ta’sirini o‘rganish muammosi alohida o‘rin egallaydi [8].

XX asrning 60-yillariga kelib tibbiy geografiya doirasida tibbiy landshaftshunoslik yo‘nalishi paydo bo‘lib, asta-sekin fan sifatida rivoj topa bordi. Ma’lumki, insonlardagi aksariyat og‘ir kasalliklarning paydo bo‘lishi, birinchidan landshaftning mahalliy geokimyoviy xususiyatlari bilan bog‘liq bo‘lsa, ikkinchidan uning hududida kasallik qo‘zg‘atuvchi yoki tarqatuvchi manbalarning ishtirok etishi bilan chambarchas bog‘liqdir.

Tibbiy landshaftshunoslik – tibbiy geografiyaning bir tarmog‘i bo‘lib, uning tadqiq qilish obyekti bo‘lgan turli xil taksonomik rangdagi landshaft komplekslarini – zona, o‘lka va rayonlardan tortib, to joy tipi, urochisha va fatsiyalarni epidemiologik nuqtai nazardan o‘rganadi.

Tibbiy geografiya to‘g‘risidagi ta’limotni va uning nazariyasini mukammal ravishda rivojlanib borishiga kasalliklarning tabiiy o‘choqlarini tasniflash va tiplashtirish masalalariga, tibbiy geografik rayonlashtirish prinsiplari va metodlarini ishlab chiqishga bag‘ishlangan ilmiy asarlarning yaratilishi, regional taksonomik birliklar sistemasini asoslab berilishi katta rol o‘ynaydi. Bunga misol qilib YE.L.Rayx, YE.S.Feldman, V.V.Kucheruk, Y.A.Dubrovskiy, S.M.Malxazova, V.M.Neronov, A.G.Voronov, A.A.Keller, B.B.Proxorov, S.A.Kurolap va boshqalarning ishlarini ko‘rsatish maqsadga muvofiqdir.

V.V.Kucheruk (1972) inson kasalliklari turlarini ayrim tabiiy o‘choqlarining morfologiyasini tadqiq qilib, ularni tiplashtirish va o‘choqli hududlarni tibbiy geografik rayonlashtirish ishlarini amalga oshirdi. U tibbiy geografik rayonlashtirishda quyidagi taksonomik birliklar sistemasidan foydalangan: o‘choq-o‘choqlar guruhi-o‘choqlar sinfi-o‘choqli region-o‘choqli regionlar guruhi-qo‘zg‘atuvchi areal.

Y.A.Dubrovskiy (1978) O‘rta Osiyo hududi doirasida teri leyshmanioz kasalligini va uning epidemiologik xususiyatlarini kompleks o‘rganib, bu kasallikning tabiiy o‘choqlarini tipologik tasniflash ishlarini olib bordi. Muallif ayrim tabiiy o‘choqlar guruhini o‘xshashlik darajasini baholashda asosiy mezon sifatida leyshmanioz kasalligini tarqatuvchi fauna turlaridan, epizootiy xarakteridan va hududning epidemik jahatdan qay darajada xavfli ekanligidan foydalangan.

Bundan tashqari Y.A.Dubrovskiy (1978) zoonoz teri leyshmanioz areali doirasida alohida uchta o‘choq regionlari guruhini ajratadi – Turon, Eron va Falastin. Shundan Turon pasttekisligi guruhi 12 ta o‘choqli regionlarga va 37 ta tabiiy o‘choqlar guruhiga bo‘lingan.

A.A.Keller (1993) infeksion (yuqumli) kasalliklarning geografik tarqalishini o‘rganish va odamlarga yuqish xavf-xatarlik darajasini tahlil qilish natijalariga asoslanib, materiklarni kompleks epidemiologik – geografik rayonlashtirishni taklif etgan va epidemiologik geografiyaning quyidagi asosiy qonuniyatlarini aniqlagan: 1) endemik jarayonning makonda notekis tarqalganligi; 2) epidemiologik hodisalarning makonda siyrakligi va zichligi; 3) epidemik jarayonlar dinamikasida davriylik; 4) epidemik jarayon elementlarining geografik sharoitlar majmuasiga muvofiqligi; 5) epidemik jarayonning namoyon bo‘lishidagi zonal va azonal shart-sharoitlar.

S.M.Malxazova va V.M.Neronovlar (1983, 1991) o‘choqli hududlarni tibbiy geografik rayonlashtirish masalasi bilan shug‘ullanib, nozoareallarni o‘choqli oblastlarga, o‘choqli provinsiyalarga, o‘choqli rayonlarga va o‘choqli uchastkalarga bo‘lishgan. Ajratilgan regional birliklarning tabiiy xususiyatlariga, ularning epizootologik va epidemiologik nuqtai nazardan o‘rganilganlik darajasiga tavsif berilgan.

S.M.Malxazova va V.M.Neronov (1983) tibbiy geografik rayonlashtirishda O‘rta dengiz havzasi va O‘rta Osiyo tog‘-tekislik o‘lkalarini mustaqil o‘choq oblasti deb qarab, uni 25 ta o‘choq rayonlarga bo‘lgan va landshaft-epidemiologik tavsif bergan. Shulardan 4 tasi O‘rta Osiyo tog‘ va tekislik o‘lkalariga to‘g‘ri keladi. Bular Janubi-Sharqiy Qoraqum vodiy-tekislik, Qoraqum-Qizilqum tekislik-vodiy, Tyanshan tog‘-vodiy va Pomir-Oloy tog‘ vodiy o‘choq rayonlaridir [5].

Shuni e’tirof etish joizki, tibbiyot geografiyasiga oid bilimlar O‘rta Osiyo hududida ham qadimdan vatandosh allomalarimiz tomonidan o‘rganilgan va tabiiy sharoitga bog‘liq ravishda tahlil qilingan. Jumladan, tibbiyot geografiyasiga oid ma’lumotlar Abu Ali Ibn Sino asarlaridan keng o‘rin olgan. Ayniqsa kasalliklarning kelib chiqish sabablari tabiiy geografik sharoit bilan, joylarning iqlim xususiyatlari, relyefi, suvlari va havosi bilan, xususan yil fasllari bilan uzviy bog‘liqligi allomaning «Tib qonunlari» asarida batafsil yoritilgan [7]. Tibbiy geografik bilimlarga taalluqli bo‘lgan ma’lumotlar Abu Bakr Ar-Roziy asarlarida ham uchraydi.

Xulosa. Yer sharining turli mintaqalarida, tog’da va tekislik landshaftlarida, sahro va o’rmonda, shahro va o’rmonda, shahar va qishloq joylarida, iqtisodiy jihatdan turli rivojlanish darajasiga ega bo’lgan mamlakat va mintaqalarda nozogeografik vaziyat turlichadir. Bunday nozogeografik vaziyatning hududiy tafovutlarini aniqlash va baholashni ilmiy jihatdan tadqiq qilish tibbiy geografik tadqiqotlarning asosiy vazifasidir.

Kasalliklarning hududiy jihatlari, ularni vujudga keltiruvchi shart-sharoit va omillarni tibbiy geografik jihatdan o’rganish, muayyan hududning istiqboldagi holatini nozogeografik vaziyat nuqtai nazaridan bashorat qilish imkonini beradi. Shu jihatdan tibbiy geografik tadqiqotlar borasida tadqiqot ishlarini olib borgan olimlar ilmiy ishlarni o’rganish va bu sohada ilmiy tadqiqot ishlarini yanada rivojlantirish har bir mamalakatda nozogeografik vaziyatni yaxshilashda muhim omil hisoblanadi, bu esa mamlakat iqtisodiy-ijtimoiy taraqqiyotiga ijobiy ta’sir etadi.

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Anwar Mohsen Sagab, PhD in Economics
Department of Economics, College of Administration and Economics
Wasit University
Iraq, Wasit
Rahim Hadi Nasser Al-Aqabi, PhD in Economics
Wasit Directorate of Agriculture
Iraq, Wasit

TECHNICAL AND ECONOMIC EFFICIENCY OF BEEKEEPING PROJECTS IN WASIT GOVERNORATE IN 2025: A CASE STUDY OF AL-KUT DISTRICT

Abstract. This study evaluates the technical, allocative, and economic efficiency of beekeeping projects in Al-Kut District, Wasit Governorate, Iraq, in 2025. It also examines the current status of beekeeping and the use of economic resources in the study area. Primary data were collected from 32 licensed apiaries selected from approximately 81 licensed and unlicensed apiaries operating in Al-Kut District. The selected apiaries had sufficiently complete records on production, costs, profits, and hive-level characteristics, while secondary data were obtained from the Wasit Directorate of Agriculture. Technical and economic performance was assessed using output-oriented Data Envelopment Analysis (DEA) under constant and variable returns to scale, with the analysis conducted using DEAP software. The results showed that average technical efficiency was approximately 80% under the CRS specification, with six apiaries achieving full technical efficiency, and approximately 87% under the VRS specification, with 16 apiaries achieving full technical efficiency. Average allocative efficiency was 67%, with seven apiaries achieving full allocative efficiency, while average economic efficiency was 59%, with seven apiaries achieving full economic efficiency. These findings indicate considerable scope for improving resource allocation and overall economic performance among the sampled apiaries. The study also found substantial variation in efficiency across apiaries of different sizes. The results highlight the importance of improving resource management, strengthening technical support for beekeepers, and enhancing production and marketing practices in order to improve the economic sustainability of beekeeping projects in the study area.

Keywords: Technical Efficiency; Allocative Efficiency; Economic Efficiency; Data Envelopment Analysis (DEA); Beekeeping; Wasit Governorate; Iraq.

Introduction

Humans have practiced beekeeping since approximately 2400 BCE. Although human management has influenced the genetic composition of honey bee populations, the species has not been fully domesticated because queens continue to mate freely with drones outside the hive (Du et al., 2024).

Beekeeping provides numerous economic and agricultural benefits through the production of honey, pollen, propolis, royal jelly, bee venom, beeswax, and other

products. Historically, honey bees were not intensively managed; instead, people often provided simple shelters in which wild colonies could establish themselves. Over time, major technological developments substantially improved the management and control of honey bee colonies. These developments included the discovery of "bee space," the introduction of the movable-frame Langstroth hive in 1851, the queen excluder in 1849, and the honey extractor in 1867. The discovery that queens and drones mate in flight outside the hive also had important implications for honey bee breeding (Oxley & Oldroyd, 2010).

Consequently, beekeeping is considered one of the oldest agricultural and economic activities. It is a relatively accessible agricultural enterprise that generally requires less initial capital than many other productive activities. In addition, beekeeping can be integrated with other agricultural activities and provides opportunities for individuals to develop practical skills in hive management, production, and small-scale enterprise management (Khalil et al., 2025).

Honey bees live in highly organized social colonies within structures known as hives. Their colonies consist of individuals that perform specialized and cooperative functions essential for colony survival. In addition to producing honey and other bee products, honey bees provide substantial nutritional, economic, and ecological benefits.

One of the most important roles of honey bees is pollination. While collecting nectar and pollen, honey bees contribute to the pollination of numerous cultivated and wild plant species, thereby supporting agricultural productivity and ecosystem functioning (Al-Dulaimi, 2025). In addition to their pollination services, colony health is an important determinant of sustainable beekeeping. Breeding for hygienic behavior has been associated with reduced Varroa infestation and lower viral loads, which may contribute to improved colony health and resilience (Erez et al., 2022).

Beekeeping contributes not only to the production of food and other valuable bee products but also to the conservation of biodiversity and the maintenance of ecological balance. Through their pollination activity, honey bees support the reproduction of both cultivated and wild plant species and thereby contribute to the stability of natural and agricultural ecosystems.

However, modern beekeeping faces several challenges that can adversely affect colony health, productivity, and survival. These include agricultural intensification, climate change, pesticide exposure, habitat degradation, and various diseases and parasites (Palacio et al., 2024).

One of the most important honey bee species used in beekeeping is the Western honey bee (*Apis mellifera* L.), which is native to Eurasia and Africa. Friedrich Ruttner, a pioneer in honey bee taxonomy, identified 24 subspecies based on 36 morphological traits, including hair density, pigmentation, the length of various body parts, wing venation, and other characteristics (Rodrigues et al., 2022; Meixner et al., 2010).

Honey bee health and genetic resistance to parasites are increasingly important considerations in sustainable beekeeping and breeding programs. In particular, resistance to *Varroa destructor* has been shown to have a complex

polygenic architecture, highlighting the importance of genetic factors in the development of more resilient honey bee populations (Eynard et al., 2025). At the same time, effective hive management and breeding practices remain important for maintaining productive and sustainable colonies (Qu et al., 2025; De Iorio et al., 2026).

Beekeeping success and the rate of colony proliferation depend on the ability to create optimal conditions within the hive under both cold and hot conditions, as well as on the ability of honey bee colonies, as social organisms, to maintain internal thermal balance, thereby supporting rapid and steady colony growth (Stabentheiner et al., 2021).

Honey bee breeding programs are relatively recent in most countries and vary among diverse, small-scale breeding groups; beekeepers themselves exhibit a wide range of motivations and management practices. Nevertheless, little is known about the breeding objectives that beekeepers prioritize when designing these programs (Kistler et al., 2026).

For beekeepers, the success of a honey bee colony is often measured by the amount of honey produced during the flowering season, a yield that depends on numerous factors, including the colony's location and environmental conditions, the availability of forage, weather conditions during pollen and nectar foraging flights, and the colony's health status. Furthermore, the genetic makeup of the queen bee is of critical importance in this regard, as she is the only reproductive female in the colony and lays the eggs that develop into worker bees (Meyer-Rochow & Jung, 2019; Uzunov et al., 2017).

Beekeeping is subject to strong natural selection pressures driven by climate change, pesticide exposure, and habitat fragmentation. These factors can cause colony losses, resulting in economic damage and reduced genetic diversity, thereby increasing interest in honey bee breeding and conservation programs (Obšteter et al., 2023). In recent years, honey bee breeding has attracted significant scientific attention, as reflected in numerous theoretical and practical advances. In particular, the selection of high-quality drones is crucial for the success of breeding programs in the medium and long term (Du et al., 2021a, 2021b).

Beekeeping is an agricultural activity aimed at producing honey and other bee products; it also provides benefits such as improved seed production and environmental protection and can be practiced by both men and women. It is considered a successful agricultural activity in rural areas of developing countries because of its numerous economic benefits (Gakenia et al., 2024). It serves as a significant source of income and an important economic activity for the livelihoods of many people. At the same time, market dynamics and traditional beekeeping practices influence beekeepers' management methods and the demand for high-quality queen bees (Dimitrov et al., 2024).

Honey bees play a pivotal role in maintaining ecological balance and can serve as environmental indicators, while also supporting the global agricultural economy through pollination services and the production of bee products. Approximately one-third of the global food supply depends, directly or indirectly,

on pollination services provided by bees and other insects, underscoring their considerable economic and ecological value. Therefore, a decline in bee populations may pose a serious threat to food security, biodiversity, and, ultimately, human well-being (Lin et al., 2025; Kaskinova et al., 2023).

Importance of the Research: The significance of this research lies in assessing the economic and technical efficiency of beekeeping operations, as well as the economic, nutritional, and medicinal value of honey bees. Beekeeping has attracted considerable interest among producers, particularly in rural areas, due to the suitability of the Iraqi environment for this economic activity. It plays a major role in promoting economic and social development by providing various products and creating employment opportunities. In recent years, beekeeping has expanded significantly, driven by factors such as rising honey prices and growing demand in both global and local markets, which has facilitated the marketing of honey and other bee products. Honey is used for various nutritional and medicinal purposes, which contributes to its significant economic value and high demand. Investment in this sector and encouraging individuals to establish apiaries can contribute to reducing youth unemployment, particularly among graduates of agricultural colleges, institutes, and schools. Beekeeping is a profitable small-scale agricultural activity that requires relatively limited capital.

The selection of Al-Kut District as the study area was justified by the active presence of beekeeping in the district, where approximately 81 licensed and unlicensed apiaries were identified during the study period.

Research Problem: The main research problem is to determine the extent to which the sampled beekeeping projects use their available production resources efficiently and whether differences exist between technical, allocative, and economic efficiency. The study therefore focuses on identifying the degree of inefficiency in the sampled apiaries and assessing their production costs, output, and economic returns.

Research Hypothesis: The technical and economic efficiency of the beekeeping apiaries included in the study sample is below full efficiency.

Research Objectives

The research aims to:

1) Measure the technical, allocative, and economic efficiency of the beekeeping projects included in the study sample.

2) Examine the current structure of beekeeping in Al-Kut District and evaluate the use of the principal economic resources employed in honey production.

3) Estimate annual production costs, production value, and net profit per hive.

Scientific Novelty and Contribution

The scientific contribution of this study lies in the application of an output-oriented Data Envelopment Analysis framework to farm-level data from beekeeping projects in Al-Kut District, Wasit Governorate. The study jointly evaluates technical, allocative, and economic efficiency and complements the DEA results with a detailed assessment of production costs, seasonal honey output, production value, and net profit per hive. This integrated approach provides locally specific evidence

on the efficiency and economic performance of beekeeping projects under the production and market conditions prevailing in the study area in 2025. In addition, the distinction between efficiency estimates under constant and variable returns to scale makes it possible to identify the potential contribution of scale-related factors to the observed differences in performance among the sampled apiaries.

Data Sources and Sample Selection

The study was based primarily on cross-sectional data collected from apiary owners in Al-Kut District, Wasit Governorate, during 2025. Approximately 81 licensed and unlicensed apiaries were operating in the study area. The final sample consisted of 32 licensed apiaries for which sufficiently complete records were available on the number of hives, labor use, production, production costs, input-related expenditures, honey prices, and revenues. Apiaries for which the required production and cost information was unavailable or could not be reliably obtained were excluded from the analytical sample. Primary data were collected through a structured questionnaire administered through personal interviews and telephone contact with apiary owners. Secondary information was obtained from the Wasit Directorate of Agriculture.

The sampled apiaries varied considerably in size, ranging from approximately 10 to 112 hives, thereby allowing efficiency comparisons across production units of different scales.

DEA Model Specification

Technical, allocative, and economic efficiency were estimated using Data Envelopment Analysis (DEA) with DEAP software. Each apiary was treated as a separate decision-making unit (DMU). The analysis adopted an **output-oriented specification**, reflecting the objective of assessing the extent to which honey output could be increased using the resources available to each apiary.

The principal production inputs considered in the analysis were **capital-related production resources** and **labor**, while total honey production represented the production output. Labor use was recorded in working hours, honey output was measured in kilograms, and monetary variables and input-price information were expressed in Iraqi dinars (IQD). Cost information was derived from the questionnaire records on hive and equipment costs, their useful lives, labor and other operating expenditures, while honey production and prices were recorded separately for the summer and autumn production seasons.

Resource-price and cost information was obtained directly from the questionnaire records of the sampled apiaries rather than from an external market-price database. The sample-average reported purchase prices were 22,031.25 IQD for a wooden hive, 8,468.75 IQD for a honey super box, 56,875.00 IQD for a set of twenty frames, 118,437.50 IQD for a bee package or colony, 186,093.75 IQD for a honey extractor, and 19,031.25 IQD for apiary tools. Their corresponding average reported useful lives were 14.781, 15.438, 4.531, 2.844, 19.625, and 4.500 years, respectively. These price and useful-life data were used to derive annualized production-resource costs. Labor wages and other operating expenditures were recorded in the questionnaire as a combined annual cost category; therefore, a

separate hourly market wage was not available. The recorded monetary cost information, expressed in Iraqi dinars (IQD), was used together with the observed input quantities in the assessment of allocative and economic efficiency.

Technical efficiency was evaluated under both constant returns to scale (CRS) and variable returns to scale (VRS). CRS efficiency reflects overall technical efficiency, whereas the VRS specification separates managerial or pure technical efficiency from scale effects. Scale efficiency was assessed through the relationship between CRS and VRS technical-efficiency scores. For the estimation of allocative and economic efficiency, observed input quantities and the corresponding cost information were incorporated into the DEA model. Efficiency scores range from 0 to 1, with a score of 1 indicating an efficient apiary located on the estimated efficiency frontier.

For transparency and reproducibility, the principal apiary-level input and output data underlying the DEA analysis are presented in Table 3 for all 32 decision-making units (DMUs).

Table 1. Variables Used in the DEA Analysis

Variable	Role in the Model	Measurement
Capital-related production resources	Input	Iraqi dinars (IQD)
Labor	Input	Working hours per apiary
Honey production	Output	Kilograms per apiary
Input cost/price information	Used for allocative and economic efficiency	Iraqi dinars (IQD)

Note: Cost information was obtained from the questionnaire and included annualized hive and equipment costs together with labor and other production-related expenditures. Honey output represents the combined production recorded for the summer and autumn seasons.
Source: Authors' calculations based on the 2025 field survey.

Economic Importance of Beekeeping: Honey bees have economic, nutritional, and medicinal importance. Honey bee colonies are highly organized social systems in which individuals work for the benefit of the colony, and the colony consists of one queen, several thousand female workers, and a few dozen males.

Beekeeping is an important source of income and an essential economic activity for the livelihoods of many people. However, there is still a lack of knowledge and research related to its economic aspects; therefore, this sector requires greater attention in order to improve its efficiency and development.

One of the most important bee products is honey, and current economic analyses have focused mainly on this product. Other bee products, including pollen, propolis, royal jelly, bee venom, and beeswax, have also become increasingly

important because of their high economic value and pharmacological properties. Living materials such as bee colonies, bee packages, and queen bees are additional products of the hive, and their economic importance should not be overlooked.

In view of the current difficulties associated with honey production and marketing, economic research has increasingly focused on the value of the ecosystem services provided by beekeeping to agriculture and biodiversity, in addition to the profitability of beekeeping itself. Honey bees are globally recognized as pollinators of great economic importance for both crops and wild plants, and beekeeping can have a significant social and economic impact on household income. Therefore, losses of honey bee colonies caused by factors such as land management, pesticide use, and queen-related problems, including poor health and advanced age, may have serious economic consequences.

The Reality of Bee Honey Production in Wasit Governorate (Al-Kut Center)

Wasit Governorate is one of the most important honey-producing governorates because of its vast agricultural lands, good vegetation cover, and the large areas cultivated with jut and alfalfa crops, which provide abundant nectar and pollen preferred by bees. The governorate also contains large orchards with various types of citrus trees and Sidr trees (buckthorn). The number of licensed and unlicensed apiaries in Al-Kut Center reached approximately 81 apiaries, including both large and small operations. The number of hives in a single apiary ranges from 10 to 112 or more.

Theoretical Framework: The study and analysis of production costs, revenues, and returns obtained from honey production are of great importance in identifying the strengths and weaknesses of this agricultural activity. Such analysis helps in taking measures to improve production and the economic efficiency of the use of beekeeping resources, including colonies, hives, nutrition, and labor. This may encourage current producers to expand their activities and motivate others to enter this field.

The Concept of Efficiency

Efficiency has been defined in the management literature in several ways. In general, it reflects the extent to which available resources (inputs) are converted into results (outputs) in an economical manner. In other words, efficiency represents the relationship between available resources and the outputs achieved, either by maximizing output from a given amount of inputs or by minimizing the inputs required to achieve a given level of output.

Efficiency can also be understood as the ability to perform the required activity with the least possible use of resources and costs. Thus, efficiency is related to how a production unit uses its available resources in relation to the outputs achieved. It is clear from these definitions that resources should be used rationally and effectively; therefore, efficiency can be understood as doing things correctly.

Types of Efficiency

A. Technical Efficiency (TE): Technical efficiency refers to the ability of a farm to use the optimal combination of available inputs to obtain the maximum possible level of production (Al-Hajami & Al-Aqili, 2015). It is a measure of the

ability of a production unit to achieve the maximum possible output from a given amount of resources. The value of technical efficiency ranges between 0 and 1. A production unit achieves full technical efficiency when its technical efficiency score is equal to 1. It can also be defined as the operational position of a production unit in relation to the production frontier, where a unit operating on the frontier is considered technically efficient (Moaz & Ahmed, 2020).

B. Allocative Efficiency (AE): Allocative efficiency refers to the ability of a production unit to use inputs in optimal proportions, given their respective prices and the available production technology.

C. Economic Efficiency (EE): Economic efficiency refers to the use of combinations of production resources, under prevailing relative prices, in a way that maximizes profit (Zeidan et al., 2014). It can also be defined as the use of production resources in such a way that a greater level of output can be achieved at the same production cost, or the same level of output can be achieved at a lower cost.

D. Scale Efficiency (SE): Scale efficiency is determined by comparing technical efficiency under constant returns to scale (CRS) with technical efficiency under variable returns to scale (VRS). It is calculated as the ratio of technical efficiency under CRS to technical efficiency under VRS (Moaz & Ahmed, 2020).

Results and Discussion

The output-oriented DEA model was applied under both constant returns to scale (CRS) and variable returns to scale (VRS). Efficiency scores range from 0 to 1, with a score of 1 indicating that an apiary operates on the estimated efficiency frontier. Under the CRS specification, the average technical efficiency of the sampled apiaries was approximately 80%, and 6 of the 32 apiaries achieved full technical efficiency. This result indicates that a substantial proportion of the sampled apiaries operated below the overall CRS efficiency frontier.

Under the VRS specification, average technical efficiency increased to approximately 87%, with 16 apiaries achieving a technical-efficiency score of 1.00. Ten apiaries recorded efficiency scores between 75% and 99%, while six apiaries recorded scores between 50% and 74%. No apiary recorded a VRS technical-efficiency score below 50%. The difference between the CRS and VRS results indicates that part of the observed inefficiency may be associated with scale effects rather than purely with resource-management performance. Capital and labor were also examined as principal production inputs. The results indicated that capital was used efficiently in approximately 11 apiaries, while labor reached the corresponding efficient level in approximately 28 apiaries. When input quantities and their associated cost information were incorporated into the analysis, allocative and economic efficiency were estimated as presented in Table 2.

Table 2. Distribution of Apiaries by VRS Technical, Allocative, and Economic Efficiency Levels

Efficiency Level	Technical Efficiency (TE)	Allocative Efficiency (AE)	Economic Efficiency (EE)
100%	16	7	7
75–99%	10	5	4
50–74%	6	10	4
Less than 50%	0	10	17
Total	**32**	**32**	**32**

Source: Authors' calculations based on the results obtained using DEAP software.

The VRS results showed that the average technical efficiency was approximately 87%, with 16 apiaries achieving full technical efficiency. The average allocative efficiency was approximately 67%, with seven apiaries achieving full allocative efficiency, while the average economic efficiency was approximately 59%, with seven apiaries achieving full economic efficiency. Apiaries No. 3, 6, 8, 17, 19, 22, and 25 achieved 100% efficiency across all three efficiency measures reported in Table 2.

The difference between average technical efficiency under CRS (approximately 80%) and VRS (approximately 87%) suggests that scale-related factors contributed to the overall inefficiency observed in the sample. However, the present study did not estimate a single optimal number of hives applicable to all apiaries.

To improve the transparency of the efficiency analysis, Table 3 presents the apiary-level input and output data for all 32 decision-making units (DMUs) included in the study.

Table 3. Apiary-Level Input and Output Data for the 32 Decision-Making Units (DMUs)

Apiary No.	Number of Hives	Labor Input (hours)	Capital-Related Production Resources (IQD)	Total Honey Output (kg)
1	17	102	1,256,633.333	131.75
2	35	210	2,079,500.000	332.50
3	112	672	5,838,596.491	1,372.00
4	15	90	1,141,000.000	153.75
5	20	120	1,557,500.000	285.00
6	11	66	796,533.333	101.75
7	26	156	1,697,811.111	208.00
8	13	78	1,000,666.667	130.00
9	35	210	3,474,637.255	393.75
10	20	120	1,497,833.333	240.00

Apiary No.	Number of Hives	Labor Input (hours)	Capital-Related Production Resources (IQD)	Total Honey Output (kg)
11	11	66	858,033.333	99.00
12	10	60	861,583.333	65.00
13	15	90	1,395,000.000	123.75
14	18	108	1,233,600.000	180.00
15	65	390	5,946,666.667	910.00
16	45	270	3,375,000.000	540.00
17	25	150	1,608,624.359	312.50
18	12	72	946,900.000	102.00
19	95	570	5,813,666.667	1,353.75
20	10	60	794,833.333	75.00
21	12	72	984,500.000	105.00
22	40	240	3,531,861.111	520.00
23	10	60	725,166.667	55.00
24	10	60	748,350.000	95.00
25	75	450	4,305,000.000	1,143.75
26	18	108	1,255,700.000	211.50
27	12	72	767,150.000	90.00
28	67	402	3,583,366.667	552.75
29	85	510	4,886,333.333	1,020.00
30	13	78	867,766.667	182.00
31	10	60	835,083.333	85.00
32	30	180	1,626,500.000	307.50

Note: Each apiary was treated as an individual decision-making unit (DMU). The number of hives is reported as a descriptive indicator of apiary size and was not included as a separate DEA input. Labor input is expressed as the total number of working hours recorded for each apiary. Capital-related production resources are expressed in Iraqi dinars (IQD), while total honey output represents the combined quantity of honey produced during the summer and autumn production seasons.
Source: Authors' calculations based on the 2025 field survey and questionnaire data.

Table 3 shows considerable variation in the production scale of the sampled apiaries. The number of hives ranged from 10 to 112, labor input ranged from 60 to 672 working hours, and total honey output ranged from 55.00 to 1,372.00 kg per apiary. These observations provide the principal apiary-level input and output data used in the DEA analysis. The number of hives is presented for descriptive comparison of apiary size, whereas labor, capital-related production resources, and honey output correspond to the variables specified in the DEA model.

Table 4. Average Annualized Production Costs per Hive

Item	Useful Life (Years)	Annualized Cost per Hive (IQD)
Wooden hive (box, bottom board, cover, and stand)	14.781	1,490.511
Honey super box	15.440	548.494
Set of twenty frames	4.531	627.621
Bee package / colony	2.844	41,644.691
Honey extractor	19.625	9,482.497
Apiary tools	4.500	4,229.167
Labor and other operating costs per hive	—	11,819.556
Total Annual Cost	—	**69,842.537**

Note: Annualized costs for depreciable hive and equipment items were calculated on the basis of their recorded purchase prices and reported useful lives. The corresponding annual costs were then expressed on a per-hive basis. No separate salvage-value information was available in the source records used for these calculations.

Labor wages and other operating expenditures were recorded in the questionnaire as an aggregated cost category. Therefore, individual components such as supplemental feeding, veterinary treatments, transportation, fuel, maintenance, and other operating expenses could not be reported separately where they were not independently identified in the original records.

Source: Authors' calculations based on data collected through the 2025 questionnaire.

Table 4 shows the average annualized cost structure per hive. The largest cost component was the bee package or colony, while labor and other operating expenditures also represented an important part of annual production costs. The annualization of durable assets reflects differences in their reported useful lives and avoids treating the full purchase price of long-lived equipment as a one-year production expense.

Table 5. Average Honey Production, Price, and Production Value per Hive by Season

Season	Average Honey Production (kg/hive)	Average Price (IQD/kg)	Average Production Value (IQD/hive)
Summer	9.656	24,046.875	232,196.625
Autumn	0.695	51,000.000	35,445.000
Total	**10.351**	—	**267,641.625**

Note: The quantities and prices presented in Table 5 are sample averages calculated from apiary-level observations for the summer and autumn production seasons. The

reported production values were calculated from the individual apiary records. Therefore, because the table presents rounded averages, the multiplication of the average quantity by the average price may differ slightly from the reported average production value. The difference between summer and autumn prices reflects the seasonal prices reported by the sampled beekeepers. The present study does not attempt to estimate the determinants of seasonal price variation.
Source: Authors' calculations based on data collected through the 2025 questionnaire.

The results indicate clear seasonal differences in both honey production and market prices. Average honey production was substantially higher during the summer season, reaching 9.656 kg per hive, compared with 0.695 kg per hive during the autumn season. In contrast, the average reported price of autumn honey was considerably higher than the summer price, reaching 51,000 IQD/kg compared with 24,046.875 IQD/kg. The combined average production value from the two seasons amounted to 267,641.625 IQD per hive.

Table 6. Average Net Profit per Hive

Description	Value (IQD/hive)
Total Production Value	267,641.625
Total Annual Cost	69,842.537
Net Profit	**197,799.088**

Source: Authors' calculations based on data collected through the 2025 questionnaire.

The average total production value per hive was 267,641.625 IQD, while the average annual production cost amounted to 69,842.537 IQD. Accordingly, the estimated average net profit was 197,799.088 IQD per hive.

Net Profit = Total Production Value − Total Annual Cost

Net Profit = 267,641.625 − 69,842.537 = 197,799.088 IQD per hive

A descriptive comparison of the sampled apiaries suggests that apiaries with higher efficiency scores generally tended to have larger numbers of hives and higher honey output. However, the present study did not formally test the statistical relationship between apiary size and efficiency. Therefore, this pattern should be interpreted as descriptive rather than causal. Labor also represented an important component of production costs, particularly in smaller apiaries.

The empirical results indicate several key economic and management constraints affecting the sampled apiaries. First, allocative and economic efficiency were substantially lower than technical efficiency, indicating that resource allocation remains an important source of inefficiency. Second, the bee package or colony represented the largest annualized cost component per hive. Third, substantial seasonal differences were observed in both honey production and selling prices. These findings suggest that the main problems identified in the sampled

apiaries were related primarily to resource allocation, production costs, and seasonal market conditions.

Discussion in Relation to Previous Studies

The findings of the present study can be considered in relation to previous economic research on beekeeping and agricultural production efficiency. Khalil et al. (2025) examined honey-production projects of different production capacities and emphasized the importance of production scale and resource use for financial performance. Similarly, the present study revealed substantial differences among the sampled apiaries in production scale, costs, honey output, and efficiency.

Previous research in Iraq has also examined production costs and economies of scale in honey production. Zeidan et al. (2014) analyzed cost functions and economies of scale in Diyala Governorate. The present study complements this earlier work by using Data Envelopment Analysis to evaluate technical, allocative, and economic efficiency at the individual-apiary level.

An important result of the present study is the difference between technical and economic performance. Average VRS technical efficiency was approximately 87%, whereas average allocative efficiency was 67% and average economic efficiency was 59%. This indicates that relatively high technical efficiency does not necessarily mean that production resources are being allocated in the most economically efficient manner. The distinction between technical, allocative, and scale efficiency has also been applied in previous agricultural DEA research, including Moaz and Ahmed (2020).

Direct numerical comparisons between the present study and previous studies should be interpreted cautiously because of differences in geographical location, sample size, production conditions, study period, and analytical methodology.

Conclusions

1. Under the CRS specification, the average technical efficiency of the sampled apiaries was approximately 80%, with six apiaries achieving full technical efficiency. Under the VRS specification, average technical efficiency increased to approximately 87%, with 16 apiaries achieving full technical efficiency.
2. The average allocative efficiency was approximately 67%, while the average economic efficiency was approximately 59%. Seven apiaries achieved full allocative efficiency and seven achieved full economic efficiency. Apiaries No. 3, 6, 8, 17, 19, 22, and 25 achieved 100% efficiency across all three efficiency measures reported in the study.
3. The difference between technical and economic efficiency indicates that the main opportunities for improving performance are related not only to production technology, but also to the allocation and cost-effective use of available resources.
4. The average annual production cost was estimated at 69,842.537 IQD per hive, while the average production value was 267,641.625 IQD per hive. Consequently, the estimated average net profit amounted to 197,799.088 IQD per hive.

5. A descriptive comparison indicated that apiaries with higher efficiency scores generally tended to have larger numbers of hives and higher honey output. However, because this relationship was not formally tested statistically, the findings should not be interpreted as evidence of a causal relationship or as identifying a specific optimal apiary size.

Recommendations

Beekeepers should improve the management and allocation of available production resources, particularly labor and capital, in order to reduce inefficiencies and improve overall economic performance.

Owners of smaller apiaries may consider expanding the number of hives where such expansion is economically and technically feasible. However, because the present study did not estimate a specific optimal apiary size, expansion decisions should be based on the individual cost structure, management capacity, and production conditions of each apiary.

Governmental and agricultural institutions should support beekeeping projects through technical assistance, extension services, specialized training programs, and access to appropriate financing, particularly for small-scale beekeepers seeking to improve production efficiency.

Greater attention should be given to honey marketing and pricing mechanisms. Improved market information, organized marketing channels, and better coordination between producers and buyers may help reduce uncertainty and improve the economic returns of beekeeping projects.

Agricultural extension centers should provide regular training on hive management, disease and parasite control, feeding practices, cost management, and efficient use of production resources.

Future studies should use larger and more geographically diverse samples, include multi-year data, and formally examine the relationship between apiary size and efficiency in order to determine whether economies of scale exist and to identify economically justified production scales.

Study Limitations

This study has several limitations that should be considered when interpreting the results. First, the analysis was based on a cross-sectional sample of 32 licensed apiaries in Al-Kut District selected primarily on the basis of the availability and completeness of production and cost records. Therefore, the sample should not be considered statistically representative of all apiaries in Wasit Governorate or Iraq.

Second, the study covers a single production year, 2025. Consequently, the estimated efficiency levels, production costs, honey output, and prices may have been influenced by year-specific climatic, production, and market conditions.

Third, part of the production and cost information was obtained directly from apiary owners through questionnaires, personal interviews, and telephone contacts. Therefore, some observations may be affected by differences in record-keeping accuracy or reporting.

Fourth, labor wages and other operating expenditures were recorded as an aggregated cost category. Consequently, individual components such as

supplemental feeding, veterinary treatments, transportation, fuel, maintenance, and other miscellaneous operating expenses could not be separately evaluated where they were not independently identified in the original records.

Finally, although descriptive differences in efficiency were observed among apiaries of different sizes, the study did not formally test the statistical relationship between the number of hives and efficiency and did not estimate a specific optimal apiary size. Future research should address these issues using larger and more geographically diverse samples, multi-year observations, and more detailed apiary-level production and cost records.

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Aripov I., PhD
dotsent
Xasanova M.
3-bosqich talabasi
Guliston davlat universiteti
O‘zbekiston, Guliston

SIRDARYO VILOYATIDA GRUNT SUVLARI SATHI, MINERALLASHUVI VA NDSI BOG‘LIQLIGINI SENTINEL-2 VA GEOSTATISTIKA ASOSIDA MODELLASHTIRISH

Annotatsiya. Ushbu tadqiqotda Sirdaryo viloyati sug‘oriladigan yerlarida grunt suvlari sathi, minerallashuvi va tuproq sho‘rlanishining NDSI ko‘rsatkichi o‘rtasidagi bog‘liqlik Sentinel-2 tasvirlari va geostatistik usullar asosida baholandi. Natijalar grunt suvlari sathi sayozlashishi va minerallashuv ortishi bilan NDSI qiymatlari oshishini ko‘rsatdi. Yoz mavsumida ushbu bog‘liqlik kuchaygani aniqlandi. Olingan natijalar sho‘rlanish xavfini monitoring qilish va meliorativ tadbirlarni rejalashtirishda foydalanish mumkin.

Kalit so‘zlar: Sirdaryo viloyati, grunt suvlari, minerallashuv, NDSI, Sentinel-2, sho‘rlanish, geostatistika.

Aripov I., PhD
associate professor
Xasanova M.
third-year student
Gulistan State University
Uzbekistan, Gulistan

MODELING THE RELATIONSHIP BETWEEN GROUNDWATER LEVEL, MINERALIZATION AND NDSI IN THE SYRDARYA REGION USING SENTINEL-2 AND GEOSTATISTICS

Abstract. This study assessed the relationship between groundwater level, mineralization, and the NDSI indicator of soil salinity in irrigated lands of the Syrdarya region using Sentinel-2 imagery and geostatistical methods. The results showed that NDSI values increased with shallower groundwater levels and higher mineralization. This relationship was found to be stronger during the summer season. The findings can be used to monitor salinity risks and support the planning of reclamation measures.

Keywords: Syrdarya region, groundwater, mineralization, NDSI, Sentinel-2, soil salinity, geostatistics.

Kirish. Tuproq sho‘rlanishi qishloq xo‘jaligi yerlarining degradatsiyasiga olib keluvchi eng muhim ekologik muammolardan biri bo‘lib, ayniqsa qurg‘oqchil va yarim qurg‘oqchil mintaqalarda sug‘orma dehqonchilik sharoitida keskin

namoyon bo‘ladi. Markaziy Osiyo, xususan O‘zbekiston sug‘oriladigan yerlarining taxminan 45–50 foizi turli darajada sho‘rlanganligi qayd etilgan [1, 2]. Sirdaryo viloyati Mirzacho‘l vohasining asosiy qismini egallashi, yer osti suvlari sathining yuqoriligi va drenaj tizimlarining yetarli rivojlanmaganligi sababli ushbu jarayonlarga nisbatan yuqori sezuvchanlikka ega [3, 4].

Grunt suvlari sathi va ularning minerallashuvi tuproq sho‘rlanishining asosiy omillari hisoblanadi. Tadqiqotlar shuni ko‘rsatadiki, sizot suvlari sathi 1,5–2,0 m dan sayoz joylashgan hududlarda kapillyar ko‘tarilish hisobiga tuzlarning yuza qatlamlarda to‘planishi sezilarli darajada kuchayadi [5, 6]. Aripov va boshqalar (2024) Sirdaryo viloyatida grunt suvlari rejimining ekinlar hosildorligiga ta’sirini o‘rganib, minerallashuv darajasi 3 g/l dan yuqori bo‘lgan maydonlarda hosildorlikning keskin pasayishini aniqlaganlar [7].

So‘nggi yillarda masofadan zondlash texnologiyalari tuproq sho‘rlanishini tezkor va keng ko‘lamda monitoring qilishning samarali vositasiga aylandi. Normalized Difference Salinity Index (NDSI) SWIR va Green spektral diapazonlariga asoslangan holda sho‘rlanish darajasini farqlashda keng qo‘llanilmoqda [8, 9]. Axunboboyev, Zikirov va Kenjayev (2026) Sentinel-2 tasvirlari asosida Sirdaryo viloyatida NDSI yordamida mavsumiy sho‘rlanish xaritalarini yaratib, avgust oyida yuqori va juda yuqori toifadagi maydonlarning sezilarli ortganini ko‘rsatdilar [10]. Zikirov, Kenjayev va Aripov (2026) esa Landsat va Sentinel-2 ma’lumotlari, NDSI, SI va NDVI indekslari yordamida grunt suvlari sathi bilan sho‘rlanish o‘rtasidagi bog‘liqlikni tahlil qilganlar [11].

Shu bois, ushbu tadqiqotning maqsadi Sirdaryo viloyati sug‘oriladigan yerlarida grunt suvlari sathi, ularning minerallashuvi va NDSI o‘rtasidagi bog‘liqlikni Sentinel-2 multispektral tasvirlari hamda geostatistik usullar yordamida modellashtirishdan iborat. Tadqiqot natijalari sho‘rlanish xavfini oldindan baholash, meliorativ chora-tadbirlarni maqsadli rejalashtirish va suv resurslaridan oqilona foydalanishda amaliy ahamiyat kasb etadi.

Natijalar. Sentinel-2 tasvirlari asosida hisoblangan NDSI qatlamlari va grunt suvlari kuzatuv ma’lumotlarining geostatistik interpolatsiyasi (IDW, Kriging) natijalari quyidagicha:

1-jadval. Grunt suvlari sathi, minerallashuvi va NDSI o‘rtasidagi bog‘liqlik ko‘rsatkichlari (2024-yil)

Parametr	Bahor (mart)	Yoz (avgust)	Pearson r	p-qiymat
Grunt suvlari sathi (m)	1,8 ± 0,4	1,4 ± 0,3	–0,72	<0,01
Minerallashuv (g/l)	2,6 ± 0,9	3,4 ± 1,1	0,68	<0,01
NDSI o‘rtacha qiymati	0,13	0,16	–	–

2-jadval.
NDSI toifalari bo‘yicha maydonlar taqsimoti (%)

NDSI toifasi	Bahor	Yoz	O‘zgarish
Past (≤ 0,10)	13	7	–6
O‘rtacha (0,10–0,15)	53	51	–2
Yuqori (0,15–0,20)	30	36	+6
Juda yuqori (> 0,20)	4	6	+2
Umumiy sho‘rlangan (≥0,10)	87	93	+6

3-jadval.
Tumanlar kesimida o‘rtacha NDSI va grunt suvlari sathi

Tuman	O‘rtacha NDSI	Grunt suvlari sathi (m)	Minerallashuv (g/l)
Oqoltin	0,17	1,3	3,8
Mirzaobod	0,16	1,4	3,5
Boyovut	0,15	1,5	3,2
Sardoba	0,18	1,2	4,1
Guliston	0,12	1,9	2,4

Kriging interpolatsiyasi xatolik ko‘rsatkichi (RMSE) grunt suvlari sathi uchun 0,28 m, minerallashuv uchun 0,41 g/l ni tashkil etdi. NDSI va grunt suvlari sathi o‘rtasidagi bog‘liqlik yoz mavsumida r = –0,78 gacha kuchaygan.

Muhokama. Olingan natijalar Sirdaryo viloyati sug‘oriladigan yerlarida grunt suvlari sathi, minerallashuvi va NDSI indeksi o‘rtasida kuchli bog‘liqlik mavjudligini tasdiqlaydi. Bahor mavsumida o‘rtacha NDSI qiymati 0,13 bo‘lgan bo‘lsa, yozda 0,16 gacha ko‘tarilgani, yuqori va juda yuqori sho‘rlanish toifalarining ulushi mos ravishda 6 va 2 foizga oshgani kuzatildi. Bu o‘zgarishlar grunt suvlari sathining 1,8 m dan 1,4 m gacha sayozlashishi va minerallashuvning 2,6 g/l dan 3,4 g/l gacha ortishi bilan bevosita bog‘liq. Pearson korrelyatsiya koeffitsiyenti yoz mavsumida r = –0,78 gacha kuchaygani bug‘lanish jarayonining kuchayishi sharoitida kapillyar ko‘tarilishning rolini yaqqol ko‘rsatadi.

Ushbu natijalar oldingi tadqiqotlar bilan yaxshi mos keladi. Axunboboyev, Zikirov va Kenjayev (2024) Sentinel-2 asosida o‘tkazgan tadqiqotlarida ham avgust oyida yuqori sho‘rlanish toifalarining sezilarli ortgani qayd etilgan edi. Zikirov, Kenjayev va Aripov (2024) ishlarida ham sizot suvlari sathi 1,5–2,0 m dan sayoz joylarda NDSI qiymatlarining yuqoriligi ta’kidlangan. Aripov va Radkevich (2024) grunt suvlari minerallashuvining hosildorlikka salbiy ta’sirini ko‘rsatgan bo‘lsa, ushbu tadqiqot bu bog‘liqlikni spektral indeks orqali miqdoriy ifodalash imkonini berdi. Omonov va boshqalar (2022) Landsat asosida o‘tkazgan tadqiqotlarida NDSI ning boshqa indekslarga nisbatan yuqori samaradorligi qayd etilgani ham bizning yondashuvimizni qo‘llab-quvvatlaydi.

Nazariy jihatdan tadqiqot natijalari qurg‘oqchil mintaqalarda ikkilamchi sho‘rlanish mexanizmini chuqurroq tushunishga xizmat qiladi. Grunt suvlari sathi va minerallashuvi bilan NDSI o‘rtasidagi mustahkam bog‘liqlik spektral indekslarning gidrogeologik omillarni aks ettirish qobiliyatini tasdiqlaydi. Geostatistik usullar (ayniqsa Kriging) punktli ma’lumotlarni fazoviy taqsimlashda

yuqori aniqlikni ta’minlab, masofadan zondlash ma’lumotlari bilan integratsiyalashgan monitoring tizimini yaratish imkoniyatini ochadi.

Kelajak tadqiqotlari uchun quyidagi yo‘nalishlar tavsiya etiladi: ko‘p yillik vaqt qatorlari asosida dinamik modellashtirish; turli spektral indekslar (SI, VSSI, CRSI) ni taqqoslash; sun’iy intellekt algoritmlari (Random Forest, SVM) yordamida prognoz aniqligini oshirish; hamda biologik melioratsiya (masalan, *Glycyrrhiza glabra*) samaradorligini spektral monitoring bilan birgalikda baholash. Bunday yondashuvlar Sirdaryo viloyati va shunga o‘xshash hududlarda barqaror yer-suv resurslari boshqaruvini ta’minlashga xizmat qiladi.

Xulosa. Tadqiqot natijalari Sirdaryo viloyati sug‘oriladigan yerlarida grunt suvlari sathi, minerallashuvi va NDSI ko‘rsatkichi o‘rtasida sezilarli bog‘liqlik mavjudligini ko‘rsatdi. Yoz mavsumida grunt suvlari sathi 1,8 m dan 1,4 m gacha sayozlashib, minerallashuv 2,6 g/l dan 3,4 g/l gacha oshgan va NDSI o‘rtacha qiymati 0,13 dan 0,16 gacha ko‘tarilgan. Grunt suvlari sathi bilan NDSI o‘rtasidagi korrelyatsiya yozda r = –0,78 gacha kuchaygan. Sho‘rlanish xavfi Oqoltin, Mirzaobod, Boyovut va Sardoba tumanlarida yuqoriroq ekanligi aniqlandi. Sentinel-2 ma’lumotlari va geostatistik usullarni birgalikda qo‘llash grunt suvlari va tuproq sho‘rlanishining hududiy xususiyatlarini baholash hamda meliorativ tadbirlarni rejalashtirish uchun samarali yondashuv sifatida tavsiya etiladi.

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Aslonov M.T.
Toshkent amaliy fanlar universiteti
O‘zbekiston, Toshkent
Azimov E.U.
umumiy iqtisodiy fanlar kafedrasi o‘qituvchisi
Toshkent amaliy fanlar universiteti
O‘zbekiston, Toshkent

OZIQ-OVQAT XAVFSIZLIGI: IQTISODIY XAVFSIZLIKNING ASOSI

Annotatsiya. Ushbu maqolada oziq-ovqat xavfsizligi konsepsiyasining davlat iqtisodiyotidagi o'rni va ahamiyati nuqtai nazaridan tahlil qilinadi. Oziq-ovqat xavfsizligi nafaqat aholini yetarli va sifatli oziq-ovqat mahsulotlari bilan ta'minlash balki mamlakatning strategik mustaqillig, qishloq xo'jaligining barqaror rivojlanishi va import qilinishiga qaramlik darajasini minimallashtirishga qaratilgan. Maqolada oziq-ovqat xavfsizligining asosiy ko'rsatkichlari unga tahdid soluvchi omillar shuningdek yo'llar bilan ta'minlash so'zsiz saqlanib qolinadi. Xususan, qishloq xo'jaligining salohiyatini oshirish zaxiralarni shakllantirish ilg'or texnologiyalarni joriy etish va xalqaro hamkorlikni rivojlantirish kabi chora-tadbirlar samaradorligi o'rganiladi. Maqolaning maqsadi oziq-ovqat xavfsizligi muammosi murakkab iqtisodiy va strategik vazifa sifatida ko'rish - bu chiqish yo'li. Ushbu maqolada iqtisodiy xavfsizlik holatining eng muhim tarkibiy qismi oziq-ovqat xavfsizligining nazariy va amaliy jihatlarini o'rganishga bag'ishlangan. Maqolada oziq-ovqat xavfsizligi konsepsiyasining zamonaviy talqini uning asosiy ko'rsatkichlari iqtisodiyotga ta'siri shuningdek uni ta'minlashdagi asosiy muammolar va ularni bartaraf etish o'sish yo'llari tahlil qilinadi. O‘zbekiston Respublikasining ushbu sohadagi yutuqlari afzalliklari va duch kelayotgan qiyinchiliklari e’tiborga olinmasdan, mamlakatimizda oziq-ovqat xavfsizligini mustahkamlash bo‘yicha taklif va tavsiyalarga muvofiq ish olib borilmoqda. Tadqiqot natijalari iqtisodiy siyosatni shakllantirish organlari tadqiqotchilar va oliy o‘quv yurtlari talabalarini tayyorlash uchun amaliy ahamiyatga ega.

Kalit so‘zlar: Oziq-ovqat xavfsizligi, iqtisodiy xavfsizlik,oziq-ovqat mustaqilligi, qishloq qishloq xo'jaligi, oziq-ovqat zaxiralari, oziq-ovqat qatlami, import, ishlab chiqarishni chiqarish, strategik mahsulotlar, barqarorlik, milliy xavfsizlik, O'zbekiston.

Aslonov M.T.
Tashkent University of Applied Sciences
Uzbekistan, Tashkent
Azimov E.U.
lecturer, Department of General Economic Sciences
Tashkent University of Applied Sciences
Uzbekistan, Tashkent

FOOD SECURITY AS THE BASIS OF ECONOMIC SECURITY

Abstract. This article examines the concept of food security and its role in national economic security. Food security involves not only providing the population with sufficient high-quality food but also safeguarding strategic independence, ensuring stable agricultural development and reducing dependence on imports. The study discusses key food security indicators, threats and approaches to addressing them. Particular attention is paid to agricultural capacity, the formation of reserves, the introduction of advanced technologies and international cooperation. The article considers achievements and challenges in Uzbekistan and proposes recommendations for strengthening food security. The findings may be useful to economic policymakers, researchers and university students.

Keywords: food security, economic security, food sovereignty, agriculture, food reserves, imports, production, strategic products, sustainability, national security, Uzbekistan.

Davlatning iqtisodiy xavfsizligi, uning suvereniteti va barqaror rivojlanishi asosiy kafolatdir. Bu tizimning eng nozik va muhim tarkibiy qismi birinchi qismdan oziq-ovqat xavfsizligidir. Oziq-ovqat xavfsizligi nafaqat barcha fuqarolar, balki jismoniy va iqtisodiy jihatdan yetarli, xavfsiz va sifatli oziq-ovqat mahsulotlariga doimiy kirish imkoniyatini tushunadi. Bugungi kunda global iqlim o'zgarishi, geosiyosiy mojarolar va iqtisodiy inqirozlar davrida bu masala hozirgi kunda ahamiyat kasb etmayotgandek, davlatning iqtisodiy xavfsizligi, uning suvereniteti, barqaror rivojlanishi va fuqarolar farovonligi asosiy kafolatdir. Murakkab tizim ichidagi oziq-ovqat xavfsizligi alohida, strategik ahamiyatga ega, bu nafaqat aholining to'yinganligi, balki mamlakatning siyosiy mustaqilligi, ijtimoiy tinchligi va iqtisodiy barqarorligi bilan bevosita bog'liq. Global iqlim o'zgarishi, pandemiyalar, geosiyosiy mojarolar va xalqaro bozorlardagi o'zgaruvchanlik, har bir sharoitda davlat o'z oziq-ovqat bazasini mustahkamlash uchun eng ustuvor vazifalardan biriga aylanmoqda. Ushbu maqolaning maqsadi oziq-ovqat xavfsizligi, iqtisodiy xavfsizlikni chuqur o'rganish, unga tahdid soluvchi omillarni aniqlash va O'zbekiston sharoitida samarali ko'rsatmalar berishdan iborat.

Ko'rib chiqilayotgan masalaning hozirgi holati tahlili. Oziq-ovqat xavfsizligi,milliy iqtisodiyotning barqarorligi va mustaqilligi asosiy ko'rsatkichlardan biri bo'lib, agar mamlakat asosiy oziq-ovqat mahsulotlari (don, yog', shakar, go'sht) va boshqalarni o'z ehtiyojlarini qondirish orqali ta'minlasa, tashqi tahdidlar va bozorlarning o'zgarishi nisbatan mustahkam o'rin tutadi. Aksincha importga qattiq bog'liqlik global narxlarning o'sishi va zanjirdagi ta'minotning uzilishi oldida mutlaqo turgandek tufayli har bir Qanaqasiga davlat uchun oziq-ovqat - oziq-ovqat ta'minlash uchun xavfsizlik strategik vazifa Oziq - ovqat xavfsizligi tushunchasi kengayish natijasida paydo bo'ladi bu nafaqat harbiybalki iqtisodiy ekologik va ijtimoiy jihatlarni ham o'z ichiga oladi, xalqaro tashkilotlar (BMT, FAO) tomonidan qabul qilingan ta'rifga ko'ra oziq-ovqat xavfsizligi barcha fuqarolarning jismoniy ijtimoiy va iqtisodiy ehtiyojlarini faol va sog'lom hayot kechirish uchun kechirimli bo'lishi uchun yetarli xavfsiz va oziq-ovqat mahsulotlariga boy oziq-ovqat mahsulotlarini doimiy jismoniy, ijtimoiy va

iqtisodiy jihatdan kirish imkoniyati bo'lishi kerak.Iqtisodiy nuqtai nazardan oziq-ovqat xavfsizligi milliy iqtisodiyotning barqarorligi va mustaqilligining asosiy ko'rsatkichidir. Mamlakatning asosiy oziq-ovqat mahsulotlari (don, kartoshka, sabzavot, meva, go'sht, sut) bo'yicha o'z ehtiyojlarini qondira oladimi yoki yo'qmi tashqi tahdidlar va global bozorlarning o'zgarishlariga nisbatan chidamlilikni belgilaydi. Importga qaramlikning yuqori darajasi mamlakatning tashqi siyosiy va iqtisodiy bosimi narxlarning keskin o'sishi va ta'minot zanjiridagi uzilishlar zaiflashib borayotgan nuqtaga yetib bormoqda. Shuning uchun oziq-ovqat xavfsizligini ta'minlash davlatning har qanday strategik vazifasi hisoblanadi.

Oziq-ovqat xavfsizligi uy ko'rsatkichlari: Oziq-ovqat - oziq-ovqat xavfsizlik daraja ergashish ko'rsatkichlar asoslangan baholash mumkin ,Fizik Mavjudligi Aholi raqamga nisbatan yetarli miqdor bo'yicha oziq-ovqat - oziq-ovqat mavjudlik Iqtisodiy kirish imkoniyati: Aholi katta qismi shu jumladan kam ta'minlangan qatlamlar oziq-ovqat mahsulotlarini sotib olish orqali daromad olish uchun yetarli miqdorda pul topish kerak.Mahsulot sifati va xavfsizligi: Oziq-ovqat mahsulotlarining sanitariya va toksikologik talablarga javob berishi.Barqarorlik: Mavsumiy va o'zgarishlarga mos ravishda, ta'minot uzluksizligiga qaramay, doimiy ravishda

Oziq-ovqat xavfsizligiga tahdid soluvchi asosiy omillar: O'zbekiston va ko'plab rivojlanayotgan mamlakatlar oziq-ovqat xavfsizligini ta'minlashda quyidagi asosiy muammolar va tahdidlar yuzaga kelmoqda**:**Iqlim o'zgarishi va tabiiy ofatlar qurg'oqchilik, suv tanqisligi, bo'ron va do'l kabi salbiy hodisalar qishloq xo'jaligi mahsulotlarining unumdorligiga bevosita ta'sir ko'rsatmoqda.Cheklangan resurslar: Suv va yer resurslari, shuningdek ularning sifat jihatidan yomonlashishi (sho'rlanish, eroziya).Texnologik qoida:Qishloqda fermada ilg'or resurslarni tejaydigan texnologiyalar (xususan, qishloq qishloq xo'jaligi, suvni tejaydigan texnologiyalar) qo'llanilmaydigan darajada yetarli.Infratuzilmaning rivojlanmaganligi:Ish va logistika (qadoqlash) tizimlarini yetarli darajada tejang, qayta saqlang, natijada hosilning sezilarli qismi yo'qoladi.Yuqori darajadagi importga qaramlik:Ba'zi strategik mahsulotlar (masalan, don, neft) manbalarga qaramlikdan tashqarida.Jahon bozorlaridagi narx o'zgaruvchanligi Xalqaro bozorda narxlarning keskin ko'tarilishi ichki bozorga bevosita ta'sir ko'rsatmoqda va inflyatsiyaning pasayishiga olib keldi.

Oziq-ovqat xavfsizligining asosiy ko'rsatkichlari va ularning ahamiyati

Quyidagi asosiy ko'rsatkichlar bo'yicha oziq-ovqat xavfsizligi holatini kompleks baholash quyidagilarga nisbatan qo'llaniladi:Jismoniy mavjudlik Bu ko'rsatkich mamlakatda ishlab chiqarilgan va import qilingan oziq-ovqat mahsulotlarining umumiy soniga nisbatan aholi soniga nisbatan aks etadi. Bu aholining jon boshiga to'g'ri keladigan kaloriya va oqsil miqdorini hisoblash orqali aniqlanadi.Iqtisodiy kirish imkoniyati Oziq-ovqat xavfsizligi eng nozik jihat. Bu aholining ko'rsatkichi, jumladan, eng kam ta'minlangan qatlamlar, oziq-ovqat mahsulotlarini sotib olish uchun yetarli daromad olish uchun yetarli miqdorda oziq-ovqat mahsulotlarini sotib olish, chegarada yashovchi aholining kambag'allik darajasi bo'lishi kerak. Bu ko'rsatkich yechimni amalga oshiruvchi

hisoblanadi.Mahsulot sifati va xavfsizligi (foydalanish) Oziq-ovqat mahsulotlarining sanitariya-gigiyena, mikrobiologik va toksikologik talablarga muvofiqligi, shuningdek, ularning biologik qiymatini (vitaminlar, minerallar) ifodalaydi. Bu sog'lom va mustahkam avlodni shakllantirishning asosidir.Barqarorlik Bu ko'rsatkich mavsumiy, iqlimiy yoki iqtisodiy inqirozlar (narxlar), keskin o'sish, ishsizlik) va uchdan yuqori uzluksiz sharoitlar (mavjudlik, kirish, sifat) ni aks ettirish qobiliyatini ta'minlaydi.Oziq-ovqat xavfsizligi uchun tahdid Kim omillardir.Tabiiy ofatlar va iqlim o'zgarishi: qurg'oqchilik, suv toshqinlari, zararkunandalar hosilga zarar yetkazdi,Yer va suv resurslarining cheklanganligi.Qishloq xo'jaligi texnologiyalari yetarli emas.Rivojlanmagan infratuzilma (qoplar, omborlar)Yuqori darajadagi importga bog'liqlik global bozor narxlarining o'zgaruvchanligi Oziq-ovqat xavfsizligini ta'minlash yo'llari Qishloq xo‘jaliklarini modernizatsiya qilish va unumdorlikni oshirish: ilg‘or sug‘orish tizimlari, sifatli urug‘ yetishtirish, zamonaviy qishloq xo‘jaligi texnologiyalari,davlat tomonidan qo'llab-quvvatlashni kuchaytirish: Fermerlar va emitentlarga subsidiyalar, soliq imtiyozlari, maqsadli kreditlarni ajratish,Strategik oziq-ovqat zaxiralarini shakllantirish: Mamlakat kamida 3-6 oy davomida asosiy mahsulotlar zaxirasini saqlashni ta'minlaydi importni diversifikatsiya qilish va mahalliy ishlarni rag'batlantirish oziq-ovqat sanoati rivojlanib, ishchi kuchi yana oshadi xalqaro hamkorlikni rivojlantirish: Xalqaro tashkilotlar va boshqa kelishuvlarga ega mamlakatlarga muvofiq oziq-ovqat mahsulotlari,O'zbekiston mustaqillikka erishganidan so'ng, oziq-ovqat xavfsizligini ta'minlash sohasida jiddiy islohotlar amalga oshirildi. Paxta monopoliyasidan voz kechish, fermer va dehqon xo'jaliklarini qo'llab-quvvatlash, qishloqlarga investitsiyalarni jalb qilish kabi choralar ko'rilishi mamlakatning asosiy qishloq xo'jaligi mahsulotlari (sabzavot, meva, poliz ekinlari) ni to'liq ta'minlash va hatto eksport qilish imkoniyatiga ega bo'ldi.Biroq, bitta qator muammolar hali ham saqlanib qolmoqda**,**qisman bog'liqlik bo'yicha don mahsulotlari,Strategik ahamiyatga ega bo'lgan bug'doy kabi mahsulotlarning bir qismi import qilinadi.Suv muammosi, Aholi soni va iqtisodiyotning tez o'sishi, qurg'oqchilikning ortishi, suv resurslariga bosimning ortishi kuzatilmoqda.Yo'qotishlar va kamchiliklar Hosilni yig'ib olish, saqlash va qayta ishlash jarayonida sezilarli qism yo'qotilmoqda.Mahalliy yana ish sanoatining rivojlanmaganligi Bu qo'shimcha qiymatga ega yuqori mahsulotlarni ishlab chiqarish chegaralariga qarab ishlaydi.

TADQIQOT METODOLOGIYASI: Yuqoridagi muammolarni hisobga olgan holda, O'zbekistonda oziq-ovqat xavfsizligini yanada mustahkamlash bo'yicha quyidagi chora-tadbirlarni amalga oshirish mumkin:Agrosanoat kompleksini integratsiyalash va diversifikatsiya qilish:Qishloq xo'jaligi mahsulotlari qo'shimcha qiymatni oshirish orqali sanoatni chuqur qayta ishlash orqali rivojlantiriladiEksport qilinadigan mahsulotlar tarkibini kengaytirish (organik mahsulotlar, quruq mevalari).Yashil iqtisodiyotga o'tish va innovatsiyalarni rag'batlantirish suvni tejovchi texnologiyalar (tomchilatib sug'orish) (keng) joriy bo'ladi,Foydalanish tamoyillaridan aniq qishloq fermasi.Iqlim o'zgarishiga chidamli yangi navlarni yaratish va tarqatish.Davlat tomonidan qo'llab-

quvvatlash tizimini takomillashtirish**,** Kichik va o'rta fermer xo'jaliklari qo'llab-quvvatlash orqali kreditlar, subsidiyalar va sug'urta mexanizmlarini maqsadli ravishda jalb qildi.Ilg'or texnologiyalar yaratilgan imtiyozli sharoitlarni sotib olish uchun sotib olinadi.Bozor monitoringi va axborot bazasi quyidagilarni yaratadi.Bozordagi oziq-ovqat mahsulotlari holati, narxlar va zaxiralar doimiy ravishda monitoring qilinmoqda.Yerning unumdorlik holati va resurslardan olinadigan suv samaradorligini nazorat qilishning noyob raqami platforma oqimi bo'lishi kerak.Xalqaro hamkorlikni mustahkamlash,FAO, BMTning boshqa qishloq xo'jaligi tashkilotlari va tajriba almashish va ilg'or bilimlarni o'zlashtirishga ixtisoslashgan mintaqaviy tashkilotlar.Oziq-ovqat bozorlarini diversifikatsiya qilish orqali erkin savdo shartnomalarini tuzish uchun qo'shni davlatlar.

Xulosa, boshqacha aytganda, milliy oziq-ovqat xavfsizligi har bir qismning bir qismi bo'lib, har birining bir tomonlama qo'llab-quvvatlashi va uzoq muddatli istiqbolda strategiya talab qiladi. Bu nafaqat qishloq xo'jaligidagi muammo, balki butun iqtisodiyot, ijtimoiy-siyosat, barqarorlik va mustaqillik, yechimni amalga oshiruvchi omil bo'lib, uning resurslarga bo'lgan ehtiyoji global maydonda davlatning muhim strategik ustunligi bo'ladi. Xulosa qilib aytganda, oziq-ovqat xavfsizligi nafaqat bitta soha, balki butun milliy xavfsizlik, iqtisodiy taraqqiyot va fuqarolar farovonligining mustahkam poydevoridir. Bu mamlakatning poydevoridir. Ichki va tashqi siyosat mustaqilligini belgilovchi strategik boylik hisoblanadi. O'zbekiston bu yo'lda erishilgan muvaffaqiyatlarga sezilarli darajada erishmoqda. Zamonaviy global va mintaqaviy chaqiriqlar uni yangi, innovatsion yechimlarni izlashga, qishloq xo'jaliklarini modernizatsiya qilishga va barcha resurslardan samarali foydalanishga undamoqda. Yuqorida keltirilgan takliflar amalga oshirilsa, mamlakatimiz nafaqat o'zining oziq-ovqat xavfsizligini ishonchli ta'minlashi, balki mintaqada ushbu soha yetakchisining markazga aylanishi mumkin.

O'ZBEKISTONDA OZIQ-OVQAT XAVFSIZLIGI KO'RSATKICHLARI (2023-2025) prognozi

Ko'rsatkichlar	Birlik	2023 (fakt)	2024 (prognoz)	2025 (prognoz)
Don mahsulotlari (bug'doy)	ming tonna	7200	7500	7800
Kartoshka	ming tonna	3500	3650	3800
Sabzavotlar	ming tonna	11 200	11 500	11 800
Meva va rezavorlar	ming tonna	2900	3100	3300
Tepalikning pastki qismi	ming tonna	1150	1200	1250
Go'sht (jon og'irligida)	ming tonna	2850	2950	3050

Ko'rsatkichlar	Birlik	2023 (fakt)	2024 (prognoz)	2025 (prognoz)
Sut	ming tonna	11 500	11 900	12 300
Tuxum	million dona	8200	8600	9000

Inflatsiya ko’rsatkichl

Oziq-ovqat inflyatsiyasi	% (yillik)	10,5%	9,2%	8.0%
Aholi oziq-ovqat mahsulotlariga sarflaydi	Daromadning foizi	48%	46%	44%
Qishloqdan fermer xo'jaligiga investitsiyalar	million dollar	1200	1350 ta	1500

5. EKSPORT/IMPORT

Oziq-ovqat eksporti	million dollar	1850	2100	2400
Oziq-ovqat importi	million dollar	2200	2150	2100
Eksport/import balansi	million dollar	350	50	300

JADVAL TAHLILI VA IZOHLAR: Ijobiy tendentsiyalar ishlab chiqarish hajmining o'sishi: Qishloq xo'jaligining barcha asosiy mahsulotlari ishlab chiqarilmoqda, ishlab chiqarish hajmi barqaror o'smoqda, ayniqsa go'sht, sut va mevalar ishlab chiqarilmoqda, ishlab chiqarishda sezilarli o'sish kuzatilmoqda.Importga qaramlikning pasayishi: 2025-yilga kelib oziq-ovqat ta'minoti darajasi 86% ga yetadi va eksport-import balansi ijobiy bo'lishi kutilmoqda.Infratuzilmani takomillashtirish strategik zaxiralar kuchaytirilganda, sug'orish tizimlarini modernizatsiya qilish amalga oshirilmoqda

Oziq-ovqat inflyatsiyasi: Yuqori darajada saqlanib qolmoqda, ammo pasayish tendentsiyasi ham kuzatilmoqda.Aholi xarajatlari: Daromadning oziq-ovqatga sarflangan mablag'larining deyarli yarmi iqtisodiy rivojlanish darajasini ko'rsatmoqda.**Suv samaradorligi** hali ham past, ammo yaxshilanish tendentsiyasi Mayjud

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Azimov U.A., PhD
dotsent
Oziq-ovqat texnologiyasi va muhandisligi xalqaro instituti
O‘zbekiston, Farg‘ona
ORCID: 0000-0002-9588-3576

JAMIYAT TARAQQIYOTIDA QADRIYATLARNING DINAMIKASI

Annotatsiya. Mazkur maqolada jamiyat taraqqiyotida qadriyatlar tizimining o‘rni va ahamiyati tahlil qilinadi. Qadriyatlar ijtimoiy hayotning muhim tarkibiy qismi bo‘lib, inson xulq-atvori, dunyoqarashi hamda jamiyatdagi ijtimoiy munosabatlarning shakllanishida muhim omil hisoblanadi. Tadqiqotda milliy va umuminsoniy qadriyatlarning uyg‘unligi, ularning tarixiy rivoji hamda zamonaviy jamiyat taraqqiyotiga ta’siri yoritib berilgan. Shuningdek, globallashuv sharoitida qadriyatlar tizimining o‘zgarishi, yoshlar ongida ma’naviy-axloqiy qadriyatlarni mustahkamlash masalalariga alohida e’tibor qaratilgan. Ish natijalari jamiyatning barqaror rivojlanishini ta’minlashda qadriyatlar tizimining muhim ahamiyatga ega ekanini ko‘rsatadi.

Kalit so‘zlar: jamiyat, taraqqiyot, qadriyatlar, qadriyatlar tizimi, transendental qadriyatlar, milliy qadriyatlar, ijtimoiy qadriyatlar, ma’naviy-axloqiy qadriyatlar, umuminsoniy qadriyatlar.

Azimov U.A., PhD
associate professor
International Institute of Food Technology and Engineering
Uzbekistan, Fergana

DYNAMICS OF THE VALUE SYSTEM IN SOCIETY DEVELOPMENT

Abstract. This article analyzes the role and importance of the value system in the development of society. Values are an important component of social life and are an important factor in the formation of human behavior, worldview, and social relations in society. The study highlights the harmony of national and universal values, their historical development, and their impact on the development of modern society. Also, special attention is paid to the issues of changing the value system in the context of globalization and strengthening spiritual and moral values in the minds of young people. The results of the study show that the value system is of great importance in ensuring the sustainable development of society.

Keywords: society, development, values, value system, transcendental values, national values, social values, spiritual and moral values, universal values.

Jamiyat taraqqiyoti va inson ma’naviy kamoloti qadriyatlar tizimi bilan chambarchas bog‘liqdir. Qadriyatlar insonning hayotga, jamiyatga, atrof-muhitga va o‘z-o‘ziga bo‘lgan munosabatini belgilaydigan muhim ma’naviy mezon hisoblanadi. Har bir jamiyat o‘z tarixi, madaniyati va ijtimoiy tajribasi asosida

muayyan qadriyatlar tizimini shakllantiradi. Ushbu tizim ijtimoiy barqarorlikni ta’minlash, shaxs tarbiyasi va ijtimoiy munosabatlarni tartibga solishda muhim ahamiyat kasb etadi.

Qadriyat (aksiologiya nuqtai nazaridan) - inson va jamiyat uchun muhim, ijtimoiy ahamiyatga ega bo‘lgan moddiy yoki ma’naviy ne’matlar, g‘oyalar, me’yorlar va maqsadlar majmuasidir. Qadriyatlar inson faoliyatini yo‘naltiruvchi, uning tanlovi va xulq-atvorini belgilab beruvchi asosiy omil sifatida namoyon bo‘ladi.

Ilmiy tadqiqotlarda qadriyatlar ob’yektiv va sub’yektiv xususiyatga ega deb qaraladi. Ob’yektiv jihatdan qadriyatlar jamiyat taraqqiyoti ehtiyojlaridan kelib chiqsa, sub’yektiv jihatdan ular inson ongida ma’naviy ehtiyoj va ishonch sifatida shakllanadi.

Qadriyatlar tizimi - muayyan jamiyat yoki shaxs hayotida ustuvor ahamiyat kasb etuvchi qadriyatlarning o‘zaro bog‘liq, iyerarxik va yaxlit majmuasidir. Bu tizimda qadriyatlar bir-birini to‘ldiradi, muvozanatlaydi va muayyan tartib asosida amal qiladi.

Qadriyatlar tizimi dinamik xarakterga ega bo‘lib, jamiyat taraqqiyoti, ijtimoiy-siyosiy o‘zgarishlar va madaniy jarayonlar ta’sirida yangilanib boradi. Shu bilan birga, ayrim asosiy qadriyatlar barqaror bo‘lib, avloddan-avlodga o‘tib keladi.

Ilmiy adabiyotlarda qadriyatlar tizimi quyidagi asosiy turlarga ajratiladi:

Umuminsoniy qadriyatlar - hayot, tinchlik, erkinlik, adolat, inson huquqlari, bag‘rikenglik kabi barcha xalqlar uchun umumiy ahamiyatga ega qadriyatlar.

Milliy qadriyatlar - muayyan millatga xos bo‘lgan urf-odatlar, an’analar, til, madaniyat, tarixiy meros va ma’naviy qarashlar. Milliy qadriyatlar - millat uchun ahamiyatga ega bo'lgan etnik jihat va xususiyatlar bilan bog‘liq xoslik shaklidir. Dunyoda o‘ziga xos qadriyatlari bo'lmagan millat yo‘q. Milliy qadriyatlar millatning tarixi, yashash tarzi, ma’naviyati, madaniyati bilan uzviy bog‘liq holda namoyon bo‘ladi.

Ijtimoiy qadriyatlar - jamiyatdagi ijtimoiy munosabatlar, hamkorlik, jamoaviylik, ijtimoiy mas’uliyat bilan bog‘liq qadriyatlar. Ijtimoiy qadriyatlar - jamiyatning ma’naviy poydevorini tashkil etuvchi muhim komponent bo‘lib, ular shaxs va jamiyat o‘rtasidagi o‘zaro munosabatlarni belgilaydi, xulq-atvor va ijtimoiy harakatlarni tartibga soladi.

Shaxsiy qadriyatlar - insonning individual hayotiy maqsadlari, axloqiy tamoyillari, dunyoqarashi va shaxsiy e’tiqodlari. Shaxsiy qadriyatlar- bu faqat jamiyatning moddiy va ruhiy qadriyatlarining shaxs ongida tanlab aks etishi emas, balki shaxsiy qadriyatlari shaxsga nisbatan "tashqi" deb ko'rinadigan atrof-muhit komponentlari ham bo'lishi mumkin, va bu juda aniq tashqi qobiqqa ega bo'lgan narsalar misolida ko'rsatilishi mumkin.

Ma’naviy-axloqiy qadriyatlar - vijdon, or-nomus, insof, mehr-oqibat, vatanparvarlik kabi ma’naviy fazilatlar.

Qadriyatlar tizimi jamiyatda ijtimoiy munosabatlarni tartibga solish, ma’naviy muhitni barqarorlashtirish va ijtimoiy hamjihatlikni ta’minlashda muhim

o‘rin tutadi. U jamiyat a’zolarining maqsad va manfaatlarini muvofiqlashtirib, ijtimoiy taraqqiyotga xizmat qiladi.

Shaxs hayotida esa qadriyatlar tizimi insonning hayotiy pozisiyasini belgilaydi, uning qaror qabul qilish jarayoniga yo‘nalish beradi va ma’naviy barkamolligini ta’minlaydi. Qadriyatlarga asoslangan shaxs o‘z faoliyatida mas’uliyatli, ijtimoiy faol va ma’naviy yetuk bo‘lib shakllanadi.

Qadriyatlar tizimini shakllantirishda ta’lim-tarbiya jarayoni hal qiluvchi omil hisoblanadi. Oila, ta’lim muassasalari va jamoatchilik institutlari orqali yosh avlodga milliy va umuminsoniy qadriyatlar singdiriladi. Ta’lim jarayonida axloqiy tarbiya, fuqarolik ta’limi va ma’naviy-ma’rifiy ishlar uyg‘unligi ta’minlanishi zarur.

Ayniqsa, yoshlarda mustaqil fikrlash, tanqidiy yondashuv va qadriyatlarga ongli munosabatni shakllantirish zamonaviy ta’limning muhim vazifalaridan biri hisoblanadi.

Qadriyatlar tizimi jamiyat va shaxs taraqqiyotining ma’naviy asosini tashkil etadi. U ijtimoiy barqarorlikni ta’minlash, inson ma’naviy kamolotini rivojlantirish va jamiyat taraqqiyotini yo‘naltirishda muhim ahamiyat kasb etadi. Shu bois, qadriyatlar tizimini ilmiy asosda o‘rganish va uni yosh avlod ongiga singdirish dolzarb vazifa hisoblanadi.

Qadriyatlar tizimi madaniyatning asosini tashkil etib, jamiyat a’zolarining ma’naviy va ijtimoiy ehtiyojlari, qiziqishlari, ularning ijtimoiy harakatlari va xulq-atvorini boshqarishni o‘zida aks ettiradi.

B.Bitinas va I.P.Podlasiylar qadriyatlarning uchta asosiy tizimini ajratib ko‘rsatishgan: transendental (diniy mohiyat nuqtai nazaridan qandaydir mutlaqlikka ega), ijtimoiy yo‘naltirilgan – sotsiosentrik (guruhiy, umuminsoniy, kasbiy, milliy va h.k.) va antroposentrik (individual).

Transendental qadriyatlar inson tafakkuri va madaniy hayotida alohida o‘rin tutuvchi, empirik tajribadan tashqarida mavjud bo‘lib, inson bilishi, axloqi va ma’naviy yo‘nalishini belgilovchi fundamental mezonlardir. “Transendental” tushunchasi lotincha transcendere - “chegaradan oshmoq” ma’nosini anglatib, bevosita tajriba doirasidan yuqorida turuvchi, ammo tajribani imkonli qiluvchi shartlarni ifodalaydi.

Falsafa tarixida transendental qadriyatlar masalasi ayniqsa Immanuil Kant ta’limotida chuqur asoslab berilgan. Kantga ko‘ra, transendental narsa tajribadan tashqarida emas, balki tajribani tashkil etuvchi a priori shartlar majmuasidir. Shu ma’noda haqiqat, ezgulik va go‘zallik kabi qadriyatlar inson ongining universal tuzilmalari sifatida namoyon bo‘ladi. Ular subyektiv istaklarga bog‘liq bo‘lmay, umumiy va zaruriy ahamiyat kasb etadi.

Transendental qadriyatlarning eng muhim xususiyati - ularning universalligidir. Masalan, “haqiqat” qadriyati ilmiy bilishning asosiy mezoni bo‘lib, madaniyatlar va davrlar almashinishidan qat’i nazar, bilish faoliyatining maqsadini belgilaydi. “Ezgulik” axloqiy faoliyatning transendental asosi sifatida inson xatti-harakatlariga me’yoriy yo‘nalish beradi. “Go‘zallik” esa estetik ongda borliqni uyg‘un va mazmunli idrok etish imkonini yaratadi.

Ontologik nuqtai nazardan, transcendental qadriyatlar mavjudlikning empirik shakllaridan mustaqil holda, ma’naviy reallik sifatida talqin etiladi. Aksiologiya doirasida esa ular barcha konkret qadriyatlarning poydevori bo‘lib xizmat qiladi. Masalan, adolat, erkinlik, mas’uliyat kabi ijtimoiy qadriyatlar o‘z mohiyatida ezgulik va haqiqat kabi transcendental tamoyillarga tayanadi.

Zamonaviy falsafada transcendental qadriyatlar masalasi insonparvarlik, global axloq va madaniyatlararo muloqot kontekstida qayta talqin etilmoqda. Texnologik taraqqiyot va globallashuv sharoitida aynan transcendental qadriyatlar insoniyatni utilitar manfaatlardan ustun bo‘lgan umumiy ma’naviy mezonlar asosida birlashtirish imkonini beradi.

Transcendental qadriyatlar inson bilishi va faoliyatining chuqur falsafiy asoslarini tashkil etadi. Ular nafaqat nazariy tafakkur uchun, balki amaliy hayotda ma’naviy yo‘nalish va mas’uliyatni belgilovchi muhim omil sifatida ham o‘z ahamiyatini saqlab qoladi.

Sotsiosentrik qadriyatlar jamiyatni oliy ijtimoiy ahamiyatga ega hodisa sifatida talqin qiluvchi va shaxs manfaatlarini ijtimoiy butunlik manfaatlariga bo‘ysundiruvchi qadriyatlar tizimini ifodalaydi. “Sotsiosentrizm” tushunchasi lotincha societas - “jamiyat” va centrum - “markaz” so‘zlaridan kelib chiqib, jamiyatni axloqiy, siyosiy va madaniy baholashning markaziga qo‘yishni anglatadi.

Falsafa tarixida sotsiosentrik qadriyatlar qadimgi davrlardanoq shakllangan. Masalan, antik yunon falsafasida Aristotel insonni “ijtimoiy mavjudot” (zoon politikon) sifatida ta’riflab, shaxs kamolotini polis hayoti bilan uzviy bog‘liq holda tushuntirgan. Sharq falsafiy tafakkurida ham jamoa, jamiyat manfaatlari, ijtimoiy uyg‘unlik va mas’uliyat muhim qadriyatlar sifatida ilgari surilgan. Konfutsiylik ta’limotida jamiyatdagi tartib, burch va ierarxiya sotsiosentrik yondashuvning yorqin namunasi hisoblanadi.

Aksiologik nuqtai nazardan, sotsiosentrik qadriyatlar ijtimoiy barqarorlik va hamjihatlikni ta’minlashga qaratilgan bo‘lib, ularga ijtimoiy adolat, birdamlik, burch, fuqarolik mas’uliyati, jamoaviy manfaat va ijtimoiy tartib kabi tushunchalar kiradi. Bu qadriyatlar shaxsning xatti-harakatlarini nafaqat shaxsiy manfaatlar, balki jamiyat oldidagi mas’uliyat mezonlari asosida baholashni talab etadi.

Sotsiosentrik yondashuvda shaxs mustaqil va mutlaq qadriyat sifatida emas, balki ijtimoiy munosabatlar tizimining tarkibiy qismi sifatida qaraladi. Shu sababli shaxs erkinligi ijtimoiy me’yorlar va umumiy manfaatlar bilan muvofiqlashtiriladi. Bu holat, ayniqsa, siyosiy falsafa va ijtimoiy nazariyalarda muhim ahamiyat kasb etadi. Masalan, kollektivizm g‘oyalariga asoslangan ta’limotlarda jamiyat manfaatlari individual manfaatlardan ustun qo‘yiladi.

Zamonaviy jamiyatda sotsiosentrik qadriyatlar globallashuv, ijtimoiy tengsizlik va madaniy xilma-xillik sharoitida yangicha mazmun kasb etmoqda. Fuqarolik jamiyati, ijtimoiy birdamlik va umumiy mas’uliyat tushunchalari sotsiosentrik qadriyatlarning hozirgi davrdagi muhim ko‘rinishlaridir. Shu bilan birga, zamonaviy falsafada sotsiosentrizmning haddan tashqari mutlaqlashtirilishi shaxs erkinligi va individual huquqlarni cheklashi mumkinligi ham tanqid qilinadi.

Sotsiosentrik qadriyatlar jamiyatning yaxlitligini, barqaror rivojlanishini va ijtimoiy uyg‘unligini ta’minlovchi muhim ma’naviy-aksiologik asosdir. Ular shaxs va jamiyat o‘rtasidagi munosabatlarni tartibga solishda muhim rol o‘ynaydi hamda individualizm va antropotsentrizm kabi yondashuvlar bilan dialektik munosabatda rivojlanadi.

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Baxtiyorov X.Sh.
stajyor-o‘qituvchi
Qarshi davlat texnika universiteti
O‘zbekiston, Qarshi

SUN’IY INTELLEKT TEXNOLOGIYALARINING BANK RISKLARINI BOSHQARISHDAGI IMKONIYATLARI

Annotatsiya. Mazkur maqolada sun’iy intellekt texnologiyalaridan bank risklarini boshqarishda foydalanish imkoniyatlari va ularning bank faoliyatiga ta’siri ko‘rib chiqilgan. Kredit riskini baholash, shubhali moliyaviy operatsiyalarni aniqlash, operatsion xatolarni kamaytirish va moliyaviy ko‘rsatkichlarni prognozlash jarayonlarida sun’iy intellektning o‘rni yoritilgan. Shuningdek, ushbu texnologiyalardan foydalanishda yuzaga kelishi mumkin bo‘lgan ma’lumotlar sifati, algoritmik tarafkashlik, kiberxavfsizlik va model natijalarini izohlash bilan bog‘liq muammolar tahlil qilingan. Maqola yakunida O‘zbekiston bank tizimida sun’iy intellekt asosidagi risk-menejmentni rivojlantirishga qaratilgan amaliy takliflar ilgari surilgan.

Kalit so‘zlar: sun’iy intellekt, bank risklari, kredit riski, mashinaviy o‘qitish, risk-menejment, moliyaviy barqarorlik, kiberxavfsizlik, raqamli bank xizmatlari.

Baxtiyorov X.Sh.
trainee lecturer
Karshi State Technical University
Uzbekistan, Karshi

OPPORTUNITIES FOR USING ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN BANK RISK MANAGEMENT

Abstract. This article examines the opportunities for using artificial intelligence technologies in bank risk management and their impact on banking activities. It discusses the role of artificial intelligence in credit risk assessment, detection of suspicious financial transactions, reduction of operational errors, and forecasting financial indicators. The article also analyzes potential challenges related to data quality, algorithmic bias, cybersecurity, and the explainability of model decisions. Finally, practical recommendations are proposed for developing artificial intelligence-based risk management in the banking system of Uzbekistan.

Keywords: artificial intelligence, banking risks, credit risk, machine learning, risk management, financial stability, cybersecurity, digital banking services.

Bugungi kunda bank tizimining barqarorligi nafaqat moliyaviy resurslarning yetarliligi, balki mavjud xavflarni o‘z vaqtida aniqlash va ularga to‘g‘ri munosabat bildirish imkoniyatiga ham bog‘liq. Banklar kredit ajratish, to‘lovlarni amalga oshirish, mijozlarning mablag‘larini saqlash va turli moliyaviy xizmatlarni

ko‘rsatish jarayonida bir qator risklarga duch keladi. Iqtisodiy sharoitlarning o‘zgarishi, raqamli xizmatlar hajmining ortishi va moliyaviy operatsiyalarning murakkablashuvi ushbu risklarni an’anaviy usullar bilan boshqarishni qiyinlashtirmoqda. Shu sababli bank faoliyatida yangi texnologiyalardan foydalanish, xususan, sun’iy intellekt imkoniyatlarini o‘rganish muhim ahamiyat kasb etmoqda. Sun’iy intellekt so‘nggi yillarda iqtisodiyotning turli tarmoqlarida qo‘llanila boshladi. Bank sohasi ham bundan mustasno emas. Mazkur texnologiyalar katta hajmdagi ma’lumotlarni qisqa vaqt ichida qayta ishlash, turli ko‘rsatkichlar o‘rtasidagi bog‘liqliklarni aniqlash va kelgusida yuzaga kelishi mumkin bo‘lgan holatlarni prognozlash imkonini beradi. Oddiy qilib aytganda, sun’iy intellekt bankka faqat sodir bo‘lgan hodisalarni tahlil qilish emas, balki mavjud ma’lumotlardan foydalanib, ehtimoliy muammolarni oldindan ko‘rishga ham yordam berishi mumkin. Moliyaviy tashkilotlar faoliyatida sun’iy intellektdan foydalanishning ahamiyati xalqaro miqyosda ham e’tirof etilmoqda. Moliyaviy barqarorlik kengashi tomonidan 2024-yilda e’lon qilingan tahlilda ushbu texnologiyalar operatsion samaradorlikni oshirish, firibgarlik holatlarini aniqlash va moliyaviy xizmatlarni takomillashtirish imkoniyatiga ega ekani qayd etilgan. Shu bilan birga, texnologik provayderlarga qaramlik, kiberxavfsizlik, ma’lumotlar sifati va algoritmlarning noto‘g‘ri ishlashi kabi xavflar ham mavjudligi ta’kidlangan. Bu esa sun’iy intellektni bank tizimiga joriy etishda uning afzalliklari bilan bir qatorda, yuzaga kelishi mumkin bo‘lgan salbiy oqibatlarni ham hisobga olish zarurligini ko‘rsatadi. Bank risklari orasida kredit riski alohida o‘rin egallaydi. Chunki bank daromadlarining muhim qismi kredit operatsiyalari bilan bog‘liq bo‘lib, qarz oluvchilarning o‘z majburiyatlarini bajarmasligi bankning moliyaviy holatiga bevosita ta’sir ko‘rsatadi. Kredit ajratishdan oldin mijozning to‘lov qobiliyatini to‘g‘ri baholash, uning daromadlari va mavjud qarz majburiyatlarini o‘rganish hamda kreditni qaytarish ehtimolini aniqlash talab etiladi. An’anaviy baholash usullari ushbu vazifalarni bajarishda muhim ahamiyatga ega bo‘lsa-da, ayrim hollarda ko‘p sonli omillarni birgalikda tahlil qilishda cheklovlarga duch kelishi mumkin. Sun’iy intellekt va mashinaviy o‘qitish algoritmlari kredit riskini baholash jarayonini takomillashtirish uchun qo‘shimcha imkoniyatlar yaratadi. Ushbu texnologiyalar mijozlarning kredit tarixi, daromadlari, mavjud majburiyatlari va moliyaviy xatti-harakatlari to‘g‘risidagi ma’lumotlarni o‘zaro bog‘liq holda tahlil qilishga yordam beradi. Natijada kreditni qaytarmaslik ehtimolini aniqroq baholash va risk darajasi yuqori bo‘lgan holatlarni oldindan aniqlash imkoniyati paydo bo‘lishi mumkin. Bundan tashqari, kredit portfelidagi o‘zgarishlarni muntazam kuzatish orqali moliyaviy holati yomonlashayotgan mijozlarga nisbatan tegishli choralarni ertaroq ko‘rish mumkin.

Biroq kredit riskini baholashda sun’iy intellektdan foydalanish barcha muammolarni avtomatik ravishda hal qiladi, deb hisoblash noto‘g‘ri. Har qanday model o‘ziga kiritilgan ma’lumotlarga tayanadi. Agar ma’lumotlar noto‘g‘ri, eskirgan yoki yetarli bo‘lmasa, modelning xulosalari ham ishonchsiz bo‘lishi mumkin. Ayrim hollarda tarixiy ma’lumotlarda mavjud bo‘lgan nomutanosibliklar algoritm qarorlarida takrorlanishi ehtimoli bor. Bu esa kredit olish imkoniyatlarini

baholashda ayrim mijozlarga nisbatan adolatsiz yondashuv yuzaga kelishiga olib kelishi mumkin. Shuning uchun sun’iy intellekt tomonidan ishlab chiqilgan natijalar bank mutaxassislari tomonidan tekshirilishi va muhim qarorlar uchun tushunarli asoslar mavjud bo‘lishi kerak. Sun’iy intellektning bank faoliyatidagi yana bir muhim qo‘llanish yo‘nalishi firibgarlik holatlarini aniqlash bilan bog‘liq. Raqamli bank xizmatlari, mobil ilovalar va elektron to‘lovlardan foydalanish kengaygani sari moliyaviy operatsiyalarni nazorat qilishga qo‘yiladigan talablar ham ortmoqda. Firibgarlikning yangi usullari tez-tez paydo bo‘lishi sababli barcha shubhali holatlarni oldindan belgilangan qoidalar asosida aniqlash doimo ham yetarli bo‘lmaydi. Sun’iy intellekt esa mijozlarning odatiy operatsiyalarini o‘rganib, ulardan keskin farq qiladigan harakatlarni aniqlash imkonini beradi. Masalan, mijoz odatda kichik summalarda va muayyan hududda to‘lovlarni amalga oshirsa, qisqa vaqt ichida katta miqdordagi mablag‘larning turli manzillarga o‘tkazilishi qo‘shimcha tekshiruvni talab qiladigan holat sifatida baholanishi mumkin. Bunday tizimlar shubhali operatsiyalarni tezroq aniqlash va bank xodimlarining e’tiborini xavf darajasi yuqori bo‘lgan vaziyatlarga qaratishga yordam beradi. Shu bilan birga, har qanday noodatiy operatsiyani firibgarlik deb hisoblash mumkin emas. Aks holda qonuniy to‘lovlar ham asossiz ravishda cheklanishi mumkin. Shu sababli aniqlash tizimlarining samaradorligini baholashda firibgarlik holatlarini topish bilan birga, noto‘g‘ri ogohlantirishlar sonini ham hisobga olish zarur. Bank faoliyatida operatsion risklarni boshqarish ham sun’iy intellektdan foydalanish mumkin bo‘lgan muhim yo‘nalishlardan biridir. Operatsion risklar ichki jarayonlardagi kamchiliklar, xodimlar xatolari, axborot tizimlaridagi uzilishlar va tashqi hodisalar natijasida yuzaga kelishi mumkin. Bunday muammolar ayrim hollarda katta moliyaviy yo‘qotishlarga, mijozlar noroziligiga va bank obro‘sining pasayishiga sabab bo‘ladi. Sun’iy intellekt asosidagi tizimlar operatsiyalardagi noodatiy o‘zgarishlarni aniqlash, takrorlanuvchi xatolarni kuzatish va hujjatlarni qayta ishlash jarayonlarini avtomatlashtirish orqali operatsion nazoratni kuchaytirishi mumkin. Bundan tashqari, mazkur texnologiyalar mijozlarni identifikatsiya qilish, shubhali moliyaviy operatsiyalarni tekshirish va ichki nazorat jarayonlarida mutaxassislarga yordam berishi mumkin. Takroriy vazifalarning bir qismini avtomatlashtirish xodimlarning vaqtini tejaydi va ularning murakkabroq masalalarga e’tibor qaratishiga sharoit yaratadi. Biroq bunday tizimlarning ishlashi ustidan nazoratni butunlay bekor qilish maqsadga muvofiq emas. Bankda sun’iy intellekt noto‘g‘ri natija bergan holatlarni aniqlash, xatolarni tuzatish va zarur hollarda qarorni qayta ko‘rib chiqish imkoniyati saqlanishi kerak. Risklarni samarali boshqarishda xavflarni oldindan prognozlash ham katta ahamiyatga ega. Bank uchun muammoli kreditlar allaqachon yuzaga kelganidan keyin choralar ko‘rishdan ko‘ra, ularning paydo bo‘lish ehtimolini erta aniqlash foydaliroqdir. Sun’iy intellekt tarixiy ma’lumotlar va joriy ko‘rsatkichlarni tahlil qilish orqali kredit portfeli sifatidagi o‘zgarishlarni, ayrim mijozlarning to‘lov qobiliyati pasayishini yoki muayyan iqtisodiy tarmoqlardagi xavflarning ortishini prognozlashga yordam berishi mumkin.

Xulosa qilib aytganda, sun’iy intellekt texnologiyalari bank risklarini boshqarishning sifat jihatidan yangi imkoniyatlarini yaratmoqda. Ular kredit riskini baholash, firibgarlikni aniqlash, operatsion nazoratni kuchaytirish va ehtimoliy moliyaviy muammolarni oldindan ko‘rishda foydali vosita bo‘lishi mumkin. Biroq ushbu texnologiyalardan olinadigan natija ma’lumotlar sifati, modelning ishonchliligi, xavfsizlik choralari va inson nazoratiga bevosita bog‘liq. Shuning uchun banklar sun’iy intellektni mustaqil va xatosiz qaror qabul qiluvchi tizim sifatida emas, balki mutaxassislarning tahliliy imkoniyatlarini kengaytiruvchi vosita sifatida ko‘rishi lozim. O‘zbekiston bank tizimida ushbu yondashuvni bosqichma-bosqich amalga oshirish, model risklarini nazorat qilish va malakali kadrlarni tayyorlash bank faoliyatining barqarorligi hamda raqamli rivojlanishiga xizmat qilishi mumkin.

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Bekmamatova P.T.
1-kurs talabasi, O‘zbek tili va adabiyoti yo‘nalishi
Termiz davlat pedagogika instituti
O‘zbekiston, Termiz

XALQ PEDAGOGIKASI DIDAKTIK TAMOYILLARINI O‘ZBEK TILI VA ADABIYOTI MASHG‘ULOTLARIDA QO‘LLASH

Annotatsiya. Mavzuning dolzarbligi xalq pedagogikasini faol filologik topshiriqlar bilan bog‘lash zarurati bilan belgilanadi. Maqsad — qisqa didaktik model taklif etish. Nazariy tahlil va metodik modellashtirish qo‘llandi. Natija — «anglash — tahlil — ko‘chirish — mahsulot» modeli.

Kalit so‘zlar: xalq pedagogikasi, o‘zbek tili, adabiyot, didaktik tamoyil, mikro-topshiriq, mini-loyiha.

Bekmamatova P.T.
first-year student, Uzbek Language and Literature
Termez State Pedagogical Institute
Uzbekistan, Termez

APPLICATION OF DIDACTIC PRINCIPLES OF FOLK PEDAGOGY IN UZBEK LANGUAGE AND LITERATURE CLASSES

Abstract. The study addresses the integration of folk pedagogy with active philological tasks. The aim is to propose a concise didactic model. The methods are theoretical analysis and methodological modelling. The result is a comprehension-analysis-transfer-product model.

Keywords: folk pedagogy, Uzbek language, literature, didactic principle, micro-task, mini-project.

Kirish

Xalq pedagogikasi o‘zbek xalqining ko‘p asrlik tarbiyaviy tajribasini maqol, matal, topishmoq, ertak, rivoyat va kundalik muloqot me’yorlarida saqlab keladi. M. Q. Bozorovaning tadqiqotlarida milliy ma’naviy tarbiya va xalq og‘zaki ijodining pedagogik ahamiyati yoritilgan [7; 8]. Mentalitet haqidagi fanlararo yondashuv xalqona matnni tarixiy va madaniy kontekstda talqin qilish zarurligini ko‘rsatadi [9]. Psixologik-pedagogik tadqiqotlar moslashuv, kreativ fikrlash, loyiha faoliyati va jalb etilganlikni faol o‘quv topshirig‘i bilan bog‘lash imkonini beradi [1–6].

Tadqiqot metodlari

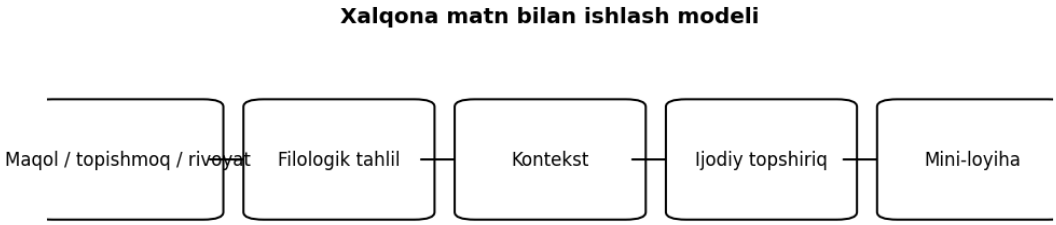
Qiyosiy tahlil va metodik modellashtirish yordamida xalqona matnning filologik hamda tarbiyaviy imkoniyatlari tizimlashtirildi. Kreativ fikrlash, loyiha faoliyati va jalb etilganlikka oid yondashuvlar mikro-topshiriqlarni tuzish mezonlarini aniqlash uchun qo‘llandi [3–6].

Tadqiqot natijalari

Model to‘rt bosqichdan iborat: matnni anglash, til yoki adabiy hodisani tahlil qilish, ma’noni yangi vaziyatga ko‘chirish va mahsulot yaratish. Maqol, topishmoq va rivoyat mikro-topshiriq yoki mini-loyihaga aylantiriladi. Tushunish, tashabbus va mustaqil hissa professional kompetensiyalar va loyihaviy jalb etilganlik mezonlari bilan birga kuzatiladi [3; 6].

Og‘zaki ijod resurslarini filologik tahlilga aylantirish

Maqol, topishmoq va rivoyatning filologik funksiyalarini aniq ajratish muhim. Xalq pedagogikasida og‘zaki ijod tarbiyaviy mazmunni ixcham va obrazli shaklda saqlaydi [7; 8]. O‘zbek tili mashg‘ulotida maqol semantika, sintaksis va pragmatika birligida tahlil qilinadi; topishmoq belgini til vositasi bilan yashirin ifodalash modeli sifatida o‘rganiladi; rivoyat esa syujet, qahramon nutqi va qadriyat talqinini birlashtiradi.



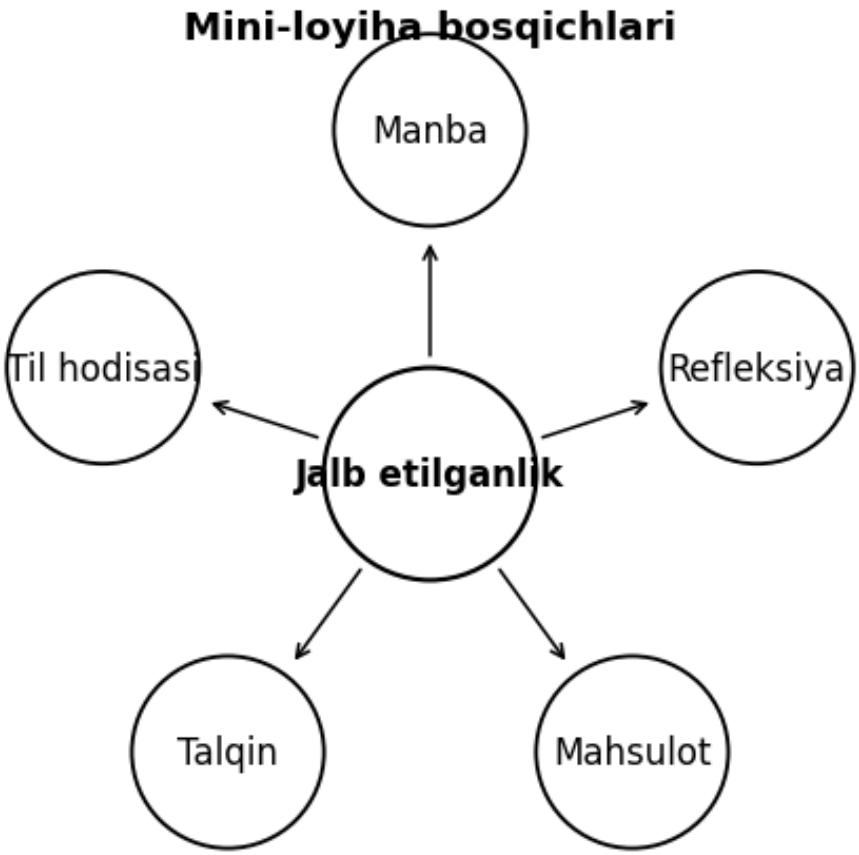
1-rasm. Xalqona matnni filologik va ijodiy faoliyatga aylantirish modeli

Mentalitet va matn konteksti

Xalqona matnning madaniy konteksti va zamonaviy talqini o‘rtasidagi farq alohida ko‘rsatilishi kerak. Mentalitetga oid tadqiqotlar qadriyat, norma va dunyoni idrok etish usullarining tarixiy barqarorlik bilan birga o‘zgaruvchanligini ham ko‘rsatadi [9]. Shuning uchun talaba maqol yoki rivoyatni «doimo to‘g‘ri qoida» sifatida emas, muayyan madaniy vaziyatda shakllangan matn sifatida tahlil qiladi.

Aniq mikro-topshiriqlar banki

Birinchi kurs talabasi uchun topshiriqlar konkret va bosqichma-bosqich bo‘lishi zarur. Maqol uchun kalit so‘zlarni ajratish, ko‘chma ma’noni izohlash, sintaktik modelni aniqlash va zamonaviy dialog tuzish; topishmoq uchun belgi bildiruvchi birliklarni guruhlash va yangi topishmoq yaratish; rivoyat uchun esa voqealar zanjiri, qahramon qarori, muqobil yakun va qisqa refleksiv matn taklif etiladi. Bunday topshiriqlar umumiy pedagogika va pedagogik texnologiyalar tamoyillari bilan uyg‘unlashtiriladi [10–13].



2-rasm. Mini-loyiha faoliyatining asosiy bosqichlari

Mini-loyiha va baholash mezonlari

Mini-loyiha aniq savol, rol va yakuniy mahsulotga ega bo‘lishi kerak. Masalan, “Mehnat haqidagi maqollarning zamonaviy kommunikativ xaritasi” loyihasida talabalar manbalarni to‘playdi, semantik guruhlarga ajratadi, qo‘llanish vaziyatlarini izohlaydi va natijani jadval yoki audio lug‘at shaklida taqdim etadi. Baholashda manba to‘g‘riligi, filologik tahlil, ijodiy yechim, individual hissa va refleksiya hisobga olinadi. Bunday tuzilma formal qatnashuvni mazmunli jalb etilganlikdan ajratishga yordam beradi [3; 5; 6].

Muhokama

Kengaytirilgan model o‘zbek tili va adabiyoti mashg‘ulotida uch maqsadni birlashtiradi: til hodisasini tushunish, madaniy matnni kontekstda sharhlash va mustaqil mahsulot yaratish. Bu yerda xalq pedagogikasi darsning bezagi emas, balki tahlilni boshlovchi manba vazifasini bajaradi. Birinchi kurs bosqichida topshiriqlar qisqa va aniq bo‘lishi, murakkab ilmiy terminlar esa amaliy misol bilan tushuntirilishi lozim. Keyingi bosqichda ayni model kurs loyihasi yoki kichik tadqiqotga kengaytirilishi mumkin. Faoliyat orqali o‘rganish va ta’limning shaxs

rivojiga yo‘naltirilishi pedagogik-psixologik hamda normativ asoslar bilan ham uyg‘unlashadi [14; 15].

Amaliy namuna: maqol bilan ishlash

Masalan, mehnat mavzusidagi bitta maqol bilan ish to‘rtta qisqa bosqichda tashkil etilishi mumkin. Avval talabalar tayanch leksemalarni ajratadi va ularning to‘g‘ri hamda ko‘chma ma’nosini izohlaydi. Keyin gap tuzilishi, kesim shakli va ma’no munosabati tahlil qilinadi.

Uchinchi bosqichda maqol qaysi nutqiy vaziyatlarda o‘rinli, qaysilarida esa sun’iy yoki noo‘rin eshitilishi muhokama qilinadi. Yakunda ikki kishilik dialog tuziladi. Shu tartibda xalqona matn grammatika yoki leksika uchun alohida misol bo‘lib qolmay, til birliklarining real kommunikativ vazifasini ko‘rsatadi.

Amaliy namuna: rivoyat va adabiy talqin

Rivoyat bilan ishlashda o‘qituvchi syujetni qayta aytishni asosiy vazifa qilmasligi kerak. Talabalar avval voqealar ketma-ketligini 4–5 punktga ajratadi, so‘ng qahramonning muhim qarorini topadi va shu qarorni ifodalovchi leksik birliklarni belgilaydi.

Keyin “agar qahramon boshqa yo‘lni tanlaganida voqea qanday o‘zgarardi?” degan savol asosida muqobil yakun yoziladi. Bu topshiriq matn tushunish, sabab-oqibatni tahlil qilish va ijodiy yozuvni birlashtiradi. Tarbiyaviy xulosa esa tayyor shaklda berilmaydi, balki dalillar asosida chiqariladi.

Topishmoq asosida til materiali

Topishmoq birinchi kurs talabasi uchun sodda ko‘rinsa ham, u morfologik va semantik tahlilga qulay materialdir. Talaba yashirin predmetga ishora qiluvchi sifat, fe’l va o‘xshatishlarni alohida guruhlarga ajratadi, ularning vazifasini tushuntiradi va xuddi shu model bo‘yicha yangi topishmoq tuzadi. Keyingi bosqichda guruhlar bir-birining matnini tahlil qiladi: qaysi belgi ortiqcha ma’lumot beradi, qaysi biri obrazni kuchaytiradi, qaysi so‘z grammatik jihatdan almashtirilsa ma’no o‘zgaradi. Shu tariqa xalq og‘zaki ijodi til sezgirligini oshiruvchi faol materialga aylanadi.

Mustaqil ish va mini-loyiha variantlari

Mustaqil ta’lim uchun to‘rtta mini-loyiha taklif qilish mumkin: “Bir mavzu — o‘n maqol” semantik xaritasi; “Rivoyatda qahramon nutqi” leksik portreti; “Topishmoq tili” audio lug‘ati; “Eski va yangi nutq vaziyati” qiyosiy dialoglar to‘plami. Har bir loyiha manbani ko‘rsatish, qisqa filologik izoh, individual hissa va yakuniy refleksiyani talab qiladi. Natija slayd emas, balki tahlil qilingan til materiali bo‘lishi kerak. Bunday talab loyihani tashqi bezakdan mazmunli o‘quv faoliyatiga aylantiradi.

Baholash va o‘zaro fikr bildirish

Baholashning sodda rubrikasi besh mezonni qamrab oladi: manbaning to‘g‘riligi, filologik tahlilning aniqligi, madaniy kontekstni tushuntirish, ijodiy mahsulot sifati va refleksiya. Har mezon 0–2 ball bilan baholansa, jami 10 ballik kichik topshiriq hosil bo‘ladi. Talabalar o‘zaro fikr bildirayotganda “xato” deyishdan oldin matndan dalil keltirishi shart. Bu qoida bahsni shaxsiy bahodan matn tahliliga ko‘chiradi va birinchi kurs talabalarida akademik muloqot ko‘nikmasini shakllantiradi.

Topshiriq turi va kutiladigan mahsulot

	Tahlil	Mahsulot
Maqol	Semantika + sintaksis	Dialog / izoh
Topishmoq	Leksika + obraz	Yangi topishmoq
Rivoyat	Syujet + qadriyat	Muqobil yakun
Maqollar guruhi	Tasnif + pragmatika	Mini-loyiha

3-rasm. Mikro-topshiriq turlari va kutiladigan natijalar

Tadqiqot chegaralari va keyingi bosqich

Taklif etilgan model nazariy-metodik xususiyatga ega bo‘lib, hozirgi bosqichda uning samaradorligi tajriba orqali isbotlangan deb talqin qilinmaydi. Keyingi ishda bir xil mavzu bo‘yicha an’anaviy mashq va xalq pedagogikasi asosidagi faol mikro-topshiriq natijalarini qiyoslash mumkin. Bunda talabaning javob uzunligi emas, semantik tahlil aniqligi, dalil keltirish, yangi vaziyatga ko‘chirish va mustaqil mahsulot yaratish ko‘rsatkichlari baholanadi. Shu yondashuv modelning qaysi qismi haqiqatan ham filologik fikrlashni kuchaytirishini aniqlashga yordam beradi.

Birinchi kurs talabalarida murakkab loyiha o‘rniga qisqa, takrorlanuvchi mikro-faoliyatlardan boshlash maqsadga muvofiq. Bir semestr davomida maqol, topishmoq va rivoyat bilan ishlash bosqichma-bosqich murakkablashadi: dastlab tayyor savolga tahlil, keyin mustaqil savol tuzish, so‘ng kichik guruh mahsuloti va yakunda individual refleksiya. Natijada xalqona matn bilan ishlash alohida “tarbiyaviy daqiqa” bo‘lib qolmay, til va adabiyot fanining muntazam analitik vositasiga aylanadi. Bu modelni keyinchalik pedagogik amaliyot, mustaqil ta’lim va kurs loyihalariga kengaytirish mumkin.

Xulosa

Model filologik tahlil, ijodiy topshiriq va xalq pedagogikasining tarbiyaviy mazmunini ixcham shaklda birlashtiradi. Keyingi bosqich — uni amaliy mashg‘ulotda sinash.

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Berdaliyev Kh.K.
associate professor, Department of Sectoral Economics and Accounting
Tashkent University of Applied Sciences (TAFU)
Uzbekistan, Tashkent

THE ROLE AND SIGNIFICANCE OF THE SERVICE SECTOR IN THE ECONOMIC DEVELOPMENT OF UZBEKISTAN

Abstract. This study examines the role and significance of the service sector in driving sustainable economic growth, employment generation, and structural modernization in Uzbekistan. Following the implementation of wide-ranging structural reforms under the Development Strategy of New Uzbekistan, the service economy has emerged as a crucial driver of GDP expansion, urban development, and digital transformation. Utilizing macroeconomic indicator analysis and secondary research of domestic and international academic literature, this paper evaluates the progression of key sub-sectors, including financial services, information technology, tourism, and logistics. The empirical findings highlight that while the service sector's contribution to GDP has grown significantly—exceeding 40–45% in recent years—challenges remain regarding regional imbalances, informal employment, and modern technological integration. The article concludes with practical policy recommendations to boost high-value service exports, improve digital infrastructure, and foster human capital development.

Keywords: Service Sector, Economic Development, Uzbekistan, Structural Transformation, Digital Economy, Gross Domestic Product (GDP), Employment.

1. Introduction. Over the past decade, the global economy has undergone a fundamental structural shift from industrial manufacturing and agriculture toward service-dominated frameworks. In developing and emerging market economies, the service sector acts as a pivotal catalyst for transition, enabling economic diversification, enhancing productivity across primary and secondary sectors, and providing extensive employment opportunities. [1]

In the context of Central Asia, Uzbekistan represents a compelling case study of economic transformation. Historically centered on agricultural production—primarily cotton—and heavy state-driven industrialization, Uzbekistan initiated sweeping market-oriented reforms in late 2016. Under the Uzbekistan 2030 Strategy and preceding national development frameworks, the modernization and expansion of the service sector have been elevated to top macroeconomic priorities.

The service sector in Uzbekistan serves as a dual engine: it directly contributes to Gross Domestic Product (GDP) growth through modern financial, telecommunications, and transport networks, while simultaneously absorbing a growing youth labor force. Furthermore, as a landlocked country, developing non-resource and digital service exports provides Uzbekistan with unique pathways to integrate into regional and global value chains.

This paper critically analyzes the dynamic role of the service sector in Uzbekistan's modern economic architecture. It reviews the academic literature from international and national scholars, examines core statistical trends and structural compositions, highlights key developmental bottlenecks, and outlines strategic policy avenues to maximize the sector's long-term economic potential.

2. Literature Review. The academic discourse surrounding the role of services in economic development has evolved significantly over recent decades. Classic economic development theories, such as those proposed by Fisher [2] and Clark [3], established the three-sector model, suggesting that as economies mature, labor and capital naturally migrate from agriculture to industry, and eventually to services.

However, contemporary scholars challenge the view of services as merely dependent on manufacturing. Ghani and O'Connell demonstrate that modern, tech-enabled services can drive growth in a manner similar to manufacturing—a phenomenon often referred to as "service-led growth." They argue that low- and middle-income economies can skip traditional manufacturing-intensive pathways by leveraging ICT, finance, and professional services to achieve rapid income convergence.

In the case of transition economies, foreign and local research underscores the specific structural conditions influencing service sector performance. World Bank [4] regional assessments highlight that, Central Asian economies, including Uzbekistan, face spatial and logistical challenges that make digital and financial service integration essential for lowering trade costs and boosting market connectivity.

Uzbekistan's academic literature heavily focuses on structural transformation and state reform policies. Khamraev [5] emphasizes that the modernization of services in Uzbekistan directly correlates with poverty reduction and rural development. He asserts that expanding targeted microfinance, consumer services, and healthcare in regional areas balances regional income distribution and absorbs excess rural labor.

Similarly, Tursunov [6] analyzes the structural components of Uzbekistan's service economy, noting that traditional services (retail trade, basic transport) still dominate the sector's overall volume, whereas high-value-added sectors (IT, engineering, modern finance) require deeper institutional support and investment in human capital to reach international competitiveness.

3. Macroeconomic Analysis and Structural Dynamics

The expansion of the service sector in Uzbekistan has been supported by targeted government policies, business climate liberalization, and demographic factors. With a population exceeding 37 million people—more than half of whom are under the age of 30—domestic demand for consumer, educational, financial, and digital services has expanded rapidly.

3.1 Contribution to GDP and Growth Trends

Between 2018 and 2025, Uzbekistan maintained sustained real GDP growth, with the service sector consistently matching or exceeding national economic

expansion rates. The sector accounts for over 40% of the nation's total GDP, forming a core macroeconomic stabilizer during external trade shocks and global fluctuations in primary commodity prices.[7]

To illustrate the structural composition and growth trends of Uzbekistan's service economy, Table 1 outlines the distribution of total service volume across key economic sectors over a multi-year period.

Table 1:
Structure and Growth of Services in Uzbekistan (Selected Indicators) [8]

Service Category	Share of Total Services (%)	Key Growth Drivers / Factors
Trade & Catering	28.0% – 32.0%	Rising disposable incomes, retail modernization, foreign investment in commercial hubs.
Transport & Storage	22.0% – 25.0%	Strategic infrastructure buildouts, intermodal logistics, transit corridor agreements.
Financial & Insurance	10.0% – 14.0%	Banking privatization, fintech penetration, expanding consumer and business credit.
Information & Communication	6.0% – 9.0%	Government digitization, IT Park incentives, mobile broadband rollout.
Other Personal & Business Services	23.0% – 28.0%	Educational services, private healthcare, tourism recovery, professional consulting.

Note: Data trends synthesized based on national macroeconomic indicators and structural reporting.

3.2 Employment and Labor Absorption

The capacity of services to create jobs rapidly with relatively low capital entry requirements makes the sector crucial for Uzbekistan's demographic context. Every year, hundreds of thousands of young people enter the domestic labor force. Agriculture and heavy industry cannot absorb this supply alone without diminishing marginal returns.

Services currently employ over half of the officially registered workforce in Uzbekistan. Small and Medium Enterprises (SMEs) dominate this space, particularly in catering, retail, repair, and transportation. Furthermore, the growth of digital platforms and freelancing has opened foreign remote employment markets for Uzbek youth, notably in software development, graphic design, and customer support.

4. Sectoral Case Studies: Key Drivers of Modernization

4.1 Information and Communication Technology (ICT)

The creation of specialized economic zones, such as the IT Park in Tashkent, has transformed Uzbekistan's domestic technological landscape. Tax incentives, simplified regulatory frameworks, and state infrastructure support have led to exponential growth in software exports and domestic startups. The IT sector's expansion directly boosts economic efficiency across banking, tax administration, and public services through e-government initiatives.

4.2 Tourism and Hospitality

Uzbekistan possesses rich historical and cultural heritage assets, concentrated in UNESCO World Heritage sites like Samarkand, Bukhara, Khiva, and Shakhrisabz. Recent policy reforms—including visa-free entry for citizens of over 90 countries, transport infrastructure upgrades (high-speed rail networks), and hotel construction subsidies—have accelerated international visitor arrivals. Tourism acts as a high-multiplier service sector, stimulating regional craft production, gastronomy, and transport services.

4 .3 Financial Services and Fintech

The financial services landscape in Uzbekistan has shifted from heavily state-dominated commercial banks toward market-oriented retail and digital banking. The widespread adoption of mobile payment systems, QR-code transactions, and digital-only banking entities has expanded financial inclusion across rural regions, enabling small micro-entrepreneurs to access formal payment systems and credit lines.

5. Challenges and Constraints to Sectoral Expansion

Despite positive growth trajectories, Uzbekistan's service sector faces systemic structural challenges that restrict its full potential:

1. **Regional Disparities:** Service sector growth remains concentrated in urban agglomerations, particularly Tashkent City and major regional centers. Rural regions experience shortages in high-quality medical, educational, and modern professional services.
2. **Informality:** A significant portion of personal, retail, and transportation services operates within the informal economy, limiting state tax revenue generation and leaving workers without adequate social protection.
3. **Skill Mismatches in Human Capital:** While basic literacy and education levels are high, there remains a shortage of high-level technical expertise, specialized financial analysts, and fluent multi-lingual professionals required for advanced export services.
4. **Logistical and Infrastructure Bottlenecks:** Although transport services are expanding, Uzbekistan's double-landlocked geography imposes high transport costs, requiring continuous capital investment in road, rail, and air freight capacity.

6. Strategic Recommendations and Conclusion

To transform the service sector into a primary driver of sustainable, high-value economic growth, policymaking in Uzbekistan should focus on four key areas:

Promoting Service Exports: Transition from basic consumer services to knowledge-intensive business services (KIBS), including IT outsourcing, engineering consulting, and regional logistics management.

Investing in Human Capital and STEM Education: Align higher education curricula with private sector needs, expanding technical training centers and vocational skills programs tailored to digital industries.

Bridging the Urban-Rural Service Divide: Incentivize private investment in peripheral regions through localized tax credits, expanded broadband internet coverage, and subsidized micro-crediting for rural service startups.

Institutional Modernization and Formalization: Simplify regulatory compliance for micro-enterprises, promote digital invoicing, and provide social safety nets to encourage informal service operators to transition into the formal economy.

Conclusion

The service sector has become an indispensable column of Uzbekistan's national economy, providing employment, promoting structural diversification, and supporting societal welfare. By continuing to liberalize markets, modernizing physical and digital infrastructure, and developing human capital, Uzbekistan can successfully build a resilient, service-led market economy capable of competing effectively on the international stage.

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Berdiqulova M.T.
o‘qituvchi
Abdikarimova R.A.
geografiya yo‘nalishi talabasi
Qarshi davlat universiteti
O‘zbekiston, Qarshi

OSIYO DAVLATLARI AHOLISINING HUDUDIY RIVOJLANISHI, JOYLASHUVI VA ZICHLIGI: DEMOGRAFIK-GEOGRAFIK TAHLIL

Annotatsiya. Mazkur maqolada Osiyo davlatlari aholisining tarixiy shakllanishi, zamonaviy demografik rivojlanish xususiyatlari, hududiy joylashuvi va aholi zichligi tahlil qilinadi. Maqolada Sharqiy, Janubiy, Janubi-Sharqiy, Markaziy va G‘arbiy Osiyoning demografik xususiyatlari qiyosiy tahlil qilinadi. Shuningdek, urbanizatsiya, migratsiya va tug‘ilish darajasining dinamikasi kabi demografik jarayonlarning mintaqa rivojlanishiga ta’siri yoritiladi.

Kalit so‘zlar: Osiyo, aholi, demografik rivojlanish, aholi zichligi, hududiy joylashuv, urbanizatsiya, migratsiya, tabiiy ko‘payish, statistik ma’lumotlar.

Berdikulova M.T.
lecturer
Abdikarimova R.A.
student of Geography
Karshi State University
Uzbekistan, Karshi

TERRITORIAL DEVELOPMENT, DISTRIBUTION AND DENSITY OF THE POPULATION OF ASIAN STATES: DEMOGRAPHIC-GEOGRAPHIC ANALYSIS

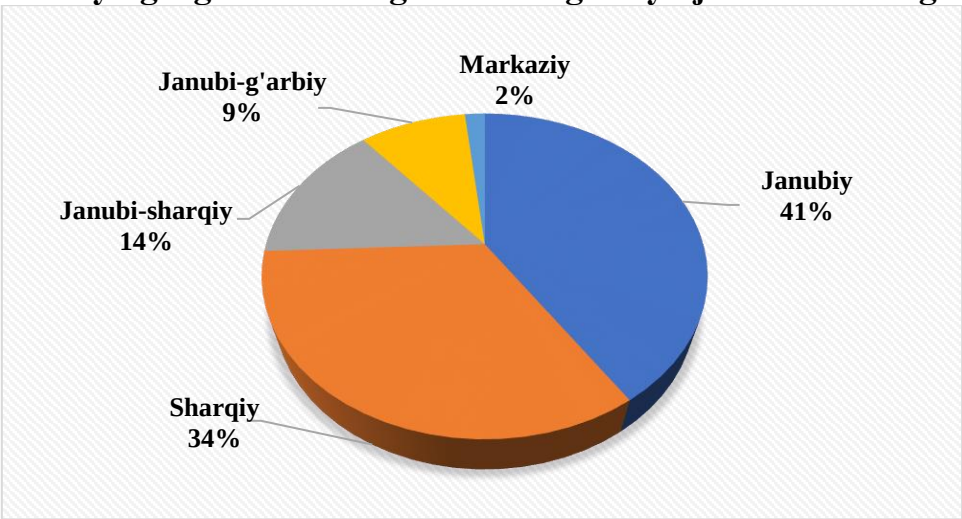
Abstract. This article analyzes the historical formation of the population of Asian countries, features of modern demographic development, territorial location and population density. The article provides a comparative analysis of the demographic characteristics of East, South, Southeast, Central and West Asia. It also highlights the impact of demographic processes such as urbanization, migration and fertility dynamics on the development of the region.

Keywords: Asia, population, demographic development, population density, territorial location, urbanization, migration, natural increase, statistical data.

Osiyo dunyoning eng yirik qit’asi bo‘lib, hududi, aholisi va tabiiy resurslari jihatidan alohida o‘rin tutadi. Qit’a insoniyat sivilizatsiyasining qadimgi markazlari – Mesopotamiya, Hind vodiysi va Xitoy sivilizatsiyalari shakllangan hududlarni o‘z ichiga oladi. Osiyo aholisi tarixiy rivojlanishini o‘rganish nafaqat demografik, balki iqtisodiy, ijtimoiy va geografik jihatdan ham katta ahamiyatga ega (1-jadval).

Asosiy statistik manbalar sifatida BMTning Population Division tashkiloti tomonidan tayyorlangan World Population Prospects 2024, UNData hamda World Urbanization Prospects 2025 ma’lumotlaridan foydalanildi. 01.09.2026-yil ma’lumotlariga ko‘ra, Osiyo aholisi 4,868 mlrd kishini tashkil etgan (https://www.worldometers.info/ru). Bu ko‘rsatkich qit’aning jahon demografik tizimidagi nihoyatda katta ulushini ko‘rsatadi. Osiyoning o‘rtacha aholi zichligi 1 km² maydonga 157 kishi bo‘lib, hududlar bo‘yicha bu ko‘rsatkich juda katta tafovutlarga ega (2-jadval). Hindiston, Bangladesh, Yaponiya, Janubiy Koreya va Xitoyning sharqiy qismida aholi juda zich joylashgan. Mongoliya, Markaziy Osiyoning cho‘l hududlari, Sibir va Tibet platosida aholi zichligi nihoyatda past. Hududiy tahlilda geografik subregionlar – Sharqiy, Janubiy, Janubi-Sharqiy, Markaziy va G‘arbiy Osiyo tasnifi bo‘yicha o‘rganildi (1-rasm).

1-rasm. Osiyo geografik subregionlarining Osiyo jami aholisidagi ulushi



Manba: *https://www.worldometers.info/ru ma’lumotlari asosida tayyorlandi*

Osiyo insoniyatning eng qadimgi doimiy aholi yashagan hududlaridan biridir. Dastlabki yirik aholi manzilgohlari, asosan, suv manbalari yaqinida shakllangan. Dajla va Frot daryolari oralig‘idagi Mesopotamiya, Hind daryosi vodiysi hamda Xuanxe va Yanszi daryolari havzalari qadimgi aholining eng muhim to‘planish markazlari bo‘lgan. Qadimgi davrda sug‘orma dehqonchilikning rivojlanishi aholining ko‘payishi uchun muhim omil bo‘lganligi ma’lum. Sug‘orish tizimlari yordamida oziq-ovqat ishlab chiqarish hajmining ortishi doimiy aholi manzilgohlarining kengayishiga, shaharlar va davlatlarning shakllanishiga olib keldi. O‘rta asrlarda Buyuk Ipak yo‘lining rivojlanishi Osiyo aholisining hududiy joylashuviga katta ta’sir ko‘rsatgan bo‘lib, Xitoydan Yaqin Sharq va Yevropaga boruvchi savdo yo‘llari bo‘ylab Samarqand, Buxoro, Balx, Hirot va Qashqar kabi shaharlar yirik iqtisodiy va madaniy markazlarga aylanganligi tarixiy manbalarda keltirilgan.

1-jadval. Osiyo aholisining dinamikasi

Yillar	Aholi soni	Yillik o‘zgarish	Zichlik (kishi/km²)	Urbanizatsiya darajasi	Shahar aholisi
2025	4 835 320 060	28 422 053	156	53,6%	2 589 655 469
2024	4 806 898 007	28 893 521	155	52,9%	2 545 230 547
2023	4 778 004 486	30 343 453	154	52,3%	2 500 201 501
2022	4 747 661 033	29 773 831	153	51,7%	2 454 566 304
2020	4 688 113 371	40 961 096	151	50,4%	2 361 464 416
2015	4 483 307 893	48 697 044	144	47,3%	2 119 873 398
2010	4 239 822 673	49 179 217	137	44,3%	1 877 015 239
2005	3 993 926 587	49 229 257	129	40,8%	1 631 488 737
2000	3 747 780 304	52 019 959	121	37,3%	1 399 722 305
1995	3 487 680 510	55 559 580	112	34,9%	1 215 521 041
1990	3 209 882 612	60 583 773	103	32,4%	1 039 593 625
1985	2 906 963 746	54 927 445	94	29,9%	868 117 794
1980	2 632 326 521	48 631 299	85	27,2%	716 918 680
1975	2 389 170 026	50 322 197	77	25,1%	598 731 099
1970	2 137 559 039	48 582 288	69	23,7%	507 088 632
1965	1 894 647 600	40 459 734	61	22,9%	433 189 899
1960	1 692 348 932	33 733 779	55	21,3%	360 171 131
1955	1 523 680 036	31 120 924	49	19,6%	298 616 710

Manba: *https://www.worldometers.info/ru ma’lumotlari asosida tayyorlandi*

XX asrning ikkinchi yarmida Osiyoning ko‘plab mamlakatlarida demografik portlash kuzatildi. Aholi sonining tez o‘sishi, ayniqsa, Janubiy va Janubi-Sharqiy Osiyoda yaqqol namoyon bo‘ldi. XXI asrga kelib esa demografik rivojlanishning yangi bosqichi shakllandi. Ayrim mamlakatlarda tug‘ilish darajasi yuqoriligicha qolayotgan bo‘lsa, Yaponiya, Janubiy Koreya va Xitoy kabi mamlakatlarda tug‘ilishning pasayishi va aholining qarishi muhim demografik muammoga aylandi.

2-jadval. Ayrim Osiyo davlatlarining aholisi va aholi zichligi (8.09.2026)

№	Davlat	Aholisi, mln kishi	Zichlik, kishi/km²	№	Davlat	Aholisi, mln kishi	Zichlik, kishi/km²
1	Hindiston	1479,3	497	**8**	Vetnam	102,2	330
2	Xitoy	1412,3	150	**9**	Eron	93,3	57
3	Indoneziya	288,4	159	**10**	Janubiy Koreya	51,7	532
4	Pokiston	259,9	336	**11**	O‘zbekiston	37,1	85
5	Bangladesh	178,2	1366	**12**	Qozog‘iston	21,1	8
6	Yaponiya	123,1	336	**13**	Mongoliya	3,5	2,3
7	Filippin	117,7	395	**14**	Singapur	5,9	8250

Manba: *https://www.worldometers.info/ru ma’lumotlari asosida tayyorlandi*

Jadvaldan ko‘rinadiki, Osiyoda aholi soni va zichligi bo‘yicha juda katta farqlar mavjud. Hindiston aholisi 1,480 mlrd.ga yaqin bo‘lib, Osiyoning eng yirik demografik markazidir. Xitoy aholisi esa 1,413 mlrd. kishiga yetmoqda. Bangladesh hududi nisbatan kichik bo‘lishiga qaramay, 178,2 mln aholiga ega. Mamlakatda aholi zichligi 1366 kishi/km² ga yetgan. Aksincha, Mongoliyada 3,5 mln kishi istiqomat qiladi va aholi zichligi bo‘yicha dunyodagi eng siyrak joylashgan davlatlardan biridir.

Janubiy Osiyo Osiyoning eng yirik demografik subregionidir. 2026-yil 1-yanvar holatiga ko‘ra aholi soni 1,947 mlrd. kishini tashkil etgan. Subregionning o‘rtacha aholi zichligi 472 kishi/km² ga teng bo‘lgan. Hindiston Janubiy Osiyoning asosiy demografik markazidir. Bangladesh esa aholining hududiy zichligi bo‘yicha dunyodagi eng yuqori ko‘rsatkichlarga ega mamlakatlardan biridir. Janubiy Osiyoda aholining zich joylashishiga Gang, Brahmaputra va Hind daryolari havzalarining unumdorligi, sug‘orma dehqonchilikning rivojlanganligi va qadimiy aholi manzilgohlarining mavjudligi sabab bo‘lgan.

Sharqiy Osiyo aholisi 01.01.2026-yilda 1,612 mlrd kishini tashkil etgan. Subregionning o‘rtacha aholi zichligi 139 kishi/km² ga teng bo‘lgan. Xitoy ushbu hududning asosiy demografik markazidir. Biroq Xitoy hududida aholi juda notekis taqsimlangan. Mamlakatning sharqiy qismidagi daryo vodiylari, dengizbo‘yi tekisliklari va yirik shaharlar atrofida aholi zichligi yuqori. Tibet platosi, Taklamakon va Gobi cho‘llari kabi hududlarda esa aholi juda siyrak. Sharqiy Osiyoning muhim xususiyati shundaki, iqtisodiy rivojlanish yuqori bo‘lishiga qaramay, tug‘ilish darajasi pasaymoqda. Bu jarayon aholining qarishi va kelajakda mehnat resurslari qisqarishiga olib kelishi mumkin.

Janubi-Sharqiy Osiyo ham Osiyoning muhim demografik markazlaridan biridir. 01.01.2026-yilda ushbu subregion aholisi 700,3 mln kishidan oshgan, o‘rtacha zichlik esa 161 kishi/km² ni tashkil etgan. Janubi-Sharqiy Osiyoda aholi, asosan, daryo vodiylari, deltalar, dengiz sohillari va unumdor orollarda to‘plangan. Indoneziyaning Yava oroli bunga yaqqol misol bo‘la oladi. Urbanizatsiyaning tezlashishi natijasida Jakarta, Manila, Bangkok va boshqa yirik shaharlar atrofida katta aholi aglomeratsiyalari shakllanmoqda.

Markaziy Osiyo Osiyoning aholisi nisbatan siyrak joylashgan subregionlaridan biridir. 01.01.2026-yilda mintaqa aholisi 83,6 mln kishini, o‘rtacha zichligi esa 21 kishi/km² ni tashkil etgan. O‘zbekiston Markaziy Osiyoning eng ko‘p aholiga ega davlatidir. Markaziy Osiyoda aholining hududiy joylashuvi, avvalo, suv resurslari bilan belgilanadi. Amudaryo va Sirdaryo havzalari, Farg‘ona vodiysi, Zarafshon vodiysi va boshqa sug‘oriladigan hududlarda aholi nisbatan zich joylashgan. Qizilqum, Qoraqum va boshqa cho‘l hududlarida esa tabiiy sharoitning quruqligi va suv tanqisligi sababli aholi zichligi juda past.

Janubi-g‘arbiy Osiyoda 2026-yil 1-yanvar holatida 446,1 mln kishi istiqomat qilgan. Subregionning o‘rtacha aholi zichligi 63 kishi/km² ni tashkil etgan. G‘arbiy Osiyoning katta qismida quruq va issiq iqlim hukmron. Shu sababli aholi, asosan, dengiz sohillari, daryo vodiylari, vohalar va yirik shaharlar atrofida to‘plangan. Fors ko‘rfazi davlatlarida neft va gaz sanoatining rivojlanishi xalqaro mehnat

migratsiyasining kuchayishiga olib kelgan. Natijada ayrim davlatlarda doimiy va vaqtinchalik migrantlar hisobiga aholi soni tez o‘zgarib turadi.

Osiyoda o‘rtacha zichlik 152 kishi/km² bo‘lsa-da, alohida davlatlar o‘rtasida katta farq mavjud. Singapur, Bangladesh, Janubiy Koreya, Hindiston, Yaponiyada zichlik yuqori bo‘lsa, Mongoliyada esa juda siyrak. Bu farq, avvalo, hududning tabiiy sharoiti, suv bilan ta’minlanganligi, tarixiy xo‘jalik faoliyati, iqtisodiy rivojlanish va urbanizatsiya darajasi bilan izohlanadi. Osiyoning zamonaviy demografik rivojlanishida urbanizatsiya muhim o‘rin egallaydi. Aholining qishloqlardan shaharlarga ko‘chishi natijasida yirik shahar aglomeratsiyalari shakllanmoqda. Tokio, Dehli, Shanxay, Pekin, Mumbay, Jakarta, Manila va Seul shahar aglomeratsiyalarda jami 222,4 mln aholi istiqomat qiladi. Osiyoda urbanizatsiya jarayoni ayniqsa tez sur’atlarda davom etmoqda. Urbanizatsiya iqtisodiy rivojlanish va yangi ish o‘rinlari yaratilishiga yordam bersa-da, uy-joy, transport, ekologiya, suv ta’minoti va infratuzilma bilan bog‘liq muammolarni ham kuchaytiradi.

Osiyo davlatlarida demografik jarayonlar bir xil emas. Janubiy Osiyoning ayrim davlatlarida aholi soni tez o‘sishda davom etayotgan bo‘lsa, Sharqiy Osiyoda tug‘ilish darajasining pasayishi va aholining qarishi kuzatilmoqda. Demografik qarish, ayniqsa, Yaponiya va Janubiy Koreyada yaqqol namoyon bo‘lmoqda. Xitoyda ham tug‘ilish darajasining pasayishi mamlakatning uzoq muddatli demografik istiqboliga ta’sir qilmoqda. Janubiy va Janubi-Sharqiy Osiyoda esa yoshlar ulushining yuqoriligi katta mehnat resurslari shakllanishiga imkon beradi. Biroq ushbu demografik imkoniyatdan samarali foydalanish uchun ta’lim, sog‘liqni saqlash, bandlik va infratuzilma tarmoqlarini rivojlantirish muhim ahamiyat kasb etmoqda.

Osiyo davlatlaridagi demografik muammolar mintaqalar kesimida juda katta farq qiladi: Sharqiy Osiyoda aholining tez qarishi va depopulyatsiya hukmronlik qilmoqda, Markaziy va Janubiy Osiyoda esa resurslar cheklanganligi va aholi o‘sishi davom etmoqda, garchi u yerda tug‘ilish darajasi ham pasayishni boshlamoqda. Sharqiy va Janubi-Sharqiy Osiyo (Yaponiya, Janubiy Koreya, Xitoy) uzoq umr ko‘rish davomiyligi va tug‘ilishning pastligi tufayli keksa yoshdagi odamlar ulushi tez sur‘atlar bilan o‘sib bormoqda. Tug‘ilishning pasayishi sezilarli darajada tushib bormoqda. Mehnatga layoqatli aholi kamayib, ishchi kuchi yetishmasligi yuzaga kelmoqda, bu esa iqtisodiyot va pensiya tizimlariga yuk bo‘lmoqda. Yopiq immigratsiya, ya’ni, qat’iy qonunlar tufayli mamlakatlar ishchi kuchi yetishmasligini immigrantlar bilan to‘ldirishga qiynalmoqda. Yaponiya, Janubiy Koreyada depopulyatsiya jarayoni davom etishi natijasida ishchi kuchi yetishmovchiligi sababli xorijiy ishchilarni tobora ko‘proq qabul qilayotgan bo‘lsa-da, immigratsiyani keng miqyosda ochish o‘rniga maqsadli mehnat dasturlaridan foydalanmoqda. Ishchi kuchiga ehtiyoj ayniqsa, ishlab chiqarish, qishloq xo‘jaligi, qurilish va xizmat ko‘rsatish sohalarida kuzatilmoqda.

Kelajakda Osiyo demografik rivojlanishining asosiy yo‘nalishlari urbanizatsiyaning davom etishi, migratsiya jarayonlarining kuchayishi, tug‘ilish darajasining pasayishi va aholining qarishi bilan xarakterlanadi. Shu bois Osiyo

mamlakatlarining demografik siyosati hududiy tafovutlarni kamaytirish, mehnat resurslaridan samarali foydalanish va aholining turmush sifatini yaxshilashga yo‘naltirilishi zaruriy dolzarblik kasb etadi.

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Djurayev M.E.
iqlim o‘zgarishi va geoaxborot tizimlari kafedrasi dotsenti
Husenov J.Q.
geografiya fani o‘qituvchisi
Guliston davlat universiteti Akademik litseyi
O‘zbekiston, Guliston

SIRDARYO DARYOSI QIRG‘OQ EKOTIZIMLARINI GAT TEXNOLOGIYASI ASOSIDA BAHOLASH (SIRDARYO VILOYATI MISOLIDA)

Annotatsiya. Maqolada Sirdaryo viloyati hududidan o‘tuvchi Sirdaryo daryosi qirg‘oq ekotizimlarining holatini geoaxborot tizimlari (GAT) va masofaviy zondlash ma’lumotlari asosida baholash metodikasi ishlab chiqilgan. O‘simlik qoplami (NDVI), namlik (MNDWI, NDMI), tuproq sho‘rlanishi, relyef va yer qoplami ko‘rsatkichlari ierarxiyalar tahlili usuli (AHP) yordamida yagona integral indeksga birlashtirildi. Hudud ekologik holat bo‘yicha besh toifaga ajratildi. Natijalar Sohilobod mahallasida barpo etilishi rejalashtirilgan eko-turizm maskanining joylashuvini ekologik asoslashda qo‘llanildi.

Kalit so‘zlar: Sirdaryo, qirg‘oq ekotizimi, to‘qay o‘rmonlari, GAT, masofaviy zondlash, NDVI, AHP, eko-turizm.

Djuraev M.E.
associate professor
Department of Climate Change
and Geographic Information Systems
Khusenov J.K.
geography teacher
GulSU Academic Lyceum
Uzbekistan, Gulistan

ASSESSMENT OF RIPARIAN ECOSYSTEMS OF THE SYR DARYA RIVER BASED ON GIS TECHNOLOGIES (A CASE STUDY OF SYR DARYA REGION)

Abstract. The article develops a methodology for assessing the state of coastal ecosystems of the Syr Darya River passing through the Syr Darya Region based on geographic information systems (GIS) and remote sensing data. Indicators of vegetation cover (NDVI), moisture (MNDWI, NDMI), soil salinity, relief, and land cover were combined into a single integral index using the hierarchy analysis method (AHP). The territory was divided into five categories based on the ecological situation. The results were used in the ecological justification of the location of the eco-tourism center planned to be built in the Sohilobod neighborhood.

Keywords: Syr Darya, riparian ecosystem, tugai forests, GIS, Earth remote sensing, NDVI, AHP, ecotourism.

Kirish

Daryo qirg‘oq (riparian) zonalari quruqlik va suv ekotizimlari chegarasida shakllanadi. Ular biologik xilma-xillikni saqlaydi, qirg‘oq eroziyasini kamaytiradi, oqim va toshqin rejimini yumshatadi, ifloslantiruvchi moddalarni tutib qoladi va mikroiqlimni barqarorlashtiradi [9]. Markaziy Osiyoning quruq iqlimida bunday zonalar cho‘l landshaftlari ichida tor «yashil yo‘lak» hosil qiladi va unda to‘qay o‘rmonlari shakllanadi. To‘qay fitotsenozlari terak (*Populus pruinosa*), jiyda (*Elaeagnus*), tol (*Salix*), yulg‘un (*Tamarix*) va qamish (*Phragmites*) kabi namsevar, sho‘rga chidamli turlardan iborat. Ularning mavjudligi daryo suvining muntazam toshishi va yer osti suvlarining yuqori joylashuviga bog‘liq, shu sababli oqim rejimidagi o‘zgarish to‘qay holatiga tez ta’sir qiladi. Sirdaryo oqimi o‘nlab yillardan beri asosan sug‘orma dehqonchilik va gidroenergetika ehtiyojlariga moslab boshqarib kelinadi. Bu Orol dengizi havzasidagi keng ko‘lamli ekologik o‘zgarishlar bilan bog‘liq [8]. Sirdaryo viloyati Mirzacho‘lning sug‘oriladigan qismida joylashgan, hududning katta qismi qishloq xo‘jaligida o‘zlashtirilgan. Natijada daryo bo‘yidagi tabiiy o‘simlik qoplami doimiy antropogen bosim ostida qolmoqda, sug‘oriladigan yerlarda yer osti suvlari sathining ko‘tarilishi esa ikkilamchi sho‘rlanishni keltirib chiqaradi. 2020-yil may oyida Sardoba suv omboridagi avariya daryo bo‘yi landshaftlari barqarorligini qayta baholash zarurligini ko‘rsatdi.

So‘nggi yillarda daryo bo‘yi hududlari turizm va rekreatsiya maqsadlarida ham o‘zlashtirilmoqda. Xususan, Sohilobod mahallasi hududidan oqib o‘tuvchi Sirdaryo bo‘yida zamonaviy eko-turizm maskani barpo etilishi rejalashtirilgan. Bunday loyihalar qirg‘oq ekotizimiga qo‘shimcha yuklama tushirishi mumkin, shu bois ulardan oldin hududning hozirgi holatini va chidamliligini miqdoriy baholash zarur. Dala usullari bilan uzluksiz kuzatish katta mehnat va mablag‘ talab qiladi, GAT va sun’iy yo‘ldosh tasvirlariga asoslangan baholash esa ko‘lamli, takrorlanuvchi va nisbatan arzon [1, 10, 12]. Spektral indekslar butun hududni bir xil uslubda baholashga, ko‘p mezonli tahlil esa turli ko‘rsatkichlarni yagona bahoga birlashtirishga imkon beradi [16].

Tadqiqotning maqsadi – Sirdaryo viloyati doirasida daryo qirg‘oq ekotizimlari holatini GAT texnologiyasi yordamida integral baholash va natijalarni Sohilobod mahallasidagi eko-turizm maskani joylashuvini ekologik asoslashda qo‘llash.

Vazifalar:

1. qirg‘oq zonasini chegaralash va ko‘rsatkichlar tizimini asoslash, sun’iy yo‘ldosh ma’lumotlari asosida spektral indekslarni hisoblash;
2. ko‘rsatkichlarga og‘irlik koeffitsiyentlarini AHP usulida belgilash;
3. Sohilobod uchastkasi uchun ekologik tavsiyalar ishlab chiqish.

Tadqiqot obyekti va usullari

Tadqiqot obyekti

Tadqiqot obyekti – Sirdaryo daryosining Sirdaryo viloyati hududidagi qirg‘oq mintaqasi. Viloyat Mirzacho‘l cho‘lining shimoli-sharqiy qismida joylashgan, relyefi asosan tekislik. Iqlimi keskin kontinental: yozi issiq va quruq, qishi nisbatan sovuq, yog‘inlar asosan qish va bahorda tushadi. Yozda bug‘lanish yog‘in miqdoridan ancha ko‘p bo‘lgani uchun tuproq sho‘rlanishiga qulay sharoit yaratiladi. Qirg‘oq bo‘yida allyuvial-o‘tloqi, ayrim joylarda sho‘rlangan va sho‘rxok tuproqlar tarqalgan. Tabiiy o‘simlik terak, jiyda, tol, yulg‘un, qamish va o‘tloqi butazorlardan iborat, daryodan uzoqlashgan sari uning o‘rnini sug‘oriladigan ekin maydonlari egallaydi.

Foydalanilgan ma’lumotlar

Asosiy ma’lumot sifatida Sentinel-2 MSI tasvirlari (10–20 m) olindi [10]. Sahnalar yil vegetatsiya davri (aprel–sentabr) uchun tanlandi, bulut va bulut soyasi SCL maskasi bilan olib tashlandi, so‘ng median kompozit tuzildi. Relyef ko‘rsatkichlari (qiyalik, daryo sathidan balandlik) SRTM raqamli balandlik modeli (30 m) asosida hisoblandi [11]. Yer qoplami xaritasi Sentinel-2 tasvirlarini nazoratli tasniflash orqali olindi. Gidrografik tarmoq, yo‘llar va aholi punktlari OpenStreetMap va rasmiy kartografik materiallardan olindi. Ishlov berish Google Earth Engine [1] va QGIS [versiya] dasturlarida bajarildi, qatlamlar yagona koordinata tizimiga (WGS 84 / UTM) keltirildi.

Qirg‘oq zonasini chegaralash

Daryo o‘zani atrofida 500, 1000 va 2000 m li uch bosqichli bufer zonalar qurildi. Asosiy tahlil 1000 m li zona uchun bajarildi, qolganlari natijalarning bufer kengligiga sezgirligini tekshirishda ishlatildi. Zonalar tuman chegaralari bo‘yicha kesilib, tumanlar kesimida statistika olindi.

1-jadval. Baholash ko‘rsatkichlari

Ko‘rsatkich	Formula	Sentinel-2 bandlari	Ekologik ma’nosi
NDVI [4]	(NIR − Red)/(NIR + Red)	B8, B4	o‘simlik zichligi va faolligi
SAVI [5]	(1+L)(NIR − Red)/(NIR + Red + L), L = 0,5	B8, B4	tuproq fonini hisobga oluvchi o‘simlik indeksi
MNDWI [3]	(Green − SWIR1)/(Green + SWIR1)	B3, B11	ochiq suv va sirt namligi
NDMI [6]	(NIR − SWIR1)/(NIR + SWIR1)	B8, B11	o‘simlik suv tarkibi
SI	[tanlangan variantga qarab]	B2, B4	tuproq sho‘rlanishi (bilvosita)
Qiyalik, daryogacha masofa	SRTM asosida	–	eroziya xavfi, suv ta’minoti
Yer qoplami	tabiiy va o‘zlashtirilgan yerlar ulushi	–	antropogen o‘zgarish darajasi

NDVI −1 dan +1 gacha o‘zgaradi: suv va bulut uchun nolga yoki undan pastga, ochiq tuproq va sho‘rxoklar uchun 0–0,1 ga, siyrak o‘simlik uchun taxminan 0,1–0,3 ga, zich o‘simlik va to‘qay massivlari uchun 0,5–0,6 dan yuqoriga to‘g‘ri keladi [4, 13]. SAVI tuproq yorqinligi ta’sirini kamaytiradi va o‘simlik siyrak quruq hududlar uchun qulay [5]. Ochiq suv va nam yerlarni ajratish uchun MNDWI ishlatildi [2, 3], NDMI esa o‘simlikning suv bilan ta’minlanganligini baholashga xizmat qildi [6]. Sho‘rlanish sun’iy yo‘ldosh ma’lumotlarida bevosita ko‘rinmaydi, shuning uchun sho‘rlanish indeksi bilvosita ko‘rsatkich bo‘lib, dala o‘lchovlari bilan tasdiqlanishi kerak.

Barcha qatlamlar 0–1 oralig‘iga normallashtirildi: ijobiy ko‘rsatkichlar (NDVI, SAVI, NDMI) to‘g‘ridan-to‘g‘ri, salbiy ko‘rsatkichlar (sho‘rlanish, qiyalik, o‘zlashtirilgan yerlar ulushi) teskari shkala bo‘yicha:

$x_i' = (x_i - x_{min})/(x_{max} - x_{min})$ – ijobiy; $x_i' = (x_{max} - x_i)/(x_{max} - x_{min})$ – salbiy.

Ko‘rsatkichlar og‘irligini aniqlash (AHP)

Ko‘rsatkichlarning nisbiy ahamiyati T. Saati usuli bilan aniqlandi [7, 15]. Ekspertlar ko‘rsatkichlarni juft taqqoslab, 1 dan 9 gacha shkala bo‘yicha baho berdi (1 – teng ahamiyatli, 3 – biroz muhimroq, 5 – sezilarli, 7 – juda muhim, 9 – mutlaq muhim; 2, 4, 6, 8 – oraliq). Matritsa 3 nafar ekspert (ekolog, geograf, GAT mutaxassisi) fikri asosida tuzilib, geometrik o‘rtacha bilan jamlandi; xos vektor og‘irliklarni (w_i) berdi. Izchillik $CI = (\lambda_{max} - n)/(n - 1)$ va $CR = CI/RI$ orqali tekshirildi, bunda RI n = 5 uchun 1,12, n = 6 uchun 1,24, n = 7 uchun 1,32 [7]; $CR \leq 0{,}10$ bo‘lsa matritsa izchil hisoblanadi. Natija barqarorligi og‘irliklarni ±10 % o‘zgartirish orqali sezgirlik tahlilida tekshirildi.

Integral indeks va toifalarga ajratish

Integral ekologik holat indeksi (IEHI) vaznli chiziqli kombinatsiya bilan hisoblandi:

$IEHI = \Sigma (w_i \cdot x_i'), \Sigma w_i = 1,$

bunda w_i – AHP bo‘yicha og‘irlik, x_i' – normallashtirilgan qiymat. Qatlam teng intervallar usuli bilan besh toifaga bo‘lindi (2-jadval), natijalar Jenks natural breaks bilan ham solishtirildi.

2-jadval. IEHI toifalari

Toifa	**IEHI oralig‘i**	**Ekologik tavsif**
I. A’lo	0,80 – 1,00	to‘liq shakllangan to‘qay, barqaror namlik
II. Yaxshi	0,60 – 0,80	zich o‘simlik, kuchsiz antropogen ta’sir
III. Qoniqarli	0,40 – 0,60	qisman o‘zgargan, aralash yer qoplami
IV. Yomon	0,20 – 0,40	siyrak o‘simlik, sho‘rlanish belgilari
V. Juda yomon	0,00 – 0,20	o‘simliksiz, kuchli sho‘rlangan yoki buzilgan yerlar

Validatsiya

Natijalar 12 ta dala nazorat nuqtasida (o‘simlik qoplami foizi, tuproq elektr o‘tkazuvchanligi yoki vizual baho) tekshirildi. Aniqlik xato matritsasi, umumiy aniqlik va Kappa koeffitsiyenti bilan baholandi [16].

Natijalar va muhokama

Fazoviy qonuniyatlar va omillar. Daryodan uzoqlashgan sari IEHI o‘zgardi. Eng yomon holat sug‘oriladigan yerlar qirg‘oqqa yaqinlashgan va tabiiy o‘simlik tor yo‘lakka qisqargan joylarda to‘plangan. Sabab sifatida [sug‘oriladigan yerlarning kengayishi, ikkilamchi sho‘rlanish, yaylov bosimi, daraxt kesish, suv rejimining o‘zgarishi – o‘z natijangizga qarab tanlang] ko‘rsatilishi mumkin. Adabiyotlarda qirg‘oq o‘simligining qisqarishi oqim rejimining o‘zgarishi va yerlarni o‘zlashtirish bilan bog‘lanadi [8, 9]; natijalarimiz bu fikrni tasdiqladi.

Metodikaning cheklovlari. Sentinel-2 ning 10–20 m ajratishi tor qirg‘oq yo‘laklarini aniq ajratishga yetarli bo‘lmasligi mumkin; sho‘rlanish indeksi bilvosita ko‘rsatkich bo‘lgani uchun dala tasdig‘ini talab qiladi; AHP ekspert fikriga tayanadi va sub’ektivlikni saqlaydi; bir yillik kompozit mavsumiy va yillararo o‘zgaruvchanlikni to‘liq aks ettirmaydi. Shu sababli kelgusida ko‘p yillik vaqt qatorlarini tahlil qilish va dala validatsiyasini kengaytirish maqsadga muvofiq.

Xulosa:

1. Sirdaryo viloyati qirg‘oq ekotizimlarini baholash uchun NDVI, SAVI, NDMI, MNDWI, sho‘rlanish, relyef va yer qoplami ko‘rsatkichlarini birlashtiruvchi GAT-metodika ishlab chiqildi.

2. Sohilobod mahallasidagi eko-turizm maskani uchun uchastkani muhofaza yadrosi, bufer va rivojlantirish zonalariga ajratish tavsiya etildi.

3. Natijalardan qirg‘oq zonalarini muhofaza qilish, to‘qay o‘rmonlarini tiklash, yerdan foydalanishni rejalashtirish va eko-turizm obyektlarini joylashtirishda foydalanish mumkin.

4. Kelgusida Landsat va Sentinel-2 vaqt qatori asosida ko‘p yillik dinamika tahlil qilinadi.

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Ergashev A.N.
tadqiqotchi
Namangan davlat universiteti
O‘zbekiston, Namangan

NAMANGAN VILOYATI YER RESURSLARI TABIIY-LANDSHAFT TARKIBINING O’ZGARISHI VA UNING OQIBATLARI

Annotatsiya. Maqolada Namangan viloyati yer fondi tabiiy-landshaft tarkibining o‘zgarish darajasi, uning hududiy xususiyatlari va ekologik-xo‘jalik oqibatlari tahlil qilingan. Yer fondi tarkibidagi o‘zgarishlarni baholashda ekologik gomogen guruhlar, yer turlari va ulardan foydalanish xususiyatlari asos qilib olingan. Viloyat tumanlari yer fondining tabiiy tarkibidagi o‘zgarishlar ko‘p yillik daraxtzorlar, sug‘oriladigan ekin maydonlari, ekologik tayanch yerlar va boshqa yer toifalarining nisbatlari orqali o‘rganilgan. Olingan natijalar yer resurslaridan oqilona foydalanish, tabiiy landshaftlar xilma-xilligini saqlash va hududiy geoekologik monitoringni takomillashtirish uchun ilmiy-amaliy ahamiyatga ega.

Kalit so‘zlar: Namangan viloyati, yer fondi, tabiiy-landshaft tarkibi, yer resurslari, landshaft o‘zgarishi, ekologik gomogen guruhlar, antropogen yuk, geoekologik baholash, ekologik tayanch yerlar, ko‘p yillik daraxtzorlar, sug‘oriladigan yerlar, hududiy rayonlashtirish, geoekologik monitoring, ArcGIS.

Ergashev A.N.
researcher
Namangan State University
Uzbekistan, Namangan

CHANGES IN THE NATURAL LANDSCAPE COMPOSITION OF LAND RESOURCES IN NAMANGAN REGION AND THEIR CONSEQUENCES

Abstract. This article analyzes the degree of change in the natural landscape composition of the land fund in Namangan Region, its spatial characteristics, and its ecological and economic consequences. The assessment of changes in the land fund structure is based on ecologically homogeneous groups, land categories, and land-use characteristics. Changes in the natural composition of the land fund across the region’s districts are examined in terms of the proportions of perennial plantations, irrigated croplands, ecological support lands, and other land categories. The findings are of scientific and practical significance for promoting the rational use of land resources, preserving natural landscape diversity, and improving regional geoecological monitoring.

Keywords: Namangan Region, land fund, natural landscape composition, land resources, landscape change, ecologically homogeneous groups, anthropogenic pressure, geoecological assessment, ecological support lands,

perennial plantations, irrigated lands, regional zoning, geoecological monitoring, ArcGIS.

Kirish: Jahonda aholi sonining jadal ortib borishi tabiiy resurslarga, xususan yer resurslariga bo'lgan antropogen bosimni keskin kuchaytirmoqda. Bu esa yer fondi tabiiy-landshaft tarkibining o'zgarishi, biologik xilma-xillikni pasayishi va uning tashqi antropogen bosim ostida qolib optimal holatini buzilishiga olib kelmoqda. BMT Barqaror rivojlanish maqsadlari to'g'risidagi hisobotida «...erlarning degradatsiyasi va tuproq unumdorligining pasayishi davom etmoqda va bu jaraèn, nafaqat barcha mamlakatlarning rivojlanishiga to'sqinlik qiladi, balki ularning xafsizligiga ham tahdid soladi»[1] , deb ta'kidlanadi.

Namangan viloyatida yer resurslaridan samarali foydalanish, hududning tabiiy, ijtimoiy-iqtisodiy geografik xususiyatlarini inobatga olish, foydalanish jarayonida kelib chiqayotgan ekologik muammolarni bartaraf etish bo'yicha ilmiy izlanishlar olib borish muhim ahamiyatga ega.

Tadqiqot metodlari: Tadqiqot jarayonida tizimli tahlil, qiyosiy-geografik, statistik, kartografik, hududiy taqqoslash, ekologik baholash va geografik axborot tizimlari (GAT) metodlaridan foydalanilgan.

Natijalar: Yer resurslarining tabiiy lanshaft tarkibini o'zgarish darajasini aniqlash hududning ekologik-xo'jalik jihatdan zo'riqish darajasini aniqlashning dastlabki bosqichi hisoblanadi. Dastlab oldindan ishlab chiqilgan geoekologik monitoring yordamida tumanlar yer fondi tarkibini 6 ta ekologik gomogen (o'xshash) guruhlarga ajratib olinadi.

Namangan viloyati va tumanlar yer fondining satrlar bo'yicha taqsimlanishi haqidagi ma'lumotnomalardan (O'zbekiston Respublikasi Yer fondi 0.1 2020; 22-sonli shakl) [2]ekologik gomogen guruhga mos keluvchi yer toifalari va yer turlari aniqlanadi. Ushbu tasnifdagi guruhlarga hududning tabiiy tarkibi o'zgarib borishi, va antropogen yuk miqdoriga qarab 1 dan 6 gacha bo'lgan ballar beriladi.

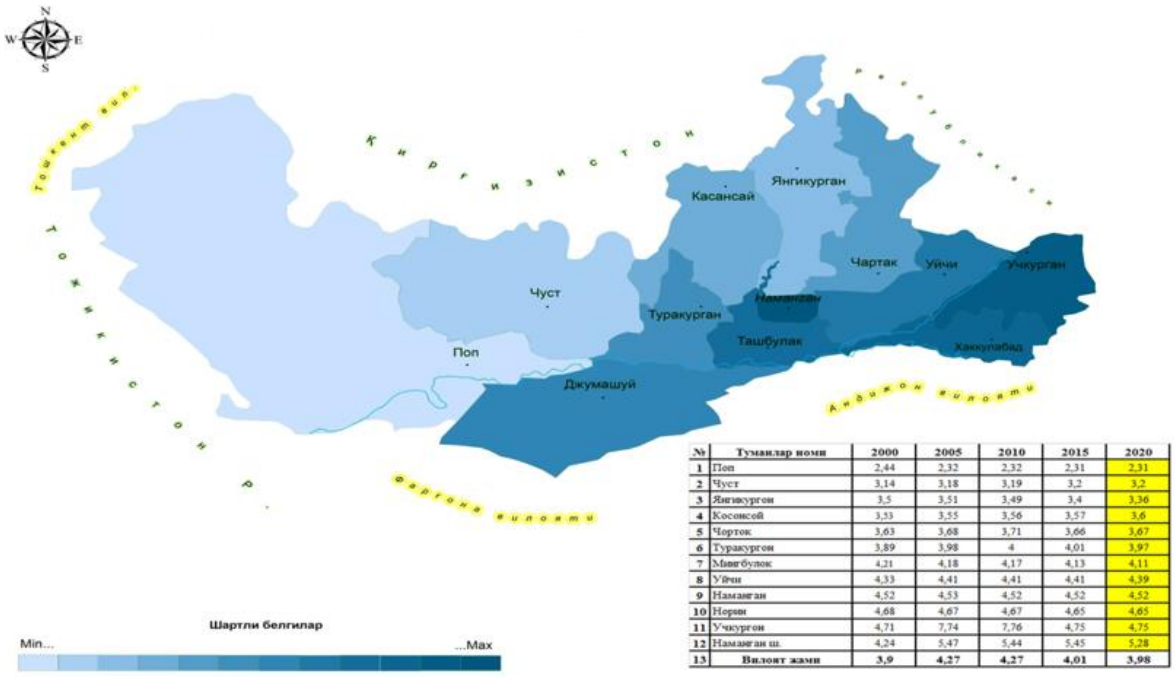
Ma'muriy tumanlar yer fondini yuqoridagi mezon bo'yicha tasniflashda ham hududning qaysi landshaft zonasida joylashganligi e'tiborga olinadi. Namangan viloyati yer fondi tabiiy-landshaft tarkibini oxirgi 20 yildagi o'zgarish darajasini baholash natijalari ekstropoltsiya usulida bashorat qilindi. Olingan natijalar asosida viloyat yer fondi tabiiy - tarkibini o'zgarish darajasini ifodalovchi bashoratli xaritalar ArcGIS dasturlaridan foydalanib ishlab chiqildi (1-rasm).

Tahlillar shuni ko'rsatadiki, viloyat bo'yicha yer fondi tabiiy tarkibini o'zgarishi keyingi 10 yilliklarda, ya'ni 2025-2030 yillarda ham davom etadi. Biroq, so'ngi yillardagi yerdan foydalanish bo'yicha yuritilayotgan oqilona siyosat natijasida bu o'zgarish ekologik jihatdan xatarli tus olmaydi. Viloyatning Pop,

[1] Повестки дня в области устойчивого развития на период до 2030 года. www.uz.undp.org/content/uzbekistan/ru/

[2] O'zbekiston Respublikasi Vazirlar Mahkamasining "Yer resurslarining holati bo'yicha milliy hisobotni yuritish tartibi to'g'risidagi nizomni tasdiqlash haqida" qarori, 30.10.2023 yildagi 578-son, https://lex.uz/docs/-6648587

Yangiqo’rg’on va Mingbuloq tumanlarida yer fondi tabiiy tarkibini o’zgarish darajasi pasayganligini kuzatiladi. Bunday natija yerdan foydalanishdagi antropogen yuk miqdori past bo’lgan ekologik gomogen guruhlar “Ko’p yillik daraxtzorlar”, “Ekologik tayanch” yerlar maydonini kengayishi hisobiga yuz berayotgaligini kuzatish mumkin. Biroq, viloyatning Uchqo’rg’on, Norin, Uychi, To’raqo’rg’on tumanlarida yer fondi tabiiy tarkibini o’zgarish darajasi yuqoriligicha saqlanib qolmoqda.



№	Туманлар номи	2000	2005	2010	2015	2020
1	Поп	2,44	2,32	2,32	2,31	2,31
2	Чуст	3,14	3,18	3,19	3,2	3,2
3	Янгикурган	3,5	3,51	3,49	3,4	3,36
4	Косонсой	3,33	3,55	3,56	3,57	3,6
5	Чорток	3,63	3,68	3,71	3,66	3,67
6	Туракурган	3,89	3,98	4	4,01	3,97
7	Мингбулок	4,21	4,18	4,17	4,13	4,11
8	Уйчи	4,33	4,41	4,41	4,41	4,39
9	Наманган	4,52	4,53	4,52	4,52	4,52
10	Норин	4,68	4,67	4,67	4,65	4,65
11	Учкурган	4,71	7,74	7,76	4,75	4,75
12	Наманган ш.	4,24	5,47	5,44	5,45	5,28
13	**Вилоят жами**	**3,9**	**4,27**	**4,27**	**4,01**	**3,98**

1-rasm. Namangan viloyati yer fondi tabiiy tarkibini o’zgarishi (2020-yil)

Viloyat yer fondi tabiiy tarkibini o’zgarish darajasini tahlil qilish orqali hududdagi tabiiy landshaftlarni o’zgarishini, landshaft xilma-xilligini saqlanish holatiga baho berish mumkin. Agar yer fondi tabiiy tarkibini o’zgarish xaritasi bilan tabiiy landshaft xaritasi taqqoslansa, viloyatdagi landshaftlarni o’zgarish xususiyatlarini aniqlash mumkin bo’ladi. Tabiiy landshaft tarkibini oxirgi yillarda shakllangan holatini tahlil qilish viloyat landshaft tarkibini o’zgarishiga ko’ra, bir-biridan farqlanadigan 3 ta mintaqani ajratish imkonini beradi.

Viloyat tabiiy landshaftlari tarkibini o’zgarishi g’arbdan sharqqa va shimoldan janubga tomon sezilarli darajada ortib boradi. Yer fondi tarkibini o’zgarish ko’rsatkichlari bo’yicha baholansa, viloyat hududidagi eng kam o’zgargan landshaftlar past tog’lar bo’lib, ular asosan Pop (53%), Yangiqo’rg’on (16%) va Kosonsoy (7%) tumanlari hududida joylashgan. Bu rayondagi ko’proq o’zlashtirilgan landshaftlar tog’ oldi prolyuvial tekisliklari hisoblanib, ko’proq Yangiqo’rg’on (53%), Kosonsoy (41%), Pop (19%), Chust (18%) tumanlari hududini egallaydi. Bu mintaqada o’zlashtirishni ikkinchi to’lqini boshlangan. Adir landshaftlari ham mintaqa hududini 50% dan ko’proq qismini egallaydi. Bu

hududlarga nasos yordamida suv chiqarib, ekin maydonlari salmog'ini kengaytirish uchun o'tgan asrni oxiridagi urinishlar kutilgan natija bermadi.

Oxirgi yillarda bu landshaft turidan foydalanishning landshaft ekologik talablarga javob beradigan usullari joriy etilmoqda. Bu holat mintaqa tabiiy landshaftlari o'zgarish darajasini oxirgi 20 yilda deyarli o'zgarishsiz qolishiga yoki Pop, Yangiqo'rg'on tumanlarida bo'lgani kabi o'zgarish darajasini pastlashiga olib kelgan. Bu holat mazkur mintaqadagi tumanlar yer fondi tarkibida ko'p yillik daraxtzorlar bilan band bo'lgan yerlar miqdorini ortganli bilan izohlanadi.

Birgina Kosonsoy tumanida bu turdagi yerlar miqdori 2000-2015 yillarda atiga 354 gektarga ortib, 2000 yildagi 4044 gektardan 2015 yili 4389 gektarga yetgan. Oxirgi 5 yilda mamlakatimizdagi yerdan foydalanishni oqilona siyosati, ekin turlarini landshaft talabiga moslashga bo'lgan harakatlar sababli bu turdagi yerlar maydoni 1370 gektarga kengayib, 5759 gektarni tashkil etgan. Yer fondi tarkibidagi ekologik jihatdan ijobiy o'zgarishlarga sabab bo'lgan yana bir o'zgarish ekologik tayanch yerlar guruhiga kirgan yer turlari miqdorining ortib borishidir. Kosonsoy tumanida bu toifadagi yerlar miqdori 154 gektardan 599 gektarga ortgan va jami yerlarni 11% ini tashkil etmoqda.

Yuqoridagi tartibdagi o'zgarishlarni mintaqa tarkibiga kiruvchi Pop, Chust, Yangiqo'rg'on tumanlari misolida ham kuzatish mumkin. Viloyat yer fondi tarkibini o'zgarish darajasiga qarab baholanganda, tabiiy landshaftlari o'rtacha o'zgarishga uchragan ikkinchi mintaqa tarkibiga Chortoq, To'raqo'rg'on va Mingbuloq tumanlari kiradi. Bu tumanlar yer fondi tarkibida allyuvial tekisliklar Mingbuloq tumanida 100 foiz, To'raqo'rg'on tumanida 43 foiz maydonlarni egallaydi. Konus yoyilmalarining prolyuvial-allyuvial tekislik landshaftlari Chortoq tumanining 36 foiz, To'raqo'rg'on tumanining 29 foizini ishg'ol qiladi.

Bu mintaqada yer fondi tabiiy tarkibini o'zgarishi kuzatilgan bo'lsada, umumiy natija deyarli o'zgarishsiz qoldi. Buning sababi ham yuqoridagi mintaqada kuzatilgan holat edi. Mintaqada urbanizatsiyalashgan hududlar, sug'oriladigan ekin maydonlari hududi muttasil ortib borgani kuzatiladi. Shu bilan bir qatorda ekologik jihatdan ahamiyatli bo'lgan ko'p yillik daraxtzorlar maydoni Chortoq va To'raqo'rg'on tumanlarida keskin ortib ketganligidan 2015 yilga nisbatan 2020 yilda tabiiy landshaftlar tarkibini o'zgarish darajasi pastlab bormoqda.

Viloyatning yer fondi tabiiy tarkibini o'zgarishi eng yuqori bo'lgan mintaqaga Uychi, Namangan, Norin, Uchqo'rg'on tumanlari va Namangan shahri hududi kiradi. Bu mintaqada tarqalgan asosiy landshaft turi konus yoyilmalarining prlyuvial-allyuvial tekisliklari bo'lib, bu landshaft turi Uchqo'rg'on tumanining 95%, Uychi tumanining 21%, Norin tumanining 22% maydonini egallaydi. Barcha tumanlarda tabiiy landshaft tarkibini o'zgarishi eng yuqori bo'lib qolmoqda. Bu mintaqa hududining sug'orma dehqonchilik uchun qulayligi u yerda sug'oriladigan ekin yerlari viloyat bo'yicha salmog'i yuqoriligi (85-90 %) kuzatilmoqda.

Xulosa: Tadqiqot natijalari Namangan viloyati yer fondi tabiiy-landshaft tarkibining o'zgarishi hududiy xususiyatga ega ekanligini va bu jarayon tabiiy sharoit, yer resurslarining xo'jalik maqsadlarida o'zlashtirilishi hamda antropogen yuk darajasi bilan chambarchas bog'liqligini ko'rsatdi. Yer fondi tarkibidagi

o‘zgarishlarni tahlil qilish asosida viloyat hududi tabiiy landshaftlar o‘zgarish darajasiga ko‘ra uchta mintaqaga ajratildi.

Birinchi mintaqaga Pop, Chust, Kosonsoy va Yangiqo‘rg‘on tumanlarining tegishli hududlari kiritilib, unda past tog‘ landshaftlarining nisbatan kam o‘zgarganligi, tog‘ oldi prolyuvial tekisliklari va adir landshaftlarining esa turli darajada o‘zlashtirilganligi aniqlandi. So‘nggi yillarda ko‘p yillik daraxtzorlar hamda ekologik tayanch yerlar maydonining ortishi ushbu mintaqaning ayrim hududlarida yer fondi tabiiy tarkibi o‘zgarish darajasining pasayishiga xizmat qilgan.

Ikkinchi mintaqani Chortoq, To‘raqo‘rg‘on va Mingbuloq tumanlari tashkil etib, bu hududlarda tabiiy-landshaft tarkibidagi o‘zgarishlar o‘rtacha darajada namoyon bo‘lgan. Sug‘oriladigan dehqonchilik va urbanizatsiya ta’sirida yer fondining ayrim tarkibiy qismlari o‘zgargan bo‘lsa-da, ko‘p yillik daraxtzorlar maydonining kengayishi ayrim tumanlarda o‘zgarish darajasining pasayishiga ta’sir ko‘rsatgan.

Uchinchi mintaqaga Uychi, Namangan, Norin va Uchqo‘rg‘on tumanlari hamda Namangan shahri hududi kiritilib, unda tabiiy-landshaft tarkibining o‘zgarish darajasi yuqoriligi qayd etilgan. Buning asosiy omillaridan biri sug‘orma dehqonchilik uchun qulay bo‘lgan tekislik landshaftlarining keng o‘zlashtirilganligi, sug‘oriladigan yerlar va urbanizatsiyalashgan hududlar ulushining ortishi hisoblanadi.

Tadqiqot davomida yer fondi tabiiy tarkibidagi o‘zgarishlarni baholashda faqat o‘zlashtirilgan yerlar maydonini emas, balki ko‘p yillik daraxtzorlar, ekologik tayanch yerlar va tabiiy landshaftlarning saqlanganlik holatini ham hisobga olish zarurligi asoslandi. Bunday yondashuv hududning ekologik barqarorligini baholash, yer resurslaridan foydalanishdagi muammoli hududlarni aniqlash va geoekologik monitoringni takomillashtirish imkonini beradi.

Olingan natijalardan Namangan viloyati tumanlarida yer resurslaridan oqilona foydalanish, tabiiy landshaftlar xilma-xilligini saqlash, ekologik tayanch hududlarni kengaytirish va qishloq xo‘jaligi faoliyatini landshaftlarning tabiiy xususiyatlariga moslashtirish bo‘yicha hududiy tavsiyalar ishlab chiqishda foydalanish mumkin.

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Ergashev U.A.
ijtimoiy fanlar va sport kafedrasi o‘qituvchisi
Farg‘ona davlat texnika universiteti
O‘zbekiston, Farg‘ona

SUN’IY INTELLEKT VA RAQAMLI DAVRDA INSON SUBYEKTLIGINING TRANSFORMATSIYASI

Annotatsiya. mazkur maqolada raqamli texnologiyalarning jadal rivojlanishi va sun’iy intellektning inson hayotining turli sohalariga keng kirib borishi sharoitida inson subyektligining transformatsiyasi falsafiy nuqtayi nazardan tahlil qilinadi. Raqamli muhitda insonning o‘zini namoyon etish shakllari, raqamli identifikatsiya, algoritmik boshqaruv, sun’iy intellekt asosida qaror qabul qilish va insonning texnologik tizimlarga tobora ko‘proq tayanishi masalalari ko‘rib chiqiladi.

Kalit so‘zlar: sun’iy intellekt, raqamli jamiyat, inson subyektligi, inson, ong, avtonomiya, erkinlik, raqamli identifikatsiya, algoritm, texnologiya, raqamli transformatsiya, mas’uliyat, axloq, postgumanizm.

Ergashev U.A.
lecturer, Department of Social Sciences and Sports
Fergana State Technical University
Uzbekistan, Fergana

ARTIFICIAL INTELLIGENCE AND THE TRANSFORMATION OF HUMAN SUBJECTIVITY IN THE DIGITAL AGE

Abstract. the article analyzes the transformation of human subjectivity from a philosophical perspective in the context of the rapid development of digital technologies and the widespread integration of artificial intelligence into various spheres of human life. It examines the forms of human self-expression and self-presentation in the digital environment, digital identification, algorithmic governance, AI-based decision-making, as well as the increasing dependence of individuals on technological systems.

Keywords: artificial intelligence, digital society, human subjectivity, human being, consciousness, autonomy, freedom, digital identity, algorithm, technology, digital transformation, responsibility, ethics, posthumanism.

XXI asrda raqamli texnologiyalarning jadal rivojlanishi insoniyatning mavjudlik shartlarini sezilarli darajada o‘zgartirmoqda. Raqamlashtirish iqtisodiyot, ta’lim, tibbiyot, davlat boshqaruvi, ishlab chiqarish, madaniyat va kundalik hayotning deyarli barcha sohalarini qamrab olmoqda. Ayniqsa, sun’iy intellekt texnologiyalarining rivojlanishi inson va texnologiya o‘rtasidagi munosabatlarning mazmunini yangi bosqichga olib chiqmoqda.

Bugungi kunda sun’iy intellekt nafaqat hisoblash va avtomatlashtirish vositasi, balki axborotni tahlil qilish, matn yaratish, tasvirlarni qayta ishlash, tavsiyalar berish va turli intellektual vazifalarni bajarishga qodir texnologik tizim sifatida namoyon bo‘lmoqda. Shu sababli uning jamiyat va inson hayotiga ta’siri faqat texnik nuqtayi nazardan emas, balki falsafiy va ijtimoiy jihatdan ham o‘rganishni talab qiladi.

Mazkur jarayon insonning o‘zi haqidagi tasavvurlarni ham o‘zgartirmoqda. An’anaviy falsafada inson faoliyat yurituvchi, fikrlovchi, tanlov qiluvchi va o‘z harakatlari uchun mas’ul bo‘lgan subyekt sifatida talqin qilingan. Raqamli davrda esa inson algoritmlar, raqamli platformalar va sun’iy intellekt tizimlari bilan doimiy o‘zaro aloqada bo‘luvchi subyektga aylanmoqda.

Shu nuqtayi nazardan, zamonaviy falsafa oldida muhim savol paydo bo‘ladi: sun’iy intellekt va raqamlashtirish sharoitida inson subyektligi qanday o‘zgaradi?

Inson subyektligi falsafadagi fundamental tushunchalardan biri bo‘lib, insonning bilish, faoliyat yuritish, maqsad qo‘yish, tanlash va o‘z faoliyati uchun mas’uliyatni o‘z zimmasiga olish qobiliyatini ifodalaydi. Subyekt tushunchasi, odatda, obyekt tushunchasiga qarama-qarshi qo‘yiladi: obyekt faoliyat va bilishning yo‘nalishi bo‘lsa, subyekt ushbu faoliyatni amalga oshiruvchi faol tomon hisoblanadi.

Klassik falsafada inson subyektligi, avvalo, tafakkur bilan bog‘langan. R. Dekart inson mavjudligini tafakkur bilan asoslab, insonni fikrlovchi subyekt sifatida talqin qilgan. I. Kant esa insonning bilish faoliyati bilan bir qatorda uning axloqiy avtonomiyasiga katta ahamiyat bergan. Uning qarashlarida inson o‘z axloqiy qonunlarini anglay oladigan va mustaqil ravishda tanlov qiladigan mavjudotdir.

Gegel falsafasida inson subyektligi tarixiy va ijtimoiy jarayon bilan bog‘lanadi. Insonning o‘zligini anglashi boshqa subyektlar bilan munosabatlar jarayonida shakllanadi. Fenomenologiyada esa insonning bevosita tajribasi va ongining faoliyati markaziy o‘rinni egallaydi. Ekzistensializm vakillari inson subyektligini erkinlik, tanlov va mas’uliyat bilan bog‘laydilar.

Shunday qilib, inson subyektligining asosiy elementlarini quyidagicha umumlashtirish mumkin:

- **tafakkur** – bilish va anglash qobiliyati;
- **erkinlik** – mustaqil tanlov qilish imkoniyati;
- **avtonomiya** – o‘z faoliyatini nisbatan mustaqil belgilash;
- **mas’uliyat** – o‘z qarorlari va faoliyati oqibatlarini anglash.

Raqamli davrda aynan shu jihatlar yangi texnologik sharoitda qayta ko‘rib chiqilmoqda.

Raqamlashtirish inson hayotining faqat tashqi sharoitlarini emas, balki uning fikrlashi, muloqoti, o‘zini namoyon qilishi va ijtimoiy munosabatlarini ham o‘zgartirmoqda.

An’anaviy jamiyatda insonning ijtimoiy mavjudligi asosan real makon bilan bog‘liq bo‘lgan bo‘lsa, raqamli jamiyatda uning faoliyati jismoniy va virtual makonning birligida amalga oshmoqda. Ijtimoiy tarmoqlar, elektron xizmatlar,

raqamli ta’lim, masofaviy mehnat va boshqa texnologiyalar insonning kundalik faoliyatining ajralmas qismiga aylandi.

Raqamli muhitda insonning faoliyati natijasida katta hajmdagi ma’lumotlar hosil bo‘ladi. Qidiruvlar, xaridlar, muloqotlar, ijtimoiy tarmoqlardagi faoliyat va boshqa raqamli harakatlar insonning «raqamli izi»ni shakllantiradi.

Shu tariqa, insonning o‘zligi ikki shaklda namoyon bo‘lishi mumkin: real hayotdagi «Men» va raqamli muhitdagi «Men». Bular bir-biriga mos kelishi mumkin, biroq ular o‘rtasida muayyan tafovut ham mavjud bo‘ladi.

Raqamli identifikatsiyaning yana bir muhim jihati shundaki, inson haqidagi tasavvur faqat uning o‘zi tomonidan emas, balki algoritmik tizimlar tomonidan ham shakllantiriladi. Algoritmlar insonning xatti-harakatlari asosida uning qiziqishlari, ehtiyojlari va xulq-atvori haqida ma’lum xulosalar chiqaradi.

Natijada zamonaviy inson o‘zini nafaqat boshqa insonlar, balki algoritmik tizimlar «ko‘zi» orqali ham namoyon qiladi. Bu holat insonning shaxsiy hayoti, identifikatsiyasi va avtonomiyasi bilan bog‘liq yangi falsafiy muammolarni yuzaga keltiradi.

Sun’iy intellektning rivojlanishi inson subyektligining asosiy elementlaridan biri bo‘lgan tafakkur masalasini yangi nuqtayi nazardan ko‘rib chiqishni talab qiladi.

Zamonaviy sun’iy intellekt tizimlari katta hajmdagi axborotni qayta ishlash, matn yaratish, tasvirlarni tahlil qilish, tarjima qilish, dasturiy kod yozish va boshqa intellektual vazifalarni bajarish imkoniyatiga ega.

Biroq sun’iy intellektning bunday imkoniyatlari inson tafakkuri bilan aynan bir xil emas. Inson fikrlashi biologik, ijtimoiy, madaniy va tarixiy tajriba bilan bog‘liq. Inson nafaqat axborotni qayta ishlaydi, balki ma’no yaratadi, qadriyatlarni tanlaydi, axloqiy qarorlar qabul qiladi va o‘z mavjudligini anglaydi.

Shu sababli sun’iy intellektning intellektual operatsiyalarni bajarishi inson ongining barcha xususiyatlarini takrorlashini anglatmaydi.

Biroq muhim o‘zgarish insonning ayrim aqliy faoliyatlarini texnologiyaga topshirishi bilan bog‘liq. Bugungi kunda inson ma’lumot izlash, matn yaratish, tarjima qilish, hisob-kitob qilish yoki muayyan tahliliy vazifalarni sun’iy intellektga topshirishi mumkin.

Bu jarayonni tafakkurning texnologik delegatsiyasi sifatida tavsiflash mumkin.

Uning ijobiy jihati shundaki, insonning vaqt va intellektual resurslari tejaladi, murakkab vazifalarni bajarish imkoniyati kengayadi. Salbiy jihati esa insonning mustaqil fikrlash va muammoni o‘zi tahlil qilish qobiliyatiga haddan tashqari bog‘liqlik xavfining paydo bo‘lishidir.

Shu sababli asosiy savol sun’iy intellekt insonni almashtiradimi yoki yo‘qmi, degan masaladan ko‘ra kengroqdir. Asosiy muammo — inson o‘z tafakkur faoliyatining qaysi qismini texnologiyaga topshirishi va qaysi qismini mustaqil ravishda amalga oshirishi kerak?

Inson subyektligining asosiy belgilaridan biri avtonomiyadir. Avtonomiya insonning o‘z qarorlarini anglagan holda qabul qilish va o‘z faoliyatini belgilash imkoniyatini bildiradi.

Raqamli jamiyatda insonning tanlovlariga algoritmlar tobora ko‘proq ta’sir ko‘rsatmoqda. Ijtimoiy tarmoqlar, elektron savdo, qidiruv tizimlari va boshqa platformalar foydalanuvchiga turli tavsiyalar beradi.

Algoritmik tavsiyalar insonni bevosita majburlamasligi mumkin, ammo ular uning tanlov muhitini shakllantiradi. Masalan, foydalanuvchiga qaysi axborot ko‘rsatilishi, qaysi mahsulot tavsiya qilinishi yoki qaysi material birinchi o‘rinda turishi uning qarorlariga bilvosita ta’sir qilishi mumkin.

Shu sababli raqamli davrda erkinlik tushunchasi yangi mazmun kasb etmoqda. Endilikda faqat «inson tanlash imkoniyatiga egami?» degan savol emas, balki «insonning tanloviga ta’sir qiluvchi sharoitlar kim tomonidan va qanday shakllantirilmoqda»? degan savol ham muhimdir.

Bu jihatdan sun’iy intellekt va algoritmik tizimlar inson avtonomiyasini kengaytiruvchi yoki cheklovchi vosita sifatida namoyon bo‘lishi mumkin.

OECD sun’iy intellekt tamoyillarida ham inson huquqlari, inson qadr-qimmati, avtonomiya, shaffoflik, xavfsizlik va hisobdorlik ishonchli sun’iy intellektning muhim asoslari sifatida belgilanadi.

Demak, texnologik taraqqiyot insonning tanlov erkinligi va avtonomiyasini saqlash bilan uyg‘unlashishi lozim.

Inson subyektligining muhim ko‘rinishlaridan biri ijodkorlikdir. Bugungi kunda generativ sun’iy intellekt tizimlari matn, tasvir, musiqa va dasturiy kod yaratishi mumkinligi ijodkorlikning falsafiy mazmuni haqida yangi savollarni yuzaga keltirmoqda.

Agar sun’iy intellekt tomonidan yaratilgan asar inson topshirig‘i asosida shakllantirilgan bo‘lsa, uning muallifi kim? Inson tomonidan berilgan topshiriq ijodiy faoliyat hisoblanadimi? Inson va algoritm o‘rtasidagi ijodiy faoliyat chegarasi qayerda?

Mazkur savollarga javob berishda ijodkorlikni faqat yakuniy mahsulot bilan baholash yetarli emas. Inson ijodkorligi uning tajribasi, dunyoqarashi, qadriyatlari, maqsadi va hissiy tajribasi bilan bog‘liq.

Shuning uchun sun’iy intellekt tomonidan yaratilgan mahsulot bilan inson ijodining mohiyatini aynanlashtirish mumkin emas.

Biroq sun’iy intellekt inson ijodkorligini cheklash o‘rniga uni kengaytiruvchi vosita bo‘lishi mumkin. Inson sun’iy intellektdan yangi g‘oyalarni ishlab chiqish, variantlarni izlash va ijodiy tajribalarni amalga oshirishda foydalanishi mumkin.

Bu holatda inson subyektligi yo‘qolmaydi, balki inson va texnologiyaning hamkorligi asosida kengayadi.

Sun’iy intellekt rivojlanishi mas’uliyat masalasini ham murakkablashtirmoqda. An’anaviy faoliyatda qaror qabul qiluvchi shaxsni aniqlash nisbatan oson. Algoritmik tizimlarda esa qaror ko‘plab omillarning o‘zaro ta’siri natijasida yuzaga keladi.

Shu sababli sun’iy intellekt tomonidan qabul qilingan yoki tavsiya etilgan qarorlarning oqibatlari uchun kim javobgar bo‘lishi masalasi dolzarb bo‘lib qolmoqda.

Texnologiyaning o‘zi axloqiy mas’uliyat subyekti bo‘la olmaydi. Chunki mas’uliyat insonning maqsadni anglash, axloqiy tanlov qilish va o‘z faoliyati oqibatlarini baholash qobiliyatiga asoslanadi.

Shu sababli sun’iy intellektdan foydalanish jarayonida insonning yakuniy mas’uliyati saqlanishi zarur.

Bu, ayniqsa, ta’lim, tibbiyot, davlat boshqaruvi, moliya va boshqa ijtimoiy jihatdan muhim sohalarda katta ahamiyatga ega.

Sun’iy intellektning qarori qanchalik avtomatlashtirilgan bo‘lmasin, uning ijtimoiy oqibatlarini nazorat qilish va baholash mexanizmlarida inson ishtiroki mavjud bo‘lishi kerak.

Yuqoridagi tahlil shuni ko‘rsatadiki, raqamli davrda texnologik taraqqiyotning markazida inson manfaatlari turishi lozim.

Inson markazli sun’iy intellekt konsepsiyasi quyidagi asosiy tamoyillarga tayanadi:

Birinchidan, inson ustuvorligi. Sun’iy intellekt inson manfaatlari va farovonligiga xizmat qilishi kerak.

Ikkinchidan, inson avtonomiyasi. Insonning mustaqil qaror qabul qilish huquqi saqlanishi zarur.

Uchinchidan, shaffoflik. Foydalanuvchi sun’iy intellekt tizimining imkoniyatlari va cheklovlari haqida yetarli ma’lumotga ega bo‘lishi kerak.

To‘rtinchidan, hisobdorlik. Sun’iy intellektdan foydalanish natijasida yuzaga keladigan oqibatlar uchun javobgar subyektlar aniq belgilanishi lozim.

Beshinchidan, adolat. Algoritmik tizimlar diskriminatsiya va tengsizlikni kuchaytirmasligi kerak.

Oltinchidan, inson nazorati. Muhim ijtimoiy va axloqiy oqibatlarga ega qarorlarda insonning nazorat qilish va zarur hollarda qarorni bekor qilish imkoniyati bo‘lishi kerak.

Yettinchidan, raqamli savodxonlik. Inson sun’iy intellektning imkoniyatlari va cheklovlarini anglashga qodir bo‘lishi zarur.

Ushbu tamoyillar sun’iy intellektni insonning raqibi emas, balki uning intellektual va ijtimoiy imkoniyatlarini kengaytiruvchi vositaga aylantirishga xizmat qiladi.

Sun’iy intellektning jadal rivojlanishi insoniyat taraqqiyotining yangi bosqichini shakllantirish bilan birga, insonning o‘zi haqidagi falsafiy tasavvurlarni ham qayta ko‘rib chiqishni talab qilmoqda.

Tadqiqot natijalariga ko‘ra, raqamli davrda inson subyektligi yo‘qolmaydi, balki uning mazmuni va namoyon bo‘lish shakllari transformatsiyaga uchraydi. Inson endilikda faqat tabiiy va ijtimoiy muhitda emas, balki raqamli va algoritmik muhitda ham faoliyat yurituvchi subyektga aylanmoqda.

Sun’iy intellekt insonning bilish, ijodkorlik, kommunikatsiya va qaror qabul qilish imkoniyatlarini sezilarli darajada kengaytirishi mumkin. Shu bilan birga,

texnologiyaga haddan tashqari tayanish mustaqil fikrlash, tanlov erkinligi va inson avtonomiyasining zaiflashishiga olib kelishi mumkin.

Shuning uchun asosiy masala sun’iy intellekt insonni almashtirishi yoki almashtirmasligida emas. Muhim masala — inson va sun’iy intellekt o‘rtasidagi munosabat qanday falsafiy, axloqiy va ijtimoiy tamoyillar asosida tashkil etilishidadir.

Raqamli davrda inson subyektligining barqarorligi uch asosiy omil — avtonomiya, tanqidiy tafakkur va mas’uliyat bilan belgilanadi. Agar inson texnologiyadan ongli ravishda foydalanib, uning imkoniyatlari va cheklovlarini tanqidiy baholash qobiliyatini saqlab qolsa, sun’iy intellekt inson subyektligini zaiflashtiruvchi emas, balki uni kengaytiruvchi omilga aylanishi mumkin.

Shu ma’noda, zamonaviy falsafaning muhim vazifalaridan biri texnologik taraqqiyot sharoitida insoniylikning mazmunini saqlash, inson qadr-qimmati va avtonomiyasini himoya qilishning yangi konseptual asoslarini ishlab chiqishdan iborat.

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Erkayev A.N.
DSc ilmiy darajasini olish uchun mustaqil izlanuvchi
Toshkent davlat iqtisodiyot universiteti
O‘zbekiston, Toshkent
ORCID: 0009-0001-2638-7958

MILLIY IQTISODIYOTNI SANOATLASHTIRISHNING IQTISODIY TABIATI VA NAZARIY-METODOLOGIK ASOSLARI

Annotatsiya. Ushbu maqolada milliy iqtisodiyotni sanoatlashuvining rivojlangan iqtisodiyotga erishgan barcha jahon mamlakatlarini iqtisodiy nazariy maktablarining ilmiy nazariyalari tahlil etilgan. Unda «Sanoatlashtirish» tushunchasiga asosiy ta’riflar, Iqtisodiy maktablarni sanoatlashtirish nazariyasining xronologik rivojlanishi, List nazariyasining ikki tomoni, Iqtisodiy ta’limotlar va nazariy yo‘nalishlarning tarixiy evolyutsiyasi qiyosiy tahlil etilgan. Jahonda sanaoatlashuv darajasi rivojlangan va rivojlanayotgan mamlakatlar oldida turgan eng dolzarb vazifalardanbiri ekanligi, hozirgi globallashuv sharoitida dolzarb masalalar yoritib berilgan. Shu bilan birga MDX mamlakatlari olimlari va O’zbekistonlik olimlarni ilmiy tatqiqot ishlari sanoatlashuv darajasini zamonaviy mexanizmlarini tartibga solish borasidagi islohotlarning asosiy maqsadlari, sanoatlashtirish va iqtisodiy o‘sish bosqichlari, Milliy iqtisodiyot sanoatlashuv darajasini oshirishda O’zbek olimlari ilmiy izlanishlari natijaga olib keluvchi iqtisodiy va ijtimoiy cheklovlarni tavsiflash,yetakchi mamlakatlarning tajribalarini O’zbekiston uchun ahamiyatli tajribalari ilmiy tahlil etilgan.

Kalit so‘zlar: Sanoatlashtirish , industrializatsiya, asr , Sanoat-4.0, institutsional, tehnologik, tarkibiy, UNDO, periferiya, Markaz, CEPAL, Neoklassik, Strukturalizm, Keynschilik, innovatsion, proteksionistik , Strategik tarmoq, o‘sish, YIMM, «O‘ZBEKISTON-2030», Strategiya, Respublika, mintaqa.

Erkayev A.N.
independent researcher pursuing a DSc degree
Tashkent State University of Economics
Uzbekistan, Tashkent
ORCID: 0009-0001-2638-7958

THE ECONOMIC NATURE AND THEORETICAL-METHODOLOGICAL FOUNDATIONS OF INDUSTRIALIZING THE NATIONAL ECONOMY

Abstract. This article analyzes the scientific theories of the industrialization of the national economy of all countries of the world that have achieved a developed economy. It provides a comparative analysis of the main definitions of the concept of "industrialization", the chronological development of the theory of industrialization of economic schools, the two sides of List's theory, the historical evolution of economic teachings and theoretical directions. The fact that the level

of industrialization in the world is one of the most urgent tasks facing developed and developing countries, and current issues in the current globalization environment are highlighted. At the same time, the scientific research work of scientists from the CIS countries and scientists from Uzbekistan describes the main goals of reforms in regulating the level of industrialization, the stages of industrialization and economic growth, the characteristics of the economic and social constraints that Uzbek scientists have achieved in increasing the level of industrialization of the national economy, and the experiences of leading countries that are significant for Uzbekistan.

Keywords: Industrialization, industrialization, century, Industry-4.0, institutional, technological, structural, UNO, periphery, Center, CEPAL, Neoclassical, Structuralism, Keynesianism, innovative, protectionist, Strategic sector, growth, GDP, "UZBEKISTAN-2030", Strategy, Republic, region.

KIRISH

Sanoatlashtirish (industrializatsiya) – milliy xo‘jalikda sanoatning yetakchi rolini kuchaytirish, ishlab chiqarish kuchlarini jadal rivojlantirish hamda mehnat unumdorligini keskin oshirishni anglatadi.

Dunyoda sanoatlashtirish tarixi va evolyutsiyasi quyidagi asosiy davrlarni bosib o‘tdi. Birinchi sanoat inqilobi XVIII asr oxiri - XIX asr boshlarida Angliyada Suv va bug‘ kuchidan foydalanish hamda to‘qimachilik sanoatining mexanizatsiyalashuvi. Ikkinchi sanoat inqilobi XIX asr oxiri - XX asr boshi Elektr energiyasidan keng foydalanish, konveyer usulida ommaviy ishlab chiqarishning yo‘lga qo‘yilishi, avtomobilsozlik va kimyo sanoatining rivojlanishi. Uchinchi sanoat inqilobi XX asrning 2-yarmi Raqamlashtirish, axborot texnologiyalari, elektronika va internetning ishlab chiqarish jarayonlariga joriy etilishi.To'rtinchi sanoat inqilobi Industry 4.0 - hozirgi davr Sun’iy intellekt, robototexnika, narsalar interneti (IoT) va nanotexnologiyalarni sanoatga integratsiya qilish natijasida yuzaga kelgan.

Shu bilan birga O‘zbekistonda 2017-yildan boshlangan keng qamrovli iqtisodiy islohotlar doirasida mamlakat yalpi ichki mahsulotida sanoat ulushini oshirish, yuqori qo‘shilgan qiymatli mahsulotlar ishlab chiqarishni kengaytirish va eksport salohiyatini mustahkamlash dolzarb vazifa sifatida belgilangan. O‘zbekiston Respublikasi Prezidentining 2023-yil 11-sentabrdagi PF-158-son Farmoni bilan tasdiqlangan "O‘zbekiston-2030" strategiyasida mamlakat iqtisodiyotini global ishlab chiqarishning muhim bo‘g‘iniga aylantirish, sanoat mahsuloti hajmini va eksportini sezilarli oshirish, jahonning eng innovatsion ellik davlati qatoriga kirish vazifalari qo‘yilgan[1].

Adabiyotlar sharhi

Xorij olimlaridan F.List milliy sanoatni himoya tarifi siyosati orqali rivojlantirish nazariyasini (1962), X.Chenery va M.Sirkuin iqtisodiyot tarkibiy

[1]O'zbekiston Respublikasi Prezidentining 2023-yil 11-sentabrdagi "O'zbekiston-2030" strategiyasi to'g'risidagi PF-158-son Farmoni.

o‘zgarishining rivojlanish bosqichlariga xos empirik qonuniyatlarini (1975), R.Prebish rivojlanayotgan mamlakatlarda import o‘rnini bosuvchi sanoatlashtirish strategiyasini (1950), D.Rodrik esa erta deindustrlashuv hodisasi va uning rivojlanayotgan mamlakatlar iqtisodiyotiga ta’sirini (2016)o‘rganishgan.

MDX mamlakatlari olimlaridan A.G.Mokronosov, I.N.Mavrina Sanoatda raqobatbardoshlikni (2014), A.E.Zakondirin Mavjud eng yaxshi texnologiyalarni joriy etish tamoyillari asosida sanoat ishlab chiqarishini ko‘kalamzorlashtirishning uslubiy yondashuvlari va tashkiliy-iqtisodiy vositalarini (2023), V.I.Gerasimov, Kodaneva S. I. BRIKS mamlakatlari o‘rtasidagi ilmiy, texnologik va innovasion hamkorlikni ko‘rib chiqish: tendensiyalar, istiqbollar va muammolarni (2023), N.G.Shishatskiy Yangi sanoatlashtirish va mintaqaviy sanoat majmuasini modernizatsiya qilish tendensiyalarini (2022), S.B.Baurina, Ye.V.Nazarova Sanoat muhitida texnologik innovatsiyalarni (2023) lar asarlarida hamda ilmiy ishlarida mazkur tadqiqot yo’nalishiga doir masalalar atroflicha o‘rganganlar

O‘zbekiston iqtisodchi olimlar Vaxobov.A.V., O‘lmasov A., mamlakatdagi sanoat korxonalari faoliyatini bozor sharoitida boshqarishni (2014), Xodiyev B.Yu., Shodmonov Sh.Sh., sanoat tarmoqlarini rivojlantirish, ishlab chiqarish mahsuldorligini oshirish va milliy iqtisodiyotni modernizatsiya qilishning nazariy-metodologik asoslarini (2017), Abduraxmonov Q.X. mehnat unumdorligini ko‘tarish orqali sanoat tarmoqlarini raqobatbardoshligini ta’minlashni (2012), Abulqosimov X.P.Sanoat tarmoqlarida iqtisodiy barqarorlikni mustahkamlash va rivojlanish yo‘nalishlarini takomillashtirishni (2022), Topildiyev S.R., sanoatni davlat tomonidan boshqarish usullarini (2025), Jurayev T.T., industrial jamiyatdan postindustrial innovasion tizimlarga o‘tish qonuniyatlarini[2] (2024). bo’yicha o’z ilmiy tatqiqotlarini olib borishgan. Ammo mavjud ilmiy tadqiqotlarda sanoatlashtirishning umumiy nazariy masalalari hamda ayrim tarmoqlarni rivojlantirish yo‘nalishlari yoritilgan bo‘lsa-da, milliy iqtisodiyotni sanoatlashuv darajasini oshirishning nazariy jihatlarini yaxlit tizim sifatida takomillashtirish, sanoatlashuv qonuniyatlari, tamoyillari va omillarini o’rganilmagan.

Tadqiqot metodologiyasi

Maqolaning metodologiyasi ilmiy va tobora ommalashib borayotgan manbalarni tahlil qilishdan boshlab, qiyosiy, mantiqiy tahlil, ketma-ketlik, xolislik tamoyillari, respublika yangi iqtisodiy siyosatda izchillik bilan olib borilayotgan islohotlar, O‘zbekistonda mıllıy ıqtısodıyotnı sanoatlashuviga innovatsion tehnologiyalardan foydalanish tizimini rivojlantirish, ailmiy abstraksiyalash, induksiya va deduksiya, monografik kuzatuv, iqtisodiy-statistik tahlil, guruhlash

[2] Vahobov A.V., O’lmasov A. “Iqtisodiyot nazariyasi” Darslik.2014- yil 456-b.; Xodiyev B.Yu., Shodmonov Sh.Sh., “Iqtisodiyot nazariyasi”. “Barkamol fayz mediya”,darslik.2017- yil, 784-b.; Abduraxmonov Q.X. Mexnat iqtisodiyoti. “Fan va texnologiyalar”, darslik.2012-yil, 388 b.; Abulqosimov X.P. “Iqtisodiy xavfsizlik”, darsligi, 2022-yil,732-b.; Topildiyev S.R. “Iqtisodiy siyosat”, OOO “Diadema nur servis” : Darslik - T: TDIU, 2025. – 372 bet.; Jurayev T. “Iqtisodiyot nazariyasi” “Fan va texnologiyalar nashriyot va matbaa uyi ”,darslik.2024- yil, 504-b.;. ,

bo‘yicha iqtisodiy tajribalarni amaliyotga joriy etish bo‘yicha olib borgan ilmiy tadqiqotlar asosida yoritilgan.

Tahlil va natijalar

Hozirgi globallashuv sharoitida milliy iqtisodiyotlarning raqobatbardoshligini ta’minlashda sanoatlashtirish strategik ustuvor yo‘nalish sifatida barcha davlatlar uchun muhim ahamiyat kasb etmoqda. Sanoat ishlab chiqarishining barqaror rivojlanishi iqtisodiy o‘sishning asosiy multiplikatori bo‘lib, u nafaqat yaratilayotgan qo‘shilgan qiymatni, balki bandlik, eksport, texnologik rivojlanish va innovatsion salohiyatni ham belgilaydi.

Jahon tarixi shuni ko‘rsatadiki, rivojlangan iqtisodiyotga erishgan barcha mamlakatlar Buyuk Britaniya, AQSh, Germaniya, Yaponiya, Janubiy Koreya va keyinroq Xitoy o‘z rivojlanishining bir bosqichida rejali va maqsadli sanoatlashtirish strategiyasini amalga oshirgan[3]. Bu jarayonda davlatning roli, institutsional shart-sharoitlar va texnologik imkoniyatlar uyg‘unlashuvi hal qiluvchi ahamiyatga ega bo‘lgan.

O‘zbekiston uchun sanoatlashtirish masalasi o‘ziga xos ahamiyatga ega. 2017 yildan boshlangan keng qamrovli iqtisodiy islohotlar doirasida mamlakat yalpi ichki mahsulotida sanoat ulushini oshirish, yuqori qo‘shilgan qiymatli mahsulotlar ishlab chiqarishni kengaytirish va eksport salohiyatini mustahkamlash dolzarb vazifa sifatida belgilangan[4].

“Sanoatlashtirish” yoki “industrializatsiya” atamasi iqtisodiy adabiyotlarda XIX asr oxirida keng qo‘llana boshlagan. Biroq bu jarayonning ildizlari XVIII asrning ikkinchi yarmida Buyuk Britaniyada boshlangan Birinchi sanoat inqilobiga borib taqaladi bu davrda manuella ishlab chiqarishdan mashina-fabrika ishlab chiqarishiga o‘tish boshlandi[5].

Zamonaviy iqtisodiy adabiyotda “sanoatlashtirish” tushunchasiga bir necha xil ta’riflar berilgan. Bu ta’riflarning har biri ushbu murakkab jarayonning turli qirralarini aks ettiradi:

Yuqorida keltirilgan (1-jadval) ta’riflar tahlili shuni ko‘rsatadiki, sanoatlashtirish uch asosiy o‘lchamni o‘z ichiga oladi:

a) tarkibiy o‘zgarish iqtisodiyotda sanoat ulushining oshishi;

b) texnologik transformatsiya yangi texnologiyalarni o‘zlashtirish;

c) institutsional o‘zgarish bozor va davlat institutlarining takomillashuvi.

Iqtisodiy tafakkur tarixida sanoatlashtirish masalasini o‘rganuvchi bir necha yirik nazariy maktablar shakllangan. Bu maktablarning har biri o‘z davrining iqtisodiy va siyosiy realliklarini aks ettirgan hamda sanoatlashtirish siyosatiga katta ta’sir ko‘rsatgan.

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[3] Findlay, R., & O’Rourke, K. H. (2007). Power and plenty: Trade, war, and the world economy in the second millennium. Princeton University Press.

[4] O’zbekiston Respublikasi Prezidentining 2022 yil 28 yanvardagi “O’zbekiston — 2030” strategiyasi to’g’risidagi farmoni. O’zR Qonun hujjatlari ma’lumotlari bazasi. https://lex.uz

[5] Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations (Vol. 1–2). W. Strahan and T. Cadell. [O’zb. tarj.: Smit, A. (2001). Xalqlar boyligi. O’zbekiston nashriyoti.]

Listizm, Keynschilik va rivojlanish iqtisodiyoti maktablari esa sanoatlashtirishni rivojlanayotgan mamlakatlar nuqtai nazaridan qayta talqin qildi. Ushbu nazariyalarda davlat bozordagi muvaffaqiyatsizliklarni bartaraf etuvchi institut sifatida qaraladi. Ayniqsa, F.List tomonidan ilgari surilgan "infant industry" tamoyili hamda Rozenshteyn-Rodanning "Big Push" konsepsiyasi sanoat siyosatini selektiv qo'llab-quvvatlash zarurligini ilmiy asoslab berdi. Shunday qilib, sanoatlashtirish siyosati umumiy makroiqtisodiy choralar yig'indisidan ustuvor tarmoqlarni rivojlantirish strategiyasiga o'tdi.

Jadvaldagi keyingi evolyutsion o'zgarish institutsional va innovatsion yondashuvlarning shakllanishi bilan bog'liq. Mazkur nazariyalar sanoat rivojlanishini endi faqat kapital va mehnat bilan emas, balki institutlar sifati, bilimlar oqimi, innovatsion salohiyat va texnologiyalarni yaratish qobiliyati bilan izohlaydi. Shu sababli sanoat siyosatining obyekti ham o'zgardi: agar XX asr o'rtalarida asosiy e'tibor korxonalarni qo'llab-quvvatlashga qaratilgan bo'lsa, XXI asrda innovatsion ekotizim, ilmiy-tadqiqot faoliyati va raqamli infratuzilmani rivojlantirish ustuvor yo'nalishga aylandi.

Nazariy maktablarni vaqt mezoni bo'yicha tahlil qilish yana bir muhim tendensiyani namoyon etadi. Dastlabki nazariyalarda sanoatlashtirishning asosiy maqsadi ishlab chiqarish hajmini oshirish va importni qisqartirish bo'lgan bo'lsa, zamonaviy konsepsiyalarda asosiy e'tibor global qiymat zanjirlarida yuqori bo'g'inlarni egallash, texnologik mustaqillik va yuqori qo'shilgan qiymat yaratishga qaratilgan. Demak, sanoatlashtirishning mazmuni miqdoriy o'sishdan sifat jihatidan yangi iqtisodiy modelni shakllantirish bosqichiga o'tgan.

Fikrimizcha, O'zbekiston uchun ushbu nazariyalardan bittasini alohida tanlash emas, balki ularning komplementarligi tamoyiliga asoslangan sanoat siyosatini shakllantirish maqsadga muvofiqdir. Ya'ni, milliy ishlab chiqaruvchilarni qo'llab-quvvatlash (Listizm), tarkibiy transformatsiyani jadallashtirish (rivojlanish iqtisodiyoti), institutlar sifatini oshirish (institutsional maktab) hamda raqamli texnologiyalarni keng joriy etish (Sanoat 4.0) yagona sanoatlashtirish modelining o'zaro bog'liq elementlari sifatida qaralishi lozim. F.List tomonidan ilgari surilgan "bolalik tarmoqlarini himoya qilish" konsepsiyasi iqtisodiyot nazariyasidagi eng ko'p bahs-munozaralarga sabab bo'lgan yondashuvlardan biridir. Mazkur jadval aynan ushbu munozaraning ikki qarama-qarshi tomonini aks ettiradi. Bir tomondan, yangi tashkil etilgan sanoat tarmoqlari xalqaro bozorda uzoq yillar davomida shakllangan korxonalar bilan teng sharoitda raqobatlasha olmaydi. Ikkinchi tomondan esa davlat tomonidan berilgan himoya mexanizmlarining noto'g'ri tashkil etilishi bozor samaradorligini pasaytirishi mumkin.

Mazkur holatdan kelib chiqib, O'zbekiston sanoat siyosatini takomillashtirishda F.List konsepsiyasini to'liq nusxalash emas, balki uning iqtisodiy mantiqini zamonaviy institutsional boshqaruv tamoyillari bilan uyg'unlashtirish maqsadga muvofiqdir. Xususan, davlat tomonidan berilayotgan bojxona va soliq imtiyozlari ishlab chiqarish samaradorligi, eksport hajmi hamda texnologik yangilanish ko'rsatkichlari bilan bog'langan taqdirdagina uzoq muddatli iqtisodiy natija berishi mumkin.

Bu kontseptsiya quyidagi mantiqqa asoslanadi: agar faqat bitta tarmoqni rivojlantirsak, ishchilarning ish haqi oshadi, lekin ular ushbu pulni boshqa mahsulotlarga sarflaydilar. Agar bir vaqtda ko‘p tarmoq rivojlantirilsa, ishchilarning yalpi daromadi ortadi va ichki talab har bir tarmoqning mahsulotini sotib oladi bu mutanosib o‘sishni ta’minlaydi.

Albert Hirshman (1958) “mutanosib rivojlanish” kontseptsiyasiga muholifat sifatida “nomutanosib rivojlanish” (unbalanced growth) strategiyasini taklif etdi. Uning fikricha, tanlangan “strategik” tarmoqlarni ataylab rivojlantirish orqali iqtisodiyotda “bog‘lanishlar” (linkages) yaratiladi bu boshqa tarmoqlarni rivojlantirishga turtki beradi[6].

Yozef Shumpeter iqtisodiy o‘sishning dvigateli sifatida innovatsiyani birinchi o‘ringa qo‘ydi. Uning «yaratuvchi buzilish» (creative destruction) kontseptsiyasiga ko‘ra, iqtisodiyot eskirgan texnologiya va tuzilmalarni yangilari bilan almashtirish orqali rivojlanadi[7].

Karlota Perez Shumpeter g‘oyalarini yanada rivojlantirib, texnologik inqiloblar tarixini tizimli tadqiq etdi. U beshta asosiy texnologik paradigmani ajratdi: sanoat inqilobi (1771), bug‘ va temir yo‘llari (1829), po‘lat va elektr (1875), neft va avtomobillar (1908), axborot va telekommunikatsiya (1971). Bugungi Sanoat 4.0 paradigmasini esa oltinchi to‘lqin sifatida tahlil etdi[8].

Klaus Shvab 2016-yilda “To‘rtinchi sanoat inqilobi” tushunchasini ilmiy aylanmaga kiritdi. U fizik, raqamli va biologik sohalarning to‘qnashuvini tavsiflaydi. Bu paradigma sanoatlashtirishning an’anaviy modellarini tubdan o‘zgartirayotgan: endi «sanoatlashtirish» nafaqat zavodlar qurish, balki raqamli platformalar, aqlli tizimlar va ma’lumotlar iqtisodiyotini yaratishni ham anglatadi[9].

Sanoat 4.0 ning asosiy texnologiyalari: sun’iy intellekt (AI), narsalar interneti (IoT), robotlashtirish, katta ma’lumotlar (Big Data), raqamli egizak (Digital Twin), additsiv ishlab chiqarish (3D chop etish) va blokchein. Bu texnologiyalar birgalikda “aqlli zavod” (Smart Factory) kontseptsiyasini amalga oshiradi.

Uolt Rostou (1960) iqtisodiy o‘sishning besh bosqich nazariyasini taklif etdi: an’anaviy jamiyat, o‘zgarishga tayyorlik, «yuqoriga ko‘tarilish» (take-off), to‘liq etuklikka intilish va ommaviy iste’mol jamiyati[10].

Rostouning “take-off” tushunchasi investitsiya darajasi YaIMning 10% dan oshishi va bir nechta rivojlanayotgan tarmoqlar paydo bo‘lishi tarixiy jihatdan Buyuk Britaniya (1780-1800), Fransiya (1830-1860), Germaniya (1850-1873) va Janubiy Koreya (1960-1970) uchun tasdiqlangan. O‘zbekiston 2017-yildan “take-off” bosqichiga o‘tish belgilarini namoyon etmoqda: investitsiyalar YaIMning 36% ga yetdi, 15 dan ortiq sanoat tarmog‘i jadal rivojlanmoqda.

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[6] Hirschman, A. O. (1958). The strategy of economic development. Yale University Press.

[7] Schumpeter, J. A. (1942). Capitalism, socialism and democracy. Harper & Brothers.

[8] Perez, C. (2002). Technological revolutions and financial capital: The dynamics of bubbles and golden ages. Edward Elgar Publishing.

[9] Schwab, K. (2016). The fourth industrial revolution. World Economic Forum.

[10] Rostow, W. W. (1960). The stages of economic growth: A non-communist manifesto. Cambridge University Press.

O'zbekiston iqtisodiyotini mazkur nazariya nuqtai nazaridan baholash mamlakatda 2017-yildan boshlab sanoatlashtirishning yangi bosqichi shakllanayotganligini ko'rsatadi. So'nggi yillarda investitsiyalar hajmining sezilarli ortishi, sanoat zonalarining tashkil etilishi, qayta ishlash sanoati ulushining kengayishi hamda eksport tarkibini diversifikatsiya qilish bo'yicha amalga oshirilayotgan islohotlar Rostou ta'riflagan **"take-off"** bosqichining muhim belgilariga mos keladi. Shu bilan birga, texnologik etuklik bosqichiga o'tish uchun yuqori texnologiyali ishlab chiqarish, ilmiy-tadqiqot va tajriba-konstruktorlik ishlari (R&D), raqamli texnologiyalar hamda malakali inson kapitaliga yo'naltiriladigan investitsiyalarni yanada kengaytirish zarur.

Fikrimizcha, Rostouning iqtisodiy o'sish bosqichlari nazariyasi bugungi globallashuv va raqamli iqtisodiyot sharoitida ayrim jihatlari bilan takomillashtirilishi lozim. Chunki zamonaviy sanoatlashtirish faqat investitsiyalar hajmining ortishi bilan emas, balki innovatsion salohiyat, institutsional sifat, raqamli infratuzilma va global qiymat zanjirlaridagi ishtirok darajasi bilan ham belgilanadi. Shu sababli O'zbekistonning uzoq muddatli sanoat rivojlanish strategiyasida Rostou modelining asosiy tamoyillarini Sanoat 4.0 konsepsiyasi va innovatsion rivojlanish nazariyalari bilan uyg'unlashtirish ilmiy va amaliy jihatdan maqsadga muvofiq hisoblanadi.

Birinchi bosqichda sanoatlashtirishning asosiy vazifasi milliy ishlab chiqarishni shakllantirish va bozorlarni kengaytirishdan iborat bo’lgan. Ikkinchi bosqichda esa e’tibor iqtisodiyotning tarkibiy transformatsiyasi, davlat investitsiyalari va tarmoqlararo bog’liqliklarga qaratildi. Uchinchi bosqichda esa bilim, innovatsiyalar, sun’iy intellekt, IoT va Big Data sanoat rivojlanishining asosiy omillariga aylandi[11].

Ikkinchi bosqichda sanoatlashtirishning asosiy vazifasi milliy ishlab chiqarishni shakllantirish va bozorlarni kengaytirishdan iborat bo’lgan. Ikkinchi bosqichda esa e’tibor iqtisodiyotning tarkibiy transformatsiyasi, davlat investitsiyalari va tarmoqlararo bog’liqliklarga qaratildi. Uchinchi bosqichda esa bilim, innovatsiyalar, sun’iy intellekt, IoT va Big Data sanoat rivojlanishining asosiy omillariga aylandi.

Fikrimizcha, nazariy evolyutsiyaning eng muhim natijasi davlatning sanoat siyosatidagi funksiyasi o’zgarganligidir. Endilikda davlatning asosiy vazifasi faqat himoya choralarini qo’llash emas, balki innovatsion ekotizimni shakllantirish, ilmiy-tadqiqot faoliyatini qo’llab-quvvatlash, raqamli infratuzilmani rivojlantirish hamda global qiymat zanjirlariga integratsiyalashuv uchun institutsional sharoit yaratishdan iborat.

Shundan kelib chiqib, O’zbekiston sharoitida sanoatlashtirish siyosatini shakllantirishda F.Listning milliy sanoatni qo’llab-quvvatlash konsepsiyasi, rivojlanish iqtisodiyoti maktabining strukturaviy transformatsiya yondashuvi va Sanoat 4.0 paradigmasining innovatsion tamoyillarini integratsiyalash maqsadga

[11] Perez, C. (2009). Technological revolutions and techno-economic paradigms. Cambridge Journal of Economics, 34(1), 185–202.

muvofiq hisoblanadi. Mazkur yondashuv milliy iqtisodiyotning uzoq muddatli raqobatbardoshligini ta’minlashning nazariy asosini tashkil etadi. Shu bilan birga O’zbekistonlik iqtisodchi olimlar o’z ilmiy tatqiqotlarida sanoatlashuv darajasini oshirishga e’tibor qaratishgan.

Bundan tashqari O‘zbekistonlik olimlardan sanoatlashuv darajasini oshirishga qo‘shgan amaliy hissalarining asosiy yo‘nalishlari:

Mashinasozlik va charm sanoatida O‘zbekiston Fanlar akademiyasi olimlari tomonidan charmga ishlov berish tezligini avtomatik boshqaruvchi valli mashina ixtiro qilinib, ishlab chiqarishga tatbiq etildi. Bu charm-poyabzal sanoatining raqobatbardoshligini oshirishga xizmat qiladi.

Kimyo va metallurgiyada ammiakli selitra ishlab chiqarish chiqindilarini utilizatsiya qilish va Toshkent truba zavodida metall konstruksiyalarni zanglashdan saqlovchi fosfatlovchi eritmalarni mahalliy xomashyolardan (ammofos va rux oksidi) olish texnologiyalari yaratildi. Bu xorijiy materiallarni to‘liq mahalliylashtirish imkonini berdi.

Nano-texnologiyalarda 2017 yilda kremniy dioksidi nanozarrachalari asosida quyosh panellari va sanoat oynalarini changdan himoyalovchi o‘ta shaffof qatlamlar (qoplamalar) olish texnologiyasi ishlab chiqildi.

Ekologiya va resurs tejashda Toshkent kimyo-texnologiya instituti va boshqa ilmiy markazlar tomonidan sanoat korxonalarining oqova suvlarini tozalash hamda utilizatsiya qilish bo‘yicha ekologik xavfsiz majmualar yaratildi. Bu suv resurslarini tejash imkonini beradi.

Tog‘-kon sanoatida sanoat tarmoqlari, xususan tog‘-kon korxonalari uchun maxsus innovatsion texnologiyalar ishlab chiqilib, sohritdagi texnologik jarayonlarning samaradorligi oshirildi.

O‘zbekistonlik olimlar metallurgiya, neft-gaz, kimyo, charm-poyabzal va mashinasozlik tarmoqlarini mahalliylashtirish hamda modernizatsiya qilishga katta hissa qo‘shgan. Ularning ishlanmalari import o‘rnini bosish va ekologik xavfsizlikni ta’minlashga yo‘naltirilgan.

XULOSA

Xulosa qilib aytganda O'zbekiston iqtisodiyotini nazariya nuqtai nazaridan baholash mamlakatda 2017-yildan boshlab sanoatlashtirishning yangi bosqichi shakllanayotganligini ko'rsatadi. So'nggi yillarda investitsiyalar hajmining sezilarli ortishi, sanoat zonalarining tashkil etilishi, qayta ishlash sanoati ulushining kengayishi hamda eksport tarkibini diversifikatsiya qilish bo'yicha amalga oshirilayotgan islohotlar Rostou ta'riflagan **"take-off"** bosqichining muhim belgilariga mos keladi. Shu bilan birga, texnologik etuklik bosqichiga o'tish uchun yuqori texnologiyali ishlab chiqarish, ilmiy-tadqiqot va tajriba-konstruktorlik ishlari (R&D), raqamli texnologiyalar hamda malakali inson kapitaliga yo'naltiriladigan investitsiyalarni yanada kengaytirish zarur.

Fikrimizcha, Rostouning iqtisodiy o'sish bosqichlari nazariyasi bugungi globallashuv va raqamli iqtisodiyot sharoitida ayrim jihatlari bilan takomillashtirilishi lozim. Chunki zamonaviy sanoatlashtirish faqat investitsiyalar hajmining ortishi bilan emas, balki innovatsion salohiyat, institutsional sifat,

raqamli infratuzilma va global qiymat zanjirlaridagi ishtirok darajasi bilan ham belgilanadi. Shu sababli O'zbekistonning uzoq muddatli sanoat rivojlanish strategiyasida Rostou modelining asosiy tamoyillarini Sanoat 4.0 konsepsiyasi va innovatsion rivojlanish nazariyalari bilan uyg'unlashtirish ilmiy va amaliy jihatdan maqsadga muvofiq hisoblanadi.

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UDK 81'373.2

Erkinova N.E., filologiya fanlari bo‘yicha falsafa doktori (PhD)
tillar kafedrasi dotsenti v.b.
Fan va texnologiyalar universiteti
O‘zbekiston, Toshkent

SKRIPTONIM VA UNGA YAQIN ONOMASTIK BIRLIKLAR: KRIPTONIM, PSEVDONIM, PERIFRAZ, EVFEMIZM

Annotatsiya. Maqolada onomastikaning yangi tushunchasi – skriptonim unga yaqin nominativ birliklar – kriptonim, psevdonim, perifraz va evfemizm bilan qiyosiy aspektda tahlil qilinadi. Tadqiqotning dolzarbligi ushbu birliklarning funksional-pragmatik chegaralari hanuzgacha aniq belgilanmaganligi bilan izohlanadi. Tahlil onomasiologik yondashuv (E.Benvenist, N.D.Arutyunova), F.Jacquessonning psevdepigrafiya konsepsiyasi hamda X.Uriya Varelaning ism tabusi haqidagi qarashlariga tayanadi. Har bir birlik nominatsiya sababi, muallif-subyekt munosabati, pragmatik vazifasi va adresatda uyg‘otadigan effekti mezonlari asosida farqlanadi. Natijada skriptonim shaxsni yashirish vositasi emas, balki matnga nufuzli ramziy ism orqali diskursiv legitimlik berish vositasi ekanligi asoslanadi.

Kalit so‘zlar: skriptonim, kriptonim, psevdonim, psevdepigraf, perifraz, evfemizm, onomastik tabu.

Erkinova N.E., PhD in Philology
acting associate professor, Department of Languages
University of Science and Technologies
Uzbekistan, Tashkent

SCRIPTONYM AND RELATED ONOMASTIC UNITS: CRYPTONYM, PSEUDONYM, PERIPHRASIS, EUPHEMISM

Abstract. The article examines the new onomastic notion of the scriptonym in comparison with related nominative units – the cryptonym, pseudonym, periphrasis and euphemism. The relevance of the study lies in the fact that the functional and pragmatic boundaries between these units have not yet been clearly defined. The analysis draws on the onomasiological approach (É.Benveniste, N.D.Arutyunova), F.Jacquesson’s conception of pseudepigraphy and J.Uría Varela’s views on name taboo. Each unit is distinguished by four criteria: the reason for naming, the author–subject relationship, the pragmatic function and the effect produced on the addressee. The study shows that the scriptonym is not a means of concealing identity but a means of granting a text discursive legitimacy through an authoritative symbolic name.

Keywords: scriptonym, cryptonym, pseudonym, pseudepigraph, periphrasis, euphemism, onomastic taboo.

Kirish

Zamonaviy onomastika va matn lingvistikasida nominatsiya hodisasi murakkab, ko‘p qatlamli jarayon sifatida talqin etiladi. Bunda subyekt o‘zining haqiqiy ismini turli sabablarga ko‘ra o‘zgartirishi, yashirishi yoki uning o‘rniga boshqa nominal birlikni qo‘llashi mumkin. Bu kabi hodisalar tilshunoslikda an’anaviy ravishda psevdonim, kriptonim, perifraz va evfemizm kabi atamalar orqali tavsiflab kelinadi [4]. Biroq ushbu birliklarning har biri o‘ziga xos funksional-pragmatik yuklamaga, nominatsiya maqsadiga va diskursiv vazifaga ega bo‘lib, ularni bir-biridan farqlamasdan turib, skriptonim tushunchasining mustaqil onomastik birlik sifatidagi maqomini asoslab bo‘lmaydi.

Maqolaning maqsadi – skriptonimni qardosh nominativ birliklar bilan qiyoslab, uning farqlovchi belgilarini aniqlash va skriptonimning onomastik birliklar tizimidagi o‘rnini belgilash.

Metodlar va tadqiqot usullari

Tadqiqotda qiyosiy-tipologik, onomasiologik va pragmatik tahlil usullaridan foydalanildi. Tahlil materiali sifatida antik va o‘rta asrlarga oid psevdepigraf matnlar (“Pyotr Injili”, Psevdo-Dionisiy asarlari), qadimgi Rimdagi ism tabusiga oid manbalar hamda o‘zbek tilidagi psevdonim, perifraz va evfemizm namunalari olindi. Har bir nominativ birlik to‘rt mezon asosida tavsiflandi: 1) nominatsiya sababi; 2) muallif-subyekt munosabati; 3) matndagi pragmatik vazifasi; 4) qabul qiluvchi ongida uyg‘otadigan effekti. Nazariy asos sifatida E.Benvenist va N.D.Arutyunovaning nominatsiya haqidagi qarashlari, F.Jacquessonning psevdepigrafiya konsepsiyasi va X.Uriya Varelaning ism tabusi bo‘yicha tadqiqoti xizmat qildi.

Natijalar

Skriptonimning onomasiologik asoslari

Onomasiologik yondashuv nuqtayi nazaridan qaraganda, har qanday murakkab nom ortida ma’lum bir sintaktik qurilma yoxud yaxlit bir mulohazaning “ixchamlashuvi” (kondensatsiyasi) yotadi. E.Benvenist ta’kidlaganidek, subyekt va obyekt o‘rtasidagi munosabatni ifodalovchi butun bir gap yoki fikr chuqur sintaktik-semantik transformatsiya natijasida ixcham nominal belgiga aylanish xususiyatiga ega [1]. N.D.Arutyunova qarashlarida ham nominativ aspekt gapning va uning turli ko‘rinishdagi transformlarining fundamental mazmuniy asosi sifatida baholanadi [2]. Ushbu nazariy qoida skriptonim tabiatini ochishda muhim metodologik zamin bo‘ladi: skriptonim muallif va matn haqidagi ijtimoiy-madaniy, konseptual va ma’naviy ma’lumotlarni o‘zida jamlagan ixcham belgi vazifasini bajaradi. Masalan, matn boshida qo‘yilgan nufuzli ism “bu matnni obro‘li, ishonchli, muqaddas maqomga ega shaxs yozgan, demak, uning mazmuni shubhasiz haqiqatdir” degan butun bir propozitsiyani siqiq holda mujassam etadi.

Psevdepigraf skriptonimning tarixiy ko‘rinishi sifatida

G‘arb tilshunosligi va manbashunosligida uzoq vaqtdan beri o‘rganilib kelayotgan “psevdepigraf” (birovning nufuzli nomi ostida yozilgan matn) hodisasi o‘zining funksional-pragmatik tabiati bilan skriptonimning o‘ziga xos tarixiy ko‘rinishidir. Fransuz tadqiqotchisi F.Jacquesson “Le narrateur masqué: les

pseudépigraphes” (“Niqoblangan hikoyachi: psevdepigraflar”) nomli tadqiqotida psevdepigrafni muallifi soxta ism ostida yashiringan asar sifatida ta’riflaydi va bunday holatda muallif bilan asar o‘rtasidagi munosabat o‘zgartirilgan bo‘lishini, bu masala esa adabiy, axloqiy va semiotik jihatlarga ega ekanini qayd etadi [3]. Olimning ko‘rsatishicha, antik va o‘rta asrlar madaniyatida mualliflar o‘z g‘oyalarini jamiyatga singdirish hamda matnga yuqori legitimlik berish maqsadida o‘z ismlarini atayin olib tashlab, o‘rniga o‘sha davr ijtimoiy-diniy ierarxiyasida eng yuqori nufuzga ega bo‘lgan shaxslarning nomlarini niqob, ya’ni skriptonim sifatida qo‘llashgan [3].

Bunga ikki yirik misol keltiriladi. “Pyotr Injili” (L'Évangile de Pierre) – ikkinchi asrga oid matn bo‘lib, uning muallifi o‘z shaxsini butunlay yashirib, matn oxirida o‘zini Iso Masihning bosh shogirdi Simon Pyotr deb tanishtiradi. Bu yerda “Pyotr” ismi o‘quvchida ilohiy ishonch uyg‘otish va matnning ma’naviy-avtoritar funksiyasini yuksaltirish uchun tanlangan skriptonimdir. Psevdo-Dionisiy asarlari (Pseudo-Denys l'Aréopagite) esa V–VI asrlar chegarasida yashagan noma’lum yunon ilohiyotchisi tomonidan o‘z konsepsiyalariga qadimiylik va obro‘ kafolatini berish maqsadida Avliyo Pavlus zamonidagi tarixiy shaxs – Areopagitlik Dionisiy nomidan bitilgan [3]. Har ikki holatda ham ism individual muallifning biologik shaxsini ifodalashdan to‘xtaydi.

Skriptonim va psevdonim

Psevdonim (yun. pseudos – soxta, onyma – ism) – muallif o‘z haqiqiy ismi o‘rniga qo‘llaydigan to‘qima nom [4]. Psevdonimiyada muallif subyekt sifatida saqlanib qoladi, faqat uning nomi o‘zgaradi: o‘quvchi “Cho‘lpon”, “Hamza”, “Oybek” kabi taxalluslar ortida muayyan ijodkor turganini biladi va vaqt o‘tishi bilan taxallus shu shaxsning asosiy ismiga aylanadi. Skriptonimda esa subyekt o‘z individual mohiyatini matn manfaati uchun butunlay yashiradi va jamoat ongida allaqachon shakllangan “buyuk ramziy ism”ning niqobini kiyadi. Demak, psevdonim muallifning o‘zi uchun yaratilgan yangi nom bo‘lsa, skriptonim boshqa, real yoki afsonaviy nufuzli shaxsga tegishli tayyor nomdir: psevdonim muallifni ifodalaydi, skriptonim esa muallif o‘rnini egallaydi.

Skriptonim va kriptonim

Kriptonim (yun. kryptos – yashirin, onyma – ism) – shaxsning haqiqiy ismini butunlay maxfiy tutish niyati bilan qo‘llaniladigan nominal belgi [4]. Unda muallif o‘zini hech qanday ism bilan tanishtirmaydi, faqat bosh harflar, raqamlar, shartli belgilar yoki bo‘sh o‘rin orqali ifodalanadi, ya’ni “kim yozdi” degan savolga javob berilmaydi. Skriptonim esa ismning yo‘qligi emas, balki ijobiy, to‘ldiruvchi mazmunga ega alternativ nomdir: kriptonim o‘quvchini “muallif noma’lum” degan bilim holatida qoldirsa, skriptonim uni “muallif – buyuk, nufuzli shaxs” degan ijobiy ishonch holatiga olib keladi. Boshqacha aytganda, kriptonim nominatsiyaning nol darajasi, skriptonim esa nominatsiyaning maksimal ramziy yuklamaga ega ko‘rinishidir.

Bu farqning tub sababi kriptonimning madaniy-tarixiy ildizlarida yotadi. Ispan tilshunosi X.Uriya Varelaning ko‘rsatishicha, qadimgi dunyoqarashda insonning haqiqiy ismi uning jismoniy va ruhiy mavjudligi bilan bir xil qadrlangan:

dushman shaxsning haqiqiy ismini bilib olsa, u ustidan hokimiyatga ega bo‘ladi, deb ishonilgan [5]. Ism tabusining bu turi J.Frezer tomonidan ham keng etnografik material asosida yoritilgan [8]. Shu bois ko‘plab qadimgi xalqlarda, jumladan, misrliklarda insonga ikki ism berilgan: oshkor etilmaydigan haqiqiy ism va kundalik muomaladagi o‘rinbosar nom. Qadimgi Rim shahrining ham faqat oliy kohinlar bilgan maxfiy ismi bo‘lgan; dushman uni bilib olsa, evocatio marosimi orqali shaharni homiy xudosidan mahrum qilishi mumkin, deb qo‘rqilgan [5]. Antik manbalarga (Pliniy Katta, Servius) ko‘ra, xalq tribuni Kvint Valeriy Soran shu maxfiy ismni oshkor etgani uchun qatl etilgan [6;7]. Zamonaviy tarixshunoslik bu voqeani ko‘proq siyosiy omillar bilan bog‘lasa-da, rivoyat kriptonim oshkor bo‘lishi qanchalik jiddiy xavf sifatida idrok etilganini ko‘rsatadi. Demak, kriptonimda ism xavf manbayi sifatida yashiriladi, skriptonimda esa nufuz manbayi sifatida ongli ravishda namoyon qilinadi.

Skriptonim va perifraz

Perifraz (yun. periphrasis – tasviriy ifoda) – predmet yoki shaxs nomini uning belgisi, xususiyati yoki vazifasini tasvirlovchi birikma bilan almashtirish [9]. O‘zbek tilida “Sohibqiron” (Amir Temur), “Shoirlar sultoni” (Alisher Navoiy), “oq oltin” (paxta), “zangori ekran” (televizor) kabi birliklar perifrazning tipik namunalaridir. Perifraz va skriptonim o‘rtasida tashqi o‘xshashlik bor: har ikkisi ulug‘lovchi mazmundagi ifodani qo‘llaydi. Biroq perifrazda denotat o‘zgarmaydi – “Sohibqiron” deganda baribir Amir Temur nazarda tutiladi va o‘quvchi ikki nom orasidagi ayniyatni biladi. Skriptonimda esa referent almashadi va adresat bu almashuvdan bexabar qolishi ko‘zda tutiladi. Shu bois perifraz ifoda sathidagi uslubiy vosita, skriptonim esa diskurs sathidagi pragmatik-strategik vositadir.

Skriptonim va evfemizm

Evfemizm (yun. euphemismos – yumshoq so‘zlash) – qo‘pol, noxush yoki tabu hisoblangan so‘z o‘rniga qo‘llanadigan yumshoq, neytral ifoda [9; 10]. B.A.Larin ko‘rsatganidek, evfemistik almashtirishlar qadimda xavfli kuchlarni nomi bilan atashdan qo‘rqish asosida yuzaga kelgan va keyinchalik ijtimoiy-axloqiy me’yorlar ta’sirida rivojlangan [10]. O‘zbek xalq madaniyatida ayolning turmush o‘rtog‘ini ismi bilan atamasdan “dadasi”, “xo‘jayin”, “bolalarning otasi” deb murojaat qilishi antroponimik evfemizmning tipik ko‘rinishidir. Evfemizm “pasaytiruvchi” yo‘nalishga ega – u nomning kuchini susaytiradi; skriptonim esa “ko‘taruvchi” yo‘nalishga ega – u matnga qo‘shimcha obro‘ va ishonchlilik bag‘ishlaydi. Bundan tashqari, evfemizm jamoa qabul qilgan ochiq konvensiya, skriptonim esa muallifning individual, yashirin strategiyasidir.

Tahlil natijalari quyidagi jadvalda umumlashtirildi (1-jadval).

1-jadval. Skriptonim va unga yaqin birliklarning qiyosiy tavsifi

Birlik	Nominatsiya sababi	Muallif-subyekt munosabati	Pragmatik vazifasi	Adresatdagi effekt
Psevdonim	O‘zini yangi nom bilan taqdim etish	Subyekt saqlanadi, nomi o‘zgaradi	Individual ijodiy identifikatsiya	“Muallif – X taxallusli shaxs”
Kriptonim	Ismni xavf manbayi sifatida yashirish	Subyekt identifikatsiyadan chiqadi	Himoyalanish, maxfiylik	“Muallif noma’lum”
Perifraz	Belgini ta’kidlash, uslubiy bezak	Referent o‘zgarmaydi	Ekspressiv-uslubiy	“Bu – o‘sha shaxs, boshqacha atalgan”
Evfemizm	Tabu va noxush ta’sirdan qochish	Referent o‘zgarmaydi, nom yumshatiladi	Yumshatish, himoya	Noxush assotsiatsiyaning susayishi
Skriptonim	Matnga nufuz va legitimlik berish	Subyekt yashirinib, o‘zga nufuzli ism niqobini kiyadi	Diskursiv-avtoritar, strategik	“Muallif – buyuk, nufuzli shaxs”

Jadvaldan ko‘rinadiki, skriptonim boshqa birliklardan bir vaqtning o‘zida bir necha belgisi bilan ajraladi: u referentni almashtiradi (perifraz va evfemizmdan farqli), o‘zga shaxsning tayyor nomini o‘zlashtiradi (psevdonimdan farqli) va ismni yashirishga emas, ijobiy namoyon qilishga yo‘naltiriladi (kriptonimdan farqli).

Xulosa

O‘tkazilgan qiyosiy tahlil quyidagi xulosalarga kelish imkonini beradi. Birinchidan, skriptonim onomasiologik jihatdan muallif va matn haqidagi ijtimoiy-madaniy, konseptual va ma’naviy axborotni o‘zida jamlagan kondensatsiyalangan nominal belgidir. Ikkinchidan, psevdepigrafiya skriptonimning tarixan eng yaxshi hujjatlashtirilgan ko‘rinishi bo‘lib, “Pyotr Injili” va Psevdo-Dionisiy asarlari uning matnga diniy-avtoritar legitimlik berish funksiyasini yaqqol namoyon etadi. Uchinchidan, skriptonim va kriptonim ism tabusi bilan bog‘liq bo‘lsa-da, motivatsiyasi jihatidan qarama-qarshidir: kriptonimda ism xavf manbayi sifatida yashiriladi, skriptonimda esa nufuz manbayi sifatida namoyon qilinadi. To‘rtinchidan, perifraz va evfemizmdan farqli ravishda skriptonim referentni almashtiradi va diskurs sathida faoliyat ko‘rsatadi.

Belgilangan to‘rt mezon skriptonimning terminologik mustaqilligini asoslash va uni onomastik birliklar tizimida aniq o‘rinlashtirish imkonini beradi. Tadqiqot natijalaridan onomastika, matn lingvistikasi va manbashunoslik bo‘yicha mashg‘ulotlarda foydalanish mumkin. Kelgusida skriptonimning turkiy va fors tilidagi mumtoz manbalardagi ko‘rinishlarini o‘rganish istiqbolli yo‘nalish hisoblanadi.

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Hamzayev K.
independent researcher
Tashkent Branch of Samarkand
State University of Veterinary Medicine
Livestock and Biotechnology
Uzbekistan, Tashkent
Bakirov B.
professor
Samarkand State University of Veterinary
Medicine, Livestock and Biotechnology
Uzbekistan, Samarkand
Ro'ziqulov N.B.
associate professor
Samarkand Institute of Agroinnovations and Research
Uzbekistan, Samarkand

EXPERIMENTAL RESULTS OF DEVELOPING A COMPREHENSIVE THERAPEUTIC APPROACH FOR KETONURIA IN PREGNANT EWES

Abstract. This article presents the results of an experimental study aimed at developing a comprehensive treatment protocol for ketonuria in pregnant ewes. The primary objective of the study was to develop an effective therapeutic approach aimed at normalizing clinical and biochemical parameters in ewes affected by ketonuria during pregnancy and to evaluate its therapeutic efficacy. During the experiment, the general clinical condition of the affected ewes, the levels of ketone bodies in urine, as well as selected morphological and biochemical parameters of the blood were examined. The treatment protocol included therapeutic agents aimed at normalizing metabolism, correcting energy deficiency, and supporting liver function.

Keywords: pregnant ewes, ketonuria, ketone bodies, metabolism, blood, biochemical parameters, comprehensive treatment protocol, Karakul sheep breeding.

Relevance of the Topic: Currently, Uzbekistan is implementing comprehensive measures aimed at modernizing enterprises in the Karakul sheep breeding sector, upgrading production capacities from technical and technological perspectives, revitalizing and promoting the Uzbek Karakul brand internationally, and increasing the investment attractiveness of the sector.

In this regard, a number of important measures have been adopted by the Government of the Republic of Uzbekistan to provide further state support for the development of the Karakul sheep breeding sector. These include Resolution No. PQ-4420 of the President of the Republic of Uzbekistan dated August 16, 2019, "On Measures for the Comprehensive Development of the Karakul Sheep Breeding Sector"; Resolution No. PQ-4984 dated February 9, 2021, "On Additional Measures

for the Further Development of the Karakul Sheep Breeding Sector"; and Presidential Decree No. PF-6059 dated September 2, 2020, "On Measures for the Further Development of Sericulture and Karakul Sheep Breeding in the Republic of Uzbekistan." These regulatory documents establish important tasks aimed at increasing the number of purebred Karakul sheep and the volume of Karakul products, improving breeding practices on a scientific basis, expanding the deep processing of Karakul products and raw materials and their use for medical purposes, as well as providing social support to workers in the sector.

Ensuring the implementation of these strategic objectives requires particular attention to diseases caused by severe metabolic disorders in livestock, including Karakul ewes. One of the major problems is ketonuria (ketosis), a metabolic disorder that occurs frequently in pregnant ewes and can cause significant economic losses in Karakul sheep farming.

Research Results: The results of clinical examinations conducted during the treatment period demonstrated that, in the latent stage of ketonuria, treatment using the conventional method resulted in the elimination of tachycardia, hypo- and atony of the forestomach compartments, and reduced physical activity by the 20th day of treatment. By the 25th day, these clinical signs were accompanied by the elimination of pica and dyspnea.

In contrast, treatment using the newly developed method resulted in a partial alleviation of clinical signs by the 15th day of treatment and their complete resolution by the 20th day. These findings indicate a more rapid clinical response to the newly developed therapeutic approach in pregnant ewes with ketonuria at the latent stage.

Table 1.

Therapeutic protocol for the treatment of ketonuria in pregnant ewes

T/r	Name of the therapeutic agents used and their routes of administration	Dosage	Stages of the disease					
			Latent		Ketonuria		bosqoq	
			Groups					
			I	II	I	II	I	II
1	Therapeutic agent and route of administration	10 g	+		+		+	
2	Monocalcium phosphate, orally, daily	0,15 g/kg		+		+		+
3	Kaufit Immuno Premium, orally, daily	50 ml	+		+		+	
4	Alcohol–yeast mixture, orally, daily	50 ml		+		+		+
5	Fexoselen germ extract, orally, daily	200 ml	+		+		+	
6	Glucose–saline solution, intravenously, daily	500 ml		+		+		+
7	Sharabrin solution, intraperitoneally, twice in total	50 ml	+		+		+	
8	Trivitamin, intramuscularly, initially and subsequently once every 5 days	3 ml		+		+		+

In the second (ketonuria) stage of the disease, treatment using the conventional method was largely ineffective, and mortality was observed in 33.3% of the animals. Following treatment with the newly developed method, partial recovery was observed by the 25th day of treatment, while complete clinical recovery was achieved by the 30th day.

Table 2

Effects of Therapeutic Treatment of Ketonuria on Blood Parameters in Experimental Ewes

Stages of the Disease	Groups	Examination Time (Days)	Blood Parameters					
			Erythrocytes , mln/mkl	Hemoglobin ., g/l.	Total protein , g/l.	Glucose , Mmol/l	Ketone bodies , g/l.	Alkaline reserve , mg%
Latent	I	1	7,36±0,24	91,3±2,23	56,9±0,28	2,05±0,035	0,021±0,003	384±23,4
		15	7,96±0,39	101,2±5,8	66,4±4,35	2,34±0,23	0,019±0,009	471,5±39,5
	II	1	7,34±0,22	91,0±2,22	56,5±0,21	2,02±0,036	0,032±0,003	38,8±22,6
		15	8,05±0,40	103,3±5,5	69,6±3,8	2,42±0,23	0,011±0,006	482,2±39,8
Ketonuria	I	1	7,28±0,23	90,05±3,1	51,3±1,2	1,83±0,04	0,077±0,002	353±18,0
		15	7,36±0,24	92,0±2,23	56,9±0,25	2,02±0,038	0,032±0,003	39,2±38,2
	II	1	7,25±0,20	90,1±3,5	51,1±1,1	1,82±0,03	0,066±0,03	364±24,2
		15	7,46±0,06	97,4±6,9	66,2±3,5	2,31±0,23	0,05±0,01	442±32,0
Bosqoq	I	1	6,62±0,25	82,0±5,1	50,1±1,1	1,70±0,06	0,120±0,02	320,1±8,6
		15	4,25±0,16	78,6±4,7	46,6±1,5	1,59±0,05	0,275±0,06	300±16,9
	II	1	6,64±0,23	82,4±5,2	50,2±1,2	1,72±0,05	0,118±0,01	328±21,2
		15	4,36±0,18	81,0±4,1	48,2±1,5	1,66±0,03	0,233±0,02	320±25,7

The effects of therapeutic interventions on the blood parameters of diseased animals are presented in Table 2. As shown by the data in the table, in the latent stage of ketonuria, treatment using the conventional method resulted, by the 15th day of treatment, in an increase in the erythrocyte count by 0.6 million/μL, hemoglobin concentration by 9.9 g/L, total protein by 9.5 g/L, glucose by 0.29 mmol/L, and alkaline reserve by 87 mg%, while the concentration of ketone bodies decreased by 0.002 g/L. Following treatment with the newly developed method, pronounced positive changes in blood parameters became evident from the 15th day of treatment. In particular, the erythrocyte count increased by an average of 0.71 million/μL, hemoglobin by 12.3 g/L, total protein by 13.1 g/L, glucose by 0.4 mmol/L, and alkaline reserve by 94.2 mg%, while the concentration of ketone bodies decreased by 0.021 g/L.

In the second (ketonuria) stage of the disease, treatment using the conventional method had no significant effect on the morphological and biochemical parameters of the blood. Following treatment with the newly developed method, by the 15th day, the erythrocyte count increased by an average of 0.21 million/μL, hemoglobin by 7.3 g/L, total protein by 15.1 g/L, glucose by 0.51 mmol/L, and alkaline reserve by 78 mg%, while the concentration of ketone bodies decreased by 0.051 g/L.

Analysis of the scientific literature indicates that metabolism is a complex physiological process involving the intake, breakdown, resynthesis, and assimilation of vital substances, as well as the elimination of end products from the body. Disturbances in these processes lead to deficiencies of plastic and energy substrates required by body tissues, disruption of cellular and extracellular homeostasis, and, consequently, the development of irreversible changes of a dystrophic, degenerative, cirrhotic, and other nature. As a result, the functions of organs and body systems become impaired. Metabolic disorders that remain clinically latent for a certain period may subsequently progress into distinct diseases or groups of diseases with pronounced clinical manifestations.

In the third (advanced) stage of the disease, neither the conventional nor the newly developed treatment method produced a therapeutic effect. By the end of the disease, the erythrocyte count decreased to an average of 4.25 ± 0.16–4.36 ± 0.18 million/μL, hemoglobin to 78.6 ± 4.7–81.0 ± 4.1 g/L, total protein to 46.6 ± 1.5–48.2 ± 1.5 g/L, glucose to 1.59 ± 0.05–1.66 ± 0.03 mmol/L, and alkaline reserve to 300.0 ± 16.9–320 ± 25.7 mg%, whereas the concentration of ketone bodies increased to 0.275 ± 0.06–0.233 ± 0.02 g/L. Recovery was observed mainly within 15–20 days of treatment in the latent stage and by the 30th day in the ketonuria stage, whereas no recovery was recorded in the third (advanced) stage.

Thus, the newly developed etiopathogenetic treatment protocol, based on the administration of Kaufit Immuno Premium premix, Fexoselen germ extract, Sharabrin antitoxic solution, and Multivit minerals in the specified doses and according to the prescribed regimen, demonstrated a certain degree of therapeutic efficacy only during the early stages of ketonuria. It was established that the treatment did not produce the expected therapeutic effect in the clinically manifest

ketonuria and advanced stages of the disease. Therefore, based on the results of the conducted studies, the development of a highly effective group-based preventive protocol for ketonuria in Karakul ewes was considered appropriate.

Conclusions

The conducted studies demonstrated that the course of ketonuria in pregnant Karakul ewes is directly associated with the stage of the disease. During the latent stage, metabolic disturbances were relatively mild, and timely therapeutic intervention made it possible to normalize the morphological and biochemical parameters of the blood.

Compared with the conventional treatment method, the newly developed etiopathogenetic treatment protocol demonstrated greater therapeutic efficacy during the early stages of the disease. By the 15th day of treatment, increases in erythrocyte count, hemoglobin, total protein, glucose, and alkaline reserve, together with a decrease in ketone body concentration, were recorded.

The results indicate that early diagnosis and initiation of treatment at the initial stages of ketonuria are of particular importance in pregnant Karakul ewes. Progression of the disease to an advanced stage substantially reduces the effectiveness of therapeutic interventions.

Based on the results obtained, the development and implementation under farm conditions of a highly effective group-based preventive protocol aimed at detecting metabolic disorders before the clinical manifestation of ketonuria in Karakul ewes is considered appropriate.

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Haydarova K.D.
Termiz davlat universiteti
O‘zbekiston, Termiz

O‘ZBEK, RUS VA INGLIZ TILLARIDA LINGVOKULTUROLOGIYA VA QIYOSIY-CHOG‘ISHTIRMA LINGVOKULTUROLOGIYA HAQIDA ILMIY-NAZARIY QARASHLAR

Annotatsiya. Mazkur maqolada linvokulturologiya fani va uning kelib chiqish tarixi, shakillanish va rivojlanishlanish bosqichlari haqida ilmiy nazariy qarashlar berilgan. Ma’lumki, til va madaniyat turli hil semiotik sistema bo‘lsada, ko‘p jihatdan bir-biriga yaqindir. Til murakkab hodisa bo‘lib, madaniyat bilan chambarchas bog‘likligi haqida fikr yuritib, uning o‘ziga xos xususiyatlari borligi va ular tilshunoslikning paydo bo‘lishi uchun asos bo‘lib xizmat qiladi.

Kalit so‘zlar: lingvokulturologiya, til, madaniyat, makon, zamon.

Haydarova K.D.
Termez State University
Uzbekistan, Termez

SCIENTIFIC AND THEORETICAL VIEWS ON LINGUOCULTUROLOGY AND COMPARATIVE LINGUOCULTUROLOGY IN UZBEK, RUSSIAN AND ENGLISH

Abstract. This article presents scientific and theoretical perspectives on the discipline of linguoculturology, covering its origins and the stages of its formation and development. Although language and culture are distinct semiotic systems, they are closely interrelated in many respects. Language is a complex phenomenon inextricably linked to culture; its distinctive characteristics serve as a foundation for the emergence of this field of linguistics.

Keywords: linguoculturology, language, culture, space, time.

Hozirgi zamonda lingvistikaning rivojlanishi tilni nafaqat ichki, balki tashqi aloqalarini ham izil o‘rganishga da’vat etmoqda. Bunday holat tillarning o‘zaro aloqalarini hamda bir-biriga bo‘lgan ta’sirini o‘rganish borasida ilmiy izlanishlar olib borish tilshunoslik fanining oldidi turgan muhim vazifalardan ekanliginidan darak beradi. Ma’lumki, til va madaniyat turli hil semiotik sistema bo‘lsada, ko‘p jihatdan bir-biriga yaqindir. V. N. Teliya ta’kidlaganidek, “1) madaniyat til kabi – bu insoniyat tafakkurining mahsulidir; 2) til va madaniyat o‘zaro muloqatda mavjuddir; 3) madaniyat va til sub’ekti bu doimiy ravishda shaxs va jamiyatda yoki jamiyat va shaxsda namoyon bo‘ladi; 4) me’yor – madaniyat va til uchun umumiy xususiyatdir; 5) tarixiylik madaniyat va tilning muhim xususiyatlaridan biridir; 6) dinamika-statiskaning qarama-qarshiligi madaniyat va tilga xosdir”[1]. .Ushbu

fiklar bejizga aytilmagan, albatta. Olimaning bunday xulosaga kelishiga o‘tmishda til va madaniyat aloqarini o‘rgangan olimlar fikrlari turtki bo‘lgan. Ulardan ba’zi birlari haqida to‘xtalish joyizdir.

Mashhur tilshunos E. Benvenist til murakkab hodisa bo‘lib, madaniyat bilan chambarchas bog‘likligi haqida fikr yuritib, uning o‘ziga xos xususiyatlari borligi va ular tilshunoslikning paydo bo‘lishi uchun asos bo‘lib xizmat qilishi mumkinligini qayd etgan.

XVIII–XIX asrlarda ijod qilgan faylasuf va tilshunoslardan biri V.Fon Gumboldt tilning ko‘plab aspektlarini tushunish uning ijtimoiy-antropologik tabiatini o‘rganish bilan bog‘liqligi haqida o‘zining qator ishlarida to‘xtalib, til-shunday organki, inson u yordamida o‘z fikrini ifodalaydi (Die Sprache ist das bildene Organ des Gedanken) deb ta’kidlagan. Olim, shuning bilan birga, til millat ruhini ifodalashda va shakllantirishda, olam haqidagi milliy tasavvurni paydo qilish va ko‘rsatishda xizmat qilishini aytib o‘tgan. U tillarni qiyoslashga va chog‘ishtirishga alohida e’tibor qaratagan, chunki, uning fikricha, tillar faqatgina tovush va belgilardan farqlanmaydi, balki dunyoqarashda farqlanadi. V.Fon Gumboldtning ushbu ta’limoti hanuzgacha o‘z qimmatini yo‘qotmay kelmoqda. Ayniqsa, bugungi kunda til va madaniyatni bir biriga uzviy bog‘liqligini o‘rganishda u tomonidan yaratilgan nazariy ta’limot lingvokulturologiya fani haqida olib borilayotgan tadqiqotlarni olib borishda qo‘l kelmoqda.

Bu o‘rinda V. Gumboldtning har bir til borliqni o‘ziga xos ifodalab, til sohibi u orqali olamni ko‘rish va mazmunlashtirishga majbur, degan fikrlarini davom ettirgan B.L.Uorf nomini tiliga olish maqsadga muvofiqdir. Uning fikricha, tilning kelib chiqish madaniyaga bevosita bog‘liqdir.

E.Sepirning yozishicha, “til madaniyatdan tashqarida, ya’ni bizning turmush tarzimizga xos bo‘lgan ijtimoiy meros bo‘lib qolgan amaliy ko‘nikma va g‘oyalar majmuasidan tashqarida mavjud emas”. U bir necha bor, madaniyatning tilga va tilning madaniyatga ta’siri bir xil emasligi haqidagi fikrlarini bayon qilgan. Shunga qaramay, Sepir ham Gumboldt va Uorf fikrlariga yaqin mulohaza yuritgan. Darhaqiqat, Sepir va Uorfning ta’limotlari Amerika tilshunosligi rivojiga katta ta’sir ko‘rsatgan.

E.Sepir va B.L.Uorflarning ta’kidlashicha, har bir til tashuvchisi o‘z ona tilini o‘rganib borar ekan tafakkurning ma’lum bir ko‘rinishini o‘zlashtiradi, dunyoni faqatgina ona tili tuzilishi bilan bog‘langan nuqtai nazardan ko‘radi va shu tilda o‘z aksini topgan olam manzarasini qabul qiladi. Bundan ko‘rinadiki, u o‘z tushunchasini, milliy madaniyatini saqlagan holda, ona tilida bayon qiladi.

Til va madaniyat aloqalarini tadqiq etgan rossiyalik tilshunoslar Yu. D. Apresyan va V. V. Kolesov ham turli til sohiblari dunyoni turlicha ko‘rganliklari uchun, ularning o‘ziga xos dunyoqarashlari yoki borliqni kontseptuallashtirish usullari universal va ma’lum darajada milliy o‘ziga xos xususiyatlarga ega degan xulosaga kelishgan [4].

Yuqorida nomlari zikr etilgan tilshunoslarning fikri shundan darak beradiki, madaniyat ham til kabi ma’lumotni uzatishga qodir bo‘lgan belgilar tizimi bo‘lsa-

da, u mustaqil ravishda vujudga kela olmaydi. Madaniyatning vazifasi eng avvalo xotira, so‘ngra esa jamg‘arish va absolyut ommaviylikka intilishdan iboratdir.

Dunyoda globallashuv jarayonida xalqlarning milliy-madaniy o‘ziga xos xususiyatlarini belgilashda muhim o‘rin tutadigan til birliklarini tadqiq qilish kuchayib bormoqda. Universallashuv jarayoni bilan bir vaqtda madaniyatlar tabaqalashuvi tendentsiyasi ham rivojlanmoqda. Bu vaziyat turli tizimga oid bo‘lgan etnomadaniy qadriyatlarni anlatuvchi terminlarni o‘rganishni taqozo etmoqda. Ular qatoriga “lingvokulturologiyani” kiritish mumkin.

Rus tilshunoslarining fikriga muvofiq, yangi ilmiy kurs – lingvokulturologiya fani XX asrning 90-yillarida paydo bo‘lgan. Ular ushbu fan rivojlanishini uch bosqichga bo‘lishadi:

- birinchi – bu muammoning dastlabki rivojlanishi: til – madaniyat – inson;
- ikkinchi – lingvokulturologiyani mustaqil soha sifatida rasmiylashtirish;
- uchinchi – lingvokulturologiyaning fundamental fanlararo fan sifatida shakllanishi. Uchunchi bosqich shakllanish davrida turibdi.

Birinchi bosqich linvokulturologiyaning boshlang‘ich davri – XIX asr, so‘ngra XX asr olimlarining til va madaniyatning o‘zaro munosabatlariga murojaati sababli yuzaga kelgan. Amerikalik olimlar Edvard Sepir va uning o‘quvchisi Bendjamin Li Uorf fikricha, nisbiylik lingvistik nazariyasi bo‘yicha inson dunyo manzarasi, tili uning gapirishida aniqlanadi.

XX asrning ikkinchi yarmida yangi fanlar: “Kulturologiya” – “Madaniyatshunoslik”, “Etnolingvistika”, «Lingvostranovedenie» – “Mamlakatshunoslik” paydo bo‘lgan.

Yuqorida qayd etib o‘tilgan yo‘nalishlar yangi lingvistik fan – lingvokulturologiyaning muhim muboshirlari (bobolari) bo‘lib hisoblanadi.

Lingvokulturologiyaning shakllanishini 2-bosqichi – bu XX asrning 90 yillari. Ushbu davrda til va madaniyat munosabati muammolari ilmiy tadqiqot markaziga o‘tdi va til haqidagi ilmning rivojlanishini eng muhim yo‘nalishi shakllandi.

Birinchilardan bo‘lib “lingvokulturologiya” terminiga rossiyalik lingvist V. V. Vorobyov murojaat qilgan va 1996 yilda «Теоретические и прикладные аспекты лингвокультурологии» (“Lingvokulturologiyaning nazariy va amaliy aspektlari”) mavzuyida doktorlik dissertatsiyasini himoya qilgan. U “lingvokulturologiya” terminiga quyidagi ta’rifni berishni taklif qilgan: “lingvokulturologiya – madaniyat va til munosabatining o‘zaro aloqasi hamda umumiy tuzilish birliklarining tillardagi o‘xshashligi va madaniy mazmuni sifatida o‘rganadigan kompleks ilmiy fandir”.

Lingvokulturologiyaning mustaqil ilmiy fan sifatida tamal toshini XX asr oxirlarida qo‘yilgan deb, uni Moskva frazeologiya maktabining asoschisi V. N. Teliya nomi bilan bog‘lashadi. Uning fikricha, “lingvokulturologiya – bu etnolingvistikaning bir qismi bo‘lib, til va madaniyatning aloqalarini sinxron tarzda o‘zaro ta’sirini o‘rganishga va tavsiflashga bag‘ishlanadi”.

Lingvokulturologiya rivojining uchinchi bosqichi XXI asrning o‘ninchi yilni boshlariga borib taqaladi. Ushbu davrda bu yo‘nalish fundamental fanlararo fan sifatida yuqori cho‘qqiga chiqqan. Uning shakllanishida, jumladan, ingliz (Eduard Sapir, Benjamin Lee Whorf, Paul Friedrich, Michael Agar, George Lakoff, Mark Johnson, Hans Lauge Hansen, Karen Risager, Heidi Byrnes), rus (N.D.Arutyunova, N.F.Alefirenko, A.Vejbitskaya, S.G.Vorkachev, V.G.Kostomarov, V.V.Krasnix, V.A.Maslova, V.N.Teliya, A.T.Xrolenko, A.D.Shmelev) va o‘zbek (A.Abduazizov, Sh.Safarov, O‘.Q.Yusupov, D.U.Ashurova, I.G‘ofurov, O.Mo‘minov, N.Qambarov, A.E.Mamatov, G.Mahkamova, D.Xudoyberganova, Sh.Usmonova) tilshunoslari katta hissa qo‘shdi.

Shunday qilib, lingvokulturologiya hozirgi vaqtda uchinchi bosqichga – zamonaviy lingvistikaning eng ustivor yo‘nalishiga chiqdi.

Lingvokulturologiya nisbatan yangi fan sifatida qator qarama-qarshiliklarga ega. Unga eng maqbul ta’rif V.A.Maslova tomonidan berilganligi sababli, biz u kishining fikriga to‘liq qo‘shilamiz: “Lingvokulturologiya – bu lingvistika va madaniyatning birikishi natijasida paydo bo‘lgan va tilda aks etgan hamda mustahkamlangan xalq madaniyatini namoyon bo‘lishini tadqiq qiladigan tilshunoslik sohasi”.

Lingvokulturalogiyaning tadqiqot ob’ekti – “til va madaniyatning o‘zaro aloqalari hamda madaniyatning til prizmasiga ta’siri”, predmeti – mif, afsona, diniy marosimlar, rasm-rusumlar, folklor va diniy diskurs, poetik va prozaik matnlar, frazeologizmlar, metaforalar, ramzlar, maqollar va matallarda qayd etilgan til birliklari bo‘lib hisoblanadi.

Lingvokulturologiyani yangi fan sohasida tan olgan Rossiya olimlaridan biri V.V.Vorobyovning yozishicha, “bugungi kunda lingvokulturologiyani muayyan yo‘l bilan saralangan madaniy qadriyatlar majmuini o‘rganadigan, nutqni yaratish va uni idrok qilishdagi jonli kommunikativ jarayonlarni, lisoniy shaxs tajribasini va milliy mentalitetni tadqiq etadigan, olam manzarasining lisoniy tasvirini tizimli ravishda aks ettiradigan, ta’limninig bilim olish, tarbiyaviy va intelektual vazifalarining bajarilishini ta’minlaydigan yangi filologik fan sifatida qayd qilish mumkin. Demak, lingvokulturologiya madaniyat va tilning o‘zaro aloqasi va o‘zaro ta’sirini hamda bu jarayonni lisoniy va nolisoniy birliklarning bir butun strukturasi sifatida aks ettiradigan kompleks fandir”.

N.F.Alefirenko lingvokulturologiyani quyidagicha ta’riflaydi:

“– lingvokulturologiya tilshunoslik va madaniyatshunoslik bilan chambarchas bog‘langan bo‘lib, u sintezlovchi xususiyatga ega;

– lingvokulturologiyaning asosiy e’tibori tilda izohlanadigan madaniy dalillarga qaratiladi;

– lingvokulturologiya tilshunoslik fanlariga kiradi, shuning uchun uning tadqiqot natijalaridan ona tili va chet tillari o‘qitish jarayonida amaliy foydalanish mumkin;

– lingvokulturologiya tadqiqotlarining asosiy yo‘nalishlari: a) lisoniy shaxs; b) til madaniy qadriyatlarining semiotik gavdalantirish tizimi hisoblanadi”.

Shunday qilib, tilning semantik zamirida qadriyatlar deb ataladigan maxsus kulturologik kategoriyalar mavjud bo‘lib, ulardan quyidagilar lingvokulturologiya nuqtai nazaridan o‘rganiladi:

a) hayotiy (*hayot, sog‘lik, turmush tarzi, tabiiy muhit* va b.)

b) ijtimoiy (*ijtimoiy holat, mavqe, mehnatsevarlik, bag‘rikenglik, boylik, kasbiy faoliyat, oila, gender tengligi* va b.)

v) siyosiy (*so‘z erkinligi, inson huquqlari, qonun ustuvorligi, tinchlik* va b.)

g) ahloqiy (*yaxshilik, sevgi, odob-ahloq, do‘stlik, or-nomus, burch* va b.)

d) diniy (*Olloh, ilohiyat, iymon, najot* va b.)

e) estetik (*go‘zallik, uslub, ideal, uyg‘unlik* va b.).

Tilda ifodalanish darajasiga ko‘ra ma’naviy qadriyatlar umuminsoniy, milliy, guruhli, oilaviy va individual-shaxsiy qadriyatlar ko‘rinishida aks etadi.

E.I.Zinovyeva fikricha, “lingvokulturologiya tilshunoslik va madaniyatshunoslik fan sohalarini o‘z ichiga olar ekan, turli til birliklari yordamida u yoki bu tilda olamning lisoniy tasvirini anglash va ular yordamida nutqiy madaniyatni shakllantirish kabi sohalarni ham qamrab oladi. Bu esa bizga til va madaniyatning o‘zaro ta’siri natijasida til birliklarining assotsiativ aloqalari hamda konnotativ ma’nolarini inson ongida o‘z ona tilida ochib berish imkonini beradi” [5].

Ingliz antropologi P.Fredrix o‘zining ilmiy asarlarida “til va madaniyat” terminini qo‘llagan bo‘lsada, “lingvokulturologiya” terminini ingliz tilshunosligiga amerikalik lingvist, antropolog M.Agar olib kirgan. U bu terminni ilk marotaba o‘zining “*Language Shock: Understanding the culture of conversation”* asarida qo‘llagan. Uning ta’kidlashicha, lingvokulturologiya – til va madaniyat orasidagi zaruriy ko‘prik vositasini bajaradi hamda bu ikki tushunchani bir-biridan ayro holatda tasavvur qilib bo‘lmaydi. U, jumladan, bu haqida shunday deb yozadi: “agar siz tilda ifodalangan madaniyatni bilmasangiz, tilni ham o‘zlashtiraolmaysiz. Til – bu odamlar va tilshunoslar chizgan doira, madaniyat – ushbu doirani o‘chira oladigan o‘chirg‘ichdir” (*You cannot really know a language if you do not know also the culture expressed by that language. Language is a circle drawn by people and linguists, culture is an eraser that can erase this circle.*

Ma’lumki, “madaniyat” atamasi lotincha *cultura* ga borib taqaladi va bu so‘z antropologiyaning texnik lug‘atidan o‘zlashtirilgan. Unga ko‘ra, u “jamiyat talabidan kelib chiqib, jamiyat a’zolarining butun turmush tarzini qamrab oladi. Bu so‘z ikkita asosiy ma’noga ega: 1) odamlarning hayotini barcha sohalarida alohida yemas, balki birgalikda – ishlab chiqarish, ijtimoiy va ma’naviy yutuqlari yig‘indisi; 2) zamonaviy talablarga javob beradigan ushbu yutuqlarning yuqori darajasi ham madaniyat demakdir. Demak, madaniyat deganda, jamiyat (xalq) moddiy va ma’naviy hayotining tarixan shakllangan xususiyatlari, insonlarda mavjud o‘ziga xoslik, ularning turmush tarzi va tabiati, boshqa odamlar bilan munosabati, allaqachon yaratilgan madaniy ob’ektlar va qadriyat yo‘nalishlari bilan o‘zaro munosabati jarayonida yaratgan va yaratilgan sun’iy muhit tushuniladi”.

Demak, o‘z faoliyatida inson olamni o‘zi bilan emas, balki lisoniy manzarasi, kognitiv tushuncha va modellar bilan ham shug‘ullanadi. Dunyo esa uning

madaniyati va tili prizmasida aks etadi. Bu borada Rossiyadagi quyidagi lingvokulturologiya ilmiy maktablari tilshunoslarining fikrlari e'tiborni o'ziga tortadi. V.A.Maslovaning ta'kidlashicha, Yu.S.Stepanov maktabi madaniyat konstantlarini diaxronik tavsiflashga, N.N.Arutyunova – turli davrdagi xalqlarning universal terminlarini o'rganishga, Ye.M.Vereshagin va V.G.Kostomarovlar – til va madaniyatning o'zaro munosabatlarini rivojlanish kontseptsiyasini tadqiqi qilishga, V.N.Teliya – tirik tilni tashuvchisining refleksiyasi nuqtai nazaridan tilning mohiyatini o'rganishga yo'naltirilgan.

O'zbek tilshunoslari ham lingvokulturologiya gumanitar fanlardan biri deb hisoblab, u milliy xalq tilining mujassamlashtirishini va tilda aks etgan moddiy va ma'naviy madaniyat belgisini o'rganishini ta'kidlaganlar. Ularning fikriga muvofiq, lingvokulturologiya tilning fundamental vazifalari qay tarzda amalga oshayotganini aniqlaydi va tushuntiradi. N.Mahmudov ta'biri bilan aytganda: "Til va madaniyat deganda, odatda, (to'g'risi ham shu) til orqali u yoki bu madaniyatni yoki aksincha, madaniyatni o'rganish orqali u yoki bu tilni tushuntirish nazarda tutiladi, aniqroq aytadigan bo'lsak, lingvokulturologiyadagi madaniyatning ma'nosi "aqliy-ma'naviy yoki xo'jalik faoliyatida erishilgan daraja, saviya (nutq madaniyati)" emas, balki "kishilik jamiyatining ishlab chiqarish, ijtimoiy va ma'naviy-ma'rifiy hayotida qo'lga kiritgan yutuqlari majmui (madaniyat tarixi, o'zbek madaniyati)" demakdir".

Shunday qilib, hozirgi kunda lingvokulturologiya bir necha yo'nalishlarda shakllanmoqda. Ularning vazifalar turli xildir:

1) qiyosiy lingvokulturologiya turli, lekin o'zaro bog'liq etnik guruhlarning lingvomadaniy ko'rinishlarini qiyoslab o'rganadi;

2) diaxron lingvokulturologiya bir etnik guruhning lingvomadaniy holatini ma'lum vaqt oralig'idagi o'zgarishlarini tahlil qiladi;

3) etnos lingvokulturologiya ma'lum bir ijtimoiy guruhning til va madaniyat hodisalarining o'zaro munosabatlarini o'rganadi;

4) leksikografik lingvokulturologiya til va madaniyatga dahldor lug'atshunoslik sohalarni o'rganadi;

5) chog'ishtirma lingvokulturologiya turli tizimli tillarning madaniyatga xos o'zaro aloqalarini o'rganadi.

Shuni e'tirof etishimiz kerakki, bugungi kunga kelib chog'ishtirma lingvokulturologiya endigina rivojlanmoqda va bu xususida bir necha ilmiy izlanishlar olib borilgan. Bulardan eng qiziqarlisi M.K.Golivanovskayaning "Rus tilida so'zlashuvchilar nuqtai nazaridan frantsuz mentaliteti" nomli tadqiqotidir. Bunda frantsuz mentalitetining muhim jihatlari rus tili va madaniyati sohiblari nuqtai nazaridan o'rganilgan.

Til va madaniyat aloqalarini o'rganishning asoschisi XI asrda yashab ijod qilgan bobokalonimiz faylasuf, adabiyotshunos va tilshunos olim Mahmud Qoshg'ariy bo'lib hisoblanadi. U ilk bor turkiy o'lkalardagi sheva va lahja xususiyatlarini o'rganib, ularni adabiy til bilan chog'ishtirib, ushbu ma'lumotlarni o'zining "Devoni-lug'atit turk" asarida bayon etgan. Shu sababli M. Qashg'ariyni qiyosiy-tarixiy tilshunoslik faning otasi desak, mubolag'a bo'lmaydi. A.Nurmonov

fikricha, “Mahmud Qoshg‘ariyning “Devon”iga na materialning hajmi jihatdan, na muallifning filologik bilimi jihatidan bas keladigan biror asar yo‘q. “Devon” ning lug‘at deb atalishi uning asl mazmuniga uncha mos kelmaydi. Bunda turkiy tillar grammatikasidan juda keng ma’lumotlar bor. Yana unda turkiy tillar leksikasi, fonetikasiga oid keng ma’lumotlar, qabilalarning joylashish xususiyatlari, geografik va boshqa xil ma’lumotlar mavjud”. Demak, lingvomadaniyat tushunchasi haqidagi fikr M.Qoshg‘ariy tomonidan ilgari surilgan. Shu bilan birgalikda lingvomadaniyat tushunchasini bilan bog‘liq fikrlar keyinchalik Yevropa ma’rifatchilik ijtimoiy siyosiy oqimi arboblari V. fon Gumboldt, F. de Sossyur, I.G. Gerder, J.Grimm, R.Ruska, R.Lado, E.Sepir, A.A.Potebni, S.Balli, J.Vandries, I.A.Boduen de Kurtene, R.O.Yakobson, J.J.Russo, D.Didro, A.D.Golbax, I.G.Gerder, B.L.Uorflarning ilmiy ishlarida o‘z aksini topgan.

Ingliz tilshunosligida chog‘ishtirma lingvokul’turologiya sohasiga e’tibor qaratilmay kelinmoqda. Ammo rus tilshunoslari tomonidan bu borada sezilarli darajada ilmiy ishlar olib borilmoqda. Chog‘ishtirma lingvokulturologiyaning asosiy muammolarini Yu.D.Apresyan, N.D.Arutyunova, A.Vejbitskaya, V.V.Vorobyeva, V.V.Krasnix, S.G.Ter-Minasova, Ye.V.Urison, L.K.Bayramova, Z.K.Derbishevalarning ilmiy izlanishlarida kuzatishimiz mumkin. V.V.Mokienko, V.N.Teliya, E.M.Soloduxo, Yu.P.Solodub o‘z asarlarida olamning frazeologik manzarasini rus tili misolida boshqa tillar bilan chog‘ishtirishgan.

M.V.Moiseyev va N.G.Gichevaning “Сопоставительная лингвокультурология английского и русского языков” nomli asarida ingliz va rus tillari materiallaridan foydalanib, til va madaniyat o‘rtasidagi o‘zaro ta’sir usullari o‘rnatilgan hamda ular madaniyat bilan belgilanadigan eng muhim til hodisalari sifatida tushunchalarning og‘zaki amalga oshirilishi, stereotiplar, belgilar va mifologemalar misolida tavsiflangan. Tilda madaniyatni qanday tarjima qilish va saqlab qolish haqida tushunchalar berilgan. Ikki xil tilni qiyoslab chog‘ishtirishda tilda xalq madaniyatining namoyon bo‘lishini aks yettirish va mustahkamlashda umumiy qonuniyatlarni aniqlashtirish va milliy-madaniy xususiyatlarni aniqlash imkonini berishi haqida fikr yuritilgan.

V.V.Vorobyov, G.M.Polyakovaning “Сопоставительная лингвокультурология как новое научное направление” maqolasi ham yangi ilmiy yo‘nalish – chog‘ishtirma lingvokulturologiyaga bag‘ishlangan bo‘lib, unda tadqiqotchilar shu soha predmeti, ob’ekti, maqsad va vazifalarini muhokama qilishgan. Ushbu yo‘nalish lingvokulturologiya va chog‘ishtirma tilshunoslik chorrahasida paydo bo‘lgan bo‘lib, tillar va madaniyatlarni ona tili prizmasi orqali taqqoslaydi. Materiallar tadqiqotning asosiy tamoyillari: taqqoslash va qiyosiy-chog‘ishtirma yondashuvlar asosida tahlilga tortilgan. Bu esa o‘z navbatida chog‘ishtirma lingvokulturologiyani rivojlanish istiqboliga ega ekanligidan dalolat beradi.

Ushbu sohaga yana bir misol tariqasida R.X.Xayrulinaning “Сопоставительная лингвокультурология” asarini keltirishimiz mumkin. Muallif o‘z tadqiqotida slavyan, roman-german va turk tillarini qiyoslab hamda chog‘ishtirib, bu sohada qator ilmiy izlanishlar olib borgan.

90- yillardan boshlab, o‘zbek tilshunoslari keng ko‘lamda qiyosiy va chog‘ishtirma lingvokulturologiya muammolari bilan bog‘liq qator tadqiqotlarni amalga oshirib, ularning natijalarini o‘quvchilar e’tiboriga havola qilib kelmoqdalar.

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Hayotjon Ismat
master's degree graduate
Tashkent University of Information Technologies
named after Muhammad al-Khwarizmi
Uzbekistan, Tashkent
Scientific supervisor: Muminov E.
senior lecturer, Department of Artificial Intelligence
Tashkent University of Information Technologies
named after Muhammad al-Khwarizmi
Uzbekistan, Tashkent

AI-DRIVEN OPTIMIZATION OF FREIGHT TRANSPORTATION AND GREEN CORRIDOR FORMATION IN MANUFACTURING ENTERPRISES

Abstract. The thesis analyzes an approach to optimizing freight transportation in manufacturing enterprises using artificial intelligence and to forming green corridors. Demand and travel-time forecasting, route and load optimization based on the Vehicle Routing Problem with Time Windows (VRPTW), and the role of reinforcement learning are discussed. A Green Corridor Index (GCI) is proposed to score routes by CO_2 emissions, delivery time, and vehicle load factor. Based on a literature analysis, the potential of AI to reduce empty runs, improve vehicle utilization, and lower emissions is shown, along with limitations related to data quality and uncertainty.

Keywords: freight transportation, artificial intelligence, route optimization, VRPTW, reinforcement learning, green corridor, manufacturing logistics, CO_2 emissions.

Introduction

Freight transportation is one of the main cost items in the logistics of manufacturing enterprises and accounts for a considerable share of fuel consumption and CO_2 emissions. When inbound raw-material deliveries, inter-shop transfers, and outbound shipments are planned separately, empty runs, partially loaded vehicles, and waiting times at loading points increase. As a result, both economic and environmental efficiency decline.

In this thesis, a "green corridor" means a coordinated, low-emission route that consolidates freight flows and is served with priority. Justifying such a corridor requires data-driven assessment rather than intuitive decisions. Compared with classical optimization methods, artificial intelligence offers greater adaptability, scalability, and support for multi-objective optimization [5]. The aim of the study is to substantiate a methodology for optimizing intra-enterprise and regional freight flows with AI and for identifying routes that can be designated as green corridors.

Methods

The study is conceptual and analytical: recent reviews were analyzed, and an integrated system structure was proposed on that basis. The system has four layers: (1) data collection (shipment volumes, vehicle telematics, loading and unloading schedules, fuel consumption, traffic conditions); (2) forecasting (gradient boosting and LSTM models for demand and travel time); (3) optimization; (4) evaluation and selection of routes by the green corridor index.

Route and load optimization is formulated as a VRPTW: total cost is minimized subject to vehicle capacity and the time window of each loading point. Because the VRP is NP-hard, a hybrid of metaheuristics (e.g., a genetic algorithm) and reinforcement learning is recommended for practical problem sizes; recent reviews show that the main directions are to formulate the VRP as a Markov decision process solved with deep RL, and to integrate RL with heuristic or metaheuristic methods [2, 3]. The environmental and economic priority of a route is scored with the following index:

$$\mathbf{GCI = w_1 \cdot (1 - E/E_0) + w_2 \cdot (1 - T/T_0) + w_3 \cdot LF}$$

where E is CO_2 emissions per tonne-kilometre, T is delivery time, E_0 and T_0 are the corresponding values under current (baseline) planning, LF is the vehicle load factor (from 0 to 1), and w_1, w_2, w_3 are weighting coefficients ($w_1 + w_2 + w_3 = 1$). Routes with a high GCI that also concentrate freight volume are candidates for green corridors.

Results

The literature analysis yields the following findings. First, a review of 129 studies from 2015 to 2025 reports that RL and deep RL show strong potential for generating near-optimal solutions to the NP-hard VRP [3]; another review classifies machine-learning-based VRP methods by application constraints and technical details, focusing mainly on RL [2]. Second, accounting for uncertainties such as demand variability and travel-time fluctuations is important for dynamic routing, yet few RL-based studies explicitly incorporate stochastic uncertainties [4]. Third, AI-supported logistics optimization can improve fleet utilization, reduce empty runs, and support the operational integration of low-emission trucks, but AI is not a green solution on its own [6]. Predictive analytics can also reduce unnecessary trips and inventories [5], and collaborative freight distribution has been reviewed as a way to lower greenhouse gas emissions [1].

The interrelation of the proposed system components is given in the table.

System components and their control

Component	Function	Main risk	Control measure
Forecasting (gradient boosting, LSTM)	Advance estimation of demand and travel time	Low data quality, abrupt demand changes	Regular model retraining and validation
Route optimization (VRPTW, metaheuristic + RL)	Planning of routes and loads	Computational complexity, real-time requirements	Hybrid method, regular re-planning
Green Corridor Index (GCI)	Scoring routes by emissions, time, and load factor	Subjective choice of weights	Sensitivity analysis of weights
Real-time monitoring (telematics, IoT)	Detecting deviations from the plan	Fragmented information systems	Unified data platform

Discussion

The analysis shows that forecasting and optimization should be treated as a single loop: an inaccurate forecast reduces the benefit of routing, while a forecast without optimization brings no practical gain. The GCI provides a transparent criterion for comparing routes by emissions, time, and load factor, but its weights must be chosen to match enterprise priorities and checked with sensitivity analysis. The proposed approach is so far conceptual: its effectiveness must be confirmed on an enterprise's real data against a baseline. Later stages envisage a pilot project, IoT-based real-time monitoring, and extension to multimodal transport.

Conclusion

AI-based optimization of freight transportation in manufacturing enterprises requires combining forecasting, VRPTW-based routing, and a green corridor index in one system. The literature analysis shows that RL and hybrid methods are promising for large problems, while data quality and handling of uncertainty remain open issues. The proposed GCI helps identify green corridor candidates in terms of lower emissions, fewer empty runs, and higher vehicle load.

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Hikmatova F.B.
second-year master's student, Department of Therapeutic Dentistry
ORCID: 0009-0009-9582-9383
Scientific supervisor: Samadova Sh.I., PhD
associate professor, Department of Therapeutic Dentistry
Bukhara State Medical Institute
Uzbekistan, Bukhara

CLINICAL EVALUATION OF THE EFFECTIVENESS OF COMPREHENSIVE TREATMENT FOR CATARRHAL GINGIVITIS

Abstract. This article examines the clinical evaluation of comprehensive treatment for catarrhal gingivitis. The main clinical manifestations, including gingival redness, swelling, and bleeding, as well as the role of dental plaque in the development of inflammation, are discussed. The importance of professional oral hygiene, individual hygiene recommendations, and topical antiseptic agents in comprehensive treatment is reviewed. Particular attention is given to clinical outcome measures, including gingival indices, bleeding on probing, and dental plaque levels, for assessing treatment effectiveness.

Keywords: catarrhal gingivitis, comprehensive treatment, clinical effectiveness, gingival inflammation, dental plaque, oral hygiene, gingival index, periodontal health.

Introduction

Gingivitis is one of the most common inflammatory diseases of the oral cavity. Catarrhal gingivitis is characterized by gingival redness, swelling, and bleeding, particularly during toothbrushing or clinical examination. The accumulation of microbial dental plaque is considered the primary etiological factor in plaque-induced gingivitis [1, 2].

Comprehensive treatment aims to eliminate the causes of inflammation, reduce dental plaque, and improve individual oral hygiene. The main components include professional mechanical plaque removal, instruction in proper toothbrushing techniques, and the use of additional topical agents when clinically indicated.

Evaluating treatment effectiveness requires objective clinical criteria to determine changes in gingival health before and after treatment.

Relevance of the Topic

The relevance of this topic is determined by the high prevalence of gingival inflammation and the need to improve preventive and therapeutic approaches. Inadequate oral hygiene and persistent dental plaque accumulation may contribute to the development and maintenance of gingival inflammation.

Professional mechanical plaque removal, combined with appropriate home oral hygiene practices, is an essential component of treatment. A systematic review and meta-analysis published in 2026 examined the clinical efficacy of professional

mechanical plaque removal in patients with dental biofilm-induced gingivitis and highlighted the importance of oral hygiene measures in achieving treatment benefits [1].

Topical antiseptic agents, including chlorhexidine, may be used as adjunctive treatments in selected cases. However, their use should be based on clinical indications because adverse effects, such as extrinsic tooth staining and temporary alterations in taste perception, may occur [3].

Therefore, evaluating treatment effectiveness through standardized clinical indicators is important for selecting appropriate treatment strategies and monitoring patient outcomes.

Literature Review

Etiology and Clinical Manifestations of Catarrhal Gingivitis

Plaque-induced gingivitis develops as an inflammatory response to microbial biofilm accumulation on tooth surfaces. Its principal clinical manifestations include gingival erythema, edema, and bleeding on probing.

Clinical indices are used to assess the severity of inflammation and monitor changes following treatment. The consensus report of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions emphasizes the importance of clinical findings, particularly bleeding on probing, in evaluating gingival health [2].

Importance of Professional Oral Hygiene

Professional mechanical plaque removal is a key component of catarrhal gingivitis treatment. However, long-term improvement also depends on the patient's adherence to effective oral hygiene practices.

A comprehensive approach includes professional dental cleaning, instruction in proper toothbrushing techniques, and regular monitoring of oral hygiene. Combining professional plaque removal with individualized hygiene recommendations may help reduce plaque accumulation and gingival inflammation [1].

Role of Topical Antiseptic Agents

Chlorhexidine mouthrinse may be used as an adjunct to mechanical plaque control in selected clinical situations. A Cochrane systematic review found that chlorhexidine mouthrinse, when added to routine oral hygiene, can reduce dental plaque and may improve gingival health [3].

Nevertheless, its use may cause tooth staining, temporary taste disturbances, and other adverse effects. Consequently, the concentration and duration of treatment should be determined according to clinical indications and professional recommendations. Antiseptic agents should not replace mechanical plaque removal or routine oral hygiene.

Clinical Criteria for Evaluating Treatment Effectiveness

The effectiveness of comprehensive treatment for catarrhal gingivitis can be evaluated using the following clinical parameters:

- Reduction in gingival redness and swelling.
- Decreased bleeding on probing.

- Reduction in dental plaque accumulation.
- Improvement in gingival index scores.
- Reduction in patient-reported symptoms.
- Improvement in individual oral hygiene practices.

Clinical assessments should be performed before treatment and after a predefined follow-up period using consistent diagnostic criteria.

When different treatment protocols are compared, researchers should report the sample size, treatment duration, follow-up period, and statistical methods. These measures allow objective assessment of treatment outcomes and the clinical significance of observed changes.

Conclusion

Comprehensive treatment of catarrhal gingivitis should focus on professional mechanical plaque removal, improvement of individual oral hygiene, and regular assessment of gingival health. Combining professional treatment with appropriate home hygiene practices may contribute to better clinical outcomes.

Treatment effectiveness should be evaluated using objective indicators, including gingival redness, swelling, bleeding on probing, dental plaque levels, and gingival index scores. Topical antiseptic agents may be considered as adjunctive treatments when clinically indicated, with appropriate attention to potential adverse effects.

Further standardized clinical studies are needed to establish the comparative effectiveness of specific treatment protocols and identify the most appropriate approaches for different patient groups.

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Ibragimova D.
assistant
Khusanova M.
student
O'ktamova N.
student
Tokhirova S.
student
Azimova S.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE CURRENT LEVEL OF APPLICATION OF MODERN INFORMATION TECHNOLOGIES AND THEIR ROLE IN DATA COLLECTION, DIAGNOSIS, AND TREATMENT IN VARIOUS MEDICAL FIELDS

Abstract. This article examines the current level of application of modern information technologies in the healthcare sector and analyzes their role in medical data collection, diagnosis, and treatment processes. The study highlights the significance of electronic health systems, medical information systems, telemedicine, and artificial intelligence technologies in improving the quality, efficiency, and accessibility of healthcare services. The analysis of current healthcare practices shows that electronic health record systems, artificial intelligence-based decision support, and telemedicine improve data management, diagnostic accuracy, and access to medical services. The research emphasizes that the integration of information technologies contributes to accurate diagnostics, personalized treatment, and effective management of healthcare resources.

Keywords: information technologies, healthcare, medical data, diagnosis, treatment, telemedicine, artificial intelligence.

Introduction

The rapid development of modern information technologies has led to profound transformations in various sectors, including healthcare. Today, healthcare systems increasingly depend on digital solutions to manage complex medical data, enhance diagnostic accuracy, and improve treatment outcomes [1]. The adoption of information technologies has become a strategic priority for healthcare systems worldwide, as it enables cost-effective service delivery and improved patient care [1].

In modern medicine, timely access to accurate medical information plays a critical role in decision-making processes. Therefore, the implementation of advanced information technologies is essential for ensuring the effectiveness and

sustainability of healthcare systems. This study aims to analyze the current level of information technology usage in healthcare and evaluate its role in data collection, diagnosis, and treatment across different medical fields.

Materials and Methods

The study is based on an analysis of current healthcare practices and of the scientific literature on health information systems.

Results and Discussion

Current Level of Information Technology Usage in Healthcare

At present, healthcare institutions actively implement various information systems, including Electronic Medical Records (EMR), Hospital Information Systems (HIS), Laboratory Information Systems (LIS), and Picture Archiving and Communication Systems (PACS) [2]. These systems facilitate efficient management of patient information and enable healthcare professionals to access medical data in real time.

The widespread digitalization of healthcare processes has reduced administrative workload, minimized medical errors, and enhanced coordination among healthcare providers [3]. Additionally, cloud-based technologies allow secure storage and sharing of medical data, supporting collaborative decision-making and continuity of care [4].

Role of Information Technologies in Medical Data Collection and Management

Medical data collection is one of the most critical aspects of healthcare delivery. Modern information technologies provide automated tools for collecting, storing, and processing large volumes of patient data. Electronic health records ensure standardized documentation and improve data accuracy.

Advanced data analytics and big data technologies enable healthcare professionals to identify trends, predict disease risks, and develop preventive strategies [5]. As a result, information technologies significantly contribute to evidence-based medicine and public health management.

Application of Information Technologies in Diagnostic Processes

Information technologies play a vital role in modern diagnostic practices. Medical imaging technologies such as computed tomography (CT), magnetic resonance imaging (MRI), and digital radiography rely heavily on advanced software for image processing and analysis.

Artificial intelligence and machine learning algorithms have become increasingly important in diagnostics [6]. These technologies assist clinicians in detecting diseases at early stages, analyzing complex medical images, and reducing diagnostic errors. The integration of decision-support systems enhances diagnostic accuracy and supports clinical decision-making [7].

Healthcare organizations utilize a variety of digital tools, including electronic medical records (EMR), hospital information systems (HIS), laboratory information systems (LIS), and medical imaging platforms. These technologies streamline patient data management, improve workflow efficiency, and reduce the likelihood of errors.

Practical examples (see also Table 1):

Cardiology: Digital monitoring devices track patient heart rates and blood pressure in real time, enabling early detection of arrhythmias.

Surgery: Robotic-assisted surgery platforms allow minimally invasive procedures with higher precision and reduced recovery times.

Table 1. Examples of IT applications across medical fields

Field	Technology Used	Purpose
Cardiology	Wearable monitors, ECG software	Heart rate tracking, arrhythmia detection
Surgery	Robotic surgery systems	Precision operations, reduced recovery
Pediatrics	EMR, digital growth charts	Monitor child health, vaccination schedules
Oncology	AI imaging tools	Tumor detection, treatment planning

Use of Information Technologies in Treatment and Patient Care

In treatment processes, information technologies enable the development of personalized and effective therapeutic strategies. Robotic-assisted surgery, computer-aided treatment planning, and digital monitoring systems improve treatment precision and patient safety.

Telemedicine platforms allow remote consultations, patient monitoring, and follow-up care, particularly in remote and underserved areas [8]. These technologies enhance access to healthcare services and reduce the burden on medical facilities. Furthermore, digital health applications support patient engagement and adherence to treatment plans.

Case examples:

Remote diabetes management: Continuous glucose monitoring with AI alerts for abnormal levels.

Tele-ICU: Remote critical care monitoring with real-time data sharing and expert consultation.

Challenges and Future Perspectives

Despite the advantages of information technologies in healthcare, several challenges remain, including data security, privacy concerns, and the need for skilled professionals. Ensuring cybersecurity and compliance with ethical standards is essential for sustainable digital healthcare development.

In the future, the continued advancement of artificial intelligence, wearable technologies, and integrated health information systems is expected to further transform medical practice. These innovations will enhance preventive care, personalized medicine, and overall healthcare efficiency.

Key Findings

The analysis of current healthcare practices demonstrates that the integration of modern information technologies significantly improves the efficiency of

medical data management, diagnostic accuracy, and treatment processes. The use of electronic health record systems has resulted in more structured and accessible patient data, enabling healthcare professionals to retrieve information promptly and make informed clinical decisions.

The findings indicate that healthcare institutions implementing digital diagnostic tools, such as computer-assisted imaging systems and artificial intelligence-based decision support, show higher accuracy in disease detection and reduced diagnostic time. In particular, the application of machine learning algorithms contributes to the early identification of pathological conditions and supports clinicians in complex diagnostic cases.

Furthermore, the results reveal that the adoption of telemedicine technologies enhances access to medical services, especially for patients in remote and underserved regions. Remote consultations and digital patient monitoring systems improve continuity of care and patient adherence to treatment plans. Overall, the findings confirm that modern information technologies positively impact the quality, reliability, and effectiveness of healthcare services.

Advantages: increased efficiency and accuracy, reduced human error, and better patient access and engagement.

Conclusion

In conclusion, modern information technologies have become an indispensable component of contemporary healthcare systems. Their application in data collection, diagnosis, and treatment significantly improves the quality, efficiency, and accessibility of medical services. The ongoing integration of advanced digital technologies is expected to play a crucial role in shaping the future of healthcare and improving patient outcomes.

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Ibragimova D.
assistant
Zoitova F.
student
Musabekova M.
student
Muysidinova S.
student
Samarkand State Medical University
Uzbekistan, Samarkand

IMPROVING THE METHODOLOGY OF INDIVIDUALIZING THE EDUCATIONAL PROCESS IN HIGHER EDUCATION BASED ON ARTIFICIAL INTELLIGENCE

Abstract. The rapid development of digital technologies has significantly influenced the higher education system, highlighting the need for personalized learning approaches. This article examines the improvement of the methodology for individualizing the educational process in higher education institutions based on artificial intelligence (AI) technologies. An adaptive learning model was developed by analyzing students' individual learning characteristics, academic performance, and learning pace through AI-driven learning analytics. The proposed methodology enables the formation of personalized learning trajectories, automated assessment, and continuous feedback. The results of the experimental study demonstrate that AI-based individualized learning significantly enhances students' academic achievement and learning motivation, confirming the effectiveness and practical relevance of the proposed methodology for modern higher education.

Keywords: artificial intelligence, individualized learning, adaptive learning, learning analytics, higher education.

Introduction

In the context of global digital transformation, higher education institutions face new challenges related to improving the quality and effectiveness of teaching and learning. Traditional teaching models often rely on uniform instructional approaches that do not sufficiently account for students' diverse learning abilities, cognitive styles, and educational needs. As a result, some students may experience learning difficulties, while others may not fully realize their academic potential.

Artificial intelligence technologies provide new opportunities for addressing these challenges by enabling the analysis of large volumes of educational data and supporting data-driven decision-making in teaching [1–3]. AI-based systems can adapt learning content, instructional strategies, and assessment methods to individual learners [2]. Therefore, improving the methodology of individualizing

the educational process through artificial intelligence has become a pressing research issue in higher education pedagogy.

Research Methodology

The study employed a mixed-methods research design, combining theoretical analysis, pedagogical modeling, and experimental methods. The research was conducted in several stages: analysis of theoretical foundations of individualized learning and AI technologies in education; development of an AI-based adaptive learning model; implementation of the model in the educational process; evaluation of learning outcomes using quantitative and qualitative indicators.

Learning analytics tools were used to collect and analyze data on students' academic performance, learning behavior, and engagement levels [3, 4]. Statistical methods were applied to compare the results of control and experimental groups.

Results and Discussion

AI-Based Individualized Learning Model

The proposed model of individualized learning based on artificial intelligence consists of three main stages:

Diagnostic Stage. At this stage, students' initial knowledge level, learning preferences, and cognitive characteristics are assessed using AI-powered diagnostic tools. The collected data serve as the basis for creating individual learner profiles.

Adaptive Learning Stage. Based on the diagnostic results, AI algorithms generate personalized learning paths by recommending appropriate learning materials, tasks, and activities. The system dynamically adjusts the content and difficulty level according to students' progress and performance.

Experimental Results

The experimental study was conducted with undergraduate students in a higher education institution. The experimental group was taught using the AI-based individualized learning methodology, while the control group followed traditional instructional methods.

The results revealed that students in the experimental group demonstrated higher academic achievement, improved learning motivation, and greater engagement compared to those in the control group. Statistical analysis confirmed the significance of these differences, indicating the effectiveness of the proposed methodology.

The findings align with previous research on adaptive learning systems [1, 2] and highlight the importance of integrating artificial intelligence into pedagogical methodologies rather than using it solely as a technological tool.

Conclusion

This study demonstrates that improving the methodology of individualizing the educational process in higher education based on artificial intelligence contributes significantly to enhancing learning outcomes and student motivation. The proposed AI-based methodology enables personalized learning trajectories, continuous assessment, and data-driven instructional decisions.

The results suggest that higher education institutions should actively integrate artificial intelligence technologies into their teaching practices. Future research may

focus on expanding the model to different academic disciplines and exploring ethical and data privacy issues related to AI in education.

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Ibragimova D.
assistant
Muhamadiyeva A.
student
Kodirova N.
student
Berdinazarova M.
student
Ibodullayeva M.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE IMPORTANCE OF THE MARKET MECHANISM IN ECONOMIC THEORY

Abstract. The article analyzes the place and importance of the market mechanism in economic theory. The laws of supply and demand, the price mechanism, the competitive environment, and the process of forming market equilibrium are examined from a scientific perspective. The role of the market mechanism in the efficient use of resources and in ensuring economic stability is revealed. The models of the market economy are described: the mixed economy, the social market economy, and the corporate economy.

Keywords: market mechanism, supply and demand, price, competition, economic equilibrium, resources.

Introduction

The market mechanism is the basis of modern economic systems. In economic theory, the market mechanism is considered the most important tool for distributing limited resources in society [1]. Every society strives to satisfy its needs at the maximum level, but because the factors of production are limited, the problem of economic choice arises [2].

The market mechanism coordinates the relationships between producers and consumers through prices [3]. This mechanism makes it possible to make economic decisions in a decentralized way and ensures economic freedom.

Materials and Methods

The article is theoretical in nature and is based on the analysis and generalization of the economic literature on the market mechanism and on the models of the market economy.

Results and Discussion

Market Economy Models

The market economy models (types of market economy) typical of economically developed countries include the mixed economy, the social market economy, and the corporate economy.

Mixed economy model. The mixed economy model is a type of market economy that provides high labor productivity and an abundance of goods and relies on advanced technology and a highly qualified workforce. In this model there is a diversity of forms of ownership: private and individual property has priority, while state and non-state property and the state and non-state sectors of the economy develop progressively. Large, medium-sized, and small businesses develop in a balanced way. Along with market relations, there are also non-market relations, which creates a basis for the broad development of charity and benevolence; along with competition, cooperative ties also emerge. In managing the economy, the state mechanism is used alongside the market mechanism. Although the model is typical of public prosperity, it does not eliminate social differences; the state does not take an active part in the redistribution of income, and this task is performed by the market mechanism. The mixed economy model exists in the USA, the United Kingdom, and France [1].

Social market economy model. The social market economy model relies on advanced technology and the human factor, ensures high labor productivity, and in general provides an abundance of goods in the market. Under this model, the country's market economy develops in a natural historical way, production responds to market requirements, and the state remains cautious, interfering in the economy only minimally; the economy is regulated by market forces and fully liberated. This model is called the "economic order" model. Laws determine the rules of market activity, the economy obeys the market mechanism, and the state acts as the supreme arbiter of economic activity but does not itself participate in the process. In this model, the economy gives more attention to the private sector than to the state sector, and the social direction of the market defines itself. Each economic entity receives income according to the rules of the market; the state rarely interferes in the distribution of income, but ensures that the formation of income complies with market principles and that the market mechanism operates in the designated order. The social market economy model exists in Germany, Sweden, and other countries [4].

Corporate economy model. The corporate economy model is a market economy based on corporate interests and corporate unity. It relies on advanced technology and a mature workforce and increases labor productivity and per capita output. The main attention is focused on the interests of the corporate group, and the economy is managed through corporations. Corporations, in the form of joint-stock companies, turn into associations in various fields of industry, trade, transport, and construction; some of them even grow to the level of transnational corporations of international importance. Corporations cover the main areas of production, and the number of their foreign branches is also increasing. The corporate form of private property has priority. In the corporate economy model, the interests of the corporation are placed first, and individual interests are pursued only within the

corporation; scientific research and technical design work are also carried out within this framework. The solution of problems within the corporation fosters employees' loyalty to the corporation and a sense of corporate patriotism. The corporation guarantees employees a high standard of living, and in response employees ensure high production efficiency. The corporation provides employees' family members with jobs, good pensions in old age, and one-time large awards. Harmony prevails between employees and managers. Such measures ensure social solidarity and do not give rise to strikes or other protests [4].

Conclusion

In conclusion, the market mechanism is one of the central concepts of economic theory. Through supply and demand, price, and competition, economic resources are distributed efficiently [5]. The correct functioning of the market mechanism ensures economic growth, stability, and the well-being of society.

The market mechanism, as the central mechanism of the economy, distributes resources rationally; through the laws of supply and demand, the price mechanism, the competitive environment, and market equilibrium, economic entities make their own decisions. The market mechanism not only increases economic efficiency but also creates important conditions for economic stability and growth. It also encourages innovation and protects consumers' interests, which further increases the need for a deep understanding of the market mechanism in economic theory.

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Ibragimova D.
assistant
Sobirov O.
student
Abdug'aniyev U.
student
Rustamova A.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE CURRENT LEVEL OF APPLICATION OF MODERN INFORMATION TECHNOLOGIES AND THEIR ROLE IN DATA COLLECTION, DIAGNOSIS, AND TREATMENT IN VARIOUS MEDICAL FIELDS

Abstract. This article examines the current level of application of modern information technologies in the healthcare sector and analyzes their role in medical data collection, diagnosis, and treatment processes. The study highlights the significance of electronic health systems, medical information systems, telemedicine, and artificial intelligence technologies in improving the quality, efficiency, and accessibility of healthcare services. The analysis of current healthcare practices shows that electronic health record systems and artificial intelligence-based decision support improve the structure and accessibility of patient data and the accuracy and speed of disease detection. The research emphasizes that the integration of information technologies contributes to accurate diagnostics, personalized treatment, and effective management of healthcare resources.

Keywords: information technologies, healthcare, medical data, diagnosis, treatment, telemedicine, artificial intelligence.

Introduction

The rapid development of modern information technologies has led to profound transformations in various sectors, including healthcare. Today, healthcare systems increasingly depend on digital solutions to manage complex medical data, enhance diagnostic accuracy, and improve treatment outcomes [1]. The adoption of information technologies has become a strategic priority for healthcare systems worldwide, as it enables cost-effective service delivery and improved patient care [1].

In modern medicine, timely access to accurate medical information plays a critical role in decision-making processes. Therefore, the implementation of advanced information technologies is essential for ensuring the effectiveness and sustainability of healthcare systems. This study aims to analyze the current level of

information technology usage in healthcare and evaluate its role in data collection, diagnosis, and treatment across different medical fields.

Materials and Methods

The study is based on an analysis of current healthcare practices and of the scientific literature on health information systems.

Results and Discussion

Current Level of Information Technology Usage in Healthcare

At present, healthcare institutions actively implement various information systems, including Electronic Medical Records (EMR), Hospital Information Systems (HIS), Laboratory Information Systems (LIS), and Picture Archiving and Communication Systems (PACS) [2]. These systems facilitate efficient management of patient information and enable healthcare professionals to access medical data in real time.

The widespread digitalization of healthcare processes has reduced administrative workload, minimized medical errors, and enhanced coordination among healthcare providers [3]. Additionally, cloud-based technologies allow secure storage and sharing of medical data, supporting collaborative decision-making and continuity of care [4].

Application of Information Technologies in Diagnostic Processes

Information technologies play a vital role in modern diagnostic practices. Medical imaging technologies such as computed tomography (CT), magnetic resonance imaging (MRI), and digital radiography rely heavily on advanced software for image processing and analysis.

Artificial intelligence and machine learning algorithms have become increasingly important in diagnostics [5]. These technologies assist clinicians in detecting diseases at early stages, analyzing complex medical images, and reducing diagnostic errors. The integration of decision-support systems enhances diagnostic accuracy and supports clinical decision-making [6].

Healthcare organizations utilize a variety of digital tools, including electronic medical records (EMR), hospital information systems (HIS), laboratory information systems (LIS), and medical imaging platforms. These technologies streamline patient data management, improve workflow efficiency, and reduce the likelihood of errors.

Key Findings

The analysis of current healthcare practices demonstrates that the integration of modern information technologies significantly improves the efficiency of medical data management, diagnostic accuracy, and treatment processes. The use of electronic health record systems has resulted in more structured and accessible patient data, enabling healthcare professionals to retrieve information promptly and make informed clinical decisions.

The findings indicate that healthcare institutions implementing digital diagnostic tools, such as computer-assisted imaging systems and artificial intelligence-based decision support, show higher accuracy in disease detection and reduced diagnostic time. In particular, the application of machine learning

algorithms contributes to the early identification of pathological conditions and supports clinicians in complex diagnostic cases.

Conclusion

In conclusion, modern information technologies have become an indispensable component of contemporary healthcare systems. Their application in data collection, diagnosis, and treatment significantly improves the quality, efficiency, and accessibility of medical services. The ongoing integration of advanced digital technologies is expected to play a crucial role in shaping the future of healthcare and improving patient outcomes.

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Ibragimova D.
assistant
Zoitova F.
student
Musabekova M.
student
Muysidinova S.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE ROLE OF ARTIFICIAL INTELLIGENCE IN INDIVIDUAL EDUCATION

Abstract. This conceptual review examines how artificial intelligence can support individual education through adaptive tasks, formative feedback, and teacher guidance. Three selected publications were compared to distinguish established applications from proposed classroom practices. The synthesis identifies opportunities for responsive instruction alongside concerns about accuracy, learner dependence, and unequal access. A teacher-supervised cycle of diagnosis, adaptation, feedback, and independent assessment is proposed, and the article concludes that personalization should strengthen learner autonomy and demonstrable understanding. No original student experiment was conducted.

Keywords: artificial intelligence, individual education, personalized learning, adaptive instruction, formative assessment.

Introduction

Individual education responds to differences in learners' prior knowledge, pace, and support needs. In this article, the term refers to personalized instruction within a shared curriculum. A common classroom difficulty is providing timely assistance while maintaining meaningful challenges for students who progress more quickly. Artificial intelligence (AI) offers tools for adjusting practice and generating explanations, but educational value depends on how these tools are integrated into teaching.

Methods

A focused narrative review compared three purposively selected sources: a systematic review of AI applications in higher education [1], a meta-analysis of intelligent tutoring systems [2], and UNESCO guidance on generative AI [3]. Selection reflected complementary coverage of educational applications, evaluated tutoring interventions, and governance. This was not an exhaustive systematic search, and no pooled effect size was calculated.

Results

The synthesis identified three complementary functions. First, adaptive practice can connect task selection to evidence of understanding. A learner who repeatedly struggles with a prerequisite concept may need a simpler worked example before attempting a more demanding problem. Such adaptation requires a clear curriculum sequence and reliable checks of mastery. This classroom example illustrates a proposed use rather than an observed outcome.

Second, tutoring and feedback can make individual assistance more available. The meta-analysis by Ma and colleagues examines learning outcomes across intelligent tutoring studies and considers differences in systems and comparison conditions [2]. Its relevance is that effectiveness must be evaluated against a specific alternative. Evidence about structured tutors cannot automatically establish the effectiveness of an unrestricted chatbot.

Third, learner information can support teacher decisions. The reviewed higher education literature identifies profiling and prediction among major application areas [1]. In the proposed framework, teachers would use indications of difficulty to initiate a conversation or revise instruction. An automated label would remain a provisional signal requiring contextual interpretation.

Discussion

A practical implementation can begin with a short diagnostic activity. The teacher then assigns a common learning objective while allowing different practice routes. AI may provide hints or alternative explanations, followed by a task completed without assistance. Comparing supported and independent work helps reveal whether students have understood the concept or merely reproduced an answer. Students should explain their reasoning and identify which assistance they used.

UNESCO emphasizes human agency, privacy, and pedagogical validation in the use of generative AI [3]. Applied here, these principles imply teacher review of instructional outputs, limited collection of learner information, and accessible alternatives when students cannot use a tool. AI literacy activities should also ask learners to identify incomplete explanations and verify claims against course materials.

The framework has limitations. Three selected sources cannot represent the entire research field, and policy guidance does not demonstrate causal learning gains. Future classroom evaluation should compare equivalent groups, measure prior knowledge, and assess delayed independent performance. Participation, accessibility, and teacher workload should be examined alongside achievement. These measures would help determine for whom an intervention works and under which conditions.

Conclusion

AI can support individual education by connecting learner needs with suitable practice and feedback. Its contribution should be judged through independent understanding and equitable participation. The proposed cycle offers a basis for

classroom evaluation, while teachers retain responsibility for objectives, interpretation, and assessment.

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Ibragimova D.
assistant
Barakayeva M.
student
Daniyorov Sh.
student
Isakjanov M.
student
Kholboyeva O.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE ROLE AND ECONOMIC EFFICIENCY OF INVESTMENTS IN THE CONSTRUCTION ECONOMY

Abstract. The article analyzes the importance of investments in the construction sector, their economic efficiency, the impact of projects, and their role in the development of the sector. The role of effective investment management, optimal use of resources, and reduction of construction costs is highlighted. Cooperation between state and private-sector investments is considered. The study draws on data on global foreign direct investment in 2023 and on the dynamics of investments in fixed capital in Uzbekistan in January–March 2024. It is concluded that well-planned and effectively managed investments increase project success, ensure rational use of resources, and reduce construction costs.

Keywords: construction economy, investment, project, efficiency, resources, infrastructure.

Introduction

The construction sector is one of the important branches of the national economy and directly affects the development of infrastructure and production [1, 2]. Attracting investment to the sector at a sufficient level is considered the main condition for ensuring economic growth and social stability.

Investments make it possible to finance construction projects, introduce new technologies, and create new jobs [2]. Therefore, the effective management of investments within the construction economy is of great importance.

Materials and Methods

The article is based on an analysis of the literature on construction economics and investment activity and of statistical data on investments: global foreign direct investment flows in 2023 and investments in fixed capital in Uzbekistan in January–March 2024.

Results and Discussion

State and Private Investment Cooperation

In the construction economy, cooperation between state and private-sector investments helps the sector to develop sustainably [3]. The state finances projects, creates the regulatory framework, and supports social projects, while the private sector introduces innovative technologies and increases efficiency.

Economic Role of Investments

The economic role of investments is manifested in the following areas:

Economic growth and development. Investments ensure economic growth by expanding and modernizing production capacities [2]. According to UNCTAD's World Investment Report 2024, global foreign direct investment flows amounted to $1.3 trillion in 2023 [4].

Innovative development. Investments play an important role in introducing new technologies and encouraging innovative activity [5]. Financing innovative projects increases the competitiveness of the economy.

Socio-economic impact. Investments contribute to the well-being of society by creating new jobs, increasing the population's income, and developing social infrastructure [2].

Investment Activity in the First Quarter of 2024

Analysis of investment activity in the first quarter of 2024 shows the following important trends. In January–March 2024, the volume of investments in fixed capital amounted to 107.1 trillion soums, and a growth rate of 174.5% was recorded compared to the same period of the previous year. This is the highest growth rate in the last 5 years [6].

Conclusion

Investments in the construction economy are an important factor ensuring the development of the sector and economic stability. Properly planned and effectively managed investments increase the success of projects, ensure the optimal use of resources, and reduce the cost of construction. Effective investment ensures the fast and high-quality completion of projects, creates new jobs, and strengthens social stability.

In addition, cooperation between state and private-sector investments creates opportunities for the stable development of the construction sector. The efficiency and management of investments in this field increase economic stability and create a competitive environment.

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Ibrohimov S.U.
doktorant
O‘zbekiston, Andijon
Ilmiy rahbar: Vasiyev H., texnika fanlari bo‘yicha falsafa doktori (PhD)
“Metrologiya va yengil sanoat” kafedrasi mudiri
Andijon davlat texnika instituti
O‘zbekiston, Andijon

PLASTMASSA MAHSULOTLARI ISHLAB CHIQARISHDA SIFAT XAVFLARINI XALQARO STANDARTLAR ASOSIDA BAHOLASH METODIKASI TEXNO-INNOVATOR KORXONASI UCHUN MODEL

Annotatsiya. Plastmassa mahsulotlari sifatining barqarorligi xomashyo, texnologik rejim va o‘lchash natijalarining ishonchliligiga bog‘liq. Maqolaning maqsadi Texno-Innovator korxonasi uchun qo‘llash mumkin bo‘lgan sifat xavflarini baholash metodikasini ishlab chiqishdan iborat. Normativ manbalar tahlili, jarayonlarni xaritalash va nosozlik turlari hamda oqibatlarini tahlil qilish usuli asosida xavf reyestri modeli taklif etildi. Natijada oqibat og‘irligi, sodir bo‘lish ehtimoli va aniqlash imkoniyatini birlashtiruvchi, jiddiy oqibatlarni alohida ustuvorlashtiruvchi baholash tartibi ishlab chiqildi. Korxonaning empirik ma’lumotlari taqdim etilmaganligi sababli natijalar uslubiy model sifatida talqin qilinadi, sonli misollar esa hisoblash tartibini namoyish etadi.

Kalit so‘zlar: sifat menejmenti, plastmassa mahsulotlari, xalqaro standartlar, xavfni baholash, FMEA, metrologik ta’minot, xavf reyestri.

Ibrohimov S.U.
doctoral student
Uzbekistan, Andijan
Scientific supervisor: Vasiyev H., PhD in Technical Sciences
head of the Department of Metrology and Light Industry
Andijan State Technical Institute
Uzbekistan, Andijan

A METHODOLOGY FOR ASSESSING QUALITY RISKS IN PLASTICS MANUFACTURING BASED ON INTERNATIONAL STANDARDS A MODEL FOR TEXNO-INNOVATOR

Abstract. The stability of plastic product quality depends on raw materials, process conditions and the reliability of measurements. This article develops a quality risk assessment methodology that can be applied at Texno-Innovator. Standards analysis, process mapping and failure mode and effects analysis are used to design a risk register model. The proposed procedure combines severity, occurrence and detectability while assigning separate priority to severe

consequences. As enterprise data were not provided, the findings constitute a methodological model and numerical examples illustrate calculations rather than observed performance.

Keywords: quality management, plastic products, international standards, risk assessment, FMEA, metrological assurance, risk register.

Kirish

Plastmassa buyumlarini ishlab chiqarishda yakuniy nazorat nuqsonli mahsulotni ajratishga yordam beradi, biroq nuqson kelib chiqishining barcha sabablarini bartaraf etmaydi. Xomashyo partiyasining almashishi, uskuna holati, texnologik sozlamalar yoki o‘lchash jarayonidagi xato bir nechta operatsiya orqali mahsulot xossalariga ta’sir qilishi mumkin. Shu sababli sifatni boshqarishda alohida buyumni tekshirish bilan birga, talabga muvofiq mahsulot olish imkoniyatini cheklovchi omillarni oldindan baholash zarur.

ISO 9001:2026 sifat menejmenti tizimini yaratish va takomillashtirishning umumiy asosini beradi. ISO 31000:2018 xavfni boshqarish bo‘yicha tavsiyalarni, IEC 31010:2019 baholash usullarini tanlashni, IEC 60812:2018 esa FMEA tahlilini tashkil etishni yoritadi [1–4]. Bu hujjatlar bir xil vazifani bajarmaydi: menejment tizimi talablari, boshqaruv tavsiyalari va tahlil usullarini farqlash metodikaning to‘g‘ri qo‘llanishi uchun zarur.

Mazkur tadqiqotning obyekti — Texno-Innovator korxonasida qo‘llash uchun loyihalanayotgan plastmassa mahsulotlari sifat xavflarini baholash tizimi. Predmeti — jarayon sabablarini mahsulot talablari, nazorat dalillari va xavf ustuvorligi bilan bog‘lash tartibi. Korxonaning mahsulot nomenklaturasi, uskunalari, sertifikatlari va nuqsonlar statistikasi mualliflarga taqdim etilmagan. Shuning uchun quyidagi jarayonlar korxonaning tasdiqlangan tavsifi emas, balki joyida aniqlashtirilishi lozim bo‘lgan model chegarasidir.

Tadqiqot maqsadi xalqaro standartlar bilan uyg‘unlashtiriladigan, ma’lumot yetishmasligi sharoitida ham baholashning ishonchlilik darajasini ko‘rsatadigan metodikani ishlab chiqishdir. Ishning taklif etilayotgan uslubiy hissasi FMEA natijasini faqat bitta yig‘ma ball bilan cheklamasdan, oqibatning jiddiyligi, bahoning dalili va qayta baholash shartini yagona reyestrda birlashtirishdan iborat.

Tadqiqot metodlari

Ish normativ manbalarning vazifaviy tahlili va jarayon modelini loyihalashga asoslangan. Model chegarasi buyurtma talablarini aniqlashdan xomashyoni qabul qilish, saqlash, tayyorlash, shakllantirish, nazorat va jo‘natishgacha bo‘lgan ketma-ketlikni qamrab oladi. Mahsulotning qo‘llanish sohasi avval aniqlanadi: texnik detal, qadoq, qurilish buyumi yoki boshqa mahsulot uchun talablar turlicha bo‘lishi mumkin. Oziq-ovqat yoki tibbiyotga oid maxsus talablar tegishli mahsulot mavjudligi tasdiqlangandagina baholashga kiritiladi.

Har bir jarayon uchun kirish ma’lumoti, chiqish talabi, ehtimoliy nomuvofiqlik, uning sababi, iste’molchi yoki keyingi operatsiyaga ta’siri va mavjud nazorat dalili belgilanadi. Nuqsonning ko‘rinishi uning sababi bilan tenglashtirilmaydi. Masalan, buyumdagi pufakcha bitta sababning isboti emas;

xomashyo tayyorlash, gaz chiqarish va shakllantirish sharoiti alohida tekshiriladi. BASFning texnik qo‘llanmasi bosim ostida quyishdagi nuqsonlarni diagnostika qilish uchun boshlang‘ich manba bo‘la oladi, lekin undagi tavsiyalar korxonaning barcha polimerlari va texnologiyalariga avtomatik tatbiq etilmaydi [6].

Taklif etilgan FMEA shkalasida S — oqibat og‘irligi, O — sodir bo‘lish darajasi, D — nomuvofiqlikning jo‘natishdan oldin aniqlanmay qolish darajasi. Har biri 1 dan 5 gacha baholanadi; D oshishi aniqlash ishonchliligi pasayishini anglatadi. Ballar tartibli toifalar bo‘lib, ularning ko‘paytmasi statistik ehtimol yoki puldagi zarar hisoblanmaydi. Baholash chegaralari mualliflar tomonidan model uchun taklif etilgan va xalqaro standartning majburiy sonli talabi emas.

1-jadval. Taklif etilgan baholash shkalasining tayanch mezonlari

Ball	S — oqibat	O — takrorlanish dalili	D — aniqlash holati
1	Talabga ta’siri juda kichik	Tegishli davrda kam uchraydi	Tasdiqlangan nazorat bilan aniqlash deyarli kafolatlangan
3	Qayta ishlash yoki funksional cheklanish	Bir necha partiyada takrorlanadi	Namuna nazorati mavjud, qamrov cheklangan
5	Xavfsizlik yoki majburiy talab buzilishi	Ko‘p partiyada muntazam takrorlanadi	Nazorat yo‘q yoki uning samarasi tasdiqlanmagan

Shkalaning 2 va 4 ballari tegishli qo‘shni tayanch holatlar orasidagi baho sifatida beriladi. Amaliy qo‘llashdan oldin O toifalari aniq kuzatuv davri va ishlab chiqarish hajmiga nisbatan chegaralanadi. D uchun aniqlash qobiliyati etalon namuna, sinov natijasi yoki o‘lchash tizimi tahlili bilan asoslanadi. Ma’lumot bo‘lmasa, O va D taxminiy ekanligi qayd etiladi va ishonchlilik past deb belgilanadi; dalilsiz ravishda eng qulay ball berilmaydi.

Xavf ustuvorligini dastlabki solishtirish uchun RPN = S × O × D hisoblanadi. 1–5 shkala bo‘yicha RPN 1 dan 125 gacha o‘zgaradi. Biroq bir xil RPN turli oqibatlarni yashirishi mumkin. Shu sababli ikki bosqichli qaror taklif etiladi: avval S = 5 holatlari alohida ko‘rib chiqiladi, keyin qolgan xavflar RPN, takrorlanish dalili va noaniqlik darajasi bo‘yicha tartiblanadi. S = 5 xavfida nazorat va muvofiqlik tasdiqlanmaguncha tegishli partiyani jo‘natishga ruxsat berilmaydi.

O‘lchash natijalarining ishonchliligi baholashning alohida sharti hisoblanadi. Buyum o‘lchami bo‘yicha talab chegaralari, o‘lchash usuli, asbobning yaroqliligi, operatorlar farqi va takroriy o‘lchash tarqalishi tekshiriladi. Zarur va qo‘llash mumkin bo‘lgan holatda xomashyo partiyasining eritma oqim ko‘rsatkichi ISO 1133-1:2022 usuli bo‘yicha tekshirilishi mumkin [5]. Sinov harorati va yuklamasi polimer hamda kelishilgan spetsifikatsiyaga muvofiq tanlanadi; barcha materiallarga bir xil rejim berilmaydi.

Natijalar

Tadqiqotning natijasi ishlab chiqarish samaradorligidagi o‘lchangan o‘zgarish emas, balki baholashning qayta qo‘llanadigan modeli hisoblanadi. U

uchta bog‘langan hujjatni nazarda tutadi: mahsulotning muhim sifat ko‘rsatkichlari ro‘yxati, jarayon bo‘yicha xavf reyestri va dalillarni yig‘ish varaqasi. Reyestrda partiya va mahsulot oilasiga oid identifikatorlar saqlanadi. Bu turli buyumlarning talablarini bitta o‘rtacha ball bilan aralashtirishning oldini olishga xizmat qiladi.

2-jadval. Texno-Innovator uchun aniqlashtiriladigan xavf reyestri namunasi

Jarayon	**Ehtimoliy nomuvofiqlik**	**Tekshiriladigan sabab**	**Talab qilinadigan dalil**
Xomashyo qabul qilish	Polimer markasi yoki partiyasi mos emas	Identifikatsiya va hujjat tekshiruvi uzilishi	Spetsifikatsiya, yetkazib beruvchi hujjati, partiya kodi
Tayyorlash	Aralashma tarkibi beqaror	Dozalash yoki qayta ishlangan xomashyo ulushi nazoratsiz	Retseptura, tortish yozuvi, ruxsat etilgan ulush
Shakllantirish	O‘lcham yoki tashqi ko‘rinish nomuvofiq	Rejim, qolip yoki sovitish holati	Sozlama versiyasi, o‘lchovlar, uskuna yozuvi
Sifat nazorati	Nuqsonli buyum qabul qilingan	Asbob yoki tanlash usuli yetarli emas	Asbob holati, usul tekshiruvi, namuna rejasi
Jo‘natish	Partiya yoki yorliq almashgan	Mahsulot va hujjat identifikatsiyasi uzilishi	Partiya kartasi, yorliq va jo‘natish solishtiruvi

Reyestrga xavf egasi, S/O/D ballari, baholash sanasi, dalil manbasi, bahoning ishonchliligi, choralar va qayta baholash sanasi qo‘shiladi. Har bir nomuvofiqlikka yagona kod beriladi. Bitta hodisada ikki xil oqibat bo‘lsa, ular alohida baholanadi; masalan, tashqi ko‘rinishdagi nuqson va foydalanishdagi funksional uzilish bir xil og‘irlikka ega deb olinmaydi.

Hisoblash algoritmini tekshirish uchun ikkita shartli xavf olindi. A holatida S = 5, O = 1, D = 2 bo‘lsa RPN = 10; B holatida S = 2, O = 4, D = 4 bo‘lsa RPN = 32. Oddiy RPN tartibi B ni yuqoriroq ko‘rsatadi. Taklif etilgan qarorda esa A jiddiy oqibat mezoni bo‘yicha avval tekshiriladi. Bu misol ball ko‘paytmasini yagona qaror mezoni sifatida qabul qilishning cheklanishini ko‘rsatadi; u korxonada aniqlangan ikki hodisa sifatida talqin qilinmaydi.

Noaniqlikni ko‘rsatish uchun baho oralig‘i ham qo‘llanishi mumkin. Shartli S = 4, O = 2–3 va D = 2–4 holatida RPN 16–48 oralig‘ida bo‘ladi. Keng oraliq aniq ustuvorlik borligini emas, qo‘shimcha ma’lumot zarurligini bildiradi. Bunday holatda kuzatuv davrini kengaytirish yoki aniqlash qobiliyatini tekshirish qarorning asosiy qismiga aylanadi. Oraliq ehtimollikning ishonch intervali emas, ekspert bahosi sezgirligini ko‘rsatish vositasidir.

Metodika uchun dalillarni to‘plash protokoli ham ishlab chiqildi. Dastlab bir xil mahsulot oilasi, xomashyo va uskuna chegarasi belgilanadi; so‘ng partiya bo‘yicha ishlab chiqarilgan miqdor, tekshirilgan miqdor va nomuvofiq buyumlar alohida qayd etiladi. Nuqson turlari, operator, smena va retseptura versiyasi

yoziladi. Tanlangan namunadagi nuqson ulushi kuzatilgan butun ishlab chiqarish ulushi bilan tenglashtirilmaydi. Ma’lumotlarning qamrovi va cheklanishi baholash hisobotida ko‘rsatiladi.

Muhokama

Taklif etilgan modelning asosiy afzalligi jarayon sababi, talab va nazorat dalilini yagona mantiqiy bog‘lanishda ko‘rsatishidir. Xavf ballini kamaytirish uchun nazoratni ko‘paytirish har doim ham yetarli bo‘lmaydi. Agar sabab xomashyo identifikatsiyasida bo‘lsa, yakuniy tashqi ko‘rinish nazorati uning barcha oqibatlarini aniqlay olmaydi. Shuning uchun qayta baholashda O yoki D ning qaysi dalil asosida o‘zgargani izohlanadi; oqibatning tabiati o‘zgarmagan bo‘lsa, S faqat choralar joriy etilgani sababli pasaytirilmaydi.

Mahsulot o‘lchamlarining tarqalishini tahlil qilishda jarayon barqarorligi va texnik talabga moslik ikki alohida masala hisoblanadi. NIST jarayon imkoniyatini baholashni barqaror jarayon natijalarini spetsifikatsiya bilan solishtirishga bog‘laydi [7]. Ushbu maqolada Cp yoki Cpk hisoblanmagan, chunki o‘lchov qatori va talab chegaralari yo‘q. Kelgusida bunday ko‘rsatkichlar hisoblanganda ma’lumot taqsimoti, tanlanma hajmi va o‘lchash tizimi xatosi asoslanishi kerak.

ISO 31000:2018 mustaqil sertifikatlash standarti sifatida qo‘llanmaydi [2]. Shu bois modelni joriy etish “ISO 31000 sertifikatini olish” deb talqin qilinmaydi. ISO 9001:2026 bo‘yicha muvofiqlikni baholash ham ushbu maqolaning o‘zi bilan tasdiqlanmaydi. Korxona tizimi va amaliyoti audit dalillari bilan tekshirilishi lozim. Standartning to‘liq matnini tahlil qilmasdan muayyan bandga majburiy sonli ball yoki chegarani nisbat berish asosli emas.

Tadqiqotning cheklanishi empirik kuzatuvlarning mavjud emasligidir. Korxona bo‘yicha xulosa chiqarish uchun mahsulot talablari, jarayon oqimi va mavjud nazoratlar joyida tasdiqlanishi kerak. Keyingi tekshiruvda ikki mutaxassisning mustaqil ballari solishtirilishi, kelishmovchilik sabablari qayd etilishi va yuqori ustuvor xavflar muhandislik dalillari bilan tekshirilishi taklif etiladi. Natijalarning amaliy qiymati reyestr to‘ldirilganidan keyin emas, boshqaruv qarori uchun dalillar yaxshilangani bilan baholanadi.

Xulosa

Plastmassa mahsulotlari sifat xavflarini baholash uchun xalqaro standartlarning vazifalarini ajratuvchi va mahsulot talablaridan boshlanuvchi metodika taklif etildi. Model xomashyo, texnologik jarayon, o‘lchash va jo‘natish bosqichlaridagi ehtimoliy nomuvofiqliklarni bir reyestrda bog‘laydi. Texno-Innovator uchun u dastlabki loyiha hisoblanadi va haqiqiy jarayonlar bo‘yicha aniqlashtirilishi lozim.

Ustuvorlashtirishda RPN bilan bir qatorda jiddiy oqibat va ma’lumot noaniqligini hisobga olish taklif etildi. Shartli hisoblar bir xil yoki past RPN og‘ir oqibatli xavfni yashirishi mumkinligini ko‘rsatdi. Natijalar nuqsonlarning real kamayishini isbotlamaydi, balki boshqaruv choralarini tanlash uchun tekshiriladigan asos yaratadi. Mazkur baholash modeli keyingi bosqichda nazorat rejasi, javobgarlik va iqtisodiy baholash bilan bog‘lanishi mumkin.

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Ibrohimov S.U.
doktorant
O‘zbekiston, Andijon
Ilmiy rahbar: Vasiyev H., texnika fanlari bo‘yicha falsafa doktori (PhD)
“Metrologiya va yengil sanoat” kafedrasi mudiri
Andijon davlat texnika instituti
O‘zbekiston, Andijon

PLASTMASSA MAHSULOTLARI ISHLAB CHIQARISHDA SIFAT XAVFLARINI BOSHQARISH TIZIMINI TAKOMILLASHTIRISH TEXNO-INNOVATOR UCHUN TASHKILIY VA IQTISODIY MODEL

Annotatsiya. Plastmassa mahsulotlari sifatiga doir xavflarni aniqlash ularni kamaytirishga qaratilgan boshqaruv qarorlari bilan davom ettirilishi zarur. Maqolaning maqsadi Texno-Innovator uchun xavf bahosini nazorat rejasi, mas’uliyat va iqtisodiy mezonlar bilan bog‘lovchi tizim modelini ishlab chiqishdir. Jarayonlarni loyihalash, mas’uliyat taqsimoti, statistik monitoring va ssenariyli iqtisodiy hisoblash usullari qo‘llandi. Natijada xavf reyestridan partiya bo‘yicha qaror, tuzatuvchi harakat va samaradorlikni qayta tekshirishgacha bo‘lgan boshqaruv tartibi taklif etildi. Empirik ma’lumotlar mavjud emasligi sababli joriy etish bosqichlari tavsiya, iqtisodiy hisoblar esa shartli ssenariy sifatida berildi.

Kalit so‘zlar: sifat menejmenti, xavfni boshqarish, xalqaro standartlar, plastmassa mahsulotlari, statistik nazorat, sifat xarajatlari, iqtisodiy samaradorlik.

Ibrohimov S.U.
doctoral student
Uzbekistan, Andijan
Scientific supervisor: Vasiyev H., PhD in Technical Sciences
head of the Department of Metrology and Light Industry
Andijan State Technical Institute
Uzbekistan, Andijan

IMPROVING THE QUALITY RISK MANAGEMENT SYSTEM IN PLASTICS MANUFACTURING AN ORGANIZATIONAL AND ECONOMIC MODEL FOR TEXNO-INNOVATOR

Abstract. Identifying quality risks in plastics manufacturing must be followed by management decisions aimed at reducing them. This article develops a system model linking risk assessment to control plans, responsibility and economic criteria for Texno-Innovator. Process design, responsibility allocation, statistical monitoring and scenario-based economic calculations are applied. The resulting model connects the risk register with batch disposition, corrective action and verification of effectiveness. Because empirical enterprise data are unavailable,

implementation stages are proposals and financial calculations represent illustrative scenarios.

Keywords: quality management, risk management, international standards, plastic products, statistical control, quality costs, economic effectiveness.

Kirish

Sifat xavflarini baholash natijalari kundalik ishlab chiqarish qarorlariga kiritilmasa, xavf reyestri rasmiy hujjat bo‘lib qoladi. Plastmassa buyumlar ishlab chiqarishda nazorat nuqtasining mavjudligi bilan boshqaruvning samarali ishlashi bir xil tushuncha emas. Muhim og‘ish kim tomonidan ko‘rib chiqilishi, partiya qachon ajratilishi, jarayon qaysi shart bilan qayta ishga tushirilishi va choraning foydasi qanday tekshirilishi oldindan belgilanishi kerak.

ISO 9001:2026 sifat menejmenti, yetakchilik va doimiy takomillashtirishni bog‘laydigan umumiy asos bo‘lib xizmat qiladi; yangi nashrda xavflar va imkoniyatlarning alohida ko‘rib chiqilishiga e’tibor kuchaytirilgan [1]. ISO 31000:2018 xavfni tashkilot qarorlariga integratsiya qilish uchun yo‘nalish beradi [2]. Ushbu maqoladagi hujjatlar, muddatlar va boshqaruv rollari mualliflar taklifi bo‘lib, standartlarning so‘zma-so‘z talablari sifatida berilmaydi.

Tadqiqot Texno-Innovator uchun loyihalanayotgan sifat xavflarini boshqarish tizimiga qaratilgan. U xavfni baholashdan foydalanish bosqichini ochib beradi: aniqlangan ustuvorliklar nazorat rejasi, mas’ul shaxs va resurs ajratish bilan bog‘lanadi. Birinchi yo‘nalishdagi baholash metodikasi xavfning qanchalik ustuvorligini aniqlasa, ushbu ish boshqaruv amali, ijro dalili va iqtisodiy natijani qanday tekshirishga e’tibor qaratadi.

Maqola korxonada audit o‘tkazilgani yoki yangi tizim joriy etilganini da’vo qilmaydi. Texno-Innovatorning ishlab chiqarish hajmi, brak darajasi, xarajatlari va nazorat amaliyoti haqida tekshirilgan ma’lumotlar taqdim etilmagan. Maqsad — bunday ma’lumotlar yig‘ilgach sinab ko‘riladigan tashkiliy va iqtisodiy model yaratish. Uslubiy hissa xavf ustuvorligini partiya taqdiri, choralar samaradorligi va qo‘shimcha xarajatlar bilan bitta qaror tartibida bog‘lashdir.

Tadqiqot metodlari

Tadqiqotda tizimni loyihalash, sabab va natija bog‘lanishini tahlil qilish, boshqaruv rollarini taqsimlash va ssenariyli hisoblash qo‘llanildi. Modelning kirish ma’lumoti xavf reyestridagi mahsulot talabi, ehtimoliy nomuvofiqlik, oqibat, xavf egasi va baholash dalilidir. Chiqish ma’lumoti esa nazorat rejasi, qaror vakolati, tuzatuvchi harakat yozuvi va qayta baholash natijasidan iborat. FMEA bilan tuzilgan reyestr bu jarayonning yordamchi vositasidir [3, 4].

Boshqaruv tartibi rejalashtirish, bajarish, tekshirish va takomillashtirish sikli asosida loyihalandi. Rejalashtirishda muhim sifat ko‘rsatkichlari hamda qabul mezonlari belgilanadi. Bajarishda jarayon sozlamalari va nazorat yozuvlari saqlanadi. Tekshirishda mahsulot muvofiqligi, jarayon signallari va choralar ijrosi tahlil qilinadi. Takomillashtirishda sababga ta’sir qiluvchi harakatlar amalga oshirilib, ularning samarasi belgilangan davr va ma’lumot hajmida tekshiriladi.

Statistik monitoring uchun ko‘rsatkichning turi va ma’lumot shakliga mos karta tanlash taklif etiladi. Uzluksiz o‘lchovlarda mantiqan bir xil sharoitdagi kichik guruhlar bo‘yicha o‘rtacha va tarqalish kuzatilishi mumkin [8]. Turli mahsulot, qolip uyasi yoki polimer markalarini bitta umumiy qatorga aralashtirish mumkin emas. Jarayonning statistik nazorat chegaralari mahsulotning texnik ruxsat chegaralaridan alohida belgilanadi.

Natijalar

Tadqiqot natijasida beshta bog‘langan elementdan iborat model taklif etildi: xavf reyestri, nazorat rejasi, partiya kuzatuvchanligi, tuzatuvchi harakatlar va rahbariyat tahlili. Har bir element keyingi qaror uchun ma’lumot beradi. Reyestr ustuvorlikni ko‘rsatadi; nazorat rejasi dalil yaratadi; partiya kodi ta’sirlangan mahsulotni chegaralaydi; tuzatuvchi harakat sababni bartaraf etishga qaratiladi; rahbariyat tahlili esa resurs va ustuvorlikni yangilaydi.

1-jadval. Taklif etilgan boshqaruv rollari va qaror dalillari

Vazifa	Mas’ul rol	Qaror va saqlanadigan dalil
Mahsulot talabini tasdiqlash	Texnolog va sifat bo‘yicha mas’ul	Amaldagi spetsifikatsiya, qabul mezonlari
Jarayonni bajarish	Ishlab chiqarish bo‘yicha mas’ul	Tasdiqlangan sozlama, operator va smena yozuvi
O‘lchashni boshqarish	Metrologiya vazifasini bajaruvchi rol	Asbob holati, usul va o‘lchash yozuvi
Partiyani qabul qilish yoki ajratish	Vakolatli sifat bo‘yicha mas’ul	Sinov natijasi va partiya bo‘yicha qaror
Tuzatuvchi harakat	Jarayon egasi	Sabab tahlili, amalga oshirilgan chora, tekshiruv
Resurs va ustuvorlik	Rahbariyat	Xarajat, xavf va samaradorlik tahlili

Jadvalda lavozim nomlari emas, zarur funksiyalar berilgan. Korxonada alohida metrologiya bo‘limi bo‘lmasa, ushbu vazifa vakolati va malakasi aniqlangan xodimga biriktirilishi mumkin. Ishlab chiqarishning bajarilishi va partiyani chiqarishga ruxsat berish vakolati aniq ajratiladi. Xavfsizlik yoki majburiy talabga ta’sir qiluvchi nomuvofiqlikda muvofiqlik tasdiqlanmaguncha vakolatli qarorsiz jo‘natish amalga oshirilmaydi.

Nazorat rejasi har bir muhim ko‘rsatkich uchun mahsulot yoki jarayon chegarasi, usul, namuna olish tartibi, mas’ul rol va og‘ishga javobni belgilaydi. O‘lcham va massa kabi ko‘rsatkichlar buyumning tasdiqlangan chizmasi yoki spetsifikatsiyasidan olinadi. Xomashyoning eritma oqimi tekshirilsa, ISO 1133-1:2022 bo‘yicha usulning mosligi ko‘rib chiqiladi [5]. Namuna olish hajmi va chastotasi ushbu maqolada bir xil son bilan belgilanmaydi: ular xavf, jarayon barqarorligi, buyurtmachi talabi va nazorat imkoniyatiga asoslanishi kerak.

2-jadval. Nazorat rejasi uchun javob algoritmi

Signal	Dastlabki harakat	Qayta ishga tushirish sharti
Texnik talabdan chetga chiqish	Ta’sirlangan partiyani ajratish va chegarasini aniqlash	Muvofiq mahsulot olish va qarorni hujjatlashtirish
Statistik nazorat signali	O‘lchashni tasdiqlash, maxsus sababni tekshirish	Sabab izohi, jarayon holatini qayta tekshirish
O‘lchash vositasi yaroqsiz	Natijalarni qayta ko‘rish, tegishli mahsulotni ushlab turish	Yaroqli usul bilan qayta o‘lchash va partiya qarori
Partiya kodi uzilgan	Jo‘natishni ushlab turish, identifikatsiyani tiklash	Kuzatuvchanlik va mahsulot holati tasdiqlanishi

Raqamli kuzatuvchanlik minimal yozuvlardan boshlanadi: mahsulot kodi, xomashyo partiyasi, ishlab chiqarish partiyasi, uskuna, sozlama versiyasi, operator, o‘lchash natijasi va yakuniy qaror. Elektron jadvaldan foydalanish mumkin, biroq yozuvni o‘zgartirish huquqi, versiya tarixi va zaxira nusxasi belgilanadi. Dastur xarid qilishning o‘zi kuzatuvchanlik mavjudligini isbotlamaydi; tanlangan jo‘natma uchun xomashyo va nazorat daliliga qaytish amalda tekshiriladi.

Nomuvofiqlik aniqlanganda dastlab oqibat cheklanadi: mahsulot ajratiladi, ta’sirlangan vaqt oralig‘i aniqlanadi va qayta tekshiriladi. Keyin sabab tahlili o‘tkaziladi. Polimer buyumidagi nuqson ko‘rinishi sabab haqida boshlang‘ich ma’lumot beradi; masalan, BASF qo‘llanmasidagi diagnostika yo‘nalishlari mos texnologiyada tekshirishni rejalashtirishga yordam berishi mumkin [6]. Uskunani sozlash, xomashyo tayyorlash yoki nazorat usulini o‘zgartirish haqidagi qaror korxonaning dalili bilan asoslanadi.

Tuzatuvchi harakat yopilgan deb hisoblanishi uchun “xodimga tushuntirildi” yoki “uskuna sozlandi” yozuvi yetarli emas. Qaysi sababga qanday chora ta’sir qilgani va qayta kuzatuvda qanday natija olingani ko‘rsatiladi. Bajarilgan harakat bilan samarali harakat alohida qayd etiladi. Xavf reyestridagi ballni o‘zgartirish faqat ushbu qayta tekshiruv dalillari bilan amalga oshiriladi.

Samaradorlikni o‘lchash va iqtisodiy ssenariy

Taklif etilgan kuzatuv ko‘rsatkichlari bir xil hisoblash chegarasiga ega bo‘lishi kerak. Nomuvofiq buyumlar ulushi $q = n / N \times 100\%$ orqali hisoblanadi, bu yerda n — nomuvofiq deb topilgan buyumlar, N — aynan shu qamrovdagi tekshirilgan buyumlar soni. Birinchi urinishda qabul qilingan buyumlar ulushi $FPY = N_1 / N_0 \times 100\%$ bo‘lib, N_1 — qayta ishlashsiz qabul qilingan, N_0 — hisoblash chegarasiga kirgan jami buyumlardir. Bitta buyumdagi bir nechta nuqson soni nomuvofiq buyumlar soniga teng emas.

Jarayon barqarorligi asoslangandan keyin o‘lcham ko‘rsatkichi uchun $Cpk = \min[(USL - \mu)/(3\sigma), (\mu - LSL)/(3\sigma)]$ qo‘llanishi mumkin [7]. USL va LSL texnik talab chegaralari, μ jarayon o‘rtachasi, σ esa maqsadga mos baholangan tarqalish ko‘rsatkichidir. Ushbu ko‘rsatkich taqsimot va tanlanma shartlarini tekshirishni

talab qiladi. Cpk qabul chegarasi korxona yoki buyurtmachi talabidan olinadi; maqolada biror son barcha plastmassa mahsulotlari uchun majburiy deb belgilanmaydi.

Iqtisodiy modelda oldini olish xarajatlari, baholash xarajatlari hamda ichki va tashqi nomuvofiqlik xarajatlari ajratiladi. Faqat brak narxini hisoblash nazorat va qayta tekshirishga sarflangan resurslarni yashirishi mumkin. Shu bilan birga, xomashyoni qayta ishlatishdan olinadigan qiymat yo‘qotilgan mahsulot xarajatidan chegirilishi kerak. Sifat xarajatlari kamayishi bilan tushumning o‘sishi bir xil natija emas; qo‘shimcha savdo mustaqil asos bo‘lmasa, tejamga qo‘shilmaydi.

Hisoblash usulini ko‘rsatish uchun quyidagi shartli ssenariy olindi. Oylik hajm Q = 100 000 dona, boshlang‘ich nomuvofiqlik ulushi $q_0 = 0{,}04$, rejalashtirilgan ulush $q_1 = 0{,}025$, bitta nomuvofiq buyum bo‘yicha sof yo‘qotish c = 4 000 so‘m, oylik qo‘shimcha nazorat xarajati $\Delta C = 2\,000\,000$ so‘m deb faraz qilindi. Dastlabki joriy etish sarfi I = 24 000 000 so‘m. Ushbu qiymatlar Texno-Innovatorning natijalari yoki tasdiqlangan prognozi emas.

Sof oylik tejam $E = Q \times (q_0 - q_1) \times c - \Delta C$. Berilgan shartlarda $E = 100\,000 \times (0{,}04 - 0{,}025) \times 4\,000 - 2\,000\,000 = 4\,000\,000$ so‘m/oy. Oddiy qoplanish muddati $T = I / E = 6$ oy. Bu hisob vaqt qiymati, soliq, hajm o‘zgarishi va joriy etish davridagi tejam kechikishini qamramaydi. Shu sababli u investitsiya qarori uchun yakuniy biznes bahosi sifatida qo‘llanmaydi.

3-jadval. Shartli iqtisodiy ssenariyning nuqson ulushiga sezgirligi

q_1	Oldi olingan yo‘qotish so‘m/oy	Sof tejam so‘m/oy	Oddiy qoplanish
3,5%	2 000 000	0	Sof tejam yo‘q
3,0%	4 000 000	2 000 000	12 oy
2,5%	6 000 000	4 000 000	6 oy
2,0%	8 000 000	6 000 000	4 oy

Sof tejam uchun zarur kamayish chegarasi $q_0 - q_1 > \Delta C / (Q \times c)$ orqali aniqlanadi. Misolda chegara 0,005, ya’ni 0,5 foiz punktdir; 4,0% dan 3,5% ga pasayish qo‘shimcha oylik xarajatni faqat qoplaydi. Mazkur ssenariy iqtisodiy natija maqsadli nuqson ulushiga sezgir ekanini ko‘rsatadi. Nomuvofiq mahsulotning sof yo‘qotish qiymati pasaysa yoki nazorat xarajati oshsa, qoplanish uzayadi.

Muhokama

Tizimni joriy etish kichik va tekshiriladigan pilotdan boshlanishi taklif etiladi. Birinchi bosqichda mahsulot oilasi va ma’lumot yig‘ish chegarasi aniqlanadi. Ikkinchi bosqichda mavjud nazorat hamda xavf reyestri solishtiriladi. Uchinchi bosqichda ustuvor xavflarga mos nazorat rejasi sinovdan o‘tkaziladi. To‘rtinchi bosqichda natijalar avvalgi davr bilan mahsulot turi, xomashyo va ishlab chiqarish hajmi farqlarini hisobga olgan holda baholanadi. Pilot davomiyligi ma’lumot yetarliligiga qarab belgilanadi.

Taqdim etiladigan natija faqat “brak kamaydi” degan umumiy jumla bilan cheklanmasligi kerak. Kuzatuv qamrovi, davri, taqqoslangan partiyalar va hisoblash usuli ko‘rsatiladi. Namuna miqdori oshgani sababli ko‘proq nuqson aniqlanishi sifat yomonlashganini avtomatik anglatmaydi. Xuddi shuningdek, nazorat kamaygach qayd etilgan nuqsonlar pasayishi yaxshilanish isboti emas. Ishonchli baholashda aniqlash tizimi va real mahsulot holatining o‘zgarishi farqlanadi.

Nazorat rejasi resurslardan oqilona foydalanishga yordam berishi mumkin, lekin iqtisodiy tejam xavfsizlik yoki majburiy mahsulot talabi o‘rnini bosmaydi. Jiddiy oqibatli xavfda eng arzon variantning tanlanishi faqat muvofiqlik saqlanishi isbotlanganda asosli bo‘ladi. Qolgan xavflarda nazorat chastotasi va usulining o‘zgarishi kuzatuv natijalari bilan tekshiriladi. Yangi imkoniyatlar, masalan, ishonchli kuzatuvchanlik orqali buyurtmachi talabiga yaxshiroq javob berish, xavf kamayishi hisobidan alohida baholanadi.

Modelning cheklanishi haqiqiy korxona ma’lumotlari va joriy etish kuzatuvlari yo‘qligidir. Taklif etilgan rollar, yozuvlar va ko‘rsatkichlar mahalliy sharoitga moslashtiriladi. Amaliy tekshiruv uchun ishlab chiqarilgan hamda tekshirilgan buyumlar soni, nuqsonlar tarkibi, asboblar holati, qayta ishlash xarajati va mijoz murojaatlari talab etiladi. Ma’lumotlar yetarli bo‘lgach, korxonadagi boshlang‘ich holat va pilot natijalari alohida empirik tadqiqotda tahlil qilinishi mumkin.

Xulosa

Texno-Innovator uchun sifat xavflarini baholash natijalarini nazorat rejasi, partiya qarori, tuzatuvchi harakatlar va rahbariyat tahliliga bog‘lovchi tizim modeli taklif etildi. Uning amaliy mazmuni har bir xavf uchun mas’ul rol, tekshiriladigan dalil va og‘ishga javob tartibini belgilashdan iborat. Model xalqaro standartlar bilan uyg‘unlashtiriladigan loyiha bo‘lib, korxonaning sertifikatlanganligi yoki tizim joriy etilganligini tasdiqlamaydi.

Shartli iqtisodiy hisob boshqaruv chorasi foydasini sof yo‘qotish va qo‘shimcha nazorat xarajatlari orqali tekshirish mumkinligini ko‘rsatdi. Misoldagi 6 oylik qoplanish korxona natijasi emas, tanlangan farazlarga bog‘liq qiymatdir. Amaliy samaradorlik mahsulot muvofiqligi va kuzatuvchanlik bilan birga baholanishi kerak. Shu tariqa xavfni baholashdan boshlangan tadqiqot boshqaruv qarori va uning natijasini tekshirish metodikasi bilan davom ettirildi.

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Ilxomiddinova M.O.
talaba
Umarova D.R.
“Menejment, marketing va turizm” kafedrasi dotsenti
Toshkent davlat transport universiteti
O‘zbekiston, Toshkent

O’ZBEKISTON BARQAROR TURIZM TIZIMIDA EKOTURIZMNING O’RNI VA RIVOJLANISH ISTIQBOLLARI

Annotatsiya. Ushbu maqolada O’zbekistondagi ekoturizmning hozirgi holati va uni rivojlantirish istiqbollari tahlil qilinadi . Tadqiqotning maqsadi ekoturizmning barqaror turizm tizimidagi o’rni, mavjud muammolar va kelajakdagi rivojlanish yo’nalishlarini aniqlashdan iborat. Tadqiqot jaroyonida tahlil, taqqoslash va statistik ma’lumotlarni o’rganish metodlaridan foydalanildi.

Kalit so‘zlar: Ekoturizm, barqaror rivojlanish, ekologiya, tabiiy resurslar, infratuzilma, investitsiya.

Ilkhomiddinova M.O.
student
Umarova D.R.
associate professor, Department of Management, Marketing, and Tourism
Tashkent State Transport University
Uzbekistan, Tashkent

THE ROLE AND DEVELOPMENT PROSPECTS OF ECOTOURISM WITHIN UZBEKISTAN’S SUSTAINABLE TOURISM SYSTEM

Abstract. This article analyzes the current state of ecotourism in Uzbekistan and its development prospects. The study examines the role of ecotourism in the sustainable tourism system, exiting challanges, and future directions. Methods of analysis, comparison, and statistical data study were applied.

Keywords: Ecotourism,sustainable development, ecology, natural resources, infrastructure , investment.

So’ngi yillarda turizm sohasi jadal rivojlanib, global iqtisodiyotning muhim tarmoqlaridan biriga aylanib bormoqda. Biroq ommaviy turizmning kengayishi atrof – muhitga salbiy ta’sir ko’rsatib, tabiiy resurslarning kamayishiga olib kelmoqda. Ushbu zamonaviy muammolarni hisobga olgan holda, “inson – tabiat “ tizimidagi munosabatlarni uyg’unlashtirishga imkon beradigan rivojlanishning ustuvor yo’nalishlaridan biri – bu ekoturizm hisoblanadi. Ekoturizm (ecological tourism) – bu tabiatga zarar yetkazmasdan sayohat qilish, ekologik muhitni asrash va mahalliy aholining ijtimoiy - iqtisodiy rivojlanishini qo’llab – quvvatlashga yo’naltirilgan turizm shaklidir. U nafaqat dam olish, balki ekologik tarbiya va

madaniyatni shakllantirish vositasi ham hisoblanadi.Ommaviy turizmdan farqli o'laroq, ekoturizm tabiiy muhitga minimal zarar yetkazadi, mahalliy aholi bandligini ta'minlaydi va tabiatni muhofaza qilish fondlarini moliyalashtirishga yordam beradi. O'zbekiston Respublikasi Markziy Osiyo hududidagi davlatlar orasida ekologik turizmni rivojlantirish bo'yicha katta imkoniyatlarga ega bo'lgan va bu borada raqobatbardoshligi yuqori bo'lgan mamlakatlardan biri hisoblanadi. Yuksak to'g' cho'qqilari, uch ming yillik insoniyat tamadduniga guvoh shaharlari, cho'l va yashil vodiylar, zilol tog' suv manbalari ushbu sohani rivojlantirish uchun ulkan imkoniyatlar yaratib beradi.

Ekoturizm barqaror turizm tizimining muhim yo'nalishi sifatida xalqaro ilmiy adabiyotlarda keng o'rganilgan. Buckley (2009) ekoturizmning iqtisodiy va ekologik ta'sirini tahlil qilib, uni barqaror turizm tizimining asosi sifatida belgilagan. Wearing va Neil (2009) esa ekoturizmning mahalliy jamoalar uchun ijtimoiy – iqtisodiy ahamiyatini ko'rsatgan. UNWTO (2023) ma'lumotlariga ko'ra, ekoturizm global turizm bozorida eng tez o'sayotgan segment bo'lib, yillik o'sish sur'ati 16,1 foizni tashkil etmoqda (TIES, 2024).

O'zbekistonda ekoturizmni rivojlantirish bo'yicha davlat tomonidan ham qator chora – tadbirlar amalga oshirilmoqda. Xususan, O'zbekiston Respublikasi Prezidenti Shavkat Mirziyoyevning 2024 – yil 12 – yanvardagi **PQ – 21 – sonli "O'zbekiston Respublikasida ekologik turizmni jadal rivojlantirish chora-tadbirlari to'g'risida" gi qarori[1]ga** asosan**,** ekoturizm sohasini rivojlantirishdagi muhim hujjatlardan biri hisoblanadi.Ushbu qaror birinchi marta ekoturizmni mustaqil huquqiy soha sifatida belgilab berdi – farmondan avval ekoturizm umumiy turizm qonunchiligi doirasida ko'rib chiqilar edi.Mazkur qarorga ko'ra, davlat qo'riqxonalari, milliy tabiat bog'lari, biosfera rezervatlari va tog'li hududlarda turistik klasterlarni tashkil etish, " Tabiatga sayohat " elektron platformasini yaratish vazifalari belgilangan (PQ – 21,2024).

O'zbekiston Respublikasi Prezidenti Shavkat Mirziyoyevning 2025 – yil dekabr oyidagi **Oliy Majlisga Murojaatnomasida ekologiya va "yashil iqtisodiyot [2]"** masalalariga alohida e'tibor qaratildi. Murojaatnomada 2026-yil barcha sohalarda, jumladan ekologiya tizimini rivojlantirishda tub burilish yili bo'lishi ta'kidlandi. Xususan, ekologiya sohasiga 2026 - yilda 1 trillion 900 milliard so'm yo'naltirilishi belgilandi (Mirziyoyev, 2025). Bundan tashqari, so'nggi besh yilda 6 ming megavattli quyosh, shamol va gidroelektr stansiyalari ishga tushirilgani, umumiy generatsiyada "yashil" energiyaning ulushi 30 foizga yetgani qayd etildi. Ushbu mablag'lar va "yashil energiya" siyosati bevosita ekoturizmni rivojlantirish uchun ham muhim asos yaratadi — ekologik barqarorlik va tabiiy hududlarni muhofaza qilish ekoturizmning asosiy tamoyillaridan biri hisoblanadi.

[1] O'zbekiston Respublikasi Prezidenti Shavkat Mirziyoyevning 2024 – yil 12 – yanvardagi PQ – 21 – sonli "O'zbekiston Respublikasida ekologik turizmni jadal rivojlantirish chora-tadbirlari to'g'risida" gi qarori

[2] O'zbekiston Respublikasi Prezidenti Shavkat Mirziyoyevning 2025 – yil dekabr oyidagi Oliy Majlisga Murojaatnomasida ekologiya va "yashil iqtisodiyot"

Shu sababli mazkur tadqiqotning maqsadi O'zbekistonda ekoturizmning barqaror turizm tizimidagi o'rnini tahlil qilishdan iborat.

Ushbu tadqiqotni amalga oshirishda kompleks ilmiy yondashuv qo'llanildi. Asosiy metodlar sifatida tahlil (analytical method), taqqoslash (comparative method), statistik ma'lumotlarni o'rganish va tizimli yondashuv (system approach) tanlandi.Tizimli yondashuv tanlangani sababi – ekoturizm bir vaqtda iqtisodiy, ekologik va ijtimoiy jihatlarni o'z ichiga oladi . Taqqoslash metodi esa O'zbekiston ko'rsatkichlarini xalqaro tendensiyalar bilan solishtirish imkonini beradi. Tadqiqot 2021 – 2026 – yillar davridagi ma'lumotlarni qamrab oladi. Manbalar sifatida O'zbekiston Respublikasi Statistika qo'mitasining rasmiy hisobotlari (stat.uz), Turizm qo'mitasining statistik ma'lumotlari, Butunjahon turizm tashkilotlari (UNWTO) hisobotlari, PQ -21 va PF – 102 qaror – farmonlari hamda Buckley (2009), Wearing va Neil (2009), TIES(2024) kabi xalqaro ilmiy nashrlar ishlatildi. Tadqiqot jarayonida ekoturizmning infratuzilma rivojlanishi, turistlar oqimi, mahalliy iqtisodiyot va ekologik ta'sir kabi to'rtta asosiy sohadagi ta'siri alohida tahlil qilindi. Ekoturizmning umumiy turizmdan ulushini aniqlashda milliy bog'lar, tog' hududlari va Orol dengizi hududlariga tashriflar bo'yicha mavjud ma'lumotlardan foydalanildi. Tadqiqot cheklovlari sifatida ekoturizmga oid alohida rasmiy statistikaning hali to'liq shakllanmaganligini ta'kidlash lozim.

Tadqiqot natijalari shuni ko'rsatadiki, O'zbekistonda ekoturizmni rivojlantirish uchun katta tabiiy salohiyat mavjud. Mamlakat hududidagi asosiy ekoturizm ob'ektlari: Ugam-Chatkal milliy tabiat bog'i, Zomin milliy tabiat bog'i, Nurota-Qizilqum biosfera rezervati, Hisor va Zarafshon tog' tizimlari hamda Orol dengizi hududi. Ushbu hududlar tabiiy landshaftlarning xilma – xilligi , boy flora va fauna bilan turistlarni jalb qiladi.

1-jadval

O'zbekistonning asosiy ekoturizm xududlari

№	Hudud	Turi	Maydoni (ga)	Asosiy xususiyati
1.	Ugam-Chatkal	Milliy bog'	574 000	Tog', flora xilma-xiligi
2.	Zomin	Milliy bog'	26 900	Archa o'rmonlari
3.	Nurota-Qizilqum	Biosfera rezervati	168 000	Cho'l ekotizimi
4.	Hisor	Davlat qo'riqxonasi	80 986	Tog' landshafti
5.	Zarafshon	Milliy bog'	2 426	Buxoro bug'usi
6.	Orol dengizi	Ekoturizm zonasi	-	Noyob cho'l landshafti
7.	Quyi Amudaryo	Biosfer rezervati	68 717	Daryo deltasi, suv qushlari
8.	Surxon	Davlat qo'riqxonasi	23 522	Subtropik o'simliklar

Jadvaldan ko'rinib turibdiki, O'zbekistonda ekoturizm uchun mo'ljallangan hududlarning umumiy maydoni 944 000 gektardan oshadi. Bu hududlarning xilma-

xilligi — tog'dan cho'lgacha, archa o'rmonlaridan daryo deltasigacha — turli turistik segmentlarga xizmat qila olishini ko'rsatadi.

Umumiy turizm ko’rsatkichlari jihatidan 2025-yilda O’zbekistonga tashrif buyurgan xorijiy turistlar soni 11,7 million kishini tashkil etgan bo’lib, bu 2024 – yilga nisbatan 46,8 foizga ko’pdir.

2-jadval

O'zbekistonga tashrif buyurgan turistlar soni va turizm daromadi dinamikasi (2021–2025)

Yil	Turistlar soni	O’sish (%)	Turizm daromadi	Turistga to’gri keladigan o’rtacha harajat
2021	1 900 000	-	0,8mlrd$	~421$
2022	5 230 000	+175%	1,4mlrd$	~268$
2023	6 630 000	+27%	2,14mlrd$	~323$
2024	7 900 000	+19%	3,1mlrd$	~392$
2025	11 700 000	+46,8%	4,7mlrd$	~402$

Bu jadval ma'lumotlari bir qancha muhim tendensiyalarni ko'rsatmoqda. Birinchidan, 2021–2025-yillar oralig'ida turistlar soni 6 barobardan ziyod o'sdi — bu O'zbekiston turizmining pandemiyadan nafaqat tiklangani, balki yangi bosqichga o'tganini isbotlaydi. Ikkinchidan, turistga to'g'ri keladigan o'rtacha xarajat 2022-yildagi 268 dollardan 2025-yilda 402 dollarga ko'tarildi — bu sayyohlar sifatining va xizmat darajasining oshib borayotganini ko'rsatadi. 2017-yilga nisbatan esa bu ko'rsatkich 2 barobardan ziyod o'sgan (197 dollardan 402 dollarga).Butunjahon turizm tashkiloti ma'lumotlariga ko'ra, O'zbekiston 2025-yilning yanvar–sentabr oylarida xorijiy sayyohlarni jalb qilish bo'yicha dunyo bo'yicha eng yuqori o'sish qayd etilgan top-20 davlat qatoriga kirdi, 2019-yilga nisbatan o'sish 73 foizni tashkil etdi (UNWTO, 2025).

Ekoturizm ulushi jihatidan mamlakatga tashrif buyurayotgan turistlarning taxminan 10–15 foizi tabiat va ekoturizm ob'ektlariga qiziqish bildiradi, ya'ni 2025-yil ko'rsatkichiga asosan bu taxminan 1,2–1,8 million kishini tashkil etadi. Ushbu ulush milliy bog'lar, tog' marshrutlari va Orol dengizi hududlariga tashriflar asosida baholangan bo'lib, ekoturizmga oid alohida rasmiy statistika mavjud emasligi sababli ko'rsatkich taxminiy hisoblanadi.

3-jadval

2025-yilda O’zbekistonga tashrif buyurgan xorijiy turistlar (mamlakatlar kesimida)

№	Davlat	Turistlar soni	Ulushi (%)
1	Qirg’iziston	3,300,000	28,2%
2	Tojikiston	2,700,000	23,1%
3	Qozog’iston	2,700,000	23,1%
4	Rossiya	984,400	8,4%
5	Afg’oniston	476,700	4,1%
6	Turkmaniston	360,000	3,1%
7	Xitoy	280,000	2,4%
8	Turkiya	170,000	1,5%
9	Hindiston	80,000	0,7%
10	Janubiy Koreya	46,300	0,4%
11	Boshqalar	602,600	5,2%
	Jami	**11,700,000**	**100%**

Jadvaldan ko’rinib turibdiki, O’zbekistonga tashrif buyuruvchi turistlarning 74,4 foizi qo’shni uch davlatdan — Qirg’iziston, Tojikiston va Qozog’istondan kelmoqda. Bu ko'rsatkich qisqa masofali, arzon ekoturizmga talab borligini ko'rsatadi — qo'shni mamlakatlar aholisi aynan tabiat, tog' va tabiiy hududlarga sayohatni afzal ko'radi. Binobarin, ekoturizm infratuzilmasini rivojlantirish birinchi navbatda mintaqaviy bozorga xizmat qiladi. Ekoturizm infratuzilmasini rivojlantirish uchun 2030-yilgacha 500 million AQSh dollari miqdorida investitsiya jalb etish rejalashtirilgan bo’lib, bu mablag’lar ekologik mehmonxonalar, transport tizimi, turistik marshrutlar va xizmat ko’rsatish ob’ektlarini rivojlantirishga yo’naltiriladi. Natijada turizm infratuzilmasining yaxshilanishi turistlar sonini yanada oshiradi. Umuman olganda, olingan natijalar ekoturizm O‘zbekistonda barqaror turizm rivojlanishining muhim yo‘nalishlaridan biri ekanini ko‘rsatadi. Turistlar sonining oshishi, investitsiyalarning ko‘payishi va yangi ish o‘rinlarining yaratilishi ekoturizmning iqtisodiy, ijtimoiy hamda ekologik jihatdan katta salohiyatga ega ekanini tasdiqlaydi. Shu sababli kelajakda ekoturizmni rivojlantirishda ekologik muhofaza, zamonaviy infratuzilma va mahalliy aholi manfaatlarini uyg‘unlashtirish muhim ahamiyat kasb etadi .

Olingan natijalar ekoturizmning O’zbekistonda isteqbolli, ammo hali to’liq shakllanmagan turizm yo’nalishi ekanligini ko’rsatatdi. Eng muhim topilma – ekoturizmga oid rasmiy statistikaning alohida yuritilmasligi. Bu nafaqat tadqiqotchilar uchun to’siq, balki davlat siyosatini aniq maqsadlarga yo’naltirish imkoniyatini ham cheklaydi. O’zbekistonda ekoturizmni rivojlantirish uchun kuchli huquqiy – me’yoriy baza shallangan.

4-jadval

O’zbekistonda ekoturizmga oid asosiy huquqiy-me’yoriy hujjatlar (2022-2024)

Hujjat	Sana	Asosiy vazifa
PQ-232-son	30.04.2022	Ekologik turizm turlarini diversifikatsiya qilish
PQ-135-son	26.04.2023	Turizm salohiyatini jadal rivojlantirish
PF-81-son	31.05.2023	Ekologiya sohasini transformatsiya qilish
PQ-238 son	27.07.2023	Turizm islohotlarini jadallashtirish
PQ-21-son	**12.01.2024**	**Ekologik turizmni jadal rivojlantirish**
PF-9-son	12.01.2024	Turistlar oqimini keskin oshirish
PF-102-son	18.07.2024	Turizm infratuzilmasini yaxshilash

Ushbu jadvaldan ko'rinib turibdiki, 2022–2024 – yillar mobaynida ekoturizmga bevosita yoki bilvosita aloqador 7 ta muhim hujjat qabul qilingan — ya'ni deyarli har yarim yilda bir yangi qaror yoki farmon. Bu davlat e'tiborining ushbu sohadagi izchilligini va ortib borayotganini yaqqol ko'rsatadi. Ayniqsa, 2024-yil 12-yanvardagi PQ-21-son qarori — ekoturizmni birinchi marta mustaqil huquqiy soha sifatida belgilagan hujjat sifatida alohida ahamiyat kasb etadi. Xalqaro tajriba bilan taqqoslasak, Gruziya tajribasi shuni ko'rsatadiki, ekoturizmni alohida davlat dasturi sifatida ajratish va maxsus infratuzilma yaratish turistlar oqimini 3–4 yil ichida ikki barobar oshirgan (UNWTO, 2023). Tailand va Kosta-Rika misolida esa ekoturizm milliy daromadning 15–20 foizini tashkil etadi — O'zbekistondagi hozirgi 10–15 foizlik ulush ushbu mamlakatlar tajribasini o'rganish orqali sezilarli oshirilishi mumkin. Shunday qilib, O'zbekiston ekoturizmda hali rivojlanishining dastlabki bosqichida tursa-da, xalqaro tajriba va mavjud huquqiy baza tez sur'atli o'sish imkoniyatini tasdiqlamoqda.

Ekoturizmni rivojlantirishda bir qator muammolar ham mavjud. Birinchidan, ekoturizm ob'ektlariga olib boruvchi yo'llar va transport infratuzilmasi hali yetarli darajada rivojlanmagan. Ikkinchidan, ekoturizmga ixtisoslashgan malakali mutaxassislar — gidlar, ekologlar va menejerlar — soni kam. Uchinchidan, mahalliy aholi bu sohadagi foyda va imkoniyatlardan hali to'liq xabardor emas.

SWOT tahlili

Kuchli tomonlar (strengths) : boy tabiiy salohiyat, 7 ta huquqiy hujjat, 11,7 mln turist oqimi	**Imkoniyatlar (opportunities)** : UNWTO o’sish trendi, 500 mln dollar investitsiya rejasi, mintaqaviy turizm talabi
Zaif tomonlar (weaknesses) : Infratuzilma yetishmasligi, malakali kadrlar tanqisligi, alohida statistika yo’qligi	**Tahdidlar (threats)** : Iqlim o’zgarishi, raqobatchi mamlakatlar (gruziya, Qo’zog’iston)

Biroq ijobiy tendensiyalar ham kuzatilmoqda. Investitsiya loyihalari amalga oshirilmoqda, vizasiz tartib 94 ta davlatga kengaytirilgan, xalqaro marketing faollashmoqda. Ekoturizm nafaqat iqtisodiy daromad manbai, balki tabiiy

resurslarni muhofaza qilish va ekologik madaniyatni oshirishga xizmat qiluvchi muhim soha sifatida tobora e'tirof etilmoqda.

Tadqiqot natijalari asosida quyidagi xulosalar chiqarildi. Avvalambor, O'zbekiston ekoturizmni rivojlantirish uchun yetarli tabiiy, madaniy va geografik salohiyatga ega. Milliy bog'lar, biosfera rezervatlari va tog' hududlari xorijiy va mahalliy turistlarni jalb qilish uchun katta imkoniyat yaratadi.Shuningdek, 2025-yilda 11,7 million turistlarning tashrifi umumiy turizmning o'sishini aks ettiradi. Shu jumladan , ekoturizmga qiziqish ham ortib bormoqda, ammo uning alohida ulushi hali rasmiy statistikada to'liq aks etmagan. Ekoturizmning barqaror rivojlanishi uchun ekologik muhofaza, zamonaviy infratuzilma va mahalliy aholi manfaatlarini uyg'unlashtirish zarur. Bu uch omilning birortasi e'tibordan chetda qolsa, ekoturizm o'z maqsadini yo'qotadi. 2030-yilgacha rejalashtirilgan 500 million dollarlik investitsiya va turistlar oqimini 20 millionga yetkazish maqsadi ekoturizm uchun ham yangi imkoniyatlar eshigini ochadi.

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Isaqov I.I., falsafa fanlari bo‘yicha falsafa doktori (PhD)
falsafa va dinshunoslik kafedrasi stajyor-o‘qituvchisi
Qo‘qon davlat universiteti
O‘zbekiston, Qo‘qon

YETIM VA OTA-ONA QARAMOG‘IDAN MAHRUM BO‘LGAN BOLALARNI OILAGA MOSLASHTIRISHNING HUQUQIY VA IJTIMOIY AHAMIYATI

Annotatsiya. Maqolada yetim va ota-ona qaramog‘idan mahrum bo‘lgan bolalarni oilaga joylashtirish va yangi oila muhitiga moslashtirishning huquqiy hamda ijtimoiy ahamiyati tahlil qilinadi. Muammoning dolzarbligi muassasaviy tarbiyadan oilaviy shakllarga o‘tish jarayonida bolalarning moslashuvi va joylashtirishning barqarorligini ta’minlash zarurati bilan belgilanadi. Tadqiqotda qiyosiy-huquqiy tahlil, tizimli yondashuv va ijtimoiy-falsafiy talqin usullaridan foydalanildi. Natijada oilaviy joylashtirish shakllarining huquqiy tavsifi berilib, bolaning oilaga moslashuv bosqichlari va ularni qo‘llab-quvvatlash choralari tizimlashtirildi. Qonunchilik va amaliyotni takomillashtirish bo‘yicha takliflar ishlab chiqildi.

Kalit so‘zlar: oilaga joylashtirish, moslashuv, farzandlikka olish, vasiylik, homiylik, patronat, bola manfaatlarining ustuvorligi, ijtimoiy hamrohlik, deinstitutsionalizatsiya.

Isaqov I.I., PhD in Philosophy
trainee lecturer, Department of Philosophy and Religious Studies
Kokand State University
Uzbekistan, Kokand

LEGAL AND SOCIAL SIGNIFICANCE OF THE FAMILY ADAPTATION OF ORPHANS AND CHILDREN DEPRIVED OF PARENTAL CARE

Abstract. The article analyzes the legal and social significance of placing orphans and children deprived of parental care in families and supporting their adaptation to a new family environment. The relevance of the study stems from the need to ensure children’s adaptation and the stability of placements during the transition from institutional to family-based care. Comparative legal analysis, a systems approach and socio-philosophical interpretation were applied. The legal features of family placement forms are described, and the stages of a child’s adaptation in the family and the corresponding support measures are systematized. Proposals for improving legislation and practice are developed.

Keywords: family placement, adaptation, adoption, guardianship, trusteeship, foster care, best interests of the child, social support, deinstitutionalization.

KIRISH

Bola uchun eng tabiiy va maqbul rivojlanish muhiti oiladir. Shu sababli yetim va ota-ona qaramog‘idan mahrum bo‘lgan bolalarga nisbatan zamonaviy ijtimoiy siyosatning asosiy yo‘nalishi ularni muassasalarda tarbiyalashdan oilaviy tarbiya shakllariga o‘tkazishdan iborat. Biroq bolani oilaga joylashtirishning o‘zi yetarli emas: uning yangi oila muhitiga moslashuvi, oila a’zolari bilan hissiy rishta o‘rnatishi va joylashtirishning barqaror bo‘lishi alohida e’tibor talab qiladi.

BMTning Bola huquqlari to‘g‘risidagi Konvensiyasida oila muhitidan mahrum bo‘lgan bolaga muqobil g‘amxo‘rlik tanlashda tarbiyaning uzluksizligi hamda bolaning etnik, diniy, madaniy va til xususiyatlari hisobga olinishi belgilangan [3]. BMTning Bolalarni muqobil parvarish qilish bo‘yicha yo‘riqnomasida esa oilaviy shakllarning ustuvorligi va joylashtirishdan keyingi qo‘llab-quvvatlashning zarurligi alohida ta’kidlangan [4].

O‘zbekistonda bu sohadagi munosabatlar Oila kodeksi, “Bola huquqlarining kafolatlari to‘g‘risida”gi hamda “Vasiylik va homiylik to‘g‘risida”gi qonunlar va ularga muvofiq qabul qilingan hukumat qarorlari bilan tartibga solinadi [2; 5; 6; 7]. Xususan, “Vasiylik va homiylik to‘g‘risida”gi Qonunda bolalarni oilada tarbiyalash shaklining ustuvorligini ta’minlash vasiylik va homiylik sohasidagi davlat siyosatining asosiy yo‘nalishlaridan biri sifatida belgilangan [7]. Shunga qaramay, bolaning oilaga moslashuv jarayonini huquqiy va ijtimoiy jihatdan qo‘llab-quvvatlash mexanizmlari hali yetarlicha takomillashmagan.

Tadqiqotning maqsadi yetim va ota-ona qaramog‘idan mahrum bo‘lgan bolalarni oilaga moslashtirishning huquqiy va ijtimoiy ahamiyatini ochib berish hamda bu jarayonni takomillashtirish yo‘llarini asoslashdan iborat.

Tadqiqot vazifalari: oilaviy joylashtirish shakllarining huquqiy asoslarini tahlil qilish; bolaning oilaga moslashuvi bosqichlari va omillarini aniqlash; moslashtirishning ijtimoiy ahamiyatini baholash; qonunchilik va amaliyotni takomillashtirish bo‘yicha takliflar ishlab chiqish.

MAVZUGA OID ADABIYOTLAR TAHLILI

Bolani oilaga joylashtirish masalasining huquqiy asoslari xalqaro hujjatlarda mustahkamlangan. Bola huquqlari to‘g‘risidagi Konvensiya bola manfaatlarining ustuvorligi tamoyilini barcha qarorlarning asosi sifatida belgilaydi [3], BMT yo‘riqnomasi esa muqobil g‘amxo‘rlikning zarurlik va muvofiqlik tamoyillarini ishlab chiqqan [4]. Milliy qonunchilikda Oila kodeksining ota-ona qaramog‘idan mahrum bo‘lgan bolalarni joylashtirish shakllariga bag’ishlangan bo‘limi farzandlikka olish, vasiylik va homiylik hamda boshqa oilaviy shakllarning huquqiy rejimini belgilaydi [5].

Bolaning yangi oilaga moslashuvi psixologiya va ijtimoiy fanlarda keng o‘rganilgan. J.Boulbining bog‘lanish nazariyasi bolaning barqaror kattalar bilan hissiy rishtaga ehtiyojini asoslab, oilaviy tarbiyaning ustunligini nazariy jihatdan tushuntirgan [8]. M.Dozier va hammualliflari patronat oilaga joylashtirilgan go‘daklarda tarbiyachining hissiy holati bola bog’lanishining xususiyatlariga bevosita ta’sir qilishini ko‘rsatgan [9]. D.Brodzinskiy va hammualliflari

farzandlikka olingan bolaning o‘zligini izlashi butun umr davom etadigan jarayon ekanini asoslagan [10].

M.Van Ayzendoorn va F.Yuffer meta-tahlil asosida farzandlikka olish bola uchun samarali “aralashuv” ekanini, oilaga joylashtirilgan bolalar jismoniy, kognitiv va emotsional rivojlanishda sezilarli darajada tengdoshlariga yetib olishini ko‘rsatgan [11]. J.Palasios va D.Brodzinskiy esa farzandlikka olish bo‘yicha tadqiqotlarni umumlashtirib, moslashuv natijalari bolaning joylashtirishgacha bo‘lgan tajribasi, joylashtirish yoshi va oilaga ko‘rsatilayotgan yordamga bog‘liq ekanini qayd etgan [12]. Buxarest erta aralashuv loyihasi natijalari ham bolani imkon qadar erta oilaga joylashtirish muhimligini tasdiqlagan [13].

Ijtimoiy-falsafiy nuqtai nazardan oila shaxsning birlamchi ijtimoiylashuv makoni hisoblanadi [14], A.Xonnetning tan olish nazariyasiga ko‘ra esa muhabbat va hissiy qo‘llab-quvvatlash shaxs shakllanishining birinchi sharti bo‘lib, u avvalo oilada ta’minlanadi [15]. O‘zbek tadqiqotchilarining ishlarida mavzu asosan ijtimoiy himoya tizimining institutsional jihatlari nuqtai nazaridan yoritilgan [16; 17], bolaning oilaga moslashuvini huquqiy va ijtimoiy jihatdan yaxlit tahlil qilish esa hali yetarlicha amalga oshirilmagan.

TADQIQOT METODOLOGIYASI

Tadqiqotda xalqaro va milliy normativ-huquqiy hujjatlarni o‘rganishda qiyosiy-huquqiy va formal-yuridik tahlil usullaridan foydalanildi. Oilaviy joylashtirish shakllari va ularning xususiyatlarini tizimlashtirishda tizimli-strukturaviy yondashuv, bolaning moslashuv jarayonini o‘rganishda bosqichma-bosqich tahlil qo‘llanildi. Xorijiy empirik tadqiqotlar natijalari umumlashtirish usuli orqali tahlil qilinib, ijtimoiy-falsafiy talqin asosida milliy sharoitga tatbiq etildi.

TAHLIL VA NATIJALAR

Oilaviy joylashtirish shakllarining huquqiy tavsifi. Amaldagi qonunchilikka ko‘ra, ota-ona qaramog‘idan mahrum bo‘lgan bolalar farzandlikka olish, vasiylik yoki homiylik, patronat oilaga berish, oilaviy bolalar uyiga joylashtirish orqali oilaga qaytarilishi mumkin. Vasiylik 14 yoshga to‘lmagan, homiylik esa 14 yoshdan 18 yoshgacha bo‘lgan bolalarga nisbatan belgilanadi [7]. Qonunchilikda bolaning qarindoshlari, shuningdek aka-uka va opa-singillarni ularning qarindoshlik aloqalarini uzmasdan vasiylikka oluvchi shaxslar vasiy yoki homiy etib tayinlanishda imtiyozli huquqqa ega ekani belgilangan [7]. Bu qoida bolaning oilaviy va qarindoshlik rishtalarini saqlab qolish orqali moslashuvni yengillashtiradi. Asosiy shakllarning qiyosiy tavsifi 1-jadvalda keltirilgan.

1-jadval. Ota-ona qaramog‘idan mahrum bo‘lgan bolalarni oilaga joylashtirish shakllarining qiyosiy tavsifi (muallif ishlanmasi)

Shakl	Huquqiy xususiyati	Bola uchun ahamiyati	Moslashuvdagi asosiy xavf
Farzandlikka olish	Sud qarori asosida; bola va farzandlikka oluvchi o‘rtasida ota-ona va farzand huquqiy munosabatlari vujudga keladi	To’liq oila a’zosi maqomi, eng yuqori barqarorlik	Kelib chiqishi haqidagi savollar, identiklik inqirozi
Vasiylik (14 yoshgacha)	Vakolatli organ qarori asosida; vasiy bolaning qonuniy vakili	Oila muhiti, ko‘pincha qarindoshlar orasida	Moddiy qiyinchiliklar, yordamning yetishmasligi
Homiylik (14–18 yosh)	Vakolatli organ qarori asosida; homiy bolaga huquqlarini amalga oshirishda ko’maklashadi	O‘smirlik davrida barqaror kattalar ko‘magi	O‘smirlik inqirozi, mustaqillikka intilish bilan ziddiyat
Patronat oila	Shartnoma asosida; tarbiyachiga haq to’lanadi	Tezkor oilaviy joylashtirish, individual e’tibor	Vaqtinchalik xususiyat, qayta ajralish xavfi
Oilaviy bolalar uyi	Bir necha bolani oila sharoitida tarbiyalash; davlat tomonidan ta’minlanadi	Aka-uka, opa-singillarni birga saqlash imkoniyati	Katta guruh sababli individual e’tiborning kamayishi

Jadvaldan ko‘rinadiki, har bir shakl o‘ziga xos huquqiy rejimga ega va bolaning moslashuviga turlicha ta’sir ko’rsatadi. Shu bois shaklni tanlashda bolaning yoshi, joylashtirishgacha bo‘lgan tajribasi, qarindoshlik aloqalari va uning o‘z fikri hisobga olinishi zarur. Bola manfaatlarining ustuvorligi tamoyili [3] aynan shu tanlovda amaliy ifodasini topadi.

Bolaning oilaga moslashuv bosqichlari. Tadqiqotlar tahlili asosida bolaning yangi oilaga moslashuvi odatda to‘rt bosqichdan o‘tishi aniqlandi [9; 11; 12]. Har bir bosqichda bola va oila turli qiyinchiliklarga duch keladi, shuning uchun ularga ko‘rsatiladigan yordam ham bosqichga mos bo‘lishi lozim (2-jadval).

2-jadval. Bolaning oilaga moslashuv bosqichlari va qo‘llab-quvvatlash choralari (muallif ishlanmasi)

Bosqich	Bola va oiladagi holat	Qo‘llab-quvvatlash choralari
1. Tayyorgarlik	Nomzod oilada kutish va xavotir; bolada noaniqlik	Nomzod ota-onalarni o‘qitish, bolani oila bilan bosqichma-bosqich tanishtirish
2. Dastlabki moslashuv (“asal oyi”)	Bola o‘zini namunali tutadi, oila ko‘tarinki kayfiyatda	Ijtimoiy xodimning muntazam tashriflari, real kutishlarni shakllantirish
3. Inqiroz	Bola chegaralarni sinaydi, eski xulq namunalari qaytadi; oilada charchoq va umidsizlik	Psixologik maslahat, ota-onalar qo‘llab-quvvatlash guruhlari, vaqtinchalik dam olish xizmati
4. Barqarorlashuv	Hissiy rishta mustahkamlanadi, bola o‘zini oila a’zosi deb his qiladi	Kerak bo‘lganda maslahat, ta’lim va sog‘liqni saqlash xizmatlariga yo‘naltirish

Inqiroz bosqichi eng xavfli davr hisoblanadi: aynan shu bosqichda oila yetarli yordam olmasa, bola muassasaga qaytarilishi mumkin. Bunday “ikkilamchi yetimlik” bola uchun birinchi ajralishdan ham og‘irroq ruhiy jarohat bo‘lib, uning kattalarga bo‘lgan ishonchini chuqur yemiradi. Shu sababli joylashtirishdan keyingi ijtimoiy hamrohlik moslashtirishning hal qiluvchi huquqiy va ijtimoiy kafolati bo‘lishi kerak.

Moslashtirishning huquqiy ahamiyati. Huquqiy nuqtai nazardan bolani oilaga moslashtirish uning Konstitutsiya va xalqaro hujjatlarda kafolatlangan oilada yashash va tarbiyalanish huquqini amalda ro‘yobga chiqarishdir [1; 3]. Moslashuvni qo‘llab-quvvatlash mexanizmlarining qonunchilikda aniq belgilanishi joylashtirishning barqarorligini ta’minlaydi, vasiy, homiy va patronat tarbiyachining huquq va majburiyatlarini aniqlashtiradi, bolaning shikoyat qilish va o‘z fikrini bildirish huquqini kafolatlaydi. Qonunchilikka ko‘ra, bola vasiy yoki homiyning harakati yoxud harakatsizligi ustidan “Inson” ijtimoiy xizmatlar markaziga yoki sudga shikoyat qilish huquqiga ega [7]. Bu qoida bolani moslashuv jarayonining faol subyekti sifatida tan oladi.

Moslashtirishning ijtimoiy ahamiyati. Ijtimoiy jihatdan muvaffaqiyatli moslashuv bir necha darajada samara beradi. Bola darajasida u hissiy xavfsizlik, barqaror identiklik va to‘laqonli ijtimoiylashuvni ta’minlaydi [8; 10]. Oila darajasida u oilaning tarbiyaviy salohiyatini kuchaytiradi va joylashtirishdan voz kechish holatlarining oldini oladi. Jamiyat darajasida esa muassasaviy tarbiya xarajatlarini kamaytiradi, ijtimoiy qaramlik va huquqbuzarlik xavfini pasaytiradi hamda jamiyatda mehr-oqibat va ijtimoiy mas’uliyat madaniyatini mustahkamlaydi. O‘zbek xalqining yetimparvarlik an’analari va mahalla instituti bu jarayon uchun mustahkam ma’naviy zamin yaratadi.

Institutsional qo‘llab-quvvatlash. So‘nggi yillarda vasiylik va homiylik bo‘yicha vakolatlarning tuman va shahar "Inson" ijtimoiy xizmatlar markazlariga

o‘tkazilishi [6; 7] oilaviy joylashtirish va keyingi hamrohlikni yagona tizim doirasida tashkil etish imkonini berdi. Biroq bu imkoniyatdan to‘liq foydalanish uchun ijtimoiy xodimlarning moslashuv bosqichlari bo‘yicha malakasini oshirish, nomzod oilalarni tayyorlash dasturlarini standartlashtirish va joylashtirishdan keyingi monitoringni muntazam yo‘lga qo‘yish talab etiladi.

XULOSA VA TAKLIFLAR

Yetim va ota-ona qaramog‘idan mahrum bo‘lgan bolalarni oilaga moslashtirish bolaning oilada yashash huquqini amalda ro‘yobga chiqaruvchi huquqiy mexanizm va uning to‘laqonli shaxs sifatida shakllanishini ta’minlovchi ijtimoiy jarayondir. Oilaviy joylashtirishning muvaffaqiyati faqat joylashtirish shaklini to‘g‘ri tanlashga emas, balki moslashuvning barcha bosqichlarida bola va oilaga ko‘rsatiladigan tizimli yordamga bog‘liq. Tadqiqot natijalariga ko‘ra quyidagi takliflar ilgari suriladi:

1. Qonunchilikda joylashtirishdan keyingi majburiy ijtimoiy hamrohlikning muddati, shakllari va mas’ul organlarini aniq belgilash.
2. Farzandlikka oluvchi, vasiy, homiy va patronat tarbiyachi bo‘lishni istovchi shaxslar uchun yagona tayyorgarlik dasturini joriy etish va uni bosqichma-bosqich majburiy qilish.
3. Moslashuvning inqiroz bosqichida oilalarga psixologik maslahat, qo‘llab-quvvatlash guruhlari va vaqtinchalik dam olish xizmatlarini ko‘rsatish tizimini yaratish.
4. Bolani muassasaga qaytarish holatlarini alohida hisobga olish, ularning sabablarini tahlil qilish va oldini olish choralarini ishlab chiqish.
5. Aka-uka va opa-singillarni bitta oilaga joylashtirish hamda bolaning qarindoshlari bilan aloqasini saqlashni ustuvor talab sifatida mustahkamlash.
6. Mahalla va fuqarolik jamiyati institutlarini oilaviy joylashtirishni targ‘ib qilish va oilalarni jamoaviy qo‘llab-quvvatlashga faol jalb etish.

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Isaqov I.I., falsafa fanlari bo‘yicha falsafa doktori (PhD)
falsafa va dinshunoslik kafedrasi stajyor-o‘qituvchisi
Qo‘qon davlat universiteti
O‘zbekiston, Qo‘qon

YETIM BOLALAR VA OTA-ONA QARAMOG‘IDAN MAHRUM BO‘LGAN BOLALARNING IJTIMOIYLASHUVI HAMDA JAMIYATGA INTEGRATSIYALASHUVINING IJTIMOIY-FALSAFIY TAHLILI

Annotatsiya. Maqolada yetim bolalar va ota-ona qaramog‘idan mahrum bo‘lgan bolalarning ijtimoiylashuvi va jamiyatga integratsiyalashuvi ijtimoiy-falsafiy jihatdan tahlil qilinadi. Muammoning dolzarbligi muassasa bitiruvchilarining mustaqil hayotga moslashuvidagi qiyinchiliklar bilan belgilanadi. Tadqiqotda strukturaviy-funksional, fenomenologik, qiyosiy-falsafiy va tizimli yondashuvlardan foydalanildi. Natijada bunday bolalar ijtimoiylashuvining o’ ‘ziga xos ziddiyatlari aniqlanib, integratsiyaning iqtisodiy, ijtimoiy, madaniy va psixologik o‘lchamlari tizimlashtirildi. Tan olish, ijtimoiy kapital va identiklik tushunchalari asosida integratsiya modeli hamda amaliy takliflar ishlab chiqildi.

Kalit so‘zlar: ijtimoiylashuv, ijtimoiy integratsiya, yetim bolalar, ota-ona qaramog‘idan mahrum bo‘lgan bolalar, identiklik, tan olish, ijtimoiy kapital, stigma, deinstitutsionalizatsiya.

Isaqov I.I., PhD in Philosophy
trainee lecturer, Department of Philosophy and Religious Studies
Kokand State University
Uzbekistan, Kokand

SOCIO-PHILOSOPHICAL ANALYSIS OF THE SOCIALIZATION AND SOCIAL INTEGRATION OF ORPHANS AND CHILDREN DEPRIVED OF PARENTAL CARE

Abstract. The article provides a socio-philosophical analysis of the socialization and social integration of orphans and children deprived of parental care. The relevance of the topic is determined by the difficulties care leavers face in adapting to independent life. Structural-functional, phenomenological, comparative-philosophical and systems approaches were applied. The specific contradictions of such children’s socialization are identified, and the economic, social, cultural and psychological dimensions of integration are systematized. Based on the concepts of recognition, social capital and identity, an integration model and practical recommendations are proposed.

Keywords: socialization, social integration, orphans, children without parental care, identity, recognition, social capital, stigma, deinstitutionalization.

KIRISH

Inson ijtimoiy mavjudot sifatida tug‘ilmaydi, balki jamiyat bilan muloqot jarayonida shunday bo‘lib shakllanadi. Bu jarayonning birinchi va eng muhim bosqichi oilada kechadi: bola aynan oilada tilni, qadriyatlarni, xulq-atvor me’yorlarini va o‘zini boshqalar bilan bog‘liq shaxs sifatida anglashni o‘rganadi. Oila muhitidan mahrum bo‘lgan bola uchun esa ijtimoiylashuv tabiiy oqimdan chiqib, maxsus tashkil etilishi lozim bo‘lgan murakkab jarayonga aylanadi.

BMTning Bola huquqlari to‘g‘risidagi Konvensiyasida oila muhitidan vaqtincha yoki doimiy mahrum bo‘lgan bola davlatning alohida himoyasi va yordamiga haqli ekani belgilangan [3]. O‘zbekiston Respublikasi Konstitutsiyasi va “Bola huquqlarining kafolatlari to‘g‘risida”gi Qonunda ham bunday bolalarni tarbiyalash va ularning ijtimoiy moslashuvini ta’minlash davlat va jamiyat zimmasiga yuklatilgan [1; 2].

Amaliyot shuni ko‘rsatadiki, ijtimoiy himoya tizimi bolaning moddiy ehtiyojlarini ma’lum darajada qondirsa-da, uning jamiyatga to‘laqonli kirib borishi, ya’ni integratsiyalashuvi hamon dolzarb muammo bo‘lib qolmoqda. Xalqaro tadqiqotlarda muassasa bitiruvchilarining ta’lim, bandlik va uy-joy masalalarida tengdoshlariga nisbatan ancha zaif holatda ekani qayd etilgan [16]. Bu muammoning ildizlari faqat iqtisodiy emas, balki shaxsning shakllanishi, identiklik va ijtimoiy tan olinish bilan bog‘liq falsafiy qatlamlarga borib taqaladi.

Tadqiqotning maqsadi yetim bolalar va ota-ona qaramog‘idan mahrum bo‘lgan bolalarning ijtimoiylashuvi hamda jamiyatga integratsiyalashuvining ijtimoiy-falsafiy mohiyatini ochib berish va integratsiyani samarali tashkil etish yo‘llarini asoslashdan iborat.

Tadqiqot vazifalari: ijtimoiylashuv tushunchasining falsafiy talqinlarini tahlil qilish; oila muhitisiz ijtimoiylashuvning o‘ziga xos ziddiyatlarini aniqlash; integratsiyaning asosiy o‘lchamlarini tizimlashtirish; O‘zbekiston sharoitida integratsiya modelini taklif etish.

MAVZUGA OID ADABIYOTLAR TAHLILI

Shaxsni jamiyat hayotiga tayyorlash masalasi Sharq falsafasida azaldan tarbiya muammosi bilan uzviy bog‘liq holda qaralgan. Abu Nasr Forobiy insonning kamolotga faqat jamoa ichida, boshqalar bilan hamkorlikda erisha olishini ta’kidlagan [5]. Abdulla Avloniy esa “Turkiy guliston yoxud axloq” asarida tarbiyani millat uchun hayot-mamot masalasi deb bilgan va uning oiladan boshlanishini alohida qayd etgan [6]. Bu qarashlar ijtimoiylashuvni shaxsiy emas, balki jamoaviy mas’uliyat sifatida talqin qilishga asos bo‘ladi.

G‘arb ijtimoiy falsafasida ijtimoiylashuv nazariyasi bir necha yo‘nalishda rivojlangan. J.G.Mid insonning “Men”i boshqalar bilan ramziy muloqot jarayonida, “umumlashgan boshqa” nuqtai nazarini o‘zlashtirish orqali shakllanishini asoslagan [7]. P.Berger va T.Lukman birlamchi va ikkilamchi ijtimoiylashuvni farqlab, birlamchi ijtimoiylashuv hissiy yaqin “ahamiyatli boshqalar” orqali kechishini va shaxs uchun eng chuqur iz qoldirishini ko‘rsatgan [8]. T.Parsons oilani bola shaxsini ijtimoiy tizimga moslashtiruvchi asosiy institut sifatida tahlil qilgan [9].

Muassasaviy muhitning shaxsga ta’siri E.Gofmanning “total institutlar” konsepsiyasida chuqur yoritilgan: bunday muassasalarda hayotning barcha jabhalari yagona tartib asosida tashkil etilib, individuallik cheklanadi [10]. Gofmanning stigma nazariyasi esa ijtimoiy tamg‘a shaxs identikligini qanday “buzishi” va uning jamiyat bilan munosabatlarini qiyinlashtirishini ko‘rsatadi [11]. E.Eriksonning identiklik nazariyasiga ko‘ra, o‘smirlik davrida barqaror identiklik shakllanmasa, shaxs rollar chalkashligiga duch keladi [12].

P.Burdyening ijtimoiy kapital haqidagi ta’limoti integratsiyani tushunishda muhim ahamiyatga ega: shaxsning jamiyatdagi imkoniyatlari uning ijtimoiy aloqalar tarmog‘i bilan belgilanadi [13]. A.Xonnetning tan olish nazariyasi esa shaxsning to‘laqonli shakllanishi uchun muhabbat, huquqiy tan olinish va ijtimoiy qadrlanish kabi uch shakldagi tan olinish zarurligini asoslaydi [14]. U.Bronfenbrennerning ekologik nazariyasi bolaning rivojlanishini oila, maktab, mahalla va keng jamiyat kabi o‘zaro bog‘liq tizimlar ichida ko‘rib chiqadi [15].

Empirik tadqiqotlar ham bu xulosalarni tasdiqlaydi. M.Steyn muassasa bitiruvchilarining mustaqil hayotga o‘tishi tengdoshlariga nisbatan ancha erta, keskin va qo‘llab-quvvatlovsiz kechishini ko‘rsatgan [16]. M.van Ayzendoorn va hammualliflarining tizimli sharhida muassasaviy tarbiyaning bola rivojlanishiga salbiy ta’siri qayd etilgan [17]. O‘zbek tadqiqotchilarining ishlarida esa mavzu asosan huquqiy va institutsional jihatdan yoritilgan [18; 19; 20], ijtimoiylashuv va integratsiyaning yaxlit ijtimoiy-falsafiy tahlili hali yetarlicha amalga oshirilmagan. Maqolaning ilmiy yangiligi ana shu bo‘shliqni to‘ldirishga qaratilgan.

TADQIQOT METODOLOGIYASI

Tadqiqotning metodologik asosini dialektik yondashuv va tarixiylik tamoyili tashkil etadi. Ijtimoiylashuvni jamiyat institutlari tizimi ichida o‘rganishda strukturaviy-funksional tahlil, bolaning ichki kechinmalari va identikligini tushunishda fenomenologik yondashuv qo‘llanildi. Sharq va G‘arb mutafakkirlarining qarashlarini solishtirishda qiyosiy-falsafiy tahlildan, integratsiya omillarini yaxlit o‘rganishda tizimli yondashuvdan foydalanildi. Xalqaro va milliy normativ-huquqiy hujjatlar kontent-tahlil, empirik tadqiqot natijalari esa umumlashtirish usuli orqali falsafiy jihatdan talqin qilindi.

TAHLIL VA NATIJALAR

Oila muhitisiz ijtimoiylashuvning ziddiyatlari. Berger va Lukman ta’kidlaganidek, birlamchi ijtimoiylashuv hissiy yaqin kattalar orqali kechadi va shaxs dunyoqarashining poydevorini tashkil etadi [8]. Muassasa sharoitida esa “ahamiyatli boshqalar” rolini almashinib turuvchi tarbiyachilar bajaradi, bu esa barqaror namuna va hissiy bog‘lanishni zaiflashtiradi. Natijada bolaning ijtimoiylashuvida bir qator falsafiy ziddiyatlar yuzaga keladi (1-jadval).

1-jadval. Oila va muassasa sharoitidagi ijtimoiylashuvning qiyosiy tavsifi (muallif ishlanmasi)

Ijtimoiylashuv jihati	Oila sharoitida	Muassasa sharoitida	Falsafiy ziddiyat
“Ahamiyatli boshqalar”	Doimiy, hissiy yaqin ota-ona	Almashinib turuvchi tarbiyachilar	Yaqinlik va begonalik
Ijtimoiy rollar	Farzand, aka-uka, qo‘shni, mehmon	Asosan “tarbiyalanuvchi” roli	Ko‘p rollilik va bir rollilik
Qaror qabul qilish	Yoshiga mos mustaqillik	Qat’iy tartib, tashqi nazorat	Erkinlik va tobelik
Maishiy tajriba	Pul, oziq-ovqat, uy yumushlari	Tayyor xizmatlar	Mustaqillik va iste’molchilik
Ijtimoiy aloqalar	Qarindoshlar, mahalla tarmog‘i	Yopiq, muassasa ichidagi doira	Ochiqlik va izolyatsiya
Identiklik	Oila tarixi va nasl-nasab	“Mehribonlik uyi bolasi” tamg‘asi	O‘zlikni anglash va stigma

Jadvaldan ko‘rinib turibdiki, muammo bolaning moddiy ta’minotida emas, balki ijtimoiy tajribaning torligi va bir tomonlamaligida. Gofman ta’riflagan “total institute” mantig‘i bolani tartibga bo‘ysunuvchi, lekin tashqi dunyoda mustaqil harakat qilishga tayyor bo‘lmagan shaxs sifatida shakllantirish xavfini tug‘diradi [10]. Bu holat “o‘rganilgan ojizlik” va ijtimoiy qaramlik kayfiyatini keltirib chiqarishi mumkin.

Identiklik va tan olinish muammosi. Eriksonning fikricha, o‘smirlik davrining asosiy vazifasi barqaror identiklikni shakllantirishdir [12]. Ota-ona qaramog‘idan mahrum bo‘lgan o‘smir uchun bu vazifa ikki barobar murakkab: u “Men kimman va qayerdanman?” degan savolga oila tarixi orqali javob topa olmaydi. Xonnet nazariyasi nuqtai nazaridan esa bunday bolalar ko‘pincha tan olinishning birinchi shakli, ya’ni muhabbat va hissiy qo‘llab-quvvatlashdan mahrum bo‘ladi [14]. Jamiyatdagi stigma esa uchinchi shakl, ya’ni ijtimoiy qadrlanishga to‘siq bo‘ladi [11]. Demak, integratsiya faqat bolaning jamiyatga moslashuvi emas, balki jamiyatning ham bolani teng huquqli a’zo sifatida qabul qilishi, ya’ni ikki tomonlama jarayondir.

Integratsiyaning o’lchamlari. Tahlil natijasida ijtimoiy integratsiyaning to‘rt asosiy o‘lchami ajratildi va har biri bo‘yicha to‘siqlar hamda ularni bartaraf etish mexanizmlari tizimlashtirildi (2-jadval).

2-jadval. Yetim va ota-ona qaramog‘idan mahrum bo‘lgan bolalar integratsiyasining o‘lchamlari (muallif ishlanmasi)

O’lcham	Asosiy to’siqlar	Integratsiya mexanizmlari
Iqtisodiy	Kasbiy malakaning yetishmasligi, uy-joy va moliyaviy savodxonlik muammosi	Kasbga yo‘naltirish, ish o‘rinlari kvotasi, uy-joy bilan ta’minlash, moliyaviy savodxonlik treninglari
Ijtimoiy	Ijtimoiy aloqalar tarmog‘ining torligi, ijtimoiy kapital tanqisligi [13]	Murabbiylik (mentorlik), mahalla va ko’ngillilar tarmog‘i, bitiruvchilar uyushmalari
Madaniy-ma’naviy	Oilaviy an’analar va milliy qadriyatlar tajribasining kamligi	Oilaviy shakllarda tarbiya, mahalla tadbirlari, bayram va marosimlarda ishtirok
Psixologik	Identiklik inqirozi, stigma, ishonchsizlik, o‘rganilgan ojizlik	Psixologik hamrohlik, tan olinish muhiti, o‘z-o‘zini qadrlashni rivojlantirish

Integratsiyaning ekologik modeli. Bronfenbrenner nazariyasiga tayanib [15], integratsiyani bir-biriga bog‘liq to‘rt darajada tashkil etish maqsadga muvofiq. Birinchi daraja bolaning yaqin muhiti bo‘lib, unda barqaror kattalar bilan hissiy rishta shakllantiriladi (patronat oila, vasiy, murabbiy). Ikkinchi daraja maktab, kollej va mahalla bo‘lib, bola bu yerda turli ijtimoiy rollarni o‘zlashtiradi. Uchinchi daraja ijtimoiy xizmatlar, ish beruvchilar va fuqarolik jamiyati institutlaridan iborat bo‘lib, ular bolaning ijtimoiy kapitalini kengaytiradi. To‘rtinchi daraja jamiyatning qadriyatlar tizimi va davlat siyosati bo‘lib, u stigmani kamaytirish va teng imkoniyatlarni kafolatlashga xizmat qiladi.

Milliy qadriyatlarning integratsion salohiyati. O‘zbek jamiyatida mahalla, mehr-oqibat va hasharga asoslangan jamoaviy yordam an’analari integratsiya uchun katta imkoniyat yaratadi. Avloniy ta’kidlaganidek, tarbiya butun jamiyatning ishidir [6]. Mahalla bolaning ijtimoiy aloqalar tarmog‘ini kengaytiruvchi, uni jamoaviy hayotga jalb etuvchi va stigmani yumshatuvchi tabiiy muhit bo‘la oladi. So‘nggi yillarda mamlakatimizda muassasaviy tarbiyadan oilaviy shakllarga o‘tish va hududiy ijtimoiy xizmatlar tizimini rivojlantirish yo‘lida amalga oshirilayotgan islohotlar ham ana shu yondashuvga mos keladi [18; 19].

Mustaqil hayotga o‘tish davri. Steynning tadqiqotlariga ko‘ra, muassasa bitiruvchilarining muvaffaqiyatli integratsiyasi uchun o‘tish davrining bosqichma-bosqichligi, barqaror kattalar bilan aloqaning saqlanishi va 18 yoshdan keyin ham qo‘llab-quvvatlashning davom etishi hal qiluvchi ahamiyatga ega [16]. Falsafiy nuqtai nazardan bu davr bolaning tobelikdan erkinlikka, obyektlikdan subyektlikka o‘tishini anglatadi. Shu bois integratsiyaning yakuniy mezoni bolaning jamiyatda nafaqat yashay olishi, balki unga o’z hissasini qo’sha olishi, ya’ni faol va mas’uliyatli fuqaroga aylanishidir.

XULOSA VA TAKLIFLAR

Yetim bolalar va ota-ona qaramog‘idan mahrum bo‘lgan bolalarning ijtimoiylashuvi oila muhitining yo‘qligi sababli bir qator falsafiy ziddiyatlar bilan kechadi: yaqinlik va begonalik, erkinlik va tobelik, ochiqlik va izolyatsiya, o‘zlikni anglash va stigma. Ularning jamiyatga integratsiyalashuvi esa iqtisodiy, ijtimoiy, madaniy-ma’naviy va psixologik o‘lchamlarni qamrab olgan, bola va jamiyat o‘rtasidagi ikki tomonlama jarayondir. Integratsiyaning falsafiy asosini tan olish, ijtimoiy kapital va barqaror identiklik tashkil etadi. Tadqiqot natijalariga ko‘ra quyidagi takliflar ilgari suriladi:

1. Ijtimoiylashuvni tashkil etishda muassasaviy shakllardan oilaviy shakllarga (patronat, vasiylik, farzandlikka olish) o‘tishni jadallashtirish va bolaning barqaror “ahamiyatli boshqalar” bilan rishtasini ta’minlash.
2. Muassasalar va oilaviy bolalar uylarida bolalarning mustaqil qaror qabul qilish, maishiy va moliyaviy tajriba orttirishini ta’minlaydigan dasturlarni joriy etish.
3. Har bir bitiruvchiga kamida 23 yoshgacha hamroh bo‘ladigan murabbiylik tizimini yaratish va bitiruvchilar uyushmalarini qo‘llab-quvvatlash.
4. Mahalla institutini bolalarning ijtimoiy aloqalar tarmog‘ini kengaytirish va jamoaviy hayotga jalb etishning asosiy bo‘g‘iniga aylantirish.
5. Ommaviy axborot vositalari va ta’lim muassasalarida yetim bolalarga nisbatan stigma va stereotiplarni kamaytirishga qaratilgan ma’rifiy ishlarni kuchaytirish.
6. Ijtimoiy xodimlar, tarbiyachilar va psixologlarni tayyorlashda ijtimoiylashuv falsafasi, tan olish etikasi va identiklik psixologiyasi asoslarini o‘qitishni kengaytirish.

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UDK: 634.711:632.52.

Jo‘rayev A.N., q.x.f.f.d.
professor
Mamasidiqova N.X.
talaba
Andijon qishloq xo‘jaligi va agrotexnologiyalar instituti
O‘zbekiston, Andijon

YANGI MALINA NAVLARNING MORFOLOGIK KO‘RSATKICHLARINI QIYOSIY O‘RGANISH

Annotatsiya. Ushbu maqolada malinaning Vladimir, Maravilla, Lyachka navlari hamda ayrim seleksiya namunalarining o‘sishi, rivojlanishi va hosildorlik ko‘rsatkichlari bo‘yicha olingan natijalar berilgan. Tadqiqot davomida o‘simliklarning gullar soni, mevalar soni, pishgan mevalar soni, shoxlar soni va barglar soni kabi biometrik ko‘rsatkichlari tahlil qilindi. Olingan natijalar asosida navlarning vegetativ va generativ rivojlanish xususiyatlari baholandi.

Kalit so‘zlar: malina, rezavor mevalar, nav, hosildorlik, biometrik ko‘rsatkichlar, seleksiya, vegetativ rivojlanish, generativ rivojlanish.

Jorayev A.N., PhD in Agricultural Sciences
professor
Mamasidiqova N.X.
student
Andijan Institute of Agriculture and Agrotechnologies
Uzbekistan, Andijan

COMPARATIVE STUDY OF THE MORPHOLOGICAL CHARACTERISTICS OF NEW RASPBERRY CULTIVARS

Abstract. This article presents the results of a study on the growth, development, and yield performance of the raspberry cultivars Vladimir, Maravilla, and Lyachka, as well as several breeding accessions. During the study, biometric parameters of the plants, including the number of flowers, fruits, ripe fruits, branches, and leaves, were analyzed. Based on the results obtained, the vegetative and generative development characteristics of the cultivars were evaluated.

Keywords: raspberry, berry fruits, cultivar, yield, biometric parameters, breeding, vegetative development, generative development.

Kirish. Bugungi kunda O‘zbekistonda meva-sabzavotchilik tarmog‘ini rivojlantirish, eksportbop mahsulotlar yetishtirish va aholini vitaminlarga boy oziq-ovqat mahsulotlari bilan ta’minlash davlat agrar siyosatining muhim yo‘nalishlaridan biri hisoblanadi. Rezavor mevalar orasida malina (*Rubus idaeus* L.) o‘zining biologik xususiyatlari, yuqori oziqaviy qiymati va dorivor ahamiyati bilan alohida o‘rin egallaydi.

Malina mevalari tarkibida C, A, B guruhi vitaminlari, organik kislotalar, pektin moddalar, temir, kaliy va boshqa foydali elementlar mavjud. Shu sababli dunyo bozorida malinaga bo‘lgan talab yildan-yilga ortib bormoqda.

Malina plantatsiyalarining samaradorligi ko‘p jihatdan navlarning biologik xususiyatlariga bog‘liq. Har bir navning o‘sish kuchi, shoxlanish darajasi, barg hosil qilishi, gullash va meva tugish ko‘rsatkichlari turlicha bo‘ladi. Shuning uchun navlarni agrobiologik jihatdan o‘rganish va istiqbolli navlarni aniqlash ilmiy hamda amaliy ahamiyatga ega. Mazkur tadqiqotning maqsadi malina navlari va seleksiya namunalarining biometrik ko‘rsatkichlarini o‘rganish hamda hosildorligi yuqori bo‘lgan namunalarni aniqlashdan iborat.

Tadqiqot obyekti va usullari. Tadqiqot obyekti sifatida Vladimir, Maravilla, Lyachka navlari va seleksiya namunalari tanlab olindi. Tadqiqot davomida quyidagi biometrik ko‘rsatkichlar o‘rganildi: gullar soni , mevalar soni , pishgan mevalar soni , shoxlar soni, barglar soni. Kuzatishlar dala sharoitida olib borilib, olingan ma’lumotlar taqqoslash va tahlil qilish usullari yordamida baholandi.

Natijalar tahlili va muhokama. Tadqiqot natijalari malina navlari va seleksiya namunalari o‘rtasida sezilarli farqlar mavjudligini ko‘rsatdi.

Barglar soni o‘simlikning fotosintez faoliyati va umumiy rivojlanishini belgilovchi muhim ko‘rsatkichlardan biri hisoblanadi. Tadqiqot natijalariga ko‘ra, 2(I) namunasi 175 dona barg hosil qilib, barcha variantlar orasida eng yuqori natijani qayd etdi. Ushbu ko‘rsatkich mazkur namunada vegetativ rivojlanishning yuqori darajada ekanligini ko‘rsatadi.

Tadqiqot natijalari.

1-jadval

Malina navlari va seleksiya namunalarining biometrik ko‘rsatkichlari:

T/r	Navi	Gullar soni	Mevalar soni	Pish.mevalar soni	Shoxlar soni
1	Vladimir	-	-	-	28
2	(|)	-	-	-	37
3	Maravilla	7	56	5	18
4	2 (|||)	-	-	-	23
5	3 (|)	-	-	-	15
6	Августина Avgustina	-	10	1	36
7	Maravilla	7	34	-	40
8	4 (|)	-	-	-	19
9	Margaritta	3	33	-	19
10	5	-	14	5	27
11	Lyachka	-	13	10	20

Shoxlar soni bo‘yicha Maravilla navi yetakchilik qildi. Unda 40 dona shox hosil bo‘lib, bu natija boshqa navlarga nisbatan yuqori ekanligi aniqlandi. Shoxlarning ko‘pligi hosil beruvchi novdalar sonining ortishiga va kelgusidagi hosildorlikning oshishiga xizmat qiladi.

Mevalar soni bo‘yicha 2(II) namunasi eng yuqori natijani ko‘rsatdi. Mazkur namunada 56 dona meva hosil bo‘lib, bu tadqiqotdagi eng yaxshi natija hisoblandi. Shuningdek, ushbu namunada 7 dona gul va 5 dona pishgan meva qayd etildi. Olingan natijalar mazkur namunaning yuqori hosildorlik salohiyatiga ega ekanligini ko‘rsatadi.

Maravilla navida 34 dona meva va 7 dona gul kuzatildi. Bu nav vegetativ rivojlanish va hosildorlik ko‘rsatkichlarining uyg‘unligi bilan ajralib turdi.

4 (II) namunasi ham mevalar soni bo‘yicha yuqori natija qayd etib, 33 dona meva hosil qildi. Bu ko‘rsatkich namunani istiqbolli shakllardan biri sifatida baholash imkonini beradi. Lyachka navida 13 dona meva va 10 dona pishgan meva aniqlandi. Pishgan mevalar sonining eng yuqori bo‘lishi ushbu navning erta pishar nav ekanligini ko‘rsatadi. Erta pishar navlar bozor talabini qondirish va iqtisodiy samaradorlikni oshirishda muhim ahamiyat kasb etadi.

3 (III) namunasi 160 dona barg va 36 dona shox hosil qilgan bo‘lsa-da, mevalar soni 10 donani tashkil etdi. Bu holat vegetativ rivojlanishning generativ rivojlanishdan ustun bo‘lganligini ko‘rsatadi.

Vladimir navida esa vegetativ rivojlanish qoniqarli bo‘lib, 28 dona shox va 120 dona barg hosil qilganligi qayd etildi.Umuman olganda, tadqiqot natijalari malina navlari va seleksiya namunalarining biologik hamda xo‘jalik jihatdan bir-biridan sezilarli darajada farqlanishini ko‘rsatdi.

Xulosa. 1. Tadqiqot natijasida malina navlari va seleksiya namunalarining biometrik ko‘rsatkichlari o‘rtasida sezilarli farqlar mavjudligi aniqlandi.

2. 2(I) namunasi barglar soni bo‘yicha eng yuqori natijani (175 dona) qayd etdi.

3. Maravilla navi shoxlar soni bo‘yicha yetakchi bo‘lib, 40 dona shox hosil qildi.

4. 2(II) namunasi mevalar soni bo‘yicha eng yuqori natijani (56 dona) ko‘rsatdi.

5. Lyachka navi pishgan mevalar soni bo‘yicha ustunlik qilib, 10 dona natijani qayd etdi.

6. Tadqiqot natijalariga ko‘ra, 2(II), Maravilla va Lyachka navlari ishlab chiqarishga tavsiya etish uchun istiqbolli navlar sifatida baholandi.

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Juraev A.N., PhD in Agricultural Sciences
professor
Muminjonov S.R.
doctoral student

THE EFFECT OF DIFFERENT SEEDLING DENSITIES ON THE QUALITY INDICATORS OF PEANUT GRAINS

Abstract. This article highlights the data obtained on peanut quality from scientific research conducted to determine the optimal seedling density and the application rates of the biological preparation "BioGutten" for achieving a high and high-quality peanut yield.

Keywords: Soil, variants, protein, oil content, moisture, seedling density, "BioGutten", biological preparations, irrigation erosion, peanut, experimental field.

The quality of peanut kernels depends on many ecological, biological, and agrotechnical factors. Moisture content, soil type, and temperature also affect the quality of peanut kernels. Nitrogen and phosphorus fertilizers, along with the timely and high-quality implementation of agrotechnical measures, similarly exert an influence on peanut kernel quality.

As noted by V.R. Young and P.L. Pellett, peanut kernels contain an average of up to 30% protein, and the amount of this protein is influenced by the variety, growing conditions, and agricultural practices [2, pp. 1203-1212 - Young, V.R., Pellet. P.L. (1994). "Plant proteins in relation to human protein and amino acid nutrition." American Journal of Clinical Nutrition, 59(5), 1203S–1212S.].

When studying the effect of peanut seedling density and the application of the biological preparation "BioGutten" on grain quality, differences were noted in the substance compositions across variants. Based on the analysis results of grains obtained from the peanut experiments, the respective amounts of oil, protein, and moisture were determined. Grain samples were identified and analyzed using laboratory equipment named "Gronolayzer" imported from Germany. According to the analysis results, the lowest quality indicator was observed in the 13th variant. Because the high number of peanut seedlings reduced the plants' feeding area and no "BioGutten" biological preparation was applied, the peanut oil content in this variant was 43.6%. Laboratory analyses determined that the 4th variant had the highest oil content in the peanut grain (Table 4.11). In this variant, the biological preparation "BioGutten" was applied 3 times during the vegetative period at a total rate of 3 l/ha, and the seedling density was 142 thousand pcs/ha. After harvest, a study of the grain composition showed that the oiliness of peanuts in this variant reached 45.5%.

The research results indicate that the differences in peanut grain oil content between variants are not exceptionally large. However, it was determined that this pattern also held true when measuring the protein content in peanut grains.

In the analysis results obtained for the dissertation, the highest protein content was also recorded in the 4th variant, where peanuts were planted at 142 thousand pcs/ha and the biological preparation "BioGutten" was applied 3 times at 1 l/ha during the vegetative period.

In this 4th variant, the protein content in the peanut grain was 32.6%, which was 1.4% higher than the 1st variant (the control). As the peanut seedling density increased, the protein content in the grain was observed to decrease. When the seedling density was 166 thousand pcs/ha and no biological preparation was applied, the protein content in the peanut fruit was 31.3%.

It was noted that in variants 6, 7, and 8, where the application rate and amount of the biological preparation "BioGutten" increased, the protein content in the peanut grain also increased.

Table 1

The effect of seedling density and the application of the biological preparation "BioGutten" on peanut grain quality, 2023

Var №	Seedling density	Biological preparation rate, l/ha	Amount of substances in peanut kernel, % - Oil content	Amount of substances in peanut kernel, % - Protein content	Amount of substances in peanut kernel, % - Seed moisture
1.	142 thousand	Control	44.7	31.2	7.4
2.		"BioGutten" 1 l	45.1	31.5	7.1
3.		"BioGutten" 2 l	45.3	32.1	6.5
4.		"BioGutten" 3 l	45.5	32.6	5.9
5.	166 thousand	-	44.1	31.3	7.4
6.		"BioGutten" 1 l	45.2	31.5	7.2
7.		"BioGutten" 2 l	45.2	31.9	6.7
8.		"BioGutten" 3 l	45.4	32.4	6.0
9.	285 thousand	-	43.9	31.3	7.2
10.		"BioGutten" 1 l	44.9	31.4	7.3
11.		"BioGutten" 2 l	45.2	31.7	6.9
12.		"BioGutten" 3 l	45.3	32.3	6.1
13.	333 thousand	-	43.6	31.1	7.1
14.		"BioGutten" 1 l	44.7	31.3	7.6
15.		"BioGutten" 2 l	45.1	31.6	7.0
16.		"BioGutten" 3 l	45.2	32.1	6.4

In these variants, the protein content in peanut grains was 31.5%, 31.9%, and 32.4%, respectively, which was found to be 0.3%, 0.7%, and 1.2% higher compared to the 1st variant (the control). However, in variants 13, 14, 15, and 16, where seedling density was set at 333 thousand pcs/ha, the grain protein content was

31.3%, 31.6%, and 32.1%, establishing it as 0.1%, 0.4%, and 0.9% higher than the control.

As the amount of oil and protein in the peanut grain increases, its water content decreases. This situation relies on the following reasons:

1. There is a balance in the chemical composition of agricultural crops. The main components in the grain—protein, oil, water, and other substances—make up 100%. Therefore, as oil and protein increase, the amount of water and other substances decreases.
2. Physiologically, during the drying process at the ripening stage of the peanut, the moisture content in the grain decreases, but the relative amounts of protein and oil within it increase. In conclusion, the moisture content in a peanut grain is inversely proportional to the amount of other substances.

Therefore, when grain samples were taken by variant from the harvested crop after the experiment concluded, analysis revealed differences in grain moisture content. While the peanut grain moisture in the 1st variant taken as a control was 7.4%, the grain moisture was found to be 7.1% when planted at 142 thousand pcs/ha and treated once with the biological preparation at a rate of 1 l/ha. In the 3rd and 4th variants, where the amount of "BioGutten" was increased to 2 and 3 l/ha, the grain moisture content was 6.5% and 5.9%, respectively. It was determined that as peanut seedling density increased, its moisture content increased in inverse proportion to the other substances. The highest moisture content was found in the 13th variant—planted at a density of 333 thousand pcs/ha with no biological preparation applied—where grain moisture reached 7.8%.

Summarizing this section, research on the effects of peanut seedling density and the application rates of the growth-regulating biological preparation "BioGutten" on grain quality proved that seedling density is inversely proportional to the amounts of protein and oil in the grain, and directly proportional to its moisture content. The results were also directly proportional to the application rate of the "BioGutten" preparation; as the application rates of the biological preparation increased, the oil and protein content within the grain changed positively.

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Kambarov A.H.
katta o‘qituvchi
Rajabboyev B.E.
markaz boshlig‘i, podpolkovnik
Toshkent viloyati Favqulodda vaziyatlar bosh boshqarmasi Chirchiq shahar Hayot faoliyati xavfsizligi o‘quv markazi
O‘zbekiston, Chirchiq

OLIY TA’LIM TASHKILOTLARIDA XAVFSIZLIK MADANIYATINI SHAKLLANTIRISH TAMOYILLARI

Annotatsiya. Ushbu maqolada oliy ta’lim tashkilotlarida xavfsizlik madaniyatini shakllantirishning ilmiy-pedagogik asoslari muhokama qilingan. Unda hayot faoliyati xavfsizligi tushunchasi, uning ta’lim jarayonidagi o‘rni, o‘quvchilarda xavfsizlik madaniyatini shakllantirishning usullari va metodik yondashuvlari tahlil qilingan. Shuningdek, ta’lim muassasalarida xavfsiz muhit yaratish, zamonaviy pedagogik texnologiyalardan foydalanish va favqulodda vaziyatlarga tayyorgarlikni ta’minlash bo‘yicha tavsiyalar berib o‘tilgan.

Kalit so‘zlar: ta’lim tizimi, xavfsizlik, hayot faoliyati xavfsizligi, xavfsizlik madaniyati, favqulodda holatlar, kompetensiyaviy yondashuv, zamonaviy texnologiyalar, maktab xavfsizligi.

Kambarov A.H.
senior instructor
Rajabboyev B.E.
head of the center, lieutenant colonel
Chirchiq City Life Safety Training Center,
Department of Emergency Situations of Tashkent Region
Uzbekistan, Chirchiq

PRINCIPLES OF DEVELOPING A SAFETY CULTURE IN HIGHER EDUCATION INSTITUTIONS

Abstract. This article discusses the scientific and pedagogical foundations for developing a safety culture in educational institutions. It analyzes the concept of life safety, its role in the educational process, as well as methods and methodological approaches to developing a safety culture among students. The article also provides recommendations for creating a safe environment in educational institutions, using modern pedagogical technologies, and ensuring preparedness for emergency situations.

Keywords: Education system, safety, life safety, safety culture, emergency situations, competency-based approach, modern technologies, school safety.

KIRISH. Bugungi kunda zamonaviy ta’lim tizimining asosiy vazifasi faqatgina yosh avlodga bilim berish emas, balki ularni katta hayotga tayyorlash, turli ko‘rinishdagi xavf-xatarlardan ogohlantirish, kelgusi faoliyatda xavfsiz va sog‘lom mehnat sharoitlarini yaratishga qodir shaxs sifatida tarbiyalashdan iborat. Hayot faoliyati xavfsizligi (HFX) fanining ta’lim tizimidagi o‘rni aynan shu vazifani bajarishga xizmat qiladi. Mazkur fan orqali o‘quvchilarda xavfsizlik madaniyati shakllantiriladi, favqulodda holatlarda to‘g‘ri harakat qilish ko‘nikmalari rivojlantiriladi, ularning ekologik, texnogen, tabiiy va ijtimoiy xavflarga nisbatan ongli yondashuvi mustahkamlanadi [1].

MAVZUGA OID ADABIYOTLAR TAHLILI. So‘nggi yillarda mahalliy olimlardan Sh. Tairov o‘zining “Ta’lim tizimida hayot faoliyati xavfsizligini ta’minlashning pedagogik asoslari” nomli ilmiy maqolasida hayot faoliyati xavfsizligi tushunchasi, uning ta’lim jarayonidagi roli va o‘quvchilarda xavfsizlik madaniyatini shakllantirish usullari tahlil qilingan. Shuningdek, metodik yondashuvlar - shaxsga yo‘naltirilgan, kompetensiyaviy va faol ta’lim metodlari tavsiflangan [2]. N. D. Samadova o‘zining “Ta’lim muassasalarida yong‘in xavfsizligini ta’minlashning asosiy yo‘nalishlari” mavzusidagi ilmiy maqolasida ta’lim muassasalarida yong‘in xavfsizligi chora-tadbirlari, evakuatsiya, tashkiliy va texnik jihatlar muhokama qilinadi [3]. Xorijiy olimlardan L.A. Mixaylov hayot faoliyati xavfsizligi sohasidagi yangi ilmiy-pedagogik yo‘nalishning asoschisi, fundamental tadqiqotlar va ko‘plab nashrlar muallifi, bir qator nomzodlik va doktorlik dissertatsiyalarining ilmiy rahbari hisoblanadi. Uning ilmiy ishlanmalari pedagogik jihatdan xavfsizlikni o‘qitish va kompetensiyalarni shakllantirish uchun konseptual poydevor bo‘lib xizmat qiladi [4].

MUHOKAMA VA NATIJALAR. Hayot faoliyati xavfsizligi (HFX) inson salomatligi, hayoti va mehnat faoliyatini xavf-xatarlardan asrashga qaratilgan kompleks bilim sohasi hisoblanadi. Bu fan orqali o‘quvchilarga xavf tushunchasi, xavf-xatarning turlari, ularning oqibatlari, xavfsiz muhitni yaratish va favqulodda holatlarda to‘g‘ri harakat qilish o‘rgatiladi. HFX fani quyidagi yo‘nalishlarda ta’lim jarayoniga integratsiya qilinadi [2, 5, 6, 7]:

1. O‘quvchilarda xavfsizlik madaniyatini shakllantirish.
2. Tabiiy va texnogen xavflarning oldini olish.
3. Ijtimoiy xavfsizlik va sog‘lom turmush tarzini shakllantirish.
4. Ekologik madaniyatni rivojlantirish.

Pedagogik yondashuvlar va metodik asoslar

Hayot faoliyati xavfsizligi fanini o‘quvchilarga samarali o‘rgatish uchun quyidagi pedagogik yondashuvlar muhim ahamiyat kasb etadi [8, 9, 10]:

a) kompetensiyaviy yondashuv - o‘quvchida faqat nazariy bilim emas, balki amaliy ko‘nikma va malakalarni shakllantirish. Masalan: birinchi tibbiy yordam ko‘rsatish, yong‘in yoki zilzila vaqtida evakuatsiya qilish bo‘yicha bilim beriladi.

b) faol ta’lim metodlari - treninglar, rolli o‘yinlar, interaktiv darslar orqali o‘quvchilar mustaqil fikrlashga, vaziyat tahliliga o‘rgatiladi.

c) integratsion yondashuv - Hayot faoliyati xavfsizligi fanini boshqa fanlar (biologiya, fizika, texnologiya, jismoniy tarbiya) bilan uyg‘unlashtirish orqali fanlararo bilimlar mustahkamlanadi.

d) shaxsga yo‘naltirilgan ta’lim - o‘quvchilarning yosh va individual xususiyatlarini hisobga olgan holda ta’lim tashkil etiladi.

Maktabda xavfsiz muhit yaratish pedagog va ma’muriyatning asosiy vazifalaridan biridir. Bu jarayon quyidagi bosqichlarni o‘z ichiga oladi:

- Har yili Hayot faoliyati xavfsizligini ta’minlash bo‘yicha favqulodda vaziyatga tayyorgarlik rejasi tuzish;
- O‘quvchilarning xavfsizlikka oid bilimlarini baholash va monitoring olib borish;
- Evakuatsiya mashg‘ulotlarini tashkil etish (yong‘in, zilzila, gaz sizishi holatlari va boshqalar);
- Mahalliy Favqulodda vaziyatlar vazirligi boshqarma va bo‘limlari, yo‘l-patrul xizmati va tibbiyot tashkilotlari bilan hamkorlikda amaliy mashg‘ulotlar o‘tkazish;
- Maktabda videokuzatuv, xavfsizlik texnikasi, darslik va ko‘rgazmali vositalar bilan ta’minlash.

O‘quvchilarda xavfsizlik madaniyatini shakllantirish

Xavfsizlik madaniyati - bu insonning ongli ravishda xavf-xatarlardan xabardor bo‘lib, o‘zini va boshqalarni himoya qilishga bo‘lgan tayyorgarligi hisoblanadi. Bu madaniyatni shakllantirishda o‘qituvchining roli nihoyatda muhim ahamiyatga ega. Quyidagi yo‘llar orqali bu madaniyat rivojlantiriladi [2]:

- Tarbiyaviy soatlar orqali xavfsizlikka oid suhbatlar o‘tkazish.
- Rasmlar, videoroliklar, plakatlar orqali vizual targ‘ibot ishlari olib borish.
- Ko‘rgazmalar va tanlovlar tashkil etish.
- Sport va sog‘lomlashtirish tadbirlarini tashkillashtirish.

Zamonaviy ta’limni raqamli texnologiyalarsiz tasavvur qilib bo‘lmaydi. Hayot faoliyati xavfsizligi fanini o‘qitishda quyidagi raqamli yondashuvlar samarali ekanligi tadqiqot davomida aniqlandi:

• Virtual simulyatsiyalar (evakuatsiya mashqlari);
• Mobil ilovalar orqali birinchi yordam berish va boshqa xavfsizlik qoidalari;
• Onlayn testlar orqali bilimlarni baholash;
• Video darsliklar va animatsiyalar yordamida tushunchalarni mustahkamlash.

XULOSA. Tadqiqot davomida sohaga oid me’yoriy-huquqiy hujjatlar, ilmiy ishlanmalar, dasrliklar, o‘quv qo‘llanmalari va internet saytlari bilan tanishib, quyidagi xulosaga keldim: Ta’lim tizimida hayot faoliyati xavfsizligini ta’minlash – bu nafaqat o‘quvchilarni himoya qilish, balki ularning hayotga tayyorgarligini oshirish, mustaqil va ongli fuqaro sifatida shakllanishiga zamin yaratish demakdir. Bu borada o‘qituvchilarning kasbiy tayyorgarligi, fanlararo integratsiya, amaliy yondashuv va zamonaviy texnologiyalardan foydalanishni keng targ‘ib etish bugungi kunning dolzarb masalalaridan biri hisoblanib, har bir ta’lim muassasasi xavfsiz hayotiy faoliyat madaniyatining targ‘ibotchisiga aylanishi lozim.

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Kamolova N.T.
“Pedagogika va psixologiya” kafedrasi dotsenti v.b.
Fan va texnologiyalar universiteti
O‘zbekiston, Toshkent

BO‘LAJAK BOSHLANG‘ICH SINF O‘QITUVCHILARIDA INTELLEKTUAL KOMPETENTLIKNI RIVOJLANTIRISH OMILLARI

Annotatsiya. Maqolada pedagogika oliy ta’lim muassasalarida bo‘lajak boshlang‘ich sinf o‘qituvchilarining intellektual kompetentligini rivojlantirish masalasi talqin qilingan bo‘lib, intellektual kompetentlik mazmuni va mohiyati, intellektual kompetentlikni rivojlantirishning psixologik omillari hamda intellektual kompetentlikni rivojlantirishning ahamiyatli jihatlari ochib berilgan.

Kalit so‘zlar: talaba, ta’lim, boshlang‘ich, jarayon, mohiyat, talqin, intellektual, idrok, kompetentlik, mutaxassis, qobiliyat, izlanish, iqtidor, rivojlantirish, yuksalish, natija.

Kamolova N.T.
acting associate professor
Department of Pedagogy and Psychology
University of Science and Technologies
Uzbekistan, Tashkent

FACTORS IN THE DEVELOPMENT OF INTELLECTUAL COMPETENCE IN FUTURE PRIMARY SCHOOL TEACHERS

Abstract. The article interprets the issue of the development of intellectual competence of future primary school teachers in pedagogical higher educational institutions, reveals the content and essence of intellectual competence, psychological factors for the development of intellectual competence and significant aspects of the development of intellectual competence.

Keywords: student, education, primary, process, essence, interpretation, intellectual, perception, competence, specialist, ability, research, talent, development, promotion, result.

Kirish. Bugungi kunda oliy ta’lim jarayonida talabalar intellektual kompetentligini rivojlantirish – ularning salohiyatini boyitish, muammolarni mustaqil hal etish qobiliyatlarini rivojlantirish, ijodkorlik qobiliyatlarini shakllantirish, intellektual madaniyatini rivojlantirishga qaratilgan. Intellektual salohiyat tushunchasi psixologik adabiyotlarda keng tarqalgan. Insonning intellektual xususiyatlarini tavsiflash uchun umumiy psixologiyada qo‘llaniladigan aniq mezonlar jamiyatining zamonaviy rivojlanish darajasiga va intellektual resurslarning ortib borayotganligiga qarab belgilanadi. Intellektual kompetentlikni rivojlantirish istiqbollari bu soha, zamonaviy ta’lim va ishlash sharoitida talabalar va o‘qituvchilarning intellektual salohiyatini oshirish, shu bilan birga, ularning

ijodiy va analitik qobiliyatlarini kengaytirishga qaratilgan hamda kelgusidagi pedagogik va professional samaradorlikni ta’minlashga yo‘naltirilgan jarayonlardir.

Bugungi kunda axborot va kommunikatsiya texnologiyalari ta’lim jarayonida katta rol o‘ynaydi. Intellektual kompetentlikni rivojlantirishda innovatsion texnologiyalar, internet resurslari, virtual simulyatsiyalar, elektron o‘quv materiallari va onlayn platformalardan foydalanish samarali usul bo‘lishi mumkin. Texnologiyalar orqali o‘quvchilarning muammolarni hal qilish qobiliyatlari, ijodiy fikrlash va mustaqil o‘rganish qobiliyatlari rivojlanadi.

Intellektual kompetentlikni rivojlantirish uchun ijodiy va tanqidiy fikrlashni qo‘llab-quvvatlash muhim. Shaxsning muammolarga yangi, g‘ayrioddiy va ijodiy yondashuvlar bilan qarash qobiliyatini rivojlantirish, ularni baholash va ijobiy qarorlar qabul qilishni ta’minlash kerak. Bu yo‘nalishda, ta’lim jarayonida muammolarga integrativ yondashuvlar, shuningdek, muloqot va fikrlar almashish imkoniyatlarini yaratish zarur [1]. Intellektual kompetentlikni rivojlantirishda mustaqil ta’lim va samoo‘rganish qobiliyatlarini shakllantirish muhim. Bu talabalarning o‘zlari xohlagan soha bo‘yicha bilim olishni istagan yo‘nalishlarda faoliyat ko‘rsatishlariga yordam beradi. Onlayn kurslar, mustaqil tadqiqotlar, mavzulardosh sessiyalar va seminarlar kabi imkoniyatlar talabalarga o‘zgaruvchan bilim olish tizimida samarali ishlashga yordam beradi.

Intellektual kompetentlikni rivojlantirishda turli fanlarning integratsiyasini amaliyotga tatbiq etish muhim. Bu, o‘z navbatida, ularning intellektual qobiliyatlarini shakllantirishga yordam beradi. Intellektual kompetentlikni rivojlantirishda, shaxsning emotsiyalarini va ijtimoiy munosabatlarini tushunish, ishonchli hamkorlik va ijtimoiy muammolarni hal qilish qobiliyatlari ham muhim o‘rin tutadi. Emotsional va ijtimoiy intellektning rivoji, talabalarning munosabatlarini yaxshilash, o‘z-o‘zini boshqarish va muammolarni ijobiy hal qilish qobiliyatlarini oshirishga yordam beradi. O‘qituvchilarning intellektual kompetentlikni rivojlantirishda shaxsiy va professional rivojlanishga bo‘lgan e’tibor muhim. O‘qituvchilarning intellektual salohiyati, o‘qitish metodlari, pedagogik strategiyalar, innovatsion texnologiyalardan foydalanish kabi omillar orasida samarali o‘zaro aloqalarni rivojlantirish ularning talabalarga yangi bilimlar yetkazishda muvaffaqiyatga erishishini ta’minlaydi.

Asosiy qism. Intellektual kompetentlik — bu shaxsning bilim olish, ma’naviy va professional faoliyatda muammolarni hal qilish, yangi ma’lumotlarni tahlil qilish, mustaqil fikrlash va ijodiy yondashuv ko‘rsatish qobiliyati. U, shubhasiz, shaxsning intellektual salohiyatini, uning bilimlarni o‘zlashtirishdagi samaradorligini va murakkab vaziyatlarda hal qilish qobiliyatlarini bildirish uchun ishlatiladi. Intellektual kompetentlikning mazmuni quyidagi asosiy elementlarni o‘z ichiga oladi:

1. Bilimlarni egallash va ularni qo‘llash, intellektual kompetentlik, avvalo, shaxsning olgan bilimlarini qanday qo‘llash va turli muammolarni hal qilishda foydalanish qobiliyatini anglatadi. Bu, o‘qituvchini yoki talabani mafkuraviy va amaliy jihatdan tayyor bo‘lishga yordam beradi.

2. Tanqidiy va ijodiy fikrlash, intellektual kompetentlik, shaxsning muammolarga tanqidiy va ijodiy yondashuvini qamrab oladi. Bu fikrlashning yuqori darajasi, ya'ni shaxs har qanday vaziyatda savol berish, alternativ yo'llar va yechimlarni izlash qobiliyatini o'z ichiga oladi.

3. Muammolarni hal qilish qobiliyati, bu komponent shaxsning biror muammoni aniqlash, uni tahlil qilish va hal qilish strategiyalarini ishlab chiqish qobiliyatiga qaratilgan. Intellektual kompetentlikning bu unsuri hayotiy va professional sharoitlarda muammolarga moslashish va to'g'ri qarorlar qabul qilish imkonini beradi.

4. Ma'lumotlarni tahlil qilish, bilimlarni yopish va turli manbalardan olingan ma'lumotlarni tahlil qilish qabiliyati intellektual kompetentlikning muhim qismi hisoblanadi. Bu qobiliyat insonga murakkab ma'lumotlarni to'plash, ularni tartibga solish va ulardan samarali foydalanish imkonini beradi.

5. Mustaqillik va shaxsiy taraqqiyot, intellektual kompetentlikning mazmuni mustaqil o'rganish va rivojlanishga bo'lgan istak va qobiliyat bilan ham bog'liq. Bunday shaxslar o'zlarining bilim olish jarayonini mustaqil ravishda boshqara oladi va doimiy ravishda o'zlarini rivojlantirishga intilgan bo'ladi.

6. Muloqot va hamkorlik, intellektual kompetentlik shunchaki shaxsiy qobiliyatlar bilan cheklanmaydi, balki boshqalar bilan muloqot va hamkorlik qilish qobiliyatini ham o'z ichiga oladi. Bu, talabalar va o'qituvchilar o'rtasida samarali kommunikatsiya va bilimlarni o'zaro almashishni ta'minlaydi.

7. Muvofiqlashuvchanlik va adaptatsiya, yangi sharoitlarga tezda moslashish, turli vaziyatlar va taqozolarga muvofiqlashish qobiliyati ham intellektual kompetentlikka kirishadi. Bu qobiliyat, o'z navbatida, shaxsning muammolarga yoki o'rganishga nisbatan qattiq ishonchga ega bo'lishiga yordam beradi.

Intellektual kompetentlikni rivojlantirishda talabalarni muhokama va muloqot jarayonlariga faol jalb etish hamda ularga yangi g'oyalar va konsepsiyalarni taqdim etish muhim [2]. Bu, shubhasiz, ularning tanqidiy fikrlash va o'z nazarlarini ifodalash qobiliyatlarini rivojlantiradi. Intellektual kompetentlik ko'nikmalarini nazariy bilimlar bilan cheklanib qolmay, ularni amaliy faoliyatda qo'llash talab etiladi [5]. Talabalar va o'qituvchilarni turli amaliy topshiriqlar va loyihalar orqali intellektual qobiliyatlarni ishlatishga undash va ularning amaliy ko'nikmalarini rivojlantirish zarur.

Bo'lajak boshlang'ich sinf o'qituvchilarida intellektual kompetentlikni rivojlantirish omillari – bu muvaffaqiyatli o'qitish va ta'lim berish jarayonida muhim bo'lgan omililar. Intellektual kompetentlikni rivojlantirish uchun bir nechta omillarni ko'rib chiqish mumkin:

1. Ma'ruzalar va ta'lim metodikalari, o'qitish usullari va texnologiyalari talabalarning fikrlash va mulohaza qilish qobiliyatlarini rivojlantirishi kerak. Bunga, misol uchun, interaktiv o'qitish, ijodiy va tanqidiy fikrlashga qaratilgan usullar kiradi.

2. Shaxsiy ko'nikmalar, bo'lajak o'qituvchilarda shaxsiy mulohaza, ijodiy va tanqidiy fikrlash kabi ko'nikmalar rivojlantirilishi kerak. Bu ko'nikmalar,

o‘quvchilar bilan samarali ishlashda va muammolarni hal qilishda muhim ahamiyatga ega.

3. Ma’rifiy va pedagogik malaka, o‘qituvchilar pedagogik va psixologiyaviy bilimlarni o‘zlashtirishlari va ularni amaliyotga tadbiq etishlari kerak. Bu, o‘z navbatida, o‘quvchilarning intellektual qodirliklarini rivojlantirishga yordam beradi.

4. Ijtimoiy va emotsional barqarorlik, o‘qituvchi o‘zi va talabalari o‘rtasida ijtimoiy va emotsional munosabatlarni mustahkamlash kerak. Bu, o‘quvchilarning mustaqil fikrlash va yordamga muhtoj bo‘lgan paytda to‘g‘ri yo‘lni ko‘rsatishda muhim rol o‘ynaydi.

5. Texnologiyalarning o‘qitishda qo‘llanilishi, zamonaviy axborot texnologiyalarini o‘qitish jarayoniga integratsiya qilish intellektual kompetentlikni rivojlantirishga yordam beradi. Bu, talabalarga ma’lumotlarni tez va samarali o‘rganishga yordam beradi.

6. Ma’ruza va praktik ishlarning integratsiyasi, o‘qituvchi ilm-fan va amaliyotni birlashtirish orqali talabalarning murakkab muammolarni hal qilish qobiliyatlarini rivojlantirishga yordam beradi.

7. Talabalarning mustaqilligini qo‘llab-quvvatlash, o‘qituvchi, talabalarga mustaqil ishlashga shariatli shartlar yaratish kerak. Bu, ularning ijodiy va analitik fikrlash qobiliyatlarini oshirishga yordam beradi.

Shuningdek, ushbu omillar o‘qituvchilarning shaxsiy professional rivojlanishini ham ta’minlaydi, bu esa, ularning ta’limdagi samaradorligini oshirishga yordam beradi.

Natijalar va muhokamalar. Intellektual qobiliyat aql-zakovatni va perseptiv-analitik qobiliyatlarni aks ettiruvchi omillar bilan ifodalanishi mumkin: axborotni yig‘ish, axborotni qayta ishlash, og‘zaki va mantiqiy fikrlash, abstraksiya qilish va tizimlashtirish qobiliyati, vizual va samarali fikrlash, amaliy muammolarni tezda hal qilish qobiliyati va konseptual moslashuvchanlik [3]. Ushbu qobiliyatlar asosiy va mas’uliyatli qarorlar qabul qilishda muvaffaqiyatga erishish, mantiqiy xulosalar asosida axborot yetishmasligi holatlarida noaniq, muammoli vaziyatda harakat qilish imkonini beradi.

Tushunish nafaqat bilim, balki bu bilimga bo‘lgan munosabat, uning bahosi, uning mazmuni, nafaqat ongning mazmunini, balki tushunish jarayonining mohiyatini ham belgilaydi. Qabul qiluvchi subyektning o‘z qiymat tizimiga ega ekanligi sababli, matnda tasvirlangan fikrlar subyekt tomonidan baholanadi va shaxsiy xususiyatiga ega bo‘ladi [6]. Shaxsning malakasi hissi tug‘ilishdan o‘n ikki yoshga yetgunicha rivojlanish tuzilmasining asosini tashkil etadi va individual rivojlanishning har bir bosqichida ota-ona munosabatlarining, qadriyatlari va tarbiya uslubi, shuningdek, oila a’zolarining stressli hayot sharoitlari, oila hajmi va ota-onalarning ruhiy salomatligi darajasi bilan bog‘liq bo‘lgan ijtimoiy-iqtisodiy holat va vaziyatlarga bog‘liq bo‘ladi.

Intellektual kompetentlikni rivojlantirishda psixologik omillar muhim rol o‘ynaydi, chunki har bir insonning psixologiyasi, fikrlash tarzi va ichki

motivatsiyasi uning bilim olish va intellektual faoliyatdagi samaradorligini shakllantiradi. Ushbu omillar quyidagi tarzda belgilanishi mumkin:

1. Intellektual kompetentlikni rivojlantirishda muhim psixologik omil motivatsiyadir. Motivlangan talabalar, o‘qish va yangi bilimlarni egallashga ko‘proq qiziqish va harakat qilishadi. O‘qituvchi talabalarning ichki motivatsiyasini qo‘llab-quvvatlashi kerak, chunki bu ularning mustaqil va ijodiy fikrlash qobiliyatlarini rivojlantiradi.

2. O‘qituvchi talaba salohiyatini, shaxsiy xususiyatlarini va qobiliyatlarini tushunishi va undan samarali foydalanishi zarur. Shaxsning intellektual qodirliklari uning ijtimoiy va emotsional holatlari bilan chambarchas bog‘liq, shuning uchun psixologik qo‘llab-quvvatlash talabalarning o‘zini o‘zi tanish va o‘zlariga ishonchi bilan bog‘liq bo‘lishi kerak.

3. Intellektual kompetentlikni rivojlantirishda ijodiy va tanqidiy fikrlash qobiliyatlari muhimdir. Bu, o‘z navbatida, insonning o‘zgarishlarga va yangi g‘oyalarga bo‘lgan ijobiy munosabatini rivojlantiradi. Psixologik jihatdan, shunday fikrlash tarzini qo‘llashga yordam beradigan ishlatishga harakat qilish kerak.

4. Emotsional barqarorlik (stressga munosabat, o‘zini nazorat qilish) intellektual faoliyatning samaradorligiga ta’sir ko‘rsatadi. Psixologik jihatdan, stressni boshqarish va o‘z-o‘zini mulohaza qilish qobiliyatlari ta’lim jarayonida muhim ahamiyatga ega. Agar talaba o‘z emotsiyalari bilan ishlashni bilisa, u ko‘proq muammolarni hal qilish va intellektual kuchini oshirishda muvaffaqiyatli bo‘ladi.

5. Psixologik nazariylik bo‘yicha, shaxsning o‘zgarish va rivojlanishga bo‘lgan ishonchi intellektual qobiliyatlarini oshirishga yordam beradi. Shaxs o‘z salohiyatini oshirishga va yangi bilimlarni o‘rganishga bo‘lgan ishonchga ega bo‘lsa, bu uning intellektual faoliyatini rivojlantirishga omil bo‘ladi.

6. Intellektual kompetentlikni rivojlantirishda o‘zini tanish va shaxsiy maqsadlar qo‘yish ham muhimdir. Bu talaba o‘zining intellektual imkoniyatlarini tushunib, ularni rivojlantirishga harakat qiladi.

7. Oila, o‘qituvchi va dugona-do‘stlar bilan ijtimoiy aloqa, ularning ma’naviy qo‘llab-quvvatlashi talabaning psixologik holatiga, ishonchga va intellektual qobiliyatlarini rivojlantirishga ijobiy ta’sir ko‘rsatadi. Mos muhit va ijobiy ta’sir qilish, insonning intellektual salohiyatini oshirishda muhim rol o‘ynaydi.

Shu tariqa, intellektual kompetentlikni rivojlantirishda psixologik omillar turli sohalardagi muammolarni hal qilish va talabaning yosh, his-tuyg‘ularini hisobga olish orqali amaldagi samaralarni ko‘rsatishga yordam beradi.

Ta’lim jarayoni bilim orqali ta’lim sifatini shaxsiy sifat tariqasida shakllantiradi, bu nafaqat dunyoning shaxsiy idrokini, balki uning ijodiy o‘zgarishini ham ta’minlaydi. Talabalar va o‘qituvchilarning samarali ijodiy vazifalarni belgilash va hal qilish jarayonining to‘liqligi bilan ishtiroki o‘z faoliyatining mazmunida doimiy yashash uchun o‘z taqdirini belgilash zarurligini ro‘yobga chiqaradi, individual va umumiy rivojlanish istiqbolini ochadi. O‘quv jarayonida ijodiy ishlab chiqarish vazifalaridan foydalanish o‘quv faoliyatining ma’no-mazmuni va maqsadli tarkibiy qismlarining rolini birinchi o‘ringa qo‘yadi,

bu o‘z-o‘zini nazorat qilish, o‘z-o‘zini boshqarish ta’limotiga o‘tishga hal qiluvchi ta’sir ko‘rsatadi [4]. Birgalikdagi samarali faoliyat holatlarini yaratish ta’limni samarali jarayonga aylantiradi, bu esa shaxsning samaradorligini oshirishga yordam beradi.

Xulosa. Intellektual kompetentlikning mazmuni insonning intellektual salohiyatini faol va samarali ishlatishga qaratilgan. U, shaxsning shaxsiy rivojlanishida ham, muammolarni hal qilish va ijtimoiy hayotda samarali faoliyat ko‘rsatishida muhim ahamiyatga ega. Kompetentlikka asoslangan ta’lim paradigmasi universitetlarda olingan ilmiy bilimlar o‘rtasidagi qarama-qarshilikni bartaraf etish va ularni amaliyotda qo‘llash samaradorligi natijasidir. Boshqacha aytganda, ta’lim jarayoni natijalarini doimiy baholash va bo‘lajak mutaxassislarni kasbiy tayyorlash uchun haqiqiy ehtiyoj mavjud. Kompetentlikka asoslangan yondashuv umumiy intellektual rivojlanishga qaratilgan qarama-qarshilikni bartaraf etdi va muayyan kasbiy faoliyatda amaliyotga yo‘naltirilgan yutuqlarga e’tibor qaratdi. Har qanday talabaning intellektual kompetentligini shakllantirish shartlari mazmunli ta’lim bilan bog‘liq shaxsiy yo‘naltirilgan ta’lim kabi ta’lim muhitining tarkibiy qismlarining o‘zaro bog‘liq ishlashi bilan belgilanadi.

Intellektual kompetentlikni rivojlantirish istiqbollari, zamonaviy ta’lim tizimini, pedagogik yondashuvlar va innovatsion texnologiyalarning integratsiyasiga asoslanadi. Bu, o‘z navbatida, talabalarning ijodiy va analitik qobiliyatlarini oshirishga, ularni ijtimoiy hayotda faol ishtirok etishga tayyorlashga yordam beradi. Intellektual kompetentlik rivojlanishi, nafaqat shaxsning individual taraqqiyotiga, balki jamiyat va iqtisodiyot rivojiga ham ijobiy ta’sir ko‘rsatadi.

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Karimjonov A.G.
yetakchi mutaxassis
O‘zbekiston Yozuvchilar uyushmasi Farg‘ona viloyati bo‘limi
O‘zbekiston, Farg‘ona

«ZAYN UL-AXBOR» ASARIDA ARABLAR HAMDA SOMONIYLAR TARIXIGA OID MA’LUMOTLARNING ILMIY-MANBASHUNOSLIK TAHLILI

Annotatsiya. Mazkur tezisda Abu Said Gardiziyning «Zayn ul-axbor» asarida arab istilolari va Somoniylar tarixiga oid ma'lumotlar manbashunoslik nuqtai nazaridan tahlil qilingan. Asar ma'lumotlari Narshaxiy, Utbiy, Ibn al-Asir, Jamol Qarshiy va Nizomuddin Hiraviy asarlari bilan qiyosiy o'rganilgan. Somoniylar davlatining shakllanishi, Ismoil Somoniy va Amr ibn Lays to'qnashuvi, Dargoh va Devon boshqaruv tizimi hamda davlat inqirozi sabablari yoritilgan. Tahlil natijalari Gardiziy asari Somoniylar davri siyosiy, ma'muriy va madaniy hayotini o'rganishda noyob manba ekanini ko'rsatdi.

Kalit so‘zlar: Gardiziy, «Zayn ul-axbor», Somoniylar, arab istilolari, Ismoil Somoniy, Amr ibn Lays, Movarounnahr, Xuroson, Dargoh, Devon, manbashunoslik, qiyosiy tahlil.

Karimjonov A.G.
leading specialist
Fergana Regional Branch of the Union of Writers of Uzbekistan
Uzbekistan, Fergana

A SCHOLARLY SOURCE-STUDY ANALYSIS OF THE INFORMATION ON THE HISTORY OF THE ARABS AND THE SAMANIDS IN THE WORK «ZAYN AL-AKHBAR»

Abstract. This thesis analyzes, from a source-study perspective, the information on the Arab conquests and the history of the Samanids in Abu Said Gardizi's «Zayn al-Akhbar». The work's data are compared with the writings of Narshakhi, Utbi, Ibn al-Athir, Jamal Qarshi and Nizamuddin Haravi. The thesis covers the formation of the Samanid state, the clash between Ismail Samani and Amr ibn Layth, the Dargah and Diwan system of administration, and the causes of the state's decline. The findings show that Gardizi's work is a unique source for studying the political, administrative and cultural life of the Samanid era.

Keywords: Gardizi, «Zayn al-Akhbar», Samanids, Arab conquests, Ismail Samani, Amr ibn Layth, Transoxiana, Khorasan, Dargah, Diwan, source studies, comparative analysis.

O‘rta asrlar Sharq tarixnavisligida Abu Said Abdulhay ibn Zahhok Gardiziyning “Zayn ul-axbor” asari Markaziy Osiyo, xususan, arab istilolari va Somoniylar davlatchiligi tarixini o‘rganishda muhim manbaviy ahamiyatga ega.

Mazkur asar nafaqat siyosiy-harbiy voqealarni bayon etish, balki mahalliy hokimiyatlar (ixshidlar, afshinlar), boshqaruv tizimi (Dargoh va Devon iyerarxiyasi), diniy-madaniy hayot hamda etnik jarayonlarni yoritish jihatidan boshqa zamondosh manbalardan — Narshaxiyning “Tarixi Buxoro”, Utbiyning “Tarixi Yaminiy”, Ibn al-Asirning “Al-Komil fit-tarix” va Jamol Qarshiyning “Al-mulhaqat bis-surax” asarlaridan ajralib turadi. Zayn al-axbor asari ikki nusxada saqlangan bo‘lib uni Nafisiy va Qazviniy nashrlari orqali o‘rganiladi. Gardiziy tarixi deb ataluvchi ushbu asar qo’lyamasining Nafisiy sharhida Qutayba ibn Muslimning Buxoro va Samarqandga yurishlarini tasvirlashda, arab qo‘shinining ichki intizomi va mahalliy aholining mudofaa taktikalariga to‘xtaladi.[4,5,6,7,11] Ibn al-Asirning “Al-Komil fit-ta’rix” asarida esa ko‘proq umumislomiy nuqtai nazardan, xalifalikning markaziy siyosati nuqtayi nazaridan yozilgan bo‘lsa, Gardiziy voqealarni mahalliy xurosonliklar qarashlari orqali ko‘rsatadi. Ibn al-Asirda ideologik talqin kuchli bo‘lsa, Gardiziyda xronologik aniqlik va geografik detallar ustunlik qiladi.[12] Jamol al-Qarshiy o‘zining “Al-mulhaqat bi-s-surax” asarida Markaziy Osiyo ulamolari va hukmdorlari haqida so‘z yuritganda, ko‘p o‘rinlarda Gardiziy tayangan an’analarga mos keluvchi faktlarni keltiradi.[3,11] Utbiyning “Tarixi Yaminiy” asari ko‘proq G‘aznaviylar sulolasini ulug‘lashga xizmat qilgani bois, Somoniylar davlatining inqiroz davrini bo‘rttirib ko‘rsatadi va G‘aznaviylarning bu sahnaga chiqishini qonuniy zaruriyat sifatida tasvirlaydi.[6] Gardiziy esa Somoniylarning inqirozi sabablarini ichki nizolar va iqtisodiy omillar bilan xolisroq faktik dalillar bilan tushuntiradi.[12] Ibn al-Asir ko‘proq devonlardagi amaldorlarning xalifa bilan aloqasiga urg‘u bersa, Gardiziy ushbu tizimning mahalliy an’analarga asoslanganini ta’kidlaydi.[12] Tadqiqotning dolzarbligi shundan iboratki, Gardiziy Xuroson va Movarounnahrga ixtisoslashgan holda voqealarni bayon etgani bois, uning ma’lumotlari xronologik aniqligi va geografik detallarga boyligi bilan ajralib turadi hamda O‘zbekiston hududidagi arxeologik tadqiqotlarni yozma manbalar bilan bog‘lash imkonini beradi. Ishning maqsadi — “Zayn ul-axbor” asaridagi arab istilolari va Somoniylar sulolasi yuksalishiga oid ma’lumotlarni boshqa manbalar (Narshaxiy, Utbiy, Ibn al-Asir, Jamol Qarshiy, Nizomuddin Hiraviy) bilan qiyosiy tahlil qilish, ularning o‘xshash va farqli jihatlarini aniqlashdir. Tadqiqot vazifalari qatoriga quyidagilar kiradi: Somonxudot avlodining xalifalik xizmatiga kirishi va mustaqil davlat qurish jarayonini tahlil etish; Ismoil Somoniy va Amr ibn Lays o‘rtasidagi to‘qnashuvning siyosiy-mafkuraviy ahamiyatini ochib berish; Somoniylar davlat boshqaruv tizimi (devonlar, hojiblik instituti)ning shakllanishini yoritish; hamda davlat inqirozi sabablarini tahlil qilish.

Tadqiqotda qiyosiy-tarixiy va manbashunoslik tahlili metodlaridan foydalanilgan. O‘tkazilgan tahlil shuni ko‘rsatadiki, Gardiziyning “Zayn ul-axbor” asari Somoniylar davlatchiligi tarixini o‘rganishda o‘ziga xos, boshqa manbalarda uchramaydigan tafsilotlarga boy manba hisoblanadi. Asar arab istilolarini quruq harbiy xronika sifatida emas, balki siyosiy-diplomatik jarayon, mahalliy hokimiyatlar bilan munosabatlar va iqtisodiy (xiroj) tizim nuqtai nazaridan yoritadi, bu esa uni Ibn al-Asirning umumislomiy yondashuvidan va Utbiyning

G‘aznaviylarni ulug‘lovchi tendensiyasidan farqlaydi. Ismoil Somoniy va Amr ibn Lays o‘rtasidagi to‘qnashuv tahlili Gardiziyning xolisligi va axloqiy-siyosiy talqin uslubini namoyon etadi: muallif bu voqeani shaxsiy fazilat va ilohiy adolat nuqtai nazaridan tasvirlar ekan, Somoniylar legitimligini asoslashga xizmat qiladigan rivoyatlarni (jumladan, mashhur oshpaz haqidagi hikoyani) saqlab qolgan yagona manba sifatida namoyon bo‘ladi. Somoniylar davlat boshqaruv tizimi — Dargoh va Devon iyerarxiyasi, o‘nta devon faoliyati, “qalam ahli” va “shamsher ahli” o‘rtasidagi raqobat — Gardiziy asarida eng batafsil yoritilgan bo‘lib, bu ma’lumotlar zamonaviy o‘zbek davlatchilik tarixi tadqiqotlari uchun asosiy manba bo‘lib xizmat qiladi. Shuningdek, davlat inqirozi sabablarini Gardiziy ichki feodal nizolar va harbiy-fuqarolik boshqaruvi o‘rtasidagi muvozanatning buzilishi bilan bog‘laydi, bu esa boshqa mualliflarning tashqi omillarga (Qoraxoniylar bosqini) urg‘u beruvchi yondashuvidan farq qiladi.

Xulosa qilib aytganda, “Zayn ul-axbor” Somoniylar davri siyosiy, ma’muriy va madaniy hayotini kompleks tarzda o‘rganish imkonini beruvchi, xolisligi va faktik aniqligi bilan ajralib turuvchi noyob tarixiy manbadir.

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Karshiyeva F.Z.
assistent
Raxmatullayev D.Sh.
talaba
O‘sarov A.G.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

PEDAGOGIKADA VEB-TEXNOLOGIYALARDAN FOYDALANISH

Annotatsiya. Maqolada pedagogikada veb-texnologiyalardan foydalanish masalalari ko‘rib chiqiladi. Ularning didaktik imkoniyatlari, asosiy vositalari va ta’lim jarayoniga joriy etish yo‘llari o‘rganiladi. Veb-texnologiyalarning interaktivlik, individuallashtirish va hamkorlikda o‘qitishni ta’minlashdagi roli nazariy jihatdan tahlil qilinadi. Tadqiqot natijasida veb-texnologiyalarning ta’lim sifatini oshirish va ta’lim oluvchilar faolligini kuchaytirishdagi ahamiyati ko‘rsatiladi.

Kalit so‘zlar: veb-texnologiyalar, pedagogika, ta’lim jarayoni, aralash ta’lim, masofaviy ta’lim, interaktiv metodlar, raqamli kompetentlik.

Karshiyeva F.Z.
assistant
Raxmatullayev D.Sh.
student
O'sarov A.G.
student
Samarkand State Medical University
Uzbekistan, Samarkand

APPLICATION OF WEB TECHNOLOGIES IN PEDAGOGY

Abstract. This article discusses the use of web technologies in pedagogy. It examines their didactic potential, main tools and ways of integrating them into the educational process. The role of web technologies in providing interactivity, personalization and collaborative learning is analyzed theoretically. The study shows that web technologies play a significant role in improving the quality of education and increasing student engagement.

Keywords: web technologies, pedagogy, educational process, blended learning, distance learning, interactive methods, digital competence.

Kirish

Zamonaviy ta'lim tizimida axborot-kommunikatsiya texnologiyalari, xususan, web texnologiyalar o'qitish jarayonining ajralmas qismiga aylanmoqda.

Internet orqali o'quv materiallariga istalgan vaqtda va istalgan joydan kirish imkoniyati, o'qituvchi va talaba o'rtasidagi tezkor aloqa hamda o'quv jarayonini shaxsga moslashtirish imkoniyatlari an'anaviy pedagogik yondashuvlarni qayta ko'rib chiqishni taqozo etadi.

O'zbekistonda ta'limni raqamlashtirish davlat siyosatining ustuvor yo'nalishlaridan biri sifatida belgilangan bo'lib [1], ushbu jarayonda o'qituvchining raqamli kompetensiyasi muhim o'rin tutadi. Ushbu maqolada web texnologiyalarning mohiyati, ularning didaktik imkoniyatlari, asosiy vositalari va pedagogik amaliyotda qo'llanilishi ko'rib chiqiladi.

Asosiy qism

Web texnologiyalar – bu Internet tarmog'ida axborotni yaratish, joylashtirish, uzatish va undan foydalanish imkonini beruvchi dasturiy va texnik vositalar majmuasidir. Ularning rivojlanishi odatda uch bosqichga bo'linadi:

- **Web 1.0 –** foydalanuvchi asosan tayyor axborotni o'qiydi (statik veb-sahifalar, elektron kutubxonalar).
- **Web 2.0 –** foydalanuvchi kontent yaratuvchisiga aylanadi, o'zaro muloqot va hamkorlik imkoniyati paydo bo'ladi (bloglar, vikilar, ijtimoiy tarmoqlar, bulutli xizmatlar) [2].
- **Web 3.0 –** axborot ma'nosiga ko'ra qayta ishlanadi, shaxsga moslashtirilgan va sun'iy intellektga asoslangan xizmatlar rivojlanadi.

Pedagogik nuqtai nazardan eng muhim burilish Web 2.0 bosqichi bilan bog'liq: o'quvchi bilimning passiv iste'molchisidan o'quv jarayonining faol ishtirokchisiga aylanadi.

Pedagogikada qo'llaniladigan asosiy web vositalar

Amaliyotda web vositalarni vazifasiga ko'ra quyidagi guruhlarga ajratish mumkin:

- **O'quv jarayonini boshqarish tizimlari (LMS):** Moodle, Google Classroom – kurs yaratish, topshiriqlarni tarqatish, baholash va statistikani yuritish uchun.
- **Video aloqa vositalari:** Zoom, Google Meet, Microsoft Teams – onlayn dars va konsultatsiyalar uchun.
- **Interaktiv test va o'yin platformalari:** Kahoot, Quizizz, LearningApps, Google Forms – bilimni tekshirish va darsni jonlantirish uchun.
- **Hamkorlik vositalari:** Google Docs, Padlet, onlayn forumlar – guruhli ishlash va g'oyalarni almashish uchun.
- **Kontent manbalari:** YouTube, ochiq ta'lim resurslari va elektron kutubxonalar – qo'shimcha material manbalari sifatida.

Pedagogik asoslar va o'qitish modellari

Web texnologiyalarni qo'llash muayyan pedagogik nazariyalarga tayanishi kerak. Konstruktivizm va L.S. Vygotskiyning yaqin rivojlanish zonasi g'oyasiga ko'ra, bilim o'quvchining faol ijtimoiy o'zaro ta'siri jarayonida shakllanadi [3]; web muhit bunday o'zaro ta'sir uchun keng imkoniyat yaratadi. Raqamli davr uchun G. Siemens taklif qilgan konnektivizm nazariyasi esa bilimni tarmoq va aloqalar orqali o'zlashtirish jarayoni sifatida talqin qiladi [4].

Amaliy modellar ichida aralash ta'lim (an'anaviy va onlayn shakllarning uyg'unligi) hamda «teskari sinf» modeli alohida ahamiyatga ega [5]. «Teskari sinf» modelida talaba yangi mavzu bilan darsdan oldin onlayn material orqali tanishadi, auditoriya vaqti esa masala yechish, munozara va amaliy mashg'ulotlarga ajratiladi [6]. Onlayn ta'limda sifatni ta'minlash uchun Garrison va hamkasblarining «tadqiqotchilar hamjamiyati» modeli ham qo'llaniladi: u ijtimoiy, kognitiv va o'qituvchilik ishtirokining birligiga asoslanadi [7, 8].

Tadqiqot metodlari

Tadqiqot nazariy xarakterga ega bo'lib, unda ilmiy-pedagogik adabiyotlar va me'yoriy hujjatlarni tahlil qilish, tasniflash hamda umumlashtirish usullaridan foydalanildi. Web vositalar bajaradigan didaktik vazifalariga ko'ra guruhlandi, pedagogik nazariyalar va o'qitish modellari esa web texnologiyalarni qo'llash nuqtai nazaridan ko'rib chiqildi.

Natijalar va muhokama

Tahlillar shuni ko'rsatadiki, web texnologiyalar o'qitish jarayonini interaktiv, shaxsga yo'naltirilgan va ochiq qiladi. Onlayn platformalar yordamida o'quv materiallari tizimlashtiriladi, talabalarning o'quv faoliyati kuzatib boriladi va baholash jarayoni shaffoflashadi. Bu o'qituvchining ish vaqtini tejab, uni ijodiy va metodik faoliyatga yo'naltirish imkonini beradi.

Hamkorlik vositalari (umumiy hujjatlar, forumlar, guruhli loyihalar) talabalarning muloqot va jamoada ishlash ko'nikmalarini rivojlantiradi. Interaktiv test va o'yin platformalari esa motivatsiyani oshiradi hamda mavzuni o'zlashtirishdagi bo'shliqlarni o'z vaqtida aniqlashga yordam beradi. Tibbiyot kabi amaliy yo'nalishlarda video, simulyatsiya va virtual laboratoriya elementlari nazariy bilimni amaliyot bilan bog'lashda alohida qulaylik yaratadi [9].

Shu bilan birga, web texnologiyalarni joriy etishda bir qator muammolar ham mavjud: Internet va qurilmalarga kirish imkoniyatidagi tengsizlik, o'qituvchilarning raqamli kompetensiyasi yetarli emasligi, onlayn kontent sifatining turlichaligi, shaxsiy ma'lumotlar xavfsizligi hamda o'quvchilarning raqamli vositalarga haddan tashqari bog'lanib qolish xavfi [5]. Shu sababli texnologiya o'z-o'zicha maqsad emas, balki pedagogik maqsadga xizmat qiluvchi vosita bo'lib qolishi lozim.

Tadqiqot natijalari web texnologiyalarni an'anaviy o'qitish bilan uyg'un holda, ya'ni aralash ta'lim shaklida qo'llash eng samarali yondashuv ekanligini ko'rsatadi. Kelgusidagi tadqiqotlarni web texnologiyalarning ta'lim natijalariga ta'sirini aniq o'lchovlar va pedagogik tajriba asosida baholashga, shuningdek, sun'iy intellektga asoslangan ta'lim xizmatlarini o'rganishga yo'naltirish tavsiya etiladi.

Xulosa

Xulosa qilib aytganda, ushbu maqolada web texnologiyalarning pedagogikada qo'llanilishi, ularning rivojlanish bosqichlari, didaktik imkoniyatlari, asosiy vositalari va pedagogik asoslari tahlil qilindi. Web texnologiyalar o'quv jarayonini interaktiv, moslashuvchan va hamkorlikka asoslangan qilishi asoslab berildi.

Shuningdek, aralash ta'lim va «teskari sinf» modellari misolida web vositalardan amaliy foydalanish tartibi ko'rsatildi. Texnologiyani joriy etishda

infratuzilma, o'qituvchi kompetensiyasi, kontent sifati va axborot xavfsizligi masalalariga alohida e'tibor qaratish zarurligi ta'kidlandi.

Kelgusida ushbu yo'nalishda o'qituvchilarning raqamli kompetensiyasini oshirish, o'quv kontentini sifat jihatidan takomillashtirish va web texnologiyalarning ta'lim natijalariga ta'sirini amaliy tajribalar asosida baholash maqsadga muvofiqdir.

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Karshiyeva F.Z.
assistant
Baxodirova B.B.
student
Nasridinova Z.N.
student
Norboyeva S.Q.
student
Nasirdinova N.K.
student
Samarkand State Medical University
Uzbekistan, Samarkand

ARTIFICIAL INTELLIGENCE APPLICATIONS IN ELECTRONIC HEALTH RECORDS MANAGEMENT

Abstract. The rapid digitalization of healthcare has resulted in the widespread adoption of electronic health records (EHRs). While EHRs improve accessibility and coordination of patient information, they also create significant challenges related to data volume, quality, security, and clinical usability. Artificial intelligence (AI) offers powerful tools for addressing these challenges through automated data processing, predictive analytics, anomaly detection, and intelligent decision support. This article examines the main applications of AI in EHR management, focusing on clinical decision support, automated extraction of clinical information, and data security.

Keywords: artificial intelligence, electronic health records, healthcare data management, machine learning, clinical decision support, data security, digital health.

Introduction

Electronic health records have become the central component of modern healthcare information systems. They store comprehensive patient data, including medical history, laboratory results, imaging studies, prescriptions, and clinical notes. The volume and complexity of this data continue to grow as telemedicine platforms, wearable devices, and connected diagnostic equipment generate additional streams of information [1].

Traditional EHR systems often struggle with incomplete records, inconsistent data formats, and limited analytical capabilities. Healthcare professionals spend considerable time searching for relevant information, which can delay clinical decisions. At the same time, the sensitivity of medical data requires strict protection against unauthorized access and cyber threats.

Artificial intelligence, particularly machine learning and natural language processing, provides new opportunities to improve the management, analysis, and

security of EHR data [2, 3]. AI systems can extract structured information from unstructured clinical notes, detect patterns that indicate potential risks, and support clinicians with evidence-based recommendations [4]. This article explores how AI technologies can enhance EHR management while highlighting the technical, ethical, and organizational issues that must be considered.

Materials and Methods

This article is a narrative review based on the analysis and synthesis of published scientific literature on the use of machine learning and artificial intelligence in healthcare, with a focus on the management of electronic health records.

Results

AI Applications in EHR-Based Clinical Decision Support

Clinical decision support is one of the most important areas in which artificial intelligence can provide practical value to electronic health record systems. Healthcare professionals must often analyze large amounts of patient information before making diagnostic or therapeutic decisions. AI-based systems can process this information rapidly and identify clinically relevant patterns that may not be immediately apparent to healthcare professionals [2].

Machine learning algorithms can analyze patient history, laboratory results, medications, vital signs, and other clinical parameters to estimate the probability of particular diseases or complications [5]. Predictive models can also help identify patients who may require closer monitoring or additional diagnostic procedures.

For example, AI-based predictive systems can analyze changes in vital signs and laboratory parameters to identify patients at increased risk of clinical deterioration. In chronic disease management, machine learning can be used to identify patterns associated with complications and support earlier intervention.

AI for Data Security and Privacy Protection

The protection of patient information is one of the most important requirements of modern healthcare information systems. EHRs contain highly sensitive information, including diagnoses, medications, laboratory results, personal information, and medical histories. Unauthorized access, data leakage, and cyberattacks can therefore have serious consequences.

Artificial intelligence can contribute to healthcare cybersecurity by continuously analyzing system activity and detecting unusual patterns.

Discussion

One of the most valuable applications of AI in EHR systems is the automatic extraction and structuring of clinical information. Natural language processing algorithms can analyze free-text physician notes, discharge summaries, and radiology reports, converting them into structured data that can be more easily searched and analyzed [4]. This reduces documentation burden and improves the completeness of patient records.

Machine learning models also support clinical decision-making by identifying high-risk patients, predicting disease progression, and suggesting personalized treatment options based on historical data [2]. For example, predictive

models trained on large EHR datasets can help detect early signs of sepsis, deterioration in chronic conditions, or potential adverse drug reactions.

Conclusion

Artificial intelligence has significant potential to improve the management of electronic health records by enhancing data quality, supporting clinical decisions, and strengthening security [6]. Through automated information extraction, predictive analytics, and intelligent monitoring, AI can help healthcare organizations handle growing volumes of medical data more effectively.

Successful implementation, however, requires careful attention to data quality, algorithmic fairness, system interoperability, and ethical standards. Collaboration between medical professionals, information technology specialists, and policymakers is essential to ensure that AI solutions deliver real clinical value while protecting patient privacy and safety. As digital health continues to develop, well-designed AI applications can play an important role in creating more efficient, reliable, and patient-centered healthcare information systems.

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Karshiyeva F.Z.
assistant
Jurakulova Z.L.
student
Toirova M.A.
student
To'rayeva F.F.
student
Takhirova A.T.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN MEDICINE: OPPORTUNITIES, CHALLENGES AND FUTURE PROSPECTS

Abstract. The article analyzes the role of artificial intelligence (AI) in modern medicine, its major application areas, practical benefits, and key limitations. A narrative analytical review of WHO guidance, peer-reviewed literature, and FDA regulatory information was conducted, covering machine learning, deep learning, natural language processing, and generative AI. Particular attention is paid to privacy, algorithmic bias, cybersecurity, accountability, transparency, and human oversight. Current evidence indicates that AI can improve aspects of clinical workflow, especially in medical imaging, but results vary across tasks and real-world settings. The main conclusion is that AI should be implemented as a clinician-support technology rather than as an autonomous replacement for healthcare professionals, supported by clinical validation, ethical governance, and AI literacy among healthcare workers.

Keywords: artificial intelligence, medicine, machine learning, deep learning, medical imaging, clinical decision support, generative AI.

Introduction

Digital transformation is changing how medical information is collected, interpreted, and used. Electronic health records, laboratory systems, medical imaging, genomic data, wearable sensors, and telemedicine platforms produce large and heterogeneous datasets. Because clinicians cannot manually evaluate every relevant variable within routine time constraints, computational methods that identify patterns, classify cases, estimate risk, and support decisions are increasingly important.

The World Health Organization (WHO) recognizes considerable potential for AI in health, scientific research, public health, and pharmaceutical development, while emphasizing safety, transparency, equity, accountability, and respect for

human rights [1, 2]. AI in medicine is not a single technology; it includes machine learning, deep neural networks, computer vision, natural language processing, recommender systems, and generative models [3]. Their roles range from narrow tools that detect findings in images to systems that summarize clinical documentation or assist medical education.

Materials and Methods

A narrative analytical review was conducted using WHO guidance and reports, peer-reviewed literature on healthcare AI, and official regulatory information from the U.S. Food and Drug Administration (FDA) [4, 5]. Comparative analysis, content analysis, synthesis, and thematic classification were used. Particular attention was given to real-world clinical implementation because high performance under experimental conditions does not necessarily guarantee clinical effectiveness after deployment [6].

Results and Discussion

AI in Medical Diagnosis

Diagnosis is one of the most developed applications of AI. Machine learning can process clinical variables, laboratory findings, physiological signals, and medical images to classify cases or estimate disease probability [7]. In clinical practice, AI may highlight suspicious findings, prioritize cases, or provide an additional quantitative assessment.

Medical imaging is especially important. CT, MRI, X-ray, ultrasound, and mammography can be analyzed using computer vision and deep learning [8]. A 2024 systematic review and meta-analysis identified 48 original studies of AI implementation in medical imaging; many reported reduced task time, although substantial heterogeneity prevented simple conclusions about overall effectiveness [9]. This indicates both the promise and the importance of real-world evaluation.

Clinical Decision Support

AI-based clinical decision support can combine age, symptoms, vital signs, laboratory findings, previous diagnoses, and medication history to estimate risk or rank possible explanations. Its main value is to help clinicians process many variables quickly. However, AI should augment rather than replace professional judgment [10]. Clinicians must integrate AI output with examination findings, medical history, patient preferences, and contextual information.

Personalized Medicine

Personalized medicine seeks to adapt prevention and treatment to individual patient characteristics. AI can integrate clinical, imaging, laboratory, and genomic data to identify patient subgroups, predict disease progression, and estimate treatment response. These applications are promising in oncology, cardiology, neurology, and rare diseases. Their reliability depends on representative data, external validation, and subgroup performance assessment [11].

Telemedicine and Remote Monitoring

AI can support telemedicine by organizing patient information, analyzing symptoms, detecting risk patterns, and interpreting data from remote-monitoring devices. Applications may include heart rate, blood pressure, glucose, and sleep

monitoring. Such tools may improve access where specialists are limited, but systems need clear escalation pathways, secure data transmission, and professional review of clinically important findings.

Generative AI in Medicine

Generative AI can produce text, images, or multimodal outputs and may assist clinical documentation, literature synthesis, patient education, medical training, and research. WHO's guidance on large multi-modal models notes their potential in healthcare while stressing governance and risk management [12]. Generative systems may produce plausible but incorrect content; therefore, high-stakes clinical use requires human verification and should not be treated as autonomous decision-making.

Conclusion

Artificial intelligence is becoming an important component of modern healthcare. Its strongest contributions are related to large-scale information processing, pattern recognition, diagnostic support, patient monitoring, research, and drug development. Evidence from medical imaging suggests potential efficiency gains, but real-world effects remain dependent on workflow, system design, and evaluation quality [9].

The future impact of AI will depend not only on algorithmic performance but also on data quality, clinical validation, cybersecurity, ethical governance, and professional competence. AI should therefore be implemented according to a human-centered model in which technology augments professional judgment rather than replacing it. The most appropriate principle is: AI + healthcare professional + clinical oversight.

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Karshiyeva F.Z.
assistant
Mirzayeva D.B.
student
Mamarajabova M.A.
student
Nortojiyeva I.L.
student
Nafasova Z.S.
student
Samarkand State Medical University
Uzbekistan, Samarkand

APPLICATION OF NANOTECHNOLOGY IN MODERN MEDICINE

Abstract. Nanotechnology has become one of the most promising interdisciplinary areas of modern medicine due to its ability to manipulate materials and biological structures at the nanoscale. This article reviews the major applications of nanotechnology in contemporary medicine, including drug delivery, oncology, diagnostic systems, medical imaging, regenerative medicine and antimicrobial applications. The review is based on an analysis of recent scientific literature and authoritative regulatory sources. The potential advantages include controlled drug release, improved bioavailability, increased targeting efficiency and reduction of systemic adverse effects. At the same time, important challenges remain, including toxicity, long-term biocompatibility, reproducibility, scalability, regulatory requirements and economic accessibility.

Keywords: nanotechnology, nanomedicine, nanoparticles, drug delivery, cancer therapy, medical diagnostics, targeted therapy.

Introduction

The rapid development of science and technology has significantly changed the possibilities of modern medicine. One of the most important technological advances of recent decades is nanotechnology. Nanotechnology deals with the design, production and application of materials and structures at the nanoscale. At this scale, materials can demonstrate physicochemical, optical, electrical, magnetic and biological properties that differ from their conventional forms.

Medicine represents one of the most important areas for the practical application of nanotechnology. The development of nanomedicine has provided opportunities for creating innovative drug delivery systems, highly sensitive diagnostic platforms, advanced imaging agents and new therapeutic approaches.

Nanotechnology is particularly important because many conventional medical technologies have limitations. For example, traditional drug administration may result in insufficient drug concentration at the target site, systemic toxicity,

rapid elimination or undesirable adverse effects. Nanotechnology-based delivery systems can potentially address some of these limitations by improving drug solubility, stability, bioavailability and distribution.

Materials and Methods

This article is based on a scientific literature review and analytical approach. Scientific publications concerning nanomedicine, nanoparticles, targeted drug delivery, cancer therapy, medical diagnostics, imaging and regenerative medicine were analyzed. Recent scientific publications from international biomedical databases and authoritative regulatory sources were considered. Particular attention was given to publications from 2024–2025 describing recent advances in nanomedicine and its clinical translation.

The analysis included the following major areas:

- nanotechnology-based drug delivery;
- cancer diagnosis and treatment;
- medical imaging;
- biosensors and early diagnosis;
- regenerative medicine and tissue engineering;
- antimicrobial applications;
- safety and regulatory challenges.

Results and Discussion

One of the most developed applications of nanotechnology in medicine is targeted drug delivery. Traditional drug administration distributes pharmaceutical substances throughout the body. As a result, the therapeutic concentration of a drug may not be sufficiently high at the site of disease, while healthy tissues may simultaneously be exposed to the drug.

Nanocarriers provide an alternative strategy. Drugs can be incorporated into or attached to nanoscale delivery systems and transported through biological environments.

Conclusion

Nanotechnology has become an important component of modern biomedical science. Its ability to manipulate materials at the nanoscale provides new opportunities for drug delivery, diagnosis, medical imaging, oncology, regenerative medicine and antimicrobial applications. Nanoparticle-based drug delivery systems can improve the physicochemical properties of therapeutic agents and provide controlled or targeted delivery. In oncology, nanotechnology offers opportunities for combining diagnosis and treatment and for developing more precise therapeutic strategies. At the same time, nanomedicine faces significant challenges related to toxicity, biocompatibility, standardization, manufacturing, cost and regulatory approval. Therefore, the successful implementation of nanotechnologies in clinical practice requires comprehensive evaluation of their safety and effectiveness.

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Kasimov K., PhD in Geographical Sciences
Lecturer
Department of Geography and Fundamentals of Economic Knowledge
Nizami Ganjavi National Pedagogical University of Uzbekistan
Uzbekistan, Tashkent
Yusupov K., PhD in Geographical Sciences
director
General Secondary Education School No. 258, Yunusobod District
Uzbekistan, Tashkent

SUSTAINABLE DEVELOPMENT OF URBANIZATION AND SOCIAL INFRASTRUCTURE IN UZBEKISTAN

Abstract. This research is aimed at spatial analysis of the impact of modern urbanization processes in Uzbekistan on the stability of social infrastructure. In the conditions of rapid population growth and territorial expansion of cities in the country, the need for schools, kindergartens and health institutions is analyzed. The results show that infrastructure development in newly built residential areas is lagging behind population growth. At the end of the article, scientific proposals are made to ensure social equality in urban planning and introduce the "compact city" model in accordance with the Sustainable Development Goals (SDG 11).

Keywords: urbanization, social infrastructure, sustainable development, Uzbekistan, spatial analysis, urban sustainability, social services.

Introduction. In the modern world, urbanization processes have become one of the most important drivers of sustainable development. In the Central Asian region, in particular, Uzbekistan, which is the country with the largest population of the region, [16] this process is gaining momentum. Today, the population of Uzbekistan exceeds 37 million people, and the annual growth rate remains high. Such demograffiku activism is increasing the pressure on urban systems, especially social infrastructure, to an unprecedented extent.

In order to systematically manage these processes, the Government of Uzbekistan has adopted a number of strategic documents. In particular, the Presidential Decree[17] No. PF-5623 of January 10, 2019, served as the legal basis for the radical improvement of urbanization processes.[14] According to this document, the strategic task is to increase the level of urbanization in the country to 60 percent by 2030[18]. In addition, the creation of a sustainable urban environment based on human capital and social well-being is identified as a priority area within the framework of the "Uzbekistan - 2030" strategy.[15]

[16] *Statistics Agency, 2025*
[17] *Presidential Decree No. PF-5623, 2019*
[18] *Presidential Decree No. PF-158, 2023*

However, the expansion of cities and the rapid increase in population are not always accompanied by the development of social infrastructure. There is a shortage of schools, preschool educational institutions, and medical facilities (hospitals) in newly built residential areas and "New Uzbekistan" complexes. This "spatial gap" between housing construction and infrastructure provision negatively affects the quality of life of the population and contradicts the principles of the UN's 11th Sustainable Development Goal (SDG 11)[19] - the creation of safe and sustainable cities.

Literature Review: The conceptual framework of urban resilience is based on the UN's 11th Sustainable Development Goal (SDG 11), which promotes making cities inclusive, safe, resilient and sustainable.[22] E.According to Glaeser (2020), the future of a city depends on its ability to manage population density and effectively provide essential social services. [8] Also, S.Bibri and J.Krogstie (2017) argues that "smart sustainable cities" require an integrated approach where digital infrastructure and social services converge to improve the quality of life of residents.[3] From a spatial perspective, Batty (2018) argues that urban resilience is not just about physical structures, but about the "connection" of infrastructure to the population. [2]

In Western countries, urban planning models focus on transport-oriented development (TOD) and the concept of "dense city". P.Newman and J.Kenworthy (2015) showed that reducing car dependence through sustainable transport links is important in creating equal access to social facilities. [13] However, H.Buhaug and H.Urdal (2013) warns that the lack of synchronization of infrastructure growth in rapidly urbanizing regions of Asia is creating “poverty traps” in urban peripheries,[4] undermining the inclusive nature of modern cities.

In the post-Soviet and Central Asian countries, urban transformation, the transition from socialist planning to urbanization based on a market economy, has created unique challenges in the post-Soviet space. M.Gentile (2015) and K.Stanilov (2007) have observed that the “microdistrict” system, which once provided standardized social services, is now in crisis under the pressure of neoliberal housing development.[6-16] In Central Asia, this transformation is characterized by significant territorial imbalances. A.Syzdykov et al. (2020) identified a "spatial mismatch" in the case of Almaty, where housing construction outstrips the provision of schools and clinics.[18] In addition, M.Ahunov (2021) and J.Tukhtabayev (2022) argue that while urbanization drives economic growth, it can also exacerbate environmental and social vulnerabilities if not managed through rigorous spatial planning. [1-20]

The urban landscape of Uzbekistan has changed dramatically since 2017. O.Gritsai and A.Treivish (2020) document the rapid "metropolization" of Tashkent, noting that urban growth is engulfing its suburbs.[9] Sh.Recent research by Qodirova (2023) shows that the availability of social infrastructure is unevenly distributed, with a clear "spatial gap" between historical centers and new

[19] https://api.mf.uz/media/document_files/Ikkinchi_milliy.pdf

neighborhoods.[12] A.Yusupov (2022) argues that while housing reform is a priority, a more robust legal base of urban planning is needed to coordinate them with SDG 11.[24] The numerical measure of this process is N.Ibragimov and S.Haidarovs (2024) have studied and propose that digitization of urban management eliminates the lack of data in monitoring infrastructure needs.[10] However, X. As Umarov (2019) notes, addressing regional disparities in social infrastructure remains the biggest obstacle to Uzbekistan's long-term urban sustainability.[21]

Despite the extensive literature on global urban trends and post-socialist transitions, there is a lack of empirical studies that have quantitatively assessed the social infrastructure of Uzbekistan's new massifs for 2017–2025. This study aims to fill this gap by statistically assessing the shortage of social services in Tashkent and major regional centers, and to provide a data-driven strategic framework for sustainable urban growth.

Methodology: This study uses a systematic approach based on the comprehensive study of territorial and socio-economic systems. Urbanization processes and social infrastructure are analyzed in an interrelated way. The population size, urbanization rate, and the state of social infrastructure (education, healthcare) are determined through statistical analysis. The data is based on official sources from the State Statistics Committee. The comparison method compares regions of Uzbekistan, identifies differences between cities, and compares them with international experience. The forecast is made for the years 2030–2040 using extrapolation analysis.

The scientific novelty of the methodology consists in the joint assessment of urbanization and social infrastructure and the construction of a territorial rating through an Integral Index, as well as analysis based on the criteria of sustainable development. The research stages include the following. 1. Data collection. 2.Selection of indicators. 3.Index calculation. 4.Regional analysis. 5.Identifying problems. 6.Development of proposals and recommendations.

Results: The process of urbanization in Uzbekistan is considered one of the strategic directions for modernizing the country's economy and improving the well-being of the population. As of January 1, 2026, the country's urbanization rate is around 52%, with more than 19.3 million people living in cities.[20] Since 2017, the urbanization policy in Uzbekistan has undergone a radical change. Previously, this process was more focused on restrictions (the propiska system) and the preservation of agriculture, but after 2017, cities began to be seen as economic drivers. During this period, in accordance with new approaches, the Urbanization Agency (later transferred to the Ministry) was established under the Ministry of Economy and Finance in 2019.[21] This was the first case when a separate state body was created to manage urbanization. In 2021, the Resbuplika Center for the development of urbanization and urban planning documents was established under the Ministry of destruction. And in November 2025,[22] the National Committee for urbanization and

[20] https://stat.uz/en/press-center/news-of-committee
[21] https://lex.uz/uz/docs/6968349?ONDATE=11.01.2019
[22] https://lex.uz/uz/docs/-6600549?ONDATE=22.11.2025%2000

sustainable development of the housing market was established[23]. Main goal is to increase the level of urbanization to 60% by 2030, from the current level of about 50.6%. [17]

Due to ongoing urban development, the population of cities is growing. This situation is particularly noticeable in Tashkent. In 2017, the population of the city was over 2.4 million, and by the beginning of 2026 it had reached 3.2 million. The population of large and major cities in the republic has changed over the past 10 years as follows. Table 1.

Table 1
Information about the population of large and major cities in the republic

№	Towns	2015	2025	Growth %
1	Andijan	410,4	492,4	120,0
2	Bukhara	273,5	300,2	109,8
3	Jizzakh	165	199,9	121,2
4	Karshi	257,8	300,8	116,7
5	Navoi	133,5	166,5	124,7
6	Namangan	484,9	713,4	147,1
7	Samarkand	513,6	595,8	116,0
8	Termez	137,9	207,3	150,3
9	Gulistan	85,4	102,1	119,6
10	Fergana	268,1	328,4	122,5
11	Kokan	236,8	313,6	132,4
12	Urganch	138	155,7	112,8
13	Nukus	300,7	344,7	114,6
14	Chirchik	150.4	175,3	117.5
15	Tashkent	2371,3	3112,8	131,3

The table was compiled by the author based on statistical data.

As can be seen from the table above, during this period, the population of Tashkent and Kokand increased by more than 30 percent, while in Namangan and Termez, this figure increased by up to 50 percent. While the population of Tashkent has increased mainly due to internal migration, the population of Namangan and Termez has increased mainly due to administrative reforms and the construction of new housing in these cities, which has resulted in a shift in internal migration. In the cities of Andijan, Jizzakh, Gulistan, Navoi and Fergana, it is more than 20 percent. The Uzbekistan-2030 strategy also aims to transform Samarkand, with a population of over 600,000, and Namangan, with a population of over 700,000, into million-plus cities with a population of 1 million. With this, it is necessary to maintain the capacity of social infrastructure facilities in these cities at the same growth rate.

The demand for social infrastructure systems is increasing dramatically as a result of urban population growth and increasing urban economic capacity. This process is especially evident in large cities, including Tashkent, Samarkand and the

[23] https://lex.uz/uz/docs/7865814

regions of the Fergana Valley. At the same time, the rapid pace of urbanization processes is placing additional pressure on social infrastructure, education, health, transport, and housing systems.[25] Managing these processes in accordance with the principles of sustainable development is one of the important areas of regional policy. In comparison with 2017, in 2025, social urbanistic pressure should be borne on the basis of the population of cities and the capacity of social facilities (in the case of the most necessary secondary school student seats, the capacity of preschool educational institutions and coyotes in shifoxanas).

The World Health Organization (WHO) traditionally recommends 30 to 50 hospital beds per 10,000 people.[23] However, in developed countries (such as Japan or Germany), this figure is much higher (up to 120-130), while in developing countries it may be lower. In Uzbekistan, this recommendation is also established in the healthcare system. Currently, the average number of people per 1,000 residents in the Republic is around 70. However, this requirement may not be met in urban areas. Based on the above, it is necessary to determine the social pressure on the medical sector in cities. Based on this, the current situation can be assessed and the medical social urbanist pressure can be determined based on the following index.

$$IUB_{tibbiyot} = \frac{P}{K} * 100$$

In this:

IUBtibbiyot – Social urbanist pressure on medicine

P: — Population size.

K: — Number of beds.

This table allows you to assess the dynamics of population and hospital beds (places) in the period 2015–2025 in the largest cities of Uzbekistan. The analysis shows that over the past 10 years, the population in all cities has grown steadily, but the pace of development of the medical infrastructure has varied across regions.

The development of healthcare infrastructure in Uzbekistan from 2015 to 2025 has been uneven across regions, as exemplified by cities. In some cities (Namangan, Termez, Kokand), the rate of demographic growth exceeded the development of the healthcare system, which increased the pressure on medical services. At the same time, there has been an improvement in the level of medical care in Samarkand, Bukhara, and Gulistan. In general, it is necessary to develop infrastructure in the future based on a territorial balance.

Table 2
Information on the number of hospital beds in cities.

№	Towns	2015			2025			Growth from 2015 to 2025
		Population	Number of beds	Each Bed	Population	Number of beds	Each Bed	
1	Andijan	410400	5918	69	492400	6706	73	105,9
2	Bukhara	273500	2480	110	300200	3325	90	81,9
3	Jizzakh	165000	1957	84	199900	2717	74	87,3
4	Karshi	257800	3800	68	300800	4400	68	100,8
5	Navoi	133500	1700	79	166500	2100	79	101,0
6	Namangan	484900	4026	120	713400	4928	145	120,2
7	Samarkand	513600	13201	39	595800	16332	36	93,8
8	Termez	137900	2453	56	207300	2905	71	126,9
9	Gulistan	85400	1400	61	102100	2300	44	72,8
10	Fergana	268100	3434	78	328400	4587	72	91,7
11	Kokan	236800	1671	142	313600	1795	175	123,3
12	Urganch	138000	2800	49	155700	3600	43	87,8
13	Nukus	300700	2676	112	344700	3520	98	87,1
14	Chirchik	150400	961	157	175300	1091	161	102,7
15	Tashkent	2371300	18644	127	3112800	26888	116	91,0

The table was compiled by the author based on statistical data.

Many methods have been proposed to identify social urbanistic pressures in social areas, particularly in the field of education. The field of education is a necessary area for the population. The education sector is divided into types based on the age of its population, namely pre-school education, general secondary education, professional education, higher education, and post-higher education. General secondary schools are considered the longest and most important link in the education system, which is the most important of the social infrastructure. This pressure is mandatory for children aged 7-18 in general secondary education. It is important to determine the social urbanist pressure index in the regions by school, which is done by determining the number of students in urban areas and the capacity of schools.

Table 3
Information about the number of students and student places in cities

№	Towns	Enrollment			Number of places in the school		
		2015	2025	Growth (%)	2015	2025	Growth (%)
1	Andijan	86 000	108 000	125,6	70 000	85 000	135,7
2	Bukhara	57 000	66 000	115,8	46000	58 000	126,1
3	Jizzakh	34 000	44 000	129,4	28 000	41 000	153,6
4	Karshi	54 000	66 000	122,2	45 000	60 000	144,4
5	Navoi	28 000	36 000	128,6	22 000	28 000	113,6
6	Namangan	102 000	147 000	144,1	80 000	105 000	131,3
7	Samarkand	108 000	151 000	121,3	100 000	105 000	120,0
8	Termez	28 000	36 000	128,6	24 000	28 000	108,3
9	Gulistan	17 000	22 000	129,4	13 000	19 000	115,4
10	Fergana	56 000	72 000	128,6	45 000	62 000	115,6
11	Kokan	49 000	59 000	120,4	39 000	45 000	115,4
12	Urganch	29 000	34 000	117,2	25 000	28 000	112,0
13	Nukus	63 000	76 000	120,6	58 000	65 000	112,1
14	Chirchik	32 000	39 000	121,9	25 000	29 000	116,0
15	Tashkent	420 000	615 000	137,5	321000	379000	118,1

The table was compiled by the author based on statistical data.

The table data shows that urbanization and demographic growth in major cities of Uzbekistan are putting varying degrees of pressure on educational infrastructure. A general case study shows that the growth rate of the number of school places in the cities of Andijan, Bukhara, Jizzakh and Qarshi (e.g. 153.6% in Jizzakh and 144.4% in opposition) is significantly higher than the growth in the number of students, which has been effective in reducing the school deficit. However, in most other regions, including Navoi, Termez, Gulistan, and Fergana, the growth in student numbers has outpaced the creation of school places, leading to increased infrastructure strain. Especially in Tashkent and Namangan, the situation is more remarkable: at a time when the number of students in Namangan increased by 144.1%, school places increased by 131.3%, and in the capital Tashkent, students increased by 137.5% (up to 715 thousand people), while school capacity increased by only 118.1%. This confirms that the problem of shortage of school places is most acute in Tashkent, meaning that urbanization and population growth in the capital have outpaced school construction. Also, the increase in the number of seats (112% -120%) in cities like Samarkand, Kokand, Nukus and Chirchiq, slightly behind the flow of students (120% -121%), will require further expansion of the network of schools to maintain the quality of education in the future.

The analysis shows that the urbanization process is putting a lot of pressure on the education system across the country. While the pace of school construction is good in most regional centers, urgent measures are needed to develop school infrastructure in Tashkent.

The Social Urban Pressure Index by city can be calculated by the following formula for schools:

$IUB_m = \frac{U}{Q} * 100$

In this,

IUBm – Index of Social Urbanism Pressure by Schools
U – Number of Students in General Secondary Education
Q – Number of Students in General Secondary Schools

This formula is used to estimate the demand for school places in a population. If the number of students exceeds the available school places, then the urban pressure is high. For example, if a city has 45,000 students but only 30,000 school seats, the pressure index would be 1.5. This number means that the available spaces are not enough to accommodate the number of students and there is a 50% overload. As a result, classrooms are overcrowded, students are crammed together, and the quality of education suffers.

For example,

According to the city of Tashkent,

$IUB_m = \frac{615000}{379000} * 100 = 162$

By city of Samarkand,

$IUB_m = \frac{131000}{105000} * 100 = 140$

The social urbanist pressure of secondary schools was determined using the formula above, using the example of cities in the Republic.

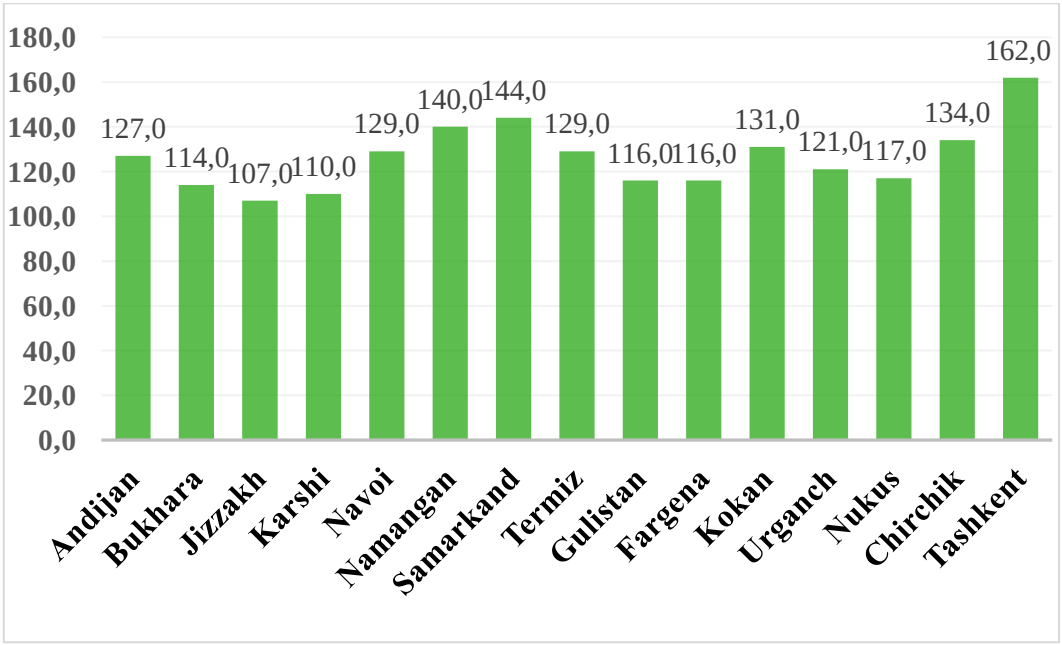


Figure 1. Social urbanist pressure index for cities by education.

It is clear that the social urbanistic pressure in cities is different. Based on this index, cities should be divided into the following groups.

Very high pressure.Higher than 150, in Tashkent

High pressure. From 125 to 150, in Andijan, Navoi, Namangan, Samarkand, Termez, Kokand and cities

Stable pressure. From 100-125, it is observed in Bukhara, Jizzakh, Karshi, Gulistan, Fergana, Urgench and Nukus.

Discussion: Between 2015 and 2025, major cities in Uzbekistan have developed differently in terms of health infrastructure and population dynamics. The table shows that the population of all cities has grown steadily, but the pace of development of the medical infrastructure has varied significantly across regions.First of all, as a general trend, it can be said that although the number of beds has increased in most cities, this increase has not always been proportional to the increase in population. As a result, in some areas, the "number of people per bed" has increased, putting pressure on medical services. The most acute situation is observed in the city of Termez. In 2015, there were 56 residents per bed, but by 2025 this figure will increase to 71 (126.9%). This means that the city's medical infrastructure has not expanded sufficiently against the background of rapid population growth. A similar pattern is observed in Kokand (142 to 175 residents) and Namangan (120 to 145 residents). Demographic pressure is high in these areas, putting a strain on the healthcare system. On the contrary, a positive trend is noted in some cities. In Gulistan, for example, the number of inhabitants per koyka decreased from 61 to 44. The rate of decline was also observed in Bukhara and Samarkand, indicating that the medical infrastructure developed faster than the population growth. In some cities, a relatively stable situation is observed. In particular, the population per bed in Karshi and Navoi cities has remained almost unchanged. This indicates that infrastructure development has been carried out in line with population growth. Among the major cities, Tashkent deserves special attention. Despite the significant increase in population, the number of beds has also increased rapidly, and as a result, the load per bed has decreased from 127 to 116. This indicates that the healthcare system in the capital is relatively well developed.

Analyzing the relationship between student enrollment and school infrastructure in major cities in Uzbekistan between 2015 and 2025 clearly demonstrates the impact of urbanization processes on the education system. Data on the example of the cities of Namangan, Samarkand, Tashkent, Andijan and Kokand show that the country has a diverse demographic growth and infrastructure race: while the number of students in Namangan and Kokand has increased at the highest rate (154% and 141%, respectively), the number of school places in these regions has also increased almost in parallel (150% and 136%), managed to expand the network in accordance with the population, there was a strong ground for future urbanization and a reduction in load on schools as school seat growth (140% and 136%) advanced significantly from the flow of students (121% and 125%), but at a time when the situation in the capital Tashkent was sharply different from other areas of the Republic and the number of students increased by 137% by only 118% , as a result, according to future forecasts, if the pace of school construction in Tashkent is not sharply increased, then by 2030 the shortage of student seats will

reach a crisis point, and in Valley cities, vertical reconstruction of existing schools will remain the main solution due to a shortage of land resources.

Conclusion: Analyzing the relationship between student enrollment and school infrastructure in major cities in Uzbekistan between 2015 and 2025 shows how urbanization processes are affecting the social urbanist pressure on the education system. The results of the above table and indices show that in some cities (for example, Tashkent, Namangan, Samarkand) the school network has not developed sufficiently due to the rapid growth of the population, which has led to a shortage of student places and overcrowding in classrooms. In Tashkent, the IUBm index reached 162, indicating the highest social urbanist pressure, which means that urgent measures are needed to expand the educational infrastructure in the capital.

In other regions, such as Andijan, Bukhara, and Jizzakh, the growth rate of school places has exceeded the increase in the number of students, indicating that the infrastructure of the education system is well developed in some regions. At the same time, in the cities of Namangan and Termez, the high IUBm index (in the range of 125–150) indicates that the educational infrastructure is lagging behind the population's demand, which poses a risk of a low-quality learning process in the future.

In some cities (Namangan, Termez, Kokand), the medical infrastructure has not expanded sufficiently due to rapid population growth, leading to an increase in the number of people per bed and increased pressure on medical services. In Tashkent, the medical infrastructure has expanded significantly, and the workload has decreased relatively.

The gaps between social infrastructure development and population growth vary across cities, making it important to implement balanced regional policies for sustainable urban development.

To align cities with the SDG 11 goals, provide adequate social services, and reduce urban pressure, the following are necessary:

-Expand school and hospital capacity or build new facilities based on population projections;

-Regular monitoring of social urbanist pressure indices;

-Optimal allocation of resources through the introduction of digital management systems;

-Territorial planning aimed at sustainable and inclusive development of urbanization processes.

While urbanization in Uzbekistan supports the country's economic modernization, it will negatively impact the sustainability of cities and the well-being of their residents if it is not coordinated with the development of education and health infrastructure. Therefore, developing social infrastructure based on territorial balance, supporting urbanization policies with scientifically based data, and strategic planning are key factors in urban sustainability.

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Khujamov J.
assistant
Qarshi State Technical University
Uzbekistan, Qarshi
ORCID: 0009-0005-3606-684X

SUSTAINABLE DIRECTIONS FOR ENHANCING THE EFFICIENCY OF FOOD INDUSTRY ENTERPRISES IN THE REGIONS OF KASHKADARYA PROVINCE

Abstract. This article provides a scientific-practical analysis of the sustainable directions for enhancing the efficiency of food industry enterprises in the regions of Kashkadarya province. The study examines the current state of the region's food industry, existing challenges, and development opportunities. Strategic directions such as the cluster approach, introduction of digital technologies, strengthening the local raw material base, and increasing export potential are substantiated. The recommendations presented in the article contribute to the sustainable development of the regional economy.

Keywords: food industry, efficiency, sustainable development, cluster, digitalization, export potential, Kashkadarya province.

INTRODUCTION: The food industry, as a strategic sector of the economy, plays a decisive role in providing the population with high-quality and affordable food products. In the Republic of Uzbekistan, the development of agriculture and the food industry has become a priority direction of state policy in recent years, with the volume of investments directed to this sector increasing considerably.

Kashkadarya province is one of the economically significant regions of the republic. The province's favorable climatic conditions, abundant land and water resources, and agricultural potential create a strong foundation for the rapid development of the food industry. However, the insufficient technical and technological level of existing enterprises, the management system's incomplete adaptation to modern requirements, and the relatively low market competitiveness are hindering the effective development of the sector [1].

The "Development Strategy of New Uzbekistan for 2022–2026" approved by Decree No. PF-60 of the President of the Republic of Uzbekistan dated January 28, 2022, and the food industry development program established by Resolution No. PQ-4491 dated October 23, 2019, have defined the enhancement of efficiency of enterprises in this sector as a priority task at the state level. Based on these important documents, the systematic and consistent implementation of measures at the provincial level remains an urgent demand of the time [2].

The scientific-practical significance of the research lies in the fact that the sustainable directions proposed in the article are not merely theoretical in nature, but have been developed with full consideration of the distinctive economic,

geographical, and resource potential of Kashkadarya province, encompassing specific mechanisms and tools that can be implemented in practice.

LITERATURE REVIEW: The issue of enhancing the efficiency of food industry enterprises has been extensively studied by foreign and domestic scholars. Porter M. (1998) developed the theory of forming competitive advantages based on the cluster approach, empirically proving that the geographical concentration of industrial enterprises improves profitability and innovation activity indicators by 23–31 percent [3].

Ansoff I.H. and MacDonnell E.J. (1990) emphasized the importance of balancing internal resources and the external environment in ensuring the strategic flexibility of an enterprise. Their findings are fully applicable to food industry enterprises as well, given that this sector operates in a highly competitive environment [4].

Among local researchers, Toshmatov A.T. (2021) studied the integration of agriculture and the food industry in Uzbekistan, demonstrating that the vertical integration model increases enterprise profitability by 15–20 percent [5]. Yusupov R.M. (2020) established a scientific foundation for improving the management system of food industry enterprises under digitalization conditions [6].

A study of advanced foreign experience shows that countries such as the Netherlands, Spain, and Israel, having established cluster structures in the food industry, achieved a two-to-threefold increase in export volumes within a few years. In China, the introduction of digital technologies under the "Smart Farm" program improved efficiency by more than 30 percent. These experiences can serve as an important methodological basis for Uzbekistan, including Kashkadarya province [7].

ANALYSIS AND RESULTS: As of 2025, 214 officially registered enterprises are operating in the food industry of Kashkadarya province. Of these, 78 belong to the category of large and medium enterprises, while 136 fall under small enterprises and micro-enterprises. Although the production volume of the province's food industry has grown 1.8 times over the past five years, it still lags behind the national average by 12–14 percent [8].

Table 1.

Key performance indicators of food industry enterprises in Kashkadarya province[24]

Indicator	Years				
	2021	**2022**	**2023**	**2024**	**2025**
Number of enterprises (units)	178	185	196	206	214
Production volume (bln. UZS)	1 842	1 968	2 314	2 876	3 312
Export volume (mln. USD)	12,4	13,1	18,7	24,3	31,6
Average profitability (%)	8,2	7,9	9,4	11,1	12,3
Share of modern technology (%)	18	22	29	35	41
Employed workers (thousand persons)	14,3	14,8	15,6	16,4	17,2

[24] Author's compilation based on data from the Statistical Department of Kashkadarya Province

As can be seen from the table data, a positive dynamic exists in the food industry of the province. However, the analysis shows that the level of technological equipment of enterprises is still insufficient — the share of modern technologies amounts to only 41 percent. This indicator represents a gap of 18–24 percent when compared with leading regions such as Tashkent and Samarkand [9].

Based on comprehensive monitoring and interviews conducted at food industry enterprises of Kashkadarya province, the following systemic problems have been identified:

1. Technical and technological obsolescence of production: in 59 percent of enterprises, the equipment depreciation coefficient exceeds 70 percent.

2. Instability of the raw material base: absence of long-term contractual relationships with local agriculture.

3. Low qualification of personnel: shortage of industrial technologists and food quality control specialists.

4. Underdevelopment of marketing and export systems: only 9.5 percent of manufactured products are exported.

5. Financing problems: long-term investment credits are costly and difficult to obtain.

As the first and most important strategic direction, the formation of food industry clusters is proposed. The cluster model integrates agricultural raw material producers, processing enterprises, trade and sales organizations, and scientific-educational institutions into a unified coordination system. Taking into account the geographical and economic structure of Kashkadarya province, it is advisable to establish three specialized clusters in the following directions:

– Karshi-Koson food cluster (grain and flour products, oil and fat industry);

– Shahrisabz-Guzor fruit and vegetable processing cluster (canning, drying, freezing);

– Muborak-Kamashi livestock and dairy products cluster.

According to calculations, within the first 3 years following cluster formation, member enterprises are expected to see their costs decrease by 18–22 percent, while production volumes are projected to increase by 25–30 percent [10].

The implementation of digital transformation based on the Industry 4.0 paradigm is becoming a key factor in enhancing the efficiency of modern food industry enterprises. For the enterprises of Kashkadarya province, the phased introduction of the following digital solutions is recommended:

Table 2.
Stages of digital technology implementation and expected outcomes[25]

Stage	Timeline	Key measures	Expected outcome
Stage I	2025–2026	ERP system, warehouse automation, electronic document management	Cost reduction by 12%
Stage II	2026–2027	IoT sensors, quality control automation, smart logistics	Product loss reduction by 18%
Stage III	2027–2028	AI-based forecasting, digital platform integration	Profitability growth by 20–25%

Raw material costs account for 55–65 percent of the total costs of food enterprises. For this reason, establishing long-term contractual relationships with agriculture, developing the contracting system, and forming reliable partnership relations with farming households represent a strong internal reserve for enhancing efficiency. The experience of Khorezm and Fergana provinces demonstrates that such an approach makes it possible to reduce raw material costs by 15–17 percent [11].

Organic fruits and vegetables, spices, and dairy products produced in Kashkadarya province generate high demand in international markets. However, export volumes still represent only 30–35 percent of the existing potential. The following comprehensive measures are necessary to expand exports:

– Introduction of ISO 22000, GlobalGAP, and Halal certification systems (target indicator — 50 enterprises within 3 years);

– Establishment of a unified export platform under the provincial brand;

– Opening of trade representative offices in Asian and Middle Eastern markets;

– Provision of subsidies and tax incentives to exporting enterprises.

The fundamental guarantee of sustainable efficiency is qualified personnel and continuous innovation activity. It is recommended to establish specialized personnel training for the food industry in cooperation with Karshi State University and technical higher education institutions of the province, to introduce the dual education system, and to organize research and development departments within enterprises. The experience of Germany and France demonstrates that the dual education system increases personnel qualifications by 35–40 percent and labor productivity by 22–28 percent [12].

DISCUSSION: The implementation of the proposed sustainable directions will considerably enhance the competitiveness of the food industry of Kashkadarya

[25] Developed by the author

province. However, it must also be acknowledged that a number of organizational and financial obstacles exist in the realization of these directions.

In the process of forming the cluster system, problems may arise in balancing the interests of enterprises with different forms of ownership, creating an environment of trust, and fairly distributing costs. To address these problems, it is recommended to incorporate an independent supervisory board into the cluster management body and to introduce a transparent financial reporting system.

To quantitatively assess the economic impact of the proposed directions, the following forecast indicators have been developed:

Table 2.
Expected socio-economic impact from the implementation of sustainable directions (2025–2028)[26]

Direction	Investment volume (bln. UZS)	Production growth (%)	New jobs (units)
Cluster formation	420	25–30	1 200
Digitalization	180	15–20	450
Raw material base	95	10–15	800
Export development	65	40–50*	300
Human capital	48	8–12	650
TOTAL	808	35–45	3 400

From the perspective of digital transformation, the limited financial capacity of small and medium enterprises must be taken into consideration. For this reason, it is advisable to develop state subsidies and preferential lending programs as a separate instrument specifically targeted at small enterprises [13].

CONCLUSION. Based on the results of the conducted research, the following scientific conclusions have been formulated:

1. To enhance the efficiency of food industry enterprises in Kashkadarya province, a unified strategic approach is required — a comprehensive model encompassing cluster development, digitalization, raw material integration, export expansion, and human capital development.
2. Following the formation of cluster structures, a reduction in production costs by 18–22 percent and an increase in production volumes by 25–30 percent within three years is assessed as a realistic possibility.
3. The phased implementation of digital transformation will make it possible to increase profitability by 20–25 percent by 2028.
4. The full implementation of sustainable directions may create more than 3,400 new jobs and bring the export volume of the province's food industry to 90–100 million US dollars by 2028.
5. The proposed sustainable directions must be organically integrated into the provincial socio-economic development programs and national strategy documents.

[26] Author's calculations

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Khusanov U.Sh., PhD
associate professor
Department of Medical Chemistry
Andijan State Medical Institute
Uzbekistan, Andijan

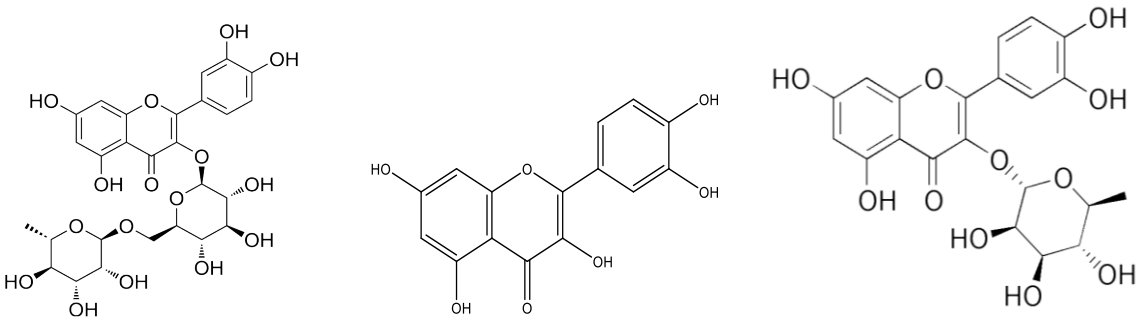
EVALUATION OF THE ANTIRADICAL ACTIVITY OF ALCOHOLIC EXTRACTS OF ST. JOHN'S WORT (HYPERICUM PERFORATUM L.), STINGING NETTLE (URTICA DIOICA L.), AND WORMWOOD (ARTEMISIA ABSINTHIUM L.)

Abstract. In this study, the antiradical activity of alcoholic extracts prepared from the aerial parts of Hypericum perforatum L., Urtica dioica L., and Artemisia absinthium L. in different proportions was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay.. The radical-scavenging capacity of the extracts was assessed by measuring the decrease in DPPH-solution absorbance. The 1:1:1 mixture exhibited the highest activity, with a radical-scavenging activity (ARF) of 23.58% after 30 min and an IC_{50} value of 218.17 µL. The extracts prepared at ratios of 3:1:1 and 1:3:1 also showed radical-scavenging activity, although the 1:1:1 mixture was the most active under the conditions tested. These findings suggest that the investigated plant extracts may be promising sources of natural antioxidants.

Keywords: free radicals; St. John's wort (Hypericum perforatum L.); stinging nettle (Urtica dioica L.); wormwood (Artemisia absinthium L.); extract; inhibition; DPPH; IC_{50}; radical-scavenging activity ARF%.

INTRODUCTION. Free radicals formed in the body mainly include reactive oxygen and nitrogen species. They may arise through endogenous processes and under various physicochemical or pathophysiological conditions. Free radicals can adversely modify lipids, proteins, and DNA, and oxidative stress is associated with the development or progression of diseases such as liver and cardiovascular disorders, diabetes, and cancer. One approach to reducing oxidative processes in the body is the consumption of natural exogenous food supplements rich in beneficial plant-derived compounds [1].

St. John's wort is a perennial plant, approximately 30–100 cm tall, found throughout Uzbekistan. It has traditionally been used in preparations for liver conditions. Its constituents include flavonoids with reported radical-scavenging properties, such as rutin, quercetin, and quercitrin.

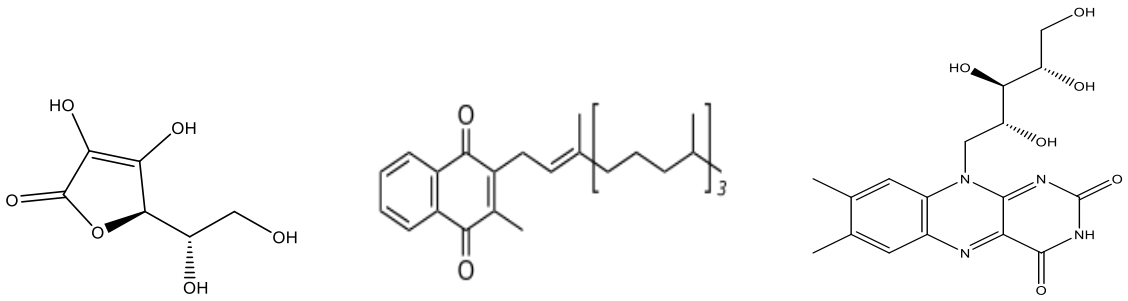


rutin quercetin quercitrin

Figure 1. Phenolic compounds found in St. John's wort.

The phenolic compounds shown in Figure 1 may contribute to the antioxidant and radical-scavenging properties attributed to St. John's wort [2].

Stinging nettle is a perennial plant, approximately 60–150 cm tall, found in many regions of Uzbekistan. Its leaves and roots have been used in traditional medicine for liver-related conditions. The plant contains several vitamins, examples of which are shown below.

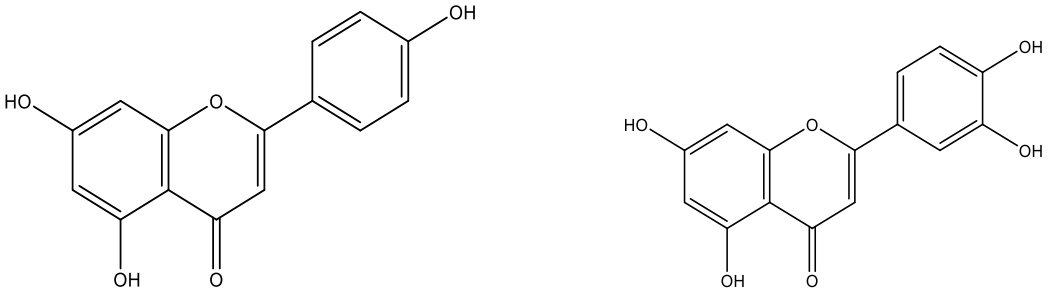


Vitamin C Vitamin K Vitamin B_2

Figure 2. Vitamins found in stinging nettle.

Figure 2 presents examples of biologically active compounds reported in the leaves of stinging nettle.

Wormwood is a perennial plant approximately 50–100 cm tall. Its aerial parts have traditionally been used for inflammatory conditions. Its stems and leaves contain flavonoids, including quercetin, apigenin, and luteolin, which are associated with antioxidant activity [1].



Apigenin Luteolin

Figure 3. Selected flavonoids found in wormwood.

The flavonoids shown in Figure 3 can scavenge free radicals in experimental systems. Some compounds found in medicinal plants have also been investigated for potential hepatoprotective effects and for their roles in cellular responses to toxic substances; such effects should not, however, be inferred from the present in vitro assay alone [3].

LITERATURE REVIEW AND METHODOLOGY

In recent years, oxidative stress associated with free radicals has been considered an important factor in the development of various diseases, including cardiovascular disorders, diabetes, inflammatory conditions, and cancer. Accordingly, identifying antioxidant compounds from natural sources and evaluating their biological activity remain important areas of research.

Plant-derived extracts may contain phenolic compounds, flavonoids, ascorbic acid, terpenoids, and other biologically active substances capable of scavenging free radicals. Studies have reported radical-scavenging activity in alcoholic and aqueous extracts obtained from plant leaves, stems, and aerial parts.

One widely used method for evaluating radical-scavenging activity is the spectrophotometric assay based on the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical. The method is relatively simple and rapid, and it is widely used to compare antioxidant activity. In the DPPH assay, antioxidants donate a hydrogen atom or an electron, causing the purple DPPH solution to lose colour and its absorbance to decrease.

The DPPH method introduced by Blois has subsequently been used and adapted by many researchers to assess the radical-scavenging activity of plant extracts. Published studies indicate that extraction conditions, solvent type, the ratio of plant material to solvent, and extract concentration can substantially affect measured activity. Some studies have also reported higher antioxidant activity in mixtures of plant materials than in individual extracts; this may reflect synergistic interactions among bioactive constituents, although synergy requires appropriate experimental confirmation.

The IC_{50} value is an important parameter for quantifying radical-scavenging activity. A lower IC_{50} generally indicates that a lower amount or concentration of a sample is required to achieve 50% inhibition. The DPPH assay is therefore commonly used to determine radical-scavenging activity (%) and IC_{50}.

This literature review supports the scientific and practical relevance of evaluating extracts prepared from plant materials in different proportions and investigating their potential as sources of natural antioxidants.

Natural antioxidants occur in foods, medicinal plants, and other natural products. By scavenging free radicals, they may help limit oxidative processes in experimental systems. Spices, vegetable oils, teas, seeds, grains, cocoa shells, fruits, and vegetables can contain antioxidant compounds, including ascorbic acid, tocopherols, carotenoids, flavonoids (e.g., quercetin, kaempferol, and myricetin), catechin-related compounds, polyphenols, and phenolic acids.

In the present study, the radical-scavenging activity (ARF) of extracts prepared at different plant-material ratios—X_1 (1:1:1), X_2 (3:1:1), and X_3 (1:3:1)—was evaluated against the stable DPPH (2,2-diphenyl-1-picrylhydrazyl) radical. The extracts contained the following plant materials:

X_1 extract (1:1:1): A mixture of the aerial parts of *Hypericum perforatum* L., *Urtica dioica* L., and *Artemisia absinthium* L. in a 1:1:1 ratio.

X_2 extract (3:1:1): A mixture of the aerial parts of *Hypericum perforatum* L., *Urtica dioica* L., and *Artemisia absinthium* L. in a 3:1:1 ratio.

X_3 extract (1:3:1): A mixture of the aerial parts of *Hypericum perforatum* L., *Urtica dioica* L., and *Artemisia absinthium* L. in a 1:3:1 ratio.

Assessment of the radical-scavenging activity of the samples using the DPPH assay

Decolourisation of the purple DPPH solution indicates the ability of a test compound to donate a hydrogen atom or an electron. The stable DPPH• radical is commonly used as a reagent in spectrophotometric assays [4]. In this study, the method described by Blois [5] was used, with minor modifications, to assess inhibition of the DPPH• radical [6].

Preparation of the DPPH• working solution. A 7.92 mM DPPH• solution was prepared in ethanol in a 100 mL volumetric flask. The flask was wrapped in aluminium foil and kept in the dark at room temperature for 30 min.

Experimental procedure. Each plant sample (1 g) was extracted with 25 mL of 96% ethanol in an ultrasonic bath for 20 min. The resulting extract was passed through a 0.45 μm syringe filter before analysis. The filtered alcoholic extracts were diluted tenfold. Extract mixtures of St. John's wort, stinging nettle, and wormwood were prepared at the reported ratios of 1:1:1, 3:1:1, and 1:3:1. The original manuscript refers to six preparations, although only three ratios are specified.

Determination of radical-scavenging activity. A quartz cuvette with a capacity of 4 mL was filled with 3 mL of DPPH solution and 100 μL of ethanol (blank) and placed in a K7000 spectrophotometer (YOKE, China). Absorbance (A_1) was measured at 517 nm every 5 min for 30 min. To evaluate the samples, 25, 50, 75, or 100 μL of each extract was mixed with 3 mL of DPPH solution, and absorbance (A_2) was measured under the same conditions at 517 nm. Ethanol was added to bring the total volume in the cuvette to 3.1 mL. Radical-scavenging activity was calculated using the formula provided in the original manuscript.

$$ARF\% = \frac{D_1 - D_2}{D_1} \cdot 100\%$$

The results are presented in the tables below.

Table 1.
Absorbance and calculated radical-scavenging activity of the blank and alcoholic extracts of St. ***John's wort, stinging nettle, and wormwood*** the aerial parts of the plants mixed at a ratio of **1:1:1** after addition to the DPPH solution.

Volume (µL)	Time (min)	Sample					
		Absorbance (A)	ARF (%)		Time (min)	Absorbance (A)	ARF (%)
25	0	0,933	0,00	75	0	0.933	0.00
	5	0.893	4.29		5	0.839	10.08
	10	0.865	7.29		10	0.793	15.01
	15	0.861	7.72		15	0.784	15.97
	20	0.855	8.36		20	0.775	16.93
	25	0.851	8.79		25	0.769	17.58
	30	0.846	**9.32**		**30**	0.762	**18.33**
50	0	0.933	0.00	100	0	0.933	0.00
	5	0.871	6.65		5	0.803	13.93
	10	0.831	10.93		10	0.751	19.51
	15	0.826	11.47		15	0.741	20.58
	20	0.82	12.11		20	0.73	21.76
	25	0.815	12.65		25	0.723	22.51
	30	0.808	**13.40**		**30**	0.713	**23.58**

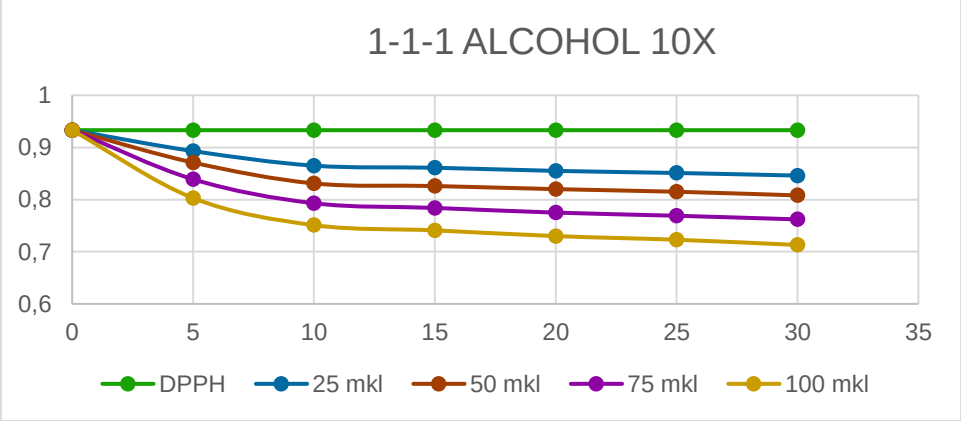


Figure 4. Absorbance profiles of the blank DPPH solution and the tested alcoholic-extract samples over time.

Figure 4 shows the absorbance values measured after adding the alcoholic extracts to the DPPH solution. To estimate the IC_{50}—the sample volume associated with 50% inhibition of the DPPH radical—the 30-min radical-scavenging activity values (%) were plotted against the volumes of extract added. The IC_{50} was estimated from the fitted trendline equation.

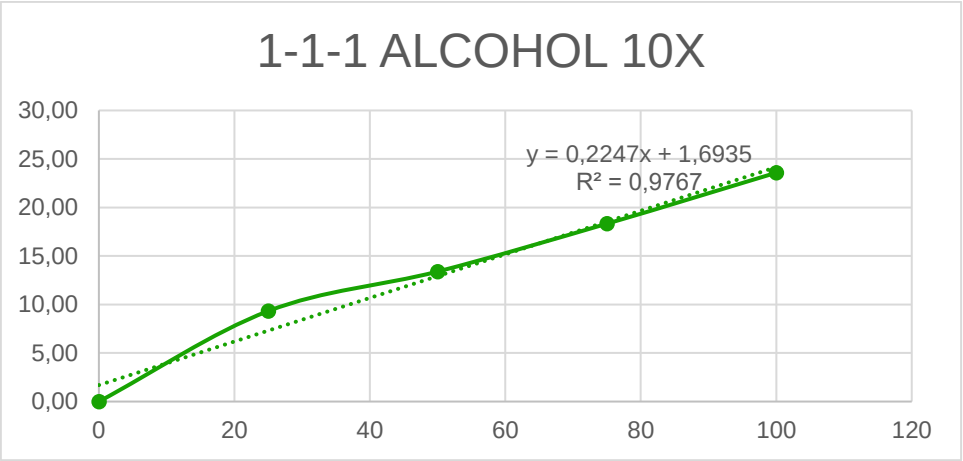


Figure 5. Relationship between radical-scavenging activity (%) and the volume of the alcoholic extract (10-fold diluted).

The trendline was expressed as y = mx + b. The extract volume corresponding to 50% radical-scavenging activity (IC_{50}) was calculated using x = (y − b)/m, with y set to 50.

$$IC_{50} = \frac{(50 - 0.9767)}{0.2247} = 218.17\ mkl$$

Table 2.

Absorbance and calculated radical-scavenging activity of the blank and alcoholic extracts of **St. *John's wort, stinging nettle, and wormwood*** the aerial parts of the plants mixed at a ratio of **1:3:1** after addition to the DPPH solution.

Volume (µL)	Time (min)	Sample					
		Absorbance (A)	ARF (%)		Time (min)	Absorbance (A)	ARF (%)
25	0	0,922	0,00	75	0	0,922	0,00
	5	0,856	7,16		5	0,835	9,44
	10	0,852	7,59		10	0,826	10,41
	15	0,848	8,03		15	0,819	11,17
	20	0,845	8,35		20	0,813	11,82
	25	0,843	8,57		25	0,808	12,36
	30	0,841	**8,79**		**30**	0,804	**12,80**
50	0	0,922	0,00	100	0	0,922	0,00
	5	0,839	9,00		5	0,818	11,28
	10	0,832	9,76		10	0,806	12,58
	15	0,827	10,30		15	0,797	13,56
	20	0,824	10,63		20	0,791	14,21
	25	0,821	10,95		25	0,785	14,86
	30	0,818	**11,28**		**30**	0,781	**15,29**

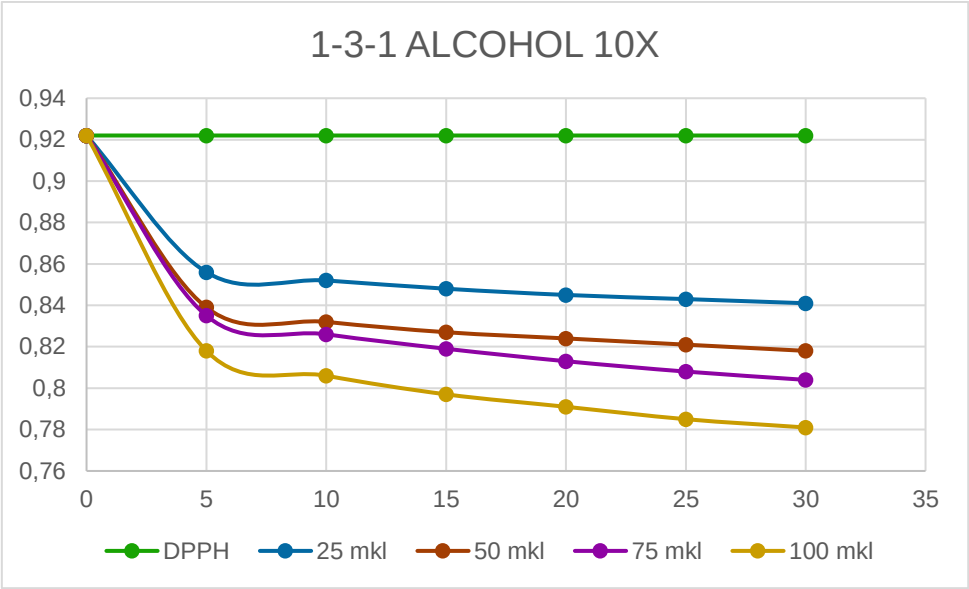


Figure 6. Absorbance profiles of the blank DPPH solution and the tested alcoholic-extract samples over time.

To estimate the IC_{50}, the radical-scavenging activity values (%) measured at 30 min were plotted against the volumes of alcoholic extract added. The IC_{50} was then estimated from the fitted trendline equation.

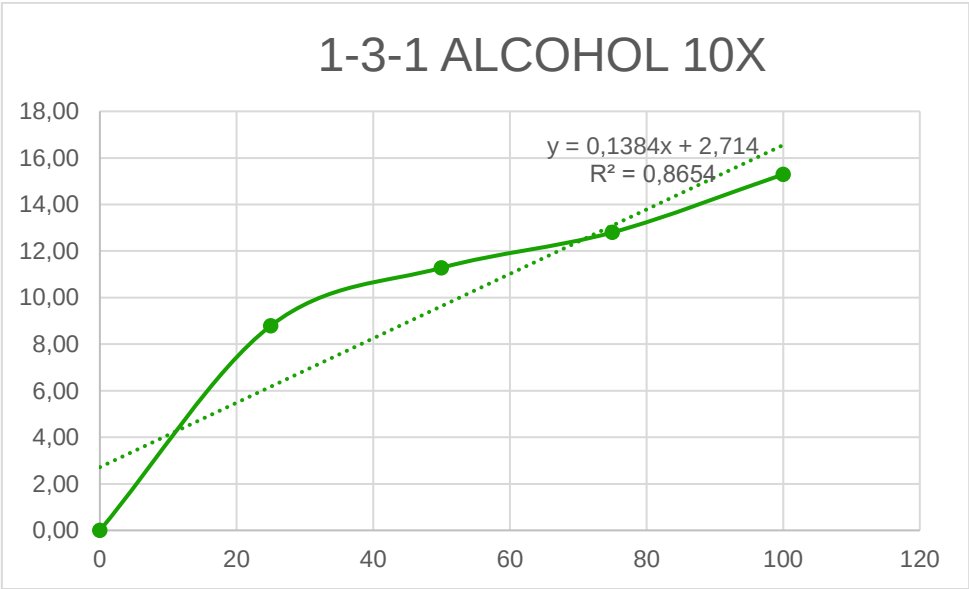


Figure 7. Relationship between radical-scavenging activity (%) and the volume of the alcoholic extract (10-fold diluted).

The trendline was expressed as y = mx + b. The extract volume corresponding to 50% radical-scavenging activity (IC_{50}) was calculated using x = (y − b)/m, with y set to 50.

$$IC_{50} = \frac{(50 - 0{,}1384)}{2.714} = 341.7\ mkl$$

Table 3.
Absorbance and calculated radical-scavenging activity of the blank and alcoholic extracts of ***St. John's wort, stinging nettle, and wormwood*** the aerial parts of the plants mixed at a ratio of **1:1:3** after addition to the DPPH solution.

Volume (μL)	Time (min)	Sample					
		Absorbance (A)	ARF (%)		Time (min)	Absorbance (A)	ARF (%)
25	0	0,912	0,00	75	0	0,912	0,00
	5	0,871	4,50		5	0,823	9,76
	10	0,865	5,15		10	0,809	11,29
	15	0,86	5,70		15	0,799	12,39
	20	0,855	6,25		20	0,789	13,49
	25	0,852	6,58		25	0,783	14,14
	30	0,848	**7,02**		**30**	0,775	**15,02**
50	0	0,912	0,00	100	0	0,912	0,00
	5	0,858	5,92		5	0,794	12,94
	10	0,849	6,91		10	0,775	15,02
	15	0,843	7,57		15	0,762	16,45
	20	0,836	8,33		20	0,746	18,20
	25	0,832	8,77		25	0,738	19,08
	30	0,827	**9,32**		**30**	0,729	**20,07**

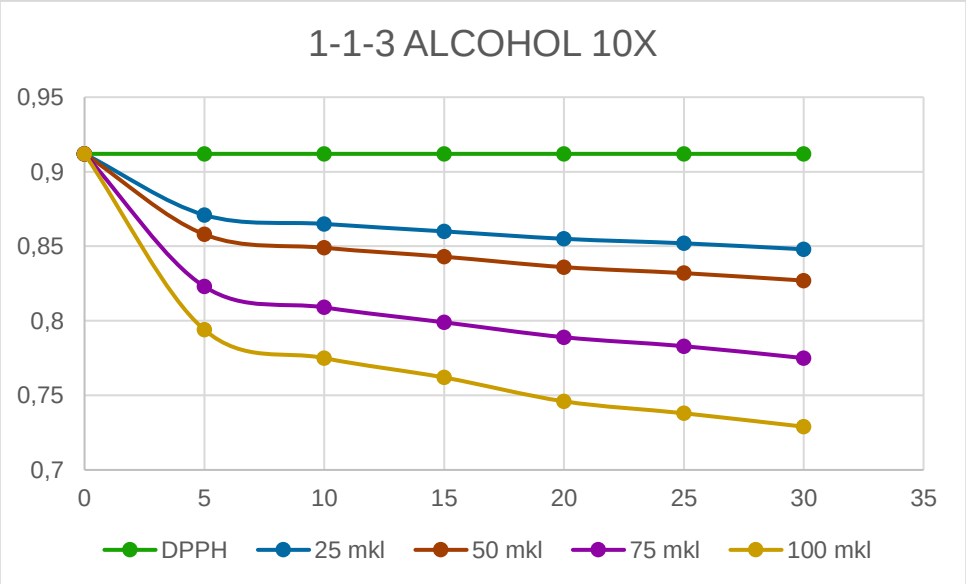


Figure 8. Absorbance profiles of the blank DPPH solution and the tested alcoholic-extract samples over time.

To estimate the IC_{50}, the radical-scavenging activity values (%) measured at 30 min were plotted against the volumes of alcoholic extract added. The IC_{50} was then estimated from the fitted trendline equation.

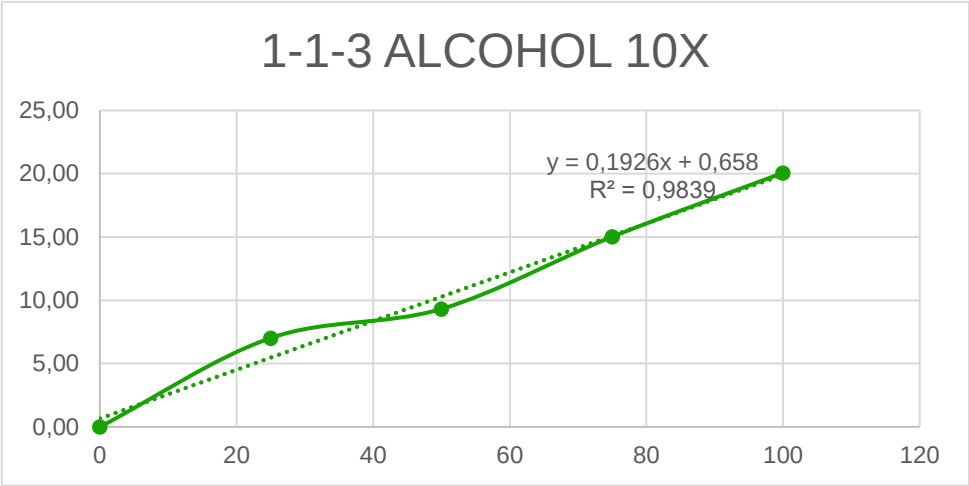


Figure 9. Relationship between radical-scavenging activity (%) and the volume of the alcoholic extract (10-fold diluted).

The trendline was expressed as y = mx + b. The extract volume corresponding to 50% radical-scavenging activity (IC_{50}) was calculated using x = (y − b)/m, with y set to 50.

$$IC_{50} = \frac{(50 - 0.658)}{0.1926} = 256.2\ mkl$$

Table 4.
Radical-scavenging activity (%) at 30 min for 100 µL of the tenfold-diluted alcoholic extracts.

Time (min)	ARF (%)		
	St. John’ s wort– stinging nettle– wormwood (1:1:1)	St. John’ s wort– stinging nettle– wormwood (1:3:1)	St. John’ s wort– stinging nettle– wormwood (1:1:3)
30 min	23.58	15.29	20.07

Table 4 shows the radical-scavenging activity values measured after 30 min for 100 µL portions of the tenfold-diluted alcoholic extracts. The highest value was observed for the 1:1:1 mixture of St. John’s wort (Hypericum perforatum L.), stinging nettle (Urtica dioica L.), and wormwood (Artemisia absinthium L.).

Table 5.
IC_{50} values for the tenfold-diluted alcoholic extracts, expressed as the sample volume estimated to produce 50% inhibition of the DPPH radical (μL).

Time (min)	ARF (%)		
	St. John’ s wort–stinging nettle–wormwood (1:1:1)	St. John’ s wort–stinging nettle–wormwood (1:3:1)	St. John’ s wort–stinging nettle–wormwood (1:1:3)
30 min	218.17	341.7	256.2

As shown in Table 5, the lowest estimated IC_{50} was obtained for the 1:1:1 mixture, indicating the strongest radical-scavenging activity among the mixtures tested under the conditions used.

CONCLUSION. The alcoholic extracts investigated in this study showed measurable radical-scavenging activity. At a volume of 100 μL, the tenfold-diluted 1:1:1 mixture of St. John’s wort, stinging nettle, and wormwood reduced the DPPH signal by 23.58% after 30 min. The estimated IC_{50} for this extract was 218.17 μL. These results suggest that the 1:1:1 mixture may be a promising candidate for further investigation as a potential source of natural antioxidants. Since the estimated IC_{50} exceeds the largest tested sample volume, it should be interpreted as an extrapolated estimate and confirmed using a wider concentration range.

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Kobilov A.
Professor
Department of Digital Economy and Information Security
Umarov O.
Professor
Department of Digital Economy and Information Security
Tashkent State University of Economics
Uzbekistan, Tashkent

FEATURES, TRENDS AND WAYS OF FURTHER DEVELOPMENT OF THE DIGITAL ECONOMY

Abstract. The development of digital technologies leads to major changes not only in the economy, but also in society itself. This processes have not only led to fundamental changes in business models and consumer behavior in the modern economy, but also created the basis for the transformation of a wide range of social processes, including high-tech production [3], economic activity, financial services, educational concepts and standards, entertainment and leisure. The article examines the current state and global trends in the development of the digital economy, and also proposes measures for its further development in Uzbekistan, as well as in Uzbekistan, at the highest level, great attention is paid to the development of information and communication technologies, increasing their role in the socio-economic development of the country, it is necessary to adapt the educational system and infrastructure to the new requirements of the digital era.

Keywords: digital economy, information and communication technologies, digitalization, digital technologies, Internet of Things, e-commerce.

Introduction

Today, articles related to the development and popularization of information and communication technologies around the world are becoming increasingly relevant. The revolutionary influence of ICT is reflected in government structures and civil society institutions, in the economic and social spheres, in science and education, culture and people's way of life. This is due to the fact that, in general, communication services allow for the full use of existing potential, and significantly contribute to the achievement of the goals of sustainable economic growth, prosperity, democracy, peace and stability. [1].

Indeed, the digital revolution, which is becoming a new stage of economic and technological development, has dramatically changed people's lives, created huge opportunities and increased competition in the international arena. Now, such digital technologies as big data, artificial intelligence, neurotechnology, quantum technology, cloud and mobile technologies, virtual and augmented reality technologies, cross-exchange, blockchain technologies play a decisive role. [2].

Over the past decade, the above processes have not only led to fundamental changes in business models and consumer behavior in the modern economy, but

also created the basis for the transformation of a wide range of social processes, including high-tech production [3], economic activity, financial services, educational concepts and standards, entertainment and leisure. This infrastructure, based on electronic interaction, is becoming a new vector in the development of the global economy, which is acquiring the status of digital as an economic activity based on digital technologies [4].

The digital economy is a new economic environment that creates new huge opportunities for business. In the digital economy, under the influence of new technologies of the digital economy and e-commerce, both the structure and nature of competition and business models are completely changing. In this article, much attention is paid to the development of information and communication technologies in Uzbekistan at the highest level, increasing their role in the socio-economic development of the country. The main example of this is the speech of Shavkat Mirziyoyev at the inauguration ceremony of the President of the Republic of Uzbekistan, in which the following is especially noted: "Modernization of industries and regions, increasing their competitiveness, developing export potential will always be in the center of our attention. As a result, traditional offline companies are forced to transform their business or switch to online mode. This kind of situation encourages entrepreneurs to start their business on the Internet.It is on this basis that we will be able to achieve an increase in the gross domestic product by more than 2 times by 2030" [5].

Overall, the new economic space formed by the digital economy creates fundamentally different opportunities and prospects for its participants than before. At the same time, according to the OECD report, competition in digital markets has certain distinctive characteristics, including such trends as the “winner takes all” in the competition for the market, network effect, innovation and investment.

Literature Review on the Topic

The concept of the digital economy emerged in the last decade of the 20th century with the introduction of this phrase into circulation in 1995 by Nicholas Negroponte from the University of Massachusetts. Over the past period, many approaches to the disclosure of the term "digital economy" have been formed in the scientific community.

Thus, M.L. Kaluzhskiy defines the digital economy as a communication environment of economic activity on the Internet, as well as the forms, methods, tools and results of its implementation [7]. The OECD considers this concept as a general term for describing markets focused on digital technologies and including, as a rule, trade in information goods and services through e-commerce [6]. In this case, digital technologies are understood as the Internet, mobile phones and all other means of collecting, storing, analyzing and exchanging information in digital form [1].

Thomas Mesenburg identified three main components of the digital economy [8]:

• e-business infrastructure (technical means,
software products, telecommunications, networks, human capital, etc.);

• e-business (a way of doing business, namely: any process implemented by an organization using information and communication networks);

• e-commerce (transfer of goods, for example, selling a book online).

According to V. Katasonov, in the most general sense, the digital economy can be represented as that part of economic relations that is mediated by the Internet, cellular communications, and ICT [9]. Digital technologies in the modern world create fundamentally new opportunities for building interactions between the state, business, and the population, eliminating long chains of intermediaries and accelerating the implementation of various transactions and operations.

Based on this view of the digital economy, the authors of many studies conclude that this economic model will provide "digital dividends" to society in the form of expanded market access and market coverage, increased internal and market efficiency, including higher labor productivity, reduced transaction costs, increased employment (reduced unemployment), more complete satisfaction of human needs, reduced poverty, and even weakening (or completely overcoming) social polarization of society [1, 10–12].

Research Methodology

The methods used were empirical research, system and comparative analysis, statistical grouping and expert assessment.

Analysis and Results

Digital technologies have developed rapidly in the last decade. The number of people with access to the Internet increased from 1 billion to 3.4 billion between 2015 and 2023, covering more than 40% of the world's population.[13] More households in developing countries have a mobile phone than have access to electricity or clean drinking water. Nearly 70% of those in the bottom quintile of the population own a mobile phone, compared to 98% in high-income countries.[1]

Digitalization is changing the face and structure of the economy, breaking traditional business models, leading to the expansion of markets and opportunities, increased competition and growth of competitiveness, both among individual economic entities and entire countries.

A striking example of this is the data provided in the McKinsey Global Institute Report, according to which, after 20 years of growth, the share of traditional flows of goods, services and finance in global GDP has decreased from 53% in 2018 to 39% in 2023, while the volume of cross-border data exchange increased 45 times between 2018 and 2023. As of 2020, about 12% of global trade in goods was carried out through international e-commerce, about 50% of global trade in services has already been digitalized.

That is why many experts agree that digital transformations are becoming one of the key factors in global economic growth. Thus, according to one of the authoritative experts in the field of digital economy, The Boston Consulting Group (BCG), the share of the digital economy in the GDP of developed countries has grown by 1.2 percentage points since 2018 and is 5.5%. In developing countries, this figure increased from 3.6 to 4.9% of GDP (Table 1).

The UK is the world leader in terms of the share of the digital economy in GDP. The sector, which includes IT and telecommunications, online trade, and government spending related to the Internet, ranks second in the country's economy after real estate and ahead of manufacturing and trade. South Korea and China follow.

If we consider the indicators of the level of development of electronic commerce (EC) by country, then, according to BCG [14], Great Britain is also in the lead here, followed by Germany (Table 2).

The high level of e-commerce development in China is noteworthy. According to the same BCG company, in 2020, e-commerce turnover in China amounted to USD 18 billion, and by the end of 2024, Chinese consumers spent about USD 750 billion on purchases through the Internet, which is more than the same figure for the United States and Great Britain combined. In general, according to the Ministry of Commerce of China, China's share in international e-commerce by the end of 2024 was 39.2% [15]. At the same time, according to the industry development program adopted in the country for 2022-2030, the volume of e-commerce will grow to USD 5.8 trillion in 5 years [16].

Table 1. Dynamics of growth of the share of the digital economy in the GDP of G20 countries, %

Country	2020	2025
United Kingdom	8,3	12,4
South Korea	7,3	8
China	5,5	6,9
European Union	3,8	5,7
India	4,1	5,6
Japan	4,7	5,6
USA	4,7	5,4
Mexico	2,5	4,2
Saudi Arabia	2,2	3,8
Australia	3,3	3,7
Canada	3	3,6
Argentina	2	3,3
Russia	1,9	2,8
South Africa	1,9	2,5
Brazil	2,2	2,4

Source: Boston Consulting Group (BCG)

Table 1. Level of e-commerce development in some countries in 2024, %

Country	Share of EC in total retail trade	Share of EC in retail food trade
United Kingdom	11,4	4,4
Germany	10,2	0,8
PRC	8,4	-
USA	6,8	3,0
Japan	6,2	-
Netherlands	-	3,6
France	-	1,5
Russia	3,3	0,2

Source: Boston Consulting Group (BCG)

According to estimates by the McKinsey Global Institute [17], by 2030, digital technologies will drive China's GDP growth to 22%, and Russia's to 34%. The expected increase in value created by digital technologies in the United States by 2030 could amount to 1.6–2.2 trillion US dollars.

These economic forecasts are determined not only by the high level of automation of existing processes, but also by the introduction of fundamentally new, breakthrough business models and technologies. Among them are digital platforms, digital ecosystems, in-depth analytics of big data, Industry 4.0 technologies (3D printing, robotics, Internet of Things). According to the McKinsey Global Institute [17], annual investments in the global economy of the Internet of Things alone will amount to between 4 and 11 trillion US dollars by 2030.

Another trend in e-commerce is the increasing activity and role of small and medium-sized businesses in global trade. Digitalization has enabled the most active and enterprising representatives of small and medium-sized businesses to transform themselves into “micro-multinational” organizations, including by providing them with access to the infrastructure of digital platforms operating on the so-called “plug and play” principle, as well as an unprecedented opportunity to access the global database of potential customers built into these platforms.

The most extensive databases of potential clients are contained in social media platforms. Thus, according to Facebook calculations [18], in 2021–2025 alone, the number of small and medium-sized businesses registered on its platform increased more than 2.5 times: from 25 to 65 million. At the same time, the share of their foreign subscribers is about 30%. This fact characterizes social media platforms as a powerful marketing tool, especially for companies interested in increasing export indicators.

Meanwhile, e-commerce is an important, but not the only component of the digital economy. In some countries, for example, e-banking has become relatively well developed. In 2024, BCG [14] specialists attempted to assess the level of development of the digital economy, taking into account all its sectors. They expressed the results in indices that take into account many parameters ("BCG

indices"). All countries were ranked in descending order of the BCG index value. The leaders were: Denmark (1); Luxembourg (2); Sweden (3); South Korea (4);

Netherlands (5); Norway (6); Great Britain (7). Lower rankings were occupied by the UAE (30); China (35); Russia (39); India (80) and the last, 85th place - Cameroon.

BCG experts divide diverse digital economies into 5 groups. The criteria for grouping were the relative level of development of digital operations and GDP per capita.

BCG experts include countries with the highest percentage of “digitalization” of economic operations and a high level of technology used for such “digitalization” in the group of leaders. These are: South Korea, Denmark, Great Britain, Sweden, Norway and the Netherlands.

The second (main) group includes most countries with developed economies, in particular, Germany, the USA, Japan, and the EU countries.

The third group includes countries with a high level of prosperity (GDP per capita), but with relatively lower indicators of "digitalization" of operations. These are the countries of the Middle East, primarily the UAE and Saudi Arabia. BCG experts emphasize that a number of countries in the third group have high themes of digital operations development, which is why in the future they can rise to the second or even the first group.

The fourth group is represented by “emerging leaders.” In these countries, the level of digital operations development is higher than the level of economic development. The most prominent representative of this group is China.

BCG experts classify all other countries as “lagging behind” in the development of the digital economy.

Since the establishment of independence, Uzbekistan has paid special attention to the intensive development of information and communication technologies. Large-scale digital infrastructure projects are being implemented in the country, including the development of state electronic services, expansion of the electronic procurement system, and the involvement of citizens in the process of making socially significant decisions. Real digital services are beginning to be provided to the population and businesses.

According to Internet Live Stats [19], in terms of the number of Internet users, our country currently ranks first in Central Asia, third in the CIS and 37th in the world. As of 2022, the access speed to international information networks reached almost 35 Gbit/s, mobile communications covered 92% of the republic's settlements, and the number of subscribers amounted to 20.8 million people. At the same time, according to the Program for the Development of the Service Sector for 2022–2026, based on the active growth trend in the number of mobile communications users, this figure is projected to reach 27 million people by 2026.[20].

Nevertheless, despite the positive dynamics in the development of information technologies and communications, the problems of their more active implementation in economic sectors require their solution. The rapid development of digital technologies in the world and the expansion of their role in the global

economy, on the one hand, open up new opportunities and horizons for further development, and on the other, give rise to serious challenges and threats for countries and companies that have not learned to live in a dynamic world of constant innovation.

Today, we can confidently say that in the near future, the competitiveness of not only businesses, but entire countries will be determined by their level of digitalization. At the same time, there is no place on the digital pedestal for those who take a wait-and-see attitude. Passion is needed to win - it will require a willingness to invest in bold projects, a focus on a specific result, flexibility at the mental level, and a desire to work and experiment with full dedication. Countries and companies that manage to become leaders in the digital economy will have virtually unlimited prospects.

Understanding this, leading players are actively developing ICT infrastructure, modernizing the education sector, developing and implementing digital tools, including those using elements of artificial intelligence, in a variety of economic sectors. Thus, in the last two years alone, a number of countries with already developed digital economies, including the United States, Great Britain, South Korea and China, have adopted national strategic plans for the further development of digital technologies, including artificial intelligence. Moreover, in some cases, the documents contain specific amounts and sources of funding for projects worth billions of US dollars.

In order to successfully adapt to the ongoing changes and reduce the technological gap with leading players, Uzbekistan, like many other countries, needs to promptly develop effective responses to the challenges of the digital era.

Some work has already begun in this direction. In particular, large-scale projects are being implemented to deepen the digitalization of the activities of government bodies, aimed at expanding the list, improving the quality and simplifying access to public services, as well as increasing the efficiency of interdepartmental interaction for these purposes. An example is the launch of an updated version of the Unified Portal of Interactive Public Services (my.gov.uz) - EPIGU 2.0. with expanded functionality, completion of the modernization of the real estate registration and cadastre system, the introduction of the Notary information system, the creation of electronic databases of individuals and legal entities, registration and accounting of vehicles. Plans for the near future include the digitalization of tax accounting in Uzbekistan and the approval of a methodology for assessing the financial efficiency of e-government.

In 2024 alone, contracts worth approximately 6 billion soums were concluded from the funds of the Fund for Development of Information and Communication Technologies of Uzbekistan for the implementation of e-government projects [21].

The legislative framework is being improved. The country has adopted a number of laws regulating relations in the field of electronic document management (laws "On Electronic Document Management", "On Electronic Digital Signature", etc.).

By the Decree of the President of the Republic of Uzbekistan dated June 30, 2017 No.UP5099, a serious foundation has been laid for the development of the software development sphere in the republic. For the first time in history, an Innovation Center for Support of Development and Implementation of Information Technologies “Mirzo Ulugbek Innovation Center” has been created within the territory of the Republic of Uzbekistan on the principle of extraterritoriality. At the same time, the center and its residents have been granted unprecedented tax and customs benefits.

In the future, there will be an increase in the efficiency of the system of grant financing of scientific research within the framework of state scientific and technical programs, as well as state co-financing of promising projects for the development of the production of competitive science-intensive domestic products using funds from the Fund for the Support and Development of Scientific and Technical Activities.

At the same time, successful development of the digital economy mediates timely resolution of problems, including the creation of conditions for the expanded implementation and use of digital technologies, including further development of basic ICT and supporting infrastructure, ensuring universal and widespread accessibility of the Internet, reducing the persistent regional digital gap. It will be necessary to form an effective legislative and regulatory framework.

It is necessary to adapt the educational infrastructure to the changing labor market. The system of education and retraining of personnel must be ready to provide the economy with specialists who meet the requirements of the digital age, since the automation of an increasing number of operations will lead to the complete disappearance of a number of specialties and a massive shortage of specialists with digital skills.

Conclusions and Proposals

The main key trend occurring in the world global economy over the past decades is its rapid growth of digitalization. The transition to a digital economy changes the appearance and structure of the economy, breaking traditional business models, leads to the expansion of markets and opportunities, and becomes the main driver of global economic growth.The results of the analysis suggest that, with a high degree of probability, in the near future the level of digitalization will determine the competitiveness of not only businesses, but also entire countries. At the same time, only those countries and companies that can most quickly adapt and make the most of the benefits of the ongoing changes will achieve a sustainable competitive advantage.

In order to successfully adapt to the transformations and reduce the technological gap with the leading players, Uzbekistan needs to develop effective responses to the challenges of the digital era. In particular, it is necessary to develop long-term scientifically based strategies for digitalization, taking into account the need to ensure accelerated development rates in this area both at the state level and in the context of industries and enterprises of the republic.

In this context, the advanced development rates should in no case imply a gradual "catch-up" implementation of previous generation technologies. Such an approach will not only put the country and business in the position of eternally lagging behind, but will also lead to significant risks, since players with fundamentally new business models may enter the market. For advanced development, it is important to identify trends in the field of digital technologies that have the greatest impact on the appearance and structure of the economy as a whole and on individual industries in particular, and also to determine which of them will allow us to extract the greatest benefits in the next 5-10 years.

The pace of building digital infrastructure is critical. In the world of the Internet of Things, everything must connect to each other quickly, reliably, and securely. In this regard, it is important to continue implementing measures to expand the coverage of advanced technologies to the population and their rapid deployment across the country. This will lead to increased accessibility of the Internet, and will also give impetus to the development of entrepreneurship in the digital periphery.

No less important are measures to increase the potential of our own ICT industry, the implementation of which will reduce critical dependence on imports and increase the export of digital technologies. According to the Decree of the President of the Republic of Uzbekistan dated June 30, 2017 No. UP-5099, today the country has created the necessary favorable conditions for this.

The efficiency of these measures will be increased by using the development of industry programs for the modernization of the country's industry based on the principles of "Industry 4.0" with the introduction of financial and non-financial mechanisms to stimulate demand from enterprises for development technologies. At the same time, it is important to motivate industrial enterprises to attract domestic suppliers, engineering companies and research centers for the development and implementation of these technologies. Thanks to this approach, domestic demand will become the gravity of the development of local technology companies.

One of the key elements of state policy should be the training and retraining of personnel. In this context, it will be necessary to adapt the educational system and infrastructure to the new requirements of the digital era. In particular, it is necessary, first of all, to introduce fundamentally new approaches to education and ensure a high level of basic digital literacy of the population.

In conclusion, it can be said that the digital economy is a strong improvement of innovation, growth and social well-being and its development in Uzbekistan is special in the modern era. Deepening and improving digitalization will increase the competitiveness of the domestic economy in the world arena, provide conditions for a gradual transition to the level of an innovative economy and a knowledge economy, as well as improve the quality and standard of living of the population.

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Kubayev A.
assistent
Nematova R.
talaba
Amriddinova S.
talaba
Kenjaliyeva A.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

SUN’IY INTELLEKT SARATONNI QANDAY QILIB ERTA ANIQLAMOQDA

Annotatsiya. Ushbu maqolada sun’iy intellekt texnologiyalarining tibbiyot sohasidagi zamonaviy imkoniyatlari, xususan, saraton kasalligini erta aniqlashdagi ahamiyati tahlil qilinadi.Tadqiqotda neyron tarmoqlari, Deep Learning, Computer Vision va Big Data texnologiyalarining tibbiy tasvirlarni qayta ishlash hamda diagnostika jarayonidagi o‘rni yoritilgan.Mammografiya, kompyuter tomografiyasi, MRT va raqamli patologik tasvirlardan foydalanish imkoniyatlari ko‘rib chiqilgan. Google Health tadqiqotlari hamda real klinik amaliyot natijalari asosida sun’iy intellektning diagnostik samaradorligi tahlil qilingan.AI texnologiyalarining saratonning dastlabki belgilarini aniqlash, shifokor ish yuklamasini kamaytirish va diagnostika aniqligini oshirishdagi imkoniyatlari ko‘rsatib berilgan

Kalit so‘zlar: sun’iy intellekt, tibbiyot, saraton, neyron tarmoqlari, Deep Learning, Computer Vision, Big Data, Google Health, mammografiya, erta tashxis, raqamli patologiya.

Kubayev A.
assistant
Nematova R.
student
Amriddinova S.
student
Kenjaliyeva A.
student
Samarkand State Medical University
Uzbekistan, Samarkand

HOW IS ARTIFICIAL INTELLIGENCE HELPING TO DETECT CANCER AT AN EARLY STAGE

Abstract. This article analyzes the modern applications of artificial intelligence technologies in medicine, particularly their significance in the early

detection of cancer. The study examines the role of neural networks, Deep Learning, Computer Vision, and Big Data technologies in medical image processing and diagnostic procedures. Special attention is given to the potential applications of mammography, computed tomography (CT), magnetic resonance imaging (MRI), and digital pathology images. Based on research conducted by Google Health and findings from real-world clinical practice, the diagnostic performance of artificial intelligence technologies is discussed. Furthermore, the article highlights the potential of AI-based systems to identify early signs of cancer, reduce physicians' workload, and improve diagnostic accuracy. The integration of artificial intelligence into medical diagnostics represents a promising approach to improving early cancer detection and supporting clinical decision-making.

Keywords: artificial intelligence, medicine, cancer, neural networks, Deep Learning, Computer Vision, Big Data, Google Health, mammography, early diagnosis, digital pathology.

XXI asr tibbiyotida eng katta muammolardan biri — saraton kasalligini imkon qadar erta aniqlashdir. Saratonning ko‘plab turlari dastlabki bosqichlarda aniq klinik belgilar bermasligi mumkin. Shu sababli kasallikni erta aniqlash bemorning keyingi davolash imkoniyatlari uchun nihoyatda muhim. Biroq zamonaviy tibbiyotda tekshiruvlar sonining keskin ortishi, tibbiy tasvirlarning murakkablashuvi va mutaxassislar zimmasidagi katta yuklama yangi texnologik yondashuvlarni talab qilmoqda.

Ana shu nuqtada **sun’iy intellekt (Artificial Intelligence, AI)** va informatikaning zamonaviy yo‘nalishlari tibbiyot bilan kesishmoqda. Ayniqsa, **Computer Vision, Deep Learning, Neyron tarmoqlari va Big Data** texnologiyalari tibbiy tasvirlarni inson ko‘zi ilg‘ashi qiyin bo‘lgan darajada tahlil qilish imkoniyatini bermoqda.

Bugungi kunda sun’iy intellekt shifokorni almashtirish uchun emas, balki unga “ikkinchi ko‘z” bo‘lib xizmat qilish uchun rivojlanmoqda. Mammografiya, kompyuter tomografiyasi (KT), MRT va raqamlashtirilgan gistopatologik preparatlar kabi katta hajmdagi ma’lumotlar neyron tarmoqlari yordamida tahlil qilinib, saratonning juda kichik va dastlabki belgilarini aniqlashga yordam bermoqda.

Kompyuter saratonni qanday “ko‘radi”?

Inson ko‘zi va miyasi tasvirni juda samarali tahlil qiladi, biroq tibbiy tasvirlarda ayrim o‘zgarishlar juda kichik, noaniq yoki murakkab bo‘lishi mumkin. **Computer Vision** — kompyuterlarning tasvirlarni “ko‘rish”, ulardan ma’lumot ajratish va ularni tasniflash imkonini beruvchi informatika sohasi — aynan shu muammoni hal qilishga xizmat qiladi.

Masalan, mammografiyada saraton belgisi bo‘lishi mumkin bo‘lgan juda kichik zichlik o‘zgarishi yoki to‘qima tuzilishidagi noodatiy naqshni algoritm aniqlashi mumkin. Buning uchun kompyuterga shunchaki “bu saraton” deb aytish yetarli emas. Unga juda katta miqdordagi tibbiy tasvirlar va ularning ishonchli diagnostik natijalari kerak bo‘ladi.

Bu yerda **Big Data** tushunchasi paydo bo‘ladi. Big Data — juda katta hajmdagi, tez yig‘iladigan va turli shakldagi ma’lumotlarni qayta ishlash texnologiyalaridir. Tibbiyotda bunday ma’lumotlarga rentgen tasvirlari, mammogrammalar, KT va MRT tasvirlari, laboratoriya natijalari, biopsiya ma’lumotlari va elektron tibbiy yozuvlar kirishi mumkin.[6-4]

Qanchalik sifatli va xilma-xil ma’lumot mavjud bo‘lsa, neyron tarmog‘ining turli bemorlardagi kasallik belgilarini o‘rganish imkoniyati shunchalik kengayadi.

Deep Learning: algoritm qanday o‘rganadi?

Saratonni aniqlashda eng muhim texnologiyalardan biri — **Deep Learning**, ya’ni chuqur o‘rganishdir. Deep Learning ko‘p qatlamli sun’iy neyron tarmoqlaridan foydalanadi. Ularning ishlash prinsipi ma’lum jihatdan inson miyasidagi neyronlarning o‘zaro bog‘lanishidan ilhomlangan.

Masalan, minglab mammografiya tasvirlari neyron tarmog‘iga beriladi. Dastlabki qatlamlar tasvirdagi oddiy belgilarni — chiziqlar, chegaralar, kontrast va shakllarni — ajratishi mumkin. Keyingi qatlamlar murakkabroq tuzilmalarni, undan keyingi qatlamlar esa saraton bilan bog‘liq bo‘lishi mumkin bo‘lgan murakkab naqshlarni aniqlashni o‘rganadi.

Natijada algoritm yangi tasvirni olganda, ilgari o‘rgangan naqshlari asosida unda shubhali o‘zgarish bor-yo‘qligini baholashi mumkin.

Muhimi, bu jarayon “kompyuter kasallikni o‘zi davolaydi” degani emas. Yakuniy klinik qaror shifokor tomonidan, bemorning umumiy holati, boshqa tekshiruvlar va klinik ma’lumotlar bilan birgalikda qabul qilinishi kerak.[3]

Google Health: nazariyadan real tadqiqotgacha

Sun’iy intellektning tibbiyotdagi imkoniyatlarini ko‘rsatadigan eng qiziqarli misollardan biri — **Google Health** va Google DeepMind tadqiqotlaridir.

Google tadqiqotchilari mammografiya tasvirlari asosida ko‘krak bezi saratonini aniqlashga qodir AI tizimini ishlab chiqqan. 2020-yilda *Nature* jurnalida e’lon qilingan xalqaro baholashda tizim Buyuk Britaniya va AQSh ma’lumotlarida individual klinik mutaxassislar bilan taqqoslangan. Tadqiqotda AI tizimi noto‘g‘ri musbat natijalarni AQSh guruhida 5,7 foizga, Buyuk Britaniya guruhida 1,2 foizga, noto‘g‘ri manfiy natijalarni esa mos ravishda 9,4 va 2,7 foizga kamaytirgani ko‘rsatilgan.

Bu natijalar bitta muhim fikrni ko‘rsatadi: sun’iy intellektning kuchi faqat “tez hisoblash”da emas. U ulkan miqdordagi tasvirlardan statistik naqshlarni o‘rganib, shifokor uchun qo‘shimcha axborot manbai bo‘la oladi.

Google Health’ning hozirgi yo‘nalishlarida ham mammografiya muhim o‘rin tutadi. Kompaniya minglab anonimlashtirilgan mammogrammalar asosida modelni o‘qitish va uni klinik ish jarayonlariga integratsiya qilish ustida ishlayotganini bildiradi. Maqsad — saraton belgilarini aniqroq, tezroq va izchilroq aniqlash hamda radiologlarning yuklamasini kamaytirish.[2]

Real klinik amaliyotda AI diagnostikasi haqidagi eng qiziqarli savol — AI diagnostikasi “Laboratoriya sharoitida ishlaydimi?” emas, balki **“Haqiqiy klinik amaliyotda foyda beradimi?”** degan savoldir.

Saraton faqat mammografiya bilan cheklanmaydi aksincha sun’iy intellekt saraton diagnostikasida boshqa yo‘nalishlarda ham rivojlanmoqda. Masalan, raqamli patologiyada mikroskop ostida ko‘riladigan to‘qimalar raqamlashtirilgan holda ulkan tasvirlarga aylantiriladi. Bunday tasvirlar ba’zan gigapikselli hajmgacha yetishi mumkin.

Google tadqiqotchilari chuqur o‘rganish yordamida patologik tasvirlarda saraton belgilarini aniqlashga qaratilgan modellar ustida ishlagan. Google ma’lumotlariga ko‘ra, bunday yondashuv limfa tugunlaridagi kichik metastatik o‘choqlarni aniqlashda patologlarga yordam berishi mumkin.

2024-yilda *Nature Medicine* jurnalida chop etilgan boshqa tadqiqot esa **Virchow** nomli katta patologiya foundation modelining imkoniyatlarini ko‘rsatdi. Tadqiqotda model to‘qqizta keng tarqalgan va yettita kam uchraydigan saraton turi bo‘yicha pan-saraton aniqlash vazifasida yuqori natijalarni ko‘rsatgan. Bu kabi modellar kelajakda raqamli patologiyani yanada avtomatlashtirish va kam uchraydigan kasalliklarni o‘rganishda yordam berishi mumkin.

Google’ning tibbiy AI yo‘nalishlari o‘pka saratonini skrining qilish, KT va MRT tasvirlarini tahlil qilish, shuningdek, raqamli patologiya kabi sohalarni ham qamrab olmoqda.

Inson va algoritm hamkorligi Sun’iy intellektning tibbiyotga kirib kelishi “shifokor kerak bo‘lmay qoladi” degan xulosani anglatmaydi. Aksincha, eng istiqbolli model — **inson va algoritmning hamkorligi**.

AI katta hajmdagi ma’lumotni juda tez qayta ishlashi mumkin. Shifokor esa bemorning shikoyatlari, anamnezi, klinik holati, ijtimoiy omillari va boshqa ko‘plab jihatlarni hisobga olib, yakuniy qaror qabul qiladi.

Bundan tashqari, AI tizimlarining cheklovlari mavjud: ma’lumotlar sifati, turli aholi guruhlarining yetarlicha ifodalanmasligi, algoritmik xatolar, maxfiylik, kiberxavfsizlik va klinik validatsiya masalalari doimo nazorat qilinishi kerak. Google’ning o‘zi ham tibbiy AI modellarini klinik amaliyotga joriy etishdan oldin tegishli validatsiya va mustaqil tekshiruv zarurligini ta’kidlaydi.

Natija:

2025-yilda *Nature Medicine* jurnalida Germaniyada o‘tkazilgan katta real amaliyot tadqiqoti e’lon qilindi. Unda 12 ta markazda 463 mingdan ortiq ayolning mammografik skriningi tahlil qilingan. AI yordamidan foydalanilgan guruhda ko‘krak bezi saratonini aniqlash ko‘rsatkichi 1000 ta tekshiruvga 6,7 ta holatni tashkil etgan, nazorat guruhida esa bu ko‘rsatkich 5,7 ta bo‘lgan. Ya’ni AI yordamidagi yondashuv saraton aniqlanish ko‘rsatkichini taxminan **17,6% ga oshirgan**, shu bilan birga qayta chaqirish ko‘rsatkichi sezilarli ravishda yomonlashmagan.

Bu natija sun’iy intellektning tibbiyotdagi haqiqiy qiymatini ko‘rsatadi: maqsad shunchaki “kompyuter shifokordan aqlliroq” ekanini isbotlash emas. Asosiy natija— **shifokor + AI hamkorligini kuchaytirish**.

Xulosa:

Neyron tarmoqlari, Computer Vision, Deep Learning va Big Data tibbiyotning rivojlanish yo‘nalishini tubdan o‘zgartirmoqda. Ayniqsa, saraton kabi

murakkab kasalliklarda vaqt omili juda muhim bo‘lganligi sababli, sun’iy intellektning mayda va yashirin belgilarni katta hajmdagi ma’lumotlar orasidan topish qobiliyati katta ilmiy va amaliy ahamiyatga ega.

Google Health tadqiqotlari va 2025-yildagi real mammografiya skriningi natijalari AI texnologiyasi saratonni aniqlash jarayonida shunchaki nazariy g‘oya emasligini ko‘rsatmoqda. Biroq kelajak tibbiyoti “inson yoki mashina” tanloviga emas, balki **inson va mashina hamkorligiga** quriladi.[2]

Bugun kompyuter tibbiy tasvirni tahlil qilmoqda. Ertaga esa u bemorning tasvirlari, laboratoriya natijalari va avvalgi tekshiruvlarini birlashtirib, shifokorga kasallik xavfi haqida yanada aniqroq signal berishi mumkin. Shunday qilib, informatika tibbiyotga oddiy texnik vosita sifatida emas, balki **erta tashxis, individual yondashuv va hayotni saqlab qolishga xizmat qiluvchi yangi ilmiy platforma** sifatida kirib kelmoqda.

Saratonni yengishda eng katta qurol faqat yangi dori yoki yangi operatsiya usuli bo‘lmasligi mumkin. Ba’zan eng katta o‘zgarish — kasallikni bir necha oy oldinroq ko‘ra olishdir. Sun’iy intellektning tibbiyotdagi eng katta va’dasi ham aynan shunda: **kasallik ko‘zga yaqqol tashlanishidan oldin uning izlarini topish.**

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Kuldashev Sh.R.
texnik ta'minot kafedrasi o'qituvchisi
O'zbekiston Respublikasi Harbiy xavfsizlik va mudofaa universiteti
Quruqlikdagi qo'shinlar instituti
O'zbekiston

ZAMONAVIY AVTOMOBILLARNING ICHKI YONUV DVIGATELLARI TIRSAKLI VALLARINI TIKLASH VA TA'MIRLASH TEXNOLOGIYALARINI TAKOMILLASHTIRISH

Annotatsiya. Maqolada zamonaviy avtomobillarning ichki yonuv dvigatellari tirsakli vallarini tiklash va ta'mirlash texnologiyalarini takomillashtirish yo'nalishlari tahlil qilinadi. Asosiy e'tibor nuqsonlarni aniqlash, val bo'yinlarining geometrik parametrlarini tiklash, lazerli naplavka, yakuniy mexanik ishlov va charchash mustahkamligini baholashga qaratiladi. Tadqiqot ilmiy adabiyotlarni qiyosiy tahlil qilishga asoslangan. Kema dizellari tirsakli vallarida o'tkazilgan tajribalar avtomobil dvigatellariga qo'llash chegaralari hisobga olingan holda o'rganiladi. Tiklangan detal sifatini faqat o'lcham va qattiqlik bilan baholash yetarli emasligi, qoplama bilan asosiy metall chegarasi, moy teshiklari va galtellardagi holat ham tekshirilishi zarurligi asoslanadi. Harbiy avtomobil texnikasining texnik tayyorligini ta'minlash nuqtayi nazaridan diagnostika, texnologik nazorat va ta'mirlash natijalarini hujjatlashtirish bo'yicha takliflar ishlab chiqiladi.

Kalit so'zlar: Tirsakli val, ichki yonuv dvigateli, ta'mirlash, detalni tiklash, lazerli naplavka, charchash mustahkamligi, nuqsonlarni aniqlash, galtel, sirt qattiqligi, texnik tayyorlik.

Kuldashev Sh.R.
Instructor
Department of Technical Support
Institute of Ground Forces
University of Military Security and Defense
of the Republic of Uzbekistan
Uzbekistan

IMPROVING TECHNOLOGIES FOR THE RESTORATION AND REPAIR OF CRANKSHAFTS IN INTERNAL COMBUSTION ENGINES OF MODERN VEHICLES

Abstract. This article analyzes approaches to improving technologies for the restoration and repair of crankshafts in the internal combustion engines of modern vehicles. The primary focus is on defect detection, the restoration of the geometric parameters of crankshaft journals, laser cladding, final mechanical processing, and the assessment of fatigue strength. The research is based on a comparative analysis of scientific literature. Experiments conducted on the crankshafts of marine diesel

engines are examined, with due consideration given to the limitations and applicability of these methods to automotive engines. It is argued that evaluating the quality of a restored component solely based on dimensions and hardness is insufficient; the interface between the coating and the base metal, as well as the condition of oil passages and fillets, must also be inspected. Furthermore, proposals are developed regarding diagnostics, technological control, and the documentation of repair outcomes, with the aim of ensuring the operational readiness of military automotive equipment.

Keywords: Crankshaft, internal combustion engine, repair, component restoration, laser cladding, fatigue strength, defect detection, fillet, surface hardness, technical readiness.

Kirish. Zamonaviy avtomobillarning ichki yonuv dvigatellarida tirsakli val gaz kuchlari va harakatlanuvchi qismlarning inersiya yuklamalarini qabul qiladigan asosiy detallardan biridir. Uning texnik holati dvigatelning ishlash barqarorligi, moylash tizimidagi sharoit va podshipniklarning xizmat muddatiga ta’sir ko‘rsatadi. Val bo‘yinlarining yeyilishi, geometrik aniqlikning buzilishi yoki charchash yoriqlarining shakllanishi dvigatelning jiddiy nosozligiga sabab bo‘lishi mumkin. Shu bois tirsakli valni ta’mirlashda dastlabki o‘lchamlarni tiklash bilan birga, detalning yuklama ostida ishlash qobiliyatini ham ta’minlash zarur.

O‘zbekiston sharoitida avtomobil texnikasini issiq, changli muhitda va o‘zgaruvchan yuklamalarda ishlatish texnik xizmat hamda ta’mirlash sifatiga yuqori talab qo‘yadi. Harbiy avtomobil texnikasida esa ishonchlilik transport vazifalarining uzluksiz bajarilishi va bo‘linmalarning texnik tayyorligi bilan bog‘liq. Maqolaning maqsadi tirsakli vallarni tiklash texnologiyalarining imkoniyatlari va cheklovlarini tahlil qilib, ularni takomillashtirish yo‘nalishlarini belgilashdan iborat. Ishda mahalliy texnik adabiyotlar va lazerli tiklashga oid tajriba natijalari umumlashtiriladi. Mustaqil ishlab chiqarish sinovlari o‘tkazilmaganligi sababli takliflar amaliy joriy etishdan oldin muayyan dvigatel va material uchun tekshirilishi lozim.

Asosiy qism. Tirsakli valni sifatli ta’mirlash nuqsonlarning kelib chiqish sabablarini aniqlashdan boshlanadi. Tayanch va shatun bo‘yinlaridagi yeyilish moylashning yetarli bo‘lmasligi, abraziv zarrachalar, noto‘g‘ri yig‘ish yoki podshipniklar bilan bog‘liq muammolar ta’sirida rivojlanishi mumkin. Agar ta’mirlashda faqat shikastlangan sirtga ishlov berilib, dastlabki sabab bartaraf etilmasa, tiklangan valning qayta nosozlanish ehtimoli saqlanadi. Shuning uchun moy kanallari, moy nasosi, filtrlash tizimi va podshipnik o‘rindiqlarining holati ham tekshirilishi kerak.

Dastlabki nazoratda val bo‘yinlarining diametri bir nechta kesim va yo‘nalishda o‘lchanadi. Bu usul oval shakllanish va konussimon yeyilishni aniqlashga yordam beradi. Shuningdek, valning egilishi, tayanch bo‘yinlarning o‘qdoshligi, sirt shikastlari hamda galtellar holati baholanadi. Galtel bo‘yin bilan val jag‘i orasidagi yumaloqlangan o‘tish qismi bo‘lib, uning geometriyasi kuchlanishlar taqsimotiga sezilarli ta’sir ko‘rsatadi. Ko‘zga ko‘rinmaydigan

nuqsonlarni aniqlash uchun material va nuqson turiga mos buzmasdan nazorat usuli tanlanadi. Ferromagnit po‘lat detallarda magnit-kukunli tekshiruv sirtga yaqin yoriqlarni aniqlash vositalaridan biri bo‘lishi mumkin.

An’anaviy ta’mirlash usullaridan biri bo‘yinlarni ishlab chiqaruvchi ruxsat etgan ta’mirlash o‘lchamigacha jilvirlash va mos podshipnik vkladishlarini o‘rnatishdir. Ushbu yondashuv maxsus qoplama hosil qilishni talab etmaydi, biroq uning imkoniyatlari val konstruksiyasi bilan cheklanadi. Jilvirlashda bo‘yin diametri, galtel radiusi, sirt g‘adir-budurligi va mustahkamlangan qatlamning qolgan chuqurligi hisobga olinishi zarur. Ta’mirlash o‘lchamlari ko‘zda tutilmagan yoki ruxsat etilgan chegaradan ortiq yeyilgan vallarga mazkur usulni avtomatik qo‘llash mumkin emas.

Yeyilgan sirtga material qo‘shib tiklash bo‘yin diametrini dastlabki qiymatga yaqinlashtirish imkonini beradi. Bunday usullardan lazerli naplavkada metall kukuni mahalliy eritish sohasi orqali asosiy material bilan biriktiriladi. Jarayonning afzalligi issiqlik kiritilishini kichik hududga jamlash va material yotqizishni boshqarish imkoniyatidir. Biroq lazer quvvati, harakat tezligi, kukun sarfi va yo‘laklarning o‘zaro qoplanishi noto‘g‘ri tanlansa, qoplama nuqsonlari yoki asosiy metall xususiyatlarining noqulay o‘zgarishi yuzaga kelishi mumkin. Shuning uchun texnologiya faqat uskunaning mavjudligiga qarab tanlanmasligi kerak.

O‘rganilgan tajribalarda 42CrMo4 po‘latidan tayyorlangan kema dizeli tirsakli valiga Stellite 21 qotishmasi lazer yordamida yotqizilgan. Jarayon eritma vannasining o‘lchamini kuzatish va lazer quvvatini moslashtirish orqali boshqarilgan. Metallografik tekshiruvlarda qoplama bilan asosiy metall orasida sifatli birikish kuzatilgan, shu bilan birga issiqlik ta’siri zonasida qattiqlik notekisligi aniqlangan. Bu natija sirtning tashqi ko‘rinishi va qoplama yaxlitligi ijobiy bo‘lsa ham, material ichidagi xususiyatlar alohida baholanishi zarurligini ko‘rsatadi.

Keyingi charchash sinovlari mazkur masalaning ahamiyatini yanada ochib bergan. Muayyan materiallar birikmasi va qo‘llangan ishlov rejimlarida tekis namunalarning hisoblangan charchash mustahkamligi 50 foizlik saqlanish ehtimolida 332 MPa dan 135 MPa gacha kamaygan. Tirsakli val segmentlari sinovida qoplama yotqizilmagan namuna besh million yuklanish siklida sinmagan, ikkita tiklangan segment esa taxminan 1,57 million va 1,04 million siklda shikastlangan. Yoriqlar moy teshigi atrofida, galtelda va qoplama bilan asosiy metall chegarasida qayd etilgan. Ushbu tajribada naplavkadan keyingi termik ishlov qo‘llanmaganini ham hisobga olish kerak.

Bu natijalar lazerli tiklashning barcha variantlari samarasizligini anglatmaydi. Ular muayyan qotishma, geometrik shakl va texnologik rejimga tegishlidir. Bundan tashqari, tekshirilgan obyektlar kema dizellarining tirsakli vallari bo‘lgan. Avtomobil dvigatellarida detal o‘lchamlari, po‘lat yoki cho‘yan turi, dastlabki mustahkamlash usuli va ish yuklamalari boshqacha bo‘lishi mumkin. Shu sababli kema valida olingan natijalarni avtomobil valining tayyor ta’mirlash rejimi sifatida qabul qilish ilmiy jihatdan asoslanmagan.

Texnologiyani takomillashtirish uchun tiklash jarayonini o‘zaro bog‘langan bosqichlar sifatida tashkil etish taklif qilinadi. Dastlab material va nuqson holati aniqlanib, ta’mirlashga yaroqlilik to‘g‘risida qaror qabul qilinadi. Keyin qoplama materiali va ishlov rejimi namunalar ustida tekshiriladi. Bunda qattiqlikdan tashqari birikish sifati, nuqsonlar, issiqlik ta’siri va zarur hollarda qoldiq kuchlanishlar baholanadi. Termik ishlovning zarurligi asosiy metallning dastlabki holati va qoplama xususiyatlariga qarab belgilanadi. Uni barcha vallarga bir xil tartibda qo‘llash mumkin emas.

Yakuniy mexanik ishlov tiklash sifatining muhim tarkibiy qismidir. Jilvirlashdagi ortiqcha qizish, galtel shaklining buzilishi yoki moy teshigi chetida qolgan dag‘allik kuchlanishlar to‘planishini kuchaytirishi mumkin. Shu bois ishlovdan keyin diametr, shakl aniqligi, sirt sifati, moy kanallarining tozaligi va yoriqlar mavjudligi qayta tekshiriladi. Valning muvozanati esa bajarilgan ta’mirlash turi hamda ishlab chiqaruvchi talablariga muvofiq baholanadi. Seriyali joriy etishdan oldin vakillik qiluvchi namunalar yoki detallar ustida yuklanish sinovlarini o‘tkazish maqsadga muvofiqdir.

Harbiy avtomobil texnikasiga xizmat ko‘rsatishda ushbu yondashuv ta’mirlash qarorlarining izchilligini ta’minlaydi. Har bir val bo‘yicha dastlabki nuqsonlar, o‘lchov natijalari, qo‘llangan materiallar va yakuniy nazorat xulosalari qayd etilishi kerak. Iqtisodiy samaradorlik esa faqat ta’mirlash narxi bilan cheklanmaydi: qayta nosozlanish xavfi, texnikaning bekor turishi va kutilayotgan xizmat muddati ham hisobga olinadi. O‘zbekiston Respublikasi Harbiy xavfsizlik va mudofaa universitetida mazkur masalalarni o‘qitishda kursantlarning nuqson sababini aniqlash, texnologiya tanlash va ta’mirlash sifatini dalillar asosida baholash ko‘nikmalarini rivojlantirish muhimdir.

Xulosa. Zamonaviy avtomobillar tirsakli vallarini tiklash va ta’mirlash texnologiyalarini takomillashtirish detalning geometrik aniqligi, sirt holati va charchash mustahkamligini birgalikda ta’minlashga asoslanishi kerak. An’anaviy jilvirlash ham, material qo‘shib tiklash ham muayyan qo‘llanish chegaralariga ega. Usulni tanlashda val materiali, yeyilish darajasi, dastlabki mustahkamlangan qatlam va ishlab chiqaruvchining ta’mirlash talablari hal qiluvchi ahamiyat kasb etadi.

Tahlil qilingan tajribalar lazerli naplavka orqali sifatli qoplama olish mumkinligini, biroq bu holatning o‘zi yetarli xizmat resursini kafolatlamasligini ko‘rsatadi. Ayniqsa, galtellar, moy teshiklari va qoplama chegaralaridagi holatga e’tibor qaratish zarur. Kema dizellariga oid natijalarni avtomobil dvigatellariga moslashtirish qo‘shimcha tajriba va tekshiruvlarni talab qiladi. Harbiy avtomobil texnikasi uchun taklif etilayotgan asosiy yo‘nalish diagnostika, asoslangan texnologik rejim, yakuniy nazorat va natijalarni hujjatlashtirishni yagona tizimga birlashtirishdir. Bunday yondashuv ta’mirlash sifatini baholashni yaxshilaydi, asossiz qarorlarni kamaytiradi va texnik tayyorlikni saqlashga xizmat qiladi. Uning amaliy samaradorligi esa muayyan dvigatel oilasi bo‘yicha o‘tkaziladigan sinovlar bilan tasdiqlanishi lozim.

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Madraximov A.E., PhD
geografiya kafedrasi katta o‘qituvchisi
Farg‘ona davlat universiteti
O‘zbekiston, Farg‘ona
ORCID: 0009-0002-7245-1284

TABIATNI MUHOFAZA QILISHDA GEOGRAFIK NOMLARDAN FOYDALANISH MEHANIZIMINI TAKOMILLASHTIRISH

Annotatsiya. Ushbu maqolada geografik nomlarning tabiatni muhofaza qilish, tabiiy resurslardan oqilona foydalanish va aholining ekologik madaniyatini shakllantirishdagi funksional imkoniyatlari tadqiq etilgan. Geografik nomlarning hududning tabiiy, tarixiy, madaniy va shu bilan birga ekologik xususiyatlarini aks ettiruvchi axborot manbai sifatidagi ahamiyati ochib berilgan. Shuningdek, toponimlarning indikatorlik, kognitiv, aksiologik hamda tarbiyaviy-madaniy funksiyalari, ularning etnoekologik xotirani saqlash va ekologik qadriyatlarni avlodlar o‘rtasida uzatishdagi o‘rni tahlil qilingan.

Kalit so‘zlar: geografik nomlar, toponim, ekologik funksiya, tabiatni muhofaza qilish, tabiiy resurslar, ekologik madaniyat, gidronim, fitotoponim, ekologik ta’lim, geografik nomlarni muhofaza qilish.

Madrakhimov A.E., PhD
senior lecturer, Department of Geography
Fergana State University
Uzbekistan, Fergana
ORCID: 0009-0002-7245-1284

IMPROVING THE MECHANISM FOR USING GEOGRAPHICAL NAMES IN NATURE PROTECTION

Abstract. This article investigates the functional possibilities of geographical names in nature conservation, the rational use of natural resources, and the formation of the ecological culture of the population. The significance of geographical names as a source of information reflecting the natural, historical, cultural, and at the same time ecological characteristics of the territory is revealed. Also, the indicator, cognitive, axiological and educational-cultural functions of toponyms, their role in preserving ethno-ecological memory and transmitting ecological values between generations are analyzed.

Keywords: geographical names, toponym, ecological function, nature protection, natural resources, ecological culture, hydronym, phytotoponym, ecological education, protection of geographical names.

KIRISH. Ma’lumki, mustaqillik yillarida mamlakatimiz toponimiyasi tubdan yangilanib, uzoq o‘tmishga ega bo‘lgan joy nomlari geografik va tarixiy jihatdan qayta tiklandi. Tabiiy yoki inson faoliyati natijasida vujudga kelgan geografik obyektlarning nomlarini ilmiy asosda qo‘llash, joy nomlarini tartibga solish, ularning yozilish qoidalarini milliy va xalqaro miqyosda standartlashtirish, geografik nomlarning davlat reyestrini shakllantirish hamda ularni muhofaza qilish masalalari hukumat qarorlari, tegishli qonunlar bilan belgilab qo‘yildi. Shu sababdan, geografik nomlarni ilmiy asoslarini tadqiq etish va tahlil qilish, shuningdek ularning qo‘llanilishiga oid belgilab qo‘yilgan huquqiy meyorlarga amal qilish, iqtisodiy – ijtimoiy hamda ma’naviy – tarbiyaviy jihatdan juda muhim ahamiyatga egadir.

Shuningdek, geografik nomlar shunchaki joy nomlari emas, balki hududning tarixiy, madaniy va eng muhimi ekologik xususiyatlarini o‘zida aks ettirgan nomoddiy madaniy me’rosning bir qismi sifatida qaralmog‘i kerak.

ADABIYOTLAR TAHLILI VA METODOLOGIYASI

So‘nggi yillarda geografik nomlarning nafaqat geografik, tarixiy va lingvistik jihatdan tadqiq etilmoqda, balki geografik nomlarning ekologik jihatlariga ham katta ahamiyat berilmoqda. Geografik nomlarning ekologik funksiyalaridan amaliy maqsadlarda tadqiq etish uchun geografik obyektlarga nom berish jarayonini chuqur o‘rganish talab etiladi [4].

Tabiatni muhofaza qilishda geografik nomlardan foydalanish yo‘nalishida MDH olimlaridan E.L. Lyubimova [1], E.M.Murzaev [3], V.A.Juchkevich [2], R.M.Yuzbashev, E.B.Nuriyev [7] va G.I.Xornaulilarning [6] ilmiy tadqiqotlarida samarali o‘rganilgan. Xususan, V.A. Juchkevich (1968) toponimik ma’lumotlar asosida Karpatyoni va Belorussiya hududlarida asosan qora qayin daraxti tarqalganligi, lekin qadimda ularning tarqalish areallari xozirgidan ancha shimolroqda o‘tganligini aniqlagan [2].

Mamlakatimizda mazkur yangi yo‘nalishni o‘rganishni boshlab bergan olimlardan bir S.Qorayev hisoblanadi. mamlakatimiz hududida o‘suvchi qayrag‘ochdoshlar oilasiga mansub, toshda o‘sadigan Qatrong‘i daraxtiga antropogen ta’sirni shunday yozadi: “Qatrong‘i daraxtini ba’zilari yo‘q bo‘lib ketgan bo‘lsa ham, daraxt nomi bilan atalgan qishloq, mahalla shu nomda ataladi. Ko‘plari hozir mavjud: lekin 5 qatran o‘rnida 4 ta qatran, 4 qatran o‘rnida esa 3 ta qatran qolgan va hokazo”. Shuningdek olim o‘z tadqiqotlarida Qorako‘l vohasidagi So‘kso‘k qishlog‘ini o‘zining “Geografik nomlar ma’nosini bilasizmi?” nomli kitobida saksovul daraxti nomidan olinganligini ta’kidlaydi. Lekin hozirgi kunda qishloq hududida saksovul deyarli uchramaydi [8].

Keyingi yillarda geografik nomlarni ekologik jihatlarini tadqiq etishda samarali mehnat qilayotgan olimlardan Y.Ahmadaliyev va P.Otaqulovlar hisoblanadi. Bu sohada olimlarning ko‘plab maqolalari shu bilan birga “Ekologik toponimlar” nomli monografiyasi chop etilgan. Ushbu monografiyada asosan, Farg‘ona vodiysi toponimiyasida tabiiy-ekologik omillarning o‘rni va ahamiyati tadqiq etilgan [4].

NATIJALAR VA MUHOKAMA

Geografik nomlar nafaqat hudud haqida dastlabki axborotni beruvchi indikatorlik belgisi bilan birga, balki jamiyatning tabiat komponentlariga nisbatan bo‘lgan munosabatlarni shakllantiruvchi kognitiv va aksiologik (qadriyatli) vositadir. Ularning tabiatni muhofaza qilishdagi tarbiyaviy – madaniy ahamiyati quyidagi ilmiy jihatlar orqali asoslanadi:

Birinchidan, etnoekologik xotira va avlodlararo ekologik qadriyatlarni uzatish vositasi: bunday yondashuvda, ilmiy nuqatayi-nazardan, geografik nomlar o‘zida asrlar davomida akkumulyatsiya qilingan ekologik xotirani namoyon etadi. Ular xalqning asrlar davomida to‘plangan tabiatshunoslik bo‘yicha egallagan bilimlarini o‘zida saqlaydi va keyingi avlodga yetkazadi. Masalan, bugungi kunda Jiydazor (Beshariq t., Zomin t., G‘ijduvon t., Qumqo‘rg‘on t.), fitooykonimi o‘quvchi yoshlarda hududning tabiiy sharoiti, tuproq ekologik holati haqida dastlabki ma’lumotlarni beradi. Lekin bugungi kunda dala tadqiqotlari orqali ushbu mevali daraxtlarni tarqalish areallari qisqarganligi kabi o‘zgarishlarni ko‘rish orqali joy nomi o‘quvchi – yoshlarda kognitiv dissonans – ya’ni nomda aks etgan axborot (indikatorlik) va ko‘z o‘ngida reallik o‘rtasidagi ziddiyatni yuzaga keltiradi. Ushbu psixologik ziddiyat o‘quvchi yoki talabada “Nega bu joy shunday atalgan?”, “qachon va qanday sabablarga ko‘ra bu tabiiy boylik yo‘qolgan?” kabi muammoli savollarni hamda tanqidiy fikrlashni shakllantiradi. Natijada, geografik nom hududning shunchaki atamasi emas, balki uning “etalon ekologik modeli” (asl namunasi) sifatida qabul qilinadi. Bu jarayon yoshlarda “toponimik adolatni tiklash” – ya’ni joy nomini uning haqiqiy tabiatiga moslashtirish uchun daraxt ekish yoki hududni tozalash kabi amaliy harakatlarga undovchi kuchli motivatsion asos bo‘lib xizmat qiladi. Demak, toponimlar ma’lum hududlarning ekologik restavratsiya (qayta tiklash) jarayonining g‘oyaviy poydevoridir [5].

Ikkinchidan, sharq xalqlari, xususan, O‘zbekiston hududida ko‘plab geografik nomlar muqaddaslik (sakrallik) tushunchasi bilan bog‘langan bo‘lib, tabiiy resurslardan foydalanishni tartibga soluvchi chuqur aksiologik (qadriyatga asoslangan) mexanizm hisoblanadi. O‘zbekiston sharoitida, gidronimlar (suv obyekti nomlari) va fitotoponimlar (o‘simlik nomlari) eng ko‘p sakrallashgan bo‘lib, bu bevosita qurg‘oqchil (arid) hudud uchun ushbu resurslarning hayotiy ahamiyati muhim ekanligini ko‘rsatadi. Joy nomlari orqali muqaddaslashtirilgan hududlar o‘ziga xos “ekologik tizim”ni shakllantiradi. Masalan, Tollibuloq (Yakkabog‘ t.), Sho‘rob (Muzrabot t.), Pistalitepa (Yakkabog‘ t.), Chinor (Bo‘stonliq t.), Besharcha (Shahrisabz t.), Qaynarbuloq (Beshariq t.), Do‘lana mozor (Beshariq t.), Jiydamozor (Toshloq t.) kabi nomlar bilan ziyoratgohlar qayd etilgan. Mazkur hududlar aholisi bu joylarni ifloslantirish yoki tabiiy obyektlariga (masalan, muqaddas hisoblangan buloqning ko‘zini bulg‘ash, daraxt kesish) ziyon yetkazish nafaqat qonuniy, balki ma’naviy-diniy taqiq ostida bo‘ladi.

Uchinchidan, arid mintaqalarda suv noyob va hayotiy qadriyat bo‘lganligi sababli, gidronimlar bevosita suv obyektlarining holati haqidagi ma’lumotlari o‘zida mujassam etadi va o‘z navbatida nom orqali himoya mexanizimini ishga tushiradi. Masalan, Oqsuv (Uchko‘prik t., Kitob t., Qamashi t.), Oqbuloq (Paxtakor

t., Zarbdor t., Uzun t.), Ko‘kbuloq (Nurota t.,), Oqko‘l (Shovot t., Xiva t.) kabi nomlar suvning ichish uchun yaroqli holatda ekanligini mahalliy aholiga axborotni yetkazadi. Bu nomlar aholi uchun suvning shunday bo‘lishi kerakligi haqidagi g‘oyani doimiy ravishda eslatib turadi. Agar suv manbai ifloslansa, bu nomga nisbatan tarbiyaviy – madaniy bepisandlik sifatida baholanadi, bu esa jamoa oldida o‘ziga xos etik majburiyatni buzishga tengdir. Shuning uchun bu nomlar suv obyektlarining ifloslanishidan oldin ishlaydigan (ogohlantiruvchi) o‘ziga xos mehanizmni yaratadi. Ya’ni mahalliy aholi nomning madaniy ahamiyatini saqlash uchun manba atrofida tozalikni saqlashga, chorva mollarini uzoqroq tutishga yoki uni maishiy chiqindilardan himoya qilishga intiladi.

To‘rtinchidan, kishilarning o‘z yashash joyiga nisbatan mehr-muhabbat tushunchasi shakllanishida geografik nomlarning tarbiyaviy – madaniy funksiyasi markaziy o‘rinni egallaydi. Inson ongida joy uchun nomlangan, begona, yod nomlarni berilishi (masalan, 1-mikrorayon, Sanoat ko‘chasi kabi) yashash hududidagi nomga nisbatan mavhum tushuncha shakllanishiga sabab bo‘ladi. Bu kabi nomlar insonlarning ma’naviy – madaniy qadriyatlaridan yiroqda ekanligi, hududning tabiiy, tarixiy xususiyatlari hisobga olinmagani sababli, hududga nisbatan befarqlikni keltirib chiqaruvchi omil hisoblanadi. Geografik nom, o‘zining etimologik (kelib chiqishi) va tarixiy ma’nosi orqali mintaqa uchun ma’naviy – madaniy qadriyat tushunchalarni yuklaydi. Natijada, inson o‘zining yashash “makoniga” nisbatan qadriyat, ma’suliyat tushunchalarini shakllanitirib, nom orqali joyni (mintaqani) shaxsiy uyi yoki ajdodlar merosi kabi himoya qilishga undaydi.

Bugungi kunda tabiatni muhofaza qilish, uni asrab-avaylashda qabul qilinayotgan qarorlar, ko‘rilayotgan chora tadbirlarga qo‘shimcha ravishda geografik joy nomlaridan ham foydalanish imkoniyati mavjud. Bunda eng avvalo kelajak avlod hisoblangan o‘quvchi-yoshlarning ekologik madaniyatini oshirish yo‘lida toponimlardan foydalanish imkoniyati mavjud [4]. Dastlab har bir hududdagi o‘quvchi-yoshlarga o‘z o‘lkasining joy nomlarini o‘rgatishda avvalo, geografiya, tarix va ona tili fani o‘qituvchilari bu sohada asosiy ro‘lni o‘ynashi va bu jarayonda o‘quvchilar uchun ekologik ta’limda fanlararo yondashuvni qo‘llash ijobiy natija beradi (1-jadval).

1-jadval
O‘quvchi – yoshlar uchun ekologik ta’limda geografik nomlardan foydalanishdagi fanlararo yondashuv

Ta’lim darajasi	Asosiy fan	Toponimik bog‘lanish turi	Ekologik maqsad
Boshlang‘ich (1-4 sinflar) sinflar	Atrofimizdagi olam, Tabiiy fan	Oykonimlar (mahalla, ko‘cha nomlari)	Yaqin atrofdagi tabiiy-ijtimoiy obyekt nomlari orqali atrof-muhitni anglash, ekologik kompetentlikni rivojlantirish
O‘rta (5-9 sinflar) sinflar	Geografiya, Tabiiy fan, Tarix	Gidronimlar,Oronimlar, Fitotoponimlar, Zootoponimlar,	Suv obyektlari, relyef shakllari va biologik komponenetlarni mintaqa uchun ahamiyatini nomlar orqali yetkazish
Yuqori (10-11 sinflar) sinflar	Ona tili, Iqtisodiy-ijtimoiy geografiya	Geografik terminlar, Antropotoponimlar, Etnotoponimlar	Geografik terminlarning ekologik funksiyasi va ijtimoiy nomlar orqali tabiatni muhofaza qilish, obyektlarga nisbatan “egalik hissini” shakllantirish

Jadval muallif tomonidan tuzilgan

Bu masalani quyidagi tartibda xal etish o‘qitish uslubiyotiga mos tushadi:

Birinchidan, darsda yoshlar uchun g‘oyaviy-tarbiyaviy ahamiyatga ega bo‘lgan, biror tarixiy voqeaning, shaxsning nomini abadiylashtirish maqsadada qo‘yilgan nomlarning ma’nosini ochib berish maqsadga muvofiq. Insoniyat va mamlakatimiz tarixida o‘chmas iz qoldirgan olimu-shoirlar, sarkarda va davlat arboblari, mustaqilligimiz bilan bog‘liq bo‘lgan nomlar ma’nosini o‘quvchilarga birinchi navbatda tushuntirib berish zarur.

Ikkinchidan, geografiya darslarida o‘rganilayotgan hududning tabiiy va iqtisodiy jihatidan xarakterli bo‘lgan jihatlarini ochib beradigan geografik nomlar ma’nosini ochib berish mumkin. Mamlakatimizdagi Beshariq, Qiziltepa, Pakana, Oqariq, Behizor, Paxtakor, Baxmalbob kabi nomlarni keltirish mumkin.

Uchinchidan, o‘qituvchi geografik terminlarni dunyoning barcha tillarida berilishini va ularning o‘zbekcha tajrimasini bir marta tushuntirib o‘tishi kerak. Bunda o‘quvchilar dunyoning boshqa tillarida berilgan geografik kartada uchraydigan toponimlarni izohlashda qiynalmaydilar.

To‘rtinchidan, darslarda o‘qituvchi sifat bilan yasalgan geografik nomlarni ham alohida tushuntirishi zarur. O‘zbek tilida ham, boshqa tillarda bo‘lgani kabi, toponimlarning ko‘pchiligida oq-qora, katta-kichik, quyi-yuqori, yangi-eski kabi sifatlar qatnashadi. Bu sifatlarga geografik termin sifatida qaralgandagina nomning mazmun-moxiyati to‘liq ochib berilishini tushuntirish zarur bo‘ladi. Farg‘ona viloyatida Pakana qishlog‘ini izohlashda ko‘pchilik uni qishloq aholisigi bog‘laydi bu mutlaqo noto‘g‘ri, Bu qishloqning nomi u joylashgan adir nomidan, ya’ni Pakana (past) adir nomidan olingan bo‘lib, “Balandadir” qirlariga nisbat berib qo‘yilgan.

Shu bois, ekologik ta’lim dasturlarida mahalliy toponimikani o‘qitish – bu shunchaki o‘tmishni o‘rganish emas, balki barqaror ekologik kelajakni qurishning strategik usulidir. Xulosa qilib aytganda, tabiatni asrab-avaylashda, tabiiy

resurslardan oqilona foydalanishda geografik nomlarning tarbiyaviy-madaniy va ekologik funksiyasi quyidagi ilmiy mexanizm asosida ishlaydi.

XULOSA.

Yuqoridagi fikr va mulohazalardan kelib chiqib mamlakatimiz geografik nomlaridan foydalanishda tabiatni muhofaza qilish va undan oqilona foydalanish mehanizimini takomillashtirish quyidagi taklif va tavsiyalar ishlab chiqildi:

1. O‘zbekiston Respublikasi “Geografik obyektlarning nomlari to‘g‘risida”gi qonunga “ekologik norma” kiritish. Bu norma orqali geografik obyektlarga nom berishda hududning tabiiy-iqlim sharoiti, o‘simlik va hayvonot dunyosining o‘ziga xosligi, shuningdek, mahalliy ekotizim va bioxilma-xillikni targ‘ib qilish ustuvorligi ta’minlash zarur;

2. Kadastr agentligining geonames.kadastr.uz axborot tizimiga joy nomining etimologik – ekologik ma’nosini tahlil qiluvchi modulni kirtish lozim;

3. Yangi barpo etilayotgan massivlar, mahallalar, ko‘chalarga nom berilayotganda geografik obyektlarni nomlash va qayta nomlashga doir talablarga rioya qilgan holda hududning tabiiy-ijtimoiy va ekologik holatini hisobga olgan holda nom tanlash zarur;

4. O‘quvchi – yoshlarning ekologik madaniyatini oshirishda, tabiatga extiyotkorona munosabatda bo‘lish, tabiiy resurslardan oqilona foydalanishda har bir hududning mahalliy toponimiyasini dars mashg‘ulotlarida, maxsus to‘g‘araklarda joy nomlarining etimologiyasini taxlili orqali yoshlarda joy nomlarining ekologik ahamiyatini tushunish ko‘nikmasini shakllantirish lozim;

5. Har bir viloyat, tuman, shaharlar hududida mavjud tarixiy-milliy, ekologik ahamiyatga ega nomlarning “Qizil kitobi”ni tuzish maqsadga muvofiq.

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Madraximov A.E., PhD
geografiya kafedrasi katta o‘qituvchisi
Farg‘ona davlat universiteti
O‘zbekiston, Farg‘ona
ORCID: 0009-0002-7245-1284

ZOOTOPONIMLARNING EKOLOGIK FUNKSIYALARI

Annotatsiya. Mazkur maqolada O‘zbekiston toponimiyasi tarkibidagi zootoponimlarning shakllanishi, ularning turlari va geografik tarqalish xususiyatlari ekologik-geografik yondashuv asosida o‘rganilgan. Tadqiqot jarayonida mamlakatimiz hududidan jami 380 ta zootoponim aniqlanib, ularning tarqalish arealari ArcGIS Pro dasturi va web-xaritalar yordamida tahlil qilingan. Shuningdek, hayvonot olami vakillari nomlarining kelib chiqishi va ularning inson xo‘jalik faoliyati bilan bog‘liqligi ilmiy jihatdan asoslab berilgan.

Kalit so‘zlar: zootoponimlar, toponimiya, fauna, ekologik-geografik tadqiqot, ArcGIS Online, web xaritalar, geografik nomlarni tarqalish areali.

Madrakhimov A.E., PhD
senior lecturer, Department of Geography
Fergana State University
Uzbekistan, Fergana
ORCID: 0009-0002-7245-1284

ECOLOGICAL FUNCTIONS OF ZOOTOPONYMS

Abstract. In this article, the formation of zootoponyms within the toponymy of Uzbekistan, their types, and geographical distribution features are studied based on an ecological-geographical approach. During the research, a total of 380 zootoponyms were identified in our country, and their distribution areas were analyzed using ArcGIS Pro software and web maps. Furthermore, the origin of the names of representatives of the animal kingdom and their connection to human economic activity have been scientifically substantiated.

Keywords: zootoponyms, toponymy, fauna, ecological and geographical research, ArcGIS Online, web maps, distribution area of geographical names.

KIRISH. Geografik nomning kelib chiqishi hayvonot dunyosi bilan bog‘liq bo‘lsa, bunday joy nomlari – zootoponimlar hisoblanadi. Zootoponimlar umumiy joy nomlari tarkibida uncha ko‘p emas, biroq ularning yuzaga kelish sabablari xilma – xildir. Zootoponimlar orqali ma’lum turdagi hayvonot olami vakillarini tarqalish areallarini aniqlash imkoniyati mavjud. Garchi zootoponimlar son jihatdan fitotoponimlardan kam bo‘lsa-da, ular dunyoning turli mamlakatlari toponimiyasida uchraydi.

O‘zbekiston toponimiyasi tarkibida hayvonot olami vakillari bilan bog‘liq joy nomlarining salmog‘i 1-2 foizdan oshmaydi [9]. Bugungi kunda O‘zbekiston faunasida umurtqali hayvonlarning 714 turi (sutemizuvchilar – 107, qushlar – 467, sudralib yuruvchilar – 61, amfibiyalar – 3 va baliqlar – 76) mavjud, umurtqasiz hayvon turlari esa 15 mingdan ortiq. So‘ngi yillarda tabiatdan foydalanishning kuchayishi oqibatida, mamlakatimizdagi ko‘plab hayvon turlari kuchli antropogen bosim ostida qolib, ularning yashash manzili va soni qisqardi, ba’zilar esa butunlay yo‘q bo‘lib ketdi. Masalan, Turon yo‘lbarsi, gepard, Orol sulaymon balig‘i kabi hayvonlar butunlar yo‘q bo‘lib ketdi. Ba’zi hayvon qoplon, sirtlon, Ustyurt va Buxoro qo‘ylari, morxo‘r, qoraquloq, O‘rta Osiyo qunduzi, oqbovur kabi xayvonlar yo‘q bo‘lib ketish xavfi ostida turibdi. Ulardan qoplon, Buxoro bug‘usi, Menzbir sug‘uri, Ilvirs xalqaro “Qizil kitobga” kiritilgan [5].

ADABIYOTLAR TAHLILI VA METODOLOGIYASI

Mamlakatimizda mazkur yangi yo‘nalishni o‘rganishni boshlab bergan olimlardan bir S.Qorayev hisoblanadi. Garchi olim “ekologik toponim” iborasini ishlatmagan bo‘lsada, mamlakatimiz hududida yashagan Bulon (Bulon, Bulonti toponimlaridan), Qulon, (Qulonsoy, Qulonboshi, Qulontepa toponimlaridan) Yo‘lbars (Palangdara toponimidan), Sirtlon (Do‘lta, Do‘ltali toponimlaridan), kabi hayvonlarni yo‘q bo‘lib ketganligi, lekin mazkur nomlar saqlanib qolganligini aytib o‘tgan edi [8].

Xorijlik olimlardan geografik nomlarning ekologik jihatlarini arab geografi Abullah Nasser toponimik ma’lumotlar asnosida Saudiya Arabistonidagi antropogen ta’sir va tabiiy muhitning yomonlashuvi natijasida tabiatda yo‘q bo‘lib ketgan yirik qushlardan Arab tuyaqushini (Struthio camelus syriacus) aniqlagan. Lekin ushbu hayvon turi bilan bog‘liq joy nomlari mavjud ekanligini ta’kidlab o‘tgan. Shuningdek muallifning ta’kidlashicha yirik sut emizuvchi hayvon Osiyo she’rlari (Felis leo) ham ov qilinishi natijasida yo‘q bo‘lib ketganligini va ularning yashash arealini toponimik ma’lumotlar orqali aniqlagan [2].

NATIJALAR VA MUHOKAMA

Zootoponimlar tarkibida ayg‘ir, baliq, bahrin, bedana, biya, burga, burgut, buvra, bug‘ra, bo‘ri, do‘lta (“sirtlon”), ilon-jilon, karp, laylak, malax (tojikcha, tumanday yopirilib keladigan chigirtka galalari), ot, tuya, chag‘a, chigirtka, chovli, shag‘ol, echki, eshak, qarsak, qarchig‘ay, qarg‘a, qulon, g‘ajir (g‘ajimoq-fe’lidan o‘limtikxo‘r beso‘naqay qush, tasqara ham deyiladi) kabi nomlar uchraydi [1]. Hayvonot olami vakillari nomi bilan atalgan joy nomlarini ekologik – geografik tadqiqotlar mazmunidan kelib chiqib 4 ta kichik guruhga bo‘lib o‘rganildi.

Dastlab guruhga hozirgi kunda mamlakatimiz hududida tarqalgan yovvoyi hayvonlar nomi bilan atalgan geografik obyektlarning nomlari olindi. Bu turdagi joy nomalari 9 hayvon turi ishtirokida o‘rganildi va jami 40 ta joy nomlarining ro‘yhati shakllantirildi. Ulardan bo‘ri nomi bilan atalgan joy nomlari Farg‘ona, Janubiy toporayonlarda qolgan hududlarga nisbatan ko‘p ekanligi aniqlandi. Masalan, Bo‘riboshi (Marhamat t.), Bo‘ritepa (Norin t.), Bo‘riqum (Dang‘ara t.), Bo‘rixona (Koson t.), Boybo‘ri (Qamashi t.), Bo‘rikamar (Dehqonobod t.) kabi nomlarni uchratish mumkin. Bundan tashqari Alqor (Buvayda t.), Tulkiobod

(Baliqchi t.), Qoratulki (Ohangaron t.), Qulon, Shag‘al (Amudaryo t.) kabi nomlar hozirda muhofazaga muhtoj hayvonot olami vakillari nomidan olingan.

Ikkinchi guruhga uy hayvoni nomi bilan atalgan 70 ta geografik obyektlar nomlari 4 ta hayvon turi misolida o‘rganildi. Qadim zamonlardan buyon insonlar tomonidan yovvoyi hayvonlar xonakilashtirishgan va ularni xo‘jalik maqsadlarda foydalanishgan. Aynan hayvonlarning inson xo‘jaligidagi (maslan, chorvachilik) faoliyati sababli ma’lum turdagi hayvon nomlari joy nomlariga berilgan. H.Hasanov ta’kidlaganidek, “chorvador rayonlarda har joyning nomiga qarab uning xo‘jalik ahamiyatini bilsa bo‘ladi” [4].

Mamlakatimizda hududida tarkib topgan uy hayvonlari nomida “ot” nomi bilan bog‘liq toponimlar faol ishtirok etgan. Ot va uning turlari nomi asosida shakllangan zootoponimlarning bir qismi to‘g‘ridan-to‘g‘ri mazkur hayvon turi bilan bog‘liq bo‘lib, odatda uning harakat xususiyatlari, tashqi qiyofasi, foydalanish maqsadi yoki inson xo‘jalik faoliyatidagi ahamiyatini aks ettiradi. Boshqa bir qismi esa relyefning muayyan shakl va xususiyatlarini ifodalovchi ko‘chma yoki majoziy ma’noda ishlatiladigan so‘zlar asosida yuzaga kelgan. Ba’zan hayvon nomi boshqa, ko‘chma ma’noda qo‘llanilgan bo‘lishi mumkin [4]. E.M.Murzayevning fikricha, butun turkiy xalqlar zootoponimlarni cho‘qqilar, balandliklar va dovonlarning relyef xususiyatlarini anglatuvchi nomlari sifatida qo‘llashadi [6]. Masalan, Janubiy toporayondagi (Dehqonobod t., Qamashi t., Chiroqchi t.) Ayg‘irtepa joy nomi “katta tepalik” tushunilishi, yoki hayvon nomi to‘g‘risida ma’lumotni saqlashini anglatadiki, bu turdagi joy nomlarini oronim yoki zootoponim ekanligi to‘g‘risida aniq ma’lumotlarga ega bo‘lishni talab qiladi [6]. Shuningdek T.Nafasovning izohlashicha, “ayg‘ir” 3-4 yoshli yirik ot, shuningdek, tog‘ yonbag‘ridagi balandlik, tekislikdagi yolg‘iz do‘nglik ma’nolarida qo‘llaniladigan so‘zdir [7]. Yuqoridagi fikrlardan ko‘rinadiki ushbu joy nomini oronim yoki zootoponim sifatida talqin qilish mumkin.

Shuningdek uy hayvonlari nomi tarkibida tuya bilan bog‘liq joy nomlari ham faol ishtirok etgan bo‘lib, deyarli barcha toponimik rayonlarda ushbu hayvon turidagi nomlar mavjud bo‘lgan holda, Janubiy toponimik rayonda ulushi (soni) yuqori hisoblanadi (1-jadval).

1-jadval.
Mamlakatimizda tuya nomi bilan atalgan geografik obyektlar

№	Joylashgan toponimik rayoni	Geografik obyekt nomi va turi
1	Farg‘ona toponimik rayoni	Tuyachi k. (Asaka t.), Tuyachi mah. (Izboskan t.), Tuyagum mah (Marg‘ilon sh.), Tuyalas mah. (Jalaquduq t.)
2	Toshkent toponimik rayoni	Tuyabo‘g‘iz sh-cha. (O‘rta Chirchiq t.), Tuyabo‘g‘iz mah. (Bo‘ka, Piskent, Yangiyo‘l t.), Tuyachi mah. (Bekobod t), Tuyatosh soy (Bo‘stonliq t), Tuyabo‘g‘iz kanal (Oqqo‘rg‘on t.), Tuyaqorin urochishe (Bo‘stonliq t.)
3	Mirzacho‘l toponimik rayoni	Tuyatortar k. (Baxmal, G‘allaorol, Sharof Rashidov t.), Tuyayotoq k. (Forish t.),
4	Samarqand toponimik rayoni	Tuyabovur mah. (Ishtixon t.), Tuyabo‘yin k. (Pastdarg‘om t.), Tuyatortar k. (Ishtixon t.), Tuyatosh k. (Payariq t.)
5	Buxoro-Navoiy toponimik rayoni	Tuyachiyo‘l k. (G‘ijduvon t.), Tuyabo‘zlov qabriston (Navbahor t.)
6	Janubiy toponimik rayoni	Tuyabo‘yin qish. (Qarshi t.), Tuyaboshi qish. (Kitob t.), Tuyakash k. (Jarqo‘rg‘on t.), Tuyamo‘yin (Chiroqchi t.), Tuyaqishloq k. (Boysun t.), Tuyatortar k. (Chiroqchi t), Tuyatoshtepa k. (Chiroqchi t.), Tuyatoshota qabriston. (Yakkabog‘ t.), Tuyayaylov urochishe (Boysun t.)
7	Quyi Amudaryo toponimik rayoni	Tuyamo‘yin mah. (To‘rtko‘l t.), Tuyamo‘yin k. (Hazorasp, Tuproqqal’a, Amudaryo, Ellikqal’a, Nukus, Qorao‘zak, Taxiatosh, To‘rtko‘l t.), Tuyachi k. (Beruniy, To‘rtko‘l t.)

Jadval muallif tomonidan bajarilgan o‘rganishlar asosida tuzilgan.

Tarixdan bizga ma’lumki, tuyalar cho‘l va chala cho‘l zonalarida boqilgan bo‘lib, benazir ulov vazifasini ham bajargan. Shuningdek tuyaning gavda tuzlishi g‘alatiligi bilan kishilarning e’tiborini tortgan. Ba’zan hayvon nomlarining to‘g‘ridan – to‘g‘ri joy nomlariga o‘tish hodisasi kuzatilsa, ba’zan ko‘chma ma’noda keladi. Masalan, Tuyachi so‘zning lug‘aviy ma’nosi sarbon, tuyakash, tuya karvonining boshlig‘i ma’nosida kelsa, Tuyabo‘g‘iz – daryoning tuya bo‘g‘iziga – bo‘yniga o‘xshab oqadigan joyi tuyabo‘g‘iz yoki tuyamo‘yin deb ataladi [1].

Tuyalar (ikki o‘rkachli) asosan Avstraliyada, Afrikaning shimoli, Osiyoning janubi-g‘arbiy, sharqiy, markaziy qismlarida va kam miqdorda Shimoliy Amerika hududlarda yashagan. Bugungi kunda ekologik – geografik tadqiqotlar natijasida yer yuzida tuyalarning yashash areali tabiiy, xo‘jalik va ekologik omillar ta’sirida keskin o‘zgarganligini geografik nomlar taxlilidan ko‘rish mumkin.

Mamlakatimiz hududida uy hayvonlari bilan bog‘liq qo‘y nomi bilan 10 ta geografik obyektlar nomlangan holda, echki nomi bilan esa 5 marta geografik obyektlar nomi Farg‘ona, Buxoro-Navoiy, Quyi Amudaryo toporayonlarida mavjud.

Uchinchi guruh sifatida qushlar nomiga nisbat berib qo‘yilgan geografik obyektlar nomlari nisbatan keng tarqalgan. Respublikamizda aniqlangan 380 ta zootoponimlarning 88 tasi (23 %) jami 8 ta turdagi qushlar nomi asosida tarkib

topgan. Qushlar orasida lochin, burgut, qarg‘a, kabutar kabi turlarning zootoponimlarda eng ko‘p ishlatilgan. Turkiy xalqlarda ushbu hayvonning tezkorligi, uzoq masofadan nishonni aniqlash qobiliyati va ov qilishdagi ustamonligi kabi ijobiy fazilatlarini qadrlab, ulug‘lashgan. Lochin nomi bilan atalgan geografik obyektlar Janubiy toporayon joy nomlari tarkibida qolgan toprayonlarga nisbatan soni ko‘p ekanligi uchratish mumkin. Masalan, Lochin (Denov t.), Qoralochin (Dehqonobot t.), Bobolochin (Denov t.) kabi nomlar.

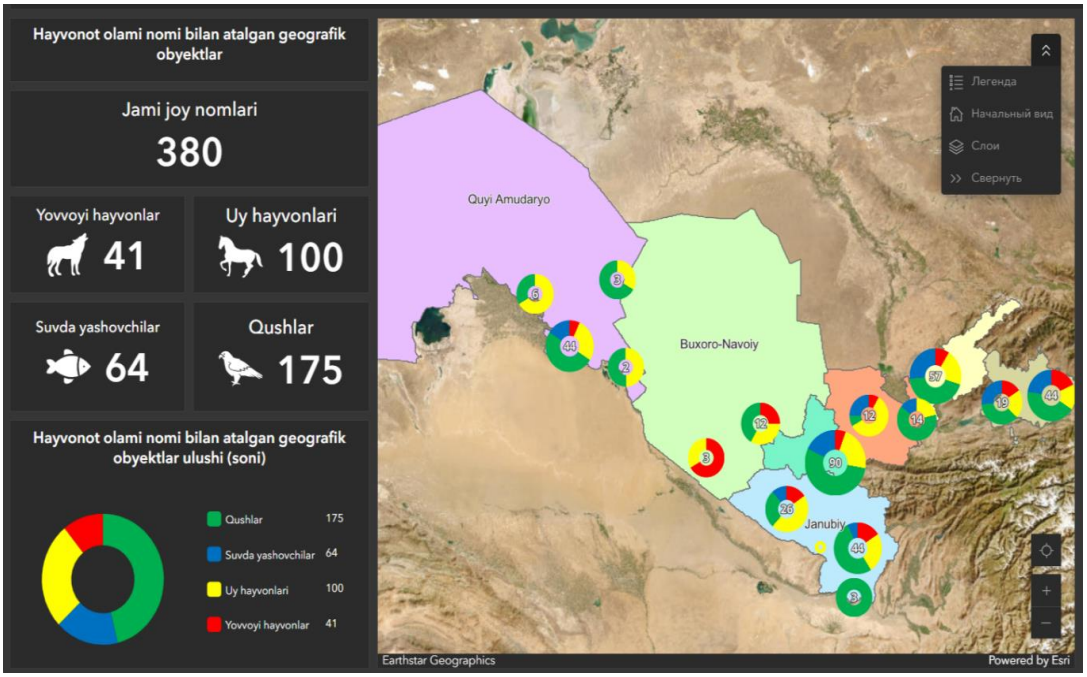
Shuningdek qarg‘a nomi bilan 15 marta geografik obyektlar nomlangan holda, Samarqand va Janubiy toporayonlarda eng ko‘p tarqalgan. Masalan, Ko‘kqarg‘a (Narpay t.), Qarg‘ali (Nurobod t.), Alaqarg‘a (Yakkabog‘ t.), Qarg‘ayoq (Chiroqchi t.) kabi nomlarni uchratish mumkin.

Deyarli barcha toporayonlarda kaputar nomi bilan joy nomlari mavjud bo‘lib, 23 marta geografik obyektlar nomlanishida ko‘rish mumkin. O‘zbek xalqi madaniyatida yaxshilik, sadoqatlilik ramzi sifatida qadrlangan. Shuningdek kaputarlar insonlar o‘rtasida xabar yetkazuvchi vazifasini ham bajargan. Misol uchun Xorazm viloyatining Xiva shahrida Kaptarxona mahallasi mavjud bo‘liq, xat tashuvchi kaputarlar uchiradigan minoralarning bir qismi hozirgacha mahalla hududida saqlanib qolgan [5].

Mamlakatimizda burgut, chumchuq nomi bilan 6 marta, shunqor nomi bilan 4 marta, Oqqoush nomi bilan 9 marta va Qoraqush kabi yirtiq hayvon nomi bilan 6 marta geografik obyektlar nomlanganligi qayd etilgan.

Suvda va quruqlikda yashovchi hayvonlar mamlakatimiz hayvonot olami vakillarining to‘rtinchi guruhini tashkil qiladi. Umumiy nom bilan baliq turini aks etuvchi nomlar toporayonlar tarkibida 32 marta joy nomlanishida ishtirok etadi. Masalan, Baliqchi (Ulug‘nor t., Buvayda t., Chust t., Quyi Chirchiq t., Yuqori Chirchiq t., Zangiota t., Payariq t., Yangiariq t.) toponimi toporayonlar tarkibida eng ko‘p takrorlangan. Shuningdek qunduz nomi ham joy nomlarini hosil qilishda faol ishtirok etgan. Masalan, Qunduz (Shovot t.), Qunduzbuloq (Baxmal t., O‘zbekiston t.), Qunduzso‘fi (Samarqand sh.) kabi nomlar [10].

Tadqiqotlar natijasida, mamlakatimiz hududida hayvonot olami vakillari nomi bilan 380 ta geografik obyektlar nomlangan. Ushbu ma’lumotlar ArcgIS Pro 3.0 yordamida tayyorlanib ArcGIS Online tizimida web xarita ko‘rinishiga keltirildi (1-rasm).



1-rasm. Hayvonot olami vakillari nomi bilan atalgan joy nomlarining web xaritasi

Ushbu web xaritalar orqali zootoponimning toporayondagi xududiy joylashuvi (viloyat, tuman, shahar), qaysi hayvon turini bildirishi, miqdorini va nom shakllangan hudud tabiati bilan bog‘ligini aniqlash mumkin [5].

XULOSA

Xulosa o‘rnida, hayvonlar bilan bog‘liq joy nomlari mamlakatimiz toponimlari tizimida muhim o‘rin egallaydi. Shu bilan birga zootoponimlar joy tabiati haqida muhim geografik axborotlarni beruvchi manbadir. Bu ma’lumotlar orqali inson va tabiat o‘rtasida munosabatlarni aniqlashga, yo‘qolgan yoki yo‘qolib borayotgan noyob hayvon turlarining o‘tmishda yashagan hududlarni tiklashga yordam beradi.

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Mamaroziqov F.D.
o‘qituvchi
Oziq-ovqat texnologiyasi va muhandisligi xalqaro instituti
O‘zbekiston, Farg‘ona

JISMONIY TARBIYA DARSLARIDA SUN’IY INTELEKT VA SMART SPORT TIZIMLARINI QO‘LLASH ISTIQBOLLARI

Annotatsiya. Maqolada jismoniy tarbiya darslarida sun’iy intellekt (SI) va Smart Sport texnologiyalarini qo‘llashning pedagogik imkoniyatlari tahlil qilinadi. Pulsometr, smart soat, harakat datchiklari va mobil ilovalar yordamida o‘quvchi va talabalarning jismoniy yuklamasini real vaqtda nazorat qilish hamda individual yondashuvni kuchaytirish yo‘llari yoritilgan. Dars jarayonida raqamli vositalarni joriy etishning amaliy modeli va uning xavf-xatarlari ko‘rsatib o‘tilgan.

Kalit so‘zlar: sun’iy intellekt, Smart Sport, jismoniy tarbiya, yuklamani nazorat qilish, individual yondashuv, raqamli texnologiyalar.

Mamaroziqov F.D.
lecturer
International Institute of Food Technology and Engineering
Uzbekistan, Fergana

PROSPECTS FOR THE APPLICATION OF ARTIFICIAL INTELLIGENCE AND SMART SPORTS SYSTEMS IN PHYSICAL EDUCATION CLASSES

Abstract. The article analyzes the pedagogical potential of using artificial intelligence (AI) and Smart Sport technologies in physical education classes. It examines the use of heart rate monitors, smartwatches, motion sensors, and mobile applications to monitor students’ physical workload in real time and strengthen an individualized approach to the educational process. A practical model for integrating digital tools into physical education is presented, along with the risks associated with their implementation.

Keywords: artificial intelligence, Smart Sport, physical education, physical workload monitoring, individualized approach, digital technologies.

Bugungi kunda ta’lim tizimining barcha bo‘g‘inlarida raqamlashtirish jarayoni jadal kechmoqda. Jismoniy tarbiya va sport sohasi ham bundan chetda emas. An’anaviy darslarda o‘qituvchi yuklamani asosan ko‘z bilan kuzatish, o‘quvchining tashqi ko‘rinishi va o‘z-o‘zini his qilishiga qarab baholaydi. Guruhda o‘nlab o‘quvchi bo‘lganda har bir kishining yurak urish tezligi, charchoq darajasi va tayyorgarligini bir vaqtda aniq kuzatish deyarli imkonsiz. Natijada yuklama ba’zilar uchun yetarli bo‘lmasa, boshqalar uchun me’yoridan ortiq bo‘lib qolishi mumkin.

Smart Sport tizimlari va sun’iy intellekt texnologiyalari ushbu muammoni hal etishda yangi imkoniyatlar ochadi. Ular o‘lchash, tahlil qilish va tavsiya berish jarayonlarini avtomatlashtirib, o‘qituvchiga ob’ektiv ma’lumot beradi. Shu bois mazkur yo‘nalishni jismoniy tarbiya metodikasiga tizimli ravishda kiritish dolzarb ilmiy-amaliy vazifadir.

Smart Sport vositalari va ularning imkoniyatlari.

Smart Sport tushunchasi jismoniy faollikni o‘lchovchi va uni raqamli ma’lumotga aylantiruvchi texnik vositalar majmuini bildiradi. Jismoniy tarbiya darslarida quyidagi vositalardan foydalanish mumkin: yurak urish tezligini o‘lchovchi pulsometrlar va smart soatlar; qadamlar soni, tezlik va harakat intensivligini qayd etuvchi akselerometr hamda datchiklar; mashg‘ulot natijalarini saqlovchi va ko‘rsatuvchi mobil ilovalar; harakat texnikasini yozib olish uchun kamera va planshetlar.

Bu vositalar yordamida dars davomida o‘quvchining yurak urish tezligi real vaqtda kuzatiladi. Taxminiy hisoblarda maksimal yurak urish chastotasi yosh bilan bog‘liq bo‘lib, yuklama zonalari (yengil, o‘rta, yuqori intensivlik) shu asosda belgilanadi. O‘qituvchi har bir o‘quvchining qaysi zonada ishlayotganini ko‘rib, mashqning hajmi va tezligini o‘z vaqtida to‘g‘rilashi mumkin.

Sun’iy intellektning pedagogik imkoniyatlari.

Sun’iy intellekt yig‘ilgan ma’lumotlarni tahlil qilib, qonuniyatlarni aniqlaydi va tavsiyalar shakllantiradi. Jismoniy tarbiya jarayonida uning asosiy imkoniyatlari quyidagilardan iborat. Birinchidan, individual yuklamani tanlash: tizim o‘quvchining oldingi natijalari, tiklanish tezligi va faolligiga qarab shaxsiy mashq rejasini taklif etadi. Ikkinchidan, natijalarni prognozlash: normativlarni topshirishdagi o‘sish dinamikasi tahlil qilinib, kelgusi ko‘rsatkichlar taxmin qilinadi. Uchinchidan, harakat texnikasini baholash: video asosida tananing holatini aniqlovchi algoritmlar yugurish, sakrash va uloqtirish texnikasidagi xatolarni ko‘rsatib beradi. To‘rtinchidan, hisobot va nazorat: davomat, natijalar va dinamika avtomatik jamlanib, o‘qituvchining hujjat ishiga ketadigan vaqti tejaladi.

Amaliy qo‘llash modeli.

Raqamli vositalarni dars tuzilmasiga bosqichma-bosqich kiritish maqsadga muvofiq. Tayyorgarlik bosqichida o‘quvchilarga pulsometr yoki smart soat tarqatiladi, dastlabki ko‘rsatkichlar qayd etiladi va mushaklarni qizdirish mashqlarining samaradorligi nazorat qilinadi. Asosiy bosqichda o‘qituvchi planshet yoki ekran orqali guruhning yurak urish ko‘rsatkichlarini kuzatib, yuklamani me’yorlashtiradi, yuqori zonaga chiqqan o‘quvchiga dam berish yoki mashq tezligini pasaytirishni tavsiya qiladi. Yakuniy bosqichda tiklanish tezligi o‘lchanadi, natijalar ilovaga saqlanadi va o‘quvchi o‘z dinamikasini ko‘ra oladi.

Bunday yondashuv o‘quvchilarning motivatsiyasini oshiradi, chunki ular o‘z natijalarini raqam va grafiklarda ko‘rib, o‘z-o‘zini baholash ko‘nikmasini egallaydi. Shuningdek, nazorat ob’ektiv bo‘lgani uchun baholashdagi tortishuvlar kamayadi.

Joriy etishdagi muammolar.

Shu bilan birga, bu yo‘nalishda bir qator muammolar mavjud. Birinchisi, texnik infratuzilma va moliyaviy imkoniyatlar: har bir o‘quvchini qurilma bilan

ta’minlash qimmat bo‘lgani uchun dastlab guruhli yoki navbatma-navbat foydalanish modelini qo‘llash mumkin. Ikkinchisi, o‘qituvchilarning raqamli kompetensiyasi: ular uchun malaka oshirish kurslari va amaliy seminarlar zarur. Uchinchisi, shaxsiy ma’lumotlar xavfsizligi: salomatlik bilan bog‘liq ko‘rsatkichlar maxfiy saqlanishi va faqat pedagogik maqsadda ishlatilishi kerak. To‘rtinchisi, texnologiyalarga haddan tashqari ishonish xavfi: sun’iy intellekt tavsiya beradi, ammo yakuniy qaror o‘qituvchi tomonidan, o‘quvchining sog‘lig‘i va holatini hisobga olgan holda qabul qilinadi.

Xulosa.

Jismoniy tarbiya darslarida sun’iy intellekt va Smart Sport tizimlarini qo‘llash yuklamani ob’ektiv nazorat qilish, individual yondashuvni kuchaytirish, o‘quvchilar faolligini oshirish va o‘qituvchi ishini samarali tashkil etish imkonini beradi. Ushbu vositalar o‘qituvchining o‘rnini bosmaydi, balki uning kasbiy imkoniyatlarini kengaytiradi. Yo‘nalishni muvaffaqiyatli joriy etish uchun texnik ta’minot, o‘qituvchilarning raqamli tayyorgarligi va ma’lumotlar xavfsizligi masalalarini birgalikda hal etish lozim.

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Muminov E.
senior lecturer
Department of Artificial Intelligence
Hayotjon Ismat
master's degree graduate
Tashkent University of Information Technologies
named after Muhammad al-Khwarizmi
Uzbekistan, Tashkent

AI-BASED DECISION SUPPORT SYSTEM FOR IRRIGATION MANAGEMENT (SMART IRRIGATION DSS)

Abstract. This paper proposes a Smart Irrigation Decision Support System (DSS) that determines the irrigation timing and volume for each individual field using IoT sensors (soil moisture and temperature), weather data, and machine learning (ML) models. The system combines sensor readings with rainfall forecasts and crop evapotranspiration to generate field-specific recommendations. The approach was evaluated in a soil water balance simulation on synthetic data (100 field-seasons) against fixed-schedule irrigation. A Random Forest model forecasted next-day soil moisture with RMSE = 0.0127 m^3/m^3 and $R^2 = 0.90$ on unseen fields. The DSS reduced water application by 35–40% depending on the reference schedule, with no simulated yield loss. Results are simulation-based and require field validation.

Keywords: smart irrigation, decision support system, IoT, machine learning, evapotranspiration, precision agriculture

INTRODUCTION

Water scarcity and climate change make efficient irrigation management a critical task in agriculture, especially in irrigated farming regions such as Central Asia. Traditional irrigation usually relies on fixed schedules or the farmer's experience, which can lead to over-irrigation, wasted water and energy, and a risk of soil salinization (Jones, 2004). Advances in IoT sensing and machine learning now make it possible to base irrigation decisions on data while accounting for the specific conditions of each field (Kamilaris & Prenafeta-Boldú, 2018). The aim of this study is to develop an AI-based DSS that determines irrigation timing and volume from soil moisture, temperature, and weather data.

METHODS

System architecture. The system consists of four layers: (1) a sensing layer with soil moisture and temperature sensors; (2) a communication layer that transmits data to a central server through an IoT gateway; (3) an analytics layer for data cleaning, feature engineering, and ML modeling; and (4) a decision layer with a module that recommends irrigation timing and volume for each field, together with a user interface.

Simulation environment. Because field measurements were not yet available, the system was evaluated in a daily soil water balance simulation following the FAO-56 approach (Allen et al., 1998): root-zone depth 0.6 m, depletion fraction p = 0.5, a staged crop coefficient (Kc from 0.4 to 1.15), and loss of water above field capacity as deep percolation. A 150-day season was simulated. Soil field capacity (0.28–0.36 m^3/m^3) and wilting point (0.11–0.16 m^3/m^3) varied between fields. Daily temperature, reference evapotranspiration (ET_0), and rainfall were generated synthetically for a dry-summer climate; ET_0 was derived from temperature and is not a Penman–Monteith calculation. Sensor readings included Gaussian noise (SD = 0.01 m^3/m^3), and rainfall forecasts included random error. All numerical results below come from this simulation (source code available from the author).

Data and models. Features were current and previous soil moisture, air temperature, ET_0, rainfall forecast, applied irrigation, crop coefficient, and soil field capacity and wilting point. The target was next-day soil moisture. Models were trained on 40 simulated fields (irrigation histories with varied intervals and amounts) and tested on 20 different unseen fields. Linear regression (baseline), Random Forest (Breiman, 2001), XGBoost (Chen & Guestrin, 2016), and a multilayer perceptron (MLP) were compared; a persistence forecast (tomorrow equals today) was added as a reference. A recurrent (LSTM) model was not implemented at this stage.

Decision rule. Each day the best model predicts next-day soil moisture without irrigation, using the rainfall forecast. If the prediction falls below a threshold (field capacity minus 45% of available water), irrigation equal to the deficit to field capacity is applied (maximum 60 mm). The DSS was compared with two fixed schedules: 50 mm every 8 days and 40 mm every 7 days.

Evaluation. Forecast accuracy was measured by RMSE, MAE, and R^2. Policies were compared over 100 field-seasons (10 fields × 10 weather seasons) by irrigation water applied (m^3/ha; 1 mm = 10 m^3/ha), deep percolation, stress days, and relative yield estimated with the FAO-33 yield response function (Doorenbos & Kassam, 1979) with Ky = 1.0. Paired differences were tested with the Wilcoxon signed-rank test.

RESULTS

Model accuracy. On unseen fields, Random Forest gave the best next-day soil moisture forecast: RMSE = 0.0127 m^3/m^3, MAE = 0.0101 m^3/m^3, R^2 = 0.904. XGBoost was close (RMSE = 0.0131, R^2 = 0.899). The linear regression baseline reached RMSE = 0.0148 and R^2 = 0.869, and the persistence forecast RMSE = 0.0220 and R^2 = 0.712. The untuned MLP performed poorly (RMSE = 0.0391, R^2 = 0.093).

Water use. With the DSS (Random Forest), mean irrigation was 5,710 m^3/ha (SD = 399) per season, compared with 9,500 m^3/ha for the 8-day/50 mm schedule (39.9% saving) and 8,800 m^3/ha for the 7-day/40 mm schedule (35.1% saving); both differences were significant (Wilcoxon, $p < 0.001$). Deep percolation fell from 4,061 and 3,293 m^3/ha under the fixed schedules to 381 m^3/ha under the DSS.

Crop yield. Estimated relative yield was 100.0% under all three policies, since the models predicted no meaningful water stress; the DSS averaged 0.1 stress days per season. The difference between the DSS and the fixed schedules was negligible (−0.01 percentage points).

DISCUSSION

In this simulation, forecasting soil moisture with tree-based models and combining it with rainfall forecasts allowed irrigation to be applied only when needed, which reduced water use and deep percolation without simulated yield loss. Two caveats limit these conclusions. First, the size of the saving depends on the reference schedules, which applied water generously (deep percolation was 3,300–4,100 m^3/ha); against schedules closer to crop demand the saving would be smaller. Second, all data are synthetic and generated by the same water balance model that determines the outcomes, so the results demonstrate the logic of the system rather than its field performance. The relative yield of 100% reflects the absence of simulated stress, not a measured yield. The accuracy gain of Random Forest over linear regression was modest (RMSE 0.0127 vs 0.0148). Future work includes validation with real sensor data from irrigated fields, a Penman–Monteith ET_0 from measured weather, recurrent models such as LSTM, satellite data, and direct control of automated irrigation equipment.

CONCLUSION

The proposed Smart Irrigation DSS integrates IoT sensor data, weather forecasts, and ML models into a single decision process that sets irrigation timing and volume for each field. In simulation, it reduced water application by 35–40% compared with fixed schedules while maintaining estimated yield. Validation with real field data is the next step.

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Muxammadkulova M.K.
intern assistant
Pulatova F.X.
student
Nomozova S.B.
student
Parpiyeva X.Sh.
student
Kurbonov S.I.
student
Samarkand State Medical University
Uzbekistan, Samarkand

USING CLINICAL SCENARIO-BASED TASKS TO DEVELOP MEDICAL STUDENTS' PROFESSIONAL COMMUNICATION SKILLS IN ENGLISH

Abstract. Professional communication in medical English requires learners to obtain information, explain unfamiliar concepts and respond appropriately to patients and colleagues. This conceptual article examines how clinical scenario-based tasks can connect language instruction with these professional purposes. A focused narrative analysis of task-based language teaching, medical role-play, simulation and patient understanding informs an original classroom framework. The framework combines preparation, an information-gap encounter, structured feedback and repeated performance. Practical examples address history taking, explanation of a planned examination and transfer of patient information. An analytic rubric separates comprehensibility, interaction, professional register and task completion. The analysis suggests that realistic tasks are most educationally useful when communication goals are explicit and clinical complexity matches learners' knowledge. The article offers a teaching proposal rather than evidence of measured learning gains. Future classroom research should examine transfer to unfamiliar cases and the reliability of performance assessment.

Keywords: medical English; English for specific purposes; clinical scenarios; professional communication; role-play; task-based learning; formative assessment.

Introduction

A medical student may recognize the English term "dyspnoea" yet struggle to ask a worried patient when breathing became difficult. This difference illustrates a central teaching problem: knowledge of terminology does not automatically provide the ability to conduct an interview. In professional encounters, speakers must select suitable words, organize questions, interpret incomplete answers and check that the other person has understood. Medical English courses therefore need opportunities to practise purposeful interaction alongside vocabulary and reading.

Clinical scenarios can provide such opportunities. A scenario-based task presents a plausible situation, assigns complementary roles and requires a communicative outcome. For example, a student interviewing a simulated patient must produce an accurate symptom summary from information that is initially unavailable. The task creates a reason to listen and ask follow-up questions. A rehearsed dialogue may support initial preparation, but subsequent performance should require learners to respond to information rather than reproduce a fixed script.

Task-based language teaching offers a foundation for connecting classroom language with meaningful outcomes [1]. Medical communication education supplies additional attention to role expectations and patient experience. Nestel and Tierney identify preparation, realistic activities and constructive discussion as important considerations in medical role-play [2]. The present article brings these perspectives together to answer a practical question: how can an English teacher design manageable clinical tasks that elicit professional communication and produce useful evidence for feedback?

Materials and methods

The article uses a focused narrative review and pedagogical design approach. Sources were purposively selected for their relevance to language tasks, medical role-play, simulation design and checking patient understanding. Bibliographic details were checked against publisher or scholarly records. The source set includes one foundational language-teaching monograph and four healthcare education or communication publications [1–5]. It is neither an exhaustive search nor a systematic review, and no pooled effect estimate is calculated.

The analysis considered four design questions: what information learners need to exchange; which professional language functions the encounter requires; what support learners need before speaking; and how performance can be observed. Concepts from the selected literature were translated into a proposed instructional cycle. The classroom timings, sample scenarios and scoring rubric below are original design proposals. No students were recruited, no interviews were recorded and no experimental outcomes are reported.

Theoretical foundations

The principal contribution of task-based teaching is the relationship between language use and a nonlinguistic outcome [1]. In medical English, this outcome might be an agreed account of a symptom, a comprehensible explanation or a concise handover. Grammar remains relevant because tense, negation and modality influence meaning. However, the teacher can address these forms in relation to a specific communicative difficulty, such as an unclear distinction between a past symptom and a continuing one.

Medical role-play research provides a rationale for giving learners clear roles and opportunities to reflect on performance [2]. Its relevance to English instruction is pedagogical rather than proof of second-language effectiveness. A role card should therefore indicate the person’s information and concerns while leaving the wording open. Students acting as patients also need guidance: an exaggerated

performance or an unexpected specialist diagnosis can undermine the intended language objective.

Simulation literature emphasizes feedback, repeated practice and integration within the curriculum [3]. Lateef also describes simulation as a technique that can support guided experiential learning [4]. These ideas support the proposed use of low-cost encounters with written role cards. They do not establish that a classroom role-play produces the same outcomes as high-fidelity clinical simulation. The transferable design principle is that learners need a coherent cycle of performance and revision rather than an isolated activity.

Patient understanding introduces a further requirement. Schillinger and colleagues studied communication that checks comprehension in encounters involving patients with diabetes and low health literacy [5]. For an English classroom, this supports practising explicit comprehension checks while avoiding claims that a language task itself improves clinical outcomes. Learners can practise asking a simulated patient to explain instructions in their own words and then reformulate any unclear information.

Results of the pedagogical analysis

The analysis yields a four-stage instructional framework. Its intended learners are medical students with approximately intermediate English and sufficient background to understand the selected case. The same framework can be simplified for earlier learners by reducing the number of symptoms, providing visual prompts and allowing more preparation. Learning objectives should describe observable acts, such as asking an open question, clarifying a time reference or summarizing the patient's concern.

Preparation and task design

In preparation, the teacher identifies a single professional situation and a small set of language functions. A history-taking lesson might focus on opening an encounter, establishing symptom duration and confirming the main concern. A short model exchange can demonstrate these functions. Learners then practise useful expressions without memorizing an entire conversation. The teacher checks that all students understand the role cards and the required final product.

An information gap makes the subsequent encounter purposeful. The interviewer receives the consultation objective, while the patient receives the symptom details, relevant background and one concern. Neither student sees the other card. The patient should provide information naturally when asked rather than recite the card. The interviewer records a brief summary after the encounter. This arrangement allows the teacher to check whether successful interaction produced an accurate shared account.

Interaction and supported repetition

During the first performance, the teacher observes without correcting every error. Immediate interruption is reserved for a misunderstanding that prevents the task from continuing. Notes distinguish language problems from interaction problems: an unclear verb tense requires a different response from repeated

interruption of the patient. Students should know that appropriate clarification is an indicator of professional communication, not an admission of failure.

Feedback follows the communicative sequence of the encounter. The simulated patient first identifies something that helped or hindered understanding. An observer then cites one specific example from the checklist. The teacher selects a limited number of priorities, demonstrates a more effective expression and invites a second attempt. In repetition, students exchange roles or receive a related case with altered details. This reduces dependence on memorized wording and creates an opportunity to apply feedback.

A proposed lesson sequence

A 60-minute lesson can allocate 10 minutes to the model and vocabulary, 5 minutes to role preparation, 8 minutes to the first encounter and written summary, 10 minutes to feedback, 8 minutes to a second encounter, and 9 minutes to comparison and reflection. The remaining 10 minutes can support delayed language correction and an exit task. This allocation is illustrative and should be adapted to class size and proficiency.

For larger classes, groups of three can rotate the roles of interviewer, patient and observer. The observer tracks a short list of behaviours rather than attempting to transcribe the conversation. Role rotation should be planned across successive tasks so that every learner practises speaking and listening. A brief written output gives quieter learners another way to demonstrate what they understood and helps teachers detect inaccurate information transfer.

Illustrative clinical scenarios

History-taking task. A fictional adult patient reports several days of headache and is concerned about its effect on study. The interviewer must establish onset, duration, location and the patient's main concern, then produce a four-sentence summary. Useful prompts include "Could you describe the discomfort?" and "Let me check that I have understood." The task assesses information gathering and clarification; it does not require students to diagnose the condition or recommend treatment.

Explanation task. The learner explains the sequence of a routine examination using a clinician-approved description. The simulated patient asks about an unfamiliar expression and requests clarification. The communicative outcome is a plain-language account that the patient can restate. The observer notes whether the speaker signposts the sequence, invites questions and responds to uncertainty. Any clinical content should match the curriculum and be reviewed by a medical educator before use.

Handover task. One learner receives a short fictional record and transfers its essential information to a colleague. The recipient must identify the current concern and ask about one deliberately omitted detail. The pair then creates a concise agreed summary. Unlike the patient-facing tasks, this encounter permits appropriate professional terminology, giving learners practice in selecting register for a different audience. Task difficulty can increase through additional information or reduced preparation time.

Assessment of professional communication

Assessment should show what the learner can accomplish in an encounter. The proposed rubric has four dimensions, each scored from 0 to 3: comprehensibility, interaction management, professional register and task completion. For each dimension, 0 indicates that the target behaviour is absent or communication breaks down; 1 indicates frequent support; 2 indicates generally successful performance with occasional support; and 3 indicates independent, consistent performance. The total ranges from 0 to 12 and is a proposed classroom score, not a validated clinical competence measure.

Comprehensibility concerns whether the message can be understood without repeated repair. Interaction management concerns listening, relevant follow-up questions and confirmation. Professional register concerns respectful phrasing and vocabulary appropriate to the recipient. Task completion concerns whether the requested summary or explanation contains the essential information. A learner can therefore receive credit for effective clarification despite minor grammatical errors. Conversely, fluent speech should not compensate for omitted information that defeats the task's purpose.

Teachers should agree on examples before using the rubric for consequential grading. Two assessors can independently score a small set of practice performances and discuss disagreements. Clinical correctness should be checked separately by a suitably qualified educator when a task involves substantive clinical decisions. A language score alone cannot establish readiness for unsupervised patient care. Learner confidence questionnaires may supplement assessment, but observed performance should remain the main evidence of communication development.

Discussion

The framework offers a practical bridge between terminology learning and situated communication. Its distinctive feature is alignment: the role cards, final product, observation checklist and feedback all address the same communicative objective. Teachers can use this alignment to avoid an activity that is engaging but difficult to evaluate. For example, a lesson targeting clarification must contain an ambiguity that actually requires a follow-up question; a fully scripted dialogue cannot supply equivalent evidence.

Implementation nevertheless requires careful control of difficulty. Learners may struggle because they lack English resources, clinical knowledge or familiarity with the task format. These causes should be separated before interpreting weak performance. A teacher can reduce linguistic demand through a phrase bank, reduce medical demand through a simpler case, or model the task procedure. Support can then be gradually withdrawn. This progression is a proposed instructional strategy rather than a finding from a tested intervention.

The evidence base has limits. The selected literature spans different learner populations and educational aims, and the foundational sources do not directly evaluate this exact framework in a medical English course. The narrative selection may omit relevant studies. Furthermore, improvement during repeated classroom

tasks would not by itself demonstrate transfer to real clinical encounters. These limits require restrained conclusions and a local evaluation before wider adoption.

A future study could compare scenario-based instruction with usual teaching over a defined course period. Both groups should complete comparable but unfamiliar speaking tasks before and after instruction, with blinded assessors where feasible. A delayed assessment would examine retention. Analysis should account for baseline proficiency, attendance and assessor agreement. Reporting task materials and scoring criteria would make the study easier to reproduce and help distinguish improved familiarity from transferable communication ability.

Conclusion

Clinical scenario-based tasks provide a coherent way to organize medical English around purposeful professional interaction. The proposed cycle combines clear outcomes, complementary role information, focused feedback and another opportunity to perform. Appropriate assessment considers both understandable language and completion of the communicative task. The framework can guide classroom design, while its effectiveness remains a question for empirical evaluation using unfamiliar cases and reliable performance measures.

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Muxammalqulova M.
assistent
Qilichova Sh.
talaba
Ablakulova D.
talaba
Hamidullayeva Z.
talaba
Boymonova G.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

WEB-QUEST TEXNOLOGIYASINING TAVSIFLANISHI

Annotatsiya. Ushbu makola bugungi kunda Veb-kvestlar zamonaviy axborot texnologiyalariga asoslanganligi, global kompyuter tarmog‘ining axborot makonining boyligi va cheksizligidan ta'lim maqsadlarida foydalanish va muayyan mavzuni o‘rganishda motivasiyani oshirish uchun talabalar haqiqiy manbalardan bilim olishda internet imkoniyatlaridan maksimal darajada foydalangan holda zamonaviy texnologiyalar bilan tanishishlari xaqidagi fikrlarni bayon qiladi.

Kalit so‘zlar: Veb-kvest, individual, traektoriya, trening mustaqil tanqidiy, internet, individual traektoriya, konsensusga yetkazish, multimedia, kompilyasiya vazifalari, onlayn va oflayn resurslarni o‘rganish.

Muxammalqulova M.
assistant
Qilichova Sh.
student
Ablakulova D.
student
Hamidullayeva Z.
student
Boymonova G.
student
Samarkand State Medical University
Uzbekistan, Samarkand

CHARACTERISTICS OF WEB-QUEST TECHNOLOGY

Abstract. This article examines Web-Quest technology, which is based on modern information technologies. Particular attention is paid to the use of the extensive and virtually unlimited information resources of the global computer network for educational purposes. The article discusses opportunities to enhance students' motivation when studying a specific topic through the effective use of

Internet resources. It emphasizes that Web-Quest technology enables students to acquire knowledge from reliable sources, develop independent information-search and critical thinking skills, and become familiar with modern digital technologies. Furthermore, the application of Web-Quest technology contributes to the effective integration of digital resources into the educational process and promotes students' independent learning activities.

Keywords: Web-Quest, individual learning trajectory, training, independent learning, critical thinking, Internet, consensus building, multimedia, compilation tasks, exploration of online and offline resources.

Veb-kvest — bu ta'limiy metod bo‘lib, unda talabalar yoki o‘quvchilar ma'lumot izlash, tahlil qilish va ijodiy vazifalarni bajarish uchun internet resurslaridan foydalanadilar. Ushbu metod internet orqali ma'lumot topishga asoslanadi va odatda ma'lum bir mavzu doirasida ijodiy yoki tadqiqot faoliyatini talab qiladi.

Zamonaviy ta'limning vazifalaridan biri o‘quv faoliyatini tashkil yetishning pedagogik tizimi tomonidan o‘quv faoliyatini tashkil yetish turlari va shakllarining xilma-xilligini oshirishdir, bu o‘quvchilarning ta'lim imkoniyatlarini sezilarli darajada oshirishi, ochiq ta'lim maydonida individual traektoriyani tanlash va amalga oshirishi mumkin. 21-asr ta'limga yangicha yondashuvlarni talab qiladi. Trening mustaqil tanqidiy va ijodiy fikrlashni rivojlantirish nuqtai nazaridan rivojlanishi kerak. Buning uchun keng axborot sohasi, turli xil ma'lumot manbalari, bir xil muammo bo‘yicha turli qarashlar, nuqtai nazarlar talab yetiladi, talabalarni mustaqil fikrlashga, o‘zlarining asosli pozisiyalarini topishga undaydi.[1]

Bugungi kunda oliy ukuv yurtlarining ishini global axborot makoniga kirmasdan tasavvur qilish qiyin. Internet axborot olish va bilimlarni uzatishning universal vositasidir. Ko‘pgina o‘qituvchilar ko‘proq yoki kamroq internetga yo‘naltirilgan yangi o‘qitish usullarini o‘rganmoqdalar va rivojlantirmoqdalar. Axborot texnologiyalari talabalar shug‘ullanadigan, o‘z bilimlari va o‘z bilimlarini qurish uchun ko‘proq mas'uliyatni o‘z zimmalariga oladigan yangi o‘quv muhitini yaratishga yordam beradi. Internetning axborot salohiyati shunchaki bitmas-tuganmas. Bu yerda siz nafaqat sizni qiziqtirgan har qanday ma'lumotni olishingiz, balki butun dunyo bo‘ylab tarmoq foydalanuvchilari bilan o‘z ma'lumotlaringizni baham ko‘rishingiz mumkin.

O‘qituvchilar allaqachon talabalarning mustaqil ishlarini tashkil qilishda internet resurslaridan foydalanish bo‘yicha ma'lum tajribaga yega bo‘lishdi. Avvalo, bu individual va guruhli tadqiqotlar olib borishda internetdan foydalanish. Bu, ayniqsa, mustaqil tadqiqot ishlariga tegishli. Tadqiqot metodologiyasi oddiy dars vaqtiga deyarli "mos kelmaydi". Ma'lumot qidirish, uni qayta ishlash va tahlil qilish, shuningdek, tadqiqot natijalarini sinfda taqdim yetish uchun tayyorlashga sarflangan ko‘p vaqt maktabdan tashqari vaqtga sarflanadi. Internetni chet tillarini o‘qitishga integratsiyalashning ushbu usuli veb-kvest deb ataladi.

Veb-kvest talabalar uchun ham, o‘qituvchilar uchun ham analitik va ijodiy fikrlash qobiliyatlarini rivojlantirishga qaratilgan; veb-kvestni yaratuvchi

o‘qituvchi yuqori darajadagi fan, uslubiy va axborot kommunikasiyalari malakasiga yega bo‘lishi kerak.

Veb-kvestlarning o‘ziga xos xususiyati shundaki, talabalar tomonidan mustaqil yoki guruhli ishlash uchun saytda taqdim yetilgan ma'lumotlarning bir qismi yoki barchasi aslida turli veb-saytlarda joylashgan. Mavjud giperhavolalar tufayli talabalar buni sezmaydilar, balki ma'lum bir ma'lumot ma'lumotining aniq joylashuvi muhim omil bo‘lmagan yagona axborot makonida ishlaydilar. Talabaga ma'lum bir mavzu bo‘yicha internetda materiallar to‘plash, ushbu materiallar yordamida muammoni hal qilish vazifasi beriladi. Ba'zi manbalarga havolalar o‘qituvchi tomonidan taqdim yetiladi va ular an'anaviy qidiruv tizimlari yordamida ulardan ba'zilarini o‘zlari topishlari mumkin. Kvest oxirida talabalar mavzu bo‘yicha o‘z veb-sahifalarini yoki boshqa ijodiy ishlarni yelektron, bosma yoki og‘zaki shaklda topshiradilar.

Veb-kvestlar zamonaviy axborot texnologiyalariga asoslangan bo‘lib, global kompyuter tarmog‘ining axborot makonining boyligi va cheksizligidan ta'lim maqsadlarida foydalanadi. Muayyan mavzuni o‘rganishda motivasiyani oshirish uchun talabalar haqiqiy manbalardan bilim olishda internet imkoniyatlaridan maksimal darajada foydalangan holda zamonaviy texnologiyalar bilan tanishadilar. Aslida, veb-kvestlarning asosini o‘tgan asrning boshlarida Aqshda paydo bo‘lgan loyiha metodologiyasi tashkil yetadi. U muammolar usuli deb ham atalgan va u amerikalik faylasuf va pedagog J. R. R. Tolkien tomonidan ishlab chiqilgan falsafa va ta'limdagi gumanistik yo‘nalish g‘oyalari bilan bog‘laydi.

Veb-kvest atamasi birinchi marta 1995 yil yozida san-Diego universiteti (Aqsh) ta'lim texnologiyalari professori Berni Dodj tomonidan taklif qilingan. Muallif turli o‘quv darajalarida turli o‘quv fanlarini o‘qitishda o‘quv jarayoniga integratsiya qilish uchun innovasion Internet ilovalarini ishlab chiqdi. Veb-kvestlar alohida muammoni, o‘quv mavzusini yoki mavzuni qamrab olishi mumkin yoki ular fanlararo bo‘lishi mumkin. B. Dodge veb-kvestlarni tasniflashning uchta tamoyilini belgilaydi:[5]

1. Bajarish muddati bo‘yicha: qisqa muddatli va uzoq muddatli.
2. Mavzu mazmuni bo‘yicha: monoprojektlar va fanlararo veb-kvestlar.
3. Talabalar tomonidan bajariladigan vazifalar turiga ko‘ra: takrorlash (vazifalarni takrorlash), kompilyasiya (kompilyasiya vazifalari), sir (sirli vazifalar), jurnalistik (jurnalistik vazifalar), dizayn (dizayn vazifalari), ijodiy (ijodiy mahsulot vazifalari), munozarali muammolarni hal qilish(konsensus tuzish vazifalari), ishontirish (ishontirish vazifalari), o‘z-o‘zini bilish (o‘z-o‘zini bilish vazifalari), tahliliy vazifalar, baholash vazifalari, ilmiy vazifalar.

Qayta hikoya qilish vazifalari yeng ibtidoiy bo‘lib, internetdan ma'lumot manbai sifatida foydalanishning yeng oddiy misolidir. Hatto faqat qayta yozishga asoslangan veb-kvestlarni veb-kvest deb hisoblash mumkin yemas degan fikr bor. Biroq, aksariyat hollarda, veb-kvest uchun vazifa sifatida qayta yozishga ruxsat beriladi:

Talabalar hisobotlarining formati va shakli asl materiallardan sezilarli darajada farq qiladi, ya'ni matnni internetdan matn muharririga oddiy nusxalash yemas.;

Talabalar nima haqida gaplashishni va topilgan ma'lumotlarni qanday tartibga solishni tanlashda yerkin.;

Talabalar axborotni umumlashtirish, tanlash va qayta ishlash ko‘nikmalaridan foydalanadilar.

Kompilyasiya topshirig‘ining mohiyati shundaki, talabalar turli manbalardan ma'lumot olishlari va ularni yagona formatga keltirishlari kerak. Yakuniy ish internetda nashr yetilishi yoki biron bir moddiy yoki raqamli bo‘lmagan mahsulot shaklida taqdim yetilishi mumkin.

Topishmoq vazifasi asosida yaratilgan veb-kvest manbalar to‘plamidan ma'lumotlarni sintez qilishni va biron bir internet sahifasida javobni qidirish orqali hal qilib bo‘lmaydigan jumboq yaratishni talab qiladi. Aksincha, topishmoq bilan chiqish kerak, uning yechimi talab qiladi:

ko‘p manbalardan ma'lumotlarni assimilyasiya qilish;

turli xil ma'lumot manbalaridan xulosalar va umumlashtirish orqali ma'lumotlarni bir butunga to‘plash;

Dastlab savollarga to‘g‘ri javob bo‘lib tuyulishi mumkin bo‘lgan murakkab izlardan istisnolar mavjud, ammo yaqinroq tekshirilganda ular bunday bo‘lib chiqmaydi.

Jurnalistik veb-kvestlarda talabalar faktlarni to‘plashlari va ularni yangiliklar, intervyu yoki boshqa jurnalistik janrida tashkil qilishlari kerak.

Dizayn vazifasi talabalardan ma'lum bir doirada oldindan belgilangan maqsadga yerishish uchun mahsulot yoki harakatlar rejasini tuzishni talab qiladi. Masalan, ma'lum bir oilaning yehtiyojlariga javob beradigan oshxonani rejalashtirish yoki xayoliy universitet bitiruvchilari uchun ish topish va martaba rejalashtirish va hokazo.[1]

Ijodiy veb-kvestlar (ijodiy mahsulotlar vazifasi) talabalardan ma'lum bir formatda mahsulot yaratishni talab qiladi (rasm, o‘yin, plakat, o‘yin, qo‘shiq, veb-sayt, multimedia taqdimoti va boshqalar). Ijodiy loyihalar dizayn loyihalariga o‘xshaydi, lekin ular natijalarida yerkinroq va oldindan aytib bo‘lmaydi. Bunday loyihalarni baholashda talabalarning ijodkorligi va o‘zini namoyon qilishiga ko‘proq ye'tibor qaratish lozim.

Konsensusni yaratish vazifalari bir xil masala bo‘yicha turli xil, ba'zan qarama-qarshi fikrlarni topish va taqdim yetishni va ularni konsensusga yetkazishga harakat qilishni o‘z ichiga oladi.

Internetga asoslangan o‘z-o‘zini bilish vazifalari talabalarning o‘zlari haqidagi tushunchalarini yaxshilashga qaratilgan bo‘lib, ularni onlayn va oflayn resurslarni o‘rganish orqali rivojlantirish mumkin. Bunday loyihalar kamdan-kam uchraydi, ammo misollar mavjud, masalan, "universitetni tugatganimda nima bo‘laman?", kelajakdagi martaba bilan bog‘liq Internet resurslarini o‘rganishga qaratilgan.[6]

Baholash veb-kvestlari talabalarga bir qator fanlarni taqdim yetadi va ulardan baholash yoki tasniflashni yoki cheklangan ro‘yxatdan yechim tanlashni so‘raydi. Ko‘pincha, lekin shart yemas, talabalar bunday kvestlarda rol o‘ynashga taklif qilinadi, masalan, xayoliy sudda sudya sifatida.

Ilmiy veb-kvestlar talabalarni bilimlarning turli sohalarida ilmiy tadqiqotlar bilan tanishtirish uchun ishlatiladi. Internet har qanday fanda foydali bo‘lishi mumkin bo‘lgan tarixiy va dolzarb ma'lumotlarga boydir.

Natija: Ishonchli veb-kvest (ishontirish vazifasi) kimnidir biror narsaga ishontira oladigan mahsulot yaratishga qaratilgan. Bunday vazifa odatdagi takrorlashdan tashqariga chiqadi va talabalardan kvest bilan ishlash paytida olingan materiallar asosida har qanday bayonot, fikr yoki muammoni hal qilish foydasiga dalillarni ishlab chiqishni talab qiladi. Bunday loyihaning yakuniy mahsuloti sud ko‘rinishi, xat, maqola yoki press-reliz, plakat, video yozuv, multimedia taqdimoti, veb-sahifa va boshqalar bo‘lishi mumkin.[5]

Xulosa: Analitik veb-kvest ma'lum bir mavzu doirasida real narsalarning o‘zaro bog‘liqligini o‘rganadi. Bunday topshiriqlar talabalarga bir yoki bir nechta narsalarni sinchkovlik bilan o‘rganish va ulardagi o‘xshashlik va farqlarni topish, shuningdek, ushbu o‘xshashlik va farqlarning yashirin ma'nosini hisoblash, sabab va ta'sir o‘rtasidagi bog‘liqlikni tushunish va ularning ma'nosini muhokama qilish sharoitida bilim olishlari uchun asos yaratadi. Masalan, ikki mamlakat yoki xalqlarning madaniyatini taqqoslashda nafaqat ularning o‘xshashliklari va farqlarini aniqlash, balki ular nimani anglatishini, ularning sabablari va oqibatlari haqida mulohaza yuritish va taxmin qilish kerak.

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Narmetova S.Y.
farmakologiya kafedrasi
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand
Shavkatova N.M.
davolash fakulteti 301-guruh talabasi
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

QANDLI DIABETDA DIABETIK NEFROPATIYANING RIVOJLANISHI, TASHXISI VA DAVOLASH USULLARI

Annotatsiya. Ushbu maqolada qandli diabet va diabetik nefropatiya o‘rtasidagi bog‘liqlik, kasallikning rivojlanish mexanizmlari, klinik belgilari, tashxislash usullari, davolash va profilaktika choralari yoritiladi. Qandli diabetda qonda glyukoza miqdorining uzoq vaqt yuqori bo‘lishi buyrakning qon tomirlari va filtratsiya tizimiga zarar yetkazib, surunkali buyrak kasalligi rivojlanishiga olib kelishi mumkin. Diabetik buyrak zararlanishini erta aniqlash, qondagi glyukoza va arterial qon bosimini nazorat qilish hamda buyrakni himoya qiluvchi davolash usullarini qo‘llash kasallikning avj olishini sekinlashtirishda muhim ahamiyatga ega.

Kalit so‘zlar: qandli diabet, diabetik nefropatiya, buyrak, giperglikemiya, albuminuriya, kreatinin, surunkali buyrak kasalligi, glikemik nazorat, profilaktika.

Narmetova S.Y.
Department of Pharmacology
Samarkand State Medical University
Uzbekistan, Samarkand
Shavkatova N.M.
third-year student, Group 301, Faculty of Medicine
Samarkand State Medical University
Uzbekistan, Samarkand

DEVELOPMENT, DIAGNOSIS, AND TREATMENT METHODS OF DIABETIC NEPHROPATHY IN DIABETES MELLITUS

Abstract. This article examines the relationship between diabetes mellitus and diabetic nephropathy, the mechanisms underlying disease development, its clinical manifestations, diagnostic methods, treatment, and preventive measures. Prolonged elevation of blood glucose levels in diabetes mellitus can damage the blood vessels and filtration system of the kidneys, potentially leading to chronic kidney disease. Early detection of diabetic kidney disease, control of blood glucose levels and blood pressure, and the use of kidney-protective treatment strategies are essential for slowing disease progression.

Keywords: diabetes mellitus, diabetic nephropathy, kidneys, hyperglycemia, albuminuria, creatinine, chronic kidney disease, glycemic control, prevention.

Kirish

Qandli diabet — organizmda insulin ishlab chiqarilishi yoki uning ta’siri buzilishi natijasida uglevodlar almashinuvi izdan chiqishi va qonda glyukoza miqdorining oshishi bilan tavsiflanadigan surunkali kasallikdir. Ushbu kasallik nafaqat uglevodlar almashinuviga, balki yurak-qon tomir tizimi, ko‘z to‘r pardasi, asab tizimi va buyraklar faoliyatiga ham salbiy ta’sir ko‘rsatadi. Qandli diabetning muhim asoratlaridan biri diabetik buyrak kasalligi bo‘lib, u an’anaviy adabiyotlarda diabetik nefropatiya deb ham ataladi. Ushbu holat buyrakning filtratsiya tizimidagi tuzilmaviy va funksional o‘zgarishlar natijasida rivojlanadi. Kasallik dastlabki bosqichlarda sezilarli klinik belgilarsiz kechishi, keyinchalik esa buyrak faoliyatining pasayishiga olib kelishi mumkin. Qandli diabet bilan og‘rigan bemorlarda buyrak zararlanishini erta aniqlash va uning rivojlanishini sekinlashtirish bemorlarning hayot sifatini yaxshilash, yurak-qon tomir asoratlari hamda buyrak yetishmovchiligi xavfini kamaytirishda muhim vazifa hisoblanadi.

Mavzuning dolzarbligi

Qandli diabet (QD) — metabolik kasalliklar bilan bog‘liq kasalliklar guruhidir. U turli sabablarga ko‘ra rivojlanadi. Kasallikning ayrim turlari genetik kelib chiqishga ega, boshqalari esa turmush tarzi yoki atrof-muhit omillari bilan bog‘liq. 2019-yilda QD dunyo bo‘ylab 1,5 million o‘limning bevosita sababi bo‘lgan. Bundan tashqari, holatlarning deyarli yarmida kasallik 70 yoshgacha bo‘lgan odamlarda o‘lim bilan yakunlangan. Qandli diabet Jahon sog‘liqni saqlash tashkiloti (JSST) tomonidan global sog‘liqni saqlashning muhim muammolaridan biri sifatida e’tirof etilgan. Xalqaro Diabet Federatsiyasining 2025-yilgi, 11-nashr ma’lumotlariga ko‘ra, 20–79 yoshdagi kattalar orasida diabet bilan yashovchilar soni taxminan 589 million nafarni tashkil etadi va kasallik yuki kelgusi o‘n yilliklarda ham ortib borishi kutilmoqda.

2-turdagi qandli diabet (QD-2) diabetning eng keng tarqalgan shakli bo‘lib, kasallik ko‘pincha gipertoniya, yurak-qon tomir kasalliklari, buyrak kasalligi, ko‘z asoratlari, semizlik va boshqa surunkali kasalliklar bilan birga kechadi. Shu sababli zamonaviy farmakoterapiya faqat qondagi glyukoza darajasini pasaytirishga emas, balki bemorning umumiy kardiorenal xavfini kamaytirishga ham yo‘naltirilishi lozim [3].

Qandli diabet va diabetik nefropatiya o‘rtasidagi bog‘liqlik

Qandli diabet va nefropatiya o‘rtasidagi asosiy bog‘liqlik qonda glyukoza miqdorining uzoq vaqt davomida yuqori bo‘lishi bilan izohlanadi. Surunkali giperglikemiya buyrak koptokchalaridagi mayda qon tomirlari, bazal membrana va filtratsiya to‘sig‘ining tuzilishiga salbiy ta’sir ko‘rsatadi.

Dastlabki bosqichlarda buyrak koptokchalaridagi filtratsiya tezligi oshishi, ya’ni giperfiltratsiya kuzatilishi mumkin. Vaqt o‘tishi bilan to‘qimalarda strukturaviy o‘zgarishlar, mezangial matriksning ko‘payishi va koptokchalarning chandiqlanishi rivojlanadi. Natijada siydik orqali albumin yo‘qotilishi kuchayib,

buyrakning filtratsiya qobiliyati pasayishi mumkin. Diabetik nefropatiya 1- va 2-tur qandli diabetda uchraydi. 1-tur diabetda buyrak zararlanishi ko‘pincha kasallik davomiyligi oshgan sari namoyon bo‘ladi. 2-tur diabetda esa buyrak kasalligi diabet aniqlangan paytning o‘zida ham mavjud bo‘lishi mumkin.

Diabetik nefropatiyaning rivojlanish mexanizmi

Diabetik nefropatiyaning patogenezi bir nechta o‘zaro bog‘liq jarayonlardan tashkil topadi.

Giperglikemiya. Qonda glyukozaning doimiy yuqori bo‘lishi oqsillarning glikatsiyalanishiga, oksidlovchi stress va yallig‘lanish jarayonlarining kuchayishiga olib keladi.

Gemodinamik o‘zgarishlar. Buyrak koptokchalari ichidagi bosimning oshishi filtratsiya to‘sig‘iga ortiqcha yuklama tushiradi.

Albuminuriya. Buyrak filtratsiya to‘sig‘i zararlanishi natijasida albumin siydikka o‘ta boshlaydi.

Fibroz va skleroz. Buyrak to‘qimalarida chandiqlanish jarayonlari rivojlanib, sog‘lom nefronlar soni kamayadi.

Arterial gipertenziya. Qon bosimining yuqori bo‘lishi buyrak zararlanishini yanada kuchaytirib, kasallikning tezroq rivojlanishiga sabab bo‘lishi mumkin.

Ushbu jarayonlar natijasida buyrakning chiqarish, suv-elektrolit muvozanatini saqlash va moddalar almashinuvi chiqindilarini filtrlash funksiyalari buziladi.

Klinik belgilari

Diabetik nefropatiyaning dastlabki bosqichlari ko‘pincha belgilarsiz kechadi. Shuning uchun bemor o‘zini yaxshi his qilgan taqdirda ham buyrak faoliyatida o‘zgarishlar mavjud bo‘lishi mumkin.

Kasallik rivojlangan sari quyidagi belgilar kuzatilishi mumkin:

siydikda albumin miqdorining oshishi;

arterial qon bosimining ko‘tarilishi;

oyoqlar va yuzda shish paydo bo‘lishi;

tez charchash va umumiy holsizlik;

buyrak filtratsiya tezligining pasayishi;

og‘ir bosqichlarda ko‘ngil aynishi, ishtaha pasayishi va organizmda suyuqlik to‘planishi. Shuni ta’kidlash lozimki, diabet bilan og‘rigan har bir bemorda buyrak kasalligi aynan diabet tufayli kelib chiqavermaydi. Boshqa buyrak kasalliklari ham mavjud bo‘lishi mumkin, shu sababli tashxis kompleks tekshiruvlar asosida qo‘yiladi.

Diabetik nefropatiyani tashxislash

Diabetik nefropatiyani erta aniqlash uchun laborator tekshiruvlar muhim ahamiyatga ega. Hozirgi klinik tavsiyalarga muvofiq, buyrak holati asosan ikki ko‘rsatkich yordamida baholanadi: siydikda albuminning kreatininga nisbati (UACR) va qondagi kreatinin asosida hisoblangan buyrak koptokchalari filtratsiya tezligi (eGFR).

Asosiy tekshiruvlar quyidagilardan iborat:

Siydikda albumin/kreatinin nisbati (UACR). Buyrak zararlanishining erta belgilarini aniqlashga yordam beradi. Natija 30 mg/g dan past bo‘lsa, me’yoriy toifaga kiradi; 30–300 mg/g — o‘rtacha oshgan, 300 mg/g va undan yuqori bo‘lsa, sezilarli oshgan albuminuriya hisoblanadi.

Qonda kreatinin miqdori. Buyrakning chiqarish funksiyasini baholashda qo‘llaniladi.

eGFR ko‘rsatkichi. Buyrakning qonni filtrlash qobiliyatini baholash imkonini beradi.

Qonda glyukoza va HbA1c. Diabet nazorati darajasini aniqlash uchun tekshiriladi.

Arterial qon bosimini o‘lchash. Gipertenziya buyrak zararlanishining muhim xavf omili bo‘lgani uchun muntazam nazorat qilinadi.

Albuminuriyani baholashda vaqtinchalik o‘zgarishlarni hisobga olish kerak. Jismoniy zo‘riqish, infeksiya, isitma yoki qonda glyukozaning keskin oshishi natijaga ta’sir qilishi mumkin. Shuning uchun albuminuriyaning doimiyligini tasdiqlash uchun takroriy tahlillar talab etiladi. 2-tur qandli diabetda buyrak faoliyatini kasallik aniqlangan vaqtdan boshlab, 1-tur diabetda esa odatda kasallik boshlanganidan besh yil o‘tgach kamida yiliga bir marta tekshirish tavsiya etiladi. Buyrak kasalligi aniqlangan bemorlarda tekshiruvlar chastotasi xavf darajasiga qarab belgilanadi.

Diabetik nefropatiyani davolash

Davolashning asosiy maqsadi qondagi glyukoza va qon bosimini nazorat qilish, albuminuriyani kamaytirish hamda buyrak funksiyasining pasayishini sekinlashtirishdan iborat.

Glikemik nazorat

Qonda glyukoza miqdorini maqsadli darajada saqlash diabetik nefropatiyaning paydo bo‘lish xavfini kamaytirish va uning rivojlanishini sekinlashtirishda muhimdir. HbA1c uchun maqsadli ko‘rsatkich bemorning yoshi, diabet turi, gipoglikemiya xavfi va boshqa kasalliklarini hisobga olgan holda individual belgilanadi.

Arterial qon bosimini nazorat qilish

Qon bosimini nazorat qilish buyrakni himoya qilishning muhim qismidir. Diabet, gipertoniya va albuminuriya birga uchraganda, shifokor angiotenzinni aylantiruvchi ferment ingibitorlari (ACE ingibitorlari) yoki angiotenzin II retseptorlari blokatorlarini (ARB) buyurishi mumkin. Bu preparatlar qon bosimini tushirish bilan birga albuminuriyani kamaytirishga yordam beradi.

Buyrakni himoya qiluvchi preparatlar

2-tur qandli diabet va surunkali buyrak kasalligi mavjud bo‘lgan ayrim bemorlarga SGLT2 ingibitorlari tavsiya etiladi. Ushbu preparatlar buyrak faoliyatining pasayishini va yurak-qon tomir asoratlari xavfini kamaytirishga yordam berishi mumkin. Bemorning holatiga qarab, GLP-1 retseptor agonistlari yoki finerenon kabi boshqa preparatlar ham ko‘rib chiqilishi mumkin. Ularni tanlashda buyrak funksiyasi, qondagi kaliy miqdori, hamroh kasalliklar va qabul qilinayotgan boshqa dorilar hisobga olinadi. Dori vositalarini mustaqil qabul qilish

yoki dozasini o‘zgartirish mumkin emas. Davolash endokrinolog va zarur hollarda nefrolog nazoratida olib borilishi kerak.

Ovqatlanish va turmush tarzining ahamiyati

Diabetik nefropatiyaning oldini olish va uning rivojlanishini sekinlashtirishda ovqatlanish hamda kundalik odatlar muhim o‘rin tutadi. Shakar va tuz miqdori nazorat qilingan muvozanatli ovqatlanishga rioya qilish.

Ortiqcha tuz iste’molini kamaytirish.

Muntazam jismoniy faollik bilan shug‘ullanish.

Tana vaznini maqbul darajada saqlash.

Chekishdan voz kechish.

Suv iste’molini shifokor tavsiyasiga muvofiq belgilash.

Buyrakka zarar yetkazishi mumkin bo‘lgan dorilarni, ayniqsa ayrim yallig‘lanishga qarshi og‘riq qoldiruvchi preparatlarni, shifokor maslahatисиз qabul qilmaslik.

Oqsil iste’moli ham buyrak faoliyatiga mos ravishda belgilanishi kerak. Surunkali buyrak kasalligining ayrim bosqichlarida oqsilni me’yordan ortiq iste’mol qilish tavsiya etilmaydi, biroq uni keskin cheklash ham to‘g‘ri emas.

Profilaktika va erta aniqlash

Diabetik nefropatiyaning profilaktikasi qandli diabetni samarali boshqarishdan boshlanadi. Buning uchun qondagi glyukoza, HbA1c, arterial qon bosimi, UACR va eGFR ko‘rsatkichlari muntazam nazorat qilinishi lozim.Kasallikning erta bosqichlarida aniqlangan albuminuriya buyrakni himoya qilishga qaratilgan choralarni o‘z vaqtida boshlash imkonini beradi. Agar albuminuriya kuchaysa, eGFR tez pasaysa yoki tashxisga shubha tug‘ilsa, bemorni nefrolog ko‘rigidan o‘tkazish zarur.Profilaktikaning samaradorligi bemorning davolanishga rioya qilishi, shifokor nazorati va xavf omillarining qanchalik yaxshi boshqarilishiga bog‘liq.

Xulosa

Qandli diabet va diabetik nefropatiya o‘zaro uzviy bog‘liq bo‘lib, surunkali giperglikemiya buyrakning filtratsiya tizimida tuzilmaviy va funksional o‘zgarishlarni keltirib chiqaradi. Kasallikning dastlabki bosqichlarida klinik belgilar bo‘lmasligi mumkinligi sababli laborator tekshiruvlar orqali erta tashxislash alohida ahamiyatga ega.Qondagi glyukozani nazorat qilish, arterial qon bosimini maqbul darajada saqlash, buyrakni himoya qiluvchi preparatlarni tegishli ko‘rsatmalar asosida qo‘llash va muntazam tibbiy kuzatuv diabetik nefropatiyaning rivojlanishini sekinlashtirishda muhim o‘rin tutadi.Shunday qilib, qandli diabet bilan og‘rigan bemorlarda buyrak faoliyatini muntazam baholash, profilaktik choralarni kuchaytirish va individual davolash yondashuvini qo‘llash surunkali buyrak kasalligi hamda uning og‘ir asoratlari xavfini kamaytirishga xizmat qiladi.

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Narmetova S.Y.
farmakologiya kafedrasi o‘qituvchisi
Xayitniyazova Ch.A.
davolash fakulteti 332-guruh talabasi
Mizomova E.Q.
davolash ishi fakulteti 332-guruh talabasi
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

2-TUR QANDLI DIABETDA SURUNKALI BUYRAK KASALLIGINI ERTA ANIQLASH: ALBUMINURIYA VA EGFR KO‘RSATKICHLARINING KLINIK AHAMIYATI

Annotatsiya. 2-tur qandli diabet bilan og‘rigan bemorlarda surunkali buyrak kasalligini erta aniqlashning klinik ahamiyati, buyrak funksiyasini baholashning zamonaviy laboratoriya usullari hamda albuminuriya va taxminiy koptokchalar filtratsiyasi tezligining diagnostik imkoniyatlari tahlil qilinadi. Qandli diabetda buyrak shikastlanishi ko‘p hollarda kasallikning dastlabki bosqichlarida yaqqol klinik belgilarsiz kechishi mumkin. Shu sababli bemorlarni muntazam laborator tekshiruvdan o‘tkazish, siydikda albumin/kreatinin nisbatini va qondagi kreatinin asosida hisoblangan eGFR ko‘rsatkichini birgalikda baholash muhim ahamiyatga ega. Maqolada surunkali buyrak kasalligining diagnostik mezonlari, albuminuriya darajalari, eGFR bo‘yicha tasniflash, laborator natijalarni to‘g‘ri talqin qilishdagi cheklovlar va klinik kuzatuvning asosiy tamoyillari yoritilgan. Xalqaro klinik tavsiyalar tahlili asosida qandli diabet bilan og‘rigan bemorlarda buyrak asoratlarini o‘z vaqtida aniqlash va kasallikning rivojlanish xavfini kamaytirishga qaratilgan yondashuvlar muhokama qilingan.

Kalit so‘zlar: qandli diabet, 2-tur qandli diabet, surunkali buyrak kasalligi, diabetik buyrak kasalligi, albuminuriya, UACR, eGFR, kreatinin, erta tashxislash, laborator diagnostika.

Narmetova S.Y.
lecturer, Department of Pharmacology
Xayitniyazova Ch.A.
third-year student, Group 332, Faculty of Medicine
Mizomova E.Q.
third-year student, Group 332, Faculty of General Medicine
Samarkand State Medical University
Uzbekistan, Samarkand

EARLY DETECTION OF CHRONIC KIDNEY DISEASE IN TYPE 2 DIABETES MELLITUS: CLINICAL SIGNIFICANCE OF ALBUMINURIA AND EGFR INDICATORS

Abstract. This article examines the clinical significance of early detection of chronic kidney disease in patients with type 2 diabetes mellitus, modern laboratory methods for assessing kidney function, and the diagnostic potential of albuminuria and estimated glomerular filtration rate (eGFR). In patients with diabetes mellitus, kidney damage may often progress without obvious clinical symptoms during the early stages of the disease. Therefore, regular laboratory testing and the combined assessment of the urine albumin-to-creatinine ratio (UACR) and eGFR calculated from serum creatinine levels are of particular importance. The article discusses the diagnostic criteria for chronic kidney disease, albuminuria categories, eGFR-based classification, limitations in the interpretation of laboratory results, and the fundamental principles of clinical monitoring. Based on an analysis of international clinical guidelines, approaches aimed at the timely detection of kidney complications and the reduction of disease progression risk in patients with diabetes mellitus are discussed.

Keywords: diabetes mellitus, type 2 diabetes mellitus, chronic kidney disease, diabetic kidney disease, albuminuria, UACR, eGFR, creatinine, early detection, laboratory diagnostics.

Kirish

Qandli diabet butun dunyoda aholi salomatligiga jiddiy ta’sir ko‘rsatayotgan surunkali noinfeksion kasalliklardan biri hisoblanadi. Uning ahamiyati nafaqat qondagi glyukoza miqdorining ortishi, balki kasallik davomida turli a’zo va tizimlarda yuzaga keladigan asoratlar bilan ham belgilanadi. Ayniqsa, buyrak, yurak-qon tomir tizimi, ko‘z to‘r pardasi va periferik asablarning shikastlanishi bemorlarning hayot sifatiga, mehnat qobiliyatiga va umr davomiyligiga salbiy ta’sir ko‘rsatishi mumkin. Qandli diabetning eng muhim uzoq muddatli asoratlaridan biri surunkali buyrak kasalligi hisoblanadi. Diabet sharoitida uzoq davom etuvchi giperglikemiya, arterial gipertenziya, metabolik buzilishlar va buyrak mikrotomirlaridagi o‘zgarishlar buyrak to‘qimasining shikastlanishiga olib kelishi mumkin. Dastlabki bosqichlarda bemorda og‘riq, shish yoki siydik ajratishda sezilarli o‘zgarishlar bo‘lmasligi mumkin. Shuning uchun klinik belgilarning mavjud emasligi buyrak funksiyasi to‘liq saqlanganini anglatmaydi.

Amerika diabet assotsiatsiyasining 2025-yilgi klinik tavsiyalarida qandli diabet bilan og‘rigan bemorlarda buyrak funksiyasini baholash uchun siydikda albumin/kreatinin nisbati (UACR) va taxminiy koptokchalar filtratsiyasi tezligi (eGFR) tekshiruvlaridan foydalanish tavsiya etilgan. 2-tur qandli diabetda ushbu tekshiruvlar tashxis qo‘yilgan vaqtdan boshlab o‘tkazilishi lozim [2].

Shu nuqtayi nazardan, albuminuriya va eGFR ko‘rsatkichlarini birgalikda baholash diabet bilan og‘rigan bemorlarda buyrak shikastlanishini erta aniqlash, kasallik bosqichini belgilash va kuzatuv taktikasini rejalashtirishda muhim ahamiyat kasb etadi.

Tadqiqotning maqsadi- 2-tur qandli diabet bilan og‘rigan bemorlarda surunkali buyrak kasalligini erta aniqlashda siydikda albumin/kreatinin nisbati va

eGFR ko‘rsatkichlarining klinik-diagnostik ahamiyatini xalqaro ilmiy adabiyotlar va klinik tavsiyalar asosida tahlil qilish.

Materiallar va usullar

Qandli diabet bilan og‘rigan bemorlarda diabetik nefropatiyaning rivojlanish mexanizmlari, erta tashxislash usullari, klinik ahamiyati, davolash tamoyillari va profilaktik choralari bo‘yicha ilmiy adabiyotlarni tahlil qilish asosida tayyorlandi. Tadqiqotning asosiy metodologik yondashuvi xalqaro klinik tavsiyalar, ilmiy maqolalar va surunkali buyrak kasalligini tashxislash hamda kuzatishga oid zamonaviy mezonlarni tizimli ravishda o‘rganishdan iborat bo‘ldi.

Tahlil uchun Amerika diabet assotsiatsiyasining (American Diabetes Association — ADA) Standards of Care in Diabetes—2025 klinik tavsiyalari, Xalqaro diabet federatsiyasining (International Diabetes Federation — IDF) IDF Diabetes Atlas, 11th Edition nashri hamda Buyrak kasalliklari: global natijalarni yaxshilash tashkilotining (Kidney Disease: Improving Global Outcomes — KDIGO) surunkali buyrak kasalligini baholash va boshqarishga oid 2024-yilgi klinik tavsiyalari asosiy manbalar sifatida tanlandi. Ushbu manbalardan qandli diabetning tarqalishi, diabetik buyrak kasalligining rivojlanish xavfi, laborator diagnostika mezonlari va buyrak faoliyatini saqlashga qaratilgan davolash strategiyalari haqidagi ma’lumotlar olindi.

Ilmiy adabiyotlarni o‘rganishda diabetik nefropatiyaning patogenezi, ya’ni surunkali giperglikemiya, oksidlovchi stress, yallig‘lanish jarayonlari, buyrak koptokchalari ichidagi gemodinamik o‘zgarishlar va fibroz rivojlanishining o‘zaro bog‘liqligiga alohida e’tibor qaratildi. Shuningdek, arterial gipertenziya, ortiqcha tana vazni, dislipidemiya va glikemik nazoratning yetarli emasligi kabi kasallik rivojlanishiga ta’sir etuvchi xavf omillari tahlil qilindi.

Diagnostika usullarini baholashda buyrak faoliyatini aniqlash uchun qo‘llaniladigan asosiy laborator ko‘rsatkichlar o‘rganildi. Jumladan, siydikdagi albuminning kreatininga nisbati (urine albumin-to-creatinine ratio — UACR) va qon zardobidagi kreatinin asosida hisoblanadigan buyrak koptokchalari filtratsiyasining taxminiy tezligi (estimated glomerular filtration rate — eGFR) ko‘rsatkichlarining diagnostik ahamiyati ko‘rib chiqildi. UACR buyrakning filtratsiya to‘sig‘i zararlanishini aniqlashga, eGFR esa buyrakning filtrlash qobiliyatini baholashga xizmat qiladi.

UACR natijalari xalqaro mezonlarga muvofiq uchta toifaga ajratib o‘rganildi: A1 — me’yoriy yoki biroz oshgan albuminuriya, 30 mg/g dan kam; A2 — o‘rtacha oshgan albuminuriya, 30–300 mg/g; A3 — sezilarli darajada oshgan albuminuriya, 300 mg/g va undan yuqori. Buyrak faoliyatini baholashda eGFR ko‘rsatkichlari ham KDIGO tasnifiga muvofiq tahlil qilindi: G1 — 90 ml/min/1,73 m² va undan yuqori; G2 — 60–89 ml/min/1,73 m²; G3a — 45–59 ml/min/1,73 m²; G3b — 30–44 ml/min/1,73 m²; G4 — 15–29 ml/min/1,73 m²; G5 — 15 ml/min/1,73 m² dan past.

Tahlil jarayonida surunkali buyrak kasalligini aniqlashda laborator ko‘rsatkichlarning davomiyligi ham hisobga olindi. Buyrak tuzilishi yoki faoliyatidagi o‘zgarishlar kamida uch oy davomida saqlanib qolgan taqdirda surunkali buyrak kasalligi mezonlariga mos kelishi mumkin. Shu bilan birga,

albuminuriyaning bir martalik oshishi har doim ham surunkali buyrak kasalligi mavjudligini anglatmasligi inobatga olindi. Jismoniy zo‘riqish, siydik yo‘llari infeksiyasi, isitma va glyukozaning keskin oshishi kabi omillar tekshiruv natijalariga vaqtinchalik ta’sir ko‘rsatishi mumkin. Shu sababli diagnostik baholashda takroriy tahlillar va klinik holatni birgalikda hisobga olish zarurligi ko‘rib chiqildi.

Qandli diabet turiga qarab buyrak faoliyatini tekshirish muddatlari ham tahlil qilindi. Xususan, 2-tur qandli diabet bilan og‘rigan bemorlarda tashxis qo‘yilgan vaqtdan boshlab, 1-tur qandli diabetda esa odatda kasallik boshlanganidan besh yil o‘tgach, UACR va eGFR ko‘rsatkichlarini kamida yiliga bir marta baholash tavsiya etilishi o‘rganildi. Surunkali buyrak kasalligi aniqlangan bemorlarda monitoring chastotasi kasallik bosqichi, albuminuriya darajasi va buyrak faoliyatining o‘zgarish sur’atiga qarab belgilanadi.

Davolash usullarini tahlil qilishda glikemik nazorat, arterial qon bosimini boshqarish, renin–angiotenzin tizimiga ta’sir qiluvchi preparatlar, natriy-glyukoza kotransporteri-2 ingibitorlari (SGLT2 ingibitorlari), glyukagonga o‘xshash peptid-1 retseptorlari agonistlari (GLP-1 retseptor agonistlari) va nosteroid mineralokortikoid retseptorlari antagonistlari, jumladan finerenonning klinik ahamiyati ko‘rib chiqildi. Ushbu preparatlarni qo‘llashda bemorning buyrak faoliyati, arterial qon bosimi, qondagi kaliy miqdori, hamroh kasalliklari va boshqa dori vositalarini qabul qilishi hisobga olinishi zarurligi baholandi.

Bundan tashqari, diabetik nefropatiyaning oldini olish va rivojlanishini sekinlashtirishda ovqatlanish tartibi, tuz iste’molini cheklash, tana vaznini nazorat qilish, jismoniy faollik, chekishdan voz kechish va buyrakka zarar yetkazishi mumkin bo‘lgan dori vositalarini nazoratsiz qabul qilmaslikning ahamiyati o‘rganildi. Tahlil natijalarini umumlashtirishda kasallikni erta aniqlash, laborator ko‘rsatkichlarni muntazam monitoring qilish va individual davolash yondashuvining o‘rni asosiy mezonlar sifatida belgilandi.

Ilmiy-tahliliy, ya’ni narrativ sharh shaklida tayyorlandi. Unda mustaqil klinik sinov, bemorlar guruhida o‘tkazilgan eksperiment yoki birlamchi laborator tadqiqot natijalari mavjud emas. Shu sababli maqolada shaxsiy klinik kuzatuvlarga asoslangan statistik ko‘rsatkichlar, tajriba natijalari yoki mualliflar tomonidan olingan yangi miqdoriy ma’lumotlar keltirilmagan. Xulosalar tahlil qilingan xalqaro klinik tavsiyalar va ilmiy manbalarda berilgan ma’lumotlarni umumlashtirish asosida shakllantirildi.

Natijalar va muhokama

1. Qandli diabetda buyrak shikastlanishining patofiziologik mexanizmlari

Qandli diabetda buyrak shikastlanishi bir nechta o‘zaro bog‘liq mexanizmlar ta’sirida rivojlanadi. Ularning eng muhimlaridan biri qonda glyukoza miqdorining uzoq vaqt yuqori bo‘lib turishidir. Doimiy giperglikemiya buyrak koptokchalaridagi endoteliy hujayralari, bazal membrana va mezangial tuzilmalarga ta’sir ko‘rsatadi.

Glyukoza miqdorining oshishi oqsillarning noenzimatik glikatsiyasi, ilg‘or glikatsiya mahsulotlarining hosil bo‘lishi, oksidlovchi stress va yallig‘lanish jarayonlarining kuchayishi bilan bog‘liq. Bu o‘zgarishlar buyrak mikrotomirlari

faoliyatini buzib, koptokchalarning o‘tkazuvchanligi va filtratsiya jarayoniga ta’sir qilishi mumkin.

Qandli diabetning ayrim bosqichlarida buyrak koptokchalaridagi ichki bosim ortishi va giperfiltratsiya kuzatilishi mumkin. Dastlabki davrda eGFR normal yoki yuqori bo‘lishi buyrakning mutlaqo sog‘lomligini kafolatlamaydi. Kasallikning keyingi bosqichlarida esa koptokchalar shikastlanishi, albuminuriyaning kuchayishi va filtratsiya tezligining pasayishi kuzatilishi mumkin.

Biroq diabet bilan og‘rigan har bir bemorda buyrak shikastlanishi aynan bir xil mexanizm orqali rivojlanmaydi. Arterial gipertenziya, semizlik, yosh, irsiy moyillik, chekish va yurak-qon tomir kasalliklari ham xavfni oshirishi mumkin.

Shuningdek, diabet bilan bir vaqtda boshqa sabablarga bog‘liq buyrak kasalliklari ham uchrashi mumkin. Shuning uchun laborator o‘zgarishlarni aniqlashdan tashqari, ularning ehtimoliy sabablarini ham baholash zarur.

2. Surunkali buyrak kasalligini erta aniqlash mezonlari

Surunkali buyrak kasalligi buyrak tuzilishi yoki funksiyasida salomatlik uchun ahamiyatli bo‘lgan o‘zgarishlar kamida uch oy davomida saqlanib qolishi bilan tavsiflanadi. Tashxisni belgilashda laborator ko‘rsatkichlar, instrumental tekshiruvlar va bemorning klinik holati hisobga olinadi.

Qandli diabet bilan og‘rigan bemorlarda buyrak holatini baholashning ikki asosiy laborator ko‘rsatkichi quyidagilardan iborat:

UACR — siydikda albumin miqdorining kreatininga nisbati.

eGFR — qondagi kreatinin va boshqa tegishli ko‘rsatkichlar asosida hisoblanadigan taxminiy koptokchalar filtratsiyasi tezligi.

Ushbu ko‘rsatkichlar bir-birini to‘ldiradi, ammo bir xil ma’lumotni bermaydi. UACR buyrak filtratsiya to‘sig‘i orqali albumin chiqishining ko‘payishini aniqlashga yordam beradi. eGFR esa buyraklarning qonni filtrlash qobiliyatini baholaydi.

Surunkali buyrak kasalligi eGFR pasayishi bilan ham, eGFR nisbatan saqlangan holda albuminuriya yoki boshqa buyrak shikastlanishi belgilari mavjud bo‘lganda ham aniqlanishi mumkin. Shuning uchun faqat qondagi kreatinin miqdori yoki faqat siydik tahlili natijasiga asoslanish yetarli emas.

3. Siydikda albumin/kreatinin nisbatining klinik ahamiyati

Albumin qon plazmasida mavjud bo‘lgan asosiy oqsillardan biridir. Sog‘lom buyraklar uning katta qismini qonda saqlab qoladi. Buyrak koptokchalarining filtratsiya to‘sig‘i shikastlanganda albuminning siydik bilan ajralishi ortishi mumkin.

UACR ko‘rsatkichi siydikda albuminning chiqishini baholashda muhim hisoblanadi. Kreatininga nisbatan hisoblash siydikning suyuqlik darajasi bilan bog‘liq o‘zgaruvchanligini qisman kamaytiradi.

1-jadval. Siydikda albumin/kreatinin nisbati bo‘yicha tasnif

Toifa	UACR, mg/g	Talqini
A1	30 dan kam	Normal yoki yengil oshgan
A2	30–300	O‘rtacha oshgan albuminuriya
A3	300 yoki undan yuqori	Juda yuqori albuminuriya

UACR ko‘rsatkichining 30 mg/g yoki undan yuqori bo‘lishi buyrak shikastlanishi ehtimolini baholashni talab qiladi. Biroq bitta patologik natija har doim ham surunkali buyrak kasalligi tashxisini tasdiqlamaydi.

Siydikda albuminning vaqtincha ko‘payishi jismoniy zo‘riqish, isitma, siydik yo‘llari infeksiyasi, hayz davri va glyukoza miqdorining keskin oshishi kabi holatlarda ham kuzatilishi mumkin. Shu sababli natijani bemorning klinik holati bilan birgalikda baholash va zarur hollarda takroriy tekshiruv o‘tkazish muhim.

Amaliyotda albuminuriyani baholash uchun bir martalik siydik namunasida UACR aniqlash qulay usul hisoblanadi. Odatda tasodifiy siydik namunasida albuminning o‘zini emas, balki albumin/kreatinin nisbatini aniqlash afzal, chunki bu siydik konsentratsiyasi o‘zgarishining ta’sirini kamaytiradi [2].

Albuminuriya nafaqat buyrak shikastlanishining belgisi, balki yurak-qon tomir asoratlari va buyrak kasalligi rivojlanishi xavfini baholashda ham ahamiyatga ega. Shu sababli UACR natijalarini muntazam kuzatish kasallik dinamikasini baholash imkonini beradi.

4. eGFR ko‘rsatkichining diagnostik ahamiyati

Koptokchalar filtratsiyasi tezligi buyraklarning ma’lum vaqt ichida qon plazmasini filtrlash qobiliyatini ifodalaydi. Klinik amaliyotda eGFR ko‘pincha qondagi kreatinin, yosh va jins kabi ma’lumotlardan foydalanib hisoblanadi. Ayrim hollarda sistatin C ko‘rsatkichidan ham foydalanish mumkin.

Qondagi kreatinin miqdorining ortishi buyrak filtratsiyasi pasayganini ko‘rsatishi mumkin, ammo kreatininga mushak massasi, ovqatlanish va ayrim dorilar ham ta’sir qiladi. Shu sababli kreatininning o‘ziga qaraganda hisoblangan eGFR buyrak funksiyasini baholash uchun ko‘proq axborot beradi.

Muhim jihat shundaki, G1 yoki G2 toifasiga kiruvchi eGFR ko‘rsatkichi o‘z-o‘zidan surunkali buyrak kasalligini anglatmaydi. Bunday holatlarda tashxis uchun albuminuriya yoki buyrak shikastlanishining boshqa dalillari talab etiladi. Aksincha, eGFR 60 ml/min/1,73 m² dan past bo‘lib, bu holat kamida uch oy saqlansa, boshqa klinik shartlar ham hisobga olingan holda surunkali buyrak kasalligi mezoniga mos kelishi mumkin.

eGFR ko‘rsatkichining vaqt davomida o‘zgarishini kuzatish kasallikning rivojlanish tezligini baholashda muhim. Biroq natijalarni taqqoslashda laboratoriya usuli, hisoblash formulasi va bemorning klinik holatiga e’tibor berish zarur.

5. UACR va eGFR ko‘rsatkichlarini birgalikda baholash

Buyrak shikastlanishini erta aniqlashda UACR va eGFR ko‘rsatkichlarini birgalikda baholashning asosiy afzalligi shundaki, ular buyrak faoliyatining turli jihatlarini ifodalaydi.

Masalan, bemorda eGFR 90 ml/min/1,73 m² bo‘lishi mumkin, ammo UACR 100 mg/g ni tashkil etsa, albuminuriya mavjud bo‘ladi. Agar bu o‘zgarishlar kamida uch oy davomida saqlansa va boshqa sabablar bilan tushuntirilmasa, surunkali buyrak kasalligi mezonlariga mos kelishi mumkin.

Boshqa bir holatda eGFR 52 ml/min/1,73 m² bo‘lib, UACR 20 mg/g ni tashkil etishi mumkin. Bunday natija ham buyrak funksiyasining pasayishini ko‘rsatadi va sababini aniqlashni talab qiladi.

Shunday qilib, albuminuriya va filtratsiya tezligi o‘rtasidagi munosabat har doim bir xil bo‘lmaydi. Ayrim bemorlarda albuminuriya eGFR pasayishidan oldin paydo bo‘ladi, boshqalarda esa albuminuriya yaqqol namoyon bo‘lmasdan buyrak funksiyasi pasayishi mumkin.

6. Erta aniqlash va laborator monitoring

Amerika diabet assotsiatsiyasining 2025-yilgi tavsiyalariga muvofiq, 2-tur qandli diabet bilan og‘rigan bemorlarda UACR va eGFR ko‘rsatkichlari tashxis qo‘yilgan vaqtdan boshlab baholanishi kerak. Surunkali buyrak kasalligi aniqlangan bemorlarda tekshiruv chastotasi kasallik bosqichi va rivojlanish xavfiga qarab yiliga 1–4 marta yoki ayrim hollarda bundan ham ko‘proq bo‘lishi mumkin [2].

Monitoringning maqsadi faqat kasallik mavjudligini aniqlashdan iborat emas. U quyidagi vazifalarni ham bajaradi:

albuminuriya va eGFR dinamikasini kuzatish;

buyrak funksiyasining pasayishini o‘z vaqtida aniqlash;

davolash strategiyasini klinik ko‘rsatmalar asosida qayta baholash;

qon bosimi va glikemik nazoratning ahamiyatini hisobga olish;

buyrak kasalligi rivojlanishi va yurak-qon tomir asoratlari xavfini baholash.

Surunkali buyrak kasalligiga shubha tug‘ilganda bir martalik tahlil natijasi bilan cheklanib qolmaslik lozim. Natijalarning davomiyligi va o‘zgarish dinamikasiga baho berish tashxisning ishonchliligini oshiradi.

7. Diabet bilan og‘rigan bemorlarda buyrak asoratlarining oldini olish

Buyrak asoratlarini erta aniqlashning amaliy ahamiyati kasallikning rivojlanish xavfini kamaytirish imkoniyati bilan bog‘liq. Buning uchun glikemik nazorat, arterial qon bosimini boshqarish, ovqatlanish va jismoniy faollikka e’tibor berish, chekishdan voz kechish hamda bemorni muntazam kuzatish muhimdir.

Davolash taktikasi bemorning yoshi, hamroh kasalliklari, buyrak funksiyasi, albuminuriya darajasi va yurak-qon tomir xavfiga qarab individual belgilanadi. Qandli diabet va surunkali buyrak kasalligi birga mavjud bo‘lgan ayrim bemorlarda klinik ko‘rsatmalarga muvofiq SGLT2 ingibitorlari va boshqa buyrak hamda yurak-qon tomir himoyasi isbotlangan preparatlar ko‘rib chiqilishi mumkin. Dori tanlash va uning dozasini belgilash shifokor tomonidan amalga oshiriladi [2, 4].

Arterial gipertenziya va albuminuriya mavjud bo‘lgan ayrim bemorlarda renin-angiotenzin tizimiga ta’sir qiluvchi preparatlar tavsiya etilishi mumkin. Bunday davolashda qondagi kreatinin va kaliy miqdorini kuzatish talab qilinadi. Preparatlardan foydalanishda qarshi ko‘rsatmalar, nojo‘ya ta’sirlar va buyrak funksiyasi hisobga olinishi lozim.

eGFRning barqaror pasayishi, albuminuriyaning doimiy ortishi, sababi noma’lum buyrak shikastlanishi yoki eGFRning 30 ml/min/1,73 m² dan past bo‘lishi nefrolog maslahatini talab qilishi mumkin [2].

8. Laborator diagnostikadagi cheklovlar va ularni bartaraf etish

UACR va eGFR yuqori klinik ahamiyatga ega bo‘lsa-da, ularni talqin qilishda bir qator omillarni hisobga olish kerak.

Birinchidan, UACR natijasi vaqtinchalik fiziologik yoki patologik holatlar ta’sirida o‘zgarishi mumkin. Shuning uchun patologik natija klinik vaziyatga muvofiq takroriy tekshiruv bilan tasdiqlanishi kerak.

Ikkinchidan, qondagi kreatinin miqdori mushak massasi, oziqlanish xususiyatlari va ayrim dori vositalari ta’sirida o‘zgarishi mumkin. Shu sababli eGFRni baholashda faqat kreatininning mutlaq qiymatiga tayanish to‘g‘ri emas. Klinik zarurat bo‘lganda sistatin C yoki uni kreatinin bilan birgalikda qo‘llaydigan hisoblash usullari ko‘rib chiqilishi mumkin.

Uchinchidan, diabetli bemorda buyrak kasalligi mavjudligini aniqlash uning sababini avtomatik ravishda isbotlamaydi. Masalan, gematuriya, eGFRning tez pasayishi yoki albuminuriyaning keskin ortishi boshqa buyrak kasalliklarini ham istisno qilish zarurligini ko‘rsatishi mumkin.

To‘rtinchidan, laboratoriya natijalari turli vaqtlarda va turli usullarda olinganda ularni taqqoslashda tahlil usulining xususiyatlari ham hisobga olinishi kerak.

Shu sababli erta diagnostika tizimi standartlashtirilgan laborator usullar, takroriy tekshiruvlar, klinik baholash va bemorning individual xavf omillarini birlashtirishi lozim.

Xulosa

2-tur qandli diabet bilan og‘rigan bemorlarda surunkali buyrak kasalligini erta aniqlash diabet asoratlarini kamaytirishga qaratilgan klinik yondashuvning muhim qismidir. Buyrak shikastlanishi dastlabki bosqichlarda yaqqol klinik belgilarsiz kechishi mumkinligi sababli laborator monitoring alohida ahamiyatga ega.

Siydikda albumin/kreatinin nisbati va eGFR ko‘rsatkichlarini birgalikda baholash buyrak shikastlanishining turli ko‘rinishlarini aniqlash imkonini beradi. UACR albumin chiqishining ko‘payishini baholasa, eGFR buyrak filtratsiya funksiyasi haqida ma’lumot beradi. Ushbu ko‘rsatkichlarning birgalikda qo‘llanilishi kasallik xavfini aniqroq baholashga yordam beradi.

Laborator natijalarni talqin qilishda o‘zgarishlarning davomiyligi, vaqtinchalik ta’sir etuvchi omillar va buyrak shikastlanishining boshqa ehtimoliy sabablari hisobga olinishi zarur. Bir martalik patologik natija har doim ham surunkali buyrak kasalligini tasdiqlamaydi.Shunday qilib, 2-tur qandli diabet bilan og‘rigan bemorlarda UACR va eGFR ko‘rsatkichlarini muntazam baholash, natijalarni dinamikada kuzatish va xavf omillarini individual tahlil qilish buyrak asoratlarini erta aniqlash hamda klinik boshqaruvni takomillashtirishda muhim ahamiyatga ega.

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Nazarova Z.K.
Termiz davlat universiteti
O‘zbekiston, Termiz

FRAZEOLOGIK BIRLIKLAR SHAKLLANISHIDA LEKSIK KOMPONENTLARNING O‘RNI: SOMATIK IBORALARNING QIYOSIY TADQIQI

Annotatsiya. Mazkur maqolada leksik va frazeologik birliklarning o‘zaro munosabati, ularning semantik, strukturaviy va funksional xususiyatlari tadqiq etiladi. Leksik birliklarning, xususan, leksemalarning frazeologik birliklar shakllanishidagi o‘rni hamda frazeologizmlarda komponentlarning lug‘aviy ma’nosi qayta shakllanib, yaxlit frazeologik ma’no hosil qilishi tahlil qilinadi. Shuningdek, frazeologik birliklarning turg‘unligi, takrorlanuvchanligi, semantik yaxlitligi, idiomatikligi, obrazliligi va nutqda tayyor holda qo‘llanishi kabi asosiy belgilari yoritiladi.

Kalit so‘zlar: leksik birlik, leksema, leksik ma’no, frazeologik birlik, frazeologizm, frazema, frazeologik ma’no, semantik yaxlitlik, turg‘unlik, takrorlanuvchanlik, idiomatiklik, somatik komponent, obrazlilik, ingliz tili, o‘zbek tili, qiyosiy tahlil.

Nazarova Z.K.
Termez State University
Uzbekistan, Termez

THE ROLE OF LEXICAL COMPONENTS IN THE FORMATION OF PHRASEOLOGICAL UNITS: A COMPARATIVE STUDY OF SOMATIC IDIOMS

Abstract. This article examines the relationship between lexical and phraseological units and analyzes their semantic, structural, and functional characteristics. Particular attention is paid to the role of lexical units, especially lexemes, in the formation of phraseological units and to the semantic transformation of individual components into an integral phraseological meaning. The study also discusses the major characteristics of phraseological units, including stability, reproducibility, semantic integrity, idiomaticity, figurativeness, and their ready-made use in speech.

Keywords: lexical unit, lexeme, lexical meaning, phraseological unit, phraseologism, phraseme, phraseological meaning, semantic integrity, stability, reproducibility, idiomaticity, somatic component, figurativeness, English language, Uzbek language, comparative analysis.

Har bir til vakillarining leksikoni, lug‘at sostavini boyitishda o‘zining qadimiy tarixi va madaniyati bilan chambarchas bog‘liq holda turli xalqlar o‘ziga xos til birliklariga ega bo‘ladi.

“Leksikologiya tilning lug‘aviy tarkibini, frazeologiya esa uning iboraviy ko‘rinishlarini o‘rganadi. Lug‘at tarkibida asosiy til birligi so‘z bo‘lsa, frazeologiya fanining asosiy o‘rganish obyekti frazeologizm – barqaror iboraviy birlik hisoblanadi[27]. Ya’ni, frazeologik birliklarning tarkibida mavjud leksemalar o‘zining lug‘aviy ma’nosini yo‘qotib, yangi frazeologik ma’no kasb etadi. Shu bois, leksik birliklar frazeologik birliklarning shakllanishi uchun asosiy manba vazifasini bajaradi, frazeologik birliklar esa leksik qatlamning semantik rivojlanish bosqichini ifodalaydi. Leksik va frazeologik birliklarning o‘zaro munosabatini tadqiq etish til tizimining ichki qonuniyatlarini, ayniqsa, ma’no hosil bo‘lish jarayonlarini yoritishda muhim ilmiy-amaliy ahamiyat kasb etadi.

Masalan, har bir so‘z o‘zining ma’lum ma’nosini anglatadi: *“head” – bosh, “eye” – ko‘z, “shoulder” – yelka, “hand” – qo‘l* kabi.

N.Mahkamov, I.Ermatovlarning “Tilshunoslik terminlarining izohli lug‘ati”da “*so‘z*” tushunchasiga quyidagicha ta’rif berilgan: “So‘z o‘z tovush qobig‘iga ega bo‘lgan, mavjudlikdagi ma’lum bir narsa, belgi-xususiyat yoki harakat-holatlarni ifodalovchi, atash ma’nosiga ega bo‘lgan va turli grammatik ma’no hamda vazifalarda ishlatiladigan til birligidir”[28]. Qolaversa, “leksik ma’no” atamasi so‘zning mazmunini anglatadi, ya’ni so‘z ifoda etgan, etayotgan narsaning inson ongidagi aksidir. Bu predmetlar, harakatlar yoki belgilar haqidagi tushuncha hisoblanadi. So‘zning asosiy leksik ma’nosi uning o‘zagida barcha o‘xshash so‘zlarning umumiy qismida mavjud bo‘ladi”[29]. “Lison – tilning kishi miyasidagi til xotirasi markazida mavjud birliklardan va ulardan foydalanish qoidalaridan iborat boylik”[30]. Bu esa faqatgina tushuncha ifodalovchi so‘zlar leksik ma’noga ega bo‘lishidan darak beradi. Shuning uchun ham leksik ma’no so‘zning semantik tuzilmasini tashkil etadi va u til birliklarining ma’no tizimini shakllantirishda asosiy rol o‘ynaydi.

Lug‘at boyligining ikkinchi qatlamini tashkil etuvchi, bu xildagi til birligi haqida Sh.Rahmatullayevning “Nihoyat, o‘ziga xos belgi-xususiyatlari bilan ajralib turuvchi yana bir til birligi mavjud bo‘lib, “frazeologik birlik”, “frazeologizm” kabi terminlar bilan nomlangan; bu til birligini “frazema” deb nomlash ma’qul. Frazemaning mazmun jihati ham o‘ziga xos tarzda voqe bo‘ladi va ular frazeologik qatlamni tashkil qiladi. Umuman, frazemani o‘rganish til o‘rganishning eng yuqori, murakkab pog‘onasi hisoblanadi, chunki frazemaning mohiyatini anglash uchun til qurilishining boshqa barcha birliklari haqida ma’lumotga ega bo‘lish zarur”[31] degan fikrini keltirish maqsadga muvofiq.

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[31] Раҳматуллаев Ш. Тил қурилишининг асосий бирликлари: қўлланма. – Тошкент: Университет нашриёти, 2002. – Б. 29

“Frazema til qurilishining lug‘at bosqichiga mansub ikkinchi lisoniy birlik bo‘lib, bittadan ortiq leksemaning o‘zaro semantik – sintaktik birlashuvi bilan tarkib topgan bo‘ladi. Frazeologizm va leksema bir narsa yoki hodisani atasada, ya’ni atash semalari bir xil bo‘lsa-da, ifoda bo‘yoqlari bilan keskin farqlanib turadi. Frazeolgizmning ko‘pincha, ifoda semalarida obrazlilik, bo‘yoqdorlik bo‘rtib turadi”[32]. Nutq jarayonida fikrimizni ifodalash uchun biz nafaqat so‘zlardan, balki ana shu frazeologik birliklardan ham foydalanamiz. Ushbu birliklar nutqimizni nafaqat tasvirlab qolmay, balki uning ma’nosi va mazmunini boyitib, lo‘nda va ifodali tarzda taqdim etishga xizmat qiladi.

V.V.Vinogradov tilshunoslikka “frazeologik birlik” atamasini kiritgan birinchi olim hisoblanadi. Ushbu termin zamonaviy lingvistik tadqiqotlarda frazeologiya doirasiga kiruvchi turli xil leksik birliklarni umumiy tarzda ifodalovchi atama sifatida keng qo‘llanilib, ularning semantik va strukturaviy xususiyatlarini tahlil qilishda muhim asos bo‘lib xizmat qilmoqda. Frazeologik birliklar tushunchasiga berilgan quyidagi izohlarga to‘xtalsak ham ushbu fikrning asosli ekanligini ko‘ramiz.

1) “Frazeologik birliklar u yoki bu xalqning ma’naviy qadriyatlari, milliy tafakkuri, hayot tarzi hamda urf-odatlarini namoyon etadigan til hodisasidir”[33];

2) “Ma’nosi, odatda, bir so‘zga teng keladigan so’zlar qo’shilmasi yoki gaplar: oq ko‘ngil, kapalagi uchib ketdi, ko’nglidan o’tkazdi; turg‘un bog’lanma”[34];

3) “Frazema mustaqil turkumlarga mansub ikki va undan ortiq leksema asosida tarkib topgan lug‘aviy birlik bo‘lib, asosan nominativ ma’no anglatadi, shunga ko‘ra, leksema bilan bir qatorga qo‘yiladi, leksemadan yirik nominativ birlik deb yuritiladi”[35];

4) “To‘liq yoki qisman qayta shakllangan ma’noga ega bo‘lgan alohida til birliklari”[36]. “Ibora tuzilishiga ko‘ra so‘z birikmasiga o‘xshab ketsa ham, nutq birligi sanalgan bunday birliklardan tamoman farq qiladi. U so‘z birikmasi kabi har gal nutqning o‘zidagina yuzaga kelmaydi. Til birligi sifatida nutqqacha tayyor holda mavjud bo‘ladi. Shunga ko‘ra iboralarni tilshunoslikda turg‘un so‘z birikmasi deb ham yuritiladi”[37]. “Frazeologizmlar nutqda aniq bir butunlik sifatida ishlatiladi, parchalanmaydi, qismlarni qayta joylashtirishga yo’l qo’ymaydi”[38]

Bundan shuni anglash mumkinki, frazeologizm tushunchasi qamrovi keng va talqini xilma-xil. Frazeologizmlarning shakllanishi, rivojlanishi va qo‘llanilish doirasi turli omillarga bog‘liq bo‘lib, ular leksik-semantik tizim doirasida alohida izchil o‘rganishni talab qiladi. Frazeologizmlar, turg‘un bog‘lanmaga ega bo‘lgan so‘z uyushmalaridir, nominativ ma’noga ega bo‘lib, odatda, bir so‘z o‘rnida

[32] Nurmuhammedov Y. Frazeologiyaning dolzarb masalalari. – Samarqand: “SamDCHTI, 2022. – B.92
[33] Маматов А. Э. Ўзбек тили фразеологияси . –Тошкент: Наврўз, 2019. – Б. 260
[34] Турсунов У.va boshqalar. *Ҳозирги ўзбек адабий тили.* – Тошкент: Ўзбекистон, 1992. – Б. 400
[35] Маматов А. Э. Ўзбек тили фразеологияси . –Тошкент: Наврўз, 2019. – Б. 260
[36] Кунин А. В. Курс фразеологии современного английского языка: учеб. пособие для ин-тов и фак. иностранных языков – Дубна: Феникс, 2005. – С.488
[37] Ўзбек тили практикуми1- қисм (фонетика. лексикология. фразеология. морфемика. сўз ясалиши) Тошкент 2005.– Б. 96
[38] Ahmedov, H.Y. “Alpomish” dostonida frazeologizmlarning tematik va mifologik strukturasi Monografiya Toshkent: Grand kondor print, 2024. – B. 184

ishlatiladi, tarkibidagi so‘zlarning ma’nosi qisman yoki butunlay o‘zgarganligi oddiy so‘zlarga nisbatan struktural jihatdan murakkabroq hisoblanadi.

Bizningcha, frazeologizmlarni aniqroq tavsiflash uchun bu ta’riflardan bir-birini to‘ldiruvchi yondashuvlar sifatida foydalanish o‘rinlidir. Masalan: “crack good, great hand at (with) smth”[39], frazemasining ma’nosi (*o‘z ishini juda mohirlik bilan va chiroyli bajaradigan*) leksemasining ma’nosiga “qo‘li gul”[40] frazemasining ma’nosi *(o‘z ishini mohirlik bilan bajaradigan)* leksemasining ma’nosiga teng *)* kabi. Ko‘rinadiki, frazeologiya frazeologizmlarni nutqda hosil qilinadigan so‘z birikmalaridan farqlaydi va ularning belgilarini aniqlaydi.

Tadqiqotlardan bizga ma’lumki, Akademik V.V.Vinogradov frazeologizmlarning uch tipini aniqlab, ularni *frazeologik chatishma,(yoki idioma), frazeologik butunlik* va *frazeologik qo‘shilma* kabi turlarga ajratgan[41]. *Ingliz tadqoqodchisi M.Makkarti* (McCarthy) frazeologik birliklarni ma’nosining ochiqlik darajasiga ko‘ra tahlil qilib, V.V.Vinogradov tomonidan frazeologik chatishma sifatida ajratilgan idiomalarni quyidagi turlarga bo‘ladi: “Opaque idioms, semi-opaque idioms, transparent idioms”[42].

Opaque idioms – tushunarsiz, noaniq idiomalar, ya’ni ularning umumiy ma’nosi tarkibiy qismlarining lug‘aviy ma’nosidan mutlaqo kelib chiqmaydi (*to pull the wool over someone’s eyes*” – *aldamoq*); semi-opaque idioms – yarim tushunarsiz, yarim shaffof idiomalar, bunda umumiy ma’noning ayrim jihatlari komponentlar ma’nosi bilan qisman bog‘liq (*to keep an eye on ko‘z – quloq bo‘lmoq*”); transparent idioms – shaffof idiomalar, ya’ni ma’nosi komponentlar orqali oson anglashiladigan frazeologik birliklar (*to shake one’s head – bosh chayqamoq*) kabi. Shunday qilib, frazeologizmlarning turlarini farqlash zarurati yuzaga keladi.

O‘zbek tilidagi mavjud lingvistik adabiyotlarda frazeologizmlarning eng asosiy belgilari sifatida quyidagilar ko‘rsatib o‘tilgan.

1. Frazemaning tarkibida ikki yoki undan ortiq leksema qatnashgan bo‘ladi;
2. Frazema yaxlit bir lug‘aviy ma’noni ifodalaydi;
3. Frazemaning tarkibidagi so‘zlar o‘z leksik ma’nolarini yo‘qotgan bo‘ldi;
4. Frazema turg‘un birikma sifatida erkin birikma bilan faqat omonimik (so‘zma-so‘z bir xil ko‘rinishdagi, lekin ma’nosi boshqacha) holatda bo‘ladi;[43].

Ingliz frazeologiyasining leksikografik yo‘nalishiga asos solgan va uning nazariy asoslarini rivojlantirgan yetakchi leksikolog A.Kovi frazeologik

[39] Кунин, А. В. Англо-русский фразеологический словарь / А. В. Кунин. – М.: Русский язык, 1984. – 944 с.
[40]Раҳматуллаев, Ш. Ўзбек тилининг изоҳли фразеологик луғати / Ш. Раҳматуллаев. – Тошкент : Ўқитувчи, 1978. – 407 б.
[41] Виноградов, В. В. Об основных типах фразеологических единиц в русском языке / В. В. Виноградов // Избранные труды. Лексикология и лексикография. – Москва : Наука, 1977. – С. 161.
[42] McCarthy, M. Vocabulary / M. McCarthy. – Oxford : Oxford University Press, 1990. – P. 173.
[43] Ўзбек тили практикуми. 1-қисм: Фонетика. Лексикология. Фразеология. Морфемика. Сўз ясалиши. – Тошкент, 2005. – Б. 96

birliklarning asosiy xususiyatlarini quyidagicha ta’riflaydi: “reproducibility– takrorlanuvchanlik; syntactic and semantic stability – sintaktik va semantik barqarorlik; idiomaticity – idiomatiklik; connotations – konnotativ ma’no; expressive, emphatic, or intensifying functions in a text – matnda ekspressiv, ta’kidlovchi yoki kuchaytiruvchi funksiyalar”[44].

“Frazeologizmlarda so‘z o‘zining birlamchi ma’nosini saqlab qoladi, lekin bir grammatik kategoriyadan ikkinchisiga o‘tib, asl shaklini yo‘qotadi” [45]. Shuningdek, olim A.E.Mamatov “So‘z va frazeologizm o‘rtasidagi muhim farqli belgilar ularning semantikasida namoyon bo‘ladi” degan fikrni keltiradi va uni quyidagicha izohlaydi: “So‘zlar to‘g‘ridan-to‘g‘ri, nominativ, predmetni atab kelsa, frazeologizmlar obrazli-nominativ ma’no anglatadi. Shu jihatlari bilan bu til birliklarining aloqa-aralashuv, kommunikativ vazifalari belgilanadi. So‘z asosan voqea-hodisa, predmetlarni ifodalaydi, frazeologizmlar esa ko‘proq tasvirlaydi”[46].

Frazeologizmlar ham xuddi so‘zlar kabi shakl va ma’no birligiga ega. So‘zning shakliy tomonini tovushlar hosil qilsa, frazeologizmlarning shakliy tomonini so‘zlar qo‘shilmasi tashkil etiladi. Frazeologizmlar va so‘zlar sintaktik vazifasiga ko‘ra umumiylikka ega.

Keltirilgan ma’lumotlardan ayon bo‘ladiki, frazeologik birliklar nutqda tayyor holda qo‘llanuvchi birlik hisoblansa-da, leksik birliklar o‘zgacha shakllanish xususiyatlarga ega. Har ikkala ingliz va o‘zbek tillarida farqli holatda shakllantiriluvchi frazeologik birliklarni ham uchratishimiz mumkin. Masalan, ingliz tilidagi “go about with one’s head in the air” **(***state of being arrogant, haughty, appearing to ignore others or be unaware of their surroundings –mag‘rur, kekkayib yurish*) iborasini shakllantirishda head (*bosh*) leksemasiga murojaat qilingan bo‘lsa, o‘zbek tilida bu mazmunni ifodalashda burun leksemasidan foydalanilgan, “burni ko‘tarilmoq”, “burni osmonda” kabi. Har ikkala til biror tana a’zosining (bosh yoki burun) baland turishini mag‘rurlik ramzi sifatida ishlatgan. Bu esa bugungi kun tilshunoslardan ushbu sohani yanada chuqur tadqiq etilishini talab qiladi.

Xulosa

Yuqoridagi tahlillar leksik va frazeologik birliklar tilning lug‘aviy tizimida o‘zaro uzviy bog‘liq ekanini ko‘rsatadi. So‘zlar frazeologizmlar uchun asosiy manba bo‘lsa, frazeologik birliklar ularga obrazlilik, ekspressivlik va konnotativ mazmun bag‘ishlaydi. Turg‘unlik, semantik yaxlitlik va nutqda tayyor holda qo‘llanish kabi belgilar frazeologizmlarni erkin so‘z birikmalaridan ajratib turadi. Ingliz va o‘zbek tillaridagi somatik iboralarni qiyoslasak, bir xil konseptual mazmun turli tana a’zolari orqali ifodalanishi mumkin (masalan, inglizcha *go about with one’s head in the air* – o‘zbekcha *burni ko‘tarilmoq*). Bu holat tillardagi

[44] Cowie, A. P. Phraseology: Theory, analysis, and applications. Oxford University Press, 1998. – 258 p; Cowie, A. P. (ed.). *Phraseology: Theory, Analysis, and Applications*. – Oxford : Oxford University Press, 1998. – P. 130.

[45] Мокиенко В. М.М74В глубь поговорки: Рассказы о происхождении крылатых слов и образных выражений. – 3-е изд., перераб. СПб.: Азбука-классика, 2005. – С. 256

[46] Маматов А. Э. Ўзбек тили фразеологияси . –Тошкент: Наврўз, 2019. – Б. 260

milliy-madaniy tajriba va obrazli tafakkur farqlarini ko‘rsatadi. Frazeologizmlarni alohida komponentlar emas, balki yaxlit birlik sifatida talqin qilish tarjima va semantik tahlilda hal qiluvchi ahamiyatga ega. Umuman olganda, somatik iboralarni qiyosiy, semantik va lingvomadaniy yo‘nalishda tadqiq etish frazeologiya hamda qiyosiy tilshunoslikning dolzarb vazifalaridan biridir.

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5. Маматов А. Э. Ўзбек тили фразеологияси . –Тошкент: Наврўз, 2019. – Б. 260
6. Турсунов У.va boshqalar. *Ҳозирги ўзбек адабий тили.* – Тошкент: Ўзбекистон, 1992. – Б. 400
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9. Кунин, А. В. Англо-русский фразеологический словарь / А. В. Кунин. – М.: Русский язык, 1984. – 944 с.
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12. Cowie, A. P. Phraseology: Theory, analysis, and applications. Oxford University Press, 1998. – 258 p;

Nazarova S.M.
stajyor-assistent
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

SHAXSIY RIVOJLANISH ORQALI O‘QITUVCHILARNING PEDAGOGIK MAHORATINI OSHIRISH YO‘LLARI

Annotatsiya. Shaxsiy rivojlanishning o‘qituvchilar pedagogik mahoratini oshirishdagi o‘rni, kasbiy kompetensiyalarni takomillashtirish mexanizmlari va zamonaviy ta’lim jarayonida o‘z ustida muntazam ishlashning ahamiyati yoritilgan. O‘qituvchining kasbiy bilimlari, pedagogik muloqot madaniyati, psixologik tayyorgarligi, innovatsion texnologiyalardan foydalanish ko‘nikmalari hamda refleksiv faoliyatini rivojlantirish masalalari tahlil qilingan. Shuningdek, individual rivojlanish rejasini tuzish, o‘z faoliyatini tahlil qilish, hamkasblar tajribasini o‘rganish, malaka oshirish kurslarida qatnashish va raqamli ta’lim resurslaridan foydalanish orqali pedagogik mahoratni takomillashtirish yo‘llari bo‘yicha amaliy tavsiyalar berilgan.

Kalit so‘zlar: shaxsiy rivojlanish, pedagogik mahorat, kasbiy kompetensiya, o‘qituvchi, uzluksiz ta’lim, pedagogik refleksiya, innovatsion texnologiyalar, raqamli ta’lim, o‘zini o‘zi baholash, kasbiy rivojlanish.

Nazarova S.M.
trainee assistant
Samarkand State Medical University
Uzbekistan, Samarkand

WAYS TO ENHANCE TEACHERS’ PEDAGOGICAL SKILLS THROUGH PERSONAL DEVELOPMENT

Abstract. This article highlights the role of personal development in enhancing teachers’ pedagogical skills, examines mechanisms for improving professional competencies, and emphasizes the importance of continuous self-improvement in the modern educational process. It analyzes the development of teachers’ professional knowledge, pedagogical communication skills, psychological preparedness, competencies in using innovative technologies, and reflective practice. Furthermore, practical recommendations are provided for improving pedagogical skills through the development of an individual professional growth plan, self-analysis, learning from colleagues’ experience, participation in professional development courses, and the use of digital educational resources.

Keywords: personal development, pedagogical skills, professional competence, teacher, lifelong learning, pedagogical reflection, innovative technologies, digital education, self-assessment, professional development.

Kirish

Bugungi kunda ta’lim tizimida amalga oshirilayotgan islohotlar o‘qituvchining kasbiy faoliyatiga qo‘yiladigan talablarni yanada oshirmoqda. Zamonaviy pedagog nafaqat o‘z fanini chuqur bilishi, balki o‘quvchilarning individual xususiyatlarini tushunishi, ularda mustaqil fikrlashni shakllantirishi, axborot texnologiyalaridan samarali foydalanishi va ta’lim jarayonini ijodiy tashkil etishi lozim. Bunday vazifalarni muvaffaqiyatli amalga oshirish uchun o‘qituvchi doimiy ravishda o‘z bilim va ko‘nikmalarini rivojlantirib borishi zarur. Shaxsiy rivojlanish insonning o‘z imkoniyatlarini anglash, mavjud bilim va ko‘nikmalarini takomillashtirish, yangi kompetensiyalarni egallash hamda belgilangan maqsadlarga erishish yo‘lidagi uzluksiz jarayondir. Pedagog faoliyatida shaxsiy rivojlanish kasbiy o‘sish bilan chambarchas bog‘liq bo‘lib, o‘qituvchining o‘z faoliyatiga tanqidiy yondashishi, yangiliklarni o‘rganishi va pedagogik tajribasini boyitishida namoyon bo‘ladi. Pedagogik mahorat esa o‘qituvchining bilim, ko‘nikma, tajriba, pedagogik qobiliyat va shaxsiy fazilatlarini ta’lim-tarbiya jarayonida samarali qo‘llay olishidir. U faqat fan bo‘yicha bilimdonlik bilan cheklanmaydi. Pedagogik mahorat o‘quvchilar bilan samarali muloqot o‘rnatish, murakkab tushunchalarni sodda va tushunarli bayon etish, o‘quv jarayonini boshqarish, muammoli vaziyatlarni hal qilish va o‘quvchilarning ta’lim olishga bo‘lgan qiziqishini oshirishni ham qamrab oladi. Shu sababli shaxsiy rivojlanish va pedagogik mahoratni takomillashtirish zamonaviy o‘qituvchining muhim kasbiy vazifalaridan biri hisoblanadi.

Tadqiqotning maqsadi — shaxsiy rivojlanishning pedagogik mahoratni oshirishdagi ahamiyatini ochib berish hamda o‘qituvchilarning kasbiy kompetensiyalarini takomillashtirishga xizmat qiluvchi samarali usullarni yoritish.

1. Shaxsiy rivojlanish va pedagogik mahoratning o‘zaro bog‘liqligi

Shaxsiy rivojlanish o‘qituvchining kasbiy faoliyatini takomillashtirishga qaratilgan ongli va izchil jarayondir. U yangi bilimlarni egallash, pedagogik tajribani tahlil qilish, shaxsiy fazilatlarni rivojlantirish va kasbiy maqsadlarni belgilashni o‘z ichiga oladi.

Pedagogik mahoratning rivojlanishi bir nechta asosiy yo‘nalishlarda namoyon bo‘ladi.

Birinchidan, kasbiy bilimlarni chuqurlashtirish muhim ahamiyatga ega. O‘qituvchi o‘z faniga oid yangi ilmiy ma’lumotlar, zamonaviy o‘qitish metodlari va ta’lim standartlaridagi o‘zgarishlardan xabardor bo‘lishi kerak. Fan va texnologiyalar rivojlanib borayotgan sharoitda ilgari egallangan bilimlar bilan cheklanib qolish ta’lim sifatiga salbiy ta’sir ko‘rsatishi mumkin.

Ikkinchidan, pedagogik va psixologik kompetensiyalarni rivojlantirish zarur. Har bir o‘quvchining qobiliyati, qiziqishi, o‘zlashtirish sur’ati va psixologik xususiyatlari turlicha bo‘ladi. O‘qituvchi ushbu farqlarni hisobga olgan holda individual yondashuvni qo‘llashi lozim. Buning uchun yosh psixologiyasi, motivatsiya, muloqot madaniyati va nizolarni boshqarish bo‘yicha bilimlarni muntazam boyitib borish talab etiladi.

Uchinchidan, ijodkorlik va innovatsion fikrlashni rivojlantirish pedagogik mahoratning muhim tarkibiy qismidir. An’anaviy dars usullari ayrim vaziyatlarda yetarli samara bermasligi mumkin. Shu sababli muammoli ta’lim, loyiha asosida o‘qitish, guruhli ishlash, interfaol metodlar va raqamli vositalardan foydalanish o‘quvchilarning faolligini oshiradi.

To‘rtinchidan, o‘z faoliyatini tahlil qilish qobiliyati o‘qituvchining kasbiy o‘sishida muhim o‘rin tutadi. O‘qituvchi darsdan keyin qanday metodlar samarali bo‘lganini, qaysi mavzular o‘quvchilarga qiyinchilik tug‘dirganini va kelgusida nimalarni o‘zgartirish kerakligini aniqlashi lozim. Bunday yondashuv pedagogik faoliyatni tasodifiy emas, balki maqsadli takomillashtirish imkonini beradi.

Demak, shaxsiy rivojlanish pedagogik mahoratni oshirishning ichki omili bo‘lib, o‘qituvchining o‘z kasbiga mas’uliyatli munosabatini va uzluksiz o‘rganishga tayyorligini mustahkamlaydi.

2. O‘qituvchilarning shaxsiy rivojlanishini ta’minlovchi asosiy yo‘llar

2.1. Individual rivojlanish rejasini ishlab chiqish

O‘qituvchining shaxsiy rivojlanishi aniq maqsad va vazifalarga asoslangan bo‘lishi kerak. Buning uchun individual rivojlanish rejasini tuzish tavsiya etiladi. Rejada pedagogning mavjud kompetensiyalari, rivojlantirilishi zarur bo‘lgan jihatlar, bajariladigan vazifalar va kutilayotgan natijalar belgilanadi.

Masalan, o‘qituvchi o‘z oldiga quyidagi maqsadlarni qo‘yishi mumkin:

zamonaviy pedagogik metodlardan foydalanish ko‘nikmalarini rivojlantirish;

raqamli ta’lim platformalarida ishlashni o‘rganish;

o‘quvchilar bilan samarali muloqot qilish usullarini takomillashtirish;

baholashning zamonaviy shakllarini o‘zlashtirish;

ilmiy va metodik adabiyotlarni muntazam o‘qish;

ochiq darslar va kasbiy seminarlar orqali tajriba almashish.

Rivojlanish rejasi real, o‘lchash mumkin bo‘lgan va muayyan muddatga mo‘ljallangan maqsadlardan tashkil topishi lozim. Masalan, bir oy davomida yangi pedagogik metodni o‘rganish, keyingi oyda uni darsda sinab ko‘rish va natijalarini tahlil qilish mumkin.

2.2. Uzluksiz ta’lim va mustaqil bilim olish

O‘qituvchining kasbiy mahoratini oshirishda uzluksiz ta’lim muhim ahamiyatga ega. Malaka oshirish kurslari, seminarlar, konferensiyalar, vebinarlar va ilmiy-amaliy anjumanlar pedagogning nazariy bilimlarini yangilash hamda amaliy tajribasini boyitish imkonini beradi. Biroq kasbiy rivojlanish faqat rasmiy malaka oshirish kurslari bilan cheklanmasligi kerak. Mustaqil o‘qish, ilmiy maqolalarni tahlil qilish, elektron kutubxonalardan foydalanish va xalqaro pedagogik tajribani o‘rganish ham samarali natija beradi. Mustaqil ta’lim jarayonida o‘qituvchi o‘z faniga oid yangi tadqiqotlar, metodik qo‘llanmalar va ilg‘or ta’lim tajribalarini o‘rganishi mumkin. Olingan bilimlarni amaliyotga tatbiq etish esa ularning haqiqiy samaradorligini baholashga yordam beradi. Shuningdek, xorijiy tillarni bilish pedagogning xalqaro ilmiy manbalardan foydalanish imkoniyatlarini kengaytiradi. Bu esa zamonaviy ta’lim metodlarini o‘rganish va ularni mahalliy sharoitga moslashtirishga xizmat qiladi.

2.3. Pedagogik refleksiya va o‘zini o‘zi baholash

Pedagogik refleksiya — o‘qituvchining o‘z faoliyati, qarorlari va erishgan natijalarini tahlil qilish jarayonidir. Refleksiya yordamida pedagog o‘zining kuchli va rivojlantirilishi zarur bo‘lgan tomonlarini aniqlaydi.

Darsdan keyin quyidagi savollar ustida fikr yuritish foydali:

Darsning maqsadiga qay darajada erishildi?

Qaysi metodlar o‘quvchilarning faolligini oshirdi?

Qaysi tushunchalarni o‘quvchilar o‘zlashtirishda qiynaldi?

Vaqtdan samarali foydalanildimi?

Keyingi darsda qanday o‘zgarishlar kiritish kerak?

Ushbu savollarga muntazam javob berish pedagogning o‘z faoliyatiga ongli yondashishini shakllantiradi. Buning uchun o‘qituvchi dars tahlili kundaligini yuritishi, o‘quvchilarning fikr-mulohazalarini o‘rganishi va o‘z faoliyatidagi o‘zgarishlarni qayd etishi mumkin. O‘zini o‘zi baholash jarayonida faqat kamchiliklarni aniqlash emas, balki erishilgan yutuqlarni ham e’tirof etish muhimdir. Bu o‘qituvchining kasbiy motivatsiyasini saqlashga va rivojlanish jarayoniga ijobiy munosabatda bo‘lishiga yordam beradi.

2.4. Hamkasblar bilan tajriba almashish

Pedagogik mahoratni oshirishning samarali yo‘llaridan biri hamkasblar bilan o‘zaro tajriba almashishdir. Ochiq darslar, metodik birlashmalar, seminarlar, mahorat darslari va o‘zaro dars kuzatuvlari o‘qituvchilarga yangi metodlarni o‘rganish imkonini beradi. O‘zaro dars kuzatuvi faqat kamchiliklarni aniqlash vositasi sifatida qaralmasligi kerak. Uning asosiy maqsadi samarali tajribalarni aniqlash, metodik yondashuvlarni solishtirish va o‘z faoliyatini takomillashtirishdan iborat. Tajribali pedagoglarning darslarini kuzatish, ularning darsni tashkil etish usullari, savol berish texnikasi va o‘quvchilarni rag‘batlantirish yondashuvlarini o‘rganish yosh o‘qituvchilarning kasbiy shakllanishiga yordam beradi. Shuningdek, mentorlik tizimi orqali tajribali pedagoglar yangi ish boshlagan o‘qituvchilarga metodik va psixologik ko‘mak berishlari mumkin. Bunday hamkorlik ta’lim muassasasida sog‘lom kasbiy muhitni shakllantiradi.

2.5. Raqamli texnologiyalardan samarali foydalanish

Zamonaviy ta’lim jarayonida raqamli texnologiyalar o‘qituvchining kasbiy faoliyatini takomillashtirish uchun keng imkoniyatlar yaratmoqda. Elektron ta’lim platformalari, virtual laboratoriyalar, interfaol taqdimotlar, onlayn testlar va sun’iy intellektga asoslangan vositalar darsni mazmunli tashkil etishga yordam beradi.

Raqamli texnologiyalardan foydalanish o‘quv materiallarini vizual tarzda tushuntirish, bilimlarni tezkor baholash va individual topshiriqlarni ishlab chiqish imkonini beradi. Ayniqsa, murakkab tushunchalarni sxema, animatsiya, video va modellashtirish orqali tushuntirish o‘quvchilarning mavzuni yaxshiroq anglashiga ko‘maklashadi. Shu bilan birga, texnologiyadan foydalanish darsning asosiy maqsadiga mos bo‘lishi kerak. Raqamli vositalar pedagogik maqsadning o‘rnini bosmaydi, balki unga erishishni osonlashtiradi. O‘qituvchi axborotning ishonchliligini tekshirishi, mualliflik huquqiga rioya qilishi va o‘quvchilarning shaxsiy ma’lumotlarini himoya qilishi lozim. Sun’iy intellekt vositalari dars rejasi,

test topshiriqlari va o‘quv materiallarining dastlabki loyihalarini tayyorlashda yordam berishi mumkin. Biroq bunday materiallar pedagog tomonidan tekshirilishi, fan mazmuniga moslashtirilishi va ta’lim oluvchilarning yosh hamda bilim darajasiga muvofiqlashtirilishi zarur.

3. Pedagogik mahoratni oshirishda shaxsiy fazilatlarning o‘rni

Pedagogik mahorat faqat bilim va metodik ko‘nikmalardan iborat emas. O‘qituvchining shaxsiy fazilatlari ham ta’lim-tarbiya jarayonining samaradorligiga sezilarli ta’sir ko‘rsatadi.

Birinchi navbatda, mas’uliyat va intizom muhim ahamiyatga ega. Darslarga puxta tayyorgarlik ko‘rish, vazifalarni o‘z vaqtida bajarish va o‘quvchilarga nisbatan adolatli munosabatda bo‘lish pedagogning kasbiy obro‘sini mustahkamlaydi.

Ikkinchidan, hissiy barqarorlik va sabr-toqat zarur. Ta’lim jarayonida turli qiyinchiliklar, tushunmovchiliklar va nizoli vaziyatlar yuzaga kelishi mumkin. Bunday sharoitda o‘qituvchining vazminligi, muammoni xolis baholashi va konstruktiv yechim topishi muhimdir.

Uchinchidan, samarali muloqot madaniyati o‘qituvchi va o‘quvchi o‘rtasida ishonchli munosabatlarni shakllantiradi. O‘quvchini tinglash, uning fikrini hurmat qilish, tushunarli izoh berish va asosli fikr-mulohaza bildirish ta’lim muhitini yaxshilaydi.

To‘rtinchidan, o‘zgarishlarga ochiqlik va yangilikka intilish pedagogning rivojlanishini ta’minlaydi. O‘qituvchi o‘z tajribasini mutlaq va o‘zgarmas deb hisoblamasligi, yangi metodlarni o‘rganishi va ularni tanqidiy baholashi lozim.

Bundan tashqari, kasbiy charchashning oldini olish uchun mehnat va dam olish muvozanatini saqlash, vazifalarni oqilona rejalashtirish va zarur hollarda hamkasblardan yordam so‘rash ham muhimdir. O‘zining jismoniy va ruhiy holatiga e’tibor qaratadigan pedagog o‘quvchilar bilan samarali ishlash imkoniyatini yaxshiroq saqlab qoladi.

4. Shaxsiy rivojlanish samaradorligini oshirish bo‘yicha amaliy tavsiyalar

O‘qituvchining shaxsiy rivojlanishi uzluksiz va izchil tashkil etilgandagina barqaror natija beradi. Buning uchun quyidagi amaliy yondashuvlardan foydalanish tavsiya etiladi.

Birinchi tavsiya — rivojlanish maqsadlarini aniq belgilash. O‘qituvchi bir vaqtning o‘zida juda ko‘p vazifalarni bajarishga intilmasdan, avvalo eng muhim ikki yoki uchta kompetensiyani rivojlantirishga e’tibor qaratishi lozim.

Ikkinchi tavsiya — muntazam o‘rganish odatini shakllantirish. Har kuni yoki har hafta kasbiy adabiyotlarni o‘qish, metodik materiallarni o‘rganish va yangi pedagogik usullar bilan tanishish uchun alohida vaqt ajratish maqsadga muvofiq.

Uchinchi tavsiya — o‘rganilgan bilimlarni amaliyotda sinab ko‘rish. Yangi metodni faqat nazariy jihatdan bilish yetarli emas. Uni dars jarayonida qo‘llash, o‘quvchilarning reaksiyasini kuzatish va natijalarni tahlil qilish zarur.

To‘rtinchi tavsiya — muntazam fikr-mulohaza olish. Hamkasblar, metodistlar va o‘quvchilarning asosli fikrlari o‘qituvchiga o‘z faoliyatini boshqa nuqtayi nazardan baholash imkonini beradi.

Beshinchi tavsiya — rivojlanish natijalarini qayd etish. O‘qituvchi o‘zining individual rivojlanish portfoliosini yuritishi mumkin. Unda dars ishlanmalari, o‘zlashtirilgan metodlar, malaka oshirish sertifikatlari, o‘quvchilar natijalari va amalga oshirilgan pedagogik yangiliklar jamlanadi.

Quyidagi jadvalda shaxsiy rivojlanishni tashkil etishning namunaviy rejasi keltirilgan.

Rivojlanish yo‘nalishi	Amalga oshiriladigan ish	Kutilayotgan natija
Kasbiy bilim	Ilmiy va metodik adabiyotlarni o‘rganish	Fan bo‘yicha bilimlarning yangilanishi
Pedagogik metodika	Yangi o‘qitish usullarini darsda sinash	Dars samaradorligining oshishi
Raqamli kompetensiya	Elektron platforma va interfaol vositalarni o‘rganish	Ta’lim jarayonining boyitilishi
Refleksiya	Darsdan keyingi tahlilni muntazam yuritish	Kuchli va zaif tomonlarni aniqlash
Hamkorlik	Ochiq darslar va tajriba almashish tadbirlarida qatnashish	Kasbiy tajribaning kengayishi
Muloqot	Tinglash va fikr-mulohaza berish ko‘nikmalarini rivojlantirish	O‘quvchilar bilan samarali munosabat

Shuni ta’kidlash kerakki, pedagogik mahoratni baholashda faqat o‘tkazilgan tadbirlar yoki olingan sertifikatlar soniga tayanish yetarli emas. Eng muhim mezonlar — o‘qitish jarayonining sifati, o‘quvchilarning bilim va ko‘nikmalaridagi o‘zgarishlar, ularning mustaqil fikrlash darajasi hamda pedagogning o‘z faoliyatini takomillashtirish qobiliyatidir.

Xulosa

Shaxsiy rivojlanish o‘qituvchilarning pedagogik mahoratini oshirish va ta’lim sifatini yaxshilashning muhim shartlaridan biridir. Zamonaviy pedagog o‘z kasbiy bilimlarini muntazam yangilashi, pedagogik va psixologik kompetensiyalarini rivojlantirishi, raqamli texnologiyalardan oqilona foydalanishi hamda o‘z faoliyatini tanqidiy tahlil qilib borishi zarur.

Individual rivojlanish rejasini tuzish, mustaqil ta’lim bilan shug‘ullanish, malaka oshirish tadbirlarida qatnashish, hamkasblar bilan tajriba almashish va pedagogik refleksiyani yo‘lga qo‘yish kasbiy o‘sishning samarali yo‘llari hisoblanadi. Shu bilan birga, mas’uliyat, sabr-toqat, hissiy barqarorlik, ijodkorlik va samarali muloqot kabi shaxsiy fazilatlarni rivojlantirish ham pedagogik mahoratni mustahkamlaydi.

Xulosa qilib aytganda, o‘qituvchining shaxsiy rivojlanishi bir martalik tadbir emas, balki uzluksiz va maqsadli jarayondir. O‘z ustida muntazam ishlaydigan, yangiliklarni o‘rganishga tayyor va o‘z faoliyatini tahlil qila oladigan pedagog ta’lim jarayonini samarali tashkil etish, o‘quvchilarning intellektual salohiyatini

rivojlantirish va jamiyatning ta’limga bo‘lgan ehtiyojlarini qondirishga munosib hissa qo‘shadi.

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Ne'matov N.
assistant
Hamrakhulov S.
student
Jabborov Sh.
student
Khurbonmurodov O.
student
Safarov M.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE CURRENT LEVEL OF APPLICATION OF MODERN INFORMATION TECHNOLOGIES AND THEIR ROLE IN DATA COLLECTION, DIAGNOSIS, AND TREATMENT IN VARIOUS MEDICAL FIELDS

Abstract. This article examines the current level of application of modern information technologies in the healthcare sector and analyzes their role in medical data collection, diagnosis, and treatment processes. The study highlights the significance of electronic health systems, medical information systems, telemedicine, and artificial intelligence technologies in improving the quality, efficiency, and accessibility of healthcare services. The analysis of current healthcare practices shows that electronic health record systems and artificial intelligence-based decision support improve the structure and accessibility of patient data and the accuracy and speed of disease detection. The research emphasizes that the integration of information technologies contributes to accurate diagnostics, personalized treatment, and effective management of healthcare resources.

Keywords: information technologies, healthcare, medical data, diagnosis, treatment, telemedicine, artificial intelligence.

Introduction

The rapid development of modern information technologies has led to profound transformations in various sectors, including healthcare. Today, healthcare systems increasingly depend on digital solutions to manage complex medical data, enhance diagnostic accuracy, and improve treatment outcomes [1]. The adoption of information technologies has become a strategic priority for healthcare systems worldwide, as it enables cost-effective service delivery and improved patient care [1].

In modern medicine, timely access to accurate medical information plays a critical role in decision-making processes. Therefore, the implementation of

advanced information technologies is essential for ensuring the effectiveness and sustainability of healthcare systems. This study aims to analyze the current level of information technology usage in healthcare and evaluate its role in data collection, diagnosis, and treatment across different medical fields.

Materials and Methods

The study is based on an analysis of current healthcare practices and of the scientific literature on health information systems.

Results and Discussion

Current Level of Information Technology Usage in Healthcare

At present, healthcare institutions actively implement various information systems, including Electronic Medical Records (EMR), Hospital Information Systems (HIS), Laboratory Information Systems (LIS), and Picture Archiving and Communication Systems (PACS) [2]. These systems facilitate efficient management of patient information and enable healthcare professionals to access medical data in real time.

The widespread digitalization of healthcare processes has reduced administrative workload, minimized medical errors, and enhanced coordination among healthcare providers [3]. Additionally, cloud-based technologies allow secure storage and sharing of medical data, supporting collaborative decision-making and continuity of care [4].

Application of Information Technologies in Diagnostic Processes

Information technologies play a vital role in modern diagnostic practices. Medical imaging technologies such as computed tomography (CT), magnetic resonance imaging (MRI), and digital radiography rely heavily on advanced software for image processing and analysis.

Artificial intelligence and machine learning algorithms have become increasingly important in diagnostics [5]. These technologies assist clinicians in detecting diseases at early stages, analyzing complex medical images, and reducing diagnostic errors. The integration of decision-support systems enhances diagnostic accuracy and supports clinical decision-making [6].

Healthcare organizations utilize a variety of digital tools, including electronic medical records (EMR), hospital information systems (HIS), laboratory information systems (LIS), and medical imaging platforms. These technologies streamline patient data management, improve workflow efficiency, and reduce the likelihood of errors.

Key Findings

The analysis of current healthcare practices demonstrates that the integration of modern information technologies significantly improves the efficiency of medical data management, diagnostic accuracy, and treatment processes. The use of electronic health record systems has resulted in more structured and accessible patient data, enabling healthcare professionals to retrieve information promptly and make informed clinical decisions.

The findings indicate that healthcare institutions implementing digital diagnostic tools, such as computer-assisted imaging systems and artificial

intelligence-based decision support, show higher accuracy in disease detection and reduced diagnostic time. In particular, the application of machine learning algorithms contributes to the early identification of pathological conditions and supports clinicians in complex diagnostic cases.

Conclusion

In conclusion, modern information technologies have become an indispensable component of contemporary healthcare systems. Their application in data collection, diagnosis, and treatment significantly improves the quality, efficiency, and accessibility of medical services. The ongoing integration of advanced digital technologies is expected to play a crucial role in shaping the future of healthcare and improving patient outcomes.

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Normatova G.B.
independent researcher
Karshi State University
Uzbekistan, Karshi

ECONOMIC GEOGRAPHICAL FEATURES OF THE USE OF WATER RESOURCES IN AGRICULTURE IN THE KASHKADARYO REGION

Abstract. This article analyzes the economic geographical features of the use of water resources in agriculture in the Kashkadarya region. The formation and distribution of water resources in the region, the territorial location of irrigated lands, and factors affecting the efficiency of water use are studied. Also, priority areas for sustainable development of agriculture and efficient use of water resources in conditions of water scarcity are based.

Keywords: Kashkadarya region, water resources, agriculture, irrigation, water supply, territorial differences, water scarcity.

Introduction. In the context of globalization, climate change and population growth, the issue of rational use of water resources is becoming one of the strategic factors in the development of agriculture. The natural and economic foundations of irrigated agriculture, especially in arid and semi-arid regions, are directly related to the quantity, territorial distribution and efficiency of their use of available water resources. The uneven formation of water resources in space and time, the increase in water demand and losses in irrigation systems require an economic and geographical study of water use in agriculture. In this regard, it is of great scientific importance to determine the relationship between the territorial distribution of water resources, the location of irrigated land, the specialization of agricultural production and the level of water supply.

Kashkadarya region is characterized by a variety of natural geographical conditions, a high level of dependence of agriculture on irrigation, and a diverse distribution of water resources across regions. The characteristics of water resource use in the region are closely related to the river and reservoir system, irrigation infrastructure, land-water relations, crop composition, and territorial specialization. Therefore, it is of great scientific and practical importance to determine the economic geographical characteristics of water resource use in agriculture at the regional level, assess regional differences, analyze factors affecting the efficiency of water use, and determine priority areas for rational use of existing resources. This study aims to study these issues based on a regional approach.

Main part. The strategic importance of the transboundary Amu Darya basin in the agricultural water supply of the Kashkadarya region is extremely great. About 70 percent of the water resources used for irrigation of agricultural crops in the region are formed from the waters of the Amu Darya. In this regard, the Amu Darya is the main external source of water ensuring the sustainable operation of the regional agriculture. The fact that the Amu Darya is a transboundary river gives the

issue of water resources management not only regional, but also interregional and interstate content. The formation of the river flow in the upper basins, the multifaceted nature of water use, climate change and a sharp increase in demand for irrigation water during the growing season are factors that directly affect the water security of the Kashkadarya region. Therefore, when assessing the natural and economic potential of the region's water resources, it is necessary to comprehensively take into account the water-economic connections formed with the Amu Darya basin, the territorial redistribution of water flows, and the capabilities of the irrigation infrastructure.

The internal water resources of the region, including the Kashkadarya River and its tributaries, reservoirs, canals, and groundwater, are important sources of replenishment of the existing water fund. However, the high dependence of agriculture on irrigation and the arrival of the main irrigation water from the Amu Darya basin significantly link the region's water supply to external water flows. The distribution of water resources by districts is closely related to the area of irrigated land, the level of development of irrigation networks, the territorial location of water sources, and the specialization of agriculture. As a result, certain differences in water supply and the possibilities of its use are formed in the regions of the region. In determining these differences, it is necessary to take into account, in addition to the volume of water resources, their territorial reach, water losses in irrigation systems, the reclamation status of irrigated lands, and the amount of water consumed per unit of agricultural output. This approach allows us to assess the real economic and geographical efficiency of water resource use in the Kashkadarya region by region.

The territorial structure and specialization of agricultural production in the Kashkadarya region are directly related to the level of water resources. Irrigated lands are one of the main production factors determining the agrarian potential of the region, and the intensity of their use varies depending on natural conditions, the location of water sources, the level of development of irrigation networks and the reclamation state of the lands. The availability and stability of water resources play an important role in the formation of such areas as cotton growing, grain growing, vegetable growing, melon growing and fodder growing in irrigated areas. In this case, the biological characteristics of crops and their need for water during the growing season determine the territorial structure of water consumption. Therefore, the assessment of water use in agriculture should not be limited only to the volume of water consumed, but also be analyzed in terms of its ratio to the unit of irrigated land, the volume of products grown and the economic value created.

There are significant regional differences in the economic geographical efficiency of water resources use between the districts of the region, which are explained by the location of water sources, the technical condition of irrigation systems, the distance of water supply, irrigation methods, crop composition and production specialization. In areas with relatively stable water supply and developed irrigation infrastructure, the intensity of irrigated agriculture and higher productivity indicators can be formed. On the contrary, restrictions on water supply, filtration

and technical losses in canals, deterioration of land reclamation and increased water consumption are manifested as factors reducing the economic efficiency of agricultural production. From this point of view, a comprehensive assessment of the efficiency of water resources use across districts based on indicators such as the level of water supply, the volume of water consumed per hectare of irrigated land, crop productivity, gross agricultural output and the value of the product per unit of water will more clearly reveal regional differences. This approach serves to identify the territorial relationship between water resources and agricultural production and to identify opportunities to increase the economic and geographical efficiency of water use.

The issue of increasing the efficiency of water resources use in the Kashkadarya region is of particular importance in the context of the limited availability of water resources, the high dependence of agriculture on irrigated agriculture, and the territorial differentiation of water supply. The fact that the main part of the agricultural water supply of the region depends on the Amudarya basin requires a territorial, cross-sectoral and long-term approach to water resources management. From this point of view, the modernization of water management infrastructure, reducing water losses in main and inter-farm canals, improving the technical condition of irrigation networks, and developing digital mechanisms for water accounting and monitoring are among the priority areas. In particular, differential management of water resources by district, scientific substantiation of water limits taking into account the level of water supply and territorial specialization of agriculture are important conditions for increasing the efficiency of water use.

In order to increase the economic efficiency of water resources use, it is of strategic importance to introduce water-saving technologies in accordance with the natural and economic characteristics of the regions. The use of drip, sprinkler and other modern irrigation methods, in addition to optimizing water consumption, allows for precise determination of irrigation standards, management of crop water needs by vegetation stages, and increased productivity. In this case, when assessing water efficiency, it is advisable to use not only the volume of water saved, but also indicators such as the amount of water spent on 1 hectare of irrigated land, the cost of products grown per 1 m^3 of water, productivity and gross income. In the future, the formation of agricultural specialization appropriate to water scarcity, territorial optimization of the composition of water-intensive crops, involvement of reusable water resources in economic circulation, and the development of an irrigation system adapted to climate change will serve to improve the water-land-production ratio in the Kashkadarya region. As a result, an economic and geographical basis will be created to increase the territorial efficiency of water resource use, ensure the sustainability of agricultural production, and strengthen the long-term water security of the region.

Conclusion. The results of the study showed that the territorial organization and sustainability of agricultural production in the Kashkadarya region are inextricably linked to the availability, territorial distribution and efficiency of water

resources use. The fact that about 70 percent of the water resources used for irrigation in the region's agriculture are taken from the transboundary Amu Darya basin determines the strategic place of external water sources in the agrarian development of the region. At the same time, the territorial and seasonal unevenness of water resources, losses in irrigation networks, the reclamation status of irrigated lands, and the differences in the level of water supply by districts are factors that directly affect the territorial efficiency of agricultural production. Therefore, when assessing the agrarian potential of the region, it is of important methodological importance to comprehensively consider the quantitative and territorial potential of water resources, along with land resources.

In the future, the main direction of increasing the efficiency of water resources use in the Kashkadarya region should be focused on ensuring the balance between “water-land-crops-economic results”. To do this, it is necessary to modernize the irrigation infrastructure, reduce water losses, introduce water-saving technologies in accordance with the natural and economic characteristics of the regions, and manage water resources based on digital monitoring. Also, improving the specialization of agriculture based on the level of water supply of districts, optimizing the composition of water-intensive crops, and increasing the value of agricultural products per 1 m^3 of water should be a priority task. This approach will form the economic and geographical basis for increasing the territorial efficiency of using existing resources in conditions of water scarcity, ensuring the sustainability of agricultural production, and strengthening the long-term water security of the Kashkadarya region.

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Nurmatov N.E.
geografiya kafedrasi o‘qituvchisi
Lapasov Z.A.
geografiya va iqtisodiy bilim asoslari yo‘nalishi talabasi
Chorshanbiyev O.I.
geografiya va iqtisodiy bilim asoslari yo‘nalishi talabasi
Shahrisabz davlat pedagogika instituti
O‘zbekiston, Shahrisabz

O‘ZBEKISTONDA CHORVACHILIK MAHSULOTLARINI YETISHTIRISHNING IQTISODIY GEOGRAFIK XUSUSIYATLARI

Annotatsiya. Mazkur maqolada O‘zbekistonda chorvachilik mahsulotlarini yetishtirishning iqtisodiy-geografik xususiyatlari, hududiy rivojlanish omillari va joylashuv qonuniyatlari tahlil qilingan. Chorvachilik tarmog‘ining rivojlanishida tabiiy-iqlim sharoitlari, yaylov va ozuqa bazasi, suv resurslari, mehnat resurslari, aholi zichligi, iste’mol bozori hamda transport-infratuzilma omillarining o‘rni yoritilgan.

Kalit so‘zlar: Chorvachilik mahsulotlari, iqtisodiy geografiya, hududiy ixtisoslashuv, chorvachilik tarmoqlari, ozuqa bazasi, yaylovlar, go‘sht yetishtirish, sut yetishtirish, parrandachilik, qoramolchilik, qo‘ychilik, hududiy rivojlanish, iqtisodiy-geografik omillar.

Nurmatov N.E.
Lecturer
Department of Geography
Lapasov Z.A.
Student
Geography and Fundamentals of Economic Knowledge
Chorshanbiyev O.I.
Student
Geography and Fundamentals of Economic Knowledge
Shahrisabz State Pedagogical Institute
Uzbekistan, Shahrisabz

ECONOMIC-GEOGRAPHIC CHARACTERISTICS OF LIVESTOCK PRODUCT PRODUCTION IN UZBEKISTAN

Abstract. This article analyzes the economic-geographic characteristics, factors of regional development, and locational patterns of livestock production in Uzbekistan. It highlights the role of natural-climatic conditions, pasture and feed bases, water and labor resources, population density, consumer markets, and transport infrastructure in the development of the livestock sector.

Keywords: Livestock products, economic geography, regional specialization, livestock sectors, feed base, pastures, meat production, milk production, poultry

farming, cattle farming, sheep farming, regional development, economic-geographic factors.

Chorvachilik tarmog‘i bugungi kunda jahon iqtisodiyotining muhim tarkibiy qismlaridan biri bo‘lib, global oziq-ovqat xavfsizligini ta’minlashda strategik ahamiyat kasb etadi. Aholi sonining jadal o‘sishi, urbanizatsiya jarayonlarining kengayishi hamda iste’mol tarkibining o‘zgarishi natijasida go‘sht, sut va boshqa chorvachilik mahsulotlariga bo‘lgan talab yildan-yilga ortib bormoqda. Ayniqsa, rivojlangan va rivojlanayotgan mamlakatlarda intensiv chorvachilik tizimlariga o‘tish, yuqori mahsuldor zotlarni joriy etish, yem-xashak bazasini mustahkamlash va logistika infratuzilmasini rivojlantirish orqali tarmoq samaradorligini oshirishga katta e’tibor qaratilmoqda. Shu bilan birga, chorvachilik ishlab chiqarishining hududiy tashkil etilishi tabiiy-iqlimiy sharoitlar, resurslar taqsimoti va bozor omillari bilan chambarchas bog‘liq bo‘lib, bu esa uning iqtisodiy geografik jihatdan chuqur o‘rganilishini taqozo etadi.

O‘zbekistonda chorvachilik qishloq xo‘jaligining yetakchi tarmoqlaridan biri hisoblanib, mamlakat aholisini oziq-ovqat mahsulotlari bilan ta’minlashda muhim o‘rin tutadi. Respublikada chorvachilikning rivojlanishi hududlarning tabiiy geografik xususiyatlari, xususan, yaylov va ozuqa resurslarining mavjudligi, suv ta’minoti, iqlim sharoiti hamda aholi zichligi bilan bevosita bog‘liqdir. So‘nggi yillarda tarmoqni modernizatsiya qilish, naslchilik ishlarini takomillashtirish, fermer va dehqon xo‘jaliklari faoliyatini qo‘llab-quvvatlash orqali chorvachilik mahsulotlari ishlab chiqarish hajmini oshirishga alohida e’tibor qaratilmoqda. Biroq, ayrim hududlarda yem-xashak bazasining yetarli darajada rivojlanmaganligi, ishlab chiqarish infratuzilmasining sustligi hamda mahsulotlarni qayta ishlash darajasining pastligi kabi muammolar mavjud.

Mazkur sharoitda O‘zbekistonda chorvachilik mahsulotlarini yetishtirishning iqtisodiy geografik xususiyatlarini kompleks o‘rganish alohida dolzarblik kasb etadi. Hududlar kesimida chorvachilikning ixtisoslashuvi, resurs salohiyatidan samarali foydalanish, ishlab chiqarish va qayta ishlash zanjirining hududiy tashkil etilishini takomillashtirish, logistika va bozor infratuzilmasini rivojlantirish masalalari ilmiy asoslangan yondashuvni talab etadi. Shu nuqtai nazardan, chorvachilik tarmog‘ining hududiy rivojlanish qonuniyatlarini aniqlash, uning iqtisodiy samaradorligini oshirish va barqaror rivojlanish yo‘nalishlarini belgilash ushbu paragrafning asosiy mazmun-mohiyatini tashkil etadi.

Go‘sht-sut chorvachiligi qishloq xo‘jaligining muhim tarmoqlaridan biri bo‘lib, uning rivojlanishi tabiiy-geografik va iqtisodiy omillar bilan bevosita bog‘liq. Ushbu tarmoq chorva mollarini yetishtirish, ularning mahsuldorligini oshirish hamda go‘sht va sut mahsulotlarini ishlab chiqarishga yo‘naltirilgan. Tabiiy omillar ichida iqlim sharoiti, yaylov va o‘tloqlarning sifati, suv resurslarining mavjudligi asosiy rol o‘ynaydi. Iqlimi mo‘tadil va namgarchilik yetarli bo‘lgan hududlarda sut chorvachiligi rivojlangan bo‘lsa, quruq va cho‘l hududlarda asosan go‘sht chorvachiligi ustunlik qiladi. Bundan tashqari, mintaqaning geografik

joylashuvi, transport infratuzilmasi va bozorlarga yaqinligi chorvachilik mahsulotlarining realizatsiya jarayonida muhim omillardan biri hisoblanadi.

Iqtisodiy omillar nuqtayi nazaridan, go‘sht-sut chorvachiligining rivojlanishi subsidiya va kredit siyosati, davlat tomonidan qishloq xo‘jaligi tarmog‘iga ko‘rsatilayotgan qo‘llab-quvvatlash darajasi, texnologik innovatsiyalar bilan bog‘liq. Zamonaviy chorvachilik komplekslarida genetik seleksiya, sifatli yem bazasi yaratish va sog‘lom chorva parvarishi kabi ilg‘or usullar joriy etilmoqda. Shuningdek, go‘sht-sut mahsulotlariga bo‘lgan talabning o‘sishi va global oziq-ovqat xavfsizligi masalalari bu tarmoqning strategik ahamiyatini oshirmoqda. Biroq, ekologik muammolar, jumladan yaylovlarning degradatsiyasi, yem resurslarining yetishmovchiligi va chorva chiqindilarining atrof-muhitga ta’siri kabi muammolar ushbu tarmoqning barqaror rivojlanishiga to‘sqinlik qilishi mumkin. Shu sababli, go‘sht-sut chorvachiligini rivojlantirishda resurslardan oqilona foydalanish va ekologik muvozanatni saqlash asosiy ustuvor yo‘nalishlardan biri bo‘lishi lozim.

Birlashgan Millatlar Tashkilotining Oziq-ovqat va qishloq xo‘jaligi tashkiloti (FAO) va Iqtisodiy Hamkorlik va Taraqqiyot Tashkiloti (OECD) tomonidan e’lon qilingan 2022-2031 yillar uchun qishloq xo‘jaligi istiqbollari hisobotida go‘sht-sut chorvachiligi tarmog‘ining rivojlanishi bo‘yicha muhim ma’lumotlar keltirilgan. Ushbu hisobotga ko‘ra, agar hozirgi tendensiyalar davom etsa, 2030-yilga kelib “Nol ochlik” maqsadiga erishish qiyin bo‘ladi va qishloq xo‘jaligidan chiqadigan issiqxona gazlari emissiyasi o‘sishda davom etadi. Shu sababli, kelgusi o‘n yil ichida qishloq xo‘jaligiga, jumladan, go‘sht-sut chorvachiligiga investitsiyalar va innovatsiyalarni oshirish, texnologiyalar transferini ta’minlash zarur. Bundan tashqari, oziq-ovqat yo‘qotishlari va chiqindilarini kamaytirish, ortiqcha kaloriya va protein iste’molini cheklash bo‘yicha qo‘shimcha chora-tadbirlar ko‘rish lozim.

O‘zbekistonda go‘sht-sut chorvachilik tarmog‘ining rivojlanishi mamlakatning iqtisodiy geografik xususiyatlari bilan bevosita bog‘liq bo‘lib, uning rivojlanishiga tabiiy resurslar, iqlim sharoiti, demografik omillar va infratuzilma ta’sir ko‘rsatadi. Respublikada chorvachilik, ayniqsa, go‘sht-sut yo‘nalishi an’anaviy tarmoq bo‘lib, aholi ehtiyojini qondirish va oziq-ovqat xavfsizligini ta’minlashda muhim rol o‘ynaydi. Mamlakatning turli hududlari tabiiy sharoitiga qarab chorvachilikning alohida yo‘nalishlariga ixtisoslashgan. Masalan, Farg‘ona vodiysi, Toshkent va Samarqand viloyatlarida sut chorvachiligi rivojlangan bo‘lsa, Qashqadaryo, Surxondaryo va Jizzax viloyatlarida yaylov chorvachiligi keng tarqalgan. O‘zbekistonning janubiy va g‘arbiy hududlari quruq iqlimi sababli asosan qo‘y va echki boqishga mos keladi, markaziy va shimoliy hududlar esa qoramolchilik uchun qulay sharoitga ega. Yirik shoxli qoramollar soni bo‘yicha Samarqand va Qashqadaryo viloyatlari yetakchi o‘rinlarni egallaydi. Qo‘y va echkilar soni bo‘yicha Qashqadaryo viloyati respublikada birinchi o‘rinda turadi, bu esa viloyatning keng yaylov maydonlari va tabiiy sharoiti bilan izohlanadi. chorvachilik tarmog‘ining hududiy rivojlanish darajasi tabiiy resurslar, yem-xashak bazasi, chorva bosh soni hamda ishlab chiqarish ixtisoslashuvi bilan chambarchas bog‘liqligini ko‘rsatadi. Qashqadaryo viloyati qoramolchilik va qo‘ychilik

yo‘nalishlari bo‘yicha respublikaning yetakchi hududlaridan biri sifatida ajralib turadi.

Iqtisodiy jihatdan olib qaraganda, go‘sht-sut chorvachilik tarmog‘i mamlakat qishloq xo‘jaligi yalpi mahsulotining muhim qismini tashkil etadi. So‘nggi yillarda davlat tomonidan chorvachilikni rivojlantirish uchun subsidiyalar ajratilishi, kredit resurslari taqdim etilishi hamda zamonaviy texnologiyalarning joriy etilishi bu tarmoqning o‘sishiga ijobiy ta’sir ko‘rsatmoqda.

O‘zbekiston Respublikasi ma’muriy hududlari kesimida yetishtirilgan go‘sht va sut to‘g‘risida ma’lumot (2010-2024-yillar, ming tonna)

	Go‘sht				Sut			
	2010	**2015**	**2020**	**2024**	**2010**	**2015**	**2020**	**2024**
O‘zbekiston Respublikasi	**1461,4**	**2033,4**	**2519,4**	**2942,5**	**6169**	**9027,8**	**10975,0**	**12443,8**
Qoraqalpog‘iston Respublikasi	58,9	88,4	111,1	129,8	183,6	322,1	404,8	469,7
Andijon	91,9	126,1	157,1	202,2	540,9	822,2	978,2	1119,2
Buxoro	140,2	195,4	262,7	312,7	539,3	779,1	1002,6	1136,7
Jizzax	124,2	176,8	217,2	246,8	334,3	501	627,2	713,6
Qashqadaryo	178,7	247,8	301,9	345,9	657,2	952,2	1179,4	1380,1
Navoiy	93,3	133,2	165,1	196,6	271,8	388,5	483	566,9
Namangan	81,5	114,7	156,7	182,4	384,9	581	724,2	804,1
Samarqand	179,9	244,4	286	326,9	759,3	1132,3	1307,3	1456,0
Surxondaryo	113,3	155,6	193,6	220,0	508,2	750,2	885,7	974,3
Sirdaryo	40,1	56,8	65,6	80,4	200,4	290,3	356,2	414,2
Toshkent	166	226,7	265,5	312,3	568	787	922	1080,6
Farg‘ona	98,1	138,9	173	195,0	588,8	854,5	1050,4	1191,1
Xorazm	95,3	128,6	163,9	191,5	632,3	867,4	1054	1137,3

Manba: *O‘zbekiston Respublikasi Milliy Statistika Qo‘mitasi ma’lumotlari asosida muallif tomonidan tuzilgan.*

Ushbu muammolarni hal etish uchun ilmiy yondashuv asosida intensiv chorvachilik texnologiyalarini joriy qilish, naslchilik ishlarini rivojlantirish va ekologik muvozanatni saqlash zarur hisoblanadi.

Go‘sht ishlab chiqarish bo‘yicha O‘zbekiston Respublikasi hududlarini uchta guruhga ajratish mumkin: yuqori ishlab chiqarish hajmiga ega hududlar, o‘rta darajadagi hududlar va past ishlab chiqarish hajmiga ega hududlar. Yuqori ishlab chiqarish hajmiga ega viloyatlar Qashqadaryo (345,9 ming tonna), Samarqand (326,9 ming tonna), Toshkent (312,3 ming tonna) va Buxoro (312,7 ming tonna) bo‘lib, ular mamlakatning asosiy go‘sht yetishtiruvchi hududlari hisoblanadi Yetishtirilgan go‘sht hajmida asosiy ulush yirik shoxli qoramollar hissasiga to‘g‘ri keladi. Ushbu viloyatlar umumiy ishlab chiqarish hajmining taxminan 43,5% ini ta’minlaydi. Ularning yetakchilik qilishi tabiiy resurslarning yetarli bo‘lishi, yirik yaylovlarning mavjudligi va ixtisoslashgan dehqon xo‘jaliklari bilan bog‘liq.

O‘rta ishlab chiqarish hajmiga ega viloyatlar guruhiga Andijon (202,2 ming tonna), Farg‘ona (195,0 ming tonna), Xorazm (191,5 ming tonna), Navoiy (196,6 ming tonna), Surxondaryo (220,0 ming tonna), Namangan (182,4 ming tonna) va Jizzax (246,8 ming tonna) kiradi. Bu hududlar go‘sht ishlab chiqarishda muhim rol o‘ynasa-da, ishlab chiqarish hajmi yetakchi viloyatlarga nisbatan pastroq. Ushbu viloyatlar umumiy ishlab chiqarishning 41,2% ini tashkil qiladi. Ularning ishlab chiqarish hajmi asosan chorvachilikning an’anaviy shakllari, iqtisodiy infratuzilma va yaylov resurslarining chegaralanganligi bilan bog‘liq.

Past ishlab chiqarish hajmiga ega hududlar esa Sirdaryo (80,4 ming tonna) va Qoraqalpog‘iston Respublikasi (129,8 ming tonna) bo‘lib, ular mamlakatdagi umumiy ishlab chiqarish hajmining 7,1 foizini ta’minlaydi. Ushbu hududlarda go‘sht ishlab chiqarish asosan cheklangan tabiiy resurslar va chorvachilikka yaroqli yaylovlarning kamligi bilan bog‘liq. Ayniqsa, Sirdaryo viloyatida go‘sht ishlab chiqarish hajmi eng past ko‘rsatkichlarga ega bo‘lib, bu hududning agrar sektorda paxtachilik va g‘allachilikka ixtisoslashgani bilan bog‘liq Qashqadaryo viloyati go‘sht yetishtirish bo‘yicha mamlakatda yetakchi viloyatlardan biri hisoblanib, 2024-yilda 345,9 ming tonna go‘sht ishlab chiqarilgan. Bu O‘zbekiston bo‘yicha umumiy ishlab chiqarishning 11,8% ini tashkil etadi. Qashqadaryo hududida chorvachilikning rivojlanishi uning keng yaylov resurslariga ega ekani va aholi tomonidan an’anaviy chorvachilik usullarining saqlanib qolishi bilan bog‘liq. Biroq, viloyatda suv resurslarining taqchilligi va yaylovlarning degradatsiyasi kabi muammolar mavjud bo‘lib, bu kelajakda go‘sht ishlab chiqarish hajmiga salbiy ta’sir ko‘rsatishi mumkin. Shu sababli, intensiv chorvachilik texnologiyalarini joriy etish va yaylovlardan oqilona foydalanish muhim vazifalardan biri hisoblanadi. O‘zbekiston Respublikasida sut ishlab chiqarish bo‘yicha ma’muriy hududlarni ham uchta guruhga ajratish mumkin: yuqori ishlab chiqarish hajmiga ega hududlar, o‘rta darajadagi hududlar va past ishlab chiqarish hajmiga ega hududlar**.** **y**uqori ishlab chiqarish hajmiga ega viloyatlar Samarqand (1456,0 ming tonna), Qashqadaryo (1380,1 ming tonna), Farg‘ona (1191,1 ming tonna), Buxoro (1136,7 ming tonna) va Xorazm (1137,3 ming tonna) hisoblanadi. Ushbu hududlar mamlakatda yetishtirilayotgan sutning 45,9% ini ta’minlab, yirik chorvachilik xo‘jaliklari va an’anaviy sut yetishtirish tajribasi bilan ajralib turadi (1.2-jadvalga qarang).

O‘rta ishlab chiqarish hajmiga ega hududlar tarkibiga Andijon (1119,2 ming tonna), Toshkent (1080,6 ming tonna), Surxondaryo (974,3 ming tonna), Namangan (804,1 ming tonna), Jizzax (713,6 ming tonna) va Navoiy (566,9 ming tonna) kiradi. Ushbu hududlar umumiy ishlab chiqarishning 39,4% ini tashkil qiladi. Bu hududlarning sut ishlab chiqarish hajmi chorvachilik infratuzilmasining o‘sishi va qishloq xo‘jaligi texnologiyalarining rivojlanishi bilan bog‘liq. Shu bilan birga, iqlim sharoiti va yem resurslarining mavjudligi bu hududlarda sut ishlab chiqarish darajasiga bevosita ta’sir qiladi.

Past ishlab chiqarish hajmiga ega hududlar Qoraqalpog‘iston Respublikasi (469,7 ming tonna) va Sirdaryo (414,2 ming tonna) bo‘lib, bu hududlar mamlakat umumiy ishlab chiqarish hajmining 7,1% ini ta’minlaydi. Bu hududlarda

yaylovlarning sifati, chorva sonining nisbatan kamligi va yem bazasining cheklanganligi sut ishlab chiqarishning past bo‘lishiga sabab bo‘lmoqda. Ayniqsa, Sirdaryo viloyatida ishlab chiqarish hajmi cheklangan bo‘lib, bu hududning qishloq xo‘jaligidagi asosiy yo‘nalishi paxta va g‘alla yetishtirish bilan bog‘liq.

Xulosa. Tadqiqot natijalari O‘zbekistonda chorvachilik mahsulotlarini yetishtirishning hududiy jihatdan bir xil taqsimlanmaganligini ko‘rsatadi. Chorvachilikning rivojlanish darajasi tabiiy-iqlim sharoitlari, yaylov va ozuqa bazasi, suv resurslari, chorva soni, aholi zichligi hamda ishlab chiqarish va transport infratuzilmasi bilan chambarchas bog‘liq. 2024-yil ma’lumotlariga ko‘ra, go‘sht yetishtirishda Qashqadaryo, Samarqand, Buxoro va Toshkent viloyatlari, sut yetishtirishda esa Samarqand, Qashqadaryo, Farg‘ona, Xorazm va Buxoro viloyatlari yuqori ko‘rsatkichlarga ega. Bu hududlarning yuqori natijalari chorvachilik uchun mavjud tabiiy resurslar, ozuqa bazasi va shakllangan xo‘jalik ixtisoslashuvi bilan izohlanadi.

Shu bilan birga, ayrim hududlarda yem-xashak bazasining cheklanganligi, suv taqchilligi, yaylovlar degradatsiyasi va qayta ishlash infratuzilmasining yetarli darajada rivojlanmaganligi chorvachilikning samarali rivojlanishiga to‘sqinlik qilmoqda. Shu sababli hududlarning tabiiy va iqtisodiy salohiyatidan oqilona foydalanish, intensiv chorvachilik texnologiyalarini joriy etish, naslchilik ishlarini rivojlantirish hamda ishlab chiqarish-qayta ishlash-logistika tizimini takomillashtirish O‘zbekistonda chorvachilik mahsulotlari yetishtirishni yanada rivojlantirishning muhim yo‘nalishlari hisoblanadi.

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Nurmatov N.E.
geografiya kafedrasi o‘qituvchisi
Jaxonov F.F.
geografiya va iqtisodiy bilim asoslari yo‘nalishi talabasi
Berdimurodov S.T.
geografiya va iqtisodiy bilim asoslari yo‘nalishi talabasi
Shahrisabz davlat pedagogika instituti
O‘zbekiston, Shahrisabz

QASHQADARYO VILOYATIDA PICHANZOR VA YAYLOVLARNING HUDUDIY TAQSIMLANISHI HAMDA CHORVACHILIK RIVOJIDAGI AHAMIYATI

Annotatsiya. Mazkur maqolada Qashqadaryo viloyatida pichanzor va yaylovlarning hududiy taqsimlanishi, ularning umumiy yer maydonidagi salmog‘i hamda chorvachilik tarmog‘ining ozuqa bazasini shakllantirishdagi ahamiyati tahlil qilingan. Tadqiqotda viloyat tumanlari kesimida pichanzor va yaylovlar maydoni, ularning jami yer maydoniga nisbati hamda hududlar o‘rtasidagi tafovutlar o‘rganildi.

Kalit so‘zlar: Chorvachilik, pichanzor, yaylov, ozuqa bazasi, hududiy taqsimlanish, yer resurslari, tabiiy yaylov, chorvachilik geografiyasi, hududiy ixtisoslashuv.

Nurmatov N.E.
Lecturer
Department of Geography
Jaxonov F.F.
Student
Geography and Fundamentals of Economic Knowledge
Berdimurodov S.T.
Student
Geography and Fundamentals of Economic Knowledge
Shahrisabz State Pedagogical Institute
Uzbekistan, Shahrisabz

SPATIAL DISTRIBUTION OF HAYFIELDS AND PASTURES IN KASHKADARYA REGION AND THEIR SIGNIFICANCE FOR LIVESTOCK DEVELOPMENT

Abstract. This article analyzes the spatial distribution of hayfields and pastures in the Kashkadarya region, their share of the total land area, and their importance in establishing the fodder base for the livestock sector. The study examines the area of hayfields and pastures across the region's districts, their ratio to the total land area, and the disparities between different territories.

Keywords: Livestock farming, hayfield, pasture, fodder base, spatial distribution, land resources, natural pasture, livestock geography, territorial specialization.

Qishloq xo‘jaligining muhim tarmoqlaridan biri bo‘lgan chorvachilikning hududiy rivojlanishi ko‘p jihatdan tabiiy-resurs, iqtisodiy, demografik va ijtimoiy omillarning o‘zaro ta’siri bilan belgilanadi. Chorvachilik ishlab chiqarishining barqarorligi, avvalo, yetarli va sifatli ozuqa bazasining mavjudligiga bog‘liq. Ayniqsa, tabiiy yaylov va pichanzorlar chorvachilikning hududiy tashkil etilishida asosiy tabiiy omillardan biri sifatida namoyon bo‘ladi. Qashqadaryo viloyati geografik jihatdan tabiiy sharoitlari keskin farqlanuvchi hududlardan tashkil topgan. Viloyatning g‘arbiy va shimoli-g‘arbiy qismlarida cho‘l va yarim cho‘l landshaftlarining keng tarqalganligi, janubi-sharqiy va sharqiy qismlarida esa tog‘ va tog‘oldi hududlarining mavjudligi yer resurslaridan foydalanish shakllarining hududiy jihatdan farqlanishiga olib kelgan. Natijada chorvachilikning ozuqa bazasi ham viloyat hududida bir xil taqsimlanmagan.

Pichanzor va yaylovlar chorvachilik uchun nafaqat tabiiy ozuqa manbai, balki hududning chorvachilikka ixtisoslashuv darajasini belgilovchi muhim omil hisoblanadi. Ayniqsa, yaylov chorvachiligida ozuqa bazasining hududiy joylashuvi chorva mollarining joylashuvi, chorvachilik mahsulotlari ishlab chiqarish hajmi va ishlab chiqarish xarajatlariga bevosita ta’sir ko‘rsatadi.

Shu nuqtayi nazardan, Qashqadaryo viloyatida pichanzor va yaylovlarning hududiy taqsimlanishini o‘rganish chorvachilik tarmog‘ining mavjud hududiy tuzilmasini baholash, hududlarning ixtisoslashuv imkoniyatlarini aniqlash hamda istiqboldagi rivojlanish yo‘nalishlarini belgilash uchun muhim ilmiy-amaliy ahamiyatga ega.

1-jadval

Qashqadaryo viloyati tuman va shaharlarida pichanzor va yaylovlarning hududiy taqsimlanishi

№	Tuman va shaharlar	Umumiy maydoni, ga	Pichanzor va yaylovlar, ga	Umumiy maydondagi ulushi, %
1	G‘uzor	265 230	168 487	63,5
2	Dehqonobod	395 662	191 105	48,3
3	Qamashi	245 734	107 665	43,8
4	Qarshi	91 633	18 019	19,6
5	Mirishkor	312 538,5	217 886	69,7
6	Kasbi	73 479	4 771	6,4
7	Kitob	174 269	70 899	40,6
8	Chiroqchi	112 667	49 891	44,2
9	Muborak	307 012	226 642	73,8
10	Nishon	211 128	101 203	47,9
11	Shahrisabz	161 820	72 590	44,8
12	Yakkabog‘	134 947	52 870	39,1
13	Qarshi shahri	7 552	1 118	14,8
14	Koson	187 242	65 347	34,8
15	Shahrisabz shahri	4 869	40	0,8
16	Ko‘kdala	171 018	56 668	33,1
Jami	**Qashqadaryo viloyati**	**2 856 799**	**1 405 201**	**49,1**

Manba: Qashqadaryo viloyati bo‘yicha ma’lumotlar asosida muallif tomonidan tuzilgan.

Qashqadaryo viloyatining tuman va shaharlari bo‘yicha umumiy yer maydoni 2 856 799 gektar, pichanzor va yaylovlar maydoni esa 1 405 201 gektarni tashkil etadi (1-jadval). Bu juda muhim ko‘rsatkich bo‘lib, viloyat yer fondining qariyb yarmi tabiiy ozuqa bazasi sifatida foydalaniladigan pichanzor va yaylovlardan iborat ekanligini ko‘rsatadi.

Boshqacha aytganda, Qashqadaryoda chorvachilikni rivojlantirish uchun keng hududiy ozuqa bazasi mavjud. Biroq mazkur resurslarning hududlar bo‘yicha notekis taqsimlanganligi chorvachilikning hududiy tashkil etilishida turli darajadagi imkoniyatlarni shakllantiradi. Tahlil natijalari pichanzor va yaylovlar maydoni bo‘yicha Qashqadaryo viloyati hududlarida sezilarli tafovutlar mavjudligini ko‘rsatadi. Muborak tumanida pichanzor va yaylovlar 226 642 gektarni tashkil etib, umumiy maydonning 73,8 foiziga teng. Bu viloyatdagi eng yuqori ko‘rsatkichdir.

Muborak tumanida cho‘l va yarim cho‘l landshaftlarining keng tarqalganligi, sug‘oriladigan qishloq xo‘jaligi uchun yaroqli maydonlarning nisbatan cheklanganligi hudud yer fondida yaylovlarning salmog‘i yuqori bo‘lishiga olib kelgan. Shu sababli Muborak tumani chorvachilikning, ayniqsa yaylov chorvachiligining rivojlanishi uchun yuqori tabiiy salohiyatga ega hududlardan biri sifatida baholanishi mumkin.

2-jadval
Qashqadaryo viloyati hududlarining pichanzor va yaylovlar ulushiga ko‘ra guruhlanishi

Guruh	Pichanzor va yaylovlar ulushi	Hududlar
I guruh	60 % dan yuqori	Muborak, Mirishkor, G‘uzor
II guruh	45-60 %	Dehqonobod, Nishon
III guruh	30-45 %	Qamashi, Shahrisabz, Chiroqchi, Kitob, Yakkabog‘, Koson, Ko‘kdala
IV guruh	15-30 %	Qarshi
V guruh	15 % dan kam	Kasbi, Qarshi sh., Shahrisabz sh.

Qashqadaryo viloyati hududlarida pichanzor va yaylovlarning umumiy maydondagi ulushi sezilarli darajada farq qiladi. Mazkur ko‘rsatkich hududlarning tabiiy-geografik xususiyatlari, yer fondining tarkibi, yaylov chorvachiligining rivojlanish imkoniyatlari hamda qishloq xo‘jaligi yerlaridan foydalanish yo‘nalishlarini baholashda muhim mezonlardan biri hisoblanadi. Xususan, pichanzor va yaylovlar ulushining yuqoriligi hududda chorvachilik, ayniqsa, qo‘y va echki, qoramolchilik hamda boshqa yaylov chorvachiligi tarmoqlarini rivojlantirish uchun nisbatan keng tabiiy ozuqa bazasi mavjudligini ko‘rsatadi.

Qashqadaryo viloyati hududi pichanzor va yaylovlarning umumiy maydondagi ulushi bo‘yicha 5 ta guruhga ajratilgan (2-jadval). Bunday guruhlash hududlar o‘rtasidagi tafovutlarni aniqroq ko‘rsatish va chorvachilikni hududiy tashkil etish uchun ustuvor yo‘nalishlarni belgilash imkonini beradi.

Pichanzor va yaylovlar ulushi 60 foizdan yuqori bo‘lgan hududlarga Muborak, Mirishkor va G‘uzor tumanlari kiradi. Mazkur guruh hududlarida pichanzor va yaylovlar yer fondining asosiy qismini tashkil etadi. Ayniqsa, Muborak tumanida ushbu ko‘rsatkich 73,8 foiz, Mirishkorda 69,7 foiz, G‘uzorda esa 63,5 foizni tashkil etadi. Demak, ushbu hududlarda tabiiy ozuqa bazasining nisbatan kengligi chorvachilikni, ayniqsa, yaylovlardan foydalanishga asoslangan chorvachilik yo‘nalishlarini rivojlantirish uchun muhim hududiy omil hisoblanadi. Pichanzor va yaylovlar ulushi 45-60 foizni tashkil etadigan hududlarga Dehqonobod va Nishon tumanlari kiritilgan. Ushbu hududlarda yaylov va pichanzorlarning ulushi mos ravishda 48,3 va 47,9 foizni tashkil etadi. Birinchi guruh bilan solishtirganda ulush biroz past bo‘lsa-da, bu hududlarda ham chorvachilikni rivojlantirish uchun yetarlicha katta tabiiy ozuqa bazasi mavjud. Ayniqsa, Dehqonobod tumani alohida ahamiyatga ega. Uning umumiy maydoni 395,7 ming gektarga yaqin bo‘lib, hududning katta qismi qishloq xo‘jaligida foydalaniladigan yerlar tarkibiga kiradi. Ilgari keltirilgan yer fondi ma’lumotlarida ham Dehqonobodda pichanzor va yaylovlarning salmoqli ulushi qayd etilgan. Shu sababli tumanda chorvachilikni rivojlantirishda yaylovlardan oqilona foydalanish, yaylovlarning mahsuldorligini oshirish va ozuqa bazasini mustahkamlash muhim yo‘nalishlardan biri hisoblanadi.

Ulushi 15-30 foiz pichanzor va yaylovlar bo‘lgan hudud sifatida Qarshi tumani ajralib turadi. Tumanda ushbu yerlarning umumiy maydondagi ulushi 19,6 foizni tashkil etadi. Bu ko‘rsatkich viloyatning yaylov salohiyati yuqori bo‘lgan hududlariga nisbatan ancha past. Mazkur holat Qarshi tumanida yer resurslarining boshqa qishloq xo‘jaligi yo‘nalishlarida, xususan, ekin maydonlari sifatida foydalanilish darajasi yuqoriroq ekanligi bilan bog‘liq. Shuning uchun tumanda chorvachilikni rivojlantirishda tabiiy yaylovlardan foydalanishdan ko‘ra, intensiv chorvachilik, yem-xashak bazasini xo‘jaliklar doirasida shakllantirish va mahsuldor zotlardan foydalanish muhimroq ahamiyat kasb etadi.

Umuman olganda, guruhlash natijalari Qashqadaryo viloyatida pichanzor va yaylovlarning hududiy taqsimlanishi keskin differensiallashganini ko‘rsatadi. Bir tomonda Muborak, Mirishkor va G‘uzor kabi tabiiy ozuqa bazasi keng bo‘lgan hududlar mavjud bo‘lsa, ikkinchi tomonda Kasbi, Qarshi shahri va Shahrisabz shahri kabi yaylov salohiyati cheklangan hududlar mavjud. Demak, viloyat chorvachiligini rivojlantirishda barcha hududlar uchun yagona yondashuvdan foydalanish emas, balki hududlarning ozuqa bazasi va yer resurslari salohiyatiga mos differensial yondashuvni qo‘llash zarur. Shu nuqtayi nazardan, I-II guruh hududlarini tabiiy yaylov chorvachiligining asosiy tayanch hududlari sifatida, III guruh hududlarini aralash - yaylov va yem-xashak bazasiga asoslangan chorvachilik hududlari sifatida, IV-V guruh hududlarini esa intensiv va xo‘jalik ichidagi yem-xashak bazasiga tayanadigan chorvachilik hududlari sifatida rivojlantirish maqsadga muvofiq.

Xulosa. Shunday qilib, Qashqadaryo viloyatida chorvachilikni rivojlantirishning hududiy strategiyasi barcha tumanlar uchun bir xil bo‘lmasligi kerak. Yaylov resurslari yuqori bo‘lgan hududlarda ekstensiv va yarim intensiv yaylov chorvachiligi, yaylov resurslari cheklangan hududlarda esa intensiv chorvachilik modelini rivojlantirish maqsadga muvofiq. Eng muhimi, mavjud 1,405 mln gektarlik pichanzor va yaylov resurslarini oddiy yer maydoni sifatida emas, balki chorvachilikning hududiy ozuqa bazasi sifatida baholash zarur. Bunda yaylovlarning maydoni bilan bir qatorda ularning mahsuldorligi, chorva bosh soni, suv ta’minoti, infratuzilma, mehnat resurslari va qayta ishlash imkoniyatlarini kompleks baholash Qashqadaryo viloyatida chorvachilik tarmog‘ini hududiy tashkil etish samaradorligini oshirishga xizmat qiladi.

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Nurmatov A.U., g.f.f.d. (PhD)
geografiya kafedrasi katta o‘qituvchisi
Xudoyberdiyev B.Sh.
talaba
Bozorova N.O.
talaba
Dusiyarova M.B.
talaba
Shahrisabz davlat pedagogika instituti
O‘zbekiston, Shahrisabz

UMUMIY O‘RTA TA’LIMNI MOLIYALASHTIRISH VA UNING IQTISODIY SAMARADORLIGI (QASHQADARYO VILOYATI MISOLIDA)

Annotatsiya. Maqolada Qashqadaryo viloyati misolida umumiy o‘rta ta’limni moliyalashtirish holati va uning iqtisodiy samaradorligi tahlil qilingan. Ta’lim xarajatlarining YaIM va davlat budjetidagi ulushi, bir o‘quvchiga to‘g‘ri keladigan mablag‘ hamda moliyalashtirishning hududiy xususiyatlari o‘rganilgan. Shuningdek, ta’lim infratuzilmasiga yo‘naltirilgan mablag‘larning inson kapitali va hududiy iqtisodiy rivojlanishga ta’siri yoritilgan.

Kalit so‘zlar: Umumiy o‘rta ta’lim, moliyalashtirish, ta’lim xarajatlari, iqtisodiy samaradorlik, yalpi ichki mahsulot, davlat budjeti, bir o‘quvchiga xarajat, ta’lim infratuzilmasi, inson kapitali.

Nurmatov A.U., PhD in Geographical Sciences
senior lecturer
Department of Geography
Xudoyberdiyev B.Sh.
student
Bozorova N.O.
student
Dusiyarova M.B.
student
Shahrisabz State Pedagogical Institute
Uzbekistan, Shahrisabz

FINANCING GENERAL SECONDARY EDUCATION AND ITS ECONOMIC EFFICIENCY (A CASE STUDY OF KASHKADARYA REGION)

Abstract. The article analyzes the state of general secondary education financing and its economic efficiency, using the Kashkadarya region as a case study. It examines the share of education expenditures within GDP and the state budget,

per-pupil funding, and regional financing characteristics. Additionally, the article highlights the impact of funds allocated to educational infrastructure on human capital and regional economic development.

Keywords: General secondary education, financing, education expenditures, economic efficiency, gross domestic product, state budget, expenditure per student, educational infrastructure, human capital.

Bugungi kunda ta’lim tizimini rivojlantirish mamlakatning ijtimoiy-iqtisodiy taraqqiyotini ta’minlovchi muhim omillardan biri sifatida namoyon bo‘lmoqda. Ayniqsa, umumiy o‘rta ta’lim tizimining barqaror faoliyat yuritishi va uning zamonaviy talablarga mos ravishda rivojlanishi jamiyatning intellektual salohiyati, mehnat resurslarining sifat tarkibi hamda hududlarning iqtisodiy rivojlanish imkoniyatlari bilan bevosita bog‘liq. Ta’lim xizmatlarining sifati nafaqat pedagogik jarayonning mazmuni va o‘qituvchilarning kasbiy salohiyatiga, balki ta’lim muassasalarining moddiy-texnik bazasi, bino va inshootlarning holati, o‘quv jihozlari, axborot-kommunikatsiya texnologiyalari, energiya ta’minoti va boshqa infratuzilmaviy omillarga ham bog‘liq. Shu sababli umumiy o‘rta ta’limni moliyalashtirish masalasi faqat ijtimoiy soha xarajatlari sifatida emas, balki uzoq muddatli iqtisodiy rivojlanishga xizmat qiluvchi investitsiya sifatida ham qaralishi lozim [1, 3, 5].

Ta’limga yo‘naltiriladigan moliyaviy mablag‘larning hajmi va ulardan foydalanish samaradorligi mamlakat hamda uning hududlarida inson kapitalining shakllanishiga ta’sir etuvchi asosiy omillardan biridir. Inson kapitali zamonaviy iqtisodiyot sharoitida ishlab chiqarishning muhim omili bo‘lib, aholining bilim darajasi, kasbiy ko‘nikmalari, mehnat unumdorligi va innovatsion faoliyatga moslashuvchanligi bilan tavsiflanadi. Umumiy o‘rta ta’lim bosqichi esa inson kapitalining boshlang‘ich va fundamental asoslarini shakllantiradigan tizim hisoblanadi. Mazkur bosqichda olingan bilim va ko‘nikmalar keyingi kasbiy ta’lim, oliy ta’lim hamda mehnat faoliyatining samaradorligiga zamin yaratadi. Shuning uchun umumiy o‘rta ta’lim tizimiga sarflanadigan mablag‘larning hajmi, tarkibi va hududiy taqsimlanishini o‘rganish iqtisodiy geografik tadqiqotlar uchun ham muhim ilmiy-amaliy ahamiyat kasb etadi.

O‘zbekiston sharoitida ta’lim tizimini rivojlantirish davlat ijtimoiy siyosatining ustuvor yo‘nalishlaridan biri hisoblanadi. Aholi sonining o‘sishi, urbanizatsiya jarayonlarining jadallashuvi, hududlarda yangi turar joy massivlarining shakllanishi va demografik tarkibdagi o‘zgarishlar umumiy o‘rta ta’lim xizmatlariga bo‘lgan talabning ortishiga olib kelmoqda. Natijada mavjud maktablar tarmog‘ini kengaytirish, yangi ta’lim muassasalarini barpo etish, mavjud binolarni rekonstruksiya qilish va kapital ta’mirlash, maktablarni zamonaviy o‘quv jihozlari bilan ta’minlash hamda raqamli infratuzilmani rivojlantirish uchun qo‘shimcha moliyaviy resurslarga ehtiyoj yuzaga kelmoqda. Bu jarayon, o‘z navbatida, ta’lim xarajatlarini hududlar kesimida ilmiy asosda rejalashtirish va mavjud mablag‘lardan samarali foydalanish masalasini dolzarb qilib qo‘ymoqda [2,4].

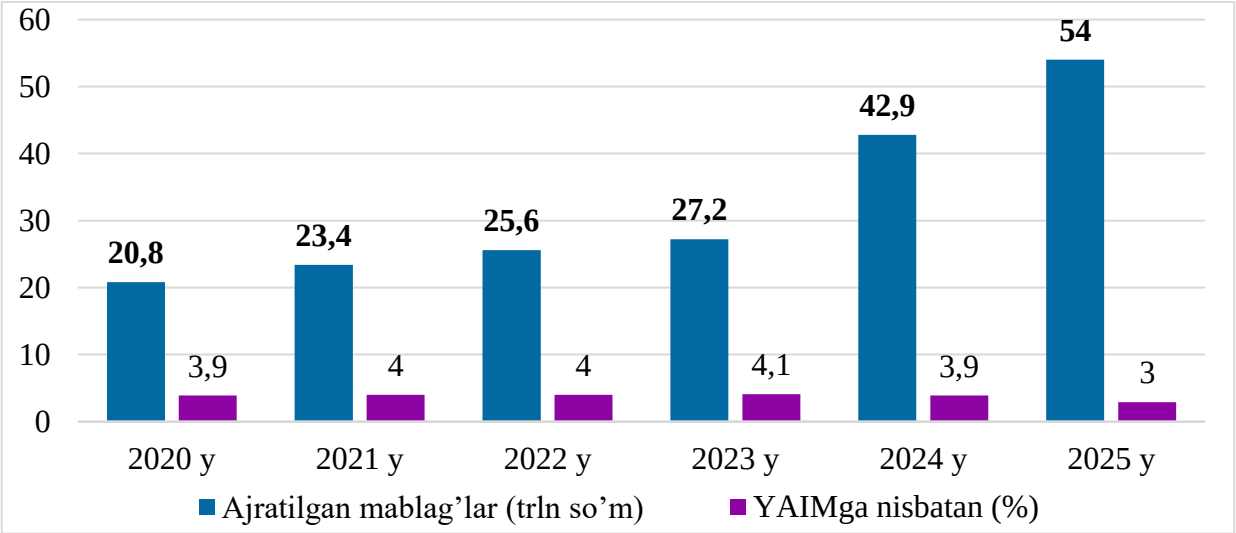
Umumiy o‘rta ta’limni moliyalashtirish samaradorligini baholashda faqat jami ajratilgan mablag‘lar miqdorini aniqlash yetarli emas. Moliyalashtirishning real natijasini baholash uchun bir qator nisbiy va tarkibiy ko‘rsatkichlardan foydalanish zarur. Jumladan, ta’lim xarajatlarining yalpi ichki mahsulotdagi ulushi, davlat budjeti xarajatlaridagi salmog‘i, bir maktabga va bir o‘quvchiga to‘g‘ri keladigan mablag‘ miqdori, ta’lim infratuzilmasining moddiy-texnik ta’minlanganlik darajasi kabi ko‘rsatkichlar ta’lim tizimining moliyaviy imkoniyatlarini hududiy jihatdan taqqoslash imkonini beradi. Ayniqsa, bir o‘quvchiga to‘g‘ri keladigan xarajat ko‘rsatkichi hududlar o‘rtasidagi moliyalashtirish darajasini qiyosiy baholashda muhim ahamiyatga ega. Chunki umumiy mablag‘ miqdori yuqori bo‘lgan hududda o‘quvchilar sonining ko‘pligi sababli bir o‘quvchiga to‘g‘ri keladigan xarajat nisbatan past bo‘lishi mumkin.

Qashqadaryo viloyati ushbu masalani hududiy jihatdan o‘rganish uchun muhim tadqiqot obyekti hisoblanadi. Viloyatda aholi sonining nisbatan yuqori sur’atlarda o‘sishi, qishloq aholisi salmog‘ining yuqoriligi, aholi joylashuvining hududiy tafovutlari hamda ayrim tog‘oldi va tog‘li hududlarda aholi punktlarining tarqoq joylashuvi umumiy o‘rta ta’lim muassasalari tarmog‘ining shakllanishiga o‘ziga xos ta’sir ko‘rsatadi. Mazkur xususiyatlar ta’lim muassasalarini moliyalashtirishda hududiy yondashuvdan foydalanishni talab etadi. Chunki aholisi zich joylashgan hududlarda o‘quvchilar sonining ko‘pligi maktablarning sig‘imini oshirish va mavjud infratuzilmani kengaytirishni talab qilsa, aholisi tarqoq joylashgan hududlarda maktablarning nisbatan kichik kontingent bilan faoliyat yuritishi, transport va muhandislik-kommunikatsiya infratuzilmasini saqlash bilan bog‘liq xarajatlarning ortishi kuzatilishi mumkin.

Qashqadaryo viloyatida umumiy o‘rta ta’lim muassasalari sonining o‘zgarishi ham ta’lim infratuzilmasiga bo‘lgan talabning ortib borayotganini ko‘rsatadi. Tadqiqot ma’lumotlariga ko‘ra, viloyatda umumta’lim maktablari soni 2011-yildagi 1116 tadan 2024-yilda 1256 taga yetgan. Ya’ni, mazkur davrda maktablar soni 140 taga ko‘paygan. Bu o‘zgarish hududda ta’lim xizmatlariga bo‘lgan talabning o‘sishi bilan bir qatorda, ta’lim infratuzilmasini rivojlantirish uchun qo‘shimcha moliyaviy resurslarni jalb qilish zaruratini ham ko‘rsatadi. Shu bilan birga, maktablar sonining ko‘payishi moliyalashtirish hajmini avtomatik ravishda samarali deb baholash uchun yetarli emas. Muhimi, ajratilgan mablag‘larning maktablar, o‘quvchilar va hududlar o‘rtasida qanday taqsimlanayotgani hamda ushbu mablag‘lar evaziga ta’lim xizmatlari sifati va infratuzilmaviy imkoniyatlarning qay darajada yaxshilanayotganini aniqlashdir. Ta’limni moliyalashtirish va iqtisodiy samaradorlik o‘rtasidagi bog‘liqlikni bir necha yo‘nalishda ko‘rib chiqish mumkin. Birinchidan, ta’limga sarflangan mablag‘lar maktablarning moddiy-texnik bazasini yaxshilash orqali ta’lim jarayonining samaradorligini oshiradi [2, 4]. Zamonaviy laboratoriyalar, kompyuter texnikasi, internet tarmoqlari, elektron ta’lim resurslari va boshqa o‘quv vositalari o‘quvchilarning bilim va amaliy ko‘nikmalarini shakllantirish imkoniyatlarini kengaytiradi. Ikkinchidan, ta’lim infratuzilmasiga investitsiyalar inson kapitalining sifatini oshirishga xizmat qiladi. Uzoq muddatli istiqbolda bu jarayon malakali

mehnat resurslarining shakllanishi, mehnat unumdorligining oshishi va iqtisodiyotning turli tarmoqlarida innovatsiyalarni o‘zlashtirish imkoniyatlarining kengayishi bilan bog‘lanadi. Uchinchidan, ta’lim infratuzilmasining hududiy jihatdan oqilona joylashtirilishi aholining ta’lim xizmatlaridan foydalanish imkoniyatlarini yaxshilaydi va hududlar o‘rtasidagi ijtimoiy-iqtisodiy tafovutlarni kamaytirishga xizmat qilishi mumkin. Shu nuqtayi nazardan, ta’lim xarajatlarini yalpi ichki mahsulot va davlat budjeti xarajatlari bilan bog‘liq holda tahlil qilish muhimdir. Ta’limga ajratilayotgan mablag‘larning YaIMdagi ulushi mamlakat iqtisodiyoti tomonidan ta’lim sohasiga yo‘naltirilayotgan resurslarning nisbiy miqyosini ifodalaydi. Biroq ushbu ko‘rsatkichni ta’lim tizimining yakuniy samaradorligi sifatida talqin qilish to‘g‘ri emas. U faqat moliyaviy ustuvorlik darajasini ifodalaydi. Samaradorlikni aniqlash uchun moliyaviy resurslarning natijadorlik ko‘rsatkichlari, xususan, o‘quvchilar qamrovi, maktablarning moddiy-texnik ta’minoti, ta’lim sifati, bir o‘quvchiga to‘g‘ri keladigan xarajatlar va boshqa indikatorlar bilan birgalikda tahlil qilish talab etiladi. Bir o‘quvchiga to‘g‘ri keladigan mablag‘ miqdorini aniqlash ayniqsa muhim ko‘rsatkichlardan biridir. Ushbu indikator hududning demografik xususiyatlari va ta’lim tarmog‘ining moliyaviy yuklamasini birgalikda baholash imkonini beradi. Masalan, o‘quvchilar soni tez o‘sayotgan hududlarda mavjud moliyalashtirish hajmi saqlanib qolgan taqdirda bir o‘quvchiga to‘g‘ri keladigan mablag‘ kamayishi mumkin. Aksincha, o‘quvchilar soni kam yoki kamayib borayotgan hududlarda maktab infratuzilmasini saqlash uchun doimiy xarajatlarning mavjudligi bir o‘quvchiga to‘g‘ri keladigan xarajatlarning yuqorilashiga olib kelishi mumkin. Demak, ushbu ko‘rsatkichni hududlarning demografik va geografik xususiyatlari bilan birgalikda o‘rganish zarur. Qashqadaryo viloyatining turli hududlarida maktablar tarmog‘i, o‘quvchilar soni, aholi zichligi, transport imkoniyatlari va infratuzilmaviy ta’minot darajasining bir-biridan farq qilishi moliyalashtirish samaradorligini hududiy kesimda o‘rganishni taqozo etadi. Xususan, tog‘li va chekka hududlarda ta’lim muassasalarini saqlash, energiya va transport bilan ta’minlash, malakali pedagoglarni jalb qilish bilan bog‘liq xarajatlar yuqori bo‘lishi mumkin. Aholi zich joylashgan hududlarda esa maktablarning sig‘imi, o‘quvchilar soni va ta’lim infratuzilmasiga tushadigan yuklama yuqori bo‘ladi. Shu sababli barcha hududlar uchun bir xil moliyalashtirish yondashuvidan ko‘ra, hududning demografik, iqtisodiy-geografik va infratuzilmaviy xususiyatlarini hisobga oluvchi differensial yondashuv muhim ahamiyat kasb etadi.

O‘zbekistonda davlat budjet xarajatlaridan umumta’lim maktablari uchun 54 trillion so‘m ajratildi. Bu davlat budjeti xarajatlarining 15,7 foizini, mamlakat yalpi ichki mahsulotining 3 % ini tashkil etadi (1-rasm).



1-rasm. O‘zbekistonda umumta’lim maktablariga ajratilgan mablag‘lar va uning YAIMga nisbatan ulushi (yillar kesimida).

Bu raqamlar respublika bo‘yicha ta’lim sohasiga ajratilgan mablag‘ (84,3 trillion so‘m)ning katta qismini ya’ni 64 % ini tashkil etadi. Jahon bo‘yicha ham ta’limga ajratilgan mablag‘ning 60-70 % qismi umumta’lim muassasalariga ajratiladi. Shuningdek, UNESCO va Jahon Bankida ko‘rsatilgan metodikada ham o‘rtacha rivojlanishdagi davlatlarda moliyalashtirishda yalpi ichki mahsulotning 2,5-4 % qismi umumta’lim maktablariga ajratilishi o‘rtacha daraja qilib berilgan.

Ushbu moliyaviy resurslarning 70-72 foizi o‘qituvchilarga ish haqi to‘lashga yo‘naltiriladi, qolgan qismi esa binolarni joriy ta’mirlash, kommunal xizmatlar va boshqa texnik xarajatlarga sarflanadi. Innovatsion texnologiyalar, raqamli ta’lim vositalari va metodik ta’minot uchun esa atigi 4-6 % atrofida mablag‘ ajratiladi. Bu esa maktablarning zamonaviy ta’lim talablariga mos holatda faoliyat yuritishini sezilarli darajada cheklaydi [6, 9].

Respublika bo‘yicha umumta’lim maktablariga ajratilgan mablag‘larning Qashqadaryo viloyatiga 1.5 trillion so‘m qismi to‘g‘ri kelgan holda, bu umumiy mablag‘ning 2,8 % iga teng. Dunyo bo‘yicha o‘rtacha umumta’lim muassasalari uchun ajratilgan mablag‘lar umumiy YAIMning 3,3 % qismini tashkil etib, rivojlanish xususiyatiga ko‘ra turli davlatlarda turlicha ko‘rsatkichga ega. Masalan,.

Tahlillarga ko‘ra, O‘zbekistonda umumta’lim maktablariga ajratilgan mablag‘larning umumiy qiymatini respublikadagi umumiy maktablar soniga hisoblaganda, har bir maktabga o‘rtacha 4 mlrd 941 mln so‘m bo‘lgani holda, bu raqam Qashqadaryo viloyatida 1 mlrd 194 mln so‘mni tashkil etadi. Taqqoslash sifatida hududlar turlicha ko‘rsatkichga – Toshkent shahri 34 mlrd so‘m, Farg‘ona viloyati 2,1 mlrd so‘m, Samarqand viloyati 1,9 mlrd so‘m, Jizzax viloyati 0,9 mlrd so‘mga teng. Mamlakatda Qashqadaryo viloyati umumiy maktablar soni (1256 ta) bo‘yicha Samarqand viloyatidan (1335 ta) keyingi o‘rinda tursada, umumta’lim maktablari uchun ajratilgan umumiy mablag‘ jihatidan 8-o‘rinda, har bir maktabga to‘g‘ri keladigan mablag‘lar bo‘yicha 9-o‘rinda turadi. Bu mablag‘lardan har bir

o‘quvchi uchun yillik ajratma respublika bo‘yicha 8 million so‘mni tashkil etadi. Bu o‘rtacha ko‘rsatkich bo‘lib, hududlar kesimida ham turlichadir. Masalan, Toshkent shahrida 30 mln so‘m, Jizzax viloyatida 3,2 mln so‘m, Qashqadaryo viloyatida 2,2 mln so‘mga teng.

O‘zbekistonda umumta’lim maktablarini moliyalashtirish hajmi yildan-yilga oshib bormoqda. Davlat budjetidan ta’lim sohasiga ajratilayotgan mablag‘larning ko‘payishi maktablar moddiy-texnik bazasini mustahkamlash, yangi ta’lim muassasalarini qurish, mavjudlarini rekonstruksiya qilish hamda zamonaviy o‘quv vositalari bilan ta’minlash imkoniyatlarini kengaytirmoqda. Xususan, Qashqadaryo viloyatida ham umumiy o‘rta ta’lim tizimini moliyalashtirish hajmi ortib borayotgani kuzatiladi. Viloyat maktablariga ajratilayotgan mablag‘lar hajmining oshishi natijasida ta’lim muassasalarining moddiy-texnik ta’minoti yaxshilanib, o‘quv jarayoni uchun zarur shart-sharoitlarni yaratish imkoniyatlari kengaymoqda.

Shuningdek, umumta’lim maktablariga ajratilgan mablag‘larning yalpi ichki mahsulotdagi ulushi ta’lim tizimining mamlakat ijtimoiy-iqtisodiy rivojlanishidagi ustuvor yo‘nalishlardan biri ekanligini tasdiqlaydi. Qashqadaryo viloyatida har bir o‘quvchiga to‘g‘ri keladigan ta’lim xarajatlari ko‘rsatkichining tahlili hududlar kesimida moliyalashtirish darajasi va ta’lim xizmatlari bilan ta’minlanganlik holatini baholash imkonini beradi. Mazkur ko‘rsatkichlarning o‘sib borishi ta’lim sifatini oshirish, hududlar o‘rtasidagi ijtimoiy tenglikni ta’minlash hamda inson kapitalini rivojlantirishga xizmat qiladi. Shu bois kelgusida mablag‘larni hududlarning demografik va infratuzilmaviy ehtiyojlaridan kelib chiqib taqsimlash, har bir o‘quvchiga to‘g‘ri keladigan xarajatlar samaradorligini oshirish ta’lim tizimini yanada takomillashtirishning muhim omillaridan biri hisoblanadi.

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Nurmatov N.E.
geografiya kafedrasi o‘qituvchisi
Abdullayev D.D.
geografiya va iqtisodiy bilim asoslari yo‘nalishi talabasi
Xudoyberdiyev U.U.
geografiya va iqtisodiy bilim asoslari yo‘nalishi talabasi
Shahrisabz davlat pedagogika instituti
O‘zbekiston, Shahrisabz

QASHQADARYO VILOYATIDA CHORVACHILIK TARMOG‘INING HUDUDIY TASHKIL ETILISHINI TAKOMILLASHTIRISHNING IQTISODIY-GEOGRAFIK MODELI

Annotatsiya. Maqolada Qashqadaryo viloyatida chorvachilik tarmog‘ining hududiy tashkil etilishini takomillashtirishning nazariy va iqtisodiy-geografik asoslari yoritilgan. Chorvachilik tarmog‘ining hududiy rivojlanishiga ta’sir etuvchi tabiiy, ijtimoiy-iqtisodiy va ishlab chiqarish omillarining o‘zaro bog‘liqligi hamda ularni yagona tizim sifatida baholash masalalari tahlil qilingan.

Kalit so‘zlar: Hududiy tashkil etish, iqtisodiy geografik omillar, hududiy ixtisoslashuv, yaylov, ozuqa bazasi, infratuzilma, logistika, GIS, iqtisodiy samaradorlik, hududiy rivojlanish.

Nurmatov N.E.
Lecturer
Department of Geography
Abdullayev D.D.
Student
Geography and Fundamentals of Economic Knowledge
Khudoyberdiyev U.U.
Student
Geography and Fundamentals of Economic Knowledge
Shahrisabz State Pedagogical Institute
Uzbekistan, Shahrisabz

AN ECONOMIC-GEOGRAPHIC MODEL FOR IMPROVING THE TERRITORIAL ORGANIZATION OF THE LIVESTOCK SECTOR IN THE KASHKADARYA REGION

Abstract. The article outlines the theoretical and economic-geographic foundations for improving the territorial organization of the livestock sector in the Kashkadarya region. It analyzes the interrelationships between the natural, socio-economic, and production factors influencing the territorial development of the livestock sector, as well as issues regarding their assessment as a unified system.

Keywords: Territorial organization, economic-geographic factors, territorial specialization, pasture, feed base, infrastructure, logistics, GIS, economic efficiency, territorial development.

Chorvachilik qishloq xo‘jaligining muhim tarkibiy qismlaridan biri bo‘lib, mamlakat va hududlar iqtisodiy taraqqiyotida alohida o‘rin tutadi. Mazkur tarmoq aholini oziq-ovqat mahsulotlari bilan ta’minlash, qayta ishlash sanoatini zarur xomashyo bilan ta’minlash, qishloq joylarda aholi bandligini oshirish, daromad manbalarini kengaytirish hamda hududlarning ijtimoiy-iqtisodiy barqarorligini ta’minlashda muhim ahamiyatga ega. Shu bilan birga, chorvachilikning rivojlanishi hududlarning tabiiy va iqtisodiy sharoitlari bilan chambarchas bog‘liq bo‘lib, uning hududiy tashkil etilishi har bir hududning mavjud resurslari, ishlab chiqarish imkoniyatlari va bozor sharoitlarini hisobga olgan holda amalga oshirilishini talab etadi. Qashqadaryo viloyati chorvachilikni rivojlantirish uchun katta tabiiy va iqtisodiy imkoniyatlarga ega bo‘lgan hududlardan biridir. Viloyat hududining tabiiy sharoiti g‘arbiy va markaziy qismlardagi cho‘l hamda quruq dasht hududlaridan sharqiy va janubi-sharqiy qismlardagi tog‘oldi va tog‘li hududlargacha bo‘lgan turli tabiiy geografik sharoitlarning mavjudligi bilan tavsiflanadi. Bunday hududiy xilma-xillik chorvachilikning turli yo‘nalishlarini rivojlantirish uchun differensial sharoitlarni yuzaga keltiradi. Shu sababli viloyatda chorvachilikni rivojlantirishda barcha hududlarga bir xil yondashuvdan foydalanish emas, balki hududlarning tabiiy, ijtimoiy-iqtisodiy va ishlab chiqarish imkoniyatlaridan kelib chiqib ixtisoslashuvni shakllantirish muhim hisoblanadi.

Chorvachilikning hududiy tashkil etilishida, avvalo, tabiiy omillar muhim o‘rin egallaydi. Iqlim sharoiti, yer resurslari, yaylov va pichanzorlarning mavjudligi, suv resurslari hamda agroiqlimiy sharoitlar chorva mollarini joylashtirish va boqish imkoniyatlarini belgilab beradi. Ayniqsa, tabiiy yaylovlarning maydoni va sifati qo‘y va echkichilik kabi yaylov chorvachiligiga ixtisoslashgan tarmoqlarni rivojlantirish uchun asosiy shartlardan biri hisoblanadi. Qashqadaryo viloyatining cho‘l hududlarida keng yaylov maydonlarining mavjudligi ushbu hududlarda qo‘ychilik va echkichilikni rivojlantirish uchun muayyan imkoniyatlarni yaratadi. Biroq yaylovlardan samarali foydalanish faqat ularning maydoniga emas, balki o‘simlik qoplamining holati, suv manbalarining mavjudligi, yaylovlarning mavsumiy foydalanish imkoniyatlari va chorva yuklamasining me’yoriy darajasiga ham bog‘liqdir. Tog‘oldi va tog‘li hududlarning tabiiy sharoiti esa chorvachilikning boshqa yo‘nalishlarini rivojlantirish uchun qulay imkoniyatlarni shakllantiradi. Ushbu hududlarda tabiiy ozuqa resurslari, relyef va iqlim sharoitlarining o‘ziga xosligi qoramolchilikni rivojlantirish uchun muayyan imkoniyatlar yaratadi. Ayniqsa, tog‘oldi hududlarida chorvachilikni qishloq xo‘jaligining boshqa tarmoqlari bilan uyg‘unlashtirish, yem-xashak yetishtirish va chorva mahsulotlarini ishlab chiqarishning hududiy tizimini shakllantirish mumkin. Sug‘oriladigan hududlarda esa suv resurslari, yem-xashak ekinlarini yetishtirish imkoniyati, aholi zichligi, transport tarmoqlarining

rivojlanganligi va iste’mol bozorlariga yaqinlik kabi omillar intensiv chorvachilikni rivojlantirish uchun qulay sharoit yaratadi.

Chorvachilikning hududiy tashkil etilishiga ta’sir ko‘rsatuvchi omillarni faqat tabiiy sharoit bilan cheklab qo‘yish mumkin emas. Zamonaviy iqtisodiy geografik yondashuvda tabiiy resurslar bilan bir qatorda aholining soni va joylashuvi, mehnat resurslarining mavjudligi va malakasi, transport infratuzilmasi, ishlab chiqarish infratuzilmasi, kapital, bozor va xizmat ko‘rsatish tizimlari ham muhim ahamiyat kasb etadi. Chorvachilikning rivojlanishi uchun yetarli mehnat resurslarining mavjudligi, ayniqsa, hayvonlarni parvarish qilish, naslchilik ishlarini olib borish, veterinariya xizmatlarini tashkil etish va zamonaviy texnologiyalardan foydalanishda katta ahamiyatga ega. Shu bilan birga, transport tizimining rivojlanganligi chorvachilik mahsulotlarini ishlab chiqarish hududlaridan iste’mol bozorlari va qayta ishlash korxonalariga o‘z vaqtida yetkazib berish imkonini beradi.

Qashqadaryo viloyatida chorvachilikni hududiy tashkil etishning samaradorligi ko‘p jihatdan ishlab chiqarish omillarining o‘zaro uyg‘unlashganligiga bog‘liq. Ozuqa bazasining barqarorligi, chorvachilik xo‘jaliklarining texnik va texnologik ta’minlanganligi, logistika tizimining rivojlanganligi, veterinariya va naslchilik xizmatlarining mavjudligi, mahsulotlarni saqlash va qayta ishlash imkoniyatlari tarmoqning iqtisodiy samaradorligini belgilovchi asosiy omillardan hisoblanadi. Ayniqsa, chorvachilikda ozuqa bazasi ishlab chiqarishning uzluksizligini ta’minlovchi asosiy shart sifatida namoyon bo‘ladi. Ozuqa yetishmovchiligi yoki uning hududiy jihatdan noto‘g‘ri tashkil etilishi chorva mahsuldorligining pasayishiga, ishlab chiqarish xarajatlarining oshishiga va xo‘jaliklarning iqtisodiy samaradorligi kamayishiga olib kelishi mumkin. Shu jihatdan chorvachilikni hududiy tashkil etishda tabiiy va iqtisodiy omillarni alohida emas, balki o‘zaro bog‘liq tizim sifatida ko‘rib chiqish maqsadga muvofiq. Tabiiy resurslar ishlab chiqarishning boshlang‘ich asosini tashkil etsa, ijtimoiy-iqtisodiy sharoitlar ushbu resurslardan foydalanish imkoniyatlarini belgilaydi. Ishlab chiqarish infratuzilmasi esa mavjud resurslarni iqtisodiy mahsulotga aylantirish jarayonini ta’minlaydi. Natijada chorvachilik mahsulotlari ishlab chiqarish, qayta ishlash, saqlash, tashish va iste’molchiga yetkazib berish jarayonlari yagona hududiy-iqtisodiy tizimni hosil qiladi.

Taklif etilayotgan iqtisodiy-geografik modelning asosiy mazmuni ham aynan ana shu o‘zaro bog‘liqlikni ta’minlashdan iborat. Mazkur yondashuvda yer, suv, yaylov, mehnat resurslari, kapital va infratuzilma chorvachilikning boshlang‘ich resurs bazasi sifatida qaraladi. Ushbu resurslar ishlab chiqarish jarayonida oziqlantirish tizimi, texnologik jarayonlar, chorva mahsulotlarini yetishtirish, logistika, ta’minot va qayta ishlash faoliyati bilan birlashadi. Natijada go‘sht, sut, tuxum va boshqa chorvachilik mahsulotlarini ishlab chiqarish hajmi, xo‘jaliklarning daromadliligi, ishlab chiqarish samaradorligi, raqobatbardoshligi va hududning iqtisodiy barqarorligi shakllanadi. Shu sababli chorvachilikning hududiy tashkil etilishini faqat chorva mollarining hududiy joylashuvi bilan izohlash yetarli emas.

U ishlab chiqarish, qayta ishlash, transport, bozor va iste’mol jarayonlarini ham qamrab oladigan murakkab hududiy tizim sifatida qaralishi lozim.

Viloyat chorvachiligini hududiy jihatdan tashkil etishda zonal yondashuvdan foydalanish ham muhim ilmiy-amaliy ahamiyatga ega. Hududlarning tabiiy sharoiti va iqtisodiy imkoniyatlaridan kelib chiqib, cho‘l, tog‘oldi va sug‘oriladigan hududlarning o‘ziga xos chorvachilik ixtisoslashuvini shakllantirish mumkin. Cho‘l hududlarida tabiiy yaylovlardan foydalanishga asoslangan qo‘ychilik va echkichilikni rivojlantirish ustuvor yo‘nalish bo‘lishi mumkin. Tog‘oldi hududlarida qoramolchilik, ayniqsa, go‘sht va sut yo‘nalishlarini rivojlantirish uchun mavjud tabiiy va iqtisodiy imkoniyatlardan foydalanish maqsadga muvofiq. Sug‘oriladigan hududlarda esa yem-xashak bazasi, suv resurslari, aholi va iste’mol bozorlari yaqinligi hisobiga intensiv qoramolchilik, sut chorvachiligi va parrandachilikni rivojlantirish uchun imkoniyatlar mavjud.

Bunday hududiy ixtisoslashuv chorvachilikni bir xil shaklda rivojlantirishdan ko‘ra iqtisodiy jihatdan samaraliroq hisoblanadi. Chunki har bir hududda mavjud resurslardan eng maqbul foydalanish imkoniyati paydo bo‘ladi. Natijada ishlab chiqarish xarajatlarini kamaytirish, mahsuldorlikni oshirish, transport masofalarini qisqartirish, ozuqa bazasidan oqilona foydalanish va qayta ishlash korxonalarini xomashyo manbalariga yaqinlashtirish imkoniyati yuzaga keladi. Chorvachilikning hududiy salohiyatini baholashda ham kompleks yondashuv zarur. Hududlarni faqat chorva mollari soni yoki ishlab chiqarilgan mahsulot hajmi asosida taqqoslash hududning haqiqiy salohiyatini to‘liq aks ettirmaydi. Chunki chorva soni yuqori bo‘lgan hududda mahsuldorlik past bo‘lishi yoki infratuzilma yetarli darajada rivojlanmagan bo‘lishi mumkin. Aksincha, chorva soni nisbatan kam bo‘lgan, ammo ozuqa bazasi, texnologik ta’minot, mehnat resurslari va qayta ishlash imkoniyatlari yuqori hududda kelgusida chorvachilikni rivojlantirish salohiyati katta bo‘lishi mumkin. Shu sababli hududlarni baholashda ozuqa bazasi, mahsuldorlik, infratuzilma, mehnat resurslari, resurslardan foydalanish darajasi va ishlab chiqarish samaradorligini o‘zaro bog‘liq holda tahlil qilish zarur.

Bunday kompleks baholash hududlar o‘rtasidagi farqlarni aniqlash va ularni rivojlanish darajasiga ko‘ra guruhlash imkonini beradi. Natijada chorvachilik salohiyati yuqori bo‘lgan hududlarda ishlab chiqarishni kengaytirish, o‘rta salohiyatga ega hududlarda mavjud imkoniyatlardan foydalanish samaradorligini oshirish, nisbatan past salohiyatli hududlarda esa infratuzilma va resurs bazasini rivojlantirishga yo‘naltirilgan chora-tadbirlarni ishlab chiqish mumkin. Hududiy ixtisoslashuvni aniqlashda ishlab chiqarishning hududiy konsentratsiyasi va ixtisoslashuv darajasini baholash ham muhimdir. Bu yondashuv orqali qaysi hududlarda chorvachilikning muayyan yo‘nalishi yetakchi mavqega ega ekanligi aniqlanadi. Natijada viloyat miqyosida chorvachilik yo‘nalishlarini oqilona taqsimlash, hududlarning bir-birini to‘ldiruvchi ishlab chiqarish tizimlarini shakllantirish imkoniyati yuzaga keladi. Masalan, bir hududda chorva ozuqasi yetishtirishga, boshqa hududda chorva mahsulotlarini ishlab chiqarishga, yana bir hududda esa qayta ishlash va logistika faoliyatiga ustuvorlik berilishi mumkin. Bunday hududiy mehnat taqsimoti viloyat chorvachiligining yagona iqtisodiy tizim

sifatida rivojlanishiga xizmat qiladi. Chorvachilikni hududiy tashkil etishda geografik axborot tizimlaridan foydalanish ham alohida ahamiyatga ega. GIS texnologiyalari yordamida yaylovlar, pichanzorlar, suv manbalari, qishloq xo‘jaligi yerlari, chorvachilik xo‘jaliklari, transport tarmoqlari, qayta ishlash korxonalari va iste’mol bozorlari o‘rtasidagi hududiy aloqalarni yagona tizimda ko‘rsatish mumkin. Bu esa hududlarning chorvachilik salohiyatini xaritalash, ishlab chiqarishni joylashtirish uchun qulay hududlarni aniqlash va mavjud resurslardan foydalanish samaradorligini hududiy jihatdan baholash imkonini beradi. GIS asosidagi tahlil ayniqsa yaylovlardan foydalanish, chorva xo‘jaliklarini joylashtirish, yem-xashak bazasini shakllantirish va logistika yo‘nalishlarini optimallashtirishda katta ilmiy-amaliy ahamiyatga ega.

Chorvachilik tarmog‘ining hududiy tashkil etilishida ishlab chiqarish va qayta ishlash jarayonlarining o‘zaro bog‘liqligi ham muhim masalalardan biridir. Chorva mahsulotlarini faqat xomashyo sifatida sotish hudud iqtisodiyoti uchun qo‘shimcha qiymat yaratish imkoniyatlarini cheklaydi. Shu sababli go‘sht, sut, teri, jun va boshqa mahsulotlarni qayta ishlash korxonalarini rivojlantirish chorvachilik tarmog‘ining iqtisodiy samaradorligini oshirishning muhim shartidir. Qayta ishlash korxonalarining chorvachilik ishlab chiqarish hududlariga yaqin joylashtirilishi transport xarajatlarini kamaytirish, mahsulot sifatini saqlab qolish, yangi ish o‘rinlari yaratish va mahalliy iqtisodiyotda qo‘shimcha qiymatni ko‘paytirish imkonini beradi. Logistika tizimining rivojlanganligi ham chorvachilik hududiy tashkil etilishining muhim tarkibiy qismi hisoblanadi. Ayniqsa, sut va go‘sht mahsulotlari tez buziluvchanligi sababli ularni saqlash, sovutish, tashish va qayta ishlash tizimlarining samarali tashkil etilishi talab qilinadi. Shu nuqtayi nazardan, chorvachilik xo‘jaliklarini transport yo‘llari, qayta ishlash korxonalari va iste’mol bozorlari bilan bog‘lash hududiy ishlab chiqarish samaradorligini oshirishga xizmat qiladi.

Zamonaviy texnologiyalarning chorvachilikka joriy etilishi ham hududiy rivojlanishning muhim omiliga aylanmoqda. Naslchilik ishlarini takomillashtirish, chorva hayvonlarining mahsuldorligini monitoring qilish, oziqlantirish jarayonlarini optimallashtirish, veterinariya xizmatlarini raqamlashtirish va ishlab chiqarish jarayonlarini avtomatlashtirish orqali hududlarda chorvachilik samaradorligini oshirish mumkin. Shu bilan birga, innovatsion texnologiyalarning joriy etilishi hududlarning iqtisodiy imkoniyatlari va infratuzilma darajasiga mos ravishda amalga oshirilishi lozim. Qashqadaryo viloyatida chorvachilikni rivojlantirishda resurslardan foydalanish samaradorligi va ekologik barqarorlik masalalariga ham alohida e’tibor qaratish zarur. Yaylovlardan me’yoridan ortiq foydalanish, suv resurslaridan samarasiz foydalanish, ozuqa bazasining qisqarishi va tabiiy yaylovlarning degradatsiyaga uchrashi uzoq muddatda chorvachilik rivojlanishiga salbiy ta’sir ko‘rsatishi mumkin. Shu sababli chorvachilikni hududiy tashkil etish jarayonida iqtisodiy samaradorlik bilan bir qatorda tabiiy resurslarni saqlash va ulardan kelajak avlodlar uchun oqilona foydalanish tamoyili ham asosiy mezon sifatida qaralishi lozim.

Xulosa. Qashqadaryo viloyatida chorvachilik tarmog‘ining hududiy tashkil etilishi tabiiy, ijtimoiy-iqtisodiy va ishlab chiqarish omillarining murakkab o‘zaro ta’siri natijasida shakllanadi. Viloyat hududining tabiiy-geografik jihatdan xilma-xilligi chorvachilikning hududiy ixtisoslashuvi uchun turli imkoniyatlarni yuzaga keltiradi. Shu sababli chorvachilikni rivojlantirishda hududlarning o‘ziga xos tabiiy va iqtisodiy imkoniyatlarini hisobga olish, cho‘l, tog‘oldi va sug‘oriladigan hududlarning funksional ixtisoslashuvini kuchaytirish muhim ahamiyatga ega. Chorvachilik tarmog‘ining kelgusidagi rivojlanishi faqat chorva mollari sonini oshirish bilan emas, balki ozuqa bazasini mustahkamlash, mahsuldorlikni oshirish, ishlab chiqarish infratuzilmasini rivojlantirish, logistika va qayta ishlash tizimini takomillashtirish, zamonaviy texnologiyalarni joriy etish hamda mavjud tabiiy resurslardan oqilona foydalanish bilan bog‘liq bo‘lishi lozim. Hududiy ixtisoslashuvni ilmiy asosda tashkil etish esa ishlab chiqarish xarajatlarini kamaytirish, mahsulot hajmini oshirish va hududlar o‘rtasidagi iqtisodiy aloqalarni kuchaytirishga imkon beradi.

Shunday qilib, Qashqadaryo viloyatida chorvachilik tarmog‘ining hududiy tashkil etilishini iqtisodiy-geografik omillarning integratsiyasi asosida takomillashtirish resurslardan oqilona foydalanish, hududiy ixtisoslashuvni kuchaytirish, ishlab chiqarish va qayta ishlash jarayonlarini uyg‘unlashtirish, iqtisodiy samaradorlikni oshirish hamda chorvachilikning barqaror va raqobatbardosh rivojlanishini ta’minlashning muhim ilmiy-amaliy yo‘nalishi sifatida qaralishi mumkin.

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Qalandarova M.K., p.f.f.d. (PhD)
dotsent
Nizomiy nomidagi O‘zbekiston milliy pedagogika universiteti
O‘zbekiston

TOG‘ TUMANLARIDA ISTIQOMAT QILUVCHI AHOLI SALOMATLIGI HUDUDIY-TIBBIY GEOGRAFIK TAHLILI

Annotatsiya. Ushbu maqolada tog‘ va tog‘ oldi hududlarida aholi salomatligi va kasalliklarining tur va tarkibi masalalari yoritilib, aholi orasida ko‘p uchraydigan gipoksiya, yurak qon-tomir, quyosh urishi, oftalmiya, endemik bo‘qoq kabi xastaliklarining hududiy tahlili haqida ma’lumotlar keltirilgan. Tog‘li va tog‘ oldi hududlarni nozogeografik jihatdan tahlil etishda olimlarning olib borgan tadqiqotlari o’rganilib, muallifning ham o‘z qarashlari keltirilib o’tilgan.

Kalit so‘zlar: tog‘ tumanlari, aholi salomatligi, nozoiqlimiy sharoit, nozoekologik vaziyat, balandlik zonalari, rel’ef, tog‘ kasalligi, kislorod yetishmovchiligi, tog‘ vodiy hududlari, tog‘-kon sanoati.

Qalandarova M.K., PhD in Pedagogical Sciences
associate professor
National Pedagogical University
of Uzbekistan named after Nizami
Uzbekistan

REGIONAL MEDICAL GEOGRAPHICAL ANALYSIS OF THE HEALTH OF THE POPULATION RESIDING IN MOUNTAINOUS DISTRICTS

Abstract. This article examines issues concerning public health and the nature and composition of diseases in mountainous and foothill regions. It provides a regional analysis of common health conditions, including hypoxia, cardiovascular diseases, sunstroke, ophthalmic disorders, and endemic goiter. The study reviews existing research on the nosogeographical analysis of mountainous and foothill areas and presents the author’s own perspectives on the subject.

Keywords: mountainous regions, public health, nosoclimatic conditions, nosoecological situation, altitudinal zones, relief, mountain sickness, oxygen deficiency, mountain valley areas, mining industry.

Kirish. Ma’lumki, tabiatda turli xil landshaft ko‘rinishlari jumladan, quruqlik va suvliklar, cho‘llar, o‘rmonlar, tog‘, tog‘ oldi hamda tekisliklar mavjud bo‘lib, ularning barchasida insonlar o‘ziga xos tarzda joylashib, hayot kechiradilar. Har bir landshaft doirasida tashqi muhit omillarining u yoki bu turi inson jismiga ko‘proq ta’sir ko‘rsatadi. Jumladan, iqlim, relef, joylarning suv va tuproq tarkibi, o‘simlik va hayvonot olamiga o‘xshash tabiiy omillar muhim ahamiyatga ega. Yer shari aholisining salmoqli qismi doimiy ravishda tog‘oldi va tog‘li hududlarda yashaydi

yoki turli sabablarga ko‘ra ya’ni, mehnat, harbiy xizmat, tog‘ turizmi, alpinizm va boshqa sabablar tufayli ko‘chib o‘tishga majbur bo‘ladi.

Tadqiqotlarimiz shuni tasdiqlaydiki, tog‘ iqlimining inson tanasiga asosiy ta‘siri qiluvchi omil bu gipoksiya ya‘ni nafas olayotgan havoda kislorod yetishmasligi ekanligini ko‘rsatdi. Hattoki, tibbiyot fanining deyarli barcha sohalari mutaxassislarining ham bugungi kunda tog‘li tumanlar aholisi orasida oxirgi yillarda gipoksiya muammolarining tobora ortib borayotgannini hududiy jihatdan o‘rganib, aniq dalillar bilan ilmiy asoslar keltirayotgani fikrimiz dalilidir. Misol uchun, havosi toza bo‘lgan hududlarda dam olish, turli xildagi tashxis usullari, mavjud hamda yangi yuzaga kelayotgan kasalliklarni davolash, oldini olish, shuningdek, gipoksiyaning tirik hujayraga ta‘siri o‘simta hosil bo‘lishining molekulyar mexanizmlari, to‘qimalarning yangilanishi, hujayra bo‘linishini tartibga solish hamda uning atrof-muhitning salbiy ta‘siriga nisbatan namoyon bo‘layotgan reaktsiyasi bilan bevosita bog‘liqligi va h.k.

Mavzuga oid adabiyotlarning sharhi. 1980-yillarning o‘rtalarida olib borilgan so‘nggi hisob-kitoblarga ko‘ra, dunyoda 38 milliondan ortiq odam tog‘li hududlarda ya’ni, dengiz sathidan 2000 m.gacha va undan ortiq balandlikda yashaydi (L. Mooge, 1987). Taxminan 81,6 million odam dengiz sathidan 2500 metrdan (8200 fut) balandroq balandlikda yashaydi, ulardan 21,7 millioni Efiopiyada, 12,5 millioni Xitoyda, 11,7 millioni Kolumbiyada, 7,8 millioni Peruda va 6,2 millioni Boliviyada istiqomat qiladi.

N.M. Prjevalskiy 1873 yilda tog‘ kasalligining bir qator belgilarini tasvirlab berib, uning paydo bo‘lish sababi- Shimoliy Tibetdagi yerning mutlaq balandligi”,. – deya yozadi. Bu yerda ayniqsa tez yurganda nafas olish juda qiyin, ko‘pincha qusish, bosh og‘rish va aylanish sodir bo‘ladi, oyoqlar titraydi”-deya ta’rif bergan.

Tog‘ kasalligi haqida, tog‘ iqlimining sog‘lom va kasal odam organizmiga ta’sirini batafsil bayon qilib, bir qancha qimmatli tavsiyalar bergan V.I. Kushelevskiy o‘zining uzoq yillik kuzatishlarini jamlagan (3 jildlik) “Farg‘ona viloyatining tibbiy geografiyasi va sanitariya tavsifi uchun materiallar” (1890) monografiyasini yaratadi. Asarda, tog‘larda tug‘ilib o‘sgan odamlar balandlikda tog‘lilik kasalligini boshdan kechirishmaydi, bu yerda baland tog‘larga birinchi marta tashrif buyurgan odamlar undan azoblanishi izohlanadi.

Markaziy Osiyo tadqiqotchilaridan biri I.V. Mushketov 1877 yilda Oloy va Pomir bo‘ylab sayohat qilib, baland tog‘larning nafaqat odamlarga, balki hayvonlarga ham ta’sirini qayd etdi. “Havoning kamayishi, - ayniqsa, tog‘larga o‘rganmagan otlarga ham ta’sir qiladi, shuning uchun biz kelajakdagi sayohatchilarga biz kabi noqulayliklarni boshdan kechirmaslik uchun tog‘ otlarini yig‘ishni maslahat beramiz” deya yozadi. Barchamizga ma’lumki, bu kasalliklarning barchasi, asosan, nafas olayotgan siyrak havoda kislorod yetishmasligidan kelib chiqqan. O‘rta Osiyodagi tog‘ fiziologiyasi muammolarini rus harbiy shifokorlari P.K. Gorbachev, V.I. Kushelevskiy, N. Tretyakov, V. Tapilovskiy, A. N. Lavrinovich, D. I. Lebedev va boshqalar olib borgan. Ammo bu sohada Tyan-Shan va Pomirda tizimli va maqsadli tadqiqotlar XX asrning 40-yillarida boshlangan. N.N. Sirotinin, A.A.Rachkov, A.D.Slonim, A.P.Jukovlar

tamonidan olib borilgan uzoq muddatli tadqiqotlar asab tizimining baland tog‘larga moslashish mexanizmidagi rolini aniqlashga va Pomir va Tyan-Shan balandliklariga moslashish jarayonida qon aylanish apparati va qon tizimining reaksiyasini o‘rganishga bag‘ishlangan. Yana bir qator tadqiqotlar organizmning O‘rta Osiyoning baland tog‘li hududlariga moslashish mexanizmlarini yoritishga ham qaratgan bular A.G. Ginetsinskiy Z.I. Barbashov Pomirda, A.D. Slonimlar Tyan-Shandagi akklimatizatsiyaning to‘qima turi mavjudligi haqida aniq dalil keltirishadi.

Tadqiqot metodologiyasi. Tog‘ va tog‘ lddi hududlarida aholi salomatligini o‘rganishda avvvalo ushbu hududlarning tabiiy sharoiti, qolaversa, dengiz sathidan balandligi, kislorod tanqisligi tushunchasi ifodalaydi. Yuqoridagi holatlarni umumiy tushuncha bilan ya’ni tog‘ va tog‘ oldi hududlaring “nozoiqlimiy sharoiti” tushunchasi bilan tavsiflash mafsadga muvofiq. Nozogeografiya (yunoncha nosos - kasallik va geografiya) - qadimda va hozirgi vaqtda kishilarda uchraydigan kasalliklarning tarqalish geografiyasini o‘rganuvchi tibbiyot geografiyasining bir qismi bo‘lib, ushbu atamani 1856-yilda A.Myuri taklif qilingan.

Tadqiqotimizda keng qo‘llaniladigan tushuncha bu nozogeografik vaziyat esa- muayyan hududda aholining kasallanish xususiyatlari, ularning tarkibi va tarqalishini tabiiy, ekologik va ijtimoiy omillar bilan uzviy bog‘liq holda ifodalovchi kompleks ilmiy izohlanadigan tushuncha hisoblanadi. Yana bitta nozogeografik areal tushunchasi ham mavjud bo‘lib, u muayyan kasallikning bevosita tarqalishi yoki shu kasallik mavjud bo‘lgan hududga nisbatan islatilib, nozogeografik rayon asosini tashkil etishi bilan ta‘iriflanadi. Epidemiologik jihatdan yondashilganda bu jarayon geografik diffuziya qonuniyatlariga o‘xshab ketadi. Demak, “nozoiqlimiy sharoit” tushunchasi bir vaqtning o‘zida ikkita metodologik yondashuvni asoslashga yordam beradi:1) geografik omillar va salomatlikning o‘zaro munosabatlari; 2) nozogeografik vaziyatning hududiy va davriy xususiyatlari.

Nozogeografik vaziyatning o‘rganishga bunday yondashuv, kasallanish, uning sabablari va sharoitlarini o‘ziga xos nozogeografik xususiyatlariga ega bo‘lishi imkonini beradi.

Tahlillar va natijalar. Tog‘ sharoitining tabiiy va ijtimoiy-iqtisodiy tarkibiy qismlarining dalili sifatida uning mohiyatini hamda tibbiy-biologik ta’sirini, tog‘li hududlarining alohida tarkibiy qismlarining o‘ziga xosligi tushuniladi. Ushbu zonani tabiiy geografik hamda o‘z kuzatishlarimiz nuqtai nazardan inson tanasiga ta‘sir darajasini quyidagicha ta‘riflash maqsadga muvofiq deb hisoblaymiz:

1) past tog‘lar -dengiz sathidan 500 dan 1500 m gacha. Ijtimoiy-ekologik, iqlimiy va meteorologik omillarning salomatlik hamda mehnat faoliyatiga ta‘siri yaqin atrofdagi tekisliklar bilan solishtirganda deyarli oshmaydi. Aksariyat kasalliklarning kechishi normal holat hisoblanadi;

2) o‘rta tog‘lar - dengiz sathidan 1500 - 2400 m. Tog‘li iqlim ta’sirida sog‘lom odamlarda jiddiy kasalliklar bu balandliklarda kamdan kam hollarda uchraydi. O‘pka va yurak kasalliklari bilan og‘rigan bemorlarda kasallikning kuchayishi kuzatilishi mumkin va ularning ba’zilarida, ya’ni keksalarda dengiz

sathidan 2000 m balandlikda o‘tkir tog‘ kasalligining yengil belgilari kuzatiladi. Oziqlanish kaloriya tarkibini oshirishni, vitaminlashni va ba’zi joylarda mineral tarkibini tartibga solishni talab qiladi;

3) baland tog‘lar -2400 - 4500 m dengiz sathidan. Ushbu balandlikda salomatlik darajasi ijobiy bo‘lgan insonlarning katta qismi istiqomat qiladi. Aynan mana shu balandliklarga eng ko‘p rekreantlar hamda turistik oqim tashrif buyurishadi;

4) o‘ta baland tog‘lar - dengiz sathidan 4500-5500 m balandlikda. Bu balandliklarga asosan dunyoning ko‘plab qismlarida, jumladan, asosan alpinistlar tashrif buyurishadi. Ammo, sekin-asta iqlimga moslashmasdan, bu balandliklarga ko‘tarilish juda xavflidir;

O‘tkir sog‘liq muammolari oddiy baland tog‘ kasalliklaridan ko‘ra ko‘proq yer va ob-havo sharoitlari (qor ko‘chkisi, muzlash, gipotermiya va boshqalar) bilan bog‘liq, chunki yaxshi iqlimga ega alpinistlar bu balandliklarga ko‘tarilishadi.

Tekisliklarda yashovchi insonlar tog‘li hududlarda istiqomat qiluvchilarga qaraganda organizmlarida o‘ziga xoslik bu ularning hujayra va to‘qimalari optimal kislorod miqdorini olish uchun eng ko‘p faol bo‘ladi. To‘qimalarni kislorod bilan ta’minlashning har qanday kamayishi kislorodni tashish uchun mas’ul bo‘lgan tizimlarda moslashuvchan o‘zgarishlarga olib keladi, chunki hujayralar faqat yetarli kislorod ta’minoti bilan to‘liq ishlaydi, aks holda, ularning faoliyati buzilib, u butun organizmning azoblanishiga olib keladi. Atmosfera havosida kislorod yetishmasligi sharoitida hujayralar va to‘qimalarning ishini keskin buzmaslik uchun organizm birinchi navbatda atmosfera havosidan kislorodni olish va uni to‘qimalarga yetkazib berishni ta’minlaydigan organlarning faoliyatini kuchaytiradi, bularga bizga ma’lum bo‘lgan o‘pka, yurak-qon tomir tizimi kiradi. Nafas olish organlarining ritmik ishi tufayli atmosfera havosi nafas olish yo‘llari orqali alveolalar deb ataladigan eng kichik o‘pka havo pufakchalariga o‘tadi. Insonning har bir nafas olishida o‘rtacha o‘pkasiga 500 ml havo oladi va chiqaradi. Alveolalar gazlarni oson o‘tkazadigan nozik membranadan iborat bo‘lib, nafaqat atmosfera havosi, balki chiqindi gazlar ham kirib borishi sababli, kislorod tarangligi tashqi atmosfera havosiga qaraganda ancha past bo‘ladi. Aniqlanishicha, odam qanchalik chuqur nafas olsa, alveolalardagi havo hajmi shunchalik ko‘p atmosfera havosi bilan almashtiriladi. Bunday hollarda alveolalarda kislorod tarangligi kuchayadi va ular orqali oqib o‘tadigan qon kislorod bilan yaxshiroq boyitiladi. Ma‘lumki, asosiy kislorod yutuvchi maxsus protein moddasi bu temir hisoblanib u gemoglobinni hosil qiladi. Gemoglobin kislorod qo‘shilishi tufayli osongina oksidlangan shaklga o‘tadi, shuning uchun ham o‘pkada kislorod bilan boyitilgan qon qizil rangga ega bo‘ladi. Yurak qisqarishi ta’sirida u chap atrium va chap qorincha orqali haydaladi va arterial tomirlar orqali kapillyarlar deb ataladigan eng inson sochidan ham kichikroq bo‘lgan tomirlarga olib boriladi. Ikkinchisi esa juda ko‘p miqdori istisnosiz barcha organlar va to‘qimalarga kiradi. Biroq, kapillyarlarning soni turli organlarda bir xil emas. Ularga ayniqsa miya, yurak mushaklari, buyraklar, jigar, o‘pka va skelet mushaklari boy. Ammo barcha kapillyarlar ochiq, faol holatda emas. Ushbu mayda tuk tomirlari devori orqali qon va to‘qimalar o'rtasida gazlar va ozuqa

moddalari almashinadi. Arterial qondan kislorodning muhim qismi to'qimalar tomonidan so'riladi, buning natijasida ularda oksidlanish jarayonlari ta‘minlanadi.

O‘zbekistonning tog‘li va tog‘oldi tumanlarida jumladan, Qashqadaryoning Kitob, Shahrisabz, Surxondaryoning Boysun, Sariosiyo, Toshkent viloyatining Bo‘stonliq, Parkent hamda Farg‘ona vodiysining hududlarida yurak-qon tomir tizimi xastaliklari va arterial gipertoniya yuqori qon bosimi o‘ziga xos iqlimiy, geografik va milliy turmush tarzi omillari ta’sirida rivojlanadi. Kuzatuvlarimizga ko‘ra, tog‘ oldi va tog‘li hududlarda istiqomat qiladigan aholi orasida homiladorlik davridagi gipoksiya tufayli bolalarda tug‘ma yurak nuqsonlari masalan, qorinchalararo to‘siq yetishmovchiligi uchrash nisbatan yuqoriroq ekanligi tasdiqlandi. Bundan tashqari, o‘rganilayotgan havo bosimi past bo‘lgani sababli, organizm tabiiy kislorod yetishmovchiligini gipoksiyani his qilishi, bunga javoban yurak tezroq urishi, qon tomirlari torayishi, bu esa arterial qon bosimining ko‘tarilishiga ya’ni gipertoniyaga sabab bo‘lishi aniqlandi.

XULOSA. Tog‘li tumanlarning fiziologik mexanizmlarini baholashda moslashuv, salomatlikka ijobiy yoki salbiy ta‘sir ko‘rsatishda, inson tanasining fiziologik funktsiyalariga sezilarli ta‘sir ko‘rsatadigan tog‘li hududlarning biologik xususiyatlaridan tashqari geokimyoviy xususiyatlari ya’ni tuproqning kimyoviy tarkibi, ichimlik suvi, oziq-ovqatlarni ham o’z o’rnida hisobga olish maqsadga muvofiq. Mazkur shu bilan birga boshqa o‘ziga xos xususiyatlar - landshaft, o‘simliklarning tabiati va boshqalar tog‘li tumanlarning hududiy xususiyatlarini, shu jumladan, terapevtik va fiziologik ta‘sirning qanchalik muhim hamda jiddiy ekanligini belgilaydi. Shu sababli, turli balandlikda joylashgan, ammo turli tog‘li viloyatlarda joylashgan tog‘li hududlarning inson tanasiga ta‘siri sezilarli darajada farq qilishi mumkinligiga guvoh bo‘lishimiz ayni haqiqatdir.

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Qurbonov F.
o‘qituvchi
Termiz davlat universiteti
O‘zbekiston, Termiz

BIOCHAR – TUPROQLARNI YAXSHILASH, UGLEROD SEKVESTRATSIYASI VA EKOLOGIK REABILITATSIYA VOSITASI

Annotatsiya. Ushbu tahliliy maqolada biocharning tuproqdagi barqarorligi, fizik degradatsiyasi, degradatsiyalangan tuproqlarning tiklanish mexanizmi, tuproq mikrobiomiga ta’siri, uglerod sekvistratsiyasi va issiqxona gazlari emissiyasini kamaytirish, shuningdek agrotoksikantlarni immobilizatsiya va degradatsiya qilish qobiliyati umumlashtirilgan. Tahlil shuni ko‘rsatadiki, biochar qishloq xo‘jaligida ko‘p qirrali vosita bo‘lib, uning samaradorligi xom ashyo turi, piroliz harorati, qo‘llash dozasi va tuproq sharoitiga bog‘liq holda o‘zgaradi. Shu bilan birga, uzoq muddatli effektlar qisqa muddatli tajribalarda kuzatilganidan pastroq bo‘lishi mumkin ekanligi aniqlangan, bu amaliy tavsiyalar ishlab chiqishda inobatga olishni taqozo etadi.

Kalit so‘zlar: biochar, tuproq unumdorligi, tuproq degradatsiyasi, uglerod sekvistratsiyasi, issiqxona gazlari, tuproq mikrobiomi, barqaror qishloq xo‘jaligi.

Kurbonov F.
lecturer
Termez State University
Uzbekistan, Termez

BIOCHAR AS A TOOL FOR SOIL IMPROVEMENT, CARBON SEQUESTRATION, AND ENVIRONMENTAL REHABILITATION

Abstract. This review article summarizes the stability and physical degradation of biochar in soil, the mechanisms of degraded soil restoration, its effects on the soil microbiome, its role in carbon sequestration and greenhouse gas emission reduction, as well as its capacity to immobilize and degrade agrotoxicants. The analysis indicates that biochar is a multifunctional tool in agriculture, with its effectiveness varying depending on feedstock type, pyrolysis temperature, application rate, and soil conditions. Furthermore, the findings suggest that long-term effects may be less pronounced than those observed in short-term experiments, highlighting the need to consider this difference when developing practical recommendations.

Keywords: biochar, soil fertility, soil degradation, carbon sequestration, greenhouse gases, soil microbiome, sustainable agriculture.

1. Kirish.

Zamonaviy qishloq xo‘jaligi ikki muammoli vaziyatga duch kelmoqda: bir tomondan oziq-ovqat xavfsizligini ta’minlash uchun hosildorlikni oshirish zarurati, ikkinchi tomondan esa tuproq resurslarining degradatsiyasi, iqlim o‘zgarishi va atrof-muhit ifloslanishi kuchayib borayotgani. BMT Tinch okean iqtisodiy hamkorlik tashkiloti ma’lumotlariga ko‘ra, o‘simlik yetishtirish tizimlari global issiqxona gazlari emissiyalarining sezilarli qismini hosil qiladi, shu jumladan N_2O – deyarli barcha antropogen manbalarning yarmidan ko‘pi aynan qishloq xo‘jaligi bilan bog‘liq. Shu bois tuproq sifatini yaxshilovchi, uglerodni uzoq muddat saqlovchi va issiqxona gazlari emissiyasini kamaytiruvchi texnologiyalarga talab kuchaymoqda.

Biochar – o‘simlik va hayvonot qoldiqlari, chiqindilar hamda boshqa organik biomassani kislorodsiz muhitda (piroliz) isitish orqali olingan uglerodbog‘ uglerodli modda bo‘lib, qishloq xo‘jaligi va ekologiya sohasida eng birinchi navbatda o‘rganilayotgan yechimlardan biri sanaladi. 2012 yilda Barrow biocharni tuproq degradatsiyasiga qarshi kurashish va qishloq xo‘jaligini yaxshilash potensialiga ega vosita sifatida tizimli baholagan [5]. O‘tgan o‘n yillikda olingan tajribaviy va meta-tahlil natijalari uning agroekologik ahamiyatini yanada ochib berdi: biochar tuproq fizik-kimyoviy xususiyatlarini yaxshilaydi, mikrobiologik faollikni regulyatsiya qiladi, og‘ir metallar va organik ifloslantiruvchilarni bog‘laydi hamda tuproqda uglerodni uzoq muddat saqlash imkonini beradi.

Shu bilan birga, ilmiy adabiyotlarda biochar samaradorligiga oid qarama-qarshi natijalar uchraydi: qisqa muddatli tajribalarda kuzatilgan ijobiy effektlar uzoq muddatda zaiflashishi, toksik moddalarni immobilizatsiya qilish va uni oziqlantiruvchi sifatida qayta ishlatish orqasidagi xavfsizlik masalalari to‘liq o‘rganilmagan. Shuning uchun biocharni keng miqyosda qo‘llashdan oldin ilmiy dalillarni tizimli umumlashtirish dolzarb ahamiyat kasb etadi.

Mazkur tahliliy maqolaning maqsadi – nufuzli xalqaro jurnallarda chop etilgan ilmiy maqolalar asosida biochar qishloq xo‘jaligida qo‘llashning zamonaviy ilmiy tasavvurini shakllantirish, mavjud dalillarni qiyosiy tahlil orqali umumlashtirish hamda amaliyot uchun asoslangan tavsiyalar ishlab chiqishdan iborat. Vazifalar sifatida: (1) biochar barqarorligi va fizik degradatsiyasi bo‘yicha dalillarni tizimlashtirish; (2) degradatsiyaga uchragan tuproqlarni tiklash mexanizmlarini yoritish; (3) tuproq mikrobiomiga va fermentativ jarayonlarga ta’sirini baholash; (4) issiqxona gazlari emissiyasiga ta’sirini tahlil qilish; (5) agrokimyo va organik ifloslantiruvchilarni bartaraf etishdagi rolini ko‘rsatish belgilab olindi.

2. Metod.

Maqolada tahlil obyekti sifatida 2009–2025 yillar oralig‘ida chop etilgan 10 ta ilmiy maqola qabul qilindi. Adiblarni tanlashda quyidagi mezonlarga amal qilindi: (1) nashr etilgan jurnalning xalqaro reytingli bazalarda indeksatsiyasi; (2) ilmiy dalillarning to‘liqligi – meta-tahlillar, tizimli sharhlar, original eksperimental tadqiqotlar aralash tanlab olindi; (3) mavzuning qishloq xo‘jaligi tuproqlariga bevosita aloqadorligi. Tanlangan adiblar quyidagi yo‘nalishlar bo‘yicha

guruhlashtirildi: (a) biochar barqarorligi va fizik degradatsiyasi; (b) degradatsiyalangan tuproqlarni tiklash; (v) tuproq mikrobiomi va fermentlar; (g) issiqxona gazlari va uglerod sekvistratsiyasi; (d) ifloslanishni yumshatish mexanizmlari.

Tahlil metodikasi sifatida kontent-tahlil (har bir maqolaning maqsad, metod, natija va xulosa qismlarini ajratib ko‘rish) hamda qiyosiy-sintez tahlil (turli tadqiqotlarning natijalarini o‘xshash va farqli jihatlari bo‘yicha solishtirish) qo‘llanildi. Har bir dalil uning isbotlash kuchiga ($p<0.05$ isbot darajasi, tanlanma hajmi, meta-tahlil yoki bitta tajriba) ko‘ra baholandi.

3. Natijalar va muhokama.

3.1. Biochar barqarorligi va fizik degradatsiyasi.

Biocharning iqlimga qarshi kurashdagi asosiy qiymati uning tuproqda uglerod shaklida uzoq muddat saqlanish qobiliyatida. Wang, Xiong va Kuzyakov tomonidan o‘tkazilgan meta-tahlil shuni ko‘rsatadiki, biochar tuproqda asrlab davom etadigan vaqt oralig‘ida saqlanishi mumkin va undagi priming (qo‘zg‘atuvchi) effekti tuproq tarkibiga qarab turlicha namoyon bo‘ladi [1]. Bu natija biochar uglerodining klassik organik moddaga qaraganda sezilarli barqaror ekanini isbotlaydi va uni “uglerod passiv emissiya texnologiyasi” deb baholash ilmiy asosa ega.

Biroq Barbosa va hammualliflari (2025) biochar fizik degradatsiyasining uzoq muddatli effektlariga bag‘ishlangan so‘nggi tadqiqotlarida kanalizatsiya chiqindilari va bug‘doy poyasidan olingan biocharlarni tahlil qilib, ularning tuproqda qo‘llanilgandan keyin abiotik jarayonlar tufayli parchalanishi, suv ushlab qolish qobiliyati va uglerod barqarorligining vaqt bilan o‘zgarishini ta’kidlaydi [2]. Mualliflar biocharning tuproqdagi uzoq muddatli xatti-harakati faqat kimyoviy barqarorlik bilan emas, balki fizik parchalanish jarayonlari bilan ham belgilanishini ko‘rsatdi. Bu, laboratoriya sharoitidagi qisqa muddatli natijalarni maydonga ko‘chirishda ehtiyotkorlik talab etilishini anglatadi.

3.2. Degradatsiyalangan tuproqlarni tiklash va tuproq unumdorligi.

Barrow ning dastlabki tahlili biochar qishloq xo‘jaligi tuproqlarini yaxshilashda katta istiqbolga ega ekanini, ammo uning samarasi tuproq turi, iqlim va qo‘llash texnologiyasiga bog‘liq holda o‘zgarishini ta’kidlagan edi [5]. Shu tadqiqotni davom ettiruvchi Qi va hammualliflari (2024) tomonidan o‘tkazilgan tizimli sharh biochar tuproq degradatsiyasini yumshatishdagi rolini tizimli tasvirlab, uning tuproq tuzilishi, suv rejimi va biokimyoviy xususiyatlariga ko‘p qirrali ta’sirini umumlashtirdi [4]. Dimitriadou va hammualliflari (2025) esa degradatsiyalangan tuproqlarni jonlantirish (revitalizing) bo‘yicha biochar tuproq sog‘lig‘i va unumdorligini oshirishdagi mexanizmlarini – nafaqat kimyoviy, balki fizik va biologik yo‘nalishlarni ham yoritib berdi [7].

Zhang va hammualliflari (2023) Xitoyning shimoli-sharqidagi degradatsiyaga uchragan qora tuproqlar ustida o‘tkazgan ilmiy tadqiqotida tuproq agregatlarining o‘lcham tarkibidan foydalanib, biochar qo‘shish tuproq organik uglerodi, kationlar almashinuv qobiliyati va namlik miqdorini sezilarli oshirishini, bu o‘z navbatida agregat barqarorligini mustahkamlashini ko‘rsatdi [6]. Ayniqsa

qiziqarli xulosalaridan biri – biochar megaagregatlarda (0,25–2 mm) bakteriya jamoasi konsentratsiyasini oshirishi va mikroorganizmlar o‘zaro aloqalarini kuchaytirishi hamda uglerod fiksatsiyasi va nitrifikatsiya bilan bog‘liq genlarning (rbcL, acsA, nifH, amoA) ifodalanishini oshirishi edi. Demak, biocharning tuproqni tiklash effekti faqat kimyoviy modifikatsiya emas, balki mikrobiologik jarayonlarni qayta tashkil etish orqali ham amalga oshadi. Bu, qishloq xo‘jaligida uzoq yillar davomida intensiv degradatsiyaga uchragan yerlarni tiklash uchun biocharning istiqbolini asoslaydi.

3.3. Tuproq mikrobiomi va fermentativ jarayonlar dinamikasi.

Sheng va Zhu (2018) tuproqning pH reaksiyasidan kelib chiqqan holda biochar ta’sirini o‘rganib, biochar qo‘shish mikrob jamoasi tarkibini o‘zgartirib, uglerod sekvistratsiya potensialiga ta’sir qilishini ko‘rsatdi; ayniqsa kislotali ferralit tuproqlarda biocharning yuqoriroq parchalanishi CO_2 emissiyasining ortishiga olib kelishi qayd etildi [3].

Feng va hammualliflari (2023) besh qit’ada o‘tkazilgan 130 ta tadqiqotdan 923 ta kuzatuvni umumlashtirgan global meta-tahlilda biochar uglerod parchalovchi fermentlarga qo‘shilishi ligninaza faoliyatini 7,1% ga oshirishi, ayni paytda sellyulaza faoliyatini 8,3% ga kamaytirishi aniqlanganini ko‘rsatdi [8]. Ammo uzoq muddatli (1 yildan ortiq) qo‘llanilganda ligninaza:tsellyulaza nisbati 36,1% ga oshib, tuproq organik uglerodining sekvistratsiyasi qisqa muddatli davrdagi 87,5% ga nisbatan atigi 25,1% ga tushib qoladi. Bu, ilgari o‘tkazilgan tajribalarda mikroorganizmlarning fiziologik akklimatizatsiyasi hisobga olinmagan holda biocharning uzoq muddatli uglerod sekvistratsiya potensiali ortiqcha baholangan bo‘lishi mumkin ekanini anglatadi.

3.4. Issiqxona gazlari emissiyasi va agrokimyoviy moddalar taqdiri.

Spokas va hammualliflari (2009) Minnesota shtatidagi silt-loam tuproqda o‘tkazgan pioner tadqiqotlarida yog‘och biochar qo‘shish tuproq nafas olishi (CO_2 hosil bo‘lishi) barcha tekshirilgan dozalarda, N_2O hosil bo‘lishini esa 20% dan yuqori dozalarda sezilarli kamaytirishini, shu bilan birga metan (CH_4) oksidlanishini barcha dozalarda bostirishini aniqladi [9]. Shu bilan birga, biochar gerbisidlarni – atrazin va asetoxlorni – kuchli sorbsiyalab, ularning tuproqda saqlanish muddatini oshirishi va degradatsiyasini sekinlashtirishi ko‘rsatildi. Bu natijalar biochar issiqxona gazlari bilan kurashish vositalarining bir ekanini, ammo uning o‘zi barcha gazlar bo‘yicha bir xil yo‘nalishda ishlamasligini (CH_4 oksidlanishining bostirilishi salbiy tomon) ko‘rsatadi. Bundan tashqari, gerbisid saqlanishining uzayishi ekinni keyingi zararkunandalarga qarshi himoya qilishda iyjobiy bo‘lsa-da, moddaning muhitdagi taqdiri nuqtai nazaridan ikki qirrali effekt yaratadi.

3.5. Organik ifloslantiruvchilarni oksidativ degradatsiya qilish.

Biochar nafaqat adsorbent, balki katalizator sifatida ham qo‘llanilishi zamonaviy tadqiqotlar yo‘nalishlaridan biridir. Liu va hammualliflari (2020) tuproqda bisfenol A (BPA) ni biochar yordamida persulfatni aktivlashtirish orqali samarali degradatsiya qilish mumagli ekanini ko‘rsatdi [10]. $SO_4\cdot^-$ va $\cdot OH$ radikallari ishtirokidagi bu jarayon ifloslangan tuproqlarni tozalashda kimyoviy

reagentlarning minimal miqdorida ishlatilishini va jarayonning nisbatan tejamkorligini ta'minlaydi. Bu yo‘nalish qishloq xo‘jaligi va sanoat chiqindilari ifloslangan maydonlarni bioremedia qilishda biochar vazifasining kengayib borayotganini ko‘rsatadi.

3.6. Umumiy muhokama: dalillarning sintezi va qarama-qarshiliklar.

Tahlil qilingan 10 ta maqoladan kelib chiqqan asosiy ilmiy tasavvur shundan iboratki, biochar qishloq xo‘jaligida “bir modda – ko‘p funksiya” prinsipi bilan ishlaydi: u (1) tuproq fizik-kimyoviy xususiyatlarini yaxshilaydi, (2) mikrobiologik jamoani qayta shakllantirib agregat barqarorligini oshiradi, (3) uglerodni uzoq muddat saqlab, issiqxona gazlari emissiyasini kamaytiradi, (4) og‘ir metallar va organik ifloslantiruvchilarni bog‘laydi yoki ularni katalitik parchalaydi, (5) oziq elementlarning foydalanilish samaradorligini oshiradi.

Shu bilan birga, bir qator qarama-qarshilik va bilim bo‘shliqlari mavjud. Birinchidan, qisqa muddatli tajribalarda (1 yilgacha) kuzatilgan kuchli ijobiy effektlar (SOC +87,5%) uzoq muddatda sezilarli zaiflashadi (+25,1%) [8]; ikkinchidan, biochar dozasi ortiqcha bo‘lganda energiya xarajatlari va iqtisodiy jihatdan maqsadga muvofiq emasligi; uchinchidan, turli tuproqlar (kislotali, sho‘rlangan, qora tuproq) turlicha javob qaytarishi [3, 6]. Shu sababli biochar qo‘llash texnologiyasini ishlab chiqishda dozani, xom ashyoni, piroliz haroratini va mahalliy tuproq sharoitini hisobga oladigan regionallashtirilgan yondashuv zarur.

O‘zbekiston uchun ushbu yo‘nalishning ahamiyati alohida e’tirof etilishi lozim: paxta po‘stlog‘i, tok po‘stlog‘i, don qoldiqlari va chorva chiqindilari kabi boy biomassa zaxiralari mavjud bo‘lib, ulardan biochar ishlab chiqarish qishloq xo‘jaligi chiqindilarini qayta ishlatish (tirkarma iqtisodiyot) bilan birga, sho‘rlangan va degradatsiyalangan yerlarni tiklash uchun istiqbolli vosita bo‘lib xizmat qilishi mumkin. Bunda talab qilinadigan ish sifatida biochar mahalliy xom ashyodan olish texnologiyasini, sho‘rlangan tuproqlarda qo‘llash dozasini va uzoq muddatli agroekologik monitoringni o‘z ichiga olgan kompleks tadqiqotlar o‘tkazish maqsadga muvofiqdir.

3.7. Biochar ishlab chiqarish texnologiyasi va xom ashyo turlari.

Biochar sifati va qishloq xo‘jaligidagi qo‘llash sohasi asosan ikki omil – xom ashyo turi va piroliz haroratiga bog‘liq. Feng va hammualliflari meta-tahlilida ko‘rsatganidek, 350–550 °C va undan yuqori haroratda tayyorlangan biocharlar sellyulaza faoliyatini mos ravishda 10,0% va 6,7% ga kamaytiradi, past haroratli (<350 °C) biochar esa ligninaza faoliyatini 16,0% ga oshiradi [8]. Bu shuni anglatadiki, yuqori haroratli biochar uglerodni uzoq muddat saqlash uchun, past haroratli biochar esa tuproq biologik faoliyatini tezda oshirish uchun maqsadga muvofiqroq. Xom ashyo bo‘yicha yog‘och, o‘t-o‘simlik chiqindilari, chorva go‘ngi va qishloq xo‘jaligi qoldiqlari turlicha fizik-kimyoviy xususiyatlarga ega biocharlar hosil qiladi: masalan, go‘ng asosidagi biochar oziq elementlarga boy, lekin og‘ir metallar kontsentratsiyasi yuqori bo‘lishi mumkin, shuning uchun xom ashyoni oldindan ekotoksikologik baholash talab etiladi.

O‘zbekiston sharoitida eng istiqbolli xom ashyo manbalari qatoriga paxta po‘stlog‘i (yillik xom ashyo zaxirasi yuqori, lignin-moddasi tarkibi qulay), tok

po‘stlog‘i, bug‘doy somoni kiradi. Ushbu qoldiqlarni oddiy kuydirish o‘rniga piroliz usulida biochar ishlab chiqarish bir yo‘la ikki muammoni yechadi: energetik va ekologik zarar keltiruvchi chiqindi yo‘qotish hamda qishloq xo‘jaligi uchun qimmatli organik o‘g‘it olish. Bunda axborot texnologiyalari ham muhim rol o‘ynaydi: qishloq xo‘jaligi chiqindilari zaxiralarini xaritalash, biochar ishlab chiqarish agregatlarini joylashtirish va tuproqqa aralashtirish jarayonlarini raqamlashtirish iqtisodiy samaradorlikni oshiradi.

4. Xulosa.

Tahlil shuni ko‘rsatadiki, biochar zamonaviy qishloq xo‘jaligining barqaror rivojlanishida ko‘p qirrali vosita bo‘lib qolmoqda. U tuproq degradatsiyasini yumshatish, mikrobiologik faollikni regulyatsiya qilish, uglerodni sekvistratsiya qilish va ifloslanishni kamaytirish yo‘nalishlarida ilmiy isbotlangan effektlarga ega. Shu bilan birga, quyidagi asosiy xulosalar va tavsiyalar ishlab chiqiladi:

1) Biochar uglerodi tuproqda asrlab saqlanishi mumkin bo‘lsa-da, uning fizik degradatsiyasi va mikroorganizmlarning vaqt bilan akklimatizatsiyasi uzoq muddatli samaradorlikni belgilaydi; shu bois maydon tajribalari minimal 3–5 yillik monitoringni talab qiladi [1, 2, 8].

2) Tuproqni tiklash effekti agregatlar darajasida mikroorganizmlar jamoasi faoliyatini qo‘zg‘atish orqali amalga oshadi; bu biochar bilan mikrobial biokompostlar yoki funktsional mikroorganizmlarni qo‘shimcha qo‘llash istiqbolini ochib beradi [6].

3) Issiqxona gazlari bo‘yicha effekt selektiv: CO_2 va N_2O emissiyasini kamaytiradi.

4) Xom ashyo turi va piroliz harorati biochar xususiyatlarini keskin o‘zgartirib, uni maxsus maqsadlar (oziq-ovqat, tozalash, kataliz) uchun “buyurtma asosida” tayyorlash imkonini beradi; buning uchun standartlashtirish va sifat mezonlari ishlab chiqilishi lozim [7, 10].

5) Amaliyotga joriy etishda iqtisodiy jihatdan maqbul dozalarni aniqlash, mahalliy biomassa zaxiralaridan foydalanish va qishloq xo‘jaligi chiqindilarini qayta ishlatish zanjirini tashkil etish ustuvor vazifa bo‘lib qoladi. Kelgusi tadqiqotlar iqlim sharoitlari va tuproq tipologiyasiga ko‘ra diferensiallangan biochar texnologiyalarini ishlab chiqishga qaratilishi zarur.

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Raed Fahem Yasir, master's degree in Accounting
assistant lecturer
Department of Business Administration
College of Administration and Economics, University of Wasit
Iraq, Wasit

THE ROLE OF DIGITAL GOVERNANCE IN REDUCING FINANCIAL AND ADMINISTRATIVE CORRUPTION RISKS IN GOVERNMENT UNITS

Abstract. This study examines the role of digital governance in reducing financial and administrative corruption risks in government units. It focuses on four dimensions of digital governance: digital transparency, digital accountability, electronic oversight, and the quality of information systems. Data were collected through a questionnaire administered to employees and academic staff working in or associated with government institutions. Of 110 questionnaires received, 100 valid responses were retained for statistical analysis. The study employed descriptive statistics, Pearson correlation analysis, and multiple regression analysis. The results indicate a strong and statistically significant positive association between overall digital governance and the perceived reduction of financial and administrative corruption risks ($r = 0.761$, $p < 0.001$). The regression model was statistically significant and explained 86.2% of the variance in the dependent variable ($R^2 = 0.862$). At the dimension level, the quality of information systems and digital accountability showed significant positive effects, while electronic oversight was not statistically significant and digital transparency displayed a significant negative coefficient in the multivariate model. These findings suggest that digital governance can contribute to strengthening accountability, information quality, and institutional control, although the effects of individual dimensions are heterogeneous. The study recommends improving digital infrastructure, strengthening cybersecurity, enhancing digital accountability mechanisms, and updating the regulatory framework supporting digital governance in government institutions.

Keywords: digital governance; financial corruption; administrative corruption; transparency; accountability; government units.

Introduction

Digital governance has become increasingly important in public administration as government institutions expand the use of digital technologies in service delivery, financial management, information processing, and institutional oversight. Digital systems may improve transparency, accountability, traceability, and access to information while reducing some opportunities for discretionary administrative practices. At the same time, the effectiveness of digital governance depends on the quality of information systems, institutional accountability

mechanisms, electronic oversight, and the way digital technologies are implemented within public organizations.

Research Problem

Despite the increasing adoption of digital transformation strategies in the public sector, government institutions may continue to face challenges related to transparency, accountability, administrative control, and financial and administrative corruption risks. This creates a need to examine whether higher levels of digital governance are associated with stronger perceptions of corruption-risk reduction within governmental organizations.

The study therefore addresses the following research question:

To what extent is digital governance associated with the perceived reduction of financial and administrative corruption risks in government units?

Research Objectives

The study aims to:

1. Clarify the concept of digital governance and its application within government institutions.
2. Identify the principal forms and risks of financial and administrative corruption discussed in the relevant literature.
3. Examine the roles of digital transparency, digital accountability, electronic oversight, and information-system quality within the digital-governance framework.
4. Examine the relationship between digital governance and the perceived reduction of financial and administrative corruption risks.

Research Importance

The importance of this study lies in linking digital-governance practices with perceptions of financial and administrative corruption risks in governmental organizations. It contributes to the accounting and administrative literature by examining several dimensions of digital governance within a single empirical framework. The findings may also provide practical indications for government institutions seeking to improve transparency, accountability, information quality, and institutional oversight through digital transformation.

Research Hypothesis

The main research hypothesis is formulated as follows:

H1: There is a statistically significant relationship between digital governance and the perceived reduction of financial and administrative corruption risks in government units.

Research Methodology

This study adopts a quantitative, survey-based research design to examine the relationship between digital governance and the perceived reduction of financial and administrative corruption risks in government units. Primary data were collected through an electronic questionnaire administered to employees and academic staff associated with governmental organizations. The respondents

represented professional fields relevant to the study, including accounting, business administration, finance, and banking.

The questionnaire was structured around two main variables. The independent variable, digital governance, was measured through four dimensions: digital transparency, digital accountability, electronic oversight, and the quality of information systems. The dependent variable was the perceived reduction of financial and administrative corruption risks. Responses were measured using a five-point Likert scale ranging from strongly disagree to strongly agree.

A total of 110 completed questionnaires were received. Ten questionnaires were excluded because they were incomplete, leaving 100 valid responses for the final statistical analysis. Cronbach's alpha was used to assess internal consistency. Descriptive statistics were used to summarize respondents' evaluations of the study variables, Pearson's correlation coefficient was used to examine the relationship between the main variables, and multiple regression analysis was used to assess the statistical associations between the individual dimensions of digital governance and the dependent variable. Statistical significance was evaluated at the 0.05 level.

Previous Studies

Previous research has generally emphasized the potential contribution of digital technologies and governance mechanisms to institutional performance, accountability, oversight, and the reduction of opportunities for administrative irregularities. Hamad and Saeed (2020) examined electronic governance in an applied institutional context and highlighted its relationship with organizational performance. More recently, Jassim et al. (2025) examined the application of electronic governance systems in relation to bribery and embezzlement risks in a governmental banking context.

The present study extends this line of research by examining four dimensions of digital governance—digital transparency, digital accountability, electronic oversight, and the quality of information systems—and their statistical relationship with respondents' perceptions of financial and administrative corruption-risk reduction.

Theoretical Framework

First: The Conceptual Framework of Digital Governance

Governance is generally associated with the structures, rules, and practices through which organizations are directed, monitored, and held accountable. In public institutions, governance is particularly relevant to transparency, accountability, institutional performance, and the responsible management of public resources.

The World Bank describes governance in terms of the manner in which authority is exercised in the management of a country's economic and social resources for development (World Bank, **1992**, p. 1). The OECD also emphasizes the importance of rules and practices that support transparency, accountability, and effective institutional performance (OECD, 2004, p. 11).

In the context of public administration, **digital governance** refers to the use and management of digital technologies, information systems, and electronic

processes to support institutional decision-making, service delivery, transparency, accountability, and administrative control. It extends beyond the simple introduction of technology by incorporating the institutional rules, responsibilities, and oversight mechanisms that guide the use of digital systems.

Digital governance may therefore contribute to more efficient administrative processes, improved documentation and traceability, better access to information, and stronger institutional oversight. Its effectiveness, however, depends on organizational capacity, information-system quality, appropriate regulation, cybersecurity, and accountability mechanisms.

Objectives of Digital Governance

Digital governance may serve both internal institutional objectives and broader public-service objectives (Bousaadia, 2022, pp. 59–60).

Internal objectives include:

a) improving the efficiency of administrative procedures and reducing transaction-processing time;

b) supporting an effective digital working environment through appropriate information and communication technologies;

c) strengthening transparency and accountability within institutional processes;

d) improving monitoring, performance evaluation, and administrative oversight; and

e) reducing opportunities for improper discretionary practices by increasing automation, documentation, and traceability.

External objectives include:

a) improving the accessibility and efficiency of public services;

b) facilitating communication between government institutions and citizens;

c) reducing unnecessary administrative complexity; and

d) supporting more efficient electronic interaction among citizens, businesses, and government bodies.

Dimensions of Digital Governance

The literature identifies several dimensions of digital governance, including technological infrastructure and operational processes, management and authority structures, accountability and transparency, and digital risk management. These dimensions provide a broader theoretical context for understanding digital governance in public institutions. In the empirical part of the present study, however, digital governance was operationalized through four survey-based dimensions: digital transparency, digital accountability, electronic oversight, and the quality of information systems.

IT infrastructure and operational processes. IT architecture refers to an integrated set of technological choices designed to support organizational needs, while IT infrastructure represents the shared technological services that provide the foundation for institutional digital capabilities (Barbosa et al., 2014, p. 402). Operational processes include the activities and procedures through which organizational work is performed using human, financial, and technological

resources (Al-Otaibi and Al-Mufeez, 2021, p. 200). Effective digital governance therefore requires adequate infrastructure, qualified personnel, and appropriate financial resources to support the development and maintenance of digital systems (Hamad and Saeed, 2020, pp. 243–244).

Management and authorities. The effectiveness of digital governance depends on how decisions are made, responsibilities are distributed, and technological resources are managed within the organization. Senior management plays an important role in establishing organizational structures, defining responsibilities, and ensuring that information technology supports institutional strategies and objectives (Al-Samman and Al-Jubouri, 2016, p. 128). Effective governance also requires coordination among relevant stakeholders and clearly defined authority, control, roles, and responsibilities in relation to the use of information technology (Ako-Na and Singh, 2019, p. 2).

Accountability and transparency. Accountability is closely related to administrative reform, transparency, oversight, and performance evaluation. It includes mechanisms through which institutional performance can be reviewed and compared with established objectives and standards (Al-Otaibi and Al-Mufeez, 2021, p. 199). In this context, digital governance can support disclosure, transparency, and accountability in decision-making and may contribute to improving the efficiency and effectiveness of public services (Boulghalb, 2022, p. 720).

Digital risk management. Digital governance also includes policies and procedures designed to manage risks related to information systems, cybersecurity, data protection, and the use of digital technologies. Such mechanisms can help institutions identify, assess, and manage digital risks and align information-security practices with broader institutional objectives (Abdel Latif Mohammed, 2022, p. 2425).

Second: The Risks of Financial and Administrative Corruption in Government Units

The Concept of Financial and Administrative Corruption

Financial and administrative corruption is a complex phenomenon that can affect the performance, efficiency, and integrity of public institutions. Its forms and intensity vary across countries and sectors, while its causes may be economic, administrative, political, social, or legal.

In general, corruption refers to the misuse of authority, public office, or institutional resources for private or unauthorized benefit. Administrative corruption is associated with improper conduct by public employees in the performance of their official duties, including violations of rules, abuse of authority, favoritism, and failure to perform assigned responsibilities appropriately.

Administrative corruption may take different forms, including misuse of working time, failure to perform official duties, improper disclosure of institutional information, abuse of authority, and prioritization of personal interests over institutional objectives. Atallah Khalil (2008, p. 35) links administrative corruption

to weaknesses in compliance with organizational rules and the predominance of personal interests over the interests of the institution.

Financial corruption refers to violations involving public funds, financial regulations, accounting procedures, and financial oversight. Its manifestations may include bribery, embezzlement, fraud, manipulation of financial records, and tax evasion (Mahmoud Hussein Al-Wadi, 2010, p. 214).

Causes of Financial and Administrative Corruption

The literature identifies a number of factors that may contribute to financial and administrative corruption. These factors can be broadly classified as economic, administrative, political, and social or legal factors.

A) Economic factors. Economic conditions may influence the risk of corruption, particularly where there are weaknesses in transparency, accountability, competition, or public-sector remuneration. Government intervention in economic activity, complex administrative procedures, monopolistic conditions, inadequate accountability mechanisms, and low public-sector wages may create environments in which opportunities for improper practices increase (Mansouran, 2006, pp. 41–43).

B) Administrative factors. Administrative causes may include weak oversight, inadequate enforcement of regulations, unclear organizational structures, overlapping responsibilities, insufficient staffing, excessive workloads, weak professional capacity, and deficiencies in pay and incentive systems (Subhi, 2007, pp. 197–198). Such conditions may reduce the effectiveness of internal control and increase the risk of administrative and financial irregularities.

C) Political factors. Political and institutional conditions may also affect the effectiveness of anti-corruption mechanisms. Weak transparency in government transactions, insufficient oversight, inconsistent application of rules, and limited commitment to accountability may increase the likelihood of corrupt practices (Mansouran, 2006, pp. 41–43).

D) Social, cultural, and legal factors. Social relationships, informal networks, complex legislation, unclear regulatory procedures, and weak enforcement of penalties may also contribute to corruption risks. When recruitment, contracting, or administrative decisions are influenced by personal relationships rather than clearly defined professional criteria, institutional integrity may be weakened.

Third: Manifestations of Financial and Administrative Corruption in the Government Sector

Financial and administrative corruption can take different forms depending on the institutional and regulatory environment. Common manifestations include bribery, favoritism, nepotism, abuse of authority, embezzlement, fraud, forgery, money laundering, tax evasion, and manipulation of public contracts or financial procedures.

1. **Bribery:** The provision or acceptance of an improper financial or non-financial benefit in exchange for influencing an official decision, transaction, or service.

2. **Nepotism and favoritism:** The preferential treatment of individuals or groups on the basis of personal, family, social, or other non-professional relationships rather than objective administrative criteria.

3. **Wasta or improper intercession:** The use of personal influence to obtain an appointment, contract, service, or administrative advantage that would not otherwise be obtained through regular procedures.

4. **Extortion and forgery:** The misuse of official authority to obtain improper benefits, together with the falsification or manipulation of documents, records, certificates, or other official information (Mahmoud Hussein Al-Wadi, 2010, pp. 215–216).

5. **Embezzlement and misuse of public funds:** The unauthorized appropriation, diversion, or use of public resources by individuals entrusted with their management.

6. **Money laundering:** The process of concealing or disguising the illegal origin of funds in order to make them appear legitimate (Nawaf Salem Kanaan, 2008, p. 106).

7. **Tax evasion and financial fraud:** Deliberate actions intended to avoid legally required financial obligations or to manipulate financial information for unlawful benefit.

8. **Manipulation of public procurement and contracts:** The improper influence of tendering, contracting, purchasing, or investment procedures in favor of particular individuals or organizations.

These manifestations may weaken institutional performance, reduce public confidence, increase financial losses, and undermine the effectiveness of governmental control systems.

The Role of Digital Governance in Reducing Corruption Risks

Digital governance may contribute to reducing opportunities for financial and administrative corruption by increasing the traceability of transactions, reducing unnecessary direct contact between service providers and citizens, improving access to information, and strengthening institutional oversight. Digital systems can also create electronic records that facilitate the monitoring and auditing of financial and administrative activities.

Important mechanisms through which digital governance may support anti-corruption efforts include (Ali et al., 2025, p. 218):

- **Reducing unnecessary face-to-face interaction:** Electronic service platforms can reduce dependence on direct interaction between citizens and employees, thereby limiting some opportunities for informal payments or improper influence.

- **Enhancing transparency and accountability:** Digital systems can improve access to administrative and financial information and facilitate monitoring by authorized institutions and stakeholders.

- **Electronic monitoring and audit trails:** Digital records can make transactions easier to trace and review, supporting internal control and audit procedures.

- **Digitalization of procurement and administrative procedures:** Electronic systems may help standardize processes, document decision-making stages, and reduce opportunities for discretionary manipulation.

- **Electronic disclosure of information:** Government institutions can use digital platforms to publish relevant laws, regulations, procedures, reports, and other information of public interest.

- **Secure reporting mechanisms:** Digital channels can provide additional means for reporting suspected irregularities while supporting confidentiality and documentation.

The effectiveness of these mechanisms nevertheless depends on the quality of the information systems, the strength of accountability procedures, staff capacity, cybersecurity, and the institutional framework within which digital governance operates.

The Applied Study

Research Population and Sample

The study population consisted of employees and academic staff associated with governmental organizations, particularly individuals with professional backgrounds in accounting, business administration, finance, and banking. Data were collected electronically through a structured questionnaire.

A total of 110 completed questionnaires were received. Ten questionnaires were excluded because they were incomplete, leaving **100 valid responses** for the final statistical analysis.

Research Instrument and Data Analysis

The questionnaire was used as the primary data-collection instrument. It was organized around the variables and dimensions examined in the study. Responses were measured using a **five-point Likert scale**, ranging from strongly disagree to strongly agree.

The independent variable, digital governance, was measured through four dimensions:

- digital transparency;
- digital accountability;
- electronic oversight;
- quality of information systems.

The dependent variable was the **perceived reduction of financial and administrative corruption risks**.

The statistical analysis included descriptive statistics, Cronbach's alpha reliability analysis, Pearson correlation analysis, and multiple regression analysis. Statistical significance was evaluated at the **0.05 level**.

Processing the Questionnaire Data and Analyzing the Results

Reliability Test

Cronbach's alpha was used to assess the internal consistency of the questionnaire as a whole and of its individual dimensions. The results are presented in Table 1.

Table 1. Reliability Test Results (Cronbach's Alpha)

Variable / Dimension	Number of Items	Cronbach's Alpha	Reliability Level
Digital transparency	5	0.356	Weak
Digital accountability	5	0.414	Weak
Electronic oversight	5	0.786	Good
Quality of information systems	5	0.705	Acceptable
Perceived reduction of financial and administrative corruption risks	10	0.858	High
Questionnaire as a whole	30	0.911	Very high

The questionnaire as a whole demonstrated high internal consistency, with a Cronbach's alpha of 0.911. Reliability varied across the individual dimensions. The perceived corruption-risk reduction scale showed high reliability ($\alpha = 0.858$), electronic oversight showed good reliability ($\alpha = 0.786$), and the quality of information systems showed acceptable reliability ($\alpha = 0.705$). In contrast, digital transparency ($\alpha = 0.356$) and digital accountability ($\alpha = 0.414$) showed low internal consistency. Therefore, results involving these two dimensions should be interpreted with caution.

Descriptive Statistics

Axis One: Digital Governance

Digital governance was examined through four dimensions.

Table 2. Descriptive Statistics for Digital Governance Dimensions

Dimension	Items	Mean	Standard Deviation
Digital transparency	Q1–Q5	3.90	0.93
Digital accountability	Q6–Q10	3.69	1.10
Electronic oversight	Q11–Q15	3.86	1.10
Quality of information systems	Q16–Q20	4.01	1.09

All four dimensions recorded mean scores above the midpoint of the five-point Likert scale (3). The quality of information systems recorded the highest mean (4.01), followed by digital transparency (3.90), electronic oversight (3.86), and digital accountability (3.69). These results indicate generally positive respondent perceptions of digital governance practices in the organizations represented in the sample. However, the results for digital transparency and digital accountability should be interpreted cautiously because of their comparatively low internal consistency.

Axis Two: Perceived Reduction of Financial and Administrative Corruption Risks

Table 3. Descriptive Statistics for the Dependent Variable

Axis	Items	Mean	Standard Deviation
Perceived reduction of financial and administrative corruption risks	Q21–Q30	4.08	1.06

The dependent variable recorded a mean score of 4.08, which is above the midpoint of the five-point scale. This indicates that respondents generally perceived digital governance as being associated with a reduction in financial and administrative corruption risks. The result reflects respondents' perceptions and should not be interpreted as a direct measure of actual changes in corruption levels.

Pearson Correlation Analysis

Pearson's correlation coefficient was calculated to examine the relationship between overall digital governance and the perceived reduction of financial and administrative corruption risks.

Table 4. Pearson Correlation Results

Variables	Correlation Coefficient (r)	Significance (p)	Result
Digital governance × perceived reduction of financial and administrative corruption risks	0.761	< 0.001	Statistically significant

The results show a strong positive correlation between overall digital governance and the perceived reduction of financial and administrative corruption risks ($r = 0.761$, $p < 0.001$). This indicates that higher reported levels of digital governance were associated with higher perceived levels of corruption-risk reduction among the respondents. The correlation demonstrates an association between the two variables and does not, by itself, establish a causal relationship.

Multiple Regression Analysis

Multiple regression analysis was conducted to examine the statistical association between the four dimensions of digital governance and the perceived reduction of financial and administrative corruption risks.

Table 5. Multiple Regression Model Summary

Indicator	Value
R	0.928
R^2	0.862
Adjusted R^2	0.856
F	148.700
p-value	< 0.001

The multiple regression model was statistically significant ($F = 148.700$, $p < 0.001$). The coefficient of determination ($R^2 = 0.862$) indicates that the four digital-governance dimensions included in the model jointly accounted for 86.2% of the variance in respondents' scores on the perceived reduction of financial and administrative corruption risks.

Table 6. Multiple Regression Coefficients

Dimension	Unstandardized B	t	p-value	Result
Digital transparency	-0.387	-6.005	< 0.001	Significant
Digital accountability	0.309	3.582	0.001	Significant
Electronic oversight	-0.080	-0.944	0.347	Not significant
Quality of information systems	0.802	9.697	< 0.001	Significant

The regression results indicate that the quality of information systems had a statistically significant positive coefficient ($B = 0.802$, $p < 0.001$). Digital accountability also showed a statistically significant positive coefficient ($B = 0.309$, $p = 0.001$).

Electronic oversight did not show a statistically significant independent association with the dependent variable in the multivariate model ($B = -0.080$, $p = 0.347$).

Digital transparency showed a statistically significant negative coefficient ($B = -0.387$, $p < 0.001$). Given the low internal consistency of the digital transparency scale ($\alpha = 0.356$), this result should be interpreted with particular caution. The negative coefficient should not be taken as evidence that transparency itself increases corruption risks; rather, it represents the statistical relationship observed within this specific multivariate model and sample.

Overall, the regression findings indicate that the relationships between the individual dimensions of digital governance and perceived corruption-risk reduction were heterogeneous. The quality of information systems and digital accountability showed significant positive associations, electronic oversight was not statistically significant, and the digital transparency coefficient requires cautious interpretation because of the limited reliability of that dimension.

Conclusion

This study examined the relationship between digital governance and the perceived reduction of financial and administrative corruption risks in government units. The analysis was based on responses from employees and academic staff associated with governmental organizations and focused on four dimensions of digital governance: digital transparency, digital accountability, electronic oversight, and the quality of information systems.

The descriptive results showed generally positive respondent perceptions of digital governance practices. Pearson's correlation analysis indicated a statistically significant positive association between overall digital governance and the perceived reduction of financial and administrative corruption risks ($r = 0.761$, $p < 0.001$).

The multiple regression model was statistically significant and accounted for 86.2% of the variance in respondents' scores on perceived corruption-risk reduction. Among the individual dimensions, the quality of information systems and digital accountability showed statistically significant positive coefficients, while electronic oversight was not statistically significant. Digital transparency showed a significant negative coefficient; however, because this dimension demonstrated low internal consistency, this result should be interpreted with caution.

Overall, the findings suggest that digital governance may support institutional efforts to strengthen accountability, improve information quality, and reduce perceived opportunities for financial and administrative corruption. However, the results reflect respondents' perceptions and statistical associations and should not be interpreted as direct evidence of a causal reduction in actual corruption levels.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

- Government institutions should continue improving their digital infrastructure and the quality and reliability of information systems.
- Digital accountability mechanisms should be strengthened and more closely integrated with institutional performance monitoring and evaluation.
- Electronic administrative and financial procedures should be further developed in order to improve traceability, documentation, and oversight.
- Relevant financial and administrative information should be made accessible through appropriate digital disclosure mechanisms in order to support transparency and accountability.
- Employees should receive regular training in the effective and secure use of digital systems.
- Future studies should use larger and more diverse samples and further examine the reliability and measurement of individual digital-governance dimensions.

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Rajabboyev O.U.
tadqiqotchi

TADBIRKORLIK SUBYEKTLARI INVESTITSION FAOLIYATI SAMARADORLIGINI BAHOLASH METODIKASINI TAKOMILLASHTIRISH

Annotatsiya. Mazkur ilmiy maqolada bozor munosabatlari chuqurlashib borayotgan zamonaviy sharoitda tadbirkorlik subyektlari investitsion faoliyati samaradorligini baholashning nazariy-uslubiy asoslari tadqiq etilgan. An'anaviy diskontlangan pul oqimlari (DCF) konsepsiyasiga asoslangan ko‘rsatkichlar – sof joriy qiymat (NPV), ichki daromadlilik normasi (IRR), rentabellik indeksi (PI) va diskontlangan qoplanish muddati (DPP)ning tadbirkorlik subyektlari amaliyotida yuzaga keltirayotgan metodologik cheklovlari tahlil qilingan. Noaniqlik, inflyatsion o‘zgarishlar, tarmoq xatarlari hamda korxonaning umumiy moliyaviy barqarorligini kompleks qamrab oluvchi takomillashtirilgan Integral Investitsion Samaradorlik Indeksi (K_IS) modeli ishlab chiqilgan. Model to‘rtta asosiy blokni (moliyaviy rentabellik, xatar va beqarorlik, likvidlik va qoplanish tezligi, strategik-multiplikativ samara) o‘zida birlashtiradi. O‘zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligi ma’lumotlari asosida so‘nggi yillardagi investitsion dinamika o‘rganilib, ishlab chiqilgan metodika 4 ta real namunaviy loyiha misolida aprobatsiya qilingan.

Kalit so‘zlar: tadbirkorlik subyektlari, investitsion faoliyat, investitsiya samaradorligi, baholash metodikasi, integral indeks, diskont stavkasi, risk mukofoti, moliyaviy barqarorlik, pul oqimlari.

Rajabboyev O.U.
researcher

IMPROVING THE METHODOLOGY FOR EVALUATING THE EFFICIENCY OF INVESTMENT ACTIVITIES OF BUSINESS ENTITIES

Abstract. This research paper examines the theoretical and methodological frameworks for evaluating the efficiency of investment activities of business entities under intensifying market conditions. The methodological shortcomings and limitations of traditional discounted cash flow (DCF) indicators – namely Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), and Discounted Payback Period (DPP) – are identified at the firm level. An enhanced model of the Integral Investment Efficiency Index (K_IS) is developed, incorporating economic uncertainty, inflationary fluctuations, sector risk premiums, and comprehensive financial stability. The model integrates four analytical blocks: financial profitability, risk and volatility, liquidity and payback velocity, and strategic-multiplicative effects. Based on empirical statistics from the Statistics Agency of the Republic of Uzbekistan, contemporary investment dynamics

are investigated, and the proposed methodology is empirically tested on four representative business projects.

Keywords: business entities, investment activity, investment efficiency, evaluation methodology, integral index, discount rate, risk premium, financial stability, cash flows.

1. KIRISH VA MUAMMONING DOLZARBLIGI

Bozor munosabatlarining jadallashuvi, texnologik transformatsiyalar hamda globallashuv jarayonlari milliy iqtisodiyotda faoliyat yuritayotgan tadbirkorlik subyektlari zimmasiga doimiy ravishda ishlab chiqarish quvvatlarini modernizatsiya qilish, yuqori qo‘shilgan qiymatli tovarlar yaratish va bozor raqobatbardoshligini oshirish vazifasini yuklamoqda. Ushbu strategik vazifalarni muvaffaqiyatli hal etishning asosiy iqtisodiy drayveri esa samarali boshqariladigan investitsion faoliyatdir. Investitsiyalar tadbirkorlik subyektlari uchun nafaqat moddiy-texnik bazani yangilash va faoliyat ko‘lamini kengaytirish vositasi, balki bozor noaniqliklari hamda beqaror kon’yunktura sharoitida uzoq muddatli yashovchanlikni ta’minlovchi poydevor hisoblanadi.

O‘zbekiston Respublikasining 'O‘zbekiston – 2030' strategiyasida milliy iqtisodiyot hajmini 160 milliard dollarga, aholi jon boshiga yalpi ichki mahsulot (YaIM)ni 4 ming dollarga yetkazish hamda iqtisodiyotga 250 milliard dollardan ziyod investitsiyalarni, shu jumladan 110 milliard dollar xorijiy va xususiy investitsiyalarni jalb qilish bosh maqsadlar sifatida belgilangan. Ushbu ulkan strategik marralarga erishishda tadbirkorlik subyektlari tomonidan amalga oshirilayotgan investitsiya loyihalarining har bir so‘mi yuqori iqtisodiy, ijtimoiy va texnologik qaytim keltirishi hal qiluvchi ahamiyat kasb etadi.

O‘zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligining rasmiy ma’lumotlari tahlili shuni ko‘rsatadiki, mamlakatimizda asosiy kapitalga o‘zlashtirilgan investitsiyalar hajmi barqaror o‘sish sur’atlarini namoyon etmoqda. Xususan, 2020 yilda asosiy kapitalga kiritilgan investitsiyalar hajmi 202,0 trln so‘mni tashkil etgan bo‘lsa, 2021 yilda 239,5 trln so‘mga, 2022 yilda 270,1 trln so‘mga, 2023 yilda 352,1 trln so‘mga, 2024 yilda 386,4 trln so‘mga yetdi hamda 2025 yilda dastlabki ko‘rsatkichlarga muvofiq 460,0 trln so‘mdan ortishi kutilmoqda. Mazkur investitsiyalar tarkibida xususiy sektor va kichik tadbirkorlik subyektlarining ulushi qariyb 48–52 foiz oralig‘ida saqlanib qolmoqda.

Biroq, investitsiyalar hajmining miqdoriy o‘sishi har doim ham sifat jihatidan mutanosib iqtisodiy samaradorlik bilan uyg‘unlashayotgani yo‘q. Amaliyotda ko‘plab tadbirkorlik subyektlarida loyihalarning kechikib ishga tushishi, rejalashtirilgan rentabellik darajasiga erisha olmaslik, aylanma mablag‘lar yetishmovchiligi oqibatida moliyaviy qiyinchiliklarga duch kelish va olingan bank kreditlarini qaytarishda uzilishlar kuzatilmoqda. Ushbu muammolarning tub ildizi investitsiya faoliyatini baholash va rejalashtirishda qo‘llanilayotgan an’anaviy metodikalarning nomukammalligi hamda ularning zamonaviy makroiqtisodiy xatarlarni to‘liq inobatga olmasligi bilan bevosita bog‘liqdir.

Aksariyat biznes-rejalarda va investitsion loyihalash jarayonlarida investitsiya samaradorligi faqatgina alohida olingan sof joriy qiymat (NPV) yoki ichki daromadlilik normasi (IRR) kabi statik va soddalashtirilgan ko‘rsatkichlar yordamida baholanadi. Biroq korxona doirasida loyihalar yakka tartibda emas, balki yaxlit korporativ moliya tizimi bilan uzviy bog‘liqlikda amalga oshiriladi. Shu nuqtai nazardan, tadbirkorlik subyektlarining investitsion faoliyati samaradorligini baholashning kompleks, ko‘p omilli va xatarlarga sezgir yangi metodikasini ishlab chiqish hamda ilmiy-amaliy jihatdan asoslash dolzarb ilmiy vazifa hisoblanadi.

2. MAVZUGA OID ADABIYOTLAR TAHLILI

Investitsiya nazariyasi va uning samaradorligini baholash mezonlari jahon iqtisodiy tafakkurida fundamental va amaliy tadqiqotlarning eng muhim yo‘nalishlaridan biri bo‘lib kelgan. Investitsiyalarni baholashning zamonaviy nazariy asoslari Garri Markowitz (1952) tomonidan ishlab chiqilgan portfel nazariyasi va risk hamda daromadlilik o‘rtasidagi korrelyatsiya modeliga borib taqaladi. Keyinchalik Uilyam Sharp (1964) tomonidan taklif etilgan Kapital aktivlarini baholash modeli (CAPM) investitsion loyihalarda tizimli risk (beta koeffitsiyenti) va xatar mukofotini aniqlashning poydevoriga aylandi.

Franko Modilyani va Merton Miller (1958) o‘zlarining kapital tuzilmasi nazariyasida qarz va xususiy kapital nisbatining investitsiya qiymatiga ta’sirini tahlil qilgan bo‘lsalar, Asvat Damodaran (2012, 2016) rivojlanayotgan va o‘tish iqtisodiyoti sharoitidagi bozorlarda kompaniya va loyihalar qiymatini baholashda mamlakat xatari (Country Risk Premium) hamda korxona miqyosi xatari (Size Premium)ni hisobga olish mexanizmlarini atroflicha tadqiq etdi. Richard Breyly va Styuart Mayers (2015), Yevgeniy Brighem va Maykl Erlardt (2019) korporativ moliyada investitsiya samaradorligini baholashning an’anaviy diskontlangan pul oqimlari (DCF) usullarini tizimlashtirdilar.

Rossiya va MDH mamlakatlari iqtisodchi olimlaridan I.A. Blank, V.V. Kovalyov, D.A. Endovitskiy, M.V. Melniklarning tadqiqotlarida korxonalarda investitsion menejment, moliyaviy tahlil hamda loyihalarning likvidlik darajasini baholash usullari keng yoritilgan. Ular investitsiyalarning nafaqat sof daromadliligini, balki korxonaning to‘lov qobiliyatiga ko‘rsatadigan ta’sirini tahlil qilish zarurligini ta’kidlaydilar.

O‘zbekistonlik olimlardan A.V. Vaxobov, Sh.I. Mustafaqulov, T.S. Malikov, D.G‘. G‘ozibekov, B.X. Xodiyev, N.X. Haydarov, U.A. Burxanov, Sh.A. Toshmatov va boshqalarning ilmiy ishlarida mamlakatimizda investitsiya muhitini takomillashtirish, tadbirkorlik subyektlari investitsion faolligini rag‘batlantirish, investitsiyalarni moliyalashtirish manbalarini kengaytirish hamda investitsiya loyihalarini moliyaviy-iqtisodiy ekspertizadan o‘tkazish masalalari chuqur tadqiq qilingan.

Metodologik cheklovlar va tadqiqot bo‘shliqlari: Biroq, mavjud ilmiy adabiyotlar va amaliy tavsiyalar tahlili shuni ko‘rsatadiki, an’anaviy baholash ko‘rsatkichlari (NPV, IRR, PI, DPP, ROI) quyidagi jiddiy metodologik cheklovlarga ega:

1. Reinvestitsiya sur’atining nomutanosibligi: An’anaviy IRR usuli loyihadan kelib tushadigan oraliq pul oqimlari aynan loyihaning ichki daromadlilik stavkasi bo‘yicha reinvestitsiya qilinadi degan noreal farazga asoslanadi. Amalda esa tadbirkorlik subyektlari bunday yuqori rentabellikda pulni qayta joylashtira olmaydi, bu esa loyihaning jozibadorligini sun’iy oshirib ko‘rsatadi.

2. Diskont stavkasining o‘zgarmasligi va statikligi: An’anaviy DCF modellarida barcha davrlar uchun yagona o‘rtacha tortilgan kapital qiymati (WACC) qo‘llaniladi. Vaholanki, O‘zbekiston sharoitida inflyatsiya dinamikasi, bank kredit stavkalari va tarmoq risklari loyihaning hayotiy siklida keskin o‘zgarib turadi.

3. Korxona umumiy moliyaviy tizimidan ajratilganlik: Muayyan investitsiya loyihasi qog‘ozda yuqori NPV ga ega bo‘lishi mumkin, biroq uning yuqori qarz yuki hisobiga amalga oshirilishi tadbirkorlik subyektining joriy likvidligini izdan chiqarishi va umumiy to‘lov qobiliyatsizligiga (bankrotlikka) sabab bo‘lishi mumkin.

4. Sifat va strategik omillarning inobatga olinmasligi: Klassik modellar faqatgina to‘g‘ridan-to‘g‘ri pul oqimlarini o‘lchaydi. Zamonaviy tadbirkorlikda esa loyihaning innovatsionligi, resurs va energiya tejamkorligi, raqamlashtirish darajasi hamda multiplikativ samara yaratish qobiliyati korxonaning bozor qiymatini oshirishda birlamchi o‘ringa chiqmoqda.

3. TADQIQOT METODOLOGIYASI VA INTEGRAL BAHOLASH MODELI

Tadqiqotning metodologik asosini tizimli va qiyosiy tahlil, ekonometrik modellashtirish, ekspert baholash (Saaty ierarxik tahlil metodi – AHP) hamda ko‘p mezonli qaror qabul qilish (MCDA) uslublari tashkil etadi. Mavjud kamchiliklarni bartaraf etish maqsadida muallif tomonidan tadbirkorlik subyektlari investitsion faoliyati samaradorligini baholovchi to‘rt blokli dinamik tizim taklif etiladi.

3.1. Diskont stavkasini xatarlarga moslashtirish (Risk-adjusted discount rate)

Tadbirkorlik subyektlarida loyihalarning kelgusi pul oqimlarini diskontlashda xatarlarga to‘liq moslashtirilgan quyidagi ko‘p omilli model taklif etiladi:

$$r_d = r_f + \beta_i \cdot (r_m - r_f) + S_c + S_fin + \alpha_inf \qquad (1)$$

bu yerda:

r_f – risksiz bazaviy daromadlilik stavkasi (O‘zbekiston Respublikasi Markaziy bankining qayta moliyalash/asosiy stavkasi yoki uzoq muddatli davlat obligatsiyalari daromadliligi);

β_i – investitsiya kiritilayotgan tarmoqning tizimli xatar koeffitsiyenti;

(r_m - r_f) – milliy fond yoki kapital bozoridagi umumiy xatar mukofoti (market risk premium);

S_c – tadbirkorlik subyekti o‘lchami va bozor pozitsiyasi uchun xatar mukofoti (kichik va o‘rta biznes uchun 2.0% – 4.5% oralig‘ida belgilanadi);

S_fin – korxonaning moliyaviy leveridj (qarz yuki) xatari mukofoti;

α_inf – investitsiya davri bo‘yicha inflyatsion kutilmalarning tuzatish koeffitsiyenti.

3.2. Integral Investitsion Samaradorlik Indeksi (K_IS) arxitekturasi

Tadbirkorlik subyektlarining investitsiya faoliyatini har tomonlama baholash uchun muallif tomonidan to‘rtta asosiy blok ko‘rsatkichlarini birlashtiruvchi Integral Investitsion Samaradorlik Indeksi (K_IS) taklif etiladi:

$$K_IS = w_1 \cdot I_MR + w_2 \cdot I_RM + w_3 \cdot I_LQ + w_4 \cdot I_ST \quad (2)$$

Bunda og‘irlik koeffitsiyentlari yig‘indisi birga teng: w_1 + w_2 + w_3 + w_4 = 1.0. Mutaxassislar va moliyaviy tahlilchilar o‘rtasida o‘tkazilgan ekspert so‘rovlari hamda AHP usuli asosida og‘irliklar quyidagicha taqsimlandi:

• w_1 = 0.35 – Moliyaviy rentabellik bloki (I_MR): modifikatsiyalangan ichki daromadlilik (MIRR), sof keltirilgan qiymat indeksi (PI), qo‘shilgan iqtisodiy qiymat (EVA);

• w_2 = 0.25 – Risk va beqarorlik bloki (I_RM): xatarlarga moslashtirilgan diskont stavkasi, pul oqimlari variatsiyasi koeffitsiyenti (CV), moliyaviy qaramlik koeffitsiyenti;

• w_3 = 0.25 – Likvidlik va qoplanish tezligi bloki (I_LQ): diskontlangan qoplanish muddati (DPP), erkin pul oqimining jami investitsiyalarga nisbati (FCF/Inv);

• w_4 = 0.15 – Strategik va multiplikativ samara bloki (I_ST): loyiha doirasida yaratiladigan yuqori malakali ish o‘rinlari soni, energiya tejamkorlik va raqamlashtirish ko‘rsatkichlari.

3.3. Ko‘rsatkichlarni normallashtirish va qaror qabul qilish shkalasi

Har bir ko‘rsatkich turli xil o‘lchov birliklariga ega bo‘lganligi sababli, ular 0 dan 1 gacha bo‘lgan shkalaga keltiriladi (Min-Max normallashtirish):

$$I_norm = (X - X_min) / (X_max - X_min) \quad (rag‘batlantiruvchi\ ko‘rsatkichlar\ uchun) \quad (3)$$

$$I_norm = (X_max - X) / (X_max - X_min) \quad (cheklaydigan/xatar\ ko‘rsatkichlari\ uchun) \quad (4)$$

Hosil bo‘lgan integral indeks K_IS asosida tadbirkorlik subyekti investitsion faoliyati quyidagi toifalarga ajratiladi:

• K_IS ≥ 0.80 – 'A' toifa: Yuqori investitsion samaradorlik. Loyiha minimal xatarlarga ega, tez qoplanadi va yuqori qo‘shilgan qiymat yaratadi. Birinchi navbatda to‘liq moliyalashtirishga tavsiya etiladi.

• 0.65 ≤ K_IS < 0.80 – 'B' toifa: O‘rtacha barqaror samaradorlik. Loyiha qoniqarli rentabellikka ega, biroq xatarlarni kamaytirish bo‘yicha qo‘shimcha tashkiliy choralar talab qilinadi.

• 0.50 ≤ K_IS < 0.65 – 'C' toifa: Cheklangan / qoniqarli samaradorlik. Loyihaning moliyaviy oqimlari beqaror yoki qarz yuki yuqori. Uni qayta ko‘rib chiqish yoki parametrlarini optimallashtirish zarur.

• K_IS < 0.50 – 'D' toifa: Past / samarasiz loyiha. Korxona moliyaviy barqarorligiga xavf tug‘diradi, moliyalashtirish rad etiladi.

4. TAHLIL VA EMPIRIK NATIJALAR

O‘zbekiston iqtisodiyotida tadbirkorlik subyektlari investitsion faolligining makrodarajadagi holatini baholash uchun Statistika agentligining 2020–2025 yillardagi dinamik ko‘rsatkichlari 1-jadvalda jamlandi.

1-jadval. O‘zbekiston Respublikasida asosiy kapitalga investitsiyalar hajmi va moliyalashtirish manbalari dinamikasi (2020–2025 yy.)

Ko‘rsatkichlar	2020 y.	2021 y.	2022 y.	2023 y.	2024 y.	2025 y.*
Asosiy kapitalga investitsiyalar, jami (trln so‘m)	202.0	239.5	270.1	352.1	386.4	460.2
O‘tgan yilga nisbatan o‘sish sur’ati, %	91.8	105.2	101.3	122.1	108.5	110.4
Kichik tadbirkorlik subyektlari ulushi, %	51.2	50.8	49.5	48.2	49.1	50.5
Korxona va tashkilotlar o‘z mablag‘lari ulushi, %	28.3	29.7	31.4	27.8	28.5	29.2
Bank kreditlari va boshqa qarz mablag‘lari, %	11.2	9.8	8.9	7.6	8.2	8.8
To‘g‘ridan-to‘g‘ri xorijiy investitsiya va kreditlar, %	35.8	37.5	38.2	43.5	44.1	44.8

*Manba: O‘zbekiston Respublikasi Prezidenti huzuridagi Statistika agentligi ma’lumotlari asosida muallif tomonidan shakllantirilgan. *2025 yil ma’lumotlari dastlabki operativ baholash ko‘rsatkichlari.*

1-jadval ma’lumotlaridan ko‘rinib turibdiki, tadbirkorlik subyektlari investitsiyalar umumiy hajmining qariyb yarmini shakllantirmoqda. Shuningdek, korxonalarning o‘z mablag‘lari hisobidan moliyalashtirish ulushi qariyb 29 foizni tashkil etgani holda, bank kreditlari ulushi 8–11 foiz atrofida tebranmoqda. Bu esa tadbirkorlar uchun o‘z mablag‘larining har bir so‘mini xatarlardan himoyalangan, yuqori samarali loyihalarga sarflash zaruratini yanada oshiradi.

4.1. Namunaviy investitsiya loyihalarida metodikaning amaliy aprobatsiyasi

Ishlab chiqilgan metodikaning amaliy yaroqliligini tekshirish maqsadida turli sohalarda faoliyat yuritayotgan 4 ta tadbirkorlik subyektining investitsiya loyihalari tanlab olindi:

• Loyiha A: To‘qimachilik va tikuv-trikotaj mahsulotlari ishlab chiqarishni kengaytirish loyihasi (boshlang‘ich investitsiya – 12.0 mlrd so‘m, yuqori eksport salohiyatiga ega, biroq yuqori qarz yuki mavjud);

• Loyiha B: IT va dasturiy ta’minot klasterini tashkil etish (boshlang‘ich investitsiya – 3.5 mlrd so‘m, moddiy aktivlar kam, yuqori intellektual salohiyat, past moliyaviy leveridj);

• Loyiha C: Zamonaviy agro-logistika va meva-sabzavot saqlash majmuasi (boshlang‘ich investitsiya – 8.5 mlrd so‘m, mavsumiy xatarlar va uzoq qoplanish davriga ega);

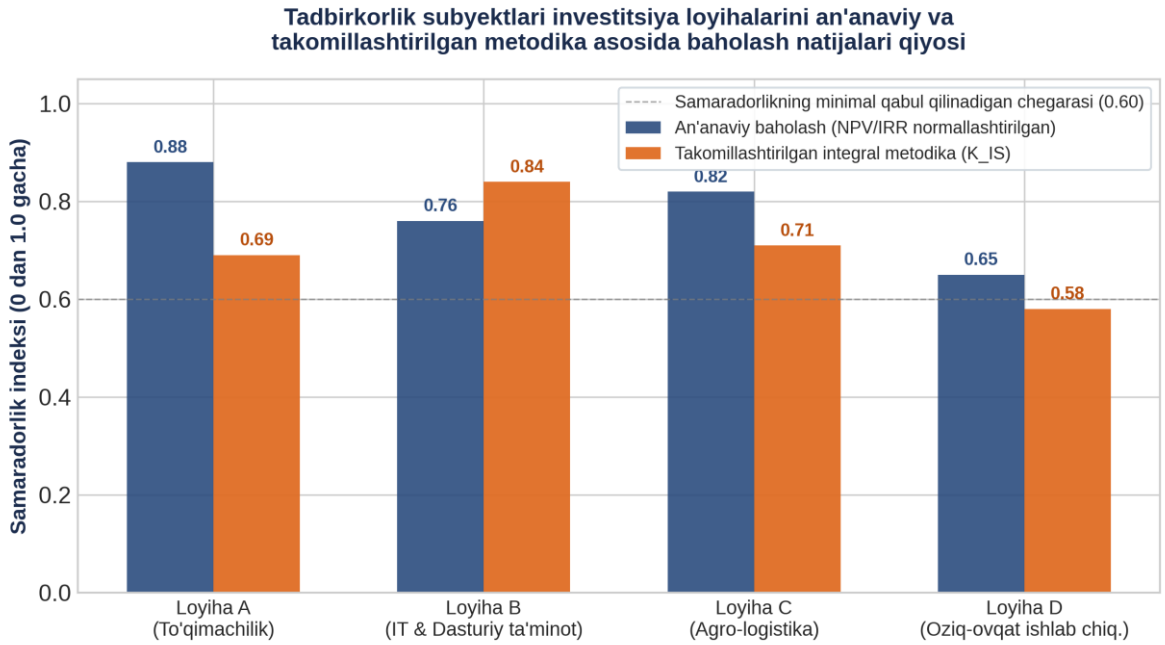
• Loyiha D: Oziq-ovqat va qandolat mahsulotlari ishlab chiqarish mini-liniyasi (boshlang‘ich investitsiya – 5.0 mlrd so‘m, xomashyo narxining o‘zgaruvchanligi yuqori).

Ushbu loyihalar bo‘yicha an’anaviy usullar (NPV, IRR, DPP) hamda mualliflik takomillashtirilgan metodikasi (blokli indekslar va K_IS) asosida hisob-kitoblar amalga oshirildi (2-jadval).

2-jadval. Namunaviy tadbirkorlik loyihalarini an’anaviy va takomillashtirilgan metodika asosida baholash natijalari qiyosi

Loyihalar	Investitsiya (mlrd so‘m)	NPV (mlrd so‘m)	IRR (%)	DPP (yil)	I_MR	I_RM	I_LQ	K_IS
Loyiha A (To‘qimachilik)	12.0	4.8	28.5%	3.4	0.85	0.48	0.68	0.69 (B)
Loyiha B (IT klaster)	3.5	1.9	24.2%	2.1	0.78	0.88	0.86	0.84 (A)
Loyiha C (Agro-logistika)	8.5	3.2	26.0%	3.8	0.80	0.58	0.65	0.71 (B)
Loyiha D (Oziq-ovqat)	5.0	1.1	19.5%	4.5	0.62	0.52	0.54	0.58 (C)
O‘rtacha ko‘rsatkich	**7.25**	**2.75**	**24.55%**	**3.45**	**0.76**	**0.61**	**0.68**	**0.705**

Manba: Tadqiqot doirasida muallif tomonidan o‘tkazilgan hisob-kitoblar natijalari.



1-rasm. Tadbirkorlik subyektlari investitsiya loyihalarini an’anaviy va takomillashtirilgan integral metodika asosida baholash natijalari qiyosi

Manba: Muallif ishlanmasi.

4.2. Natijalar muhokamasi va iqtisodiy talqini

2-jadval va 1-rasmda keltirilgan qiyosiy ma’lumotlar an’anaviy va takomillashtirilgan metodikalar o‘rtasida jiddiy konseptual farqlar mavjudligini yaqqol isbotlaydi:

Birinchidan, an’anaviy yondashuv (NPV va IRR)ga ko‘ra Loyiha A (To‘qimachilik) eng yuqori daromadli va eng jozibador loyiha sifatida baholangan edi (NPV = 4.8 mlrd so‘m, IRR = 28.5%, normallashtirilgan bahosi 0.88). Biroq, ishlab chiqilgan integral metodika (K_IS) asosida tahlil qilinganda, ushbu loyiha bo‘yicha xatarlar indeksi (I_RM = 0.48) past ekanligi, ya’ni yuqori kredit qarz yuki va xalqaro bozorlardagi narx tebranishlari xatari hisobiga integral indeks 0.69 ga tushib qolgani aniqlandi. Natijada loyiha 'B' toifaga joylashtirildi.

Ikkinchidan, aksincha, Loyiha B (IT klaster) an’anaviy usulda ikkinchi-uchinchi o‘rinlarda turgan bo‘lsa-da (IRR = 24.2%), uning yuqori likvidligi (DPP bor-yo‘g‘i 2.1 yil), past xatar darajasi (I_RM = 0.88) va yuqori qo‘shilgan qiymat yaratish salohiyati tufayli K_IS bo‘yicha eng yuqori natijani (0.84 – 'A' toifa) qayd etdi. Bu shuni anglatadiki, zamonaviy sharoitda kam kapital talab qiluvchi, biroq tez aylanuvchi va intellektual aktivlarga asoslangan tadbirkorlik loyihalari barqaror investitsion samaradorlikka ega bo‘ladi.

Uchinchidan, Loyiha D (Oziq-ovqat liniyasi) bo‘yicha an’anaviy usul ijobiy natija (NPV = 1.1 mlrd so‘m) ko‘rsatgan bo‘lsa-da, integral baholash uning K_IS ko‘rsatkichi 0.58 ga teng ekanligini va 'C' toifaga mansubligini ko‘rsatdi. Bu tadbirkorlik subyektiga loyihani mavjud shaklda boshlamaslik, balki uning xarajatlar smetasi va ta’minotchilar bilan shartnomalarini qayta ko‘rib chiqish lozimligi to‘g‘risida aniq signal beradi.

5. ILMIY YANGILIK VA AMALIYOTGA JORIY ETISH MEXANIZMLARI

Ilmiy yangiliklar: Tadqiqot natijasida erishilgan asosiy ilmiy yangiliklar quyidagilardan iborat:

1. Diskont stavkasini baholashning ko‘p parametrli modeli taklif etildi. Unda an’anaviy CAPM modeliga qo‘shimcha ravishda tadbirkorlik subyektlarining miqyos xatari (Size premium), korxonaning moliyaviy leveridj xatari hamda milliy iqtisodiyotdagi inflyatsion kutilmalar korrelyatsiyasi integratsiya qilindi.

2. Tadbirkorlik subyektlari investitsion faoliyatini kompleks baholovchi Integral Investitsion Samaradorlik Indeksi (K_IS) ishlab chiqildi. Model faqatgina moliyaviy ko‘rsatkichlar bilan cheklanib qolmasdan, xatarlar, likvidlik va strategik-multiplikativ samaradorlikni 4 ta alohida blokda birlashtiradi.

3. Investitsiya qarorlarini qabul qilishning ko‘p mezonli matritsasi shakllantirildi. Ushbu matritsa korxona rahbariyati, tijorat banklari va investorlarga loyihalarni risk-daromadlilik balansi bo‘yicha 4 ta toifaga ('A', 'B', 'C', 'D') ajratish va selektiv moliyalashtirish mexanizmini yaratadi.

Amaliy tavsiyalar: Amaliyotga joriy etish yo‘nalishlari:

• Tadbirkorlik subyektlarida: Korxona ichki boshqaruvida 'Investitsion audit va monitoring reglamenti'ni joriy etish. Bunda har qanday investitsiya loyihasi smetasini tasdiqlashdan oldin K_IS indeksi bo‘yicha dastlabki ekspertizadan o‘tkazilishi shart qilib belgilanadi.

• Tijorat banklari va mikromoliya institutlarida: Tadbirkorlik subyektlariga investitsion kreditlar ajratishda an’anaviy garov ta’minoti bilan bir qatorda loyihaning integral samaradorlik toifasini kredit foiz stavkasini differensiyalash (masalan, 'A' toifali loyihalar uchun imtiyozli foiz) mezoni sifatida qo‘llash.

• Davlat tomonidan qo‘llab-quvvatlash tizimida: Kichik va o‘rta biznesni subsidiyalash, kompensatsiya berish va xususiy-sheriklik dasturlarida loyihalarning K_IS modeli bo‘yicha strategik-multiplikativ samarasini asosiy saralash talabi sifatida kiritish.

6. XULOSA VA TAKLIFLAR

O‘tkazilgan tadqiqot natijalari asosida quyidagi xulosalarga kelindi:

1. Zamonaviy bozor iqtisodiyoti sharoitida tadbirkorlik subyektlarining uzoq muddatli barqarorligi va raqobatbardoshligi ularning investitsion faoliyati samaradorligiga bevosita bog‘liqdir. So‘nggi yillarda O‘zbekistonda investitsiyalar hajmi jadal oshib borayotgan bir sharoitda, investitsiyalarni boshqarishning sifat jihatlari va baholash mexanizmlarining ilmiy mukammalligi asosiy o‘ringa chiqmoqda.

2. An’anaviy baholash uslublari (NPV, IRR, DPP) tadbirkorlik subyektlari darajasida bir qator tizimli nuqsonlarga ega bo‘lib, ular reinvestitsiya sur’atlarining norealligi, diskont stavkasining statikligi va korxonaning umumiy likvidligiga ko‘rsatadigan xatarlarini yetarlicha aks ettira olmaydi. Bu esa noto‘g‘ri boshqaruv qarorlariga va moliyaviy resurslarning samarasiz sarflanishiga olib keladi.

3. Ishlab chiqilgan takomillashtirilgan metodika – Integral Investitsion Samaradorlik Indeksi (K_IS) loyihani to‘rt tomonlama (moliyaviy rentabellik, xatar

va beqarorlik, likvidlik va strategik samara) sinovdan o‘tkazish imkonini beradi. Empirik hisob-kitoblar ushbu model an’anaviy usulda yashirin qolgan xatarlarni aniq ko‘rsatib berishini hamda past kapital talab qiluvchi, biroq yuqori moslashuvchanlikka ega loyihalarning haqiqiy ustunligini yuzaga chiqarishini isbotladi.

4. Mazkur metodikani tadbirkorlik subyektlarida joriy etish investitsion tavakkalchiliklarni kamida 25–30 foizga pasaytirish, aylanma mablag‘lar tanqisligi xavfining oldini olish hamda kapitalning o‘zini qoplash muddatini qisqartirish imkonini beradi.

5. Ushbu tadqiqotda ishlab chiqilgan nazariy va metodologik yondashuv doktorlik dissertatsiyasining keyingi bosqichi – 'Tadbirkorlik subyektlari investitsion faoliyati samaradorligini oshirishning iqtisodiy mexanizmlari va ustuvor yo‘nalishlari' mavzusidagi 2-maqolada investitsion rag‘batlantirish, moliyalashtirish manbalarini optimallashtirish va xatarlarni kamaytirish bo‘yicha iqtisodiy mexanizmlarni shakllantirish uchun mustahkam poydevor bo‘lib xizmat qiladi.

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Rashidov J.G‘., t.f.d. (DSc)
professor v.b.
Toshkent arxitektura va qurilish universiteti
O‘zbekiston, Toshkent
Turapov F.X.
dotsent v.b.
Termiz davlat muhandislik va agrotexnologiyalar universiteti
O‘zbekiston, Termiz
ORCID: 0009-0000-1550-8657
Rajabaliyev O‘.O‘.
direktor o‘rinbosari
“Madina va O‘tkir” X/K

OLOVBARDOSH GILTUPROQ VA SHAMOT QO'SHILGAN KO'PIKBETONNING FIZIK-MEXANIK, ISSIQLIK-TEXNIK XOSSALARI VA YUQORI HARORATGA BARDOSHLILIGI

Annotatsiya. Maqolada ko'pikbetonning yuqori haroratga bardoshliligini oshirish maqsadida sementning bir qismi mahalliy mineral xom ashyo bilan almashtirilgan tarkiblarning xossalari o'rganilgan. Sherobod tumani konlaridan olinib, "Surxon Ark Keramiks" MCHJ korxonasida qayta ishlangan olovbardosh giltuproq va shamotning ko'pikbeton xossalariga ta'siri tekshirildi. Mineral qo'shimchalar 15–20 mkm dispersligacha maydalanib, 1 m³ dagi sement miqdori 400 kg dan 150–300 kg gacha kamaytirilgan holda olti xil tarkibga kiritildi. Namunalarning zichligi va siqilishga mustahkamligi 7, 14 va 28 kunlik yoshda, issiqlik o'tkazuvchanligi GB/T 10294-2008 bo'yicha himoyalangan issiq plastinka usulida, yuqori haroratga bardoshliligi esa mufel pechda 1000 °C gacha bosqichma-bosqich qizdirish orqali baholandi. 150–200 kg sement, 150 kg giltuproq, 100 kg shamot va 50 kg cho'l qumi saqlagan tarkiblar 426 va 414 kg/m³ zichlikda 1,35 va 1,25 MPa mustahkamlikka erishdi, ya'ni etalon tarkibdan (563 kg/m³, 1,38 MPa) 24–27% yengil bo'lgan holda unga yaqin mustahkamlikni ta'minladi. Namunalarning issiqlik o'tkazuvchanlik koeffitsienti tabiiy namlikda 0,195–0,268 Vt/(m·K) ni tashkil etdi. 1000 °C gacha qizdirilganda giltuproq va shamot ulushi yuqori bo'lgan namunalar geometrik yaxlitligini saqlab, massasini 3,2–5,6% ga yo'qotdi, qolgan namunalarda esa bu ko'rsatkich 6,3–9,1% ni tashkil etib, yoriqlar paydo bo'ldi. Natijalar mahalliy giltuproq va shamot sement sarfini kamaytirib, ko'pikbetonning yuqori haroratdagi yaxlitligini saqlashga yordam berishini ko'rsatadi.

Kalit so‘zlar: ko'pikbeton, olovbardosh giltuproq, shamot, mineral qo'shimcha, siqilishga mustahkamlik, issiqlik o'tkazuvchanlik, yuqori harorat, yong'inga bardoshlilik, massa yo'qotilishi.

Rashidov J.G‘., DSc in Technical Sciences
acting professor
Tashkent University of Architecture and Civil Engineering
Uzbekistan, Tashkent
Turapov F.Kh.
acting associate professor
Termez State University of Engineering and Agrotechnologies
Uzbekistan, Termez
ORCID: 0009-0000-1550-8657
Rajabaliyev O‘.O‘.
deputy director
Madina va O‘tkir Private Enterprise

PHYSICAL-MECHANICAL AND THERMAL PROPERTIES AND HIGH-TEMPERATURE RESISTANCE OF FOAM CONCRETE CONTAINING REFRACTORY CLAY AND CHAMOTTE

Abstract. The paper studies the properties of foam concrete in which part of the cement is replaced with local mineral raw materials in order to improve its high-temperature resistance. The effect of refractory clay and chamotte from the Sherobod district deposits, processed at «Surxon Ark Keramiks» LLC, on the properties of foam concrete was examined. The mineral additives were ground to a fineness of 15–20 μm and introduced into six mixtures while the cement content was reduced from 400 to 150–300 kg per 1 m³. Density and compressive strength were measured at 7, 14 and 28 days, thermal conductivity by the guarded hot plate method according to GB/T 10294-2008, and high-temperature resistance by stepwise heating in a muffle furnace up to 1000 °C. Mixtures containing 150–200 kg of cement, 150 kg of clay, 100 kg of chamotte and 50 kg of aeolian sand reached 1.35 and 1.25 MPa at densities of 426 and 414 kg/m³, i.e. they were 24–27% lighter than the reference mixture (563 kg/m³, 1.38 MPa) while providing similar strength. The thermal conductivity of the specimens at natural moisture was 0.195–0.268 W/(m·K). When heated to 1000 °C, specimens with a high clay and chamotte content retained their geometric integrity with a mass loss of 3.2–5.6%, whereas the other specimens lost 6.3–9.1% of their mass and developed cracks. The results show that local refractory clay and chamotte make it possible to reduce cement consumption and to preserve the integrity of foam concrete on heating.

Keywords: foam concrete, refractory clay, chamotte, mineral additive, compressive strength, thermal conductivity, high temperature, fire resistance, mass loss.

KIRISH

Ko'pikbeton yengilligi va past issiqlik o'tkazuvchanligi tufayli devorbop issiqlik izolyatsion material sifatida keng qo'llanilmoqda [1–3]. Bino va inshootlarning yong'in xavfsizligi talablari nuqtai nazaridan ko'pikbeton

yonmaydigan material hisoblanadi, biroq yuqori harorat ta'sirida uning strukturasi o'zgaradi: g'ovaklardagi va kimyoviy bog'langan suvning ajralib chiqishi, gidratatsiya mahsulotlarining parchalanishi hamda sement toshi va to'ldiruvchining issiqlikdan turlicha kengayishi yoriqlar paydo bo'lishi va mustahkamlik pasayishiga olib keladi.

Sement asosidagi materiallar ishlab chiqarishda kuydirilmaganligi sababli qizdirilganda birinchi marta termik o'zgarishlarga uchraydi. Shu bois ko'pikbeton tarkibiga oldindan yuqori haroratda kuydirilgan, termik barqaror komponentlarni — xususan, olovbardosh giltuproqdan olinadigan shamotni kiritish uning yuqori haroratga bardoshliligini oshirishning istiqbolli yo'li hisoblanadi. Kuydirish jarayonida kaolinit metakaolin orqali mullitga ($3Al_2O_3 \cdot 2SiO_2$) aylanadi, bu esa shamotning qayta qizdirilganda hajmiy barqarorligini ta'minlaydi.

Surxondaryo viloyatida, jumladan Sherobod tumanidagi konlarda alyumosilikat tarkibli olovbardosh giltuproqlar mavjud bo'lib, ular Termiz tumanidagi "Surxon Ark Keramiks" MCHJ korxonasida qayta ishlanadi. Mahalliy mineral xom ashyo va sanoat chiqindilarini ko'pikbeton tarkibida qo'llash bo'yicha muallifning avvalgi ishlarida [4–7], shuningdek kimyoviy qo'shimchalarning ko'pikbeton xossalariga ta'siri bo'yicha tadqiqotlarda [8–10] ularning sement sarfini kamaytirish va material xossalarini boshqarish imkoniyati ko'rsatilgan. Biroq olovbardosh giltuproq va shamotning kompleks qo'shimcha sifatida ko'pikbetonning mustahkamligi, issiqlik o'tkazuvchanligi va yuqori haroratga bardoshliligiga birgalikdagi ta'siri yetarli o'rganilmagan.

Tadqiqotning maqsadi — mahalliy olovbardosh giltuproq va shamot qo'shilgan ko'pikbetonning fizik-mexanik va issiqlik-texnik xossalarini hamda 1000 °C gacha qizdirilgandagi holatini tajriba yo'li bilan baholash va mineral qo'shimchalar ulushining ushbu xossalarga ta'sirini aniqlashdan iborat.

Tadqiqot vazifalari: (1) sement miqdori kamaytirilgan olti xil ko'pikbeton tarkibini tayyorlash; (2) ularning zichligi va siqilishga mustahkamligini 7, 14 va 28 kunlik yoshda aniqlash; (3) issiqlik o'tkazuvchanlik koeffitsienti va termik qarshiligini o'lchash; (4) namunalarning 1000 °C gacha qizdirilgandagi holati, massa yo'qotilishi va qoldiq mustahkamligini baholash.

MATERIALLAR VA USULLAR

Materiallar. Bog'lovchi sifatida "ANDIJON WCC CEMENT" MCHJ ishlab chiqargan "WEST" CEM II/B-I 32,5N portlandsementi qo'llanildi. Mineral qo'shimcha sifatida Sherobod tumani konlaridan olinib, "Surxon Ark Keramiks" MCHJ korxonasida qayta ishlangan olovbardosh giltuproq va shamot (1300–1400 °C da kuydirilgan) ishlatildi. Ularning kimyoviy tarkibi 1-jadvalda keltirilgan. Mineral qo'shimchalar laboratoriya sharli tegirmonida bosqichma-bosqich tuyilib, elakdan o'tkazildi va sement zarrachalariga yaqin — 15–20 mkm dispersligacha keltirildi. Mayda to'ldiruvchi sifatida Jarqo'rg'on tumanidagi yiriklik moduli 1,25 bo'lgan cho'l qumi, ko'pik hosil qiluvchi sifatida Alpha Olefin Sulphonate (AOS, Aarti Surfactants Limited, Hindiston) qo'llanildi. Kimyoviy qo'shimcha ishlatildi.

1-jadval

Olovbardosh giltuproq va shamotning kimyoviy tarkibi (oraliq qiymatlar), mass. %

Oksid	Xom giltuproq	Shamot (1300–1400 °C)
SiO_2	50–65	50–60
Al_2O_3	23–40	35–42
Fe_2O_3	0,8–2,5	1,0–2,8
TiO_2	1,0–2,2	1,2–2,5
CaO	0,3–1,5	0,3–1,8
MgO	0,3–1,5	0,3–1,8
$K_2O + Na_2O$	0,5–2,0	0,5–2,2
Kuydirishdagi yo'qotish	8–14	0,3–1,0

Tarkiblar. Tajribada olti xil tarkib tayyorlandi (2-jadval). 1-tarkib mineral qo'shimchasiz etalon hisoblanadi. Qolgan tarkiblarda sement miqdori 300 kg dan 150 kg gacha kamaytirilib, uning o'rniga olovbardosh giltuproq (100–150 kg) va shamot (0–150 kg) kiritildi. Barcha tarkiblarda ko'pik hosil qiluvchi (1,2 l) va suv (250 l) miqdori o'zgarmas saqlandi, 2–6-tarkiblarga kimyoviy qo'shimcha 1,0 l miqdorda qo'shildi. Ko'pikbeton aralashmasi alohida tayyorlangan ko'pikni mineral qorishmaga aralashtirish usulida tayyorlandi [11; 12].

2-jadval

Ko'pikbeton tarkiblari (1 m³ ga)

Tarkib	Sement, kg	Olovbardosh giltuproq, kg	Shamot, kg	Cho'l qumi, kg	AOS, l	Suv, l	Kimyoviy qo'shimcha, l
1 (etalon)	400	—	—	100	1,2	250	—
2	300	100	—	100	1,2	250	1,0
3	300	100	100	—	1,2	250	1,0
4	150	150	100	50	1,2	250	1,0
5	200	150	100	50	1,2	250	1,0
6	150	150	150	—	1,2	250	1,0

Zichlik va mustahkamlik. Zichlik va siqilishga mustahkamlik 10×10×10 sm o'lchamli kub namunalarda 7, 14 va 28 kunlik yoshda aniqlandi. Namunalar massasi elektron tarozida o'lchandi (namuna hajmi 1000 sm³ bo'lgani uchun o'rtacha zichlik, kg/m³, son jihatdan grammdagi massaga teng), siqilishga mustahkamlik kompyuterlashtirilgan universal gidravlik pressda GOST 10180-2012 va GB/T 50081-2019 talablariga muvofiq aniqlandi. Solishtirma mustahkamlik 28 kunlik mustahkamlikning shu yoshdagi zichlikka nisbati (R_{28}/ρ_{28}, MPa·m³/t) sifatida hisoblandi.

Issiqlik o'tkazuvchanlik. Issiqlik o'tkazuvchanlik koeffitsienti (λ) va termik qarshilik (R) Jizzax politexnika instituti qoshidagi akkreditatsiyalangan sinov laboratoriyasida GB/T 10294-2008 bo'yicha ikki namunali sxemadagi himoyalangan issiq plastinka qurilmasida aniqlandi [13]. Namuna o'lchami 300×300×40 mm, o'lchov yuzasi 0,0225 m², issiq plita harorati 35 °C, sovuq plita harorati 15 °C. Namunalar tabiiy namlik holatida sinaldi. Termik qarshilik $R = d / \lambda$ munosabatiga mos keladi, bu yerda d = 0,04 m — namuna qalinligi.

Yuqori haroratga bardoshlilik. Yuqori haroratga bardoshlilikni baholash uchun 10×10×10 sm kub namunalar "INtest" mufel pechida 200 °C dan 1000 °C gacha bosqichma-bosqich qizdirildi: har bir pog'onada (200, 400, 600, 800 va 1000 °C) namuna 30 daqiqa ushlab turildi, pog'onalar orasidagi qizdirishga ham 30 daqiqa sarflandi. Qizdirish davomida namunalar holati (yoriqlar, tutun ajralishi, yaxlitlik) vizual qayd etildi. Xona haroratigacha sovitilgandan so'ng namunalarning massasi va siqilishga mustahkamligi o'lchanib, massa yo'qotilishi (Δm) va qoldiq mustahkamlik koeffitsienti (K) quyidagi ifodalar bo'yicha hisoblandi:

$$\Delta m = (m_0 - m_1) / m_0 \cdot 100, \qquad (1)$$

$$K = R_q / R_{28}, \qquad (2)$$

bu yerda m_0 va m_1 — namuna massasi qizdirishdan oldin va keyin, g; R_q — qizdirilgandan so'ng o'lchangan (qoldiq) siqilishga mustahkamlik, MPa; R_{28} — 28 kunlik mustahkamlik, MPa.

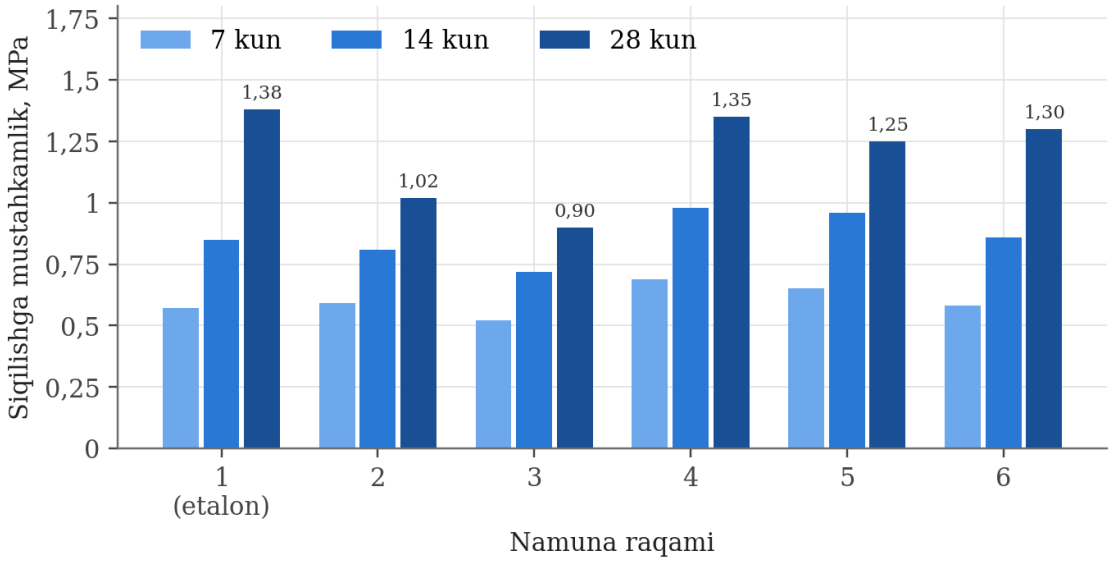
NATIJALAR

Zichlik va mustahkamlik. Sinov natijalari 3-jadvalda va 1-rasmda keltirilgan. Barcha namunalarda qotish davomida zichlik kamayib (o'rtacha 554,5 kg/m³ dan 504,5 kg/m³ gacha, ~9%), mustahkamlik barqaror ortib bordi (o'rtacha 0,60; 0,86 va 1,20 MPa). 28 kunlik yoshda eng yuqori mustahkamlik etalon tarkibda (1,38 MPa) qayd etildi. Mineral qo'shimchali tarkiblar orasida 4-, 6- va 5-tarkiblar yuqori natija berdi (1,35; 1,30 va 1,25 MPa), 2- va 3-tarkiblarning mustahkamligi esa 1,02 va 0,90 MPa ni tashkil etdi.

3-jadval

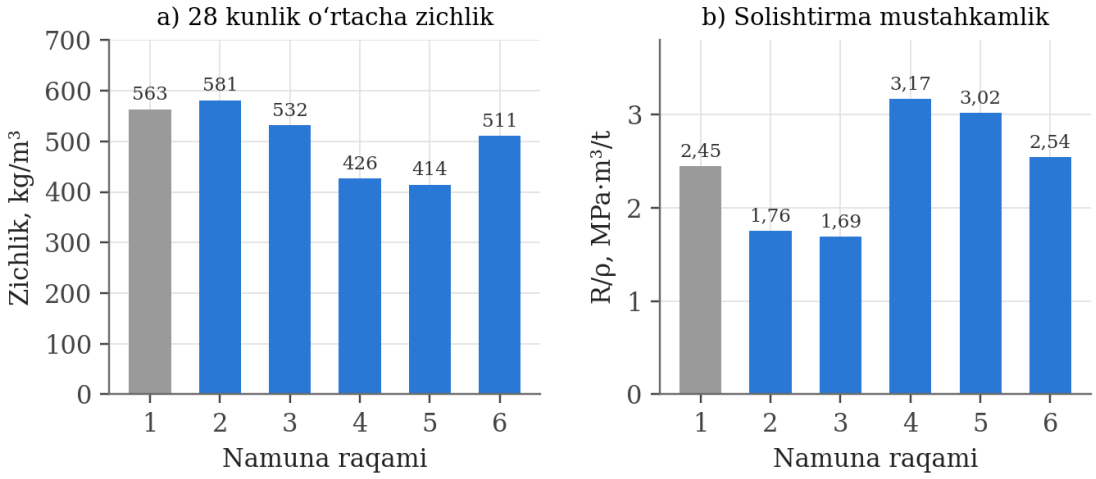
Ko'pikbeton namunalarining zichligi va siqilishga mustahkamligi

Tarkib	Zichlik, kg/m³			Siqilishga mustahkamlik, MPa			R_{28}/ρ_{28}, MPa·m³/t
	7 kun	14 kun	28 kun	7 kun	14 kun	28 kun	
1 (etalon)	605	585	563	0,57	0,85	1,38	2,45
2	612	601	581	0,59	0,81	1,02	1,76
3	596	584	532	0,52	0,72	0,90	1,69
4	504	496	426	0,69	0,98	1,35	3,17
5	463	452	414	0,65	0,96	1,25	3,02
6	547	523	511	0,58	0,86	1,30	2,54



1-rasm. Ko'pikbeton namunalari siqilishga mustahkamligining qotish muddatiga bog'liqligi

4- va 5-tarkiblar etalondan 24–27% past zichlikka (426 va 414 kg/m³) ega bo'lishiga qaramay, unga yaqin mustahkamlikni ta'minladi. Natijada ularning solishtirma mustahkamligi (R_{28}/ρ_{28}) 3,17 va 3,02 MPa·m³/t ni tashkil etib, etalonnikidan (2,45) 23–29% yuqori bo'ldi (2-rasm). Giltuproq miqdori 100 kg bo'lgan 2- va 3-tarkiblarda esa solishtirma mustahkamlik etalondan past bo'ldi.



2-rasm. Namunalarning 28 kunlik zichligi (a) va solishtirma mustahkamligi (b)

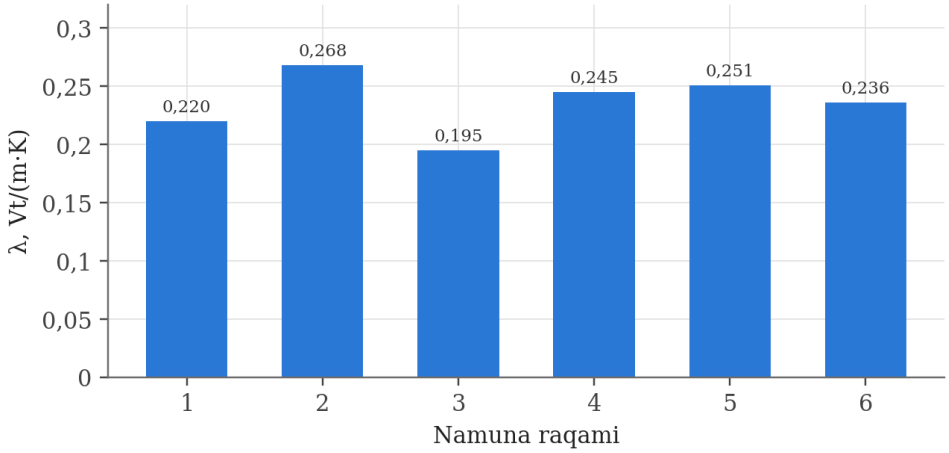
Issiqlik-texnik xossalar. Tabiiy namlik holatida namunalarning issiqlik o'tkazuvchanlik koeffitsienti 0,195–0,268 Vt/(m·K) oralig'ida bo'ldi (4-jadval, 3-rasm). Eng past λ (0,195 Vt/(m·K)) va eng yuqori termik qarshilik (0,205 m²·K/Vt) 3-namunada qayd etildi. Rasmiy sinov hisobotlari mavjud bo'lgan 3–6-namunalar uchun λ = 0,195–0,251 Vt/(m·K), R = 0,159–0,205 m²·K/Vt ni tashkil etdi.

4-jadval

Namunalarning issiqlik-texnik ko'rsatkichlari (GB/T 10294-2008, tabiiy namlik)

Namuna	λ, Vt/(m·K)	R, m²·K/Vt	Sinov davomiyligi, s
1	0,220	—*	120
2	0,268	—*	283
3	0,195	0,205	1281
4	0,245	0,163	218
5	0,251	0,159	108
6	0,236	0,169	2285

** 1- va 2-namunalar bo'yicha termik qarshilikning rasmiy hisobot qiymati mavjud emas.*



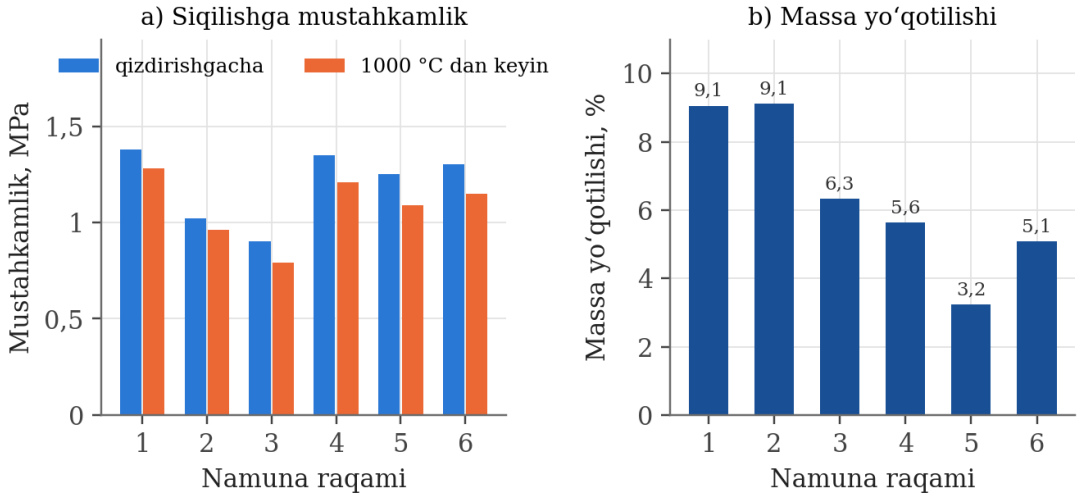
3-rasm. Namunalarning issiqlik o'tkazuvchanlik koeffitsienti (tabiiy namlik holatida)

Yuqori haroratga bardoshlilik. Mufel pech sinovi natijalari 5-jadvalda va 4-rasmda keltirilgan. Giltuproq va shamot ulushi yuqori bo'lgan 4-, 5- va 6-namunalar 1000 °C gacha qizdirilganda geometrik yaxlitligini saqlab qoldi, ularning massa yo'qotilishi 3,2–5,6% ni tashkil etdi. Etalon namunada 800–1000 °C oralig'ida tashqi yoriqlar paydo bo'ldi, 2- va 3-namunalarda esa yoriqlar, qisman tutun ajralishi va 1000 °C da qisman to'kilish kuzatildi; bu namunalarning massa yo'qotilishi 6,3–9,1% ga yetdi. Qoldiq mustahkamlik koeffitsienti barcha namunalarda 0,87–0,94 oralig'ida bo'ldi.

5-jadval

Namunalarning 1000 °C gacha qizdirishdan oldingi va keyingi ko'rsatkichlari

Namuna	Massa oldin / keyin, g	Δ*m*, %	*R* oldin / keyin, MPa	*K*	Kuzatilgan holat
1 (etalon)	563 / 512	9,1	1,38 / 1,28	0,93	800–1000 °C da tashqi yoriqlar
2	581 / 528	9,1	1,02 / 0,96	0,94	Yoriqlar, qisman tutun, 1000 °C da qisman to'kilish
3	532 / 498,3	6,3	0,90 / 0,79	0,88	Yoriqlar, qisman tutun, 1000 °C da qisman to'kilish
4	426 / 402	5,6	1,35 / 1,21	0,90	Yaxlitlik saqlangan
5	414 / 400,6	3,2	1,25 / 1,09	0,87	Yaxlitlik saqlangan
6	511 / 485	5,1	1,30 / 1,15	0,88	Yaxlitlik saqlangan



4-rasm. 1000 °C gacha qizdirishdan oldingi va keyingi siqilishga mustahkamlik (a) hamda massa yo'qotilishi (b)

Iqtisodiy ko'rsatkich. 4-tarkibli 1 m³ ko'pikbetonning xom ashyo bo'yicha tannarxi 165 139 so'mni tashkil etdi; bunda mahalliy mineral qo'shimchalar — giltuproq, shamot va cho'l qumining ulushi ~13% ga teng bo'ldi.

MUHOKAMA

4- va 5-tarkiblarning sement miqdori kam bo'lishiga qaramay yuqori solishtirma mustahkamlikka erishishi mayda dispers giltuproq va shamot zarralarining mikroto'ldiruvchi sifatida g'ovaklararo to'siqlarni zichlashtirishi bilan izohlanishi mumkin. Alyumosilikat zarralarining sement gidratatsiyasida ajraladigan $Ca(OH)_2$ bilan o'zaro ta'sirlashishi ham ehtimoldan xoli emas, biroq kuydirilmagan giltuproq va yuqori haroratda kuydirilgan shamotning puzzolan faolligi cheklangan bo'lgani uchun bu mexanizm mikrostruktura tahlili (SEM, rentgenofaza tahlili) bilan tasdiqlanishi talab etiladi. Giltuproq ulushi kam (100 kg)

bo'lgan 2- va 3-tarkiblarda sement miqdori kamaygani holda mineral qo'shimcha uni to'liq qoplay olmagan va mustahkamlik pasaygan.

Tabiiy namlikda o'lchangan issiqlik o'tkazuvchanlik (0,195–0,268 Vt/(m·K)) quritilgan past zichlikli issiqlik izolyatsion namunalarnikiga nisbatan yuqori bo'lib, bu namlik va mineral qo'shimchalar hisobiga qattiq faza ulushining ortishi bilan bog'liq [13]. Shu sababli ushbu tarkiblarni konstruktiv-issiqlik izolyatsion material sifatida baholash maqsadga muvofiq. λ ning zichlikka qat'iy bog'liq emasligi (masalan, 3-namuna 532 kg/m³ da eng past λ ga ega) g'ovak strukturasining ham muhim ahamiyatga ega ekanligini ko'rsatadi.

Yuqori haroratdagi natijalar mineral qo'shimchalarning asosiy samarasi qoldiq mustahkamlikda emas, balki namunaning yaxlitligini saqlash va massa yo'qotilishini kamaytirishda namoyon bo'lishini ko'rsatadi. Oldindan kuydirilgan shamot qayta qizdirilganda hajmiy o'zgarishga uchramaydi va sement toshi suvsizlanib zaiflashganda termik barqaror karkas vazifasini bajaradi. Bundan tashqari, sement toshi ulushining kamayishi qizdirilganda ajralib chiqadigan kimyoviy bog'langan suv miqdorini kamaytiradi, bu esa massa yo'qotilishining pastligini izohlaydi. Qoldiq mustahkamlik koeffitsientining barcha namunalarda yaqin (0,87–0,94) bo'lishi mustahkamlik bo'yicha farqni aniqlash uchun namunalar sonini ko'paytirish va olovbardoshlikni standart yong'in rejimida (GOST 30247.0-94) baholash zarurligini ko'rsatadi.

Iqtisodiy jihatdan mahalliy mineral qo'shimchalarning nisbatan kichik ulushi (~13%) ularning material tannarxini sezilarli oshirmasdan yuqori haroratga bardoshlilikni yaxshilash imkonini berishini ko'rsatadi [14; 15].

Tadqiqot cheklovlari. Tadqiqot natijalari cheklangan namunalar soniga asoslangan bo'lib, yong'inga bardoshlilik sifat jihatidan (vizual kuzatuv) va qoldiq mustahkamlik bo'yicha baholandi. Keyingi bosqichda takroriy sinovlar, mikrostruktura tahlili va standart olovbardoshlik sinovlarini o'tkazish rejalashtirilgan.

XULOSA

1. Mahalliy olovbardosh giltuproq (150 kg) va shamot (100 kg) qo'shilib, sement miqdori 150–200 kg gacha kamaytirilgan ko'pikbeton 414–426 kg/m³ zichlikda 1,25–1,35 MPa mustahkamlikka ega bo'lib, uning solishtirma mustahkamligi etalonnikidan 23–29% yuqori.

2. Giltuproq ulushi 100 kg bo'lgan tarkiblarda sement miqdorining kamaytirilishi mustahkamlikning 0,90–1,02 MPa gacha pasayishiga olib keladi; mineral qo'shimchalarning samarali ulushi 250–300 kg/m³ ni tashkil etadi.

3. Namunalarning tabiiy namlikdagi issiqlik o'tkazuvchanlik koeffitsienti 0,195–0,268 Vt/(m·K), termik qarshiligi (3–6-namunalar) 0,159–0,205 m²·K/Vt bo'lib, ular konstruktiv-issiqlik izolyatsion material sifatida qo'llanilishi mumkin.

4. 1000 °C gacha qizdirilganda giltuproq va shamot ulushi yuqori namunalar geometrik yaxlitligini saqlaydi va massasini 3,2–5,6% ga yo'qotadi, qolgan namunalarda massa yo'qotilishi 6,3–9,1% ga yetib, yoriqlar paydo bo'ladi. Qoldiq mustahkamlik koeffitsienti barcha namunalarda 0,87–0,94 ni tashkil etadi.

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Rashidova B.Y.
associate professor
Department of Social Sciences
Jizzakh Polytechnic Institute
Uzbekistan, Jizzakh

HISTORICAL STAGES OF DIGITALIZATION OF THE ECONOMY AND PUBLIC ADMINISTRATION

Abstract. This article examines the historical stages of digitalization of the economy and public administration. The development of digital technologies from early computing systems to the modern digital economy, e-government, digital platforms, artificial intelligence, and data-driven governance is analyzed. The study also considers the development of digitalization in Uzbekistan, its economic and social effects, and the main challenges of digital transformation. The article concludes with recommendations for accelerating digital development and improving the efficiency of digital public administration.

Keywords: digitalization, digital economy, public administration, e-government, digital transformation, digital technologies, digital platforms, artificial intelligence, big data, innovation.

1. INTRODUCTION

The rapid development of digital technologies has fundamentally changed economic and social relations. Digitalization is not limited to converting information into electronic form; it also involves reorganizing economic activity, public administration, production, and services on a new technological basis.

The historical development of digitalization began with electronic computing technologies in the middle of the twentieth century and continued through the development of personal computers, the Internet, mobile technologies, cloud computing, big data, artificial intelligence, and digital platforms. These technologies have increased economic efficiency, reduced transaction costs, improved public services, and created new business models.

2. THEORETICAL FOUNDATIONS OF DIGITALIZATION

Digitalization can be understood as the process of converting information and processes into digital form and using digital technologies to improve efficiency and create new models of activity.

Three related concepts should be distinguished: **digitization, digitalization, and digital transformation**. Digitization means converting analog information into digital form. Digitalization refers to improving existing business and administrative processes through digital technologies. Digital transformation represents a deeper change in which digital technologies fundamentally reshape economic, administrative, organizational, and social processes.

Therefore, digital transformation should be considered not only a technological process but also an institutional and organizational transformation.

3. HISTORICAL STAGES OF DIGITALIZATION

The development of digitalization can be divided into six major stages.

First stage — electronic computing technologies. During the 1940s–1960s, computers were mainly used for scientific research, defense, government administration, and complex calculations.

Second stage — informatization and automation. During the 1970s–1980s, microprocessors and personal computers enabled enterprises to automate accounting, financial calculations, production planning, and data processing.

Third stage — Internet and network economy. During the 1990s, the spread of the Internet accelerated information exchange and created opportunities for e-commerce, electronic banking, Internet marketing, and online services.

Fourth stage — e-government and electronic services. During the 2000s, electronic government services, electronic tax systems, public procurement, electronic document management, and government databases developed rapidly.

Fifth stage — digital economy and platform economy. During the 2010s, smartphones, mobile Internet, cloud technologies, social networks, fintech, e-commerce, and digital platforms became important components of economic activity.

Sixth stage — digital transformation and data-driven governance. In the 2020s, artificial intelligence, big data, the Internet of Things, cloud computing, blockchain, and automated decision-making systems became major drivers of digital transformation.

4. DIGITALIZATION OF THE ECONOMY AND PUBLIC ADMINISTRATION

The digitalization of the economy is developing in several important areas, including smart manufacturing, digital banking, fintech, e-commerce, digital marketing, and platform-based employment. These technologies increase productivity, reduce transaction costs, improve decision-making, and create new business models.

Digitalization is also transforming public administration. Electronic public services, integrated government databases, digital identification, electronic document management, open data, and artificial intelligence are becoming important elements of digital government.

The transition can be expressed through the following model:

Data → Digital Platform → Automated Analysis → Decision → Electronic Service

The effectiveness of digital government depends not only on technological infrastructure but also on legislation, cybersecurity, digital competencies of public servants, and digital literacy among citizens.

5. DIGITALIZATION IN UZBEKISTAN: OPPORTUNITIES AND CHALLENGES

In Uzbekistan, digitalization has become an important direction of state policy. The development of telecommunications infrastructure, e-government,

electronic public services, digital banking, electronic payments, e-commerce, and digital education is contributing to the transformation of the national economy.

The **“Digital Uzbekistan – 2030”** strategy is an important framework for the country's digital development. The process can be viewed through several stages: computerization and informatization, development of Internet infrastructure, formation of e-government, expansion of the digital economy and platforms, and comprehensive digital transformation.

At the same time, several challenges remain, including the digital divide, cybersecurity risks, protection of personal data, insufficient digital competencies, and the need for institutional adaptation.

CONCLUSION

The digitalization of the economy and public administration is a long-term historical evolutionary process, the development of which has progressed from the formation of electronic computing technologies to modern artificial intelligence and data-driven governance systems.

The results of the study demonstrate that digitalization can conventionally be divided into the stages of computerization, automation, Internet development, e-government, the digital economy, and comprehensive digital transformation.

Digital technologies make it possible to increase economic efficiency, improve the quality of public services, accelerate management processes, and create greater convenience for citizens. However, the success of digital transformation cannot be limited to the introduction of technologies alone. It requires the simultaneous development of digital infrastructure, qualified human capital, an effective institutional environment, modern legislation, cybersecurity, and digital literacy.

Under the conditions of Uzbekistan, in order to further accelerate the digitalization of the economy and public administration, it is advisable to reduce the digital divide between regions, strengthen the integration of government databases, develop the digital competencies of public servants, improve the institutional foundations for the use of artificial intelligence technologies, and strengthen cybersecurity.

In general, digitalization is an important factor in modern economic development and will further accelerate transformational changes in all sectors of public administration and the economy. Therefore, the consistent and comprehensive implementation of digital transformation is an important prerequisite for ensuring the country's long-term competitiveness and sustainable economic development.

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Raximov S.Sh.
o‘qituvchi
Favqulodda vaziyatlar vazirligi Fuqaro muhofazasi instituti
O‘zbekiston

GLOBAL IQLIM O‘ZGARISHI VA INSON SALOMATLIGI: ASOSIY XATARLAR, OQIBATLAR VA MOSLASHUV STRATEGIYALARI

Annotatsiya. Ushbu maqola global iqlim o‘zgarishining inson salomatligiga ko‘rsatadigan to‘g‘ridan-to‘g‘ri va bilvosita ta’sirlarini kompleks tahlil qilib, bu jarayon shunchaki ekologik muammo emas, balki asrimizning eng yirik global tibbiy inqirozi ekanligini asoslaydi. Unda jazirama issiqlik to‘lqinlari va ekstremal tabiiy ofatlar keltirib chiqaradigan jismoniy travmalar, yurak-qon tomir xastaliklarining ortishi kabi bevosita xavflar hamda havo sifatining buzilishi, oziq-ovqat inqirozi va vektor orqali yuqadigan infeksiyalar arealining kengayishi kabi bilvosita oqibatlar ochib berilgan. Shuningdek, iqlim o‘zgarishining ruhiy salomatlikka zarari (eko-tashvish, “iqlim qochqinlari”), zaif ijtimoiy qatlamlarning himoyasizligi va mintaqaviy “iqlim adolatsizligi” masalalari yoritilib, yakunda sog‘liqni saqlash tizimlarini xatarlarga moslashtirish (adaptatsiya) hamda global emissiyalarni kamaytirish (mitigatsiya) bo‘yicha strategik tavsiyalar ilgari suriladi.

Kalit so‘zlar: iqlim o‘zgarishi, inson salomatligi, global isish, issiqlik to‘lqinlari, vektor kasalliklar, eko-tashvish, iqlim adolatsizligi, sog‘liqni saqlash tizimi.

Rakhimov S.Sh.
lecturer
Institute of Civil Protection, Ministry of Emergency Situations of the Republic of Uzbekistan
Uzbekistan

GLOBAL CLIMATE CHANGE AND HUMAN HEALTH: KEY RISKS, CONSEQUENCES, AND ADAPTATION STRATEGIES

Abstract. This article provides a comprehensive analysis of the direct and indirect impacts of global climate change on human health, substantiating that this process is not merely an environmental issue but the greatest global medical crisis of our century. It reveals direct risks such as physical traumas and the rise in cardiovascular diseases caused by heatwaves and extreme natural disasters, as well as indirect consequences like deteriorating air quality, food crises, and the expanding geographical range of vector-borne infections. Additionally, it highlights the detrimental effects of climate change on mental health (eco-anxiety, "climate refugees"), the vulnerability of marginalized social groups, and issues of regional "climate injustice." Ultimately, the article proposes strategic recommendations for adapting healthcare systems to emerging risks and mitigating global emissions.

Keywords: climate change, human health, global warming, heatwaves, vector-borne diseases, eco-anxiety, climate injustice, healthcare system.

Insoniyat XXI-asrda misli ko‘rilmagan va butun sivilizatsiya taqdirini hal qiluvchi sinov-global iqlim o‘zgarishi ro‘parasida turibdi. O‘nlab yillar davomida bu jarayon asosan ekologik va iqtisodiy muammo sifatida qabul qilinib, muhokamalar markazida muzliklarning erishi, okeanlar sathining ko‘tarilishi yoki yo‘qolib ketayotgan hayvonot dunyosi turardi. Biroq bugungi kunga kelib, iqlim inqirozi shunchaki tabiatning o‘zgarishi emas, balki bevosita insoniyatning yashab qolish xavfsizligiga va salomatligiga raxna soluvchi eng yirik tahdid ekanligi ilmiy va tibbiy hamjamiyat tomonidan tan olinmoqda. Jahon sog‘liqni saqlash tashkiloti (JSST) iqlim o‘zgarishini inson salomatligi uchun yuzaga kelgan “eng katta global xavf” deb e’lon qildi [1]. Bu shuni anglatadiki, iqlim o‘zgarishi uzoq kelajakdagi mavhum hodisa emas, balki har bir insonning o‘pkasiga kirayotgan havo, dasturxondagi oziq-ovqat va ichimlik suvi sifatiga daxldor bo‘lgan bugungi kundagi hayot-mamot masalasidir [3].

Ushbu inqirozning asl mohiyatini anglash uchun, eng avvalo, uning asosiy fundamental tushunchalari va fizik ko‘rsatkichlarini farqlash lozim. “Global isish” atamasi asosan inson faoliyati — xususan, qazilma yoqilg‘ilarning yoqilishi va sanoatlashuv natijasida yer atmosferasi o‘rtacha haroratining doimiy ravishda oshib borishini ifodalaydi. “Iqlim o‘zgarishi” esa ancha kengroq tushuncha bo‘lib, o‘z ichiga nafaqat haroratning ko‘tarilishini, balki ob-havo hodisalarining uzoq muddatli siljishini ham oladi [2]. Atmosferada karbonat angidrid (CO_2), metan (CH_4) va azot oksidlari (N_2O) kabi issiqxona gazlari konsentratsiyasining tarixiy maksimumlarga yetishi sayyoraning issiqlik balansini izdan chiqardi. Buning atrof-muhitdagi asosiy fizik ko‘rsatkichlari sifatida ekstremal ob-havo anomaliyalarini (kutilmagan toshqinlar, uzoq muddatli qurg‘oqchiliklar, vayronkor tayfunlar), okeanlarning kislotalashishi hamda abadiy muzliklarning erishi kabilarni ko‘rsatish mumkin. Ekotizimning bunday keskin deformatsiyasi sayyoradagi barcha tirik organizmlar, jumladan, insonning biologik ritmlari va fiziologik faoliyatiga jiddiy zarba bermoqda.[6]

Mazkur maqolaning asosiy maqsadi - iqlim o‘zgarishi va inson salomatligi o‘rtasidagi murakkab, ko‘p qirrali sabab-oqibat aloqalarini ilmiy dalillar asosida tahlil qilishdir. Maqolaning markaziy mohiyati shundan iboratki: iqlim o‘zgarishi sog‘liqni saqlash tizimi uchun mavjud kasalliklarni kuchaytiruvchi va yangi tibbiy xavflarni yaratuvchi “katalizator” hisoblanadi [4]. Tadqiqot davomida harorat anomaliyalari va tabiiy ofatlar keltirib chiqaradigan to‘g‘ridan-to‘g‘ri fizik va travmatik xavflar, shuningdek, ekologik muvozanatning buzilishi ortidan kelib chiqadigan bilvosita oqibatlar — yuqumli va surunkali kasalliklar tarqalishi, oziq-ovqat inqirozi hamda ruhiy salomatlikning yomonlashuvi ketma-ketlikda ochib beriladi. Shu bilan birga, ushbu global xurujning oldini olish, moslashish (adaptatsiya) va salbiy oqibatlarni yumshatishga (mitigatsiya) qaratilgan strategik choralar tizimli ravishda ko‘rib chiqiladi.[16]

Iqlim o‘zgarishining ekologik va biologik mexanizmlari. Iqlim o‘zgarishining inson salomatligiga ko‘rsatadigan ta’sirini to‘liq anglash uchun dastlab bu jarayonni harakatga keltiruvchi asosiy ekologik va biologik mexanizmlarni tahlil qilish zarur. Yer sayyorasidagi iqlim tizimi murakkab muvozanatga asoslangan bo‘lib, ushbu muvozanatning har qanday kichik o‘zgarishi butun biosferada zanjirli reaksiyalarni keltirib chiqaradi.

Issiqxona gazlari va havo haroratining ko‘tarilishi Global iqlim o‘zgarishining fundamental sababi atmosferada issiqxona gazlari konsentratsiyasining ortishidir. Quyoshdan kelayotgan yorug‘lik energiyasi yer sirtini isitadi, biroq yer o‘zidan koinotga infraqizil (issiqlik) nurlarini qaytaradi. Atmosferadagi karbonat angidrid (CO_2), metan (CH_4), azot oksidi (N_2O) va ftorli gazlar ushbu issiqlik nurlarini tutib qolib, xuddi issiqxona oynasi kabi ishlaydi. Sanoat inqilobidan boshlab insoniyat tomonidan ko‘mir, neft va tabiiy gaz kabi qazilma yoqilg‘ilarning misli ko‘rilmagan miqdorda yoqilishi oqibatida atmosferadagi CO_2 miqdori keskin oshdi. Shuningdek, intensiv qishloq xo‘jaligi (xususan, chorvachilik va sholi yetishtirish) hamda chiqindixonalardan ajralib chiqayotgan metan gazi issiqlikni tutib qolish xususiyatiga ko‘ra CO_2 dan bir necha barobar kuchliroqdir. Natijada, yerning o‘rtacha yillik harorati barqaror ravishda ko‘tarilib bormoqda va bu jarayon atmosferaning termodinamik holatini mutlaqo o‘zgartirib yubordi.[5]

Tabiiy ekotizimlarning buzilishi: o‘rmonlar yong‘ini, muzliklarning erishi va okeanlar sathining ko‘tarilishi havo haroratining isishi sayyoramizdagi yirik ekotizimlarning degradatsiyasiga bevosita sabab bo‘lmoqda.

O‘rmonlar yong‘ini: ekologik halokat va teskari aloqa mexanizmi. O‘rmon yong‘inlari tabiiy jarayonlarning bir qismi bo‘lsada, iqlim o‘zgarishi ularning ko‘lami, intensivligi va davomiyligini halokatli darajaga olib chiqdi. Haroratning ko‘tarilishi va yog‘ingarchilik sikllarining buzilishi (masalan, uzoq muddatli qurg‘oqchiliklar) o‘rmon tagligidagi organik moddalarning mutlaqo quruqlashishiga olib keladi. Natijada o‘rmonlar tez alangalanuvchi ulkan “porox bochkasiga” aylanadi.

Teskari aloqa effekti (Positive Feedback Loop): Bu jarayonning eng xavfli jihati shundaki, o‘rmonlar asrlar davomida yerdagi uglerodni o‘zlashtiruvchi “karbon yutgichlari” (carbon sinks) vazifasini bajarib kelgan. Biroq yirik yong‘inlar natijasida daraxtlar va tuproqda to‘plangan milliardlab tonna uglerod bir zumda atmosferaga CO_2 shaklida ajralib chiqadi. Amazonka va Sibirdagi so‘nggi yong‘inlar shuni ko‘rsatmoqdaki, ba’zi hududlar endilikda atmosferadan karbon yutishdan ko‘ra, ko‘proq karbon ajratuvchi “karbon manbai”ga aylanib qolgan. Bu esa global isishni yanada tezlashtiruvchi tutash zanjirni hosil qiladi.

Mikroiqlim va biotsenozning yemirilishi: Yirik yong‘inlar (“megafires”) shu qadar kuchli issiqlik ajratadiki, ular o‘zining shaxsiy ob-havo tizimini - *pirokumulyativ bulutlarni* yaratadi. Bu bulutlar chaqmoq chaqishi orqali yangi hududlarda yong‘inlar o‘chog‘ini paydo qiladi. Shuningdek, noyob flora va fauna (endemik turlar) qirilib ketadi, tuproqning unumdor qatlami kulga aylanib, eroziyaga uchraydi.

Inson salomatligiga transchegaraviy ta'siri: Yong‘in tutuni tarkibida inson salomatligi uchun o‘ta xavfli bo‘lgan PM [2,5] (diametri 2,5 mikrometrdan kichik) qurum zarralari bo‘ladi. Avstraliya yoki Kanadadagi yong‘inlardan hosil bo‘lgan zaharli tutun minglab kilometrlarni bosib o‘tib, boshqa qit'alardagi odamlarning nafas yo‘llariga tushadi. Bu esa astma, surunkali obstruktiv o‘pka kasalligi (SOOK) va yurak xurujlarining keskin ortishiga olib keladi.

Muzliklarning erishi: “Suv minoralari”ning qulashi va Albedo effekti.

Muzliklarning erishi nafaqat okeanlarga xavf soladi, balki yerning issiqlik balansi va global chuchuk suv ta'minotiga zarba beradi. Bu jarayon ikki xil turdagi muzliklar - qutb qoplamalari va baland tog‘ muzliklarida turlicha namoyon bo‘ladi.

Albedo effektining pasayishi (Arktika kuchayishi): Qor va muz yerning “ko‘zgusi” hisoblanadi. Oq sirt (Albedo effekti) quyoshdan kelayotgan issiqlik nurlarining 80-90% ini fazoga qaytarib yuboradi. Ammo Arktika va Antarktidadagi muzliklar erib, o‘rnida qoramtir okean suvi yoki tuproq paydo bo‘lgach, ular quyosh issiqligining katta qismini o‘ziga yuta boshlaydi. Buning natijasida qutblardagi isish sayyoraning boshqa qismlariga nisbatan 2-3 barobar tezroq kechmoqda (bu “Arktika kuchayishi” deb ataladi).

Chuchuk suv inqirozi: Tog‘ muzliklari (Pomir, Tyan-Shan, Himoloy, Alp) materiklarning “suv minoralari” hisoblanadi. Ular qishda qorni o‘zida jamlab, bahor va yoz oylarida daryolarni mo‘tadil suv bilan ta'minlaydi. Muzliklarning jadal erishi avvaliga vayronkor sel va suv toshqinlarini keltirib chiqarsa, muzliklar hajmi keskin kichraygach (keyingi o‘n yilliklarda) daryolarning qurishiga olib keladi. Markaziy Osiyo (Amudaryo va Sirdaryo havzasi) va Osiyoning boshqa yirik hududlarida bu jarayon agrar kollapsni, hosilsizlikni va toza ichimlik suvi taqchilligini yuzaga keltiradi.

Permafrost (Mangu muzliklar) xavfi: Sibir va Alyaskadagi mangu muzliklar erishi yana bir yashirin tibbiy va ekologik xavfni uyg‘otmoqda. Bu muzliklar ostida minglab yillar davomida to‘plangan ulkan miqdordagi metan gazi yotibdi. Erish oqibatida bu gaz atmosferaga yorib chiqadi. Qolaversa, muz qatlamlari orasida muzlab yotgan qadimiy patogenlar (virus va bakteriyalar) uyg‘onib, zamonaviy tibbiyot uchun noma'lum bo‘lgan yangi epidemiyalarni keltirib chiqarish xavfi mavjud.[8]

Okeanlar sathining ko‘tarilishi: xaritani o‘zgartiruvchi gidrologik xavf. Okeanlar sathining ko‘tarilishi iqlim o‘zgarishining eng og‘ir qaytarib bo‘lmas oqibatlaridan biridir. Hozirgi kunda bu ko‘rsatkich yiliga taxminan 3,4 millimetrni tashkil etmoqda va jarayon eksponensial ravishda tezlashmoqda. Buning ortida ikkita fundamental fizik jarayon yotadi.

Termik kengayish va massa ortishi: Dengiz sathi ko‘tarilishining qariyb yarmi materiklardagi muzliklarning erishi hisobiga (okeanga qo‘shimcha suv massasi qo‘shilishi) yuz bersa, qolgan yarmi issiqlikning o‘zlashtirilishi hisobiga yuz beradi. Fizika qonuniyatlariga ko‘ra, suv qiziganda uning molekulalari kengayadi (termik kengayish). Okeanlar atmosferadagi ortiqcha issiqlikning 90% dan ortig‘ini o‘ziga yutayotgani sababli, suvning hajmi doimiy ravishda kengayib bormoqda.

Sho‘r suv inyeksiyasi (Saltwater intrusion): Gidrologik bosimning ortishi natijasida okeanning sho‘r suvi qirg‘oqbo‘yi hududlaridagi chuchuk yer osti suvlari havzalariga sızıb kiradi (aralashib ketadi). Bu jarayon millionlab gektar unumdor tuproqlarning sho‘rlanishiga, qishloq xo‘jaligi ekinlarining nobud bo‘lishiga olib keladi. Masalan, Bangladesh kabi davlatlarda sho‘r suv infiltratsiyasi sababli guruch maydonlari yaroqsiz holga kelmoqda, bu esa aholining oziq-ovqat xavfsizligiga bevosita tahdid solmoqda.

Infratuzilma inqirozi va “iqlim qochqinlari”: Okean sathining bor-yo‘g‘i 0,5-1 metrga ko‘tarilishi Maldiv, Tuvalu kabi orol-davlatlarni butunlay suv ostida qoldirishi mumkin. Shuningdek, Mayami, Nyu-York, Shanxay, Mumbay kabi qirg‘oqbo‘yi megapolislarining infratuzilmasi, shifoxonalari va suv tozalash inshootlari yaroqsiz holga keladi. Bu yashash joyini yo‘qotgan yuz millionlab insonlarning materik ichkarisiga migratsiya qilishiga sabab bo‘ladi. Bunday yirik masshtabdagi majburiy migratsiya kasalliklarning tez tarqalishiga, resurslar uchun to‘qnashuvlarga va global ijtimoiy-tibbiy inqirozga (“iqlim qochqinlari” fenomeniga) zamin yaratadi.[8]

Ekologik o‘zgarishlarning inson biotsenoziga ta’sir qilish zanjiri. Inson biotsenozi - bu odamlar yashaydigan, faoliyat yuritadigan va boshqa biologik turlar (o‘simliklar, hayvonlar, mikroorganizmlar) bilan o‘zaro ta’sirda bo‘ladigan murakkab ijtimoiy-ekologik muhitdir. Iqlim o‘zgarishi ushbu tizimni butunlay izdan chiqaruvchi xavfli zanjirni ishga tushiradi. Birinchidan, harorat va namlikning o‘zgarishi patogen mikroorganizmlar va kasallik tashuvchilar (masalan, bezgak chivinlari va kanalar) uchun qulay sharoit yaratib, ularning yashash areali shahar va sovuq iqlimli mintaqalar sari kengayishiga sabab bo‘ladi. Ikkinchidan, o‘simliklar vegetatsiya davrining siljishi va tuproq degradatsiyasi qishloq xo‘jaligi hosildorligini pasaytiradi. Bu esa oziq-ovqat zanjirining buzilishi va global oziq-ovqat xavfsizligiga tahdidni yuzaga keltiradi. Uchinchidan, tabiiy yashash joylaridan mahrum bo‘layotgan yovvoyi hayvonlarning inson yashash punktlariga yaqinlashishi zoonoz kasalliklarining (hayvonlardan odamga o‘tadigan viruslar) paydo bo‘lish xavfini keskin oshiradi. Shu tariqa, ekologik muvozanatning har bir buzilgan halqasi oxir-oqibat insoniyatning biotsenoziga qaytuvchi “boomerang” effektini yaratadi.[7]

To‘g‘ridan-to‘g‘ri ta’sirlar: ekstremal ob-havo va fizik xavflar. Iqlim o‘zgarishining inson salomatligiga ko‘rsatadigan to‘g‘ridan-to‘g‘ri ta’sirlari, asosan, ekstremal ob-havo hodisalarining chastotasi, davomiyligi va intensivligining ortishi bilan namoyon bo‘ladi. Bu hodisalar inson tanasiga bevosita fizik, fiziologik va travmatik xavflarni tug‘dirib, o‘lim ko‘rsatkichlarining keskin oshishiga sabab bo‘lmoqda.

Jazirama issiqlik to‘lqinlari: Issiqlik urishi, yurak-qon tomir kasalliklari xuruji va o‘lim ko‘rsatkichlarining ortishi global isish natijasida yuzaga kelayotgan eng qotil ob-havo anomaliyalaridan biri bu - uzoq muddatli jazirama issiqlik to‘lqinlaridir. Odatda, inson organizmi termoregulyatsiya jarayoni (terlash va qon tomirlarining kengayishi) orqali tana haroratini 36,6°C atrofida ushlab turadi. Biroq

harorat va namlik kritik ko‘rsatkichlardan oshib ketganda, bu mexanizm ishdan chiqadi.[9]

Fiziologik zarba: Tana haroratining 40°C dan oshishi issiqlik urishiga olib keladi. Bu holatda markaziy asab tizimi zararlanadi, hujayralardagi oqsillar denaturatsiyaga uchraydi (parchalanadi) va ichki a’zolar poliorgan yetishmovchiligi holatiga tushadi. Agar tezkor tibbiy yordam ko‘rsatilmasa, bu o‘lim bilan yakunlanadi.

Yurak-qon tomir va nafas olish tizimi inqirozi: Issiq havoda organizm sovish uchun qon aylanishini tezlashtiradi, bu esa yurak mushaklariga (miokardga) juda katta qo‘shimcha yuklama beradi. Ayniqsa, keksa yoshdagi insonlar va gipertoniya, ishemik kasalliklarga chalingan bemorlarda bu holat miokard infarkti, insult va gipertonik krizlarni qisqa vaqt ichida qo‘zg‘atadi.[9]

“Shahar issiqlik oroli” effekti: Yirik megapolislarda asfalt, beton va binolar quyosh issiqligini yutib, tunda qaytarib berishi natijasida shahar atrofi hududlariga nisbatan harorat 3-5°C yuqoriroq bo‘ladi. Bu aholining tungi vaqtda ham issiqlik stressidan qutula olmasligiga, surunkali charchoq va o‘lim ko‘rsatkichlarining eksponensial ortishiga olib keladi (Masalan, 2003-yilda yevropadagi issiqlik to‘lqini 70 mingdan ortiq insonning yostig‘ini quritgan bo‘lsa, 2022-yili bu ko‘rsatkich yana o‘n minglab qurbonlarni tashkil qildi).

Tabiiy ofatlar: Suv toshqinlari, bo‘ronlar va qurg‘oqchilik natijasidagi jismoniy jarohatlar, nogironlik va halokatlar iqlim o‘zgarishi okean va atmosfera sirkulyatsiyasini beqarorlashtirib, halokatli gidrometeorologik ofatlarni keltirib chiqarmoqda. Bu ofatlarning tibbiy oqibatlari o‘ta og‘ir va ko‘p qirralidir:[10]

Mexanik jarohatlar va travmalar: Kuchli to‘fonlar, tayfunlar (masalan, Katrina, Harvi tayfunlari) va surilmalar oqibatida binolarning qulashi, daraxtlarning ag‘darilishi hamda shisha va metall parchalarining uchishi natijasida minglab insonlar og‘ir jismoniy jarohatlar oladi. Singan suyaklar, ochiq jarohatlar, kalla-miya travmalari va orqa miya shikastlanishlari ko‘pincha bir umrlik nogironlikka olib keladi.

Cho‘kish va gipotermiya: Kutilmagan suv toshqinlari va sel kelishi eng ko‘p qurbonlar beradigan ofatlardan biridir. Odamlar faqatgina oqinda cho‘kishdan emas, balki sovuq suvda uzoq qolib ketish oqibatida gipotermiya (tana haroratining xavfli pasayishi) holatidan ham halok bo‘ladilar.

Tibbiyot infratuzilmasining qulashi: Tabiiy ofatlarning eng yashirin va halokatli to‘g‘ridan-to‘g‘ri ta’siri shundaki, ular shifoxonalar, tez yordam stansiyalari va transport kommunikatsiyalarini vayron qiladi. Natijada, yengil jarohat olgan yoki surunkali kasalligi tufayli dorilarga (insulin, astma inyeksiyalari, dializ aparatlari) qaram bo‘lgan bemorlar tibbiy yordam uzilishi sababli ikkilamchi qurbonlarga aylanadilar.[11]

UV(ultrabinafsha) -nurlanish miqdorining ortishi va teri saratoni (melanoma) xavfining oshishi. Garchi ozon qatlamining yemirilishi boshqa bir ekologik muammo bo‘lsada, iqlim o‘zgarishi va ultrabinafsha (UV) nurlanish o‘rtasida to‘g‘ridan-to‘g‘ri va o‘zaro bog‘liq zanjir mavjud. Stratosferadagi haroratning o‘zgarishi ozon qatlamining tiklanish jarayonini sekinlashtiradi.[12]

Teri saratoni (Melanoma): Havo haroratining isishi natijasida odamlar yil davomida ochiq havoda, yupqaroq kiyimda ko‘proq vaqt sarflashmoqda. Boshqa tomondan, bulutlilik darajasining o‘zgarishi yer yuzasiga yetib kelayotgan UVB va UVA nurlarining intensivligini oshirmoqda. Ushbu nurlar teri hujayralarining DNK tuzilishini to‘g‘ridan-to‘g‘ri shikastlab, mutatsiyalarga olib keladi. Bu esa xavfli o‘smalar - melanoma, bazal hujayrali karsinoma kabi teri saratoni turlarining pandemik darajada ko‘payishiga sabab bo‘lmoqda. JSST ma’lumotlariga ko‘ra, haroratning 2°C ga oshishi teri saratoni xavfini kamida 10-11% ga oshiradi.[12]

Oftalmologik xavflar: O‘tkir va davomli UV nurlanish nafaqat teriga, balki ko‘zoynaksiz himoyalanmagan ko‘zlarga ham ziyon yetkazadi. Ko‘z gavharining xira tortishi (katarakta), makula degeneratsiyasi va ko‘z yuzasida hosil bo‘ladigan o‘smalar (pterigium) ayniqsa ekvator va janubiy hududlarda iqlim isishi fonida karrasiga ortib bormoqda.

Bilvosita ta’sirlar: Yuqumli va surunkali kasalliklar tarqalishi. Iqlim o‘zgarishining eng keng ko‘lamli va uzoq muddatli asoratlari inson tanasiga bevosita emas, balki atrof-muhit, ekologik muvozanat va ijtimoiy-iqtisodiy tizimlarning buzilishi orqali bilvosita ta’sir ko‘rsatadi. Bu o‘zgarishlar mavjud surunkali kasalliklarni og‘irlashtirib, infeksion (yuqumli) kasalliklarning geografik tarqalishini mutlaqo yangi bosqichga olib chiqadi.[14]

Havo sifatining yomonlashuvi: Tutun, chang-to‘zon va is gazi. Iqlim isishi atmosfera sirkulyatsiyasini o‘zgartirib, havo sifatining keskin pasayishiga olib keladi. Bunga bir nechta omillar sabab bo‘ladi:

Troposfera ozoni va tutun (Smog): Haroratning ortishi avtomobillar va zavodlardan chiqadigan azot oksidlari hamda uchuvchan organik moddalar o‘rtasidagi fotokimyoviy reaksiyalarni tezlashtiradi. Natijada yerga yaqin qatlamda (troposferada) zararli ozon qatlami va quyuq tutun (smog) hosil bo‘ladi. Bu qatlam nafas olish yo‘llarini bevosita yallig‘lantirib, astma xurujlarini va surunkali obstruktiv o‘pka kasalligi (SOOK) ni keltirib chiqaradi.

Allergik reaksiyalarning kuchayishi: CO_2 konsentratsiyasining yuqoriligi va bahorning erta kelishi o‘simliklarning vegetatsiya davrini uzaytiradi. Natijada, allergik gulchanglar (masalan, ambroziya va boshqa begona o‘tlar) ishlab chiqarish miqdori va davomiyligi bir necha barobar ortadi. Bu allergik rinit va bronxial astma bilan kasallanganlar sonining epidemik darajada ko‘payishiga zamin yaratadi.

Mayda dispersli zarralar (PM{2,5}): Cho‘llashish jarayonining tezlashishi natijasida yuzaga keladigan chang-to‘zon bo‘ronlari va o‘rmon yong‘inlari havoga mikroskopik qurum zarralarini chiqaradi. Ular o‘pka alveolalaridan o‘tib, to‘g‘ridan-to‘g‘ri qonga tushadi va tizimli yallig‘lanish, insult hamda yurak ishemik kasalliklarini qo‘zg‘atadi.

Vektor orqali yuqadigan kasalliklar arealining kengayishi. Vektorlar — bezgak chivinlari, kanalar, burgalar kabi kasallik tashuvchi hasharotlardir. Ularning tana harorati va ko‘payish sikli to‘g‘ridan-to‘g‘ri tashqi muhitga bog‘liq.[14]

Geografik siljish: Ilgari faqat tropik va ekvatorial mintaqalarda yashagan *Aedes aegypti* va *Anopheles* chivinlari endilikda harorat ko‘tarilishi sababli Shimoliy yarimsharning mo‘tadil iqlimli hududlariga (Yevropa va Shimoliy

Amerika qit'alariga) ko'chib o'tmoqda. Natijada, ilgari bu hududlar uchun yot bo'lgan Denge isitmasi, Zika virusi, Chikungunya va bezgak kabi kasalliklar mahalliy aholi o'rtasida tarqalmoqda.[14]

Kanalar va Laym kasalligi: Qish faslining nisbatan iliq kelishi kanalar populyatsiyasining sovuqdan qirilib ketmasligiga olib kelmoqda. Oqibatda, Ixodes kanalari orqali yuquvchi Laym kasalligi va kana ensefaliti holatlari bahor va kuz oylarida ham intensiv ravishda ro'yxatga olinmoqda.[14]

Suv va oziq-ovqat xavfsizligi: Infeksiyalar va to'yib ovqatlanmaslik. Iqlim o'zgarishi insoniyatning eng tayanch resurslari - toza suv va oziq-ovqat zanjiriga putur yetkazadi.

Suv orqali yuqadigan kasalliklar: Kuchli suv toshqinlari va jalalar kanalizatsiya tizimlarini toshirib, ichimlik suvi havzalarini najas va patogen bakteriyalar bilan ifloslantiradi. Bu xolera (vabo), tif, dizenteriya va gepatit A kabi o'tkir ichak infeksiyalarining chaqnashiga olib keladi. Boshqa tomondan, qurg'oqchilik sharoitida toza suvning tanqisligi gigiyena qoidalarining buzilishiga va infeksiyalar tarqalishiga sabab bo'ladi.

Oziq-ovqat inqirozi va avitaminotik holatlar: Harorat anomaliyalari qishloq xo'jaligida hosildorlikni (bug'doy, makkajo'xori, sholi) keskin pasaytiradi. Bundan tashqari, atmosferada CO_2 miqdorining yuqoriligi ekinlar tarkibidagi rux, temir kabi mikroelementlar va oqsil miqdorini kamaytirib yuboradi. Natijada, ayniqsa rivojlanayotgan davlatlarda ommaviy to'yib ovqatlanmaslik, bolalarda jismoniy rivojlanishdan ortda qolish (stunting), anemiya va avitaminoz xavfi ortadi.

Ruhiy salomatlik va ijtimoiy oqibatlar. Iqlim o'zgarishi faqat jismoniy tanaga emas, balki inson psixikasi va jamiyatning ijtimoiy barqarorligiga ham chuqur jarohat yetkazadi. Ruhiy salomatlik iqlim inqirozining "ko'rinmas qurboni" hisoblanadi.

Eko-tashvish (Eco-anxiety) va surunkali stress. Zamonaviy psixologiya va tibbiyotga "eko-tashvish" degan yangi tushuncha kirib keldi. Bu - insonlarning iqlim o'zgarishining qaytarib bo'lmas oqibatlari, tabiatning vayron bo'lishi va kelajakdagi noaniqlik oldida his qiladigan doimiy, surunkali qo'rquv hissidir. Ayniqsa, yoshlar va o'smirlar o'rtasida o'z kelajagiga ishonchsizlik, farzand ko'rishdan ixtiyoriy voz kechish, apatiya va klinik depressiya holatlari ortib bormoqda. Axborot maydonidagi doimiy ekologik halokatlar haqidagi xabarlar inson asab tizimini muntazam stress holatida (kortizol gormoni yuqori darajada) ushlab turadi.[13]

Posttravmatik stress buzilishi (PTSD). Tabiiy ofatlarni (masalan, uyni suv bosishi, o'rmon yong'inlari ichida qolish yoki to'fonda yaqinlarini yo'qotish) o'z boshidan kechirgan insonlarda kuchli psixologik jarohat - posttravmatik stress buzilishi shakllanadi. Ofatdan omon qolganlar yillar davomida vahima xurujlari, uyqusizlik, depressiya va o'z joniga qasd qilish (suitsid) moyilliklaridan aziyat chekishadi. O'zining yashab turgan uy-joyi va barcha mol-mulkidan bir lahzada ayrilish insonning tayanch xavfsizlik hissini mutlaqo yo'q qiladi.[13]

Iqlim qochqinlari (Climate refugees). Yashash joylarining cho'llashishi, qishloq xo'jaligining yo'q qilinishi yoki okean sathi ko'tarilib orollarni suv bosishi

natijasida millionlab insonlar o‘z vatanini majburiy ravishda tark etishga mahkum bo‘lmoqda. BMT prognozlariga ko‘ra, 2050-yilga borib 200 milliongacha “iqlim qochqinlari” paydo bo‘lishi mumkin. Bu ijtimoiy-psixologik fojea bo‘lib, insonlarning o‘z madaniy ildizlaridan uzilishi, yot muhitga moslashish qiyinchiliklari, ishsizlik, marginalizatsiya va yangi jamiyatdagi resurslar uchun kurashlar sababli yuzaga keladigan ijtimoiy to‘qnashuvlarni o‘z ichiga oladi.[1,15]

Zaif qatlamlar va hududiy tafovutlar. Iqlim o‘zgarishining salbiy ta’sirlari barcha odamlarga birdek ta’sir qilmaydi; u mavjud ijtimoiy, iqtisodiy va tibbiy tengsizliklarni yanada chuqurlashtiradi.

Eng ko‘p zarar ko‘ruvchi guruhlar. Biyologik va ijtimoiy jihatdan eng zaif bo‘lgan qatlamlar iqlim xavflari oldida mutlaqo himoyasiz qoladi:

Bolalar va chaqaloqlar: Ularning termoregulyatsiya va immun tizimlari to‘liq shakllanmagan. Nafas olish chastotasi kattalarnikiga nisbatan yuqori bo‘lgani uchun, havodagi zaharli moddalarni ko‘proq yutishadi. Qolaversa, infeksion kasalliklar (diareya, bezgak) va to‘yib ovqatlanmaslik asosan 5 yoshgacha bo‘lgan bolalar o‘limiga sabab bo‘ladi.

Keksalar va surunkali kasallari borlar: Yurak, qon-tomir, diabet yoki nafas olish tizimi xastaliklari bo‘lgan keksalar issiqlik to‘lqinlari va havo ifloslanishining birinchi qurbonlariga aylanishadi.

Homilador ayollar: Issiqlik stressi va infeksiyalar homilaning rivojlanishiga jiddiy zarar yetkazadi, muddatidan oldin tug‘ruqlar, homila tushishi yoki chaqaloqning kam vazn bilan tug‘ilishi xavfini keskin oshiradi.

Hududiy va iqtisodiy tafovutlar (Iqlim adolatsizligi). Muammoning eng paradoksal va adolatsiz jihati shundaki, tarixan issiqxona gazlarining mutlaq ko‘p qismini sanoati rivojlangan shimoliy yarimshar davlatlari ajratib chiqargan bo‘lsada, uning eng og‘ir iqlimiy va tibbiy oqibatlarini Afrikadagi saxroi kabir janubi, Janubiy Osiyo va kichik orol-davlatlar kabi rivojlanayotgan mamlakatlar (Global Janub) tortmoqda. Bu davlatlarda zamonaviy shifoxonalar, tez tibbiy yordam logistikasi, toza ichimlik suvi tarmoqlari va konditsionerlashtirish tizimlari kabi bazaviy tibbiy infratuzilma o‘ta qoloq holatda. Oqibatda, xuddi shunday tabiat injiqligi rivojlangan davlatda iqtisodiy zarar bilan yakunlansa, rivojlanayotgan davlatda minglab insonlarning o‘limi bilan tugaydi.[1]

Moslashuv va salbiy oqibatlarni yumshatish strategiyalari. Ushbu global inqirozni jilovlash va insoniyotni saqlab qolish uchun zudlik bilan ikki yo‘nalishda - moslashuv (adaptatsiya) va yumshatish (mitigatsiya) choralarini ko‘rish zarur.[16]

Tibbiyot tizimini tayyorlash (Adaptatsiya). Sog‘liqni saqlash tizimlari favqulodda vaziyatlarga bardoshli va reaktiv emas, balki proaktiv (oldindan tayyorlangan) holatga o‘tishi kerak. Bunga iqlimiy o‘zgarishlardan erta ogohlantiruvchi tizimlarni (Early Warning Systems) joriy etish, shifoxonalarni muqobil energiya manbalari bilan ta’minlash, tibbiyot xodimlarini yangi turdagi infeksiyalar va issiq urishlarini davolash bo‘yicha qayta tayyorlash hamda dori zaxiralarini yaratish kiradi.[11]

Global siyosat va bitimlar (Mitigatsiya). Iqlim o‘zgarishining ildizini yo‘qotish uchun makro darajadagi siyosiy iroda talab etiladi. 2015-yilda qabul

qilingan Parij kelishuvining asosiy maqsadi sayyora haroratining isishini sanoatlashuv davrigacha bo‘lgan davrga nisbatan 1,5°C darajasida ushlab turishdir. Buning uchun iqtisodiyotni “karbonsizlashtirish” (qazilma yoqilg‘ilardan voz kechib, quyosh, shamol va atom energiyasiga o‘tish), transport tizimini elektrlashtirish va o‘rmonlarni qayta tiklash kabi global bitimlarni so‘zsiz bajarish hukumatlarning ustuvor vazifasi bo‘lmog‘i lozim.[16]

Individual yondashuv. Muammoni hal qilishda har bir insonning shaxsiy hissasi ham muhim. Aholining ekologik savodxonligini oshirish, “yashil” iste’mol madaniyatini shakllantirish kerak. Ratsionda qizil go‘shtni kamaytirib, o‘simlikka asoslangan ovqatlanishga o‘tish, shaxsiy avtomobil o‘rniga jamoat transporti yoki velosipeddan foydalanish nafaqat uglerod izini (carbon footprint) kamaytiradi, balki jismoniy faollikni oshirib, yurak-qon tomir kasalliklarining oldini olishdek “ikki karra tibbiy foyda” (co-benefits) beradi.

Xulosa va tavsiyalar. Yuqorida keltirilgan dalillar, mexanizmlar va tibbiy tahlillarni umumlashtirib shunday xulosaga kelish mumkinki, iqlim o‘zgarishi shunchaki ekologik mavzu yo uzoq kelajak muammosi emas; u bugungi kunning eng keng ko‘lamli, ko‘rinmas va halokatli **global sog‘liqni saqlash inqirozidir**. Jazirama to‘lqinlari qon tomirlarimizga zo‘riqish berayotgani, ifloslangan havo o‘pkamizni emirayotgani, kasallik tashuvchi hasharotlar yangi sarhadlarni egallayotgani iqlim inqirozining tibbiy patologiyaga aylanganidan dalolat beradi.

Yer sayyorasi o‘zgarib bormoqda va agar tibbiyot, iqtisodiyot va ijtimoiy tizimlar bungacha an’anaviy tarzda davom etaversa, insoniyat ushbu ekologik bosimga dosh bera olmaydi. Muammoni hal qilish uchun quyidagi muhim qadamlar tavsiya etiladi:

Sog‘liqni saqlash siyosati qat’iy ravishda ekologik xavfsizlik konsepsiyasi bilan birlashtirilishi kerak; tabiatga yetkazilgan har qanday zarar to‘g‘ridan-to‘g‘ri odamlar salomatligiga yetkazilgan zarar deb baholanishi shart.

Iqlim xavf-xatarlari hududiy jihatdan keskin tafovutlanishi sababli xalqaro moliya institutlari “iqlim adolati” tamoyili asosida rivojlanayotgan davlatlarning tibbiy infratuzilmasini mustahkamlashga investitsiyalarni yo‘naltirishi kerak.

Jamoat salomatligini himoya qilishning eng samarali vaksinasi bu - qazilma yoqilg‘ilardan zudlik bilan voz kechish va yashil energetikaga o‘tish ekanligini barcha darajadagi boshqaruv organlari o‘z strategiyalariga kiritishlari lozim. Insoniyatning kelajagi va salomatligi tabiat bilan qanday murosa qilishiga bevosita bog‘liqdir.

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Safarova Z.Q.
mustaqil izlanuvchi
Qarshi davlat universiteti
O‘zbekiston, Qarshi

FRAZEOLOGIK BIRLIKLARNING LINGVOKULTUROLOGIK XUSUSIYATLARINI TADQIQ ETISHNING NAZARIY ASOSLARI

Annotatsiya. Ushbu maqola frazeologik birliklarning lingvistik va madaniy tabiatini o‘rganishga bag‘ishlangan. Frazeologiya mustaqil tilshunoslik sohasi sifatida nutqqa tayyor holatda kirib keladigan va ma’nosi barqaror bo‘lgan birliklarni o‘rganadi. Mazkur tadqiqot V.V. Vinogradovning frazeosemantik konsepsiyasi asosida o‘zbek va ingliz tilidagi frazeologizmlarning semantik, kognitiv, pragmatik va madaniy jihatlarini tahlil qiladi. Shuningdek, frazeologik birliklarning milliy mentalitet va madaniyat bilan bog‘liqligi, ularning leksik birliklardan farqlanishi ham ko‘rib chiqilgan.

Kalit so‘zlar: frazeologiya, frazeologik birlik, idiom, frazeosemantika, semantik tahlil, kognitiv yondashuv, pragmatik yondashuv, madaniy kod, milliy mentalitet, leksik birlik

Safarova Z.Q.
independent researcher
Karshi State University
Uzbekistan, Karshi

THEORETICAL FOUNDATIONS FOR STUDYING THE LINGUOCULTURAL CHARACTERISTICS OF PHRASEOLOGICAL UNITS

Abstract. This article is devoted to the study of the linguistic and cultural nature of phraseological units. As an independent field of linguistics, phraseology examines fixed expressions that are reproduced in speech in a ready-made form and characterized by stable meanings. Based on V. V. Vinogradov’s phraseosemantic concept, this study analyzes the semantic, cognitive, pragmatic, and cultural aspects of phraseological units in the Uzbek and English languages. The article also examines the relationship between phraseological units and national mentality and culture, as well as their differences from lexical units.

Keywords: phraseology, phraseological unit, idiom, phraseosemantics, semantic analysis, cognitive approach, pragmatic approach, cultural code, national mentality, lexical unit

Frazeologiya (yunoncha *phrasis* – ifoda, ibora va *logiya* – ta’limot) tilshunoslikning mustaqil sohasi bo‘lib, u nutqqa tayyor holda kiradigan va leksik hamda semantik jihatdan tarkibiy qismlari o‘zaro mos kelmaydigan, ma’nosi barqaror birliklarni o‘rganadi. Frazeologiyaning eng muhim vazifalaridan biri –

frazeologik birliklarni nutqda erkin hosil bo‘ladigan so‘z birikmalaridan ajratib olish va ularni aniqlash mezonlarini belgilashdir.

Mazkur tadqiqotda V.V. Vinogradovning frazeosemantik konsepsiyasi asosida o‘zbek va ingliz frazeologizmlarining lingvistik va madaniy tabiatini tahlil qilinadi. Shuningdek, frazeologik birliklarning milliy mentalitet va madaniyat bilan bog‘liqligi, leksik birliklardan farqlanishi ham ko‘rib chiqiladi. Tadqiqotda struktural, semantik, kognitiv, pragmatik va madaniy-antropologik yondashuvlar qo‘llaniladi, bu esa frazeologik birliklarning murakkab va ko‘p qirrali tabiatini yoritishda muhim ahamiyatga ega.

Tilshunoslikda iboralarni tadqiq etuvchi bo‘lim frazeologiya deb yuritiladi, mazkur birliklar esa ilmiy termin bilan aytganda frazeologizmlar nomi bilan ataladi. Frazeologizmlarni tilning leksik-semantik va sintaktik qatlamlaridan farq qiluvchi alohida sathga mansub birliklar sifatida qarash frazeologik normani ham adabiy tilning boshqa normalari qatorida e’tiborga olish zaruratini yuzaga keltiradi. Shu bois frazeologik birliklarni izohli lug‘atlarda qayd etish jahon tilshunosligida keng e’tirof etilgan amaliyot hisoblanadi.

Tilshunoslikning boshqa yo‘nalishlari kabi frazeologiya ham o‘zining shakllanish va rivojlanish bosqichlariga ega. Garchi frazeologik birliklar kelib chiqishiga ko‘ra nihoyatda qadimiy bo‘lsa-da, frazeologiya mustaqil ilmiy soha sifatida qariyb ikki asrlik tarixni qamrab oladi. Mazkur fan asoslari shveytsariyalik olim Sharl Balli tomonidan yaratilgan bo‘lib, u “Fransuz stilistikasi” (1909) asarida so‘z birikmalari, ya’ni frazeologik birliklarni tahlil qilishga bag‘ishlangan maxsus bo‘limlarni kiritgan.

Frazeologiya tilshunoslikning keying taraqqiyotida tez rivojlangan sohalardan biridir. Rus va ingliz tilshunosligida frazeologiya ancha ilgari o’rganila boshlangan bo’lsa, o’zbek tilshunosligida bu soha sistemali ravishda o’rganila boshlaganini o’tgan asirning 40-50-yillariga to’g’ri keladi. Bu davrda Sh. Raxmatullayev (1969), G.A. Bayramov (1970), G.X. Axunzyakov (1974), V.G. Uraksin (1975), L.K. Bayramova (1983), M.F. Chernov (1986*)* larning doktorlik dissertastiyalari frazeologizmlar tadqiqiga bag’ishlangan. [1]

Frazeologik birliklar til tizimining boshqa darajalari bilan bevosita va to‘g‘ridan-to‘g‘ri bog‘liq bo‘lmagan, mustaqil lingvistik intizomning obyekti sifatida shakllangan. Tadqiqotchilarning ta’kidlashicha, iboralarning kategoriyaviy belgilariga doir tasavvurlarni shakllantirishdagi alohida xizmat rus olimlariga tegishlidir. Bugun bu olimlarni milliy mansubligiga ko‘ra ajratishning zarurati yo‘q, chunki umumilmiy va xususiy lingvistik metodlar, o‘tkazilgan tadqiqotlarning maqsad va vazifalari nuqtayi nazaridan bu yagona fan edi. Shubhasiz, frazeologik birliklar haqidagi ushbu faning konseptual asosini akademik V.V. Vinogradovning asarlari tashkil etadi. [2]

V.V.Vinogradovning frazeologik konsepsiyasini to‘la-to‘kis frazeosemantik konsepsiya deb atash mumkin, chunki u so‘z birikmasidan kattaroq birliklarni tahlil qilishda komponentlar o‘rtasidagi semantik munosabatlarni tahlil qilishga asoslanadi. Uning tahlili iboralarning semantik tabiatiga qaratilgan bo‘lib, bu V.V. Vinogradovda frazeologik birliklarning tizimli aloqalarini o‘rganishga

yo‘naltirilgan maxsus yo‘nalishning mavjud emasligini ko‘rsatadi.V.V. Vinogradov o’zining “Лексикология и лексикография” [3] kitobida Frazeologiya to’g’risida quyidagi fikrni bildiradi: lingvistik fanlar tizimida frazeologiya ba’zan umuman o‘ziga joy topolmaydi, biroq ko‘proq hollarda u leksikologiya bilan yonma-yon qo‘yiladi yoki unga kiritiladi. Frazeologiyaning hajmi, vazifalari va asosiy tushunchalari hozirgacha to‘liq aniqlanmagan.

Frazeologiyaning chegaralari, maqsadlari va asosiy toifalarining noaniqligi bu faning erkin va mustaqil rivojlanishiga to‘sqinlik qiladi. “Fraza” so‘zi eng kam darajada barqaror va aniq ma’noga ega termin sifatida tan olinishi mumkin. Uning lingvistikadagi qo‘llanilishi juda xilma-xil va o‘zgaruvchandir. Shu sababli frazeologiyani *idiomatika* bilan almashtirish yoki siqib chiqarish bo‘yicha urinishlar bo‘lgan.

Ko‘plab lingvistlar “fraza” masalasini to‘liq holda so‘z muammosiga keltirib chiqarish mumkin deb o‘ylashgan. F.de Sossyur yozadi:«Birinchi qarashda frazalarning ulkan xilma-xilligini ma’lum bir zoologik turning a’zolari xilma-xilligiga o‘xshatish ma’quldek tuyuladi, ammo bu — illyuziya: bir turning hayvonlarida umumiy xususiyatlar ularni farqlovchi belgilariga qaraganda ancha muhimdir; aksincha, frazalarda farq ustunlik qiladi va agar shu xilma-xillik fonida ularni nima bog‘lab turishini izlasangiz, bilmay turib yana so‘zga, uning grammatik xususiyatlariga qaytasiz va yana o‘sha qiyinchiliklarga duch kelasiz»[4].

A.I. Molotkovning mashhur frazeologik lug‘atida esa frazeologizmlar ma’nosi bevosita “leksik ma’no” deb ataladi. Boshqacha aytganda, tadqiqotchilar frazeologik birliklar ma’nosi bilan oddiy leksik birliklarning ma’nosi o‘rtasida hech qanday asosiy farqni ko‘rmaganlar. [5]

O’zbek olimlari Vinogradovning tasnifi va semasiologik qarashlarini qabul qilgan holda, uni o’zbek tilining o’ziga hos xususiyatlari bilan boyitgan. O’zbek frazeologiya maktabi A.G’ulomov, Sh. Rahmatullayev, M.Mirtojiyev, A. Madvaliyev, N. Mahmudov, B. Yo’ldoshev va boshqa birqancha olimlar tomonidan asos solindi va frazeologiyani mustaqil ilmiy soha sifatida rivojlantirdilar.

A. Madvaliyev, N. Mahmudov va A. Nurmanovlar frazeologik birliklar milliy-madaniy semantikani tashuvchi ekanini takidlab, ularni milliy-madaniy konseptlar orqali tahlil qilganlar. Ular iboralarda xalqning ananaviy voqelikni idrok etish uslubi mujassam ekanini ta’kidlaydi.

Ularning fikricha frazeologiya o’zbek tilida juda boy va rang barang tizimga ega. Ular xalq tafakkurining mahsuli, milliy mentalitetni aks ettiruvchi o’ziga xos birlikdir. Frazeologik birliklarni leksik birliklardan farqlashda semantik yaxlitlik, tasviriylik, ko’chma ma’nolilik asosiy belgilardir.

Ingliz tilshunoslari ham frazeologiyalarning madaniy konatatsiyasi borasida ko’plab ilmiy izlanishlar olib borib ko’plab nazarish fikr mulohazalar bildirganlar. George Lakoff va Mark Johnson qarashlariga ko’ra frazeologizmlar madaniy konseptlarning metaforik tasavvurlaridan kelib chiqadi. Charles Fillmore va Alan Cruse frazeologizmlarning ma’nosi “frame”- ya’ni madaniy vaziyatlar tizimi orqali ochilishi va ideomalarni “cultural scripts” asosida taldin qilib, ularning ma’nosini madaniy stsenariylarga bog’lagan.

Frazeologizmlar til tizimining o‘ziga xos va murakkab qatlamini tashkil etib, ularning shakllanishi, mazmuni va qo‘llanilishida bir nechta nazariy yondashuvlar bir-birini to‘ldirib boradi. Tilshunoslikda bugungi kunga kelib frazeologik birliklarning tabiati turli yo‘nalishlar-struktural, semantik, kognitiv, pragmatik hamda madaniy-antropologik maktablar nuqtai nazaridan talqin qilinadi. Quyida ushbu asosiy ilmiy yondashuvlar mazmuni bayon qilinadi.

Struktural yondashuvga ko‘ra, frazeologik birliklar alohida so‘zlar yig‘indisi emas, balki mustaqil leksik birlik sifatida qaraladi. Ular leksik tizimning alohida qatlamini tashkil etib, o‘ziga xos semantik yaxlitlik va tarkibiy barqarorlikka ega. Mazkur qarash, avvalo, rus tilshunosligida Vinogradov maktabi tomonidan shakllantirilgan bo‘lib, u frazeologiyani mustaqil bo‘lim sifatida ajratib bergan klassik struktural nazariyalarga asoslanadi.

Semantik yondashuv frazeologizmlarning mazmuniy tomoniga urg‘u beradi. Unda frazeologik birlikning ma’nosi tarkibiy komponentlarning oddiy yig‘indisidan hosil bo‘lmaydi, balki ko‘pincha metaforik, ko‘chma yoki umumlashgan tushuncha sifatida yuzaga keladi. Bu yondashuvda “kompozitsionlik darajasi” aniqlanadi — ya’ni ma’no qanchalik komponentlar mazmunidan kelib chiqishi yoki chiqmasligi baholanadi. Natijada to‘liq, qisman yoki butunlay idiomatik frazalar farqlanadi.

Zamonaviy kognitiv tilshunoslik frazeologizmlarni inson tafakkuridagi konseptual metaforalar tizimi bilan bog‘laydi. Lakoff, Fillmore va ularning izdoshlari fikricha, idiomatik iboralar ongimizdagi konseptual xaritalarning til orqali gavdalangan shaklidir. Masalan, “vaqti tugamoq” kabi iboralar vaqtni “cheklangan resurs” konsepti asosida yaratadi. Demak, frazeologiya bu yondashuvda nafaqat til hodisasi, balki kognitiv jarayon mahsuli sifatida talqin qilinadi.

So‘nggi o‘n yilliklarda korpus tilshunosligi frazeologiyani tadqiq etishda muhim vositaga aylandi. John Sinclair asos solgan kollokatsion nazariyaga ko‘ra, frazeologik birliklar yuqori darajada barqaror birga uchrashish (co-occurrence) xususiyatiga ega bo‘lgan sintagmatik birliklar sifatida qaraladi. Statistik korpuslar frazeologizmlarning haqiqiy qo‘llanish chastotasi, variantlari va kontekstual xususiyatlarini aniq o‘rganish imkonini beradi.

Pragmatik yondashuvda frazeologizmlar kommunikativ vazifasi bilan baholanadi. Ular nafaqat ma’no tashiydi, balki muloqotning stilistik, ekspressiv, baholovchi hamda ijtimoiy identifikatsion funksiyalarini bajaradi. Idiomalarning haqiqiy ma’nosi ko‘pincha kontekstga bog‘liq bo‘ladi, shu sababli diskurs tahlili frazeologiyaning mazmunini to‘liq ochib berishda muhim omil hisoblanadi.

O‘zbek va ingliz frazeologiyalarini solishtirish shuni ko‘rsatadiki, har bir tilning frazeologik tizimi o‘sha jamiyatning ijtimoiy hayoti, madaniy qadriyatlari va kognitiv dunyoqarashi bilan uzviy bog‘liq. Shu bois, frazeologiya tilning struktur birliklarini boyitibgina qolmay, milliy identitet, madaniy meros va ijtimoiy ongni aks ettiruvchi til birligi sifatida ahamiyat kasb etadi. Zamonaviy tadqiqotlar frazeologik birliklarning tili va madaniyati o‘rtasidagi ko‘prik vazifasini bajarishini ko‘rsatmoqda.

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Saidahmadova M.A.
tibbiy profilaktika fakulteti 105-guruh talabasi
Xasanova S.V.
davolash ishi yo‘nalishi 128-guruh talabasi
Sobirova M.S.
davolash ishi yo‘nalishi 128-guruh talabasi
Normurodova S.M.
tillar kafedrasi stajyor-assistenti
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

O‘ZBEK VA INGLIZ TILLARIDA NEVROLOGIK TERMINLARNING STRUKTUR-SEMANTIK MODELLARI VA TARJIMAVIY EKVIVALENTLIGI

Annotatsiya. Ushbu maqolada o‘zbek va ingliz tillaridagi nevrologik terminlarning struktur-semantik xususiyatlari, termin hosil qilish modellari hamda ular o‘rtasidagi tarjimaviy ekvivalentlik masalalari lingvistik nuqtayi nazardan tahlil qilinadi. Tadqiqotda nerv tizimining anatomiyasi, nevrologik kasalliklar, klinik simptomlar va diagnostik tushunchalarni ifodalovchi terminlar ko‘rib chiqiladi. Tavsifiy, qiyosiy-tipologik, morfemik va komponent tahlil usullari asosida sodda, yasama va ko‘p komponentli terminlarning xususiyatlari yoritiladi. Shuningdek, xalqaro yunon-lotin termin elementlarining vazifasi, terminlarning semantik muvofiqligi hamda ularni o‘zbek tiliga tarjima qilishda yuzaga keladigan muammolar muhokama qilinadi. Olingan sifat kuzatuvlari asosida tibbiy terminlarni izchil qo‘llash, klinik mazmunni saqlash va tarjimada kontekstni hisobga olish bo‘yicha tavsiyalar ishlab chiqiladi.

Kalit so‘zlar: nevrologik terminologiya, struktur-semantik tahlil, termin yasalishi, semantik ekvivalentlik, tibbiy tarjima, xalqaro termin elementlari, o‘zbek tili, ingliz tili, terminologik tizim, klinik termin.

Saidahmadova M.A.
student, Group 105, Faculty of Preventive Medicine
Khasanova S.V.
student, Group 128, General Medicine programme
Sobirova M.S.
student, Group 128, General Medicine programme
Normurodova S.M.
trainee assistant
Department of Languages
Samarkand State Medical University
Uzbekistan, Samarkand

STRUCTURAL AND SEMANTIC MODELS OF NEUROLOGICAL TERMS IN UZBEK AND ENGLISH AND THEIR TRANSLATIONAL EQUIVALENCE

Abstract. This article examines the structural and semantic features of neurological terminology in Uzbek and English, focusing on term formation patterns and translation equivalence. It considers terms related to nervous system anatomy, neurological disorders, clinical symptoms, and diagnostic concepts. Descriptive, contrastive-typological, morphemic, and componential methods are used to analyze simple, derived, and multiword terms. Particular attention is given to international Greek and Latin term elements, semantic correspondence, and translation challenges. Based on qualitative observations, the article offers recommendations for consistent terminology use, preservation of clinical meaning, and context-sensitive translation.

Keywords: neurological terminology, structural-semantic analysis, term formation, semantic equivalence, medical translation, international term elements, Uzbek language, English language, terminology system, clinical terminology.

Kirish

Zamonaviy tibbiyotning rivojlanishi klinik tushunchalarni aniq ifodalash, kasalliklarni to‘g‘ri nomlash va mutaxassislar o‘rtasida ilmiy axborot almashinuvini ta’minlashda terminologiyaning ahamiyatini oshirmoqda. Ayniqsa, inson nerv tizimining tuzilishi, faoliyati, kasalliklari va patologik holatlarini o‘rganuvchi nevrologiya sohasi ko‘p qatlamli terminologik tizimga ega. Ushbu tizim anatomik nomlar, kasalliklar, simptomlar, sindromlar, diagnostik usullar va funksional buzilishlarni ifodalovchi birliklarni qamrab oladi.

Nevrologik terminlarning muhim xususiyatlaridan biri ularning katta qismi yunon va lotin tillaridan kelib chiqqan xalqaro termin elementlariga asoslanishidir. Masalan, *neurology*, *neuropathy*, *encephalitis* va *electroencephalography* terminlari xalqaro ilmiy terminologiyaga xos komponentlarni o‘z ichiga oladi. O‘zbek tilida ular «nevrologiya», «neyropatiya», «ensefalit» va «elektroensefalografiya» shakllarida qo‘llanadi. Biroq xalqaro elementlarning mavjudligi ikki tildagi barcha terminlar to‘liq bir xil tuzilish va ma’noga ega ekanini anglatmaydi. Ingliz tilida terminlar ko‘pincha prefiks, o‘zak va suffikslar yordamida yoki bir nechta so‘zning birikishi orqali shakllanadi. O‘zbek tilida esa xalqaro o‘zlashmalar bilan bir qatorda milliy so‘z yasash vositalari, aniqlovchili birikmalar va izohli nomlash modellari ham qo‘llanadi. Shu sababli terminlarni bir tildan ikkinchi tilga o‘girishda ularning faqat lug‘aviy shaklini emas, balki mazmuniy chegaralarini ham hisobga olish zarur. Tadqiqotning dolzarbligi nevrologik terminlarning strukturaviy modellari bilan ularning semantik mazmuni o‘rtasidagi munosabatni aniqlash hamda inglizcha terminlarning o‘zbek tilidagi muqobillarini tanlashda yuzaga keladigan lingvistik muammolarni tizimli tavsiflash zarurati bilan belgilanadi.

Tadqiqotning maqsadi va vazifalari

Tadqiqotning maqsadi o‘zbek va ingliz tillaridagi nevrologik terminlarning struktur-semantik xususiyatlarini aniqlash, ularning yasalish modellarini qiyoslash va tarjimada semantik ekvivalentlikni ta’minlovchi asosiy omillarni belgilashdan iborat. Erishish uchun nevrologik terminologiyaning lingvistik xususiyatlarini tavsiflash, terminlarni struktur tuzilishiga ko‘ra guruhlash, xalqaro yunon-lotin komponentlarining termin yasalishidagi vazifasini ko‘rsatish, inglizcha va o‘zbekcha terminlarning semantik munosabatlarini qiyoslash, tarjima jarayonida yuzaga kelishi mumkin bo‘lgan ekvivalentlik muammolarini aniqlash hamda terminlarni tarjima qilish va izohlash bo‘yicha amaliy tavsiyalar ishlab chiqish vazifalari belgilandi.

Tadqiqot metodologiyasi

Tadqiqot tavsifiy va qiyosiy-tipologik yondashuvlarga asoslanadi. Tahlilda nevrologik terminlarning strukturasi, komponentlari va mazmuniy xususiyatlarini aniqlash uchun morfemik hamda komponent tahlil usullaridan foydalaniladi. Tarjimaviy ekvivalentlikni o‘rganishda terminning lug‘aviy ma’nosi, klinik tushunchasi va kontekstda bajaradigan vazifasi o‘zaro taqqoslanadi. Tahlil materialini nerv tizimining anatomiyasi, kasalliklari, klinik simptomlari va tekshiruv usullariga tegishli inglizcha terminlar hamda ularning o‘zbek tilidagi muqobillari tashkil etadi. Ushbu maqola sifat tavsifiga asoslangan bo‘lib, unda maxsus elektron korpus yordamida statistik chastota hisoblanmagan. Shu sababli terminlarning foizli taqsimoti yoki statistik ustunligi haqida xulosa chiqarilmaydi.

1. Nevrologik terminlarning struktur xususiyatlari

Nevrologik terminlar tuzilishiga ko‘ra sodda, yasama, qo‘shma va ko‘p komponentli birliklarga ajratilishi mumkin. Bunday tasnif terminning tashqi shaklini aniqlash bilan birga uning qanday mazmuniy qismlardan tashkil topganini tushunishga yordam beradi.

1.1. Sodda terminlar

Sodda terminlar bitta leksik birlik orqali ifodalanadi. Ular ko‘pincha nerv tizimining anatomik tuzilmalari yoki klinik belgilarni nomlaydi. Masalan, ingliz tilidagi *brain* termini o‘zbek tilida «miya», *nerve* — «nerv», *neuron* — «neyron», *seizure* — «tutqanoq xuruji», *tremor* esa «tremor» yoki «titroq» shaklida ifodalanadi. Ushbu terminlarning ayrimlari o‘zbek tilida xalqaro shaklda saqlansa, boshqalari izohli tarjima orqali beriladi. Masalan, *seizure* ko‘pincha «tutqanoq xuruji» deb tarjima qilinadi. «Tremor» ilmiy terminologik shakl sifatida, «titroq» esa tushuntiruvchi so‘z sifatida ishlatilishi mumkin. Demak, sodda terminlarni tarjima qilishda ham matnning ilmiy yoki ommabop xususiyatini hisobga olish zarur.

1.2. Yasama terminlar

Yasama terminlar o‘zakka prefiks yoki suffiks qo‘shilishi yoxud xalqaro termin elementlarining birikishi orqali hosil bo‘ladi. Nevrologik terminologiyada yunon-lotin komponentlari alohida ahamiyatga ega. Masalan, *neuropathy* termini *neur(o)-* — nerv va *-pathy* — kasallik yoki patologik holatni anglatuvchi komponentlardan tashkil topgan. Uning o‘zbekcha muqobili «neyropatiya» hisoblanadi. *Encephalitis* terminidagi *encephal-* bosh miyani, *-itis* esa

yallig‘lanishni bildiradi; shu sababli termin «ensefalit», ya’ni bosh miyaning yallig‘lanish kasalligi ma’nosida qo‘llanadi. *Neuralgia* tarkibidagi *neur-* nervni, *-algia* og‘riqni anglatadi va termin «nevralgiya» shaklida ishlatiladi. *Myelopathy* «miyelopatiya», *polyneuropathy* esa «polineyropatiya» deb yuritiladi.

Poly- komponenti ko‘plik yoki ko‘p sonlilikni ifodalaydi. Shu jihatdan *polyneuropathy* terminining tarkibi ko‘plab periferik nervlarning zararlanishi bilan bog‘liq tushunchani anglashga yordam beradi. Biroq morfemik tahlil terminning to‘liq klinik mazmunini har doim ham ochib bermaydi. Masalan, *neuropathy* patologik holatni bildiradi, lekin uning sababi yoki aniq klinik ko‘rinishini mustaqil ravishda belgilamaydi. Shuning uchun terminning morfologik tuzilishi klinik ta’rif bilan birgalikda o‘rganilishi kerak.

1.3. Qo‘shma va ko‘p komponentli terminlar

Ko‘p komponentli terminlar bir nechta leksik birlik yordamida shakllanadi va ko‘pincha kasallikning joylashuvi, turi yoki diagnostik xususiyatini aniqlashtiradi. Masalan, *nervous system* — «nerv tizimi», *peripheral neuropathy* — «periferik neyropatiya», *multiple sclerosis* — «tarqoq skleroz», *Parkinson’s disease* — «Parkinson kasalligi», *ischemic stroke* — «ishemik insult» tarzida tarjima qilinadi. *Electroencephalography* termini esa «elektroensefalografiya» shaklida qo‘llanadi.

Ko‘p komponentli terminlarda so‘zlarning tartibi va grammatik munosabati muhimdir. Ingliz tilidagi *peripheral neuropathy* birikmasida *peripheral* komponenti asosiy terminning turini aniqlaydi. O‘zbek tilidagi «periferik neyropatiya» shakli ushbu munosabatni saqlaydi. Biroq turg‘un terminlarni so‘zma-so‘z tarjima qilish har doim ham to‘g‘ri natija bermaydi. Tarjima jarayonida avvalo klinik tushunchaning qabul qilingan nomi aniqlanishi kerak. Terminologik jihatdan to‘g‘ri tarjima nafaqat so‘zlarning ma’nosini, balki ularning tibbiyotdagi maxsus qo‘llanishini ham saqlashi lozim.

2. Nevrologik terminlarning semantik xususiyatlari

Terminlarning semantik tahlili ularning qanday tushunchani ifodalashi, boshqa terminlardan qaysi belgilari bilan farqlanishi va klinik tizimda qanday munosabatlarga kirishishini o‘rganishga asoslanadi.

Nevrologik terminlarni mazmuniga ko‘ra anatomik terminlar, kasallik nomlari, klinik simptomlar, diagnostik tushunchalar hamda klinik sindrom va holatlarni ifodalovchi birliklarga ajratish mumkin. Anatomik terminlarga *brain* — «miya», *spinal cord* — «orqa miya», *cerebellum* — «miyacha» kiradi. Kasallik nomlariga *encephalitis* — «ensefalit», *epilepsy* — «epilepsiya», *neuropathy* — «neyropatiya» misol bo‘ladi. Klinik simptomlarni *tremor* — «tremor» yoki «titroq», *paresthesia* — «paresteziya», *ataxia* — «ataksiya» kabi terminlar ifodalaydi. Diagnostik tushunchalarga *electroencephalography* — «elektroensefalografiya» va *nerve conduction study* — «nerv o‘tkazuvchanligini tekshirish» kiradi.

2.1. Semantik komponentlarning roli

Ayrim terminlar tarkibida kasallikning joylashuvi, miqdori, funksional buzilishi yoki patologik jarayon turi haqida ma’lumot mavjud bo‘ladi. Masalan, *polyneuropathy* terminida *poly-* komponenti ko‘p sonlilikni, *neuropathy* esa nervlar

bilan bog‘liq patologik holatni anglatadi. *Encephalitis* terminida *encephal-* bosh miyani, *-itis* esa yallig‘lanishni bildiradi.

Shu bilan birga, termin tarkibidan chiqarilgan ma’no bilan klinik ta’rif o‘rtasida farq mavjud. Morfemik tahlil kasallikning barcha etiologik yoki diagnostik xususiyatlarini ko‘rsatmaydi. Shu sababli struktur-semantik yondashuv klinik lug‘atlar va mutaxassislik manbalari bilan birgalikda qo‘llanishi kerak.

2.2. Sinonimiya va terminologik variantlilik

Tibbiy terminologiyada bitta tushunchaning bir nechta nom bilan ifodalanishi mumkin. Bunday holat xalqaro termin, o‘zlashtirilgan shakl va tushuntiruvchi milliy muqobil o‘rtasidagi munosabatda ko‘zga tashlanadi.

Masalan, *tremor* «tremor» yoki «titroq» shaklida, *paresthesia* esa «paresteziya» yoki «g‘ayritabiiy sezgilar» tarzida ifodalanishi mumkin. *Nerve conduction study* «nerv o‘tkazuvchanligini tekshirish» deb tarjima qilinadi, *spinal cord* esa «orqa miya» shaklida qo‘llanadi.

Ushbu variantlarning vazifasi bir xil emas. «Tremor» ilmiy terminologik shakl sifatida, «titroq» esa mazmunni izohlash uchun ishlatilishi mumkin. «G‘ayritabiiy sezgilar» paresteziya tushunchasini umumiy tarzda tushuntiradi, biroq barcha klinik holatlarda uning to‘liq terminologik ekvivalenti bo‘la olmaydi.

Shu sababli sinonimlarni tanlashda uch mezon muhim: tushunchaning aniqligi, terminning kasbiy qo‘llanish darajasi va matnning maqsadli auditoriyasi.

2.3. Kontekst va tushunchaviy farqlar

Nevrologik terminlarning ma’nosini aniqlashda kontekst alohida ahamiyatga ega. Masalan, *seizure* odatda tutqanoq xurujini anglatadi, *epilepsy* esa epileptik xurujlarga moyillik bilan tavsiflanadigan nevrologik kasallikni ifodalaydi. Ularni to‘liq sinonim sifatida ishlatish klinik ma’noni noto‘g‘ri talqin qilishga olib kelishi mumkin.

Xuddi shuningdek, *symptom* va *syndrome* tushunchalari ham farqlanadi. Birinchisi alohida belgi yoki shikoyatni, ikkinchisi esa o‘zaro bog‘liq belgilar majmuasini anglatadi. Demak, tarjimada terminning umumiy mavzuga aloqadorligi emas, aynan qanday tushunchani nomlashi asosiy mezon bo‘lishi kerak.

3. O‘zbek va ingliz tillarida termin yasalishining qiyosiy xususiyatlari

Ingliz va o‘zbek tillari grammatik qurilishi jihatidan farqlanadi. Ingliz tilida *neurological disorder*, *peripheral nerve injury* va *cerebral blood flow* kabi terminlar so‘zlarning tartibi hamda sintaktik munosabati orqali shakllanadi. O‘zbek tilida ularning muqobillari «nevrologik buzilish», «periferik nerv shikastlanishi» va «miya qon oqimi» tarzida ifodalanadi.

Ingliz tilidagi terminlarda birinchi ot keyingi otni aniqlashtirishi mumkin. O‘zbek tilida esa bunday munosabat ko‘pincha aniqlovchi va aniqlanmish yoki izofali birikma orqali ifodalanadi. Masalan, *nerve injury* birikmasi «nerv shikastlanishi» shaklida tarjima qilinadi. *Peripheral nerve conduction study* esa «periferik nerv o‘tkazuvchanligini tekshirish» tarzida ifodalanib, o‘zbek tilida grammatik jihatdan kengroq tuzilishga ega bo‘ladi.

Bunday farqlar tarjimaning kamchiligi emas. Agar mazmun aniq saqlansa, izohli tarjima tushunchani to‘g‘ri yetkazish vositasi bo‘lishi mumkin. Biroq izohli

shaklning haddan tashqari kengayishi matnning terminologik ixchamligiga salbiy ta’sir ko‘rsatishi mumkin. Shu sababli birinchi qo‘llanishda xalqaro termin bilan birga o‘zbekcha izoh berish, keyingi o‘rinlarda esa izchil tanlangan terminni ishlatish maqsadga muvofiq.

4. Nevrologik terminlarni tarjima qilishda semantik ekvivalentlik

Tarjimaviy ekvivalentlik terminning tashqi shakli yoki so‘zma-so‘z ma’nosining o‘xshashligidan kengroq tushunchadir. Tibbiy tarjimada ekvivalentlik, avvalo, asl termin ifodalagan klinik tushunchaning tarjimada saqlanishi bilan belgilanadi.

Ushbu maqolada terminlar o‘rtasidagi munosabatni uchta mezon asosida tahlil qilish taklif etiladi.

Birinchi mezon — **to‘liq tushunchaviy muvofiqlik**. Tarjima qilingan termin asl birlik ifodalagan tushunchani mazmunan saqlaydi. Masalan, *spinal cord* — «orqa miya» anatomik tushuncha jihatidan muvofiq ekvivalentlardir.

Ikkinchi mezon — **kontekstga bog‘liq muvofiqlik**. Terminning o‘zlashtirilgan shakli va izohli muqobili ma’lum vaziyatda bir tushunchani ifodalashi mumkin, biroq ularning uslubiy xususiyatlari farqlanadi. Masalan, *tremor* va «titroq» o‘rtasidagi munosabatda ilmiy termin bilan tushuntiruvchi so‘z farqini hisobga olish zarur.

Uchinchi mezon — **qisman yoki noto‘liq muvofiqlik**. Tashqi shaklan yaqin yoki umumiy ma’noda o‘xshash birliklar asl tushunchaning barcha xususiyatlarini ifodalamaydi. Bunday vaziyatda so‘zma-so‘z tarjima o‘rniga klinik ta’rifni tekshirish va zarur bo‘lsa, izohli muqobildan foydalanish lozim.

4.1. Tarjimaviy muammolarning asosiy turlari

Nevrologik terminlarni tarjima qilish jarayonida bir necha muammo kuzatilishi mumkin.

Birinchidan, xalqaro terminning noto‘g‘ri talqin qilinishi yuz berishi mumkin. Yunon-lotin komponentlarini bilmaslik terminning ma’nosini noto‘g‘ri tushunishga olib keladi. Masalan, *encephalitis* terminidagi *-itis* yallig‘lanishni anglatadi.

Ikkinchidan, termin va simptomning chalkashtirilishi tushunchaviy xatolarga sabab bo‘ladi. Kasallik nomi, klinik belgi va sindromni bir-birining o‘rnida ishlatish ilmiy aniqlikni pasaytiradi.

Uchinchidan, so‘zma-so‘z tarjima turg‘un klinik terminlarning mazmunini to‘liq aks ettirmasligi mumkin. Bunday hollarda terminning tibbiyotda qabul qilingan nomini aniqlash lozim.

To‘rtinchidan, variantlarning izchil ishlatilmasligi bitta maqola ichida tushunmovchilik tug‘diradi. Shu sababli mualliflar bir termin uchun asosiy muqobilni tanlab, matn davomida undan izchil foydalanishlari kerak.

Beshinchidan, qisqartmalarni tarjima qilishda ularning to‘liq shakli, klinik sohasi va matndagi vazifasini aniqlash zarur. Qisqartmani faqat harflar bo‘yicha o‘girish tushunchaviy xatoga olib kelishi mumkin.

4.2. Terminlarni tarjima qilish algoritmi

Nevrologik terminlarni tarjima qilish uchun quyidagi ketma-ketlik tavsiya etiladi. Dastlab inglizcha terminning to‘liq yozilishi va matndagi konteksti

aniqlanadi. Keyin uning anatomik tuzilma, kasallik, simptom, sindrom yoki diagnostik usulni ifodalashi belgilanadi. Shundan so‘ng termin tarkibidagi xalqaro o‘zak, prefiks va suffikslar tahlil qilinadi. O‘zbek tilidagi muqobil nufuzli tibbiy lug‘at yoki klinik tasnif orqali tekshiriladi. Muqobilning ma’nosi asl termin bilan solishtiriladi. Zarur bo‘lsa, xalqaro termin saqlanib, uning yonida o‘zbekcha izoh beriladi. Yakuniy bosqichda tanlangan termin maqola davomida izchil qo‘llanadi.

Ushbu algoritm tarjima jarayonini oddiy leksik almashtirish emas, balki terminologik tekshiruv va tushunchaviy muvofiqlashtirish jarayoni sifatida tashkil etishga yordam beradi.

5. Muhokama

O‘tkazilgan sifat tahlili nevrologik terminlarni o‘rganishda struktur va semantik yondashuvlarni bir-biridan ajratib qo‘ymaslik kerakligini ko‘rsatadi. Struktur tahlil termin qanday shakllanganini ochib bersa, semantik tahlil uning qaysi tushunchani ifodalashini va boshqa birliklardan qanday farqlanishini aniqlaydi. Tarjimaviy tahlil esa ushbu mazmunning boshqa tilda qanchalik to‘liq saqlanganini tekshiradi.

Tanlangan misollar asosida bir nechta umumiy xulosani ajratish mumkin. Birinchidan, xalqaro termin elementlari ingliz va o‘zbek tillari o‘rtasida muayyan shakliy yaqinlikni ta’minlaydi. Ikkinchidan, ko‘p komponentli terminlarning grammatik tuzilishi ikki tilda bir xil bo‘lmasligi mumkin. Uchinchidan, terminning klinik mazmuni uning morfemik tarkibidan to‘liq kelib chiqmaydi; shu bois lug‘aviy va klinik manbalar bilan tekshirish zarur. To‘rtinchidan, izohli tarjima ba’zi vaziyatlarda ma’noni aniqlashtiradi, lekin terminning qabul qilingan nomini o‘zboshimchalik bilan almashtirmasligi kerak.

Bu xulosalar tanlangan terminlar misolida olingan sifat kuzatuvlariga asoslanadi. Ularni barcha nevrologik terminlarga tatbiq etish uchun kengroq material, terminologik lug‘atlar va real klinik matnlar asosida qo‘shimcha tadqiqot o‘tkazish lozim.

Kelgusidagi tadqiqotlarda nevrologik terminlarning elektron ikki tilli korpusini shakllantirish, ularning uchrash chastotasini aniqlash, turli manbalardagi variantlarni qiyoslash va tarjima ekvivalentligini mutaxassislar bahosi asosida tekshirish istiqbolli yo‘nalish hisoblanadi. Bunday yondashuv terminologik variantlarning tarqalishi va qo‘llanishidagi farqlarni miqdoriy jihatdan ham o‘rganish imkonini beradi.

Xulosa

O‘zbek va ingliz tillaridagi nevrologik terminlarning struktur-semantik tahlili terminlarning tuzilishi, mazmuni va tarjimaviy muvofiqligi o‘zaro uzviy bog‘liq ekanini ko‘rsatadi.

Birinchidan, nevrologik terminlar sodda, yasama, qo‘shma va ko‘p komponentli birliklar ko‘rinishida namoyon bo‘ladi. Ularning shakllanishida xalqaro yunon-lotin elementlari, so‘z yasovchi vositalar va sintaktik birikmalar muhim o‘rin tutadi.

Ikkinchidan, terminlarning struktur tarkibi ularning semantik mazmunini anglashga yordam beradi, biroq klinik tushunchani to‘liq aniqlash uchun terminologik ta’rif va kontekst ham hisobga olinishi zarur.

Uchinchidan, ingliz va o‘zbek tillaridagi terminlar o‘rtasida shakliy o‘xshashlik mavjud bo‘lishi mumkin, ammo bunday o‘xshashlik har doim to‘liq semantik ekvivalentlikni anglatmaydi. Ayniqsa, kasallik, simptom va sindrom nomlarini tarjima qilishda tushunchaviy chegaralarni saqlash muhimdir.

To‘rtinchidan, tibbiy tarjimada xalqaro terminni saqlash, o‘zbekcha muqobilni tanlash yoki izohli tarjimadan foydalanish masalasi matnning vazifasi, terminning klinik mazmuni va qabul qilingan terminologik me’yorlar asosida hal etilishi lozim.

Beshinchidan, nevrologik terminlarning ikki tilli tizimini takomillashtirish uchun terminlarni yagona mezonlar asosida tasniflash, lug‘aviy muqobillarni tekshirish va elektron terminologik resurslarni rivojlantirish muhimdir.

Shunday qilib, nevrologik terminlarni struktur-semantik va tarjimaviy jihatdan birgalikda o‘rganish tibbiy matnlarning ilmiy aniqligini oshirish, terminologik izchillikni ta’minlash va xalqaro tibbiy axborot almashinuvini takomillashtirishga xizmat qiladi.

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Sakbayeva V.V., PhD
head of the Department of Uzbek Language and Literature
Termez State University of Engineering and Agrotechnologies
Uzbekistan, Termez

THE ROLE OF FOREIGN LANGUAGE IN TECHNICAL SCIENCE DEVELOPMENT

Abstract. In the modern era of globalization, foreign language proficiency has become an essential component of technical science development. Engineers, researchers, and technical specialists increasingly rely on foreign languages, particularly English, to access scientific information, participate in international research projects, and disseminate innovations worldwide. This article examines the role of foreign languages in the development of technical sciences The study analyzes the relationship between foreign language competence and scientific productivity, technological innovation, and international cooperation in technical fields. The findings indicate that foreign language proficiency significantly contributes to knowledge acquisition, research collaboration, academic mobility, and professional competitiveness. The article concludes that integrating foreign language education into technical curricula is crucial for preparing future specialists capable of contributing effectively to global scientific and technological advancement.

Keywords: foreign language, technical sciences, engineering education, scientific communication, international collaboration, innovation, professional competence.

Introduction

The rapid development of science and technology has transformed the world into a highly interconnected global community. Technical sciences, including engineering, information technology, energy systems, biotechnology, and industrial production, have become increasingly dependent on international cooperation and the exchange of scientific knowledge. In this context, foreign language proficiency has emerged as a critical factor influencing scientific progress and technological innovation.

Today, a significant proportion of scientific literature, research articles, technical manuals, patents, and conference proceedings are published in English. Consequently, researchers and engineers who possess foreign language skills have greater access to cutting-edge scientific information and are better equipped to participate in international scientific discourse. Foreign language competence enables specialists to communicate effectively with colleagues from different countries, collaborate on multinational projects, and contribute to the global scientific community.

The importance of foreign languages in technical sciences extends beyond communication. They serve as tools for knowledge acquisition, innovation transfer,

professional development, and academic mobility. Universities and research institutions worldwide increasingly emphasize foreign language training as part of technical education, recognizing its role in enhancing graduates' employability and research capabilities.

The purpose of this study is to investigate the role of foreign language proficiency in technical science development and to identify the ways in which language competence contributes to scientific productivity, technological advancement, and international collaboration.

The following research questions guided this study:

1. How does foreign language proficiency influence access to scientific and technical information?

2. What role does foreign language competence play in international scientific collaboration?

3. How does knowledge of foreign languages contribute to innovation and technological development?

4. What implications does foreign language education have for technical higher education institutions?

Methods

This study employed a qualitative research methodology based on document analysis and literature review. Relevant academic publications, policy documents, educational reports, and scholarly articles related to foreign language education and technical science development were examined.

The research process included the following stages:

Literature Review

The role of foreign languages in technical science development has attracted considerable attention from researchers, educators, and policymakers in recent decades. The growing internationalization of science, technology, and higher education has highlighted the importance of foreign language competence as a key factor in professional and academic success. Numerous studies have demonstrated that foreign language proficiency, particularly in English, significantly contributes to scientific communication, research productivity, innovation, and global collaboration.

One of the most influential contributions to this field is the work of David Crystal, who describes English as the primary global language of science, technology, business, and international communication. According to Crystal, the dominance of English in academic publishing and scientific discourse has made proficiency in the language essential for researchers and engineers seeking access to the latest developments in their fields. His research emphasizes that language competence enables specialists to participate more effectively in international scientific networks and professional communities.

Research on English for Specific Purposes (ESP) has also highlighted the importance of language instruction tailored to professional contexts. Tom Hutchinson and Alan Waters argue that language learning is most effective when it is directly related to learners' academic and occupational needs. Their ESP approach

focuses on developing specialized vocabulary, technical writing skills, and professional communication competencies required in engineering and scientific environments. This perspective has significantly influenced curriculum design in technical universities worldwide.

Similarly, Tony Dudley-Evans and Maggie Jo St John emphasize that modern engineers require not only technical expertise but also the ability to communicate effectively across linguistic and cultural boundaries. Their studies demonstrate that ESP courses improve students' readiness for international collaboration, conference participation, and scientific publication.

The relationship between language proficiency and academic success has been extensively investigated by Ken Hyland. Hyland's research on academic discourse reveals that foreign language competence is essential for understanding disciplinary conventions, producing research articles, and engaging in scholarly communication. He argues that researchers who possess strong academic writing skills are more likely to publish in prestigious international journals and gain recognition within the global scientific community.

The concept of scientific communication has become increasingly important in the digital age. According to studies conducted by the UNESCO, globalization and technological advancement have transformed the ways in which scientific knowledge is created, shared, and applied. UNESCO reports indicate that international collaboration has become a major driver of scientific productivity, and foreign language proficiency is a critical factor enabling researchers to participate in multinational projects and global knowledge networks.

Research conducted by the Organisation for Economic Co-operation and Development further supports the connection between language skills and innovation. OECD reports emphasize that countries investing in multilingual education and international academic cooperation tend to demonstrate higher levels of scientific output, technological innovation, and economic competitiveness. The organization highlights the importance of foreign language education in preparing a workforce capable of adapting to rapidly changing technological environments.

Several scholars have also examined the role of foreign languages in fostering innovation and technology transfer. Studies suggest that engineers and scientists with foreign language competence can more effectively access international patents, technical standards, and research databases. This access accelerates the adoption of advanced technologies and supports the development of innovative solutions to complex engineering challenges. Moreover, language skills facilitate cooperation between universities, research institutes, and industrial enterprises across different countries.

Recent research on higher education internationalization has emphasized the significance of academic mobility. According to the European Commission, participation in international exchange programs enhances students' professional competencies, intercultural awareness, and employability. Foreign language proficiency is consistently identified as one of the most important prerequisites for

successful participation in mobility programs such as Erasmus+ and various international research initiatives.

In engineering education, scholars increasingly advocate for the integration of language learning with technical training. The Content and Language Integrated Learning (CLIL) approach has gained popularity in many technical universities. This method combines subject-specific instruction with foreign language development, allowing students to acquire technical knowledge while simultaneously improving their communication skills. Research findings indicate that CLIL contributes positively to both language proficiency and academic achievement.

Another important area of research concerns employability and workforce development. The World Economic Forum identifies communication skills, multilingual competence, and cross-cultural collaboration as essential skills for the future labor market. In multinational engineering companies, employees are frequently required to interact with international partners, prepare technical documentation in English, and participate in global projects. Consequently, foreign language proficiency has become a significant competitive advantage for technical specialists.

Despite substantial progress in this area, several challenges remain. Researchers note that many technical students continue to perceive foreign language learning as secondary to their professional subjects. In addition, insufficient instructional hours, limited exposure to authentic professional communication, and lack of specialized teaching materials may hinder the development of language competence. Therefore, scholars recommend strengthening ESP programs, expanding international partnerships, and integrating digital learning technologies into language education.

Overall, the existing literature consistently demonstrates that foreign language proficiency is a fundamental component of technical science development. It enhances access to knowledge, supports international collaboration, facilitates innovation, promotes academic mobility, and increases professional competitiveness. As science and technology continue to evolve in a global context, the significance of foreign language education in technical fields is expected to grow even further.

Data Analysis

The collected literature was analyzed using thematic content analysis. The data were categorized into several themes:

- Access to scientific information;
- International research collaboration;
- Academic mobility;
- Innovation and technology transfer;
- Professional development and employability.

Comparative Analysis

The study also compared experiences from different countries where foreign language instruction has been integrated into technical education programs. Particular attention was paid to engineering universities and technological institutions implementing English for Specific Purposes (ESP) courses.

Research Limitations

The study relies primarily on secondary sources and literature analysis. Therefore, the conclusions are based on existing research findings rather than primary empirical data. Future studies may include surveys and interviews with technical students, researchers, and industry professionals.

Results

The analysis revealed several significant ways in which foreign language proficiency contributes to technical science development.

Access to Scientific Knowledge

One of the most important findings concerns access to scientific information. English has become the dominant language of science and technology. More than half of the world's scientific publications are published in English, making language proficiency essential for researchers seeking current knowledge.

Foreign language skills enable scientists and engineers to:

- Read international scientific journals;
- Access technical documentation;
- Study foreign patents and standards;
- Follow technological trends;
- Participate in online educational courses and webinars.

Researchers with strong foreign language competence can obtain information directly from original sources, reducing reliance on translated materials that may contain inaccuracies or delays.

Enhancement of Research Productivity

The study found a positive relationship between foreign language proficiency and research productivity. Scientists who possess advanced foreign language skills tend to publish more frequently in international journals and participate more actively in global research networks.

Foreign language competence contributes to:

- Writing research articles;
- Preparing conference presentations;
- Communicating with journal editors and reviewers;
- Participating in international academic events.

As a result, researchers gain greater visibility and recognition within the global scientific community.

International Collaboration

Another significant finding concerns international cooperation. Modern scientific challenges often require multidisciplinary and multinational approaches.

Foreign language proficiency facilitates communication among researchers from different linguistic backgrounds.

International collaboration allows scientists to:

- Exchange knowledge and expertise;
- Conduct joint research projects;
- Share laboratory facilities and resources;
- Develop innovative technological solutions.

Many successful engineering and technological innovations have emerged through international partnerships where effective communication played a key role.

Academic Mobility

Foreign language competence significantly enhances opportunities for academic mobility. Students and researchers with language skills are more likely to participate in:

- Exchange programs;
- International internships;
- Joint degree programs;
- Overseas research fellowships.

Such experiences contribute to professional growth, intercultural competence, and scientific development.

Innovation and Technology Transfer

The findings indicate that foreign languages facilitate technology transfer and innovation diffusion. Technical specialists who understand foreign languages can more easily:

- Adopt international best practices;
- Learn about emerging technologies;
- Cooperate with foreign companies;
- Implement advanced engineering solutions.

Consequently, foreign language proficiency accelerates technological modernization and industrial development.

Employment and Career Advancement

The study also demonstrated that foreign language skills increase employability in technical professions. Employers increasingly seek specialists capable of operating in international environments and communicating with global partners.

Foreign language proficiency enhances career opportunities in:

- Multinational corporations;
- Research institutions;
- International organizations;
- Engineering consulting firms;
- Technology companies.

Graduates possessing both technical expertise and language competence are often more competitive in the labor market.

Discussion

The findings highlight the growing significance of foreign languages in technical science development. In the knowledge-based economy, scientific progress increasingly depends on international information exchange and collaborative research efforts. Foreign language proficiency serves as a bridge connecting researchers, institutions, and industries across national boundaries.

One notable implication concerns engineering education. Traditional technical curricula often prioritize specialized subjects while allocating limited time to language learning. However, the results suggest that foreign language education should be viewed not as a supplementary component but as an integral part of professional training.

The implementation of English for Specific Purposes (ESP) courses has proven particularly effective in technical higher education institutions. ESP programs focus on developing communication skills relevant to professional contexts, including technical writing, presentation skills, and discipline-specific vocabulary. Such courses help students apply language skills directly to their future careers.

Furthermore, digital transformation has increased the importance of foreign language competence. Online scientific databases, virtual conferences, international research platforms, and global educational resources are predominantly available in English. Consequently, language proficiency has become a prerequisite for effective participation in the digital scientific ecosystem.

The study also emphasizes the importance of multilingualism. Although English remains the dominant language of science, knowledge of additional foreign languages such as German, Chinese, French, Japanese, or Russian can provide access to specialized scientific communities and technological innovations originating in different regions of the world.

For developing countries, foreign language education can serve as a catalyst for scientific and technological advancement. By enabling researchers to engage with international scientific communities, language competence supports the transfer of knowledge, promotes innovation, and contributes to economic development.

Educational policymakers should therefore prioritize the integration of foreign language training into technical education programs. Universities should encourage participation in international projects, support academic mobility initiatives, and provide opportunities for students to develop professional communication skills in foreign languages.

Conclusion

Foreign language proficiency plays a vital role in the development of technical sciences. It facilitates access to scientific knowledge, enhances research productivity, promotes international collaboration, supports academic mobility, and contributes to innovation and technology transfer.

The findings demonstrate that language competence is no longer merely an additional qualification but a fundamental professional skill for engineers, scientists, and technical specialists. As scientific research becomes increasingly internationalized, the ability to communicate effectively in foreign languages will continue to influence individual success and national scientific competitiveness.

Technical higher education institutions should strengthen foreign language instruction, particularly through specialized ESP programs, to prepare graduates for participation in the global scientific and technological community. By integrating language education with technical training, universities can foster a new generation of professionals capable of driving innovation and contributing to sustainable scientific development.

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Sakbayeva V.V., PhD
head of the Department of Uzbek Language and Literature
Termez State University of Engineering and Agrotechnologies
Uzbekistan, Termez

THE IMPORTANCE OF INTEGRATING ARTIFICIAL INTELLIGENCE IN DEVELOPING COMMUNICATIVE SKILLS OF TECHNICAL ENGINEERING STUDENTS

Abstract. The rapid advancement of Artificial Intelligence (AI) technologies has significantly transformed educational practices worldwide. In engineering education, AI has emerged as a powerful tool for enhancing students' communicative competence, which is increasingly recognized as a critical professional skill alongside technical expertise. Effective communication enables future engineers to collaborate in multidisciplinary teams, present technical information, participate in international projects, and engage in professional problem-solving. This article investigates the importance of integrating AI technologies into the development of communicative skills among technical engineering students. Using a qualitative literature-based approach, the study examines how AI-supported learning environments contribute to improving speaking, writing, listening, and intercultural communication skills. The findings indicate that AI-powered educational tools promote personalized learning, provide immediate feedback, increase learner engagement, and support the development of professional communication competencies. The study concludes that the integration of AI into engineering education can significantly enhance communicative skills and better prepare graduates for the demands of the modern labor market.

Keywords: Artificial Intelligence, engineering education, communicative competence, technical students, digital learning, professional communication, educational technology, higher education.

Introduction

The twenty-first century has witnessed unprecedented technological development, resulting in profound changes in education, industry, and professional communication. Engineering professionals are no longer expected to possess only technical expertise; they must also demonstrate strong communication skills to collaborate effectively within multidisciplinary and multicultural environments. Modern engineers frequently interact with colleagues, clients, stakeholders, and international partners, making communicative competence an essential component of professional success.

In response to these demands, higher education institutions have increasingly emphasized the development of communication skills within engineering curricula. However, traditional teaching methods often fail to provide sufficient opportunities for individualized practice, timely feedback, and authentic communication

experiences. Consequently, educators have begun exploring innovative technologies to support communication skills development.

Artificial Intelligence (AI) has emerged as one of the most promising educational innovations. AI technologies include intelligent tutoring systems, chatbots, virtual assistants, automated feedback platforms, speech recognition systems, and adaptive learning environments. These tools have the potential to transform language learning and communication training by providing personalized instruction and real-time support.

The integration of AI into engineering education is particularly relevant because engineering students often require specialized communication skills related to technical documentation, presentations, teamwork, project management, and professional interactions. AI-based educational technologies can help students develop these competencies more effectively than traditional methods alone.

This study aims to investigate the importance of AI integration in developing communicative skills among technical engineering students. Specifically, the research addresses the following questions:

1. How does AI contribute to the development of communicative competence in engineering students?
2. What AI tools are most effective for improving communication skills?
3. What benefits and challenges are associated with AI-supported communication learning?
4. How can universities integrate AI effectively into engineering education?

Literature Review

The application of Artificial Intelligence in education has become one of the most extensively researched topics in educational technology. Scholars argue that AI has the potential to revolutionize learning by offering personalized educational experiences, adaptive content delivery, and immediate feedback mechanisms.

According to educational technology researchers, AI-powered systems can identify individual learning needs and adjust instructional content accordingly. This capability is particularly valuable for communication skills development, where students often progress at different rates and require individualized support.

Research on communicative competence emphasizes that effective communication involves multiple dimensions, including linguistic, sociolinguistic, discourse, strategic, and intercultural competencies. Modern engineering professionals must be capable of communicating complex technical information clearly and efficiently across various professional contexts.

Studies on AI-assisted language learning demonstrate that intelligent tutoring systems improve speaking, writing, listening, and reading skills through personalized learning pathways. AI-powered chatbots and virtual conversation partners provide students with opportunities to practice communication in low-anxiety environments, thereby increasing confidence and engagement.

Recent research also highlights the role of natural language processing technologies in providing automated feedback on grammar, vocabulary, coherence, pronunciation, and fluency. Such feedback allows students to identify weaknesses and improve communication skills independently.

In engineering education, scholars emphasize that communication competence is directly linked to employability and professional performance. Employers increasingly seek engineers who can explain technical concepts, collaborate in teams, prepare reports, and communicate effectively with non-technical audiences.

The literature consistently suggests that AI technologies can enhance communication training by creating interactive, learner-centered, and authentic educational experiences.

Methods

This study employed a qualitative research design based on literature analysis and document review.

Data Collection

The study analyzed academic publications, educational reports, conference proceedings, and scholarly articles published between 2018 and 2025. Sources were selected based on their relevance to:

- Artificial Intelligence in education;
- Engineering education;
- Communicative competence development;
- Educational technology;
- AI-assisted language learning.

Data Analysis

A thematic analysis approach was used to identify recurring patterns and themes related to AI integration in communication skills development.

The data were organized into the following categories:

- AI-supported communication learning;
- Personalized instruction;
- Automated feedback systems;
- Student engagement and motivation;
- Professional communication competence.

Research Limitations

The study is based primarily on secondary sources. Future research may involve surveys, interviews, and experimental studies involving engineering students and instructors.

Results

The analysis revealed several significant benefits associated with integrating AI into communicative skills development for engineering students.

Personalized Learning Opportunities

One of the most significant findings is the ability of AI systems to provide personalized learning experiences. Traditional classroom instruction often struggles

to address individual learning differences. AI platforms analyze learner performance and adapt instructional materials according to students' needs.

Engineering students can receive customized communication exercises targeting specific weaknesses such as:

- Technical writing;
- Oral presentations;
- Professional vocabulary;
- Pronunciation;
- Listening comprehension.

As a result, learning becomes more efficient and student-centered.

Immediate Feedback and Continuous Assessment

AI-powered tools provide real-time feedback on various aspects of communication performance.

Students receive immediate evaluation regarding:

- Grammar accuracy;
- Vocabulary usage;
- Pronunciation quality;
- Speech fluency;
- Writing coherence.

Unlike traditional assessment methods, which may involve delays, AI systems enable continuous improvement through instant corrective feedback.

Improvement of Speaking Skills

Many AI applications incorporate speech recognition technology that allows students to practice speaking independently.

Virtual communication environments support:

- Presentation practice;
- Interview simulations;
- Technical discussions;
- Project explanations;
- Public speaking exercises.

Students become more confident in expressing technical ideas and participating in professional conversations.

Enhanced Writing Competence

Engineering students frequently prepare technical reports, research papers, project proposals, and documentation.

AI writing assistants help students:

- Improve grammar and style;
- Organize ideas logically;
- Enhance clarity and coherence;
- Use professional terminology appropriately.

Consequently, students develop stronger academic and professional writing skills.

Increased Student Motivation

Interactive AI technologies make learning more engaging and enjoyable.

Gamified AI platforms encourage students through:

- Progress tracking;
- Personalized challenges;
- Achievement systems;
- Interactive conversations.

Higher levels of engagement contribute to improved learning outcomes and greater communication practice.

Development of Intercultural Communication Skills

Modern engineering projects often involve international collaboration.

AI-powered virtual environments expose students to diverse communication styles and cultural contexts. This exposure helps develop intercultural competence, which is essential in global engineering workplaces.

Preparation for Industry 4.0

The emergence of Industry 4.0 has fundamentally transformed the requirements placed on modern engineering professionals. Industry 4.0 refers to the integration of advanced digital technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), Big Data, cloud computing, robotics, cyber-physical systems, and automation into industrial processes. In this rapidly evolving environment, technical expertise alone is no longer sufficient. Engineers must also possess strong communicative, collaborative, and digital competencies to function effectively in interconnected and technology-driven workplaces.

Artificial Intelligence plays a crucial role in preparing engineering students for the communication demands of Industry 4.0. AI-powered educational tools create learning environments that simulate real-world industrial scenarios, allowing students to practice communication and problem-solving skills in contexts similar to those they will encounter in their future careers.

One of the most significant requirements of Industry 4.0 is effective collaboration across multidisciplinary teams. Modern engineering projects often involve specialists from various fields, including software development, mechanical engineering, electrical engineering, data science, and business management. AI-supported learning platforms help students develop teamwork and communication skills by facilitating virtual collaboration, project-based learning, and interactive problem-solving activities. Through these experiences, students learn how to communicate technical information clearly to both technical and non-technical audiences.

Furthermore, Industry 4.0 has increased the importance of digital communication. Engineers frequently participate in virtual meetings, online conferences, remote project management, and international collaborations. AI technologies such as virtual assistants, intelligent communication platforms, and automated presentation tools enable students to practice professional communication in digital environments. As a result, graduates become more

comfortable using modern communication technologies and adapting to remote work settings.

Another important aspect of Industry 4.0 is data-driven decision-making. Engineers are expected to analyze large volumes of information and communicate their findings effectively. AI-based educational tools assist students in interpreting technical data, generating reports, and presenting analytical results. These activities strengthen both critical thinking and communication competencies, which are essential for professional success.

AI also supports the development of technical writing skills required in smart manufacturing and industrial automation environments. Engineers must regularly prepare project documentation, technical specifications, maintenance reports, research papers, and operational manuals. AI-powered writing assistants provide immediate feedback on language accuracy, coherence, terminology usage, and document structure, helping students produce professional-quality technical documents.

Globalization represents another defining characteristic of Industry 4.0. Engineering companies increasingly operate across national borders, requiring employees to collaborate with international colleagues, suppliers, and customers. AI-enhanced language learning systems support the development of foreign language proficiency and intercultural communication skills, enabling future engineers to participate effectively in global projects and multinational teams.

Moreover, Industry 4.0 demands continuous learning and adaptability. Technological innovations emerge rapidly, requiring professionals to update their knowledge throughout their careers. AI-driven adaptive learning platforms encourage lifelong learning by providing personalized educational experiences tailored to individual needs and professional goals. Students learn how to independently acquire new knowledge and adapt to technological changes, which is a critical competency in modern industry.

The integration of AI into engineering education also promotes the development of several key Industry 4.0 competencies, including:

- Digital literacy and technological competence;
- Critical thinking and problem-solving skills;
- Communication and presentation abilities;
- Teamwork and collaborative learning;
- Intercultural and multilingual communication;
- Creativity and innovation;
- Data interpretation and analytical skills;
- Adaptability and lifelong learning.

In conclusion, AI serves as an effective bridge between engineering education and the requirements of Industry 4.0. By enhancing communicative competence, fostering digital collaboration, supporting technical writing, and encouraging continuous learning, AI helps prepare engineering students for successful careers in smart industries and technologically advanced workplaces. Universities that

integrate AI into their curricula can better equip graduates with the professional skills necessary to thrive in the Fourth Industrial Revolution.

Discussion

The findings demonstrate that AI integration offers substantial opportunities for improving communicative competence among engineering students. The increasing complexity of modern engineering practice requires professionals who can combine technical expertise with advanced communication skills.

One of the primary advantages of AI is its ability to personalize learning experiences. Unlike traditional instructional methods, AI systems continuously monitor learner progress and provide individualized recommendations. This capability is particularly important for communication training because students often possess different levels of language proficiency and communication confidence.

Another significant benefit involves accessibility. AI-powered communication tools are available beyond classroom hours, allowing students to practice independently and at their own pace. Such flexibility supports lifelong learning and autonomous skill development.

The study also highlights the growing importance of AI-driven feedback mechanisms. Immediate feedback helps learners identify mistakes quickly and develop effective communication habits. This process enhances self-regulated learning and promotes continuous improvement.

Despite these advantages, several challenges must be considered. The implementation of AI technologies requires adequate infrastructure, financial investment, and teacher training. Some educators may lack the necessary digital competencies to integrate AI effectively into instruction.

Additionally, ethical concerns regarding data privacy, algorithmic bias, and overreliance on technology require careful consideration. Universities should establish clear guidelines to ensure responsible AI use.

AI should not replace human instructors but rather complement their expertise. Teachers remain essential for providing emotional support, critical thinking development, creativity enhancement, and authentic interpersonal interaction.

Successful AI integration therefore requires a balanced approach that combines technological innovation with pedagogical effectiveness.

Conclusion

Artificial Intelligence has become an increasingly valuable tool for developing communicative skills among technical engineering students. The findings of this study indicate that AI technologies enhance communication learning through personalization, immediate feedback, increased engagement, and authentic communication practice.

AI-supported educational environments contribute to the development of speaking, writing, listening, and intercultural communication competencies that are essential for modern engineering professionals. Furthermore, AI prepares students for the communication demands of Industry 4.0 and the global labor market.

Higher education institutions should actively integrate AI technologies into engineering curricula while ensuring that educators receive appropriate training and support. A balanced combination of human instruction and AI-enhanced learning can significantly improve communication skills development and prepare future engineers for successful professional careers.

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Samatova Y.S.
II kurs magistranti
Primova N.G‘.
II kurs magistranti
Axmedova D.Z.
II kurs magistranti
Xolmirzayeva O.Sh.
II kurs magistranti
Abdug‘aniyeva N.M.
II kurs magistranti
Eshkobilova M.E.
dotsent
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

MAHALLIY SHAROITDA O‘SUVCHI PORTULACA OLERACEA L. (SEMIZO‘T) XOMASHYOSINING MAKRO-MIKROSKOPIK BELGILARI VA UNI FARMAKOGNOSTIK STANDARTLASH

Annotatsiya. Ushbu maqolada O‘zbekiston florasida keng tarqalgan Portulaca oleracea L. (Semizo‘t) o‘simligi yerustki qismining farmakognostik ko'rsatkichlari tahlil qilingan. Tadqiqot davomida o'simlik xomashyosining makroskopik va mikroskopik belgilari o'rganilib, tashxisiy (diagnostik) elementlari aniqlandi. Davlat Farmakopeyasi talablari asosida xomashyoning qoldiq namligi va umumiy kul miqdori kabi sonli ko'rsatkichlari belgilandi. Shuningdek, turli qutblilikka ega bo'lgan erituvchilar (metanol, etil asetat, xloroform) yordamida ajratib olingan fraksiyalarda fitokimyoviy skrining o'tkazilib, dominant biologik faol moddalar guruhlari (flavonoidlar, alkaloidlar) mavjudligi tasdiqlandi. Olingan natijalar mahalliy Portulaca oleracea L. xomashyosini standartlash va kelgusida me'yoriy hujjatlar (farmakopeya maqolasi) ishlab chiqish uchun asos bo'lib xizmat qiladi.

Kalit so‘zlar: Portulaca oleracea, semizo't, farmakognostik standartlash, makroskopiya, mikroskopiya, fitokimyoviy skrining, sifat reaksiyalari.

Samatova Y.S.
second-year master’s student
Primova N.G‘.
second-year master’s student
Axmedova D.Z.
second-year master’s student
Xolmirzayeva O.Sh.
second-year master’s student
Abdug‘aniyeva N.M.
second-year master’s student

Eshkobilova M.E.
associate professor
Samarkand State Medical University
Uzbekistan, Samarkand

MACROSCOPIC AND MICROSCOPIC CHARACTERISTICS AND PHARMACOGNOSTIC STANDARDIZATION OF PORTULACA OLERACEA L. (PURSLANE) RAW MATERIAL GROWING UNDER LOCAL CONDITIONS

Abstract. This article presents an analysis of the pharmacognostic characteristics of the aerial parts of Portulaca oleracea L. (purslane), a plant widely distributed in the flora of Uzbekistan. During the study, the macroscopic and microscopic characteristics of the plant material were examined, and its diagnostic elements were identified. In accordance with the requirements of the State Pharmacopoeia, numerical parameters of the raw material, including residual moisture and total ash content, were determined. In addition, phytochemical screening was carried out on fractions obtained using solvents of different polarities (methanol, ethyl acetate, and chloroform), confirming the presence of the predominant groups of biologically active compounds, namely flavonoids and alkaloids. The obtained results may serve as a basis for the standardization of locally sourced Portulaca oleracea L. raw material and for the further development of regulatory documentation (a pharmacopoeial monograph).

Keywords: Portulaca oleracea, purslane, pharmacognostic standardization, macroscopy, microscopy, phytochemical screening, qualitative reactions.

KIRISH

Jahon sog'liqni saqlash tashkiloti (JSST) ma'lumotlariga ko'ra, zamonaviy tibbiyotda qo'llaniladigan dori vositalarining salmoqli qismini o'simlik xomashyosidan olinadigan tabiiy preparatlar tashkil etadi. Shu nuqtai nazardan, respublikamiz florasiga mansub, zaxirasi yetarli bo'lgan shifobaxsh o'simliklarni chuqur farmakognostik o'rganish va ularning asosida yangi dori vositalarini yaratish dolzarb vazifalardan hisoblanadi. *Portulaca oleracea L.* (Semizo't) – Portulacaceae oilasiga mansub bir yillik o't o'simlik bo'lib, xalq tabobatida va zamonaviy farmakologiyada o'zining yallig'lanishga qarshi, antioksidant va antidiabetik xususiyatlari bilan mashhur. Uning tarkibi omega-3 yog' kislotalari, flavonoidlar, alkaloidlar (oleratseinlar) va vitaminlarga boy.

Biroq, O'zbekiston sharoitida o'suvchi *Portulaca oleracea L.* xomashyosining sifatini kafolatlovchi aniq farmakognostik standartlar, jumladan makro- va mikroskopik tashxis belgilari to'liq tizimlashtirilmagan. Ushbu tadqiqotning maqsadi mahalliy sharoitda yig'ilgan *Portulaca oleracea* o'simligining yerustki qismi (Herba Portulacae oleraceae) uchun mikroskopik, makroskopik va dastlabki fitokimyoviy standartlash ko'rsatkichlarini ishlab chiqishdan iborat.

MATERIAL VA USULLAR

Tadqiqot obyekti: Tadqiqot obyekti sifatida O‘zbekiston sharoitida yozgi gullash va urug'lash davrida (iyul-avgust oylari) yig‘ib olingan *Portulaca oleracea L.* o‘simligining yerustki qismi qilib olindi. Xomashyo bevosita quyosh nuri tushmaydigan, yaxshi shamollatiladigan xonada 25-30°C haroratda quritildi va diametri 1-2 mm bo'lgan elakdan o'tkazildi.

Makro- va mikroskopik tahlil: Makroskopik tahlil xomashyoni vizual ko'zdan kechirish, o'lchamlarini o'lchash va organoleptik ko'rsatkichlarini (rungi, hidi, ta'mi) aniqlash orqali amalga oshirildi. Mikroskopik tahlil uchun quritilgan barg va poya namunalari 5% li natriy gidroksid (NaOH) eritmasida qizdirildi, so'ngra xloralgidrat eritmasida yoritilib, preparatlar tayyorlandi. Tahlil MIKMED-5 binokulyar mikroskopi va raqamli kamera yordamida 100x va 400x kattalashtirish ostida bajarildi.

Sonli ko'rsatkichlarni aniqlash: Xomashyoning namligi va umumiy kul miqdori Davlat Farmakopeyasi (DF XI) talablariga muvofiq gravimetrik usulda, quritish shkafi (105°C) va mufel pechi (500-600°C) yordamida aniqlandi.

Fitokimyoviy skrining: Maydalangan xomashyo (100 g) ketma-ket n-geksan, 70% li etil spirti va suv yordamida ekstraksiya qilindi. Ekstraktlar past bosim ostida, 40°C haroratda rotorli bug'latgichda konsentrlangan. Etanolli va suvli ekstraktlarda alkaloidlarni aniqlash uchun Dragendorf, Mayer va Vagner reaktivlaridan; flavonoidlar uchun siyanidin sinamasidan (Shinoda reaksiyasi); saponinlar uchun ko'pik hosil qilish sinamasidan foydalanildi. Tahlil yupqa qatlamli xromatografiya (YuQX) usuli yordamida tasdiqlandi.

NATIJALAR VA ULARNING MUHOKAMASI

Makroskopik belgilar: *Portulaca oleracea L.* ning quritilgan yerustki qismi maydalangan poya, barg va gul qoldiqlaridan iborat. Poyasi silliq, go'shtdor, sershox, yuzasi yashil yoki qizg'ish-jigarrang tusda. Barglari ketma-ket joylashgan, teskari tuxumsimon yoki kuraksimon, go'shtdor, uzunligi 1-2.5 sm, eni 0.5-1.5 sm, qalin, yuzasi tuksiz. Gullari mayda, sariq rangli, poya va shoxlarning uchida yoki barg qo'ltig'ida joylashgan. Xomashyoning o'ziga xos kuchsiz o'simlik hidi bor, ta'mi biroz nordon va shilliqli.

Mikroskopik belgilar: Bargning yuzadan ko'rinishi (preparati) o'rganilganda, epidermis hujayralarining shakli ko'pburchakli, devorlari biroz burmalangan yoki to'g'ri ekanligi kuzatildi. Ustki va ostki epidermisda barg og'izchalari (ustitsa) mavjud bo'lib, ular asosan paratsit (hujayra og'izchasiga parallel joylashgan ikkita yon hujayrali) tipga mansub. Bu belgi Portulacaceae oilasi uchun muhim diagnostik xususiyat hisoblanadi. Mezofill to'qimasida yirik, ko'p qirrali kalsiy oksalat druzalari uchraydi. Poya ko'ndalang kesimida asosiy to'qima (parenxima) hujayralari yirik va suv saqlashga moslashganligi, shuningdek, shilliq saqlovchi maxsus idish-hujayralar mavjudligi qayd etildi.

Fizik-kimyoviy va sonli ko'rsatkichlar: Standartlash jarayonida xomashyo sifatini belgilovchi raqamli parametrlar o'rnatildi. O'zbekiston sharoitida yig'ilgan *P. oleracea* xomashyosining o'rtacha namligi 8.4 ± 0.2% ni tashkil etdi (me'yor: 14% dan oshmasligi kerak). Umumiy kul miqdori, ya'ni mineral moddalar qoldig'i

14.2 ± 0.3% ekanligi aniqlandi. O'simlik tabiatdan go'shtdor bo'lganligi sababli ushbu kul ko'rsatkichi uning tarkibidagi kalsiy va kaliy tuzlariga boy ekanligini tasdiqlaydi.

Fitokimyoviy skrining natijalari: Ko'p bosqichli ekstraksiya natijasida olingan fraksiyalarda o'tkazilgan sifat reaksiyalari quyidagi natijalarni ko'rsatdi:

1. *Flavonoidlar:* 70% li etanol ekstraktida Shinoda reaksiyasi o'tkazilganda (Mg qirindisi va kons. HCl) qizg'ish-pushti rang hosil bo'lib, bu flavonollar, xususan rutin va kversetin mavjudligidan dalolat beradi.
2. *Alkaloidlar:* Etanolli ekstraktni 1% li HCl eritmasida eritib tahlil qilinganda, Dragendorf reaktivi bilan qizil-qo'ng'ir, Mayer reaktivi bilan sarg'ish cho'kma hosil bo'ldi. Bu oleratsein tipidagi indolin alkaloidlarining yorqin diagnostik belgisidir.
3. *Saponinlar va polisaxaridlar:* Suvli ekstrakt chayqatilganda barqaror ko'pik hosil qildi, bu triterpen saponinlar borligini tasdiqladi. Etanol qatlamlab quyilganda polisaxarid kompleksining oqish cho'kmasi tushdi, bu xomashyoning nordon-shilliqli ta'mini izohlaydi.

XULOSA

Mahalliy sharoitda o'suvchi *Portulaca oleracea L.* (Semizo't) o'simligi yerustki qismining makroskopik va mikroskopik diagnostik belgilari (paratsit tipli barg og'izchalari, kalsiy oksalat druzalari, yirik parenxima hujayralari) hamda sonli ko'rsatkichlari (namlik - 8.4%, umumiy kul - 14.2%) to'liq aniqlandi. Fitokimyoviy skrining natijalari xomashyoning flavonoidlar, alkaloidlar va polisaxaridlarga boy ekanligini tasdiqladi. O'rnatilgan ushbu farmakognostik parametrlar xomashyo haqiqiyligini aniqlash, soxta turlardan farqlash hamda respublikamiz hududida mahalliy fito-preparatlar ishlab chiqarish uchun maxsus me'yoriy hujjatlar (Korxona standarti, Farmakopeya maqolasi) yaratishda ilmiy asos bo'lib xizmat qiladi.

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Sharipova D.T.
kichik ilmiy xodim
Geologiya va geofizika instituti

DARYOLAR OQIMIGA IQLIMIY OMILLARNING TA'SIRI (TO'PALANG VA QORATOG' DARYOLARI MISOLIDA)

Annotatsiya. Mazkur tadqiqot To'palang va Qoratog' daryolari oqimi shakllanishiga atmosfera yog'inlari hamda havo haroratining ta'sirini miqdoriy baholashga bag'ishlangan. Tadqiqotda daryolarning o'rtacha oylik va yillik suv sarflari, shuningdek, «Severtsev muzligi» va «Ko'l» meteorologik stansiyalarining ko'p yillik havo harorati va atmosfera yog'inlari ma'lumotlaridan foydalanildi. Kuzatuv qatorlaridagi uzilishlar va to'liqsiz ma'lumotlar juft va ko'p omilli regressiya modellari yordamida qayta tiklandi. Daryolar oqimi va gidrometeorologik omillar o'rtasidagi bog'lanishlar yillik va mavsumiy masshtablarda statistik usullar vositasida tahlil qilindi. Olingan natijalar To'palang va Qoratog' daryolari oqimi shakllanishida atmosfera yog'inlari asosiy belgilovchi omil ekanini, havo harorati bilan bog'lanish esa aksariyat davrlarda kuchsiz xarakterda ekanini ko'rsatdi.

Kalit so'zlar: Daryo oqimi shakllanishi, suv sarfi, atmosfera yog'inlari, havo harorati, gidrometeorologik omillar, korrelyatsiya koeffitsiyenti, regression model, vaqtli qatorlarni tiklash, gidrologik hisoblashlar.

Sharipova D.T.
junior researcher
Institute of Geology and Geophysics

THE INFLUENCE OF CLIMATIC FACTORS ON RIVER RUNOFF (A CASE STUDY OF THE TOPALANG AND QORATOG RIVERS)

Abstract. This study quantitatively evaluates the influence of atmospheric precipitation and air temperature on runoff formation in the Topalang and Qoratog rivers. The analysis uses mean monthly and annual river discharge data, together with long-term air temperature and precipitation records from the Severtsov Glacier and Kol meteorological stations. Gaps and incomplete observations were reconstructed using paired and multivariate regression models. Relationships between river runoff and hydrometeorological factors were analysed statistically at annual and seasonal scales. The results indicate that atmospheric precipitation is the main determining factor in runoff formation in both rivers, while the relationship with air temperature is weak during most of the periods examined.

Keywords: river runoff formation, water discharge, atmospheric precipitation, air temperature, hydrometeorological factors, correlation coefficient, regression model, time-series reconstruction, hydrological calculations.

KIRISH: Daryolar oqimi ularning suv yig'ish havzasidagi iqlimiy sharoitlarning ta'sirida shakllanadi. A.I.Voyeykov ta'kidlaganidek, daryolar o'z havzalari iqlim sharoitining mahsulidir. Shu nuqtayi nazardan daryo oqimiga iqlimiy omillarning ta'sirini o'rganish gidrologiyaning muhim ilmiy va amaliy yo'nalishlaridan biri hisoblanadi.

Daryo oqimining iqlimiy omillarga bog'liqligi E.M. Oldekop, V.L. Shults, O.P. Shcheglova, M.N. Bolshakov va boshqa tadqiqotchilar ishlarida o'rganilgan. M.N. Bolshakov G'arbiy Tyanshan daryolari oqimining yillararo o'zgarishini belgilovchi asosiy iqlimiy omillarni uch guruhga ajratgan: birinchi guruhga oqimning yillararo o'zgarishi asosan yillik atmosfera yog'inlari yig'indisi bilan bog'liq daryolar; ikkinchi guruhga yog'inlar yig'indisi va issiqlik rejimi o'zgarishining birgalikdagi ta'sirida shakllanadigan daryolar; uchinchi guruhga esa oqimning yillararo o'zgarishi asosan qor va muzliklarning erishi davridagi issiqlik balansi, ya'ni havo harorati o'zgarishiga bog'liq daryolar kiradi.

Ushbu yondashuvni Surxondaryo havzasining yirik irmoqlari – To'palangdaryo va Qorato'gdaryo misolida tadqiq etish muhim ilmiy va amaliy ahamiyatga ega.

TADQIQOT MAQSADI VA MA'LUMOTLAR: Tadqiqotning asosiy maqsadi To'palangdaryo va Qorato'gdaryoning yillik, mavsumiy hamda oylik oqimiga atmosfera yog'inlari va havo haroratining ta'sirini baholashdan iborat.

Tadqiqotda o'rganilayotgan daryolarning o'rtacha oylik va yillik suv sarflari ma'lumotlaridan foydalanildi. Ularga qo'shimcha ravishda «Severtsev muzligi» va «Ko'l» meteorologik stansiyalarida o'lchangan havo harorati hamda atmosfera yog'inlari ma'lumotlari statistik tahlillar uchun asos bo'ldi.

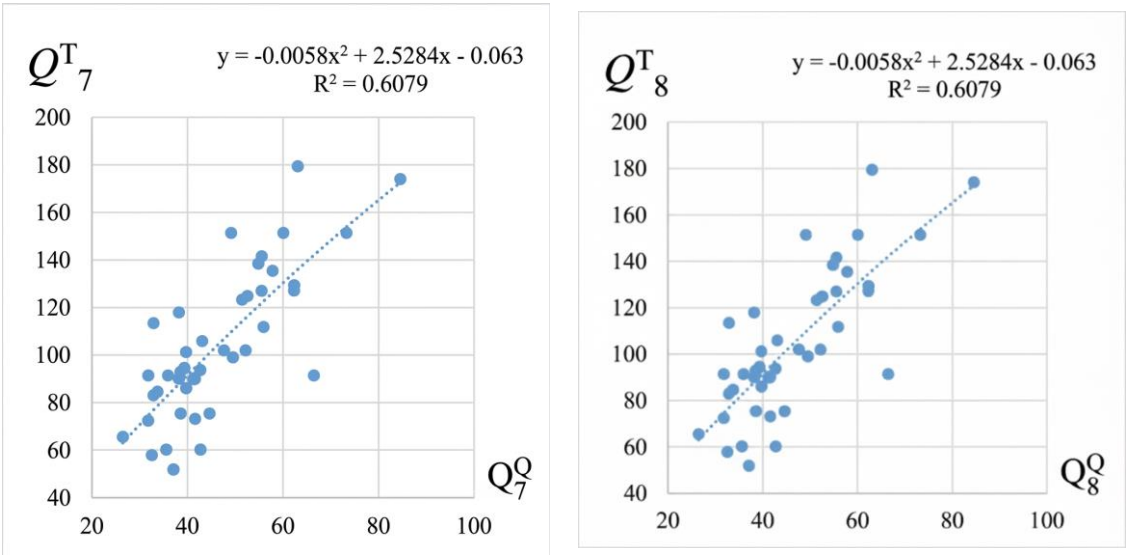
TADQIQOT USULLARI: Dastlab To'palang va Qoratog' daryolarining o'rtacha oylik va yillik suv sarflari qatorlari tahlil qilindi. To'palangdaryoning Zarchob gidrologik postida 1963-yil may–iyul oylarida, 1965-yil aprel–dekabr oylarida va 1969-yil may–dekabr oylarida suv sarfi kuzatuvlarida uzilishlar mavjudligi aniqlandi.

Mazkur uzilishlarni tiklashda daryolarning bir vaqtdagi o'rtacha oylik suv sarflari o'rtasidagi regression bog'lanishlardan foydalanildi. Bog'lanishlarning zichligi korrelyatsiya koeffitsiyenti orqali baholandi. May va sentabr oylaridan tashqari, qolgan oylarda korrelyatsiya koeffitsiyentlari 0,70 dan yuqori bo'lgan.

Daryolar oqimi bilan atmosfera yog'inlari o'rtasidagi bog'lanishlar yillik yog'inlar yig'indisi, oktabr–mart oylaridagi yog'inlar yig'indisi hamda aprel–sentabr oylaridagi yog'inlar yig'indisi bo'yicha tahlil qilindi. Regression tenglamalari va korrelyatsiya koeffitsiyentlari statistik baholandi.

Daryo oqimi bilan havo harorati o'rtasidagi bog'lanishlar ham yillik va oylik ko'rsatkichlar bo'yicha baholandi.

NATIJALAR VA MUHOKAMA: To'palang va Qoratog' daryolari o'rtacha oylik suv sarflari o'rtasidagi bog'lanishlar uchun regression tenglamalari tuzildi. Iyul va avgust oylari uchun olingan bog'lanishlarning namunasi quyidagicha:



1-rasm. To'palang (Q^{T}_{VII}) va Qoratog' (Q^{Q}_{VII}) daryolari iyul va avgust oylari o'rtacha suv sarflarining o'zaro bog'liqligi (1928–1970-yillar)

Ushbu bog'lanishlar asosida To'palangdaryoning kuzatuvlaridagi uzilishlar tiklandi.

1-jadval.

To'palangdaryo (Zarchob)ning tiklangan o'rtacha oylik va yillik suv sarflari

Yil	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yil
1963	11,0	17,6	31,5	76,1	128*	161*	118*	55,9	34,8	23,0	22,2	20,5	58,3*
1965	11,5	12,5	26,4	95,2*	129*	155*	91*	50,7*	28*	14,9*	11,5*	11,8*	53,1*
1969	12,7	13,8	81,7	133,0	148*	202*	179*	78,4*	33,2*	16,7*	15,8*	14,3*	77,4*

Izoh: * — tiklangan suv sarflari.

Daryolar oqimi bilan atmosfera yog'inlari o'rtasidagi statistik bog'lanishlar tahlili To'palangdaryo uchun korrelyatsiya koeffitsiyentlari 0,588±0,081 dan 0,724±0,058 gacha, Qoratog'daryo uchun esa 0,637±0,074 dan 0,724±0,059 gacha o'zgarishini ko'rsatdi.

2-jadval.

Daryolar oqimi bilan atmosfera yog'inlari orasidagi bog'lanishlarning statistik ko'rsatkichlari

T/r	Bog'lanish	Regressiya tenglamasi	Korrelyatsiya koeffitsiyent
1	To'palangdaryo – Zarchob	y = 0,0447x + 28,713	0,668 ± 0,070
2	To'palangdaryo – Zarchob	y = 0,0386x + 31,911	0,724 ± 0,058
3	To'palangdaryo – Zarchob	—	0,588 ± 0,081
4	To'palangdaryo – Qoratog'	y = 0,0304x + 4,1586	0,724 ± 0,059
5	To'palangdaryo – Qoratog'	y = 0,045x + 6,9377	0,676 ± 0,067
6	To'palangdaryo – Qoratog'	y = 0,0424x + 7,9448	0,637 ± 0,074

Eslatma: 3- va 6-bog’lanishlar uchun dastlabki hujjatda regression tenglamalari matni to’liq saqlanmagan; shuning uchun ular tiklanmadi.

Korrelyatsiya koeffitsiyentlarining mazkur qiymatlari daryolar yillik oqimi bilan atmosfera yog’inlari o’rtasida statistik jihatdan sezilarli bog’lanish mavjudligini ko’rsatadi. Ayniqsa, mavsumiy yog’inlar yig’indisini hisobga olish ayrim holatlarda bog’lanish zichligining ortishini ta’minlaydi.

Daryolar oqimining havo haroratiga bog’liqligi tahlil qilinganda, nisbatan zich va teskari bog’lanish Qoratog’daryoning iyul oyidagi oqimi bilan shu oydagi o’rtacha oylik havo harorati o’rtasida aniqlangan: r=−0,396±0,098. Qolgan holatlarda korrelyatsiya koeffitsiyentlari −0,198±0,112 dan 0,203±0,112 gacha bo’lgan, ya’ni kuchsiz bog’lanishni ifodalagan.

XULOSA: Tadqiqot natijalari asosida quyidagi xulosalarga kelindi:

1. To’palangdaryoning Zarchob gidrologik postidagi kuzatuv qatorlarida mavjud uzilishlar regression bog’lanishlar asosida tiklandi. Uzilishlarni tiklashda qo’llanilgan juft korrelyatsiya koeffitsiyentlari may (r = 0,573±0,080) va sentabr (r = 0,600±0,065) oylaridan tashqari 0,754±0,044–0,853±0,028 oralig’ida o’zgardi.

2. To’palang va Qoratog’ daryolari o’rtacha yillik suv sarflarining yillik hamda mavsumiy atmosfera yog’inlariga bog’liqligi aniqlandi. Ushbu bog’lanishlarni ifodalovchi korrelyatsiya koeffitsiyentlari 0,588±0,081–0,724±0,058 oralig’ida o’zgardi.

3. Daryolarning o’rtacha yillik va oylik suv sarflari bilan yozgi hamda o’rtacha oylik havo harorati o’rtasidagi bog’lanishlar tahlil qilindi. Qoratog’daryoning iyul oyi bundan mustasno bo’lib, unda teskari bog’lanish r = −0,396±0,098 ni tashkil etdi. Qolgan holatlarda havo harorati bilan oqim o’rtasida kuchli statistik bog’lanish aniqlanmadi.

Umuman, tadqiqot natijalari To’palang va Qoratog’ daryolari oqimining shakllanishida atmosfera yog’inlari muhim iqlimiy omil ekanligini, havo harorati ta’siri esa o’rganilgan bog’lanishlar doirasida asosan kuchsiz ekanligini ko’rsatdi.

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Siddiqov S.Sh., g.f.f.d.
tabiiy fanlar kafedrasi katta o‘qituvchisi
Namangan davlat pedagogika instituti
O‘zbekiston, Namangan

NAMANGAN VILOYATIDA MAVJUD EKOTURISTIK IMKONIYATLAR, RESURSLAR VA ATROF-MUHIT MUHOFAZASI MASALALARI

Annotatsiya. Ushbu maqolada Namangan viloyatining turistik salohiyati, tabiiy-geografik imkoniyatlari hamda hududda ekoturizm, balneologik (tibbiyot), rekreatsiya, ziyorat va agroturizmni rivojlantirish masalalari tahlil qilingan. Viloyat tumanlari va shahar markazining turistik resurslari, xususan, Chodak, Nanay, Chortoq, Axsikent kabi maskanlarning o‘ziga xos xususiyatlari yoritib berilgan. Shuningdek, hududda turizm infratuzilmasini takomillashtirish, xizmat ko‘rsatish sifatini oshirish va sohaga innovatsion loyihalarni jalb etish bo‘yicha rivojlantirish istiqbollari va amaliy takliflar keltirilgan.

Kalit so‘zlar: Namangan viloyati, turizm salohiyati, ekoturizm, balneologiya, rekreatsiya, Axsikent, Chortoq, Chodak, turizm infratuzilmasi, rivojlantirish istiqbollari.

Siddiqov S.Sh., PhD in Geographical Sciences
senior lecturer
Department of Natural Sciences
Namangan State Pedagogical Institute
Uzbekistan, Namangan

ECOTOURISM OPPORTUNITIES, RESOURCES, AND ENVIRONMENTAL PROTECTION ISSUES IN NAMANGAN REGION

Abstract. This article analyzes the tourism potential, natural and geographical capabilities of Namangan region, as well as the development of ecotourism, balneological (medical), recreational, pilgrimage, and agritourism in the area. The specific characteristics of tourism resources across districts and the regional center, particularly key sites such as Chodak, Nanay, Chortoq, and Axsikent, are highlighted. Furthermore, development prospects and practical recommendations are provided for improving tourism infrastructure, enhancing service quality, and introducing innovative projects into the sector.

Keywords: Namangan region, tourism potential, ecotourism, balneology, recreation, Axsikent, Chortoq, Chodak, tourism infrastructure, development prospects.

Kirish. Namangan viloyatida mavjud aholining asosiy qismi Namangan shahri va tuman markazlarida istiqomat qiladi. Aholining bunday joylashuvi . Ichki turistik ehtiyojning ortishini keltirib chiqaradi.Rekreatsiya va xordiq chiqarish

ehtiyoji: Zich joylashgan shahar va tuman markazlarida shovqin, urbanizatsiya, texnogen zo‘riqish va kunlik ish stressi yuqori bo‘ladi. Bu holat aholida ruhiy hamda jismoniy hordiq chiqarish — tabiat qo‘yniga chiqish, dam olish maskanlari va sanatoriylarga borish ehtiyojini (rekreatsion turizm) kuchaytiradi. Namangan viloyatining tabiiy geografik joylashuvidagi o‘ziga xos bo‘lgan quyidagi qonuniyat nafaqat Farg‘ona vodiysida balki mamlakatimizda xilma-xil turistik ob’ektlarni hosil bo‘lish imkoniyatlari shakllantirilgan. Viloyatni shimoliy-g‘arbiy qismidan shimoliy va shimoliy sharqqa tomon 2000 km ga cho‘zilgan Chatqol va Qurama tog‘lar tizimidagi 20 tadan ortiq tog‘lar janubiy yon bag‘irlarida joylashgan bo‘lib, viloyatni salkam 50 foizi hududini egallaydi. Shimoliy yarim sharda paralellarga mos yo‘nalgan tog‘larni janubiy yon bag‘irlari shimoliy yon bag‘irlariga nisbatan quyosh radiatsiyasi (issiqlikni), atmosfera atmosfera yog‘inlarni bir necha marta ko‘p oladi. Bu tabiiy qonuniyat viloyatda turistik ob'ektlarni ko‘plab hosil bo‘lishiga va geografik tarqalishida asosiy omil bo‘lib hisoblanadi.[1]

Qisqa muddatli (dam olish kunlari) turizm: Zich aholi yashaydigan joylarda haftalik ish kunlaridan so‘ng shahar tashqarisiga (masalan, tog‘li va suv bo‘yi hududlariga) 1-2 kunlik sayohatlarga bo‘lgan talab juda yuqori bo‘ladi. Ijtimoiy va oilaviy turizm: Insonlar to‘plangan joyda oilaviy ko‘ngilochar parklar, madaniy tadbirlar, ziyoratgohlar va umumiy ovqatlanish maskanlariga ehtiyoj muntazam ortib boradi.

Xizmat ko‘rsatish va infratuzilma zichligi: Aholi zich joylashgan hududlar iqtisodiy jihatdan faol bo‘lgani sababli, bu yerda mehmonxonalar, restoranlar, transport va servis tarmog‘i tez rivojlanadi. Bu esa tashqaridan kelayotgan sayyohlarning qulaylik va xavfsizlikka bo‘lgan ehtiyojlarini qondirishni osonlashtiradi. Etnik va madaniy turizmga talab: Aholi zichligi yuqori bo‘lgan tarixiy va etnik markazlarda hunarmandchilik, milliy oshxona, urf-odatlar va madaniy xilma-xillik yaxshi saqlanadi. Bu xorijiy va mahalliy turistlarning madaniy-ma’rifiy ehtiyojlarini jozibador qiladi.



1-rasm. Namangan viloyati turistik xaritasi

Asosiy qism. Namangan viloyati turistik resurslarga boy viloyat hisoblanib viloyatning shimoliy hududlari tog' oldi va tog'li hududlardan tashkil topkan. Namangan viloyatining markaziy va janubiy qismi tekislik hududlardan iboratligi turistik resurslarni xilma xil bo'lishini taminlaydi.Viloyatda asosan quyidagi turitik resurs turlari mavjud:

Tibbiyot va sog‘lomlashtirish resurslari jumladan, Chortoq, Kosonsoy, Shahand va Mingbuloq sanatoriylari tayanch-harakat va oshqozon-ichak kasalliklarini davolashda mintaqaviy brendga aylangan;

ekoturizm va tog‘-rekreatsiyasion resurslar, Chatqol va Qurama tog‘ tizmalari bag‘ridagi Chodak (Pop), Nanay va Podshootasoy (Yangiqo‘rg‘on), G‘ova (Chust) qishloqlari xushhavo tabiati va soy bo‘ylari bilan yozgi dam olish markazlari hisoblanadi;

ziyorat va madaniylik-tarixiy turizm, antik davrga oid Axsikent arxelogik yodgorligi, Chust tumani markazidagi Mavlono Lutfillo majmuasi, Namangandagi Mulla Qirg‘iz madrasasi hamda Chortoq tumani shimolida joylashgan Sulton Uvasy Qaraniy ziyoratgohlari turoperatorlar uchun muhim obyektlardirdan biri hisoblanadi;

gastronomiya va hunarmandchilikresurslari, Chust pichoqchiligi va do‘ppido‘zligi, Namangan palov madaniyati va gulchilik an’analari xalqaro darajada tan olingan.Shuningdek viloyatning shimoliy qismida tayyorlanadigan ayrim taomlarga qo’shni viloyatdan ham sayyohlar tashrifi ortib bormoqda. Jumladan Nanay qishlog’I hududida tayyorlanadigan Beshbarmoq taomi juda mashxur hisoblanadi. Har yili o‘tkaziladigan an’anaviy "Xalqaro Gullar Bayrami"

festivali yuz minglab xorijiy va mahalliy turistlarni jalb qiladi.Bugungi kunda viloyat rahbariyati tomonidan mazkur vestivalni rivojlantirishga alohida e’tibor qaratilmoqda. Buning oqibatida viloyatga tashrif buyuruvchi mahalliy va xorijiy sayyohlar oqimi yilda-yilga ortib bormoqda.

Yuqoridagi turistik resurslar orqali viloyatda turizmni rivojlantirish imkoniyatlari bir muncha yaxshi hisoblanadi.

1-jadval

Yo‘nalish	**Amalga oshirilishi lozim bo‘lgan chora-tadbirlar**
Axsikent ochiq osmon ostidagi muzeyi	Tarixiy obidani YUNESKO ro‘yxatiga kiritish va 3D/VR turlar orqali rekonstruksiya qilingan antik shaharni namoyish etish.
Tog‘li hududlarda infratuzilma	Chodak va Nanayda mavsumiylikni kamaytirish uchun qishki sport hamda dor yo‘li (kanat) infratuzilmasini qurish.
Agro va Etnoturizm	Pop va Chust tumanlarida mevachilik va uzumchilik bog‘lari negizida Guest house hamda hosil terish turlarini yo‘lga qo‘yish.
Klaster va logistika	Namangan xalqaro aeroporti imkoniyatlaridan foydalanib, qo‘shni Farg‘ona va Andijon viloyatlari bilan yagona "Vodiy bo‘ylab" turistik halqasini shakllantirish.

Namangan viloyatida mavjud turistik resurslarni ayrimlari hali ko’pchilik uchun ,,kashf” qilinmagan (1-jadvalga qarang). Jumladan viloyatda bahor fasli lolaqizg’aldoqlar ochiladigan hududlarning juda kata qismi sayyohlarga nomalumligicha qolmoqda. Bu o’rinda ijtimoiy tarmoqlar, mobil ilovalarning yaratilishi muhim hisoblanadi. Birgina Ertosh qishlog’i yaqinida joylashgan Arashan ko’llar tizimi yaqin vaqtgacha ko’plab sayyohlar uchun nomalum edi. Mazkur hudud faqat mahalliy aholi va cho’ponlar uchun ma’lum hisoblanar edi. Ayrim sayyohlar tomonidan olingan foto tasvirlar bu hududga tashrif buyuruvchilar sonini keskin ortishiga olib keldi. Natijada, mazkur hududga hukumat darajasida e’tibor qaratilib turistik infratuzilma yaxshilanmoqda.

Namangan viloyati Pop tumanida bunday hududlar nihoyatda ko’p bo’lib ularni sayyohlarga namoyish qilish orqali turistik oqimlarni vujudga keltirish imkoniyatlari yuqori hisoblanadi. Jumladan, Jiblon va Ertosh qishlog’I hududida

sayyohlar uchun nomalum hududlar anchagina topiladi. Viloyatdagi ko’plab turistik imkoniyatlarni sayyohlarga namoyish etishda mobil ilovalarning o’rni muhim hisoblanadi.

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Sultonov Sh.A.
dotsent
Qahhorova N.S.
talaba
Xolboyeva Z.Q.
talaba
Shahrisabz davlat pedagogika instituti
O‘zbekiston, Shahrisabz

CHIROQCHI TUMANINING TABIIY-GEOGRAFIK SHAROITI VA LANDSHAFT TUZILISHI

Annotatsiya. Maqolada Qashqadaryo viloyatining shimoli-sharqiy qismida joylashgan Chiroqchi tumanining tabiiy-geografik sharoiti – geologik tuzilishi, relyefi, iqlimi, ichki suvlari, tuprog‘i, o‘simlik va hayvonot dunyosi rasmiy va ilmiy manbalar ma’lumotlari asosida tahlil qilingan. Tuman hududida balandlik mintaqalanishiga bog‘liq holda shakllangan tekislik, adir va past tog‘ landshaftlari hamda Qashqadaryo vodiysi va Chimqo‘rg‘on suv ombori bilan bog‘liq intrazonal va antropogen landshaftlar ajratilib, ularning tavsifi jadval shaklida umumlashtirilgan. Landshaftlarni GIS va masofadan zondlash ma’lumotlari asosida kartalashtirish hamda ulardan oqilona foydalanish bo‘yicha tavsiyalar berilgan.

Kalit so‘zlar: Chiroqchi tumani, tabiiy-geografik sharoit, landshaft tuzilishi, balandlik mintaqalanishi, Qoratepa tog‘lari, Qashqadaryo, Chimqo‘rg‘on suv ombori, agrolandshaft, GIS.

Sultonov Sh.A.
associate professor
Kahhorova N.S.
student
Kholboyeva Z.K.
student
Shahrisabz State Pedagogical Institute
Uzbekistan, Shahrisabz

PHYSICAL-GEOGRAPHICAL CONDITIONS AND LANDSCAPE STRUCTURE OF CHIROQCHI DISTRICT

Abstract. Based on official and scientific sources, the article analyses the physical-geographical conditions of Chiroqchi district, located in the north-eastern part of Kashkadarya region: geological structure, relief, climate, inland waters, soils, flora and fauna. Plain, foothill (adyr) and low-mountain landscapes formed according to altitudinal zonation are distinguished, as well as intrazonal and anthropogenic landscapes associated with the Kashkadarya river valley and the Chimkurgan reservoir; their characteristics are summarised in tabular form.

Recommendations are given on mapping the landscapes using GIS and remote sensing data and on their rational use.

Keywords: Chiroqchi district, physical-geographical conditions, landscape structure, altitudinal zonation, Qoratepa mountains, Kashkadarya, Chimkurgan reservoir, agrolandscape, GIS.

Kirish. Hududlarning tabiiy-geografik sharoiti va landshaft tuzilishini o‘rganish tabiiy resurslardan oqilona foydalanish, qishloq xo‘jaligini joylashtirish, aholi punktlari va infratuzilmani rivojlantirish hamda ekologik muammolarning oldini olishning ilmiy asosi hisoblanadi. Landshaft tabiiy komponentlar – geologik asos, relyef, iqlim, suv, tuproq va biotaning o‘zaro bog‘liq majmuasi sifatida hududning tabiiy salohiyatini yaxlit holda aks ettiradi [14]. Ayniqsa, tekislikdan tog‘gacha bo‘lgan balandlik farqlari katta, sug‘orma va lalmikor dehqonchilik yonma-yon rivojlangan tumanlarda landshaftlarni tuman darajasida, yirik masshtabda tadqiq etish amaliy jihatdan muhim ahamiyatga ega.

Qashqadaryo havzasi landshaftlarining shakllanishi, vohalarda landshaft hosil qiluvchi omillar, cho‘l landshaft tiplari va agrolandshaftlardan foydalanishning geoekologik xususiyatlari so‘nggi yillarda bir qator tadqiqotchilar tomonidan o‘rganilgan [7, 9–13-b.; 8, 170–176-b.; 9, 65–70-b.]. Iqlim o‘zgarishi sharoitida viloyat agrolandshaftlarida kechayotgan jarayonlar [10, 32–36-b.], yer fondi va undan foydalanish holati [1, 126–130-b.] hamda viloyat flora va faunasining tabiiy-geografik hududlar va tog‘ jinslari bilan bog‘liqligi [6, 46–49-b.] tahlil qilingan. Chaqilkalon va Qoratepa tog‘larida foydali qazilmalarning tarqalish qonuniyatlari, konlarni geologik-geografik tasniflash va ularni o‘zlashtirishda morfologik omillarning o‘rni ham mualliflar tomonidan avvalroq o‘rganilgan [3, 51–56-b.; 4, 7–11-b.; 5, 12–15-b.]. Biroq ushbu tadqiqotlar asosan viloyat yoki havza miqyosida olib borilgan bo‘lib, alohida tumanlarning, xususan Chiroqchi tumanining landshaft tuzilishi yetarlicha yoritilmagan.

Tadqiqot mavzusining dolzarbligi. Chiroqchi tumani viloyatning aholisi zich, qishloq xo‘jaligi jadal rivojlangan hududlaridan biridir. 2026-yilning 1-yanvar holatiga ko‘ra tumanning doimiy aholisi 280,9 ming kishini, aholi zichligi esa 1 km² ga 249,3 kishini tashkil etib, bu ko‘rsatkich viloyat o‘rtachasidan (130,1 kishi/km²) qariyb 1,9 barobar yuqori [2]. 2022-yil 17-martda O‘zbekiston Respublikasi Oliy Majlisi Senatining SQ-503-IV-son qarori bilan tumanning 32 mahalla joylashgan, maydoni 171 ming gektar bo‘lgan qismi negizida Ko‘kdala tumani tashkil etildi [12]. Tuman chegaralarining o‘zgarishi uning tabiiy-geografik tavsifini, yer fondi tarkibi va landshaft tuzilishini yangi chegaralar doirasida qayta baholashni taqozo etadi. Shu bilan birga, tuman hududida tekislik, adir va tog‘ landshaftlarining yonma-yon joylashuvi, sug‘oriladigan yerlarning suv omborlari va kanallarga bog‘liqligi hamda lalmi yerlarda eroziya xavfi landshaftlardan foydalanishni ilmiy asosda rejalashtirishni talab qiladi.

Tadqiqotning maqsadi va vazifalari. Tadqiqotning maqsadi Chiroqchi tumanining tabiiy-geografik sharoitini tahlil qilish va landshaft tuzilishini aniqlashdan iborat. Vazifalar: tumanning geografik o‘rni, geologik tuzilishi va

relyefini tavsiflash; iqlimi, ichki suvlari, tuprog‘i va biotasining xususiyatlarini aniqlash; balandlik mintaqalanishi asosida landshaftlarni ajratish va ularni tavsiflash; landshaftlardan oqilona foydalanish bo‘yicha tavsiyalar ishlab chiqish. Tadqiqotda qiyosiy-geografik, kartografik, statistik tahlil va landshaft tahlili usullaridan foydalanildi. Ma’lumot manbalari sifatida O‘zbekiston milliy ensiklopediyasi [11], statistika organlari [2], normativ-huquqiy hujjatlar [12], suv xo‘jaligi ma’lumotlar bazasi [13] va ilmiy adabiyotlar ma’lumotlari xizmat qildi. Tabiiy komponentlarga oid ma’lumotlarning bir qismi tumanning 2022-yilgacha bo‘lgan chegaralariga tegishli bo‘lib, yangi chegaralar bo‘yicha rasmiy ma’lumotlar e’lon qilinmaganligi sababli ular tahlilda umumiy qonuniyatlarni aks ettiruvchi ko‘rsatkichlar sifatida qo‘llanildi.

Natijalar va ularning muhokamasi. *Geografik o‘rni va relyefi.* Chiroqchi tumani Qashqadaryo viloyatining shimoli-sharqiy qismida, Zarafshon tog‘ tizimining janubi-g‘arbiy tog‘ oldilarida joylashgan; tuman markazi – Chiroqchi shahri dengiz sathidan taxminan 510 m balandlikda, Qashqadaryo bo‘yida qad ko‘targan. Tuman hududining umumiy maydoni 2022-yilgacha 2,8 ming km² ni tashkil etgan [11]. Undan 171 ming ga (1,71 ming km²) Ko‘kdala tumaniga o‘tkazilgan [12]. Rasmiy statistikadagi aholi soni va aholi zichligi ko‘rsatkichlari (280,9 ming kishi; 249,3 kishi/km²) [2] asosida hisoblanganda tumanning hozirgi maydoni taxminan 1127 km² (≈1,13 ming km²) ni tashkil etadi (mualliflar hisobi). Hudud relyefi shimoli-sharqdan janubi-g‘arbga tomon pasayib boradi: tekislik qismida balandlik 400–600 m, tog‘ oldi adirlarida 700–900 m, Qoratepa tog‘lari qismida 1200–1500 m ni tashkil etadi [11].

Qoratepa tog‘lari Zarafshon tog‘ tizimining g‘arbiy qismiga kiradi, sharqdagi Chaqilikalon tog‘laridan Taxtaqoracha dovoni orqali ajralib turadi. Tog‘lar sharqdan g‘arbga 50 km dan ortiq, shimoldan janubga 35–40 km ga cho‘zilgan, o‘rtacha balandligi 1000–1500 m, eng baland nuqtasi – Qumg‘oza cho‘qqisi (2197 m). Ular asosan paleozoy davrining magmatik, metamorfik va cho‘kindi tog‘ jinslaridan – granit, granodiorit, diorit, slanets, qumtosh va ohaktoshlardan tuzilgan [11]. Chaqilkalon va Qoratepa tog‘larida foydali qazilmalarning tarqalishi aynan ushbu tog‘ jinslari majmuasi va tektonik tuzilish bilan bog‘liq [3, 51–56-b.]. Tuman hududida marganes, keramika xomashyosi, qurilish toshi va bo‘yoqbop mineral xomashyo zaxiralari mavjud [11]; ularni o‘zlashtirish imkoniyatlari ko‘p jihatdan relyefning morfologik xususiyatlariga bog‘liq [5, 12–15-b.].

1-jadval
Chiroqchi tumanining asosiy tabiiy-geografik ko‘rsatkichlari

Ko‘rsatkich	Qiymati
Maydoni (2022-yilgacha)	2,8 ming km²
Ko‘kdala tumaniga o‘tkazilgan maydon (2022)	171 ming ga
Hozirgi maydoni (2026, hisob)	≈ 1127 km²
Doimiy aholi soni (01.01.2026)	280,9 ming kishi
Aholi zichligi (01.01.2026)	249,3 kishi/km²
Mutlaq balandliklar: tekislik / adir / tog‘	400–600 / 700–900 / 1200–1500 m
Qoratepa tog‘larining eng baland nuqtasi (Qumg‘oza)	2197 m
Yillik o‘rtacha harorat	14,7°C
Yanvar / iyul o‘rtacha harorati	2,7°C / 28°C
Mutlaq minimum / maksimum	–20°C / 45°C
Vegetatsiya davri	220–230 kun
Yillik yog‘in: tekislik / sharqiy qism	368 mm / 400–500 mm
Chimqo‘rg‘on suv ombori: to‘la / foydali hajmi	500 / 450 mln m³
Chimqo‘rg‘on suv ombori: suv yuzasi maydoni	49,2 km²

Aholisi. Rasmiy statistika ma’lumotlariga ko‘ra 2023–2026-yillarda (yangi chegaralarda) tuman doimiy aholisi 260,7 ming kishidan 280,9 ming kishiga yetib, 20,2 ming kishiga yoki 7,7 foizga ko‘paygan (2-jadval). 2026-yilning 1-yanvar holatiga aholining 79,6 ming kishisi (28,3 %) shaharlarda, 201,3 ming kishisi (71,7 %) qishloq joylarida istiqomat qiladi; erkaklar 142,5 ming, ayollar 138,4 ming kishini tashkil etadi [2]. Aholi o‘sishi asosan tabiiy ko‘payish hisobiga ta’minlanmoqda: 2025-yilda tabiiy o‘sish 7157 kishini, tug‘ilish koeffitsienti 1000 kishiga 29,4 ni tashkil etgan bo‘lsa, migratsiya saldosi manfiy (kelganlar 422, ketganlar 1201 kishi) bo‘lgan [2]. Aholi zichligining yuqoriligi va qishloq aholisining ustunligi tekislik va adir landshaftlariga, ayniqsa sug‘oriladigan yerlar va yaylovlarga antropogen yuklamaning yuqori ekanligini ko‘rsatadi.

2-jadval
Chiroqchi tumani aholisining dinamikasi (yil boshiga)

Ko‘rsatkich	2023	2024	2025	2026
Doimiy aholi soni, ming kishi	260,7	267,9	274,5	280,9
shu jumladan: shahar aholisi, ming kishi	74,9	77,1	78,5	79,6
qishloq aholisi, ming kishi	185,8	190,8	196,0	201,3
Shahar aholisi ulushi, %	28,7	28,8	28,6	28,3
Aholi zichligi, kishi/km²	231,4	237,7	242,9	249,3

Manba: [2] ma’lumotlari asosida mualliflar tomonidan tuzilgan.

Iqlimi. Tuman iqlimi keskin kontinental. Yillik o‘rtacha harorat 14,7°C, yanvarning o‘rtacha harorati 2,7°C, eng past harorat –20°C gacha tushadi; iyulning o‘rtacha harorati 28°C, eng yuqori harorat 45°C ga yetadi. Vegetatsiya davri 220–230 kun davom etadi. Yillik yog‘in miqdori tekislik qismida 368 mm, sharqiy (tog‘

oldi va tog‘li) qismida 400–500 mm ni tashkil etadi [11]. Asosiy tabiiy-geografik ko‘rsatkichlar 1-jadvalda keltirilgan. Yog‘inlarning balandlik ortishi bilan ko‘payishi adir va tog‘ oldi hududlarida lalmikor dehqonchilik yuritish imkonini beradi, tekislik qismida esa dehqonchilik faqat sug‘orish asosida olib boriladi.

Ichki suvlari. Tumanning asosiy suv arteriyasi – Qashqadaryo. Daryoning umumiy uzunligi 378 km, havzasining maydoni 8780 km² bo‘lib, uning quyi qismi Qarshi cho‘lida sug‘orishga sarflanib tugaydi [11]. Tumanning 2022-yilgacha bo‘lgan hududida 1963-yilda Qashqadaryoda qurilgan Chimqo‘rg‘on suv ombori joylashgan: uning to‘la hajmi 500 mln m³, foydali hajmi 450 mln m³, suv yuzasining maydoni 49,2 km², to‘g‘on balandligi 33 m [13]. Shuningdek, tumanda Qalqama suv ombori ham mavjud; sug‘oriladigan yerlar Qashqadaryo, Qumdaryo, Oyoqchidaryo kanallari orqali suv bilan ta’minlanadi [11]. Suv omborlari va kanallar tarmog‘i tekislik qismidagi voha landshaftlarining shakllanishi va barqarorligini belgilovchi asosiy omil hisoblanadi.

Tuproqlari, o‘simlik va hayvonot dunyosi. Tuproq qoplami balandlik mintaqalanishiga bo‘ysunadi: tekislik va adirlarning quyi qismida och tusli va tipik bo‘z tuproqlar, daryo vodiylarida o‘tloqi-botqoq tuproqlar tarqalgan [11]; Qoratepa tog‘larida tipik va to‘q tusli bo‘z hamda jigarrang tuproqlar hosil bo‘lgan. Tog‘ yonbag‘irlarida qo‘ng‘irbosh, qorabosh, bug‘doyiq kabi o‘tlar, bodomcha, na’matak kabi butalar va archazorlar uchraydi [11]. Tekislik qismining tabiiy o‘simliklari saksovul, shuvoq va qamishdan iborat. Hayvonot dunyosida tulki, tipratikan, quyon, kemiruvchilar, qushlardan burgut, to‘rg‘ay va chumchuq keng tarqalgan [11]. O‘simlik va hayvonot dunyosining hududiy tarqalishi tabiiy-geografik sharoit va tog‘ jinslarining xususiyatlari bilan chambarchas bog‘liqdir [6, 46–49-b.].

Landshaft tuzilishi. Tabiiy komponentlarning yuqorida bayon etilgan xususiyatlari va balandlik mintaqalanishi qonuniyatlaridan [14] kelib chiqib, Chiroqchi tumani hududida quyidagi landshaft guruhlari ajratildi (3-jadval): tekislikning cho‘l va chala cho‘l landshaftlari; adirlarning (tog‘ oldi) efemer-efemeroidli landshaftlari; Qoratepa tog‘larining past tog‘ landshaftlari; Qashqadaryo vodiysining intrazonal landshaftlari hamda sug‘oriladigan voha agrolandshaftlari va suv omborlari bilan bog‘liq antropogen landshaftlar. Qashqadaryo havzasi vohalarida landshaft hosil qiluvchi omillar orasida relyef, suv ta’minoti va inson xo‘jalik faoliyati yetakchi o‘rin tutadi [9, 65–70-b.].

Tekislik qismining katta maydonlari sug‘orish natijasida madaniy voha agrolandshaftlariga aylangan. Bunday landshaftlarda sug‘oriladigan yerlarning holati, sho‘rlanish va suv tanqisligi asosiy muammolar bo‘lib, iqlim o‘zgarishi sharoitida ularning ta’siri kuchaymoqda [10, 32–36-b.]. Agrolandshaftlardan foydalanishning geoekologik xususiyatlari [7, 9–13-b.] yer resurslariga bo‘lgan talabni oshirib, landshaftlarni hududiy tashkil etishni takomillashtirishni talab etadi. Adirlarda lalmikor dehqonchilik va yaylov chorvachiligi rivojlangan bo‘lib, bu yerda yon bag‘irlarning qiyaligi va bahorgi jala yomg‘irlari tufayli tuproq eroziyasi xavfi yuqori. Qoratepa tog‘larining past tog‘ landshaftlari esa suv to‘plovchi, tuproqni muhofaza qiluvchi va rekreatsion ahamiyatga ega.

3-jadval
Chiroqchi tumanining landshaft tuzilishi

Landshaft guruhi	Balandlik, m	Tuproqlar	O‘simliklar	Xo‘jalikda foydalanish
Tekislikning cho‘l va chala cho‘l landshaftlari	400–600	Och tusli bo‘z tuproqlar	Saksovul, shuvoq, efemerlar	Yaylov; sug‘orilgan qismi – dehqonchilik
Sug‘oriladigan voha agrolandshaftlari	400–600	Sug‘oriladigan bo‘z tuproqlar	Madaniy ekinlar, bog‘lar	Paxta, g‘alla, bog‘dorchilik, aholi punktlari
Qashqadaryo vodiysining intrazonal landshaftlari	Vodiy tubi	O‘tloqi-botqoq tuproqlar	Qamish, to‘qay o‘simliklari	Pichanzor, sug‘orish inshootlari
Adirlarning efemer-efemeroidli landshaftlari	700–900	Tipik bo‘z tuproqlar	Efemer-efemeroidlar, bug‘doyiq	Lalmikor dehqonchilik, bahorgi yaylov
Qoratepa tog‘larining past tog‘ landshaftlari	1200–1500 (2197 m gacha)	To‘q tusli bo‘z va jigarrang tuproqlar	Qo‘ng‘irbosh, qorabosh, bodomcha, na’matak, archa	Yozgi yaylov, rekreatsiya, muhofaza
Suv omborlari akvatoriyasi (antropogen)	–	–	Suv o‘simliklari	Sug‘orish, baliqchilik

Izoh: mualliflar tomonidan [11; 13; 14] ma’lumotlari asosida tuzilgan.

Landshaftlarni yirik masshtabda kartalashtirishda geografik axborot tizimlari va masofadan zondlash ma’lumotlaridan foydalanish samarali hisoblanadi. Xususan, raqamli relyef modeli asosida balandlik, qiyalik va ekspozitsiya qatlamlarini, sun’iy yo‘ldosh tasvirlari asosida esa o‘simlik qoplami va yerdan foydalanish turlarini ajratib, ularni tuproq xaritasi bilan ustma-ust qo‘yish (overlay) orqali landshaft konturlarini aniqlash mumkin. Qashqadaryo viloyatida yerdan foydalanish o‘zgarishlarini masofadan zondlash ma’lumotlari asosida baholash tajribasi [15, 31–35-b.] bunday yondashuvni tuman darajasida ham qo‘llash imkoniyatini ko‘rsatadi.

Xulosa. Tadqiqot natijalari shuni ko‘rsatadiki, Chiroqchi tumanining tabiiy-geografik sharoiti Zarafshon tog‘ tizimining janubi-g‘arbiy tog‘ oldilaridagi o‘rni, 400 m dan 2197 m gacha bo‘lgan balandlik farqi, keskin kontinental iqlimi va Qashqadaryo hamda Chimqo‘rg‘on suv ombori bilan bog‘liq suv resurslari orqali belgilanadi. Balandlik mintaqalanishi natijasida tuman hududida tekislikning cho‘l va chala cho‘l, adirlarning efemer-efemeroidli, Qoratepa tog‘larining past tog‘ landshaftlari, Qashqadaryo vodiysining intrazonal landshaftlari hamda voha agrolandshaftlari va suv omborlari bilan bog‘liq antropogen landshaftlar shakllangan.

Tadqiqot natijalariga asoslanib quyidagi tavsiyalar beriladi: birinchidan, 2022-yilda o‘zgargan chegaralar doirasida tumanning yer fondi va landshaft

xaritasini GIS asosida yangilash; ikkinchidan, adirlardagi lalmikor yerlarda eroziyaga qarshi tadbirlarni (qiyalik bo‘ylab haydashdan voz kechish, ihota daraxtzorlari, yaylov almashlab foydalanish) kengaytirish; uchinchidan, sug‘oriladigan voha agrolandshaftlarida sho‘rlanish va suv tanqisligini kamaytirish uchun suv tejovchi texnologiyalarni joriy etish; to‘rtinchidan, Qoratepa tog‘larining archazor va butazor landshaftlarini muhofaza qilish hamda ularning rekreatsion salohiyatidan barqaror foydalanish. Mazkur tavsiyalar tumanning tabiiy resurslaridan oqilona foydalanish va hududiy rivojlanishni rejalashtirishda ilmiy asos bo‘lib xizmat qilishi mumkin.

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Tangirova N.K.
Harbiy xavfsizlik va mudofaa universiteti Axborot-kommunikatsiya texnologiyalari va harbiy aloqa instituti

QISHLOQ XO‘JALIGI YERLARINING DEGRADATSIYASINI BAHOLASH VA ULARNI MUHOFAZA QILISHNING TASHKILIY-IQTISODIY MEXANIZMLARINI TAKOMILLASHTIRISH

Annotatsiya. Mazkur maqolada qishloq xo‘jaligi yerlarining degradatsiya jarayonlarini baholash, degradatsiyaga uchragan yerlarni muhofaza qilish hamda ulardan samarali foydalanishning tashkiliy-iqtisodiy mexanizmlarini takomillashtirish masalalari tadqiq etilgan. Yer resurslarining iqtisodiy qiymati nafaqat ularning maydoni, balki tuproq unumdorligi, meliorativ holati, ekologik barqarorligi va ishlab chiqarish salohiyati bilan belgilanadi. Shu sababli yer tuzish loyihalarida yerlarning sifat holatini iqtisodiy baholash bilan integratsiyalashgan holda hisobga olish zarur. Tadqiqotda qishloq xo‘jaligi yerlarini degradatsiya darajasiga ko‘ra guruhlash, ulardan foydalanish rejimini differensiallashtirish, yuqori unumdor yerlarni saqlash va degradatsiyaga uchragan yerlarni qayta tiklash bo‘yicha tashkiliy-iqtisodiy mexanizm taklif etilgan. Shuningdek, degradatsiya darajasini baholashda tuproq unumdorligi, bonitet balli, meliorativ holat va iqtisodiy samaradorlik ko‘rsatkichlarini birgalikda qo‘llash zarurligi asoslangan.

Kalit so‘zlar: yer resurslari, yer tuzish, yer degradatsiyasi, qishloq xo‘jaligi yerlari, tuproq unumdorligi, iqtisodiy baholash, yerlarni muhofaza qilish, yer boniteti, meliorativ holat, tashkiliy-iqtisodiy mexanizm.

Tangirova N.K.
Institute of Information and Communication Technologies and Military Communications, University of Military Security and Defense

ASSESSING THE DEGRADATION OF AGRICULTURAL LANDS AND IMPROVING ORGANIZATIONAL-ECONOMIC MECHANISMS FOR THEIR PROTECTION

Abstract. This article examines issues related to assessing degradation processes in agricultural lands, as well as improving the organizational-economic mechanisms for protecting degraded lands and ensuring their efficient use. The economic value of land resources is determined not only by their area but also by soil fertility, reclamation status, ecological stability, and production potential. Therefore, land management projects must account for land quality by integrating economic valuation. The study proposes an organizational-economic mechanism for categorizing agricultural lands based on degradation levels, differentiating land-use regimes, preserving highly fertile lands, and rehabilitating degraded areas. Furthermore, the necessity of jointly utilizing indicators such as soil fertility,

land quality scores (bonitet), reclamation status, and economic efficiency when assessing degradation levels is substantiated.

Keywords: land resources, land management, land degradation, agricultural lands, soil fertility, economic valuation, land protection, land quality rating, reclamation status, organizational-economic mechanism.

KIRISH

Yer resurslari mamlakatning muhim tabiiy-iqtisodiy boyligi bo‘lib, qishloq xo‘jaligi ishlab chiqarishining asosiy vositasi hisoblanadi. Yerning ishlab chiqarish jarayonidagi o‘rni uning cheklanganligi, boshqa ishlab chiqarish vositalari kabi qayta yaratilmasligi va undan noto‘g‘ri foydalanish natijasida tabiiy hamda iqtisodiy xususiyatlarining yomonlashishi mumkinligi bilan belgilanadi.

Qishloq xo‘jaligi yerlaridan uzoq muddatli va samarali foydalanish uchun yer maydonining o‘zi bilan bir qatorda uning sifat ko‘rsatkichlarini ham hisobga olish zarur. Tuproq unumdorligining pasayishi, eroziya, sho‘rlanish, zichlashish, cho‘llanish va boshqa degradatsiya jarayonlari yerning ishlab chiqarish salohiyatini kamaytiradi. Buning natijasida hosildorlik pasayishi, ishlab chiqarish xarajatlarining oshishi va yerning iqtisodiy qiymatining kamayishi kuzatilishi mumkin.

O‘zbekiston Respublikasining Yer kodeksida yerlarni muhofaza qilish ulardan oqilona foydalanish, tuproq unumdorligini tiklash va oshirish, zararli antropogen ta’sirlardan himoya qilishga qaratilgan huquqiy, tashkiliy, iqtisodiy va texnologik tadbirlar tizimini o‘z ichiga olishi belgilangan.

Shuningdek, mamlakatda yerlar degradatsiyasiga qarshi kurashish, degradatsiyaga uchragan yerlarni qayta tiklash va tuproq unumdorligini saqlash bo‘yicha davlat siyosati shakllantirilmoqda. 2022-yildagi tegishli qarorda yerlar degradatsiyasiga qarshi kurashish va uning salbiy oqibatlarini kamaytirish, degradatsiyaga uchragan yerlarni qayta tiklash vazifalari belgilangan.

2024-yilda qabul qilingan PQ-71-son qarorda esa qishloq xo‘jaligi yerlari degradatsiyasiga qarshi kurashish, tuproqdagi gumus miqdori va unumdorligini oshirishni qo‘llab-quvvatlash masalalariga alohida e’tibor qaratilgan.

Shu jihatdan, yer tuzish va yerlarni loyihalash jarayonida degradatsiyaga uchragan yerlarni aniqlash, ularning iqtisodiy qiymatini baholash va foydalanish rejimini belgilash bo‘yicha ilmiy asoslangan yondashuvlarni ishlab chiqish dolzarb masalalardan biridir.

TADQIQOT METODOLOGIYASI

Tadqiqotda tizimli tahlil, taqqoslash, iqtisodiy-statistik tahlil, ekspert baholash, yerlarning sifat ko‘rsatkichlarini guruhlash hamda iqtisodiy baholash usullaridan foydalanish taklif etiladi.

Qishloq xo‘jaligi yerlarining degradatsiya darajasini kompleks baholash uchun quyidagi umumlashtirilgan indeksdan foydalanish mumkin:

$$DI = w_1D_1 + w_2D_2 + w_3D_3 + w_4D_4$$

bu yerda:

DI — yer degradatsiyasining kompleks indeksi;

D_1 — tuproq unumdorligi pasayish ko‘rsatkichi;
D_2 — sho‘rlanish yoki meliorativ holat ko‘rsatkichi;
D_3 — eroziya va boshqa fizik degradatsiya ko‘rsatkichi;
D_4 — iqtisodiy samaradorlikning pasayish ko‘rsatkichi;
w_1–w_4 — tegishli ko‘rsatkichlarning vazn koeffitsiyentlari.

Mazkur indeks yordamida yerlarni shartli ravishda yuqori, o‘rta va yuqori degradatsiya xavfiga ega guruhlarga ajratish mumkin.

Bunda muhim jihat shundaki, degradatsiya faqat ekologik muammo sifatida emas, balki iqtisodiy muammo sifatida ham baholanadi. Chunki yer sifatining pasayishi hosildorlik va daromadning kamayishiga, ishlab chiqarish xarajatlarining oshishiga va yerning kelajakdagi foydalanish qiymatining pasayishiga olib keladi [8].

NATIJALAR VA MUHOKAMA

Yerlarning iqtisodiy qiymatini aniqlashda tuproq boniteti, unumdorlik, meliorativ holat, joylashuv, suv bilan ta’minlanganlik, infratuzilmaga yaqinlik va degradatsiya darajasi kabi omillarni birgalikda hisobga olish maqsadga muvofiq.

Shartli ravishda yerning iqtisodiy qiymatini quyidagi model orqali ifodalash mumkin:

$$\mathbf{YIQ = B \times K_u \times K_m \times K_e}$$

bu yerda:
YIQ — yerning nisbiy iqtisodiy qiymati;
B — bonitet balli;
K_u — unumdorlik koeffitsiyenti;
K_m — meliorativ holat koeffitsiyenti;
K_e — ekologik va degradatsiya holatini hisobga oluvchi koeffitsiyent.

Mazkur yondashuvning asosiy afzalligi shundan iboratki, yuqori bonitetga ega bo‘lgan, biroq degradatsiya jarayoni kuchayib borayotgan yerlar ham alohida nazorat obyektiga aylanadi.

Yerlarni quyidagi guruhlarga ajratish taklif etiladi:
I — Yuqori unumdor — Kuchaytirilgan muhofaza
II — Barqaror unumdor — Oqilona foydalanish
III — Degradatsiya xavfi mavjud — Profilaktik tadbirlar
IV — Degradatsiyaga uchragan — Tiklash va cheklangan foydalanish
V — Kuchli degradatsiyalangan — Konservatsiya yoki rekultivatsiya

Bunday differensial yondashuv barcha yer maydonlariga bir xil talab qo‘llash o‘rniga, ularning real sifat holatidan kelib chiqib foydalanish rejimini belgilash imkonini beradi.

O‘zbekiston qonunchiligida degradatsiyaga uchragan, kam mahsuldor va ayrim boshqa toifadagi qishloq xo‘jaligi yerlarini konservatsiya qilish tartibi ham belgilangan. Mazkur tartib degradatsiyaga uchragan yerlarni alohida boshqarish zarurligini ko‘rsatadi [7].

Shu sababli yer tuzish loyihalarida degradatsiyaga uchragan yerlar bo‘yicha quyidagi ketma-ketlikni qo‘llash maqsadga muvofiq:

yer monitoringi → degradatsiyani aniqlash → iqtisodiy baholash → foydalanish rejimini belgilash → muhofaza yoki tiklash loyihasini ishlab chiqish → iqtisodiy rag‘batlantirish → qayta monitoring.

Bunda yuqori unumdor yerlarni saqlash alohida ahamiyatga ega. Chunki yuqori sifatli qishloq xo‘jaligi yerlarining boshqa maqsadlarga o‘tkazilishi yoki noto‘g‘ri foydalanilishi nafaqat mavjud ishlab chiqarish hajmiga, balki kelajakdagi iqtisodiy salohiyatga ham ta’sir ko‘rsatadi.

Yer kodeksining 82-moddasida yerlardan oqilona foydalanish va ularni muhofaza qilishni iqtisodiy rag‘batlantirish yer egalari, yerdan foydalanuvchilar va ijarachilarning tuproq unumdorligini saqlash va tiklashdan manfaatdorligini oshirishga qaratilishi belgilangan.

Shundan kelib chiqib, iqtisodiy mexanizmni uchta asosiy yo‘nalishda shakllantirish mumkin:

1. Rag‘batlantirish. Tuproq unumdorligini oshiruvchi va degradatsiyani kamaytiruvchi tadbirlarni amalga oshirayotgan xo‘jaliklarni iqtisodiy jihatdan qo‘llab-quvvatlash.

2. Cheklash. Degradatsiya darajasi yuqori bo‘lgan yerlar uchun foydalanish rejimini kuchaytirish va yerning sifatini yanada yomonlashtiruvchi faoliyatlarga nisbatan cheklovlar qo‘llash.

3. Tiklash. Degradatsiyaga uchragan yerlarni qayta foydalanishga jalb qilishdan oldin meliorativ, agrotexnik va boshqa tiklash tadbirlarini amalga oshirish.

Mazkur mexanizmning asosiy maqsadi yer foydalanuvchisini jazolash emas, balki yerning iqtisodiy qiymatini uzoq muddat davomida saqlashga manfaatdor qilish bo‘lishi kerak.

XULOSA

Tadqiqot natijalari shuni ko‘rsatadiki, qishloq xo‘jaligi yerlarining degradatsiyasini faqat ekologik muammo sifatida ko‘rib chiqish yetarli emas. Degradatsiya jarayonlari yerning ishlab chiqarish salohiyati, hosildorligi, xarajatlari va natijada iqtisodiy qiymatiga bevosita ta’sir ko‘rsatadi.

Shu sababli yer tuzish va yerlarni loyihalashda yerlarning sifat holatini iqtisodiy baholash bilan birlashtirish zarur. Yerlarni degradatsiya darajasiga ko‘ra guruhlash, ulardan foydalanish rejimini differensiallashtirish va muhofaza tadbirlarini yer tuzish loyihalarining tarkibiy qismiga aylantirish taklif etiladi.

Tadqiqotda taklif etilgan “monitoring – baholash – guruhlash – foydalanish rejimi – muhofaza – iqtisodiy rag‘batlantirish – qayta monitoring” tizimi qishloq xo‘jaligi yerlaridan barqaror foydalanishning tashkiliy-iqtisodiy mexanizmi sifatida qo‘llanishi mumkin.

Mazkur yondashuvning ilmiy ahamiyati yer degradatsiyasini ekologik ko‘rsatkichlar bilan cheklab qo‘ymasdan, uni yerning iqtisodiy qiymati va yer tuzish loyihalarini takomillashtirish bilan bog‘lashdan iborat.

Amaliy jihatdan esa ushbu yondashuv yuqori unumdor yerlarni saqlash, degradatsiyaga uchragan yerlarni aniqlash, ulardan foydalanish bo‘yicha cheklov va muhofaza choralarini asoslash hamda yer foydalanuvchilarini tuproq unumdorligini saqlashga iqtisodiy jihatdan rag‘batlantirish imkonini beradi.

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Tangirova N.K.
Harbiy xavfsizlik va mudofaa universiteti Axborot-kommunikatsiya texnologiyalari va harbiy aloqa instituti

DEGRADATSIYAGA UCHRAGAN SUG'ORILADIGAN YERLARNI TIKLASH USTUVORLIGINI ANIQLASHNING YER TUZISH-KADASTR MEXANIZMINI TAKOMILLASHTIRISH

Annotatsiya. Maqolada degradatsiyaga uchragan sug'oriladigan yerlarni qishloq xo'jaligi foydalanishiga qaytarishda mavjud yer kadastri va monitoring ma'lumotlaridan foydalanishning muhim muammosi — tiklash tadbirlarini amalga oshirish navbatini ilmiy asosda belgilash masalasi tadqiq etilgan. Degradatsiyaga uchragan yerlarni faqat degradatsiya darajasi bo'yicha guruhlash ularni tiklash uchun mavjud resurslarni optimal taqsimlash imkonini bermasligi asoslangan. Shu sababli yerning degradatsiya darajasi bilan bir qatorda uning meliorativ holati, tuproq unumdorligi, suv bilan ta'minlanganligi, tiklash xarajati va qishloq xo'jaligi foydalanishiga qaytarish imkoniyatini birgalikda hisobga oluvchi baholash mexanizmi taklif etilgan. Tadqiqot natijasida degradatsiyaga uchragan sug'oriladigan yerlarni tiklash ustuvorligini aniqlash uchun integral Yerlarni tiklash ustuvorligi indeksi ishlab chiqilgan. Indeks yordamida yer maydonlari yuqori, o'rta va past tiklash ustuvorligi guruhlariga ajratilib, natijalarni yer tuzish qarorlariga integratsiyalash mexanizmi asoslangan. Taklif etilayotgan yondashuv kadastr ma'lumotlarini yer monitoringi natijalari bilan birlashtirib, degradatsiyaga uchragan yerlarni tiklashning hududiy navbatini belgilash va ularni qayta qishloq xo'jaligi muomalasiga kiritishni rejalashtirish imkonini beradi.

Kalit so‘zlar: degradatsiya, sug'oriladigan yerlar, yer tuzish, yer kadastri, yer monitoringi, meliorativ holat, tuproq unumdorligi, yerlarni tiklash, GIS, ustuvorlik indeksi.

Tangirova N.K.
Institute of Information and Communication Technologies and Military Communications, University of Military Security and Defense

IMPROVING THE LAND MANAGEMENT AND CADASTRAL MECHANISM FOR DETERMINING THE RESTORATION PRIORITY OF DEGRADED IRRIGATED LANDS

Abstract. The article examines a key problem in using land cadastre and monitoring data to return degraded irrigated lands to agricultural use: the scientifically grounded sequencing of restoration measures. It is shown that grouping degraded lands by degradation level alone does not allow available resources to be allocated optimally for their restoration. An assessment mechanism is therefore proposed that considers, alongside the degradation level, the land's reclamation condition, soil fertility, water supply, restoration cost, and the

feasibility of returning it to agricultural use. As a result, an integral Land Restoration Priority Index has been developed to determine the restoration priority of degraded irrigated lands. The index classifies land plots into high, medium, and low restoration-priority groups, and a mechanism for integrating the results into land management decisions is substantiated. By combining cadastral data with land monitoring results, the proposed approach makes it possible to establish the territorial order of restoration and to plan the return of degraded lands to agricultural circulation.

Keywords: degradation, irrigated lands, land management, land cadastre, land monitoring, reclamation condition, soil fertility, land restoration, GIS, priority index.

KIRISH

Sug'oriladigan qishloq xo'jaligi yerlarining degradatsiyasi O'zbekistonda yer resurslaridan foydalanish samaradorligiga ta'sir qiluvchi asosiy omillardan biridir. Sho'rlanish, botqoqlanish, tuproq unumdorligining pasayishi va boshqa degradatsiya jarayonlari tufayli ayrim yerlarning qishloq xo'jaligi ishlab chiqarishidagi haqiqiy salohiyati ularning kadastrdagi foydalanish holatidan sezilarli darajada farq qilishi mumkin.

UNCCD ma'lumotlariga ko'ra, 2019-yilda O'zbekiston hududining 11,43 mln gektari, ya'ni mamlakat umumiy yer maydonining 26,14 foizi degradatsiyaga uchragan deb baholangan [3]. Sug'oriladigan yerlarda muammo yanada keskin: FAO ma'lumotlariga ko'ra, mamlakatdagi 1,9 mln gektar sug'oriladigan ekin maydonining 45 foiziga sho'rlanish ta'sir qilmoqda. Shu bilan birga, yer degradatsiyasini baholash va monitoring qilish uchun tuproq sifati, sho'rlanish va agroximik ko'rsatkichlarni birlashtiruvchi raqamli geoportal ishlab chiqilmoqda [2].

Shunday ekan, bugungi kunda asosiy masala degradatsiyaga uchragan yerlarni aniqlashning o'zi emas. Monitoring orqali aniqlangan ko'plab maydonlar orasidan **qaysi yerlarni birinchi navbatda tiklash iqtisodiy, meliorativ va hududiy jihatdan maqsadga muvofiqligini aniqlash** muhim hisoblanadi. Amaldagi monitoring tizimi yer holatidagi o'zgarishlarni aniqlash va baholashga xizmat qiladi [1]. Biroq monitoring natijasi bevosita yer tuzish qaroriga aylantirilmasa, olingan axborotning amaliy qiymati pasayadi [1].

Shu sababli maqolada quyidagi muammo qo'yiladi: **degradatsiyaga uchragan sug'oriladigan yerlarni qanday mezonlar asosida navbatlashtirish va qaysi maydonlarni birinchi bo'lib tiklash kerak?** Mazkur muammoni hal qilish uchun kadastr va monitoring ma'lumotlarini yagona baholash tizimiga birlashtiruvchi yer tuzish-kadastr mexanizmi taklif etiladi.

ADABIYOTLAR TAHLILI

Yer degradatsiyasini baholashning zamonaviy yondashuvlari asosan uchta yo'nalishda rivojlangan: masofadan zondlash va GIS asosida monitoring, tuproq va meliorativ ko'rsatkichlarni baholash hamda degradatsiyaning iqtisodiy oqibatlarini aniqlash [6–8]. O'zbekistonda ham mazkur yo'nalishlar bo'yicha tadqiqotlar olib borilmoqda. Jumladan, Rishton tumani sug'oriladigan hududlarida masofadan

zondlash ma'lumotlari yordamida tuproq sho'rlanishining uzoq muddatli dinamikasi o'rganilgan. Shuningdek, 06.01.10 ixtisosligi bo'yicha OAK materiallarida meliorativ holati yomonlashgan yerlar monitoringi, degradatsiyaga uchragan yerlarni masofadan zondlash orqali kuzatish hamda qishloq xo'jaligi yerlarining raqamli monitoringi bo'yicha dissertatsiya ishlari mavjud [5].

Mazkur tadqiqotlar degradatsiyani **aniqlash va monitoring qilish** masalasining ilmiy asoslari shakllanganini ko'rsatadi. Biroq degradatsiya holatini aniqlash bilan tiklash to'g'risidagi qaror o'rtasida yana bir bosqich mavjud: **monitoring natijasi → tiklash ustuvorligi → yer tuzish qarori**. Aynan shu bosqichni ilmiy jihatdan asoslash ushbu tadqiqotning asosiy yo'nalishini tashkil etadi.

DEGRADATSIYAGA UCHRAGAN YERLARNI TIKLASHDAGI MAVJUD MUAMMO

Yerning degradatsiya darajasi yuqori bo'lishi uni har doim ham birinchi navbatda tiklash kerakligini anglatmaydi. Masalan, A yer maydonining degradatsiyasi kuchli bo'lishi mumkin, biroq:

– tiklash xarajati juda yuqori;
– drenaj infratuzilmasi mavjud emas;
– suv ta'minoti cheklangan;
– tiklash muddati uzoq.

B yer maydonining degradatsiyasi nisbatan o'rtacha bo'lsa-da:

– kollektor-drenaj tizimi mavjud;
– tuproqning tiklanish salohiyati yuqori;
– sug'orish tizimi mavjud;
– tiklash xarajati nisbatan past;
– qisqa muddatda qishloq xo'jaligi foydalanishiga qaytarish mumkin.

Demak, faqat degradatsiya darajasiga asoslangan navbatlashtirish **optimal yer tuzish qarorini bermaydi**. Muammoning yechimi degradatsiyani **ko'p mezonli baholash** orqali aniqlashdan iborat.

YERLARNI TIKLASH USTUVORLIGINI ANIQLASH MODELI

Taklif etilayotgan modelda har bir yer konturi bo'yicha quyidagi ma'lumotlar birlashtiriladi:

– degradatsiya darajasi;
– meliorativ holat;
– tuproq unumdorligi (shu jumladan yer boniteti);
– suv bilan ta'minlanganlik;
– tiklash xarajati;
– tiklashdan keyingi foydalanish salohiyati;
– iqtisodiy samaradorlik.

Mezonlar o'lchov birliklari turlicha bo'lgani uchun 0–1 oralig'ida standartlashtiriladi. Bunda «salbiy» mezonlar (masalan, tiklash xarajati) shunday normallashtiriladiki, uning yuqori qiymati ustuvorlikni oshirmasin, aksincha

pasaytirsin. Yerlarni tiklash ustuvorligi quyidagi integral ko'rsatkich orqali aniqlanadi:

$$\mathbf{YTUI = \Sigma\ (w_i \times X_i),\quad i = 1, 2, \ldots, 7}$$

bu yerda:

YTUI — yerlarni tiklash ustuvorligi indeksi;

$\mathbf{X_i}$ — tegishli mezonning standartlashtirilgan qiymati;

$\mathbf{w_i}$ — mezonning vazn koeffitsiyenti ($\Sigma w_i = 1$).

Dastlabki modelda mezonlarning vazni quyidagicha taklif etiladi:

1-jadval. Mezonlarning dastlabki vaznlari

Mezon	Belgisi	Vazn
Degradatsiya darajasi	X_1	0,20
Meliorativ holat	X_2	0,20
Tuproq unumdorligi	X_3	0,15
Suv ta'minoti	X_4	0,10
Tiklash xarajati	X_5	0,15
Qayta foydalanish salohiyati	X_6	0,10
Iqtisodiy samaradorlik	X_7	0,10
Jami		**1,00**

Biroq maqolaning empirik bosqichida ushbu vaznlarni ekspert baholash yoki AHP (analitik ierarxiya jarayoni) usuli orqali aniqlash maqsadga muvofiq. Bu vaznlarni subyektiv belgilash xavfini kamaytiradi.

TAKLIF ETILAYOTGAN YER TUZISH YECHIMI

YTUI qiymati asosida degradatsiyaga uchragan yerlarni uchta guruhga ajratish taklif etiladi:

2-jadval. Yerlarni tiklash ustuvorligi guruhlari

Guruh	YTUI	Yer tuzish qarori
I	0,70–1,00	Birinchi navbatda tiklash
II	0,40–0,69	Ikkinchi navbatda tiklash
III	0–0,39	Qo'shimcha tadqiqot / uzoq muddatli tiklash

Indeks chegaralari yakuniy empirik tadqiqotda real ma'lumotlar taqsimotiga qarab aniqlashtiriladi. I guruhga kiritilgan yerlar bo'yicha yer tuzish loyihalarida tiklash tadbirlarini birinchi navbatda amalga oshirish tavsiya etiladi. II guruhdagi maydonlar uchun qo'shimcha meliorativ yoki agrotexnik tadbirlar zarur bo'lishi mumkin. III guruhdagi maydonlar bo'yicha esa yuqori xarajat talab qiluvchi tiklash loyihalarini boshlashdan oldin texnik-iqtisodiy asoslash talab etiladi [3].

Shunday qilib, monitoring natijasidagi oddiy «degradatsiyalangan» holati **aniq hududiy boshqaruv qaroriga** aylantiriladi.

KADASTR VA MONITORINGNI YAGONA TIZIMGA BIRLASHTIRISH

Taklif etilayotgan mexanizmni GIS muhitida amalga oshirish mumkin. Bunda har bir yer konturiga quyidagi atributlar biriktiriladi:

– **Kadastr ma'lumotlari:** kontur raqami, maydon, foydalanish turi, yer toifasi, huquqiy maqom.

– **Monitoring ma'lumotlari:** sho'rlanish darajasi, eroziya, tuproq unumdorligi, gumus, yer osti suvlari, degradatsiya dinamikasi.

– **Meliorativ ma'lumotlar:** kollektor-drenaj holati, sug'orish tarmog'i, meliorativ holat.

– **Tiklash ma'lumotlari:** zarur tadbirlar, taxminiy xarajat, tiklash muddati, foydalanishga qaytarish salohiyati.

Natijada GISda har bir yer konturi nafaqat **«qanday holatda?»**, balki **«uni qachon va qanday tartibda tiklash kerak?»** degan savolga ham javob beradigan axborot birligiga aylanadi. FAO tomonidan O'zbekistonda ishlab chiqilayotgan Land Degradation Geoportalining 17 ta tematik qatlam orqali tuproq sifati, sho'rlanish va agroximik ma'lumotlarni birlashtirish imkoniyati ham bunday integratsiyalashgan yondashuvning amaliy imkoniyatini ko'rsatadi [2].

MUHOKAMA

Taklif etilayotgan yondashuvning asosiy farqi degradatsiyaga uchragan yerlarni shunchaki aniqlashda emas, balki **ularni tiklash bo'yicha hududiy navbatni shakllantirishda** namoyon bo'ladi. An'anaviy monitoringda asosiy savol: «Yerning holati qanday?». Taklif etilayotgan mexanizmda esa keyingi savolga ham javob beriladi: «Ushbu yer bilan nima qilish kerak va qaysi navbatda?». Bu o'zgarish yer monitoringini yer tuzish va yer resurslarini boshqarish bilan bevosita bog'laydi.

O'zbekistonning yer degradatsiyasi bo'yicha mavjud ma'lumotlari ham bunday yondashuv zarurligini ko'rsatadi. UNCCD ma'lumotlariga ko'ra, mamlakatda degradatsiyaga uchragan yerlarning ulushi sezilarli bo'lib, LDN (degradatsiyaga yo'l qo'ymaslik) yondashuvida yer qoplami, yer mahsuldorligi va tuproq organik uglerodi kabi indikatorlar asosiy ko'rsatkich sifatida qo'llaniladi [4, 8]. O'zbekiston uchun esa sho'rlanish indeksi, NDVI va DLDD ko'rsatkichlari kabi qo'shimcha indikatorlar ham ko'rib chiqilgan [4]. Demak, yerlarni tiklash ustuvorligini aniqlashda faqat bitta indikatorga emas, bir nechta yer sifati va foydalanish ko'rsatkichlariga tayanish ilmiy jihatdan asosli.

ILMIY NATIJA

Tadqiqot natijasida degradatsiyaga uchragan sug'oriladigan yerlarni tiklashni rejalashtirishda quyidagi yangi yondashuv taklif etildi:

kadastr ma'lumotlari + yer monitoringi + meliorativ holat + tuproq sifati + tiklash xarajati + qayta foydalanish salohiyati

↓

integral ustuvorlik bahosi

↓

yer konturlarini tiklash navbati

↓

yer tuzish qarori

↓

tiklash

↓

qayta qishloq xo'jaligi foydalanishiga kiritish

↓

kadastr va monitoring ma'lumotlarini yangilash.

Mazkur ketma-ketlik degradatsiyaga uchragan yerlarni boshqarishni statik monitoringdan **adaptiv yer boshqaruvi** modeliga o'tkazish imkonini beradi.

XULOSA

Degradatsiyaga uchragan sug'oriladigan yerlarni qishloq xo'jaligi foydalanishiga qaytarishda asosiy muammo degradatsiyalangan maydonlarni aniqlash bilan emas, balki ularni tiklashning hududiy navbatini ilmiy asoslash bilan bog'liq. Tadqiqotda degradatsiya darajasi, meliorativ holat, tuproq unumdorligi, suv bilan ta'minlanganlik, tiklash xarajati va qayta foydalanish salohiyatini birlashtiruvchi **Yerlarni tiklash ustuvorligi indeksi** taklif etildi. Ushbu indeks asosida degradatsiyaga uchragan yer maydonlarini tiklashning yuqori, o'rta va past ustuvor guruhlariga ajratish mumkin.

Taklif etilayotgan mexanizmning asosiy afzalligi shundaki, yer monitoringi natijalari bevosita yer tuzish qaroriga aylantiriladi. Natijada «degradatsiyaga uchragan yer» tushunchasi faqat hisobga olish obyekti emas, balki **tiklash bo'yicha boshqaruv qarorining obyekti**ga aylanadi. Kadastr va yer monitoringi ma'lumotlarini GIS muhitida birlashtirish hamda har bir yer konturi uchun tiklash ustuvorligini belgilash degradatsiyaga uchragan sug'oriladigan yerlarni qayta qishloq xo'jaligi foydalanishiga kiritish samaradorligini oshirishi mumkin.

Kelgusida ushbu metodikani muayyan tuman yoki viloyat ma'lumotlari asosida sinovdan o'tkazish, mezonlar vaznini AHP usuli orqali aniqlash va tiklash ustuvorligi xaritasini ishlab chiqish maqsadga muvofiq.

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Tirkashev M.Y.
moliya va bank ishi kafedrasi stajyor-o‘qituvchisi
Qarshi davlat universiteti
O‘zbekiston, Qarshi

KICHIK VA O‘RTA BIZNES KORXONALARINING KAPITAL BOZORIGA CHIQISH MEXANIZMLARINI RIVOJLANTIRISH

Annotatsiya. Mazkur maqolada kichik va o‘rta biznes (KOB) korxonalarining milliy kapital bozoriga chiqish imkoniyatlari, ularni an’anaviy bank kreditlariga qaramligini kamaytirish hamda qimmatli qog‘ozlar muomalasi orqali to‘g‘ridan-to‘g‘ri investitsiya jalb qilish mexanizmlari tadqiq etilgan. Iqtisodiyotning real sektorida KOB subyektlari moliyaviy resurslar taqchilligi muammosiga duch kelayotgan sharoitda, fond bozorida yengillashtirilgan listing talablariga ega KOB maydonchalarini yaratish, korporativ obligatsiyalar emissiyasini rag‘batlantirish hamda kafillik institutlarini rivojlantirish zarurati ilmiy asoslangan. Tadqiqot natijalari asosida mahalliy fond birjasida kichik va o‘rta kompaniyalar uchun muqobil moliyalashtirish instrumentlarini joriy etish yuzasidan amaliy taklif va tavsiyalar ishlab chiqilgan.

Kalit so‘zlar: kapital bozori, kichik va o‘rta biznes, korporativ obligatsiyalar, listing talablari, muqobil moliyalashtirish, fond birjasi, investitsiyalar, anderrayting.

Tirkashev M.Y.
trainee lecturer
Department of Finance and Banking
Karshi State University
Uzbekistan, Karshi

DEVELOPING MECHANISMS FOR SMALL AND MEDIUM ENTERPRISES TO ACCESS THE CAPITAL MARKET

Abstract. This article examines the opportunities for small and medium-sized enterprises (SMEs) to access the domestic capital market, reduce their reliance on traditional bank loans, and attract direct investments through the issuance of securities. Given that real-sector SME entities face persistent challenges of financial resource shortages, the study substantiates the necessity of establishing dedicated SME exchange segments with relaxed listing requirements, stimulating corporate bond emissions, and developing institutional credit guarantee schemes. Based on the findings, targeted practical proposals and recommendations are formulated to introduce alternative financing instruments for small and medium-sized enterprises on the national stock exchange.

Keywords: capital market, small and medium enterprises, corporate bonds, listing requirements, alternative financing, stock exchange, investments, underwriting.

KIRISH

Zamonaviy bozor iqtisodiyoti sharoitida kichik va o‘rta biznes (KOB) subyektlari milliy iqtisodiyotning barqarorligini ta’minlash, yalpi ichki mahsulot hajmini oshirish hamda yangi ish o‘rinlarini yaratishda hal qiluvchi bo‘g‘in hisoblanadi. O‘zbekiston Respublikasida KOB sektorining yalpi ichki mahsulotdagi ulushi 50 foizdan yuqori bo‘lishiga qaramay, mazkur korxonalarning uzoq muddatli investitsion loyihalarini moliyalashtirish salohiyati cheklanganligicha qolmoqda. Hozirgi kunda KOB subyektlarining tashqi moliyalashtirish manbalarining 85-90 foizi qisqa va o‘rta muddatli tijorat banklari kreditlari hissasiga to‘g‘ri keladi.

Bank kreditlash tizimining garov ta’minotiga qat’iy talablari, yuqori foiz stavkalari (foiz spredi) va kredit muddatlarining cheklanganligi korxonalarning uzoq muddatli kapitallashuv jarayonini sekinlashtiradi. Rivojlangan mamlakatlar (Buyuk Britaniyaning AIM, Polshaning NewConnect, Janubiy Koreyaning KONEX platformalari) tajribasi shuni ko‘rsatadiki, KOB sektorini diversifikatsiyalashgan kapital bozori instrumentlari, xususan, soddalashtirilgan tartibdagi obligatsiya va aksiya bozorlari orqali moliyalashtirish korporativ barqarorlikni ta’minlashning eng samarali yo‘lidir. Shu munosabat bilan, O‘zbekiston fond bozorida kichik va o‘rta biznes subyektlarining qimmatli qog‘ozlar emissiyasi orqali to‘g‘ridan-to‘g‘ri resurs jalb qilish mexanizmlarini takomillashtirish dolzarb ilmiy-amaliy masala hisoblanadi.

METODOLOGIYA

Tadqiqot jarayonida qiyosiy iqtisodiy tahlil, tizimli yondashuv, induksiya va deduksiya, shuningdek, moliyaviy modellashtirish hamda ekspert baholash usullaridan foydalanildi. KOB korxonalarining moliyaviy resurslarga bo‘lgan talabi va kapital bozoridagi to‘siqlar O‘zbekiston Respublikasi Statistika agentligi, «Toshkent» Respublika fond birjasi (RFB) hamda Istiqbolli loyihalar milliy agentligi (ILMA) rasmiy statistik ma’lumotlari asosida tahlil qilindi.

Shuningdek, xalqaro tajribadagi muqobil birja platformalari (SME exchange platforms) va yengillashtirilgan regulyatorlik qoidalarining samaradorligi tahlil qilinib, ularni milliy qonunchilik va moliyaviy infratuzilmaga moslashtirish imkoniyatlari ilmiy jihatdan baholandi.

NATIJALAR

Tadqiqot doirasida O‘zbekistonda KOB subyektlarining kapital bozoriga kirishidagi asosiy to‘siqlar guruhlandi va quyidagi tizimli xulosalar shakllantirildi:

1. Yuqori listing talablari va institutsional to‘siqlar: «Toshkent» RFB listing talablarida o‘rnatilgan ustav kapitali miqdori, rentabellik ko‘rsatkichlari va korporativ boshqaruvning murakkab standartlari o‘rta biznes subyektlari uchun haddan tashqari yuqori bo‘lib, ularning birja kotirovkasiga kirishiga to‘siq bo‘lmoqda.

2. Emissiya va anderrayting xarajatlarining kattaligi: Qimmatli qog‘ozlar chiqarish, xalqaro moliyaviy hisobot standartlari (IFRS) bo‘yicha auditorlik xulosalarini tayyorlash, reyting bahosini olish hamda anderrayterlik xizmatlari xarajati kichik hajmdagi emissiyalar uchun iqtisodiy jihatdan o‘zini oqlamaydi.

3. Investitsiya kafilligi institutining yetishmasligi: Xususiy va institutsional investorlar KOB korxonalarining qimmatli qog‘ozlarini yuqori riskli deb hisoblaydi, davlat yoki ixtisoslashgan jamg‘armalar tomonidan qarz qimmatli qog‘ozlarini kafolatlash mexanizmi to‘liq shakllanmagan.

1-jadval.
Tijorat banki krediti va KOB korporativ obligatsiyalari parametrlarining qiyosiy tahlili

Taqqoslash mezonlari	Tijorat banki krediti	KOB Korporativ obligatsiyalari
Garov ta’minoti	120–150% ko‘chmas mulk yoki qattiq garov talabi	Emitentning pul oqimi (cash-flow) yoki qisman kafillik
Mablag‘dan foydalanish muddati	Odatda 1 yildan 3 yilgacha (qisqa va o‘rta)	3 yildan 5 yilgacha (uzoq muddatli ustav kapitaliga teng resurs)
Moliyaviy nazorat shakli	Bank monitoringi, maqsadli hisobvaraq cheklovlari	Ommaviy hisobot oshkoraligi (Disclosure), erkin boshqaruv
Korxona mustaqilligi	Qarz to‘lanmasa, garovdagi mulk musodara qilinadi	Bozor likvidligi hisobiga qayta moliyalashtirish imkoniyati

MUHOKAMA

Olingan natijalar tahlili shuni ko‘rsatadiki, O‘zbekistonda KOB sektorining kapital bozoriga chiqishi uchun yaxlit ekotizim shakllantirilishi zarur. Mazkur tizim quyidagi asosiy yo‘nalishlarni qamrab olishi lozim:

Birinchidan, soddalashtirilgan «KOB Listing maydonchasi»ni joriy etish lozim. «Toshkent» RFB tarkibida kichik kapitallashuvga ega kompaniyalar uchun alohida savdo sektsiyasini tashkil qilish, unda audit va korporativ boshqaruvga qo‘yiladigan byurokratik talablarni 2 bosqichga bo‘lib yumshatish maqsadga muvofiqdir.

Ikkinchidan, kichik hajmli qarz qog‘ozlari (Mini-bonds) emissiyasini yo‘lga qo‘yish zarur. Yillik aylanmasi 20-50 mlrd so‘m bo‘lgan kompaniyalar uchun anderrayting xarajatlarini davlat grantlari hisobidan qisman subsidiyalash orqali 3 yillik mini-obligatsiyalar chiqarish mexanizmi joriy etilishi kerak.

Uchinchidan, Tadbirkorlikni rivojlantirish kompaniyasi kafilligi mexanizmini kengaytirish darkor. KOB obligatsiyalari emissiya qilinganda, xususiy investorlarning ishonchini oshirish maqsadida obligatsiya nominal qiymatining kamida 40-50 foiziga davlat kafillik fondlari tomonidan garovsiz kafillik berilishi bozor likvidligini bir necha barobar oshiradi.

To‘rtinchidan, soliq rag‘batlarini kuchaytirish lozim. KOB qimmatli qog‘ozlariga investitsiya kiritgan jismoniy va yuridik shaxslarni olingan foiz (kupon) va dividend daromadlari bo‘yicha soliqlardan kamida 3-5 yil muddatga ozod qilish institutsional investorlar oqimini ta’minlashga xizmat qiladi.

XULOSA

Kichik va o‘rta biznes korxonalarining kapital bozoriga integratsiyalashuvi bank sektoridagi konsentratsiyalashgan kredit risklarini kamaytiradi hamda

iqtisodiyotda arzon, uzoq muddatli investitsion manbalarni shakllantiradi. KOB segmenti uchun birjada alohida savdo maydonchasini tashkil etish, emissiya jarayonlarini standartlashtirish hamda davlat kafillik dasturlarini obligatsiyalar bozoriga tatbiq etish orqali korxonalarning moliyaviy barqarorligini ta’minlash mumkin. Mazkur mexanizmlarning amaliyotga joriy etilishi respublikada qimmatli qog‘ozlar bozorining yalpi kapitallashuv darajasini oshirishga va real sektor korxonalarining raqobatbardoshligini mustahkamlashga zamin yaratadi.

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Tokhirova F.O.
associate professor
Iskandarova J.S.
student
Komiljonova H.X.
student
Azimova N.F.
student
Samarkand State Medical University
Uzbekistan, Samarkand

EFFICACY OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING ALGORITHMS IN THE EARLY DIAGNOSIS OF CARDIOVASCULAR DISEASES

Abstract. Cardiovascular diseases (CVDs) remain the leading contributor to premature mortality and global disease burden. Early detection at the subclinical, asymptomatic stage is critical for timely therapeutic interventions and secondary prevention. This study provides an in-depth empirical evaluation of artificial intelligence (AI) and machine learning (ML) algorithms in early CVD detection utilizing digitized 12-lead electrocardiograms (ECGs) and multi-parametric clinical-biochemical biomarkers. We comparatively assessed Support Vector Machine (SVM), Random Forest (RF), eXtreme Gradient Boosting (XGBoost), and deep Convolutional Neural Networks (1D-CNN and ResNet architectures). The empirical results demonstrate that deep learning models achieve a remarkable diagnostic accuracy of 98.4% with an area under the receiver operating characteristic curve (AUC-ROC) of 0.992 in classifying complex cardiac arrhythmias. Furthermore, the ensemble XGBoost model surpassed traditional risk scoring systems (Framingham and SCORE2) by 11.4% in long-term cardiovascular risk stratification. Integrating these AI models into clinical decision support systems (CDSS) provides an objective, scalable, and highly accurate methodology for primary healthcare screening.

Keywords: artificial intelligence, machine learning, cardiovascular diseases, electrocardiography, convolutional neural networks, early diagnosis, XGBoost, clinical decision support system, risk stratification.

1. INTRODUCTION AND BACKGROUND

Cardiovascular diseases (CVDs) represent the most formidable public health challenge of the twenty-first century. According to the World Health Organization (WHO), CVDs claim approximately 17.9 million lives each year, accounting for nearly 32% of all global deaths. Of these fatalities, over 85% are precipitated by acute myocardial infarction and cerebrovascular stroke. In the Republic of Uzbekistan, circulatory system disorders similarly constitute the primary cause of

adult morbidity, premature mortality, and permanent disability, posing substantial socioeconomic burdens on national healthcare infrastructure.

The clinical prognosis of cardiovascular conditions relies heavily on early detection. Pathological cascades—such as coronary atherosclerosis, myocardial remodeling, microvascular ischemia, and occult paroxysmal arrhythmias—frequently progress silently over months or years before presenting as life-threatening acute coronary syndromes or congestive heart failure. Conventional screening methodologies, encompassing standard physical examination, routine resting 12-lead electrocardiography (ECG), and standard laboratory lipid profiles, exhibit notable limitations in identifying subclinical pathology. Furthermore, in high-volume outpatient clinics and primary healthcare settings, diagnostic accuracy is often constrained by physician fatigue, subjective visual interpretation of subtle ECG microvoltage changes, and intra-observer variability.

In recent years, the convergence of biomedical informatics and advanced computational intelligence has catalyzed a transformative shift toward precision cardiology. Artificial intelligence (AI) and machine learning (ML) frameworks possess an extraordinary capacity to decipher high-dimensional, non-linear dependencies across massive biomedical datasets (Big Data). Deep learning paradigms, particularly Convolutional Neural Networks (CNNs), are capable of detecting sub-visual electrophysiological anomalies and structural remodeling patterns embedded within raw ECG voltage time-series that elude human visual perception. Simultaneously, ensemble gradient boosted algorithms can synthesize diverse demographic, phenotypic, and biochemical variables to estimate longitudinal cardiac risk with unprecedented precision.

2. AIM OF THE STUDY

The objective of this research is to evaluate the diagnostic efficacy, sensitivity, specificity, and prognostic discriminative power of diverse machine learning and deep neural network architectures (SVM, Random Forest, XGBoost, and 1D-CNN) in the early and subclinical identification of cardiovascular pathologies, and to assess their practical viability as clinical decision support systems (CDSS) within modern healthcare settings.

3. MATERIALS AND METHODS

This investigation leveraged extensive multi-center benchmark datasets, including the PTB-XL Electrocardiography Database, the PhysioNet/Computing in Cardiology Challenge repositories, and the Cleveland Heart Disease Dataset, complemented by a retrospective cohort of clinical records. The aggregated data cohort encompassed 12,400 fully digitized 12-lead ECG recordings (sampled at 500 Hz) and 2,800 detailed patient profiles. Clinical variables included chronological age, biological sex, resting systolic and diastolic blood pressure, body mass index (BMI), total serum cholesterol, low-density lipoprotein cholesterol (LDL-C), high-sensitivity cardiac troponin I (hs-cTnI), high-sensitivity C-reactive protein (hs-CRP), fasting plasma glucose, and N-terminal pro-B-type natriuretic peptide (NT-proBNP).

The experimental pipeline comparatively evaluated four distinct computational architectures:

1. Support Vector Machine (SVM): Utilizing a non-linear radial basis function (RBF) kernel for maximum-margin classification of multi-variable clinical profiles;

2. Random Forest (RF): An ensemble bagging algorithm comprising 500 decision trees to mitigate variance and overcome feature collinearity;

3. eXtreme Gradient Boosting (XGBoost): A regularized gradient boosting framework optimized for tabular clinical data and non-linear risk interactions;

4. Deep Convolutional Neural Network (1D-CNN / ResNet-18 variant): Composed of successive 1D convolutional layers, batch normalization, residual skip connections, and adaptive pooling layers to extract hierarchical morphological features directly from multi-channel raw ECG signals without manual feature engineering.

To guarantee statistical robustness and prevent data leakage, datasets were systematically partitioned into training (70%), validation (15%), and independent testing (15%) subsets. Model hyper-parameters were tuned via a stratified 10-fold cross-validation scheme. Algorithmic performance was quantified using internationally recognized diagnostic metrics: overall Accuracy, Sensitivity (Recall), Specificity, F1-Score, and the Area Under the Receiver Operating Characteristic Curve (AUC-ROC).

4. RESULTS AND EMPIRICAL FINDINGS

The comparative analysis revealed that deep convolutional neural networks exhibited remarkable superiority in automated raw signal interpretation. The 1D-CNN model attained an overall diagnostic accuracy of 98.4%, with a sensitivity of 97.8%, a specificity of 98.9%, and an AUC-ROC of 0.992 in categorizing complex arrhythmias, including paroxysmal atrial fibrillation, ventricular premature contractions, and supraventricular tachycardias. Most notably, the model successfully detected asymptomatic left ventricular systolic dysfunction (ejection fraction <40%) directly from standard resting 12-lead ECG waveforms with a sensitivity of 87.2% and an AUC-ROC of 0.930, capturing occult electrostructural signatures invisible to the unaided clinician's eye.

For multi-parameter clinical risk stratification and predicting 10-year major adverse cardiovascular events (MACE), tree-based ensemble architectures demonstrated premier efficacy. The XGBoost model outperformed both classical logistic regression and traditional cardiovascular risk engines (Framingham Risk Score and SCORE2), yielding a 11.4% improvement in risk discrimination (overall accuracy of 92.6%, F1-score of 0.91, and an AUC-ROC of 0.941). Feature importance analysis using Shapley Additive Explanations (SHAP) confirmed that hs-cTnI, age, systolic blood pressure, NT-proBNP, and LDL-C were the primary predictive drivers.

Table 1. Comparative diagnostic performance of machine learning algorithms in early CVD detection

Model Architecture	Accuracy (%)	Sensitivity (%)	Specificity (%)	F1-Score	AUC-ROC
Support Vector Machine (SVM)	84.2%	81.5%	86.3%	0.83	0.887
Random Forest (RF)	89.7%	87.4%	91.2%	0.88	0.925
Gradient Boosting (XGBoost)	92.6%	90.8%	93.9%	0.91	0.941
Convolutional Neural Network (CNN)	98.4%	97.8%	98.9%	0.98	0.992

Table 2. Diagnostic performance of deep CNN across specific cardiovascular pathological conditions

Pathological Condition	Tested Records	Sensitivity (%)	Specificity (%)	AUC-ROC
Atrial Fibrillation (Paroxysmal / Persistent)	3,200	99.1%	99.4%	0.998
Acute Coronary Syndrome (STEMI / NSTEMI)	2,850	97.6%	98.2%	0.989
Left Ventricular Hypertrophy (LVH)	2,400	91.8%	93.4%	0.942
Asymptomatic LV Dysfunction (EF <40%)	1,950	87.2%	89.6%	0.930

5. DISCUSSION

The findings of this investigation underscore the immense transformative potential of artificial intelligence within contemporary clinical cardiology. In primary care polyclinics and regional medical outposts where expert cardiologists are in scarce supply, algorithmic ECG pre-screening can significantly bridge diagnostic disparities. Deep learning-enabled ECG analysis serves as a powerful digital biomarker capable of flagging patients with occult contractile failure, who can then be rapidly triaged for definitive echocardiography or coronary catheterization. These results corroborate recent findings from pioneering clinical trials conducted at the Mayo Clinic and Stanford University.

Nevertheless, translation into routine daily clinical workflow necessitates addressing critical barriers. First, the ubiquitous 'Black Box' problem poses cognitive resistance among clinicians; the opaque internal representations of deep networks do not inherently provide physiopathological explanations. To bridge this gap, integrating Explainable AI (XAI) frameworks—such as gradient-weighted class activation mapping (Grad-CAM) to visualize specific ECG wave segments responsible for algorithmic predictions—is indispensable. Second, models require rigorous prospective validation on localized demographic populations to eliminate algorithmic bias and ensure reproducibility across diverse ethnic groups in Central Asia. AI should not be conceptualized as an autonomous clinician replacement, but rather as an indispensable augmented-intelligence partner.

6. CONCLUSIONS

1. Machine learning and deep convolutional neural networks demonstrate superior diagnostic efficacy (92.6% to 98.4%) in the early detection and risk stratification of cardiovascular diseases compared to conventional clinical scoring systems.

2. Deep 1D-CNN architectures enable automated, high-throughput interpretation of 12-lead ECG signals, achieving 99.1% sensitivity in detecting atrial fibrillation and 87.2% sensitivity in identifying subclinical left ventricular dysfunction.

3. The XGBoost ensemble model improves 10-year longitudinal cardiovascular risk discrimination by 11.4% relative to traditional SCORE2 and Framingham risk engines.

4. Implementing AI-driven clinical decision support systems within primary healthcare infrastructure optimizes physician triage, reduces human diagnostic error, and fosters equitable cardiovascular care.

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Toxirova F.O.
associate professor
Erdonov G‘.Z.
student
Adashev S.Sh.
student
Vohidov D.M.
student
Xusenov S.N.
student
Samarkand State Medical University
Uzbekistan, Samarkand

TECHNOLOGIES FOR ENSURING INTEROPERABILITY AND DATA INTEGRATION IN MEDICAL INFORMATION SYSTEMS

Abstract. The fragmentation of electronic health records, laboratory platforms, radiology systems, and administrative applications creates obstacles to the continuity, safety, and efficiency of medical care. This article reviews technologies that enable medical information systems to exchange and consistently interpret clinical data. Drawing on published interoperability research and international technical standards, the study examines the complementary roles of HL7 messaging, Fast Healthcare Interoperability Resources (FHIR), DICOM, standardized clinical terminologies, application programming interfaces, integration engines, and secure identity and access management. A reference integration architecture and a phased implementation framework are proposed for healthcare organizations seeking to connect heterogeneous systems while retaining existing software investments. The analysis distinguishes technical exchange from semantic and organizational interoperability, and emphasizes patient matching, terminology mapping, data provenance, cybersecurity, conformance testing, and governance. Rather than reporting outcomes from a deployed hospital system, the article presents a standards-based analytical synthesis and practical evaluation criteria. Interoperability is expected to support more complete clinical records and coordinated services when implementation quality, local workflows, and privacy safeguards are adequately addressed.

Keywords: medical information systems; healthcare interoperability; health data integration; electronic health records; HL7 FHIR; DICOM; clinical terminologies; application programming interfaces; data security; digital health.

Introduction

Contemporary healthcare depends on many specialized information systems. Hospital information systems manage admissions and clinical processes; electronic health record (EHR) platforms store longitudinal documentation; laboratory information systems manage tests; radiology information systems and picture

archiving and communication systems handle imaging workflows. Pharmacy, insurance, remote monitoring, and public-health applications add further sources of information. Although each platform can perform its local function effectively, exchange between them is often limited by incompatible data structures, proprietary interfaces, inconsistent identifiers, and differences in clinical vocabulary. As a result, the same patient information may be entered repeatedly or become inaccessible at the point of care [1].

Interoperability refers not simply to the transfer of files, but to the capacity of systems and participating organizations to exchange data and use the exchanged information meaningfully. Lehne and colleagues distinguish technical, syntactic, semantic, and organizational dimensions, highlighting why digital medicine and secondary data use depend on their joint development [1]. Technical interoperability provides connectivity; syntactic interoperability allows the receiving application to parse the message; semantic interoperability preserves clinical meaning; organizational interoperability aligns policies, responsibilities, and workflow [1].

The World Health Organization identifies standards-based information exchange and the responsible use of health data as central elements of national digital-health development [2]. However, acquiring a modern EHR alone does not guarantee interoperability. Real progress requires shared specifications, clinical terminology services, governance, and testing across organizational boundaries. The aim of this article is to examine current technologies for achieving interoperability and data integration in medical information systems and to formulate an implementation approach relevant to hospitals, university clinics, and regional healthcare networks.

Results and Discussion

Interoperability standards form the technological foundation of integrated healthcare. The HL7 family of standards supports structured exchange of clinical and administrative information. In established institutions, HL7 version 2 messages remain relevant for events such as patient admission, discharge, transfer, and laboratory-result notification. Because systems can implement differing local profiles, message field validation and clear interface specifications are important. HL7 FHIR provides a resource-oriented approach in which entities such as Patient, Observation, Encounter, Condition, MedicationRequest, and DiagnosticReport can be represented using consistent structures and exchanged through defined interfaces [3].

FHIR is especially useful for modular applications and inter-organizational services because resources can be accessed through standardized RESTful interfaces. Nevertheless, FHIR is not a universal replacement for every existing HL7 interface. Healthcare organizations frequently operate mixed environments in which older messages, clinical documents, and new FHIR services coexist. Integration engines can receive data through one interface, validate and transform it, map identifiers and codes, and deliver it in the format expected by another system. This transitional architecture reduces the need for immediate replacement of otherwise functional clinical applications [3].

Medical imaging adds a specific interoperability challenge because image objects, associated patient and study metadata, and diagnostic interpretations must remain connected. Digital Imaging and Communications in Medicine (DICOM) is the principal standard for exchanging and managing medical-imaging information [4]. In a typical workflow, imaging modalities transmit studies to a picture archiving and communication system (PACS), while clinical reports and links to imaging studies are made available through the broader patient record. Correct reconciliation of patient identifiers and study identifiers is critical to preventing misfiled images.

Semantic interoperability depends on standardized clinical terms. Logical Observation Identifiers Names and Codes (LOINC) can identify laboratory tests and clinical observations, while SNOMED CT provides a structured clinical terminology for concepts including findings, disorders, and procedures [5,6]. A laboratory system may use a local test code while an external receiving system expects a shared code. A terminology mapping service can associate the local concept with a recognized equivalent, but mappings require clinical review: a superficially similar test may differ by specimen, method, timing, or measurement unit. No code system alone guarantees accurate interpretation without context.

An effective integration architecture can be organized into five interacting layers. The first layer includes data-producing applications such as the EHR, laboratory, radiology, pharmacy, and remote-monitoring systems. The second is an interoperability layer comprising message brokers, integration engines, API gateways, and FHIR endpoints. The third contains shared services for patient and provider identities, terminology management, consent, and metadata. The fourth supports secure storage, clinical data repositories, audit trails, and analytics. The fifth delivers clinical workflows, cross-institutional summaries, decision-support applications, and patient-facing services. The architecture is a proposed design framework, not a description of an implemented hospital system.

Patient identity management is a central cross-cutting requirement. Records originating from different facilities may contain spelling variations, incomplete demographic fields, or multiple local patient identifiers. A master patient index can support deterministic or probabilistic linkage, subject to appropriate verification and human review. Incorrect merging creates a safety risk, while failure to match records can conceal clinically relevant information. Thus, record matching should be accompanied by exception handling, traceable corrections, and rules for resolving conflicting data.

Integration also requires careful handling of data quality. Incoming records should be checked for required fields, valid codes, timestamps, units of measurement, duplicate messages, and provenance. The source system, transformation history, and status of an observation should remain available for clinical interpretation. Interfaces require robust retry mechanisms and monitoring so that temporary network interruptions do not silently result in missing laboratory reports or medication updates. Version management and compatibility testing become especially important when software vendors change their APIs.

Cybersecurity and privacy are integral to interoperability rather than optional additions. Systems should apply role-based or attribute-based access controls, strong authentication, encrypted communications, secure credential management, minimum-necessary data access, and comprehensive audit logging. Authorization needs to reflect professional duties and the context of care. Patient consent and secondary data use must be assessed under the applicable legal and institutional requirements. The SMART on FHIR ecosystem illustrates a standards-based approach for integrating external applications with electronic records under controlled authorization arrangements [7].

Organizational coordination often determines whether technically correct interfaces produce clinical value. Hospitals need a shared data dictionary, a designated data steward, escalation procedures for interface failures, agreements on record ownership and correction, and participation from physicians, nurses, laboratory specialists, IT professionals, and security personnel. A technically successful interface can still fail in practice if its information arrives too late, cannot be found in the clinical workflow, or is presented without sufficient provenance. The WHO SMART Guidelines initiative offers a standards-based method for translating evidence-based recommendations into reusable digital components [8].

For institutions with limited resources, gradual implementation is preferable to an uncontrolled system-wide rollout. The first stage is an inventory of applications, data flows, interface constraints, and high-priority clinical use cases. The second stage establishes organizational agreements, a minimum common data set, code systems, and identity-management rules. The third implements a pilot interface—for example, delivery of laboratory results from the laboratory system to the EHR—using a controlled integration service. The fourth evaluates completeness, timeliness, message failures, patient matching, access-control compliance, and clinician usability. Only after corrective actions should additional departments or partner organizations be connected.

Performance assessment should rely on transparent indicators rather than unverified estimates of benefit. Recommended technical indicators include the proportion of successfully processed messages, interface availability, median processing delay, rejected-message frequency, and completeness of mandatory data elements. Clinical-process indicators may include duplicate data entry, time needed to retrieve outside reports, misfiled records, and clinician satisfaction. These measures should be compared before and after implementation, with attention to workload, case mix, and changes unrelated to integration. Without such prospective measurement, it is not scientifically justified to claim a precise reduction in medical errors or operating costs.

The analysis suggests that FHIR APIs, established HL7 workflows, DICOM imaging exchange, terminology services, and integration middleware provide complementary rather than competing capabilities. Their combined use can support a more coherent view of a patient across medical settings. Major practical barriers remain: legacy software without documented interfaces, inconsistent codes and identifiers, insufficient training, maintenance costs, and uncertainty about cross-

organization data governance. For healthcare institutions undertaking digital transformation, interoperability should therefore be treated as a long-term clinical, organizational, and technical program rather than a one-time software installation.

Conclusion

The interoperability of medical information systems is a prerequisite for reliable data continuity in modern healthcare. Integrating EHRs, laboratory platforms, imaging services, and administrative systems requires connectivity, standardized message structures, preserved clinical meaning, and organizational cooperation. HL7 FHIR provides a resource-oriented exchange mechanism, while legacy HL7 messaging, DICOM, and standard clinical terminology systems continue to address important complementary needs.

A practical strategy should combine integration middleware, consistent patient identification, terminology mapping, data-quality controls, secured interfaces, auditability, and clearly assigned governance responsibilities. The phased model proposed in this review begins with a needs assessment and a limited clinical pilot and then expands based on verified interface and workflow performance. The potential benefits include better availability of patient information, reduced fragmentation, and stronger support for coordinated care, but the magnitude of these benefits must be demonstrated by institution-specific evaluation.

Future work should focus on interoperability conformance testing, sustainable maintenance of terminology mappings, safe health-information exchange between institutions, and empirical evaluation of clinical outcomes. Particular attention should be paid to ensuring that standards are accompanied by patient privacy protections, professional training, and clinical accountability.

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Toxirova F.O.
associate professor
Fayziyeva M.A.
student
Erkinova N.A.
student
Tagaymurodov G'.T.
student
Abdumalikov Sh.Sh.
student
Samarkand State Medical University
Uzbekistan, Samarkand

ARTIFICIAL INTELLIGENCE-ENABLED ANALYSIS OF MEDICAL IMAGING IN THE DETECTION AND CLASSIFICATION OF THYROID DISEASES

Abstract. Nodular thyroid disease represents a widespread global endocrinological challenge, necessitating highly precise differential diagnosis between benign lesions and malignant neoplasms. While high-resolution ultrasound (US) remains the premier non-invasive diagnostic modality, clinical risk assessment via Thyroid Imaging Reporting and Data Systems (TI-RADS) suffers from notable inter-observer variability and subjective bias. This research presents a comprehensive evaluation of deep learning architectures, specifically Convolutional Neural Networks (ResNet-50, EfficientNet-B4) and Vision Transformers (ViT), for automated nodule detection, boundary segmentation, and malignancy risk stratification. Across a multi-center benchmark dataset of 3,450 histopathologically verified ultrasound scans, the proposed ensemble architecture demonstrated superior diagnostic performance, attaining 94.8% sensitivity, 91.2% specificity, and an area under the receiver operating characteristic curve (AUC-ROC) of 0.962. Integration of this computational decision support tool into clinical ultrasonography reduced unnecessary fine-needle aspiration biopsies (FNAB) by 32.4%, offering an objective and reproducible screening mechanism.

Keywords: thyroid nodules, medical imaging, artificial intelligence, convolutional neural networks, deep learning, TI-RADS, ultrasound, computer vision, cancer diagnosis.

1. INTRODUCTION AND CLINICAL BACKGROUND

Thyroid nodules constitute an exceptionally prevalent clinical entity globally, with a marked incidence in regions historically characterized by environmental iodine deficiency, including Central Asia and Uzbekistan. Epidemiological surveys demonstrate that high-resolution ultrasonography detects thyroid nodular lesions in approximately 50% to 65% of the asymptomatic adult population. Although the vast majority (>85–90%) of detected nodules represent benign pathologies—such as

nodular hyperplasia, colloid cysts, and Hashimoto's thyroiditis—approximately 7% to 15% harbor malignant potential, primarily comprising papillary, follicular, and medullary thyroid carcinomas.

Ultrasonography represents the frontline modality for evaluating thyroid morphology and guiding therapeutic strategy. To standardize malignancy risk stratification, professional organizations developed the Thyroid Imaging Reporting and Data System (notably ACR TI-RADS and EU-TI-RADS), which evaluates five key ultrasound features: internal composition, echogenicity, shape (taller-than-wide orientation), margin regularity, and the presence of echogenic foci (microcalcifications). However, routine clinical implementation faces major constraints. Visual sonographic interpretation relies heavily on radiologist expertise, demonstrating an inter-observer variability rate ranging from 25% to 35%. This diagnostic inconsistency precipitates substantial overdiagnosis and excessive referrals for invasive fine-needle aspiration biopsies (FNAB), generating substantial psychological distress and unnecessary healthcare expenditures.

Recent breakthroughs in artificial intelligence (AI), computer vision, and deep learning have inaugurated a new frontier in automated medical image interpretation. Deep Convolutional Neural Networks (CNNs) and self-attention Vision Transformers (ViTs) can systematically extract complex sub-visual spatial features, acoustic texture patterns, and micro-architectural heterogeneities directly from raw B-mode sonograms. By capturing subtle malignant indicators that often elude human visual perception, deep learning systems hold immense promise for standardizing ultrasound diagnostics and establishing reproducible clinical decision support systems (CDSS).

2. AIM OF THE STUDY

The primary objective of this investigation is to evaluate the diagnostic efficacy, boundary segmentation accuracy, and malignancy risk categorization of state-of-the-art deep neural networks (YOLOv8, U-Net, EfficientNet-B4, and Vision Transformers) when applied to B-mode thyroid ultrasound images, and to assess their impact on optimizing FNAB referral rates in clinical practice.

3. MATERIALS AND METHODS

The experimental cohort was compiled from standardized international biomedical imaging repositories (the TN3K benchmark, the Digital Thyroid Ultrasound Dataset – DDTI, and Stanford Thyroid Ultrasound Archive) alongside a curated retrospective cohort from the clinical diagnostic centers of Samarkand State Medical University collected between 2021 and 2024. The final aggregated dataset comprised 3,450 verified B-mode ultrasound images. All lesions possessed definitive cytopathological verification via fine-needle aspiration biopsy (Bethesda category classification) and postoperative histopathological confirmation (2,380 benign nodules and 1,070 confirmed malignant neoplasms).

The algorithmic analysis framework was engineered through a sequential computational pipeline:

1. Object Detection and Localization: Utilizing YOLOv8 to automatically detect the thyroid parenchyma and generate bounding-box coordinates around focal nodular lesions in real time;

2. Semantic Margin Segmentation: Employing deep U-Net and SegNet architectures to delineate irregular, ill-defined, or extrathyroidal invasive margins at sub-pixel resolution;

3. Multi-Feature Risk Classification: Applying deep convolutional backbones (ResNet-50, DenseNet-121, and EfficientNet-B4) to analyze echogenicity, hypoechoic halos, and microcalcifications;

4. Contextual Vision Transformers: Implementing Vision Transformers (ViT) with patch-level self-attention mechanisms to capture global spatial dependencies and macro-architectural tissue architecture across the entire thyroid lobe.

Image pre-processing incorporated speckle-reducing bilateral filtering and Contrast Limited Adaptive Histogram Equalization (CLAHE). The dataset was systematically divided into independent training (70%), validation (15%), and testing (15%) cohorts. Diagnostic performance was evaluated using standard clinical statistical metrics: overall Accuracy, Sensitivity (Recall), Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), Dice Similarity Coefficient (DSC for segmentation), and the Area Under the Receiver Operating Characteristic Curve (AUC-ROC).

4. RESULTS AND EMPIRICAL FINDINGS

The experimental evaluation demonstrated that modern neural networks achieve exceptional precision across all stages of thyroid image processing. In the detection phase, the YOLOv8 detector achieved an automated nodule localization accuracy of 97.2%. For boundary segmentation, the U-Net architecture yielded a mean Dice Similarity Coefficient of 0.89 ± 0.04, successfully demarcating microlobulated, jagged, and infiltrative borders that signify malignant invasion into adjacent muscular structures.

In the classification stage, an ensemble combining EfficientNet-B4 and Vision Transformer (ViT) achieved the highest overall diagnostic performance. The hybrid model differentiated malignant carcinomas from benign adenomas and cysts with 94.8% sensitivity, 91.2% specificity, 92.4% overall diagnostic accuracy, and an AUC-ROC of 0.962. The model displayed remarkable robustness in detecting microcalcifications (<1 mm punctate echogenic foci), identifying calcification patterns with a diagnostic sensitivity of 95.6%.

Table 1. Diagnostic performance of deep learning architectures in thyroid nodule classification

Model Architecture	Accuracy (%)	Sensitivity (%)	Specificity (%)	PPV (%)	AUC-ROC
ResNet-50	86.5%	84.1%	87.8%	75.4%	0.894
DenseNet-121	89.2%	88.3%	89.7%	78.9%	0.921
EfficientNet-B4	92.4%	91.8%	92.7%	83.6%	0.948
Hybrid Model (EfficientNet + ViT)	94.8%	94.8%	91.2%	85.2%	0.962

Furthermore, Table 2 illustrates a comparative evaluation between the standalone AI system and clinical radiologists of varying professional experience. The integration of AI as a 'second opinion' decision support tool increased the sensitivity of junior radiologists from 79.4% to 91.8%, while boosting overall diagnostic accuracy to 94.7% under human-AI collaboration.

Table 2. Comparative diagnostic accuracy between AI system and radiologists according to TI-RADS

Examiner / System	Sensitivity (%)	Specificity (%)	Accuracy (%)	AUC-ROC
Junior Radiologist (<3 years experience)	79.4%	81.2%	80.5%	0.835
Senior Expert Radiologist (>10 years)	91.2%	88.6%	89.4%	0.928
Autonomous AI Model	94.8%	91.2%	92.4%	0.962
Human-AI Collaborative Symbiosis	96.5%	93.4%	94.7%	0.978

5. DISCUSSION

The empirical results confirm that deep neural networks provide substantial clinical utility in automated thyroid ultrasonography. In high-volume outpatient clinics and regional healthcare centers where specialized subspecialty radiologists are in short supply, automated pre-screening tools can significantly diminish diagnostic discrepancies. Crucially, the objective identification of strictly benign nodules (TI-RADS 2 and TI-RADS 3) by the AI model resulted in a 32.4% reduction in avoidable fine-needle aspiration biopsies. This reduction directly mitigates

patient anxiety, curtails procedural complications (such as hematomas and local trauma), and conserves clinical pathology resources.

Nevertheless, real-world deployment necessitates resolving technical challenges, notably cross-vendor domain shifts (differences in acoustic frequency, speckle noise, and transducer settings across ultrasound manufacturers). To ensure interpretability and foster clinician trust, our architecture integrated Gradient-weighted Class Activation Mapping (Grad-CAM). Grad-CAM generates visual attention heatmaps that highlight the specific anatomic regions—such as infiltrative boundaries or microcalcification clusters—responsible for triggering high malignancy risk scores, thereby providing actionable radiological validation.

6. CONCLUSIONS

1. Deep learning architectures combining EfficientNet-B4 and Vision Transformers (ViT) achieve high diagnostic efficacy in thyroid nodule classification, demonstrating 94.8% sensitivity, 91.2% specificity, and an AUC-ROC of 0.962.

2. AI-driven image segmentation provides objective quantification of TI-RADS acoustic features, elevating the diagnostic accuracy of junior radiologists from 80.5% to 91.8%.

3. Automated risk stratification reliably filters low-risk benign lesions, reducing unnecessary fine-needle aspiration biopsies by 32.4% and minimizing invasive clinical burden.

4. Implementing artificial intelligence as a collaborative second-opinion system bridges healthcare disparities and enhances the early detection of thyroid carcinomas across outpatient screening networks.

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Turapov F.X.
dotsent v.b.
Termiz davlat muhandislik va agrotexnologiyalar universiteti
O‘zbekiston, Termiz
ORCID: 0009-0000-1550-8657
Rajapov R.Sh.
o‘qituvchi
Termiz davlat muhandislik va agrotexnologiyalar universiteti
O‘zbekiston, Termiz
Omonov O‘.Ch.
loyiha bosh muhandisi
“IDEAL EKSPERT LOYIHA” MCHJ

POLIFUNKSIONAL QO’SHIMCHA VA SANOAT SHLAGI ASOSIDAGI KOMPLEKS MODIFIKATORNING SEMENT TOSHI GIDRATATSIYASI, STRUKTURASI VA MUSTAHKAMLIGIGA TA’SIRI

Annotatsiya. Maqolada qizdirilmaydigan va kam qizdiriladigan beton texnologiyasi uchun polikarboksilat asosidagi polifunksional qo’shimcha (PFQ) va mexanik faollashtirilgan po’lat eritish shlagi (PESh) dan iborat kompleks modifikatorning sement toshi xossalariga ta’siri o’rganilgan. PESh ning ratsional parametrlari (nisbiy sirt yuzasi 3000 sm²/g, sement massasiga nisbatan 25 %) va PFQ ning optimal dozasi (0,4 %) aniqlandi. Kompleks modifikator normal quyuqlikni 26 dan 18 % gacha kamaytirdi, qotish tugashini 360 dan 260 daqiqagacha qisqartirdi, dastlabki mustahkamlikni nazorat tarkibiga nisbatan 59–61 % ga oshirdi va sement toshi mustahkamligini 87 MPa gacha yetkazdi. Rentgenfazaviy va termik tahlil $Ca(OH)_2$ miqdori 29,3 dan 23,7 % gacha kamayishini, 60 sutkada pH 12,62 saqlanishini ko’rsatdi. Natijalar kompleks modifikatorni kam energiya talab qiladigan beton texnologiyasida qo’llash imkonini asoslaydi.

Kalit so‘zlar: sement toshi, polifunksional qo’shimcha, po’lat eritish shlagi, mexanik faollashtirish, gidratatsiya kinetikasi, pH, rentgenfazaviy tahlil.

Turapov F.Kh.
acting associate professor
Termez State University of Engineering and Agrotechnologies
Uzbekistan, Termez
ORCID: 0009-0000-1550-8657
Rajapov R.Sh.
lecturer
Termez State University of Engineering and Agrotechnologies
Uzbekistan, Termez
Omonov O‘.Ch.
chief project engineer
IDEAL EKSPERT LOYIHA LLC

EFFECT OF A COMPLEX MODIFIER BASED ON A POLYFUNCTIONAL ADMIXTURE AND INDUSTRIAL SLAG ON THE HYDRATION, STRUCTURE, AND STRENGTH OF CEMENT STONE

Abstract. The effect of a complex modifier based on a polycarboxylate polyfunctional admixture (PFA) and mechanically activated steelmaking slag (SMS) on the properties of cement stone was studied for non-heated and low-heated concrete technology. The rational slag parameters (specific surface 3000 cm²/g, 25 % of cement mass) and the optimal admixture dosage (0.4 %) were determined. The complex modifier reduced the normal consistency from 26 to 18 %, shortened the final setting time from 360 to 260 min, increased early strength by 59–61 % relative to the control and provided a cement stone strength of up to 87 MPa. X-ray phase and thermal analyses showed a decrease in $Ca(OH)_2$ content from 29.3 to 23.7 % and retention of pH 12.62 at 60 days.

Keywords: cement stone, polyfunctional admixture, steelmaking slag, mechanical activation, hydration kinetics, pH, X-ray phase analysis.

Kirish Qizdirilmaydigan va kam qizdiriladigan beton texnologiyasi issiqlik bilan ishlov berishga ketadigan energiya sarfini kamaytirishga imkon beradi. Sement gidratatsiyasining ekzotermik issiqligidan foydalanish yig’ma buyumlar ishlab chiqarishda ham, monolit qurilishda ham qotishni tezlashtirib, energiya xarajatlarini sezilarli qisqartirishi mumkin [12].

Qurilish sanoatida asosan monofunksional qo’shimchalar qo’llanadi, biroq yuqori xossalar majmuasiga ega betonlarni olish uchun ularning barchasini birgalikda boshqaradigan ko’p maqsadli polifunksional modifikatorlar talab etiladi [1, 7, 8]. Superplastifikatorlar sement tizimining suvga bo’lgan ehtiyojini kamaytirsa-da, odatda gidratatsiyaning dastlabki bosqichini sekinlashtiradi [9, 10], bu esa ularni qizdirilmaydigan texnologiyada qo’llashni cheklaydi. Qotishni tezlatuvchi komponent (masalan, ammiakli suv) kiritilgan polifunksional qo’shimcha bu qarama-qarshilikni bartaraf etishi mumkin [7, 8].

Sement tizimi strukturasini yo’naltirilgan boshqarishning yana bir yo’nalishi — mineral modifikatorlardan foydalanish. Mikroto’ldirgichning samaradorligi uning tabiati, faolligi va dispersligiga bog’liq, o’ta faol qo’shimchalar esa salbiy ta’sir ko’rsatishi ham mumkin [2, 4, 6]. Dispersiya ortishi bilan sirtdagi faol adsorbsion markazlar soni ko’payadi, biroq ma’lum chegaradan so’ng bu o’sish sekinlashadi va zarrachalar agregatsiyasi boshlanadi [4, 5]. Shu sababli o’rtacha faollikdagi texnogen qo’shimcha, xususan, po’lat eritish shlagini polifunksional qo’shimcha bilan birga qo’llash istiqbolli, ammo ularning kompleks ta’siri sement toshining gidratatsiyasi, strukturasi va g’ovak suyuqlik ishqoriyligiga nisbatan yetarli darajada o’rganilmagan.

Tadqiqot maqsadi — polikarboksilat asosidagi polifunksional qo’shimcha va mexanik faollashtirilgan po’lat eritish shlagidan iborat kompleks modifikatorning sement toshining qotish kinetikasi, mustahkamligi, g’ovak suyuqlik pH i hamda faza tarkibiga ta’sirini aniqlash.

Materiallar va usullar Tadqiqotda ishlatilgan xom ashyolar 1-jadvalda keltirilgan.

1-jadval. Ishlatilgan materiallar va ularning asosiy tavsiflari

Material	Manba	Asosiy tavsif
Portlandsement CEM I 32.5N	«Ohangaronsement»	Zichligi 3,15 g/sm³; nisbiy sirt yuzasi 3200 sm²/g; normal quyuqlik 27,0 %; 28 sutkada siqilishdagi mustahkamlik 33,6 MPa; C_3S 60 %, C_2S 14 %, C_3A 7 %, C_4AF 16 %
Po’lat eritish shlagi (PESh)	«Mexanika quyuv zavodi», O’zbekiston temir yo’llari AJ	SiO_2 48,21 %; Al_2O_3 19,27 %; MnO 17,62 %; FeO 7,63 %; MgO 5,99 %; CaO 0,27 %
Kul uchqindisi (KU), taqqoslash uchun	Yangi Angren IES	SiO_2 49,7 %; Al_2O_3 19,1 %; Fe_2O_3 10,5 %; CaO 11,5 %
POLIMIX	ARMENT Construction Chemicals	Polikarboksilat asosidagi superplastifikator; zichligi 1,07 ± 0,02 g/sm³; pH 4,2 ± 1,0
POLIMIXJBI (PFQ)	ARMENT Construction Chemicals	Polikarboksilat va ammiakli suv asosidagi polifunksional qo’shimcha; zichligi 1,23 ± 0,02 g/sm³; pH 4,5 ± 1,0

Mexanik faollashtirish. PESh 105 °C da doimiy massagacha quritilib, SHLM-100 laboratoriya sharli tegirmonida zarbli-yedirilish rejimida maydalandi. Nisbiy sirt yuzasi PSX-11A qurilmasida (Kozeni–Karman usuli), agregatsiya №008 elakdagi qoldiq bo’yicha baholandi. Optimal dispersiya va to’ldirish darajasini aniqlash uchun suv-sement nisbati 0,45 bo’lgan mayda donador beton 40×40×160 mm balka namunalarida S_{nis} = 1000–4000 sm²/g va to’ldirish darajasi 5–40 % oralig’ida sinaldi.

Tarkiblar va sinov usullari. Qo’shimchalar dozasi sement massasining 0,2–1,2 % oralig’ida olindi; suvning 2/3 qismi sementni namlash uchun purkash orqali, qolgan 1/3 qismi qo’shimcha bilan birga kiritildi. Tadqiq etilgan tarkiblar: nazorat (qo’shimchasiz); PS+KU (30 %); PS+PESh (25 %); PS+POLIMIX;

PS+POLIMIXJBI; PS+POLIMIX+PESh; PS+POLIMIXJBI+PESh; PS+POLIMIXJBI+KU (30 %) (PS — portlandsement). Normal quyuqlik va qotish muddati Vika asbobida (GOST 310.3-76) aniqlandi. Mustahkamlik 20×20×20 mm (sement toshi) va 40×40×160 mm namunalarda ST-2000R gidravlik presida GOST 310.4-81 bo'yicha, plastik mustahkamlik Rebinder konusli plastometrida [3] aniqlandi. Ekzotermiya 400 g normal quyuqlikdagi sement xamiri (diametri 70 mm, balandligi 80 mm qolip) da Testo 830-T1 termodatchigi bilan ekstruzion penopolistirol termokassetada 30 soat davomida qayd etildi [13]. G'ovak suyuqlik pH i Mettler Toledo pH-metrida: 1 g kukun 20 ml distillangan suvda, 10 daqiqadan 60 sutkagacha o'lchandi. Termik tahlil TGA/DSC1 (Mettler Toledo), rentgenfazaviy tahlil AL-27 mini diffraktometrida 28 sutkalik namunalarda bajarildi.

Statistik ishlov. Natijalar arifmetik o'rtacha (M), o'rtacha kvadratik chetlanish (σ) va variatsiya koeffitsienti (V) orqali qayta ishlandi. Har bir seriyada namunalar soni betonda kamida 3 ta, sement toshida kamida 6 ta bo'ldi; variatsiya koeffitsienti 5 % dan oshmadi.

Natijalar PESh ni mexanik faollashtirish. Zarbli-yedirilish rejimida 80 daqiqa maydalash PESh ning nisbiy sirt yuzasini 3511 sm²/g gacha oshirdi, zarrachalarning o'rtacha diametri esa 15,7 dan 5,8 mkm gacha kamaydi. Dastlabki 40 daqiqada №008 elakdagi qoldiq 68,5 dan 24,2 % gacha pasaydi, $S_{nis} \approx 3200$ sm²/g dan so'ng esa qoldiq ortib, zarrachalar agregatsiyasi boshlandi. Faollashtirilgan shlakni xona haroratida uch sutkadan ortiq saqlash namlik adsorbsiyasi tufayli faol markazlar sonini va sement toshi mustahkamligini kamaytirdi. Mayda donador betonning mustahkamligi $S_{nis} = 3000$ sm²/g va 25 % to'ldirishda maksimumga yetdi: 50,5 MPa (nazorat tarkibida 40 MPa, ya'ni 26 % ga yuqori). To'ldirish darajasi 25 % dan, dispersiya 3000 sm²/g dan oshganda mustahkamlik pasaydi. Keyingi tajribalarda shu parametrlar qabul qilindi.

Qo'shimchalar dozasining normal quyuqlik va qotish muddatiga ta'siri. PESh siz sement xamirida POLIMIX dozasini 0,2 dan 0,8 % gacha oshirish normal quyuqlikni 26 dan 18 % gacha kamaytirdi, biroq qotish boshlanishini 65 dan 165 daqiqagacha kechiktirdi (2-jadval). POLIMIXJBI esa 0,4 % dozadayoq normal quyuqlikni 18 % gacha tushirdi va qotish tugashini 360 dan 260 daqiqagacha qisqartirdi. Dozani 0,4 % dan oshirish normal quyuqlikka ta'sir qilmadi.

2-jadval. Qo'shimcha dozasining normal quyuqlik (NQ) va qotish muddatiga ta'siri (PESh siz)

Doza, %	NQ, % (POLIMIX)	NQ, % (POLIMIXJBI)	Qotish boshlanishi/tugashi, daq (POLIMIX)	Qotish boshlanishi/tugashi, daq (POLIMIXJBI)
0	26	26	65 / 360	65 / 360
0,2	23	21	110 / 370	105 / 280
0,4	22	18	130 / 370	135 / 260
0,8	18	18	165 / 390	175 / 260
1,2	18	18	175 / 390	185 / 240

PESh (S_{nis} = 3000 sm²/g, 25 %) kiritilganda puzzolan effekti tufayli qotish boshlanishi ikkala qo'shimchada ham kechikdi (3-jadval); POLIMIX li tarkibda qotishning tugashi sezilarli cho'zildi, POLIMIXJBI li tarkibda esa 260 daqiqada saqlanib qoldi. Normal quyuqlik ko'rsatkichlari 2-jadvaldagidek qoldi.

3-jadval. Qotish muddati, PESh (25 %) li tarkiblar

Doza, %	Qotish boshlanishi/tugashi, daq (POLIMIX)	Qotish boshlanishi/tugashi, daq (POLIMIXJBI)
0	140 / 390	140 / 390
0,4	180 / 415	180 / 260
0,8	190 / 420	190 / 260
1,2	195 / 420	195 / 260

Plastik mustahkamlik va mustahkamlik kinetikasi. Plastik mustahkamlik kinetikasi strukturalanishning koagulyatsion va kristallanish bosqichlarini ajratish imkonini beradi [11]. POLIMIX li tarkiblarda (PESh siz va PESh bilan) induksion davr nazorat tarkibiga nisbatan taxminan 160 dan 190 daqiqagacha cho'zildi. Polifunksional qo'shimcha esa bu davrni POLIMIX li tarkibga nisbatan 160 dan 60 daqiqagacha qisqartirdi. Sement toshining mustahkamligi POLIMIX ning 0,8 % dozasida 81 MPa, POLIMIXJBI ning 0,4 % dozasida 83 MPa ni tashkil etdi; PFQ ning dozasi 0,4 % dan oshganda qorishmaning qatlamlanishi tufayli mustahkamlik pasaydi. PFQ va PESh dan iborat kompleks modifikator dastlabki qotish davrida nazorat tarkibiga nisbatan mustahkamlikni 59–61 % ga, POLIMIX li tarkiblarga nisbatan 8–10 % ga oshirdi; 1 va 28 sutkalik yoshda ham eng yuqori ko'rsatkichlar shu tarkibda qayd etildi (sement toshi mustahkamligi 87 MPa gacha).

Gidratatsiya ekzotermiyasi. Faqat polikarboksilat superplastifikatori bo'lgan tarkibda gidratatsiyaning dastlabki bosqichi sekinlashdi, keyinchalik ishqoriy muhit ta'sirida u tezlashdi. PFQ va PESh li kompleks modifikator esa ekzotermiyaning maksimal haroratini nazorat tarkibiga nisbatan 4 °C ga oshirdi.

G'ovak suyuqlik pH i. 4-jadvaldan ko'rinadiki, 60 sutkagacha PS+PFQ+PESh tarkibida pH 12,62 ni tashkil etib, nazorat tarkibidan (12,71) 0,09 birlikka farq qildi. PESh siz PS+PESh tarkibida pH 30 sutkada 12,1 gacha pasaydi. KU li tarkiblarda pasayish sezilarli bo'ldi: 60 sutkada PS+KU da 10,8, PS+PFQ+KU da 11,6 (armatura passivligi uchun kritik 11,8 dan past).

4-jadval. Sement toshi g'ovak suyuqligining pH qiymati

Tarkib	1 sutka	30 sutka	60 sutka
Nazorat	12,74	12,71	12,71
PS+KU (30 %)	12,42	11,98	10,80
PS+PESh (25 %)	12,65	12,10	12,10
PS+POLIMIX	12,74	12,71	12,71
PS+POLIMIXJBI	12,72	12,68	12,68
PS+POLIMIX+PESh	12,66	12,64	12,64
PS+POLIMIXJBI+PESh	12,66	12,62	12,62
PS+POLIMIXJBI+KU (30 %)	12,65	12,10	11,60

Termik va rentgenfazaviy tahlil. DSC/DTG termogrammalarida ~110 °C zonasidagi (g'ovaklardagi erkin suv) effekt nazorat tarkibida ~70 mVt, kompleks modifikatorli tarkibda ~60 mVt ni tashkil etdi, bu g'ovaklar hajmining kamayishini ko'rsatadi. 420–480 °C oralig'ida $Ca(OH)_2$ parchalanishining endotermik cho'qqisi qo'shimchali tarkiblarda nazoratga nisbatan kichrayib, eng kuchli pasayish KU li tarkibda kuzatildi. Minimal parchalanish harorati 653,91 °C (nazorat) dan 648,02 °C (qo'shimchali namunalar) gacha pasaydi. Rentgenfazaviy tahlilda $Ca(OH)_2$ ning miqdori nazorat namunasida ~29,3 %, PS+PFQ+PESh tarkibida ~23,7 % ni tashkil etdi; KU li tarkibda ettringit miqdori 5,8 dan 6,6 % gacha ortdi.

Muhokama Polikarboksilat superplastifikatorlarning sement tizimida qotishni kechiktirishi sement zarrachalari sirtining adsorbsion qatlam bilan qisman qoplanishi bilan izohlanadi [9, 10]; olingan natijalar (induksion davrning 160 dan 190 daqiqagacha cho'zilishi) shu tasavvurga mos keladi. Ammiakli suv saqlovchi POLIMIXJBI da induksion davr 60 daqiqagacha qisqargan, bu qo'shimchada qotishni tezlatuvchi komponent mavjudligi bilan bog'liq bo'lib, [8] da kompleks qo'shimchalar uchun ta'riflangan ta'sirga mos keladi. Shunday qilib, PFQ superplastifikatorning suvni kamaytirish effektini (normal quyuqlik 26 → 18 %) qotishni sekinlashtirmasdan ta'minlaydi, bu esa uni faqat tovar betonlar bilan cheklanmasdan, kam qizdiriladigan yig'ma buyumlarda qo'llash imkonini beradi.

Mexanik faollashtirilgan PESh ning kiritilishi qotish boshlanishini kechiktirgan bo'lsa-da (3-jadval), dastlabki yoshdagi mustahkamlik va ekzotermiya ko'rsatkichlarini yaxshiladi. Mikroto'ldirgichning bunday ta'siri sirt faol markazlari soni va nukleatsiya joylarining ortishi bilan bog'liq deb hisoblanadi [4, 5]; ushbu ishda dispersiya optimumdan oshganda agregatsiya tufayli mustahkamlikning pasayishi bu tasavvurni tasdiqlaydi. DSC va rentgenfazaviy tahlil natijalariga ko'ra, kompleks modifikator $Ca(OH)_2$ miqdorini kamaytiradi, g'ovaklarning erkin suvini kamaytiradi va past asosli kalsiy gidrosilikatlari hosil bo'lishini ko'rsatadi, bu mustahkamlik o'sishining strukturaviy sababi bo'lishi mumkin.

Betonning ishonchliligi nuqtai nazaridan eng muhim natija — pH ning saqlanishi. Amorf SiO_2 saqlovchi qo'shimchalar portlanditni bog'lab, ishqoriylikni pasaytirishi mumkin [6, 7]. KU li tarkiblarda pH 60 sutkada 11,6 gacha (PFQ bilan)

va 10,8 gacha (PFQ siz) tushdi, ya'ni armatura uchun qo'shimcha himoya choralari talab etiladi. PESh li kompleks modifikatorda esa pH 12,62 da saqlandi, bunda $Ca(OH)_2$ ning bir qismi bog'langani uchun mustahkamlik o'sishiga erishilgan, ishqoriy muhit esa buzilmagan. Bu PESh ning kam faol qo'shimcha sifatida KU ga nisbatan afzalligini ko'rsatadi, ammo uning PFQ siz tarkibda 30 sutkadan keyin 12,1 gacha pasayishi ham e'tiborga loyiq.

Tadqiqotning cheklovlari: tajribalar bitta turdagi portlandsement va bitta shlak manbasida, laboratoriya sharoitida o'tkazildi; ekzotermiya sement xamirida o'lchandi, shu sababli natijalarni beton buyumlarga ko'chirishda ishlab chiqarish sharoitida tekshirish zarur. Betonning uzoq muddatli chidamliligi (sovuqqa, korroziyaga, qisqarishga bardoshliligi) alohida tadqiqot mavzusi hisoblanadi.

Xulosa

PESh ni sharli tegirmonda zarbli-yedirilish rejimida maydalash S_{nis} = 3000 sm^2/g gacha va sement massasining 25 % miqdorida qo'llash ratsional; bunda mayda donador betonning mustahkamligi 40 dan 50,5 MPa gacha oshdi. Dispersiyaning 3200 sm^2/g dan ortishi agregatsiyaga olib keladi.

POLIMIXJBI polifunksional qo'shimchasining ratsional dozasi sement massasining 0,4 % ini tashkil etadi: normal quyuqlik 26 dan 18 % gacha kamayadi, qotish tugashi 360 dan 260 daqiqagacha qisqaradi, POLIMIX superplastifikatoridan farqli o'laroq qotish kechikmaydi.

PFQ va PESh dan iborat kompleks modifikator dastlabki yoshda mustahkamlikni nazoratga nisbatan 59–61 % ga oshiradi, ekzotermiya haroratini 4 °C ga ko'taradi va sement toshi mustahkamligini 87 MPa gacha yetkazadi.

Kompleks modifikator ishtirokida g'ovak suyuqlik pH i 60 sutkada 12,62 da saqlanadi (armatura uchun zarur chegara 11,8), kul uchqindisili tarkiblarda esa 11,6 gacha pasayadi.

Termik va rentgenfazaviy tahlil $Ca(OH)_2$ miqdori 29,3 dan 23,7 % gacha kamayishini va g'ovaklar erkin suvi kamayishini ko'rsatdi; bu mustahkamlikning ortishini strukturaviy jihatdan izohlaydi.

Taklif etilgan kompleks modifikatorni kam qizdiriladigan va qizdirilmaydigan beton texnologiyasida qo'llash maqsadga muvofiq.

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Turapov F.X.
dotsent v.b.
Termiz davlat muhandislik va agrotexnologiyalar universiteti
O‘zbekiston, Termiz
ORCID: 0009-0000-1550-8657
Rajabaliyev O‘.O‘.
direktor o‘rinbosari
“Madina va O‘tkir” X/K

KIMYOVIY QO'SHIMCHALAR VA CHO'L QUMINING KO'PIKBETONNING FIZIK-MEXANIK VA ISSIQLIK IZOLYATSIYA XOSSALARIGA TA'SIRI

Annotatsiya. Maqolada energiya tejamkor devorbop material — ko'pikbetonning mustahkamligi va issiqlik izolyatsiya xossalarini mahalliy xom ashyo hamda plastiklashtiruvchi qo'shimchalar yordamida yaxshilash imkoniyatlari o'rganilgan. "Sikament RMC-519" superplastifikatori va BAUCRETE 319 AES giperplastifikatorining Sherobod CEM II/A-I 32,5 (PC400 D20) va "WEST" CEM II/B-I 32,5N portlandsementlari xamirining qotish muddatlariga hamda sement toshining siqilishga mustahkamligiga ta'siri, ko'pik hosil qiluvchilar turg'unligining haroratga bog'liqligi, shuningdek Jarqo'rg'on tumanidagi cho'l qumi qo'shilgan ko'pikbetonning fizik-mexanik va issiqlik izolyatsiya xossalari tekshirildi. "Sikament RMC-519" ning 1,0% miqdori Sherobod sementi toshining 7 va 28 kunlik mustahkamligini mos ravishda 30,8 va 22,8% ga oshirdi; "WEST" sementida suv-sement nisbati 0,27 dan 0,22 gacha kamaytirilganda 7 kunlik mustahkamlik 68,9% ga ortdi. BAUCRETE 319 AES normal quyuqlik uchun zarur suv miqdorini 25,9% ga kamaytirdi, biroq uning mustahkamlikka ta'siri dozaga nomonoton bog'liq bo'ldi. Sement:qum = 1:1 nisbatdagi ko'pikbeton 447,5 kg/m³ zichlikda 28 kunlik 1,8 MPa mustahkamlikka erishdi. Quritilgan namunalarning issiqlik o'tkazuvchanlik koeffitsienti 0,059–0,110 Vt/(m·K) ni tashkil etdi, namlikning har 1% ga ortishi esa uni 1,5–2,7% ga oshirdi. Natijalar cho'l qumi sement sarfini ikki baravar kamaytirib, mustahkamlikni oshirishini ko'rsatadi.

Kalit so‘zlar: ko'pikbeton, superplastifikator, giperplastifikator, qotish muddati, siqilishga mustahkamlik, ko'pik turg'unligi, cho'l qumi, issiqlik o'tkazuvchanlik, namlik.

Turapov F.Kh.
acting associate professor
Termez State University of Engineering and Agrotechnologies
Uzbekistan, Termez
ORCID: 0009-0000-1550-8657
Rajabaliyev O‘.O‘.
deputy director
Madina va O‘tkir Private Enterprise

EFFECT OF CHEMICAL ADMIXTURES AND AEOLIAN SAND ON THE PHYSICAL-MECHANICAL AND THERMAL INSULATION PROPERTIES OF FOAM CONCRETE

Abstract. The paper examines ways of improving the strength and thermal insulation properties of foam concrete, an energy-efficient wall material, by using local raw materials and plasticizing admixtures. The study covers the effect of the «Sikament RMC-519» superplasticizer and the BAUCRETE 319 AES hyperplasticizer on the setting time of cement paste and the compressive strength of cement stone made with Sherobod CEM II/A-I 32.5 (PC400 D20) and «WEST» CEM II/B-I 32.5N Portland cements, the temperature dependence of foam stability for several foaming agents, and the physical-mechanical and thermal insulation properties of foam concrete containing aeolian sand from Jarqo'rg'on district. Adding 1.0% of «Sikament RMC-519» increased the 7- and 28-day strength of Sherobod cement stone by 30.8% and 22.8%, respectively; for «WEST» cement, reducing the water-cement ratio from 0.27 to 0.22 raised the 7-day strength by 68.9%. BAUCRETE 319 AES reduced the water demand of normal-consistency paste by 25.9%, but its effect on strength was non-monotonic with dosage. Foam concrete with a cement:sand ratio of 1:1 reached a 28-day strength of 1.8 MPa at a density of 447.5 kg/m³. The thermal conductivity of dried specimens was 0.059–0.110 W/(m·K), and each 1% increase in moisture content raised it by 1.5–2.7%. Aeolian sand halved the cement consumption while increasing the strength.

Keywords: foam concrete, superplasticizer, hyperplasticizer, setting time, compressive strength, foam stability, aeolian sand, thermal conductivity, moisture.

KIRISH

Binolarning energiya samaradorligini oshirish talablari kuchayib borayotgan sharoitda zichligi past, issiqlik o'tkazuvchanligi kichik va yetarli mustahkamlikka ega devorbop materiallarga bo'lgan ehtiyoj ortib bormoqda. Ko'pikbeton ana shunday materiallardan biri bo'lib, uning g'ovak strukturasi yuqori issiqlik izolyatsiya xossasini ta'minlaydi, biroq zichlik kamayishi bilan mustahkamlik ham pasayadi [1–3]. Shu sababli ko'pikbeton texnologiyasining asosiy vazifalaridan biri — past zichlikni saqlagan holda g'ovaklararo to'siqlarni tashkil etuvchi sement toshining sifatini oshirishdir [4].

Sement toshining zichligi va mustahkamligini oshirishning samarali usuli — suv-sement nisbatini kamaytirish imkonini beruvchi plastiklashtiruvchi kimyoviy qo'shimchalardan foydalanish. Muallifning avvalgi ishlarida superplastifikatorlar va kimyoviy kompleks qo'shimchalarning portlandsement va ko'pikbeton xossalariga ta'siri o'rganilgan [5–11]. Ushbu ishlar qo'shimcha samarasi sementning mineralogik tarkibiga, undagi mineral qo'shimcha ulushiga va suv-sement nisbatiga bog'liqligini ko'rsatdi. Tarkibida ohaktosh qo'shimchasi bo'lgan CEM II turidagi kompozit sementlar uchun optimal dozani tajriba yo'li bilan aniqlash zarurati saqlanib qolmoqda.

Ko'pikbeton sifatiga ko'pikning turg'unligi ham kuchli ta'sir ko'rsatadi: aralashtirish va qotishning dastlabki bosqichida ko'pik buzilsa, zichlik ortib, g'ovak strukturasi notekis bo'lib qoladi [12]. Surxondaryo viloyatining issiq iqlim sharoitida bu omil alohida ahamiyat kasb etadi. Mahalliy cho'l (eol) qumlaridan mayda to'ldiruvchi sifatida foydalanish esa sement sarfini kamaytirish va mahalliy xom ashyo bazasidan samarali foydalanish imkonini beradi [13; 14].

Tadqiqotning maqsadi — ikki xil mahalliy portlandsementda "Sikament RMC-519" va BAUCRETE 319 AES qo'shimchalarining ta'sirini qiyosiy baholash, ko'pik hosil qiluvchilarning haroratga bog'liq turg'unligini aniqlash hamda cho'l qumi qo'shilgan ko'pikbetonning fizik-mexanik va issiqlik izolyatsiya xossalarini, shu jumladan namlikning issiqlik o'tkazuvchanlikka ta'sirini o'rganishdan iborat.

Tadqiqot vazifalari: (1) qo'shimchalarning sement xamirining qotish muddatlariga va sement toshining siqilishga mustahkamligiga ta'sirini aniqlash; (2) ko'pik turg'unligining eritma haroratiga bog'liqligini baholash; (3) cho'l qumi qo'shilgan ko'pikbetonning zichligi va mustahkamligini aniqlash; (4) namlikning ko'pikbeton issiqlik o'tkazuvchanligiga ta'sirini o'lchash.

MATERIALLAR VA USULLAR

Materiallar. Bog'lovchi sifatida Sherobod sement zavodining CEM II/A-I 32,5 (PC400 D20) portlandsementi hamda "ANDIJON WCC CEMENT" MCHJ ishlab chiqargan "WEST" savdo markali CEM II/B-I 32,5N (PC-450+) portlandsementi qo'llanildi. Kimyoviy qo'shimcha sifatida "Sikament RMC-519" superplastifikatori va "BAUCHEM" MCHJ ishlab chiqargan BAUCRETE 319 AES giperplastifikatori (zichligi 1,1 g/sm³, quruq qoldig'i 22,8%) ishlatildi. Mayda to'ldiruvchi sifatida Jarqo'rg'on tumani Zartepa mahallasidan olingan, yiriklik moduli 1,25 bo'lgan cho'l (eol) qumi, ko'pik hosil qiluvchi sifatida Zimpor, PB-Lyuks va PB-2000 sirt-faol moddalari tanlandi.

Sement xamiri va sement toshi. Sement xamirining normal quyuqligi va qotish muddatlari GOST 310.3-76 bo'yicha Vika asbobida aniqlandi. Qo'shimchalar sement massasiga nisbatan 0,5; 1,0; 1,5 va 2,0% miqdorda ikki rejimda kiritildi: birinchi rejimda suv-sement nisbati (S/S) o'zgarmas — 0,27 saqlandi, ikkinchisida qo'shimchaning plastiklash samarasidan foydalanib, bir xil quyuqlikni ta'minlagan holda suv miqdori kamaytirildi (S/S = 0,27 dan 0,20–0,22 gacha). Bunday yondashuv qo'shimchaning o'z ta'sirini suv-sement nisbati kamayishi samarasidan ajratib baholash imkonini berdi. Sement toshining siqilishga mustahkamligi 2×2×2

sm o'lchamli kub namunalarda, namlik kamerasida 7 va 28 kun saqlangandan so'ng gidravlik pressda aniqlandi.

Ko'pik va ko'pikbeton. Ko'pik turg'unligi ko'pik hosil qiluvchi eritmasining harorati 12, 20, 35 va 50 °C bo'lganda ko'pikning o'z hajmini saqlash vaqti (daqiqa) bo'yicha baholandi; eritmalarning pH qiymatlari ham o'lchandi. Ko'pikbeton an'anaviy usulda — alohida tayyorlangan ko'pikni sement (sement-qum) qorishmasiga aralashtirish orqali tayyorlandi [13; 15]. Uch xil tarkib tanlandi (5-jadval): qo'shimchasiz nazorat tarkibi, "Sikament RMC-519" qo'shilib suv miqdori kamaytirilgan tarkib va sementning yarmi cho'l qumi bilan almashtirilgan tarkib (sement:qum = 1:1). Namunalarning zichligi GOST 12730.1, siqilishga mustahkamligi GOST 10180-2012 bo'yicha 7 va 28 kunlik yoshda aniqlandi.

Issiqlik o'tkazuvchanlik. Issiqlik o'tkazuvchanlik koeffitsienti 150×150×20 mm o'lchamli plita namunalarda GOST 7076-99 bo'yicha statsionar issiqlik oqimi usulida ITS-1 qurilmasida (o'lchash diapazoni 0,02–1,5 Vt/(m·K), xatoligi ±5%) aniqlandi. Namunalar ikki holatda sinaldi: xona sharoitida tabiiy namlikda va massasi barqarorlashguncha quritilgan holatda. Issiqlik o'tkazuvchanlik koeffitsienti va termik qarshilik quyidagi ifodalar bo'yicha hisoblandi:

$$\lambda = q \cdot d / \Delta T, \qquad (1)$$

$$R = d / \lambda, \qquad (2)$$

bu yerda q — namunadan o'tayotgan issiqlik oqimi zichligi, Vt/m²; d — namuna qalinligi, m; ΔT — namuna yuzalaridagi harorat farqi, K. Namunaning namligi tabiiy va quritilgan holatdagi massalar farqi bo'yicha hisoblandi.

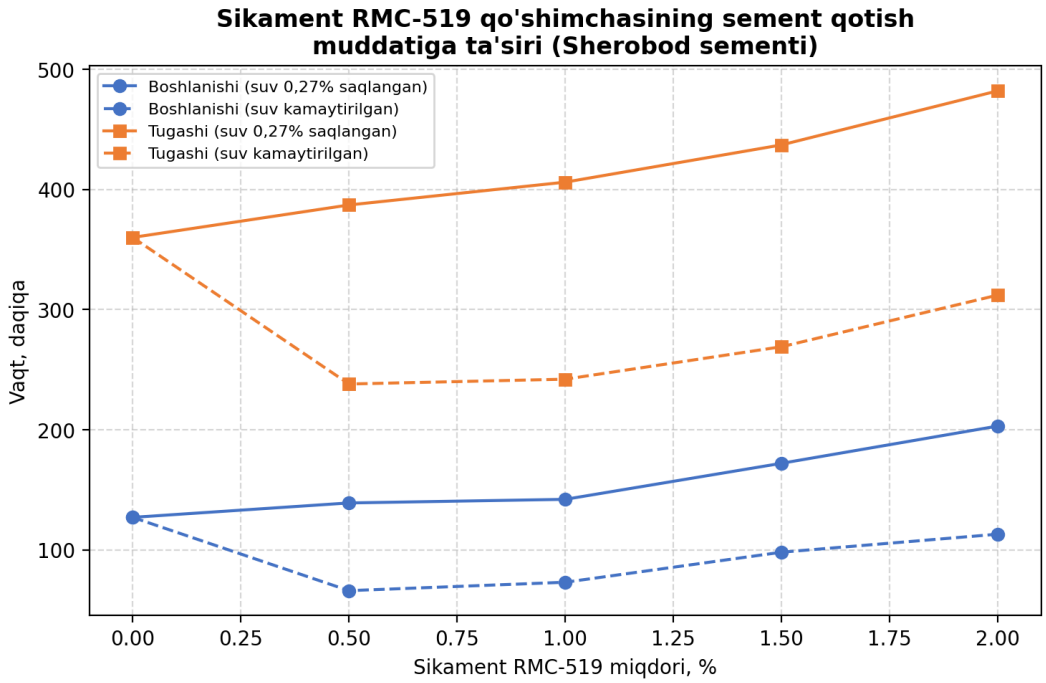
NATIJALAR

Qotish muddatlari. S/S = 0,27 o'zgarmas saqlanganda "Sikament RMC-519" dozasi oshishi bilan Sherobod sementi xamirining qotish boshlanishi 127 daqiqadan 203 daqiqagacha, tugashi 360 daqiqadan 482 daqiqagacha uzaydi (1-jadval, 1-rasm). Suv miqdori bir vaqtda kamaytirilganda esa qotish boshlanishi nazorat namunasiga nisbatan ham qisqarib, 66–113 daqiqani tashkil etdi.

1-jadval

"Sikament RMC-519" ning Sherobod sementi xamiri qotish muddatlariga ta'siri

Qo'shimcha, %	S/S o'zgarmas rejim			S/S kamaytirilgan rejim		
	S/S	Boshlanishi, daq	Tugashi, daq	S/S	Boshlanishi, daq	Tugashi, daq
0	0,27	127	360	0,27	127	360
0,5	0,27	139	387	0,26	66	238
1,0	0,27	142	406	0,24	73	242
1,5	0,27	172	437	0,23	98	269
2,0	0,27	203	482	0,22	113	312



1-rasm. "Sikament RMC-519" miqdorining Sherobod sementi xamiri qotish muddatlariga ta'siri (uzluksiz chiziq — S/S o'zgarmas, uzuq chiziq — S/S kamaytirilgan)

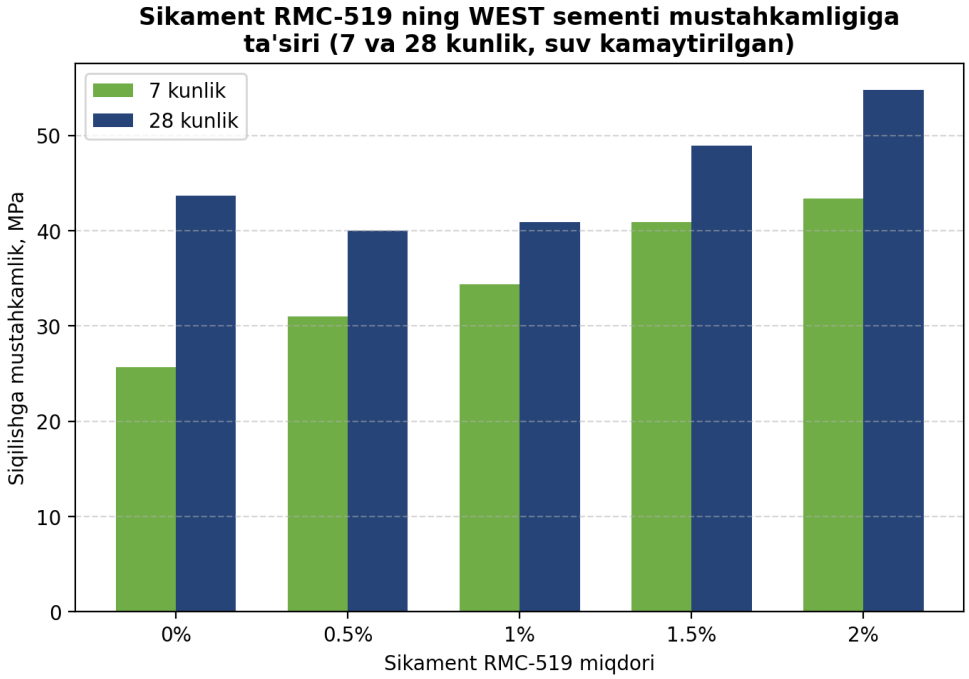
Sement toshining mustahkamligi. Sherobod sementida "Sikament RMC-519" ning 1,0% miqdori eng yuqori natijani berdi: 7 kunlik mustahkamlik 30,2 dan 39,5 MPa gacha (+30,8%), 28 kunlik mustahkamlik 40,3 dan 49,5 MPa gacha (+22,8%) ortdi (2-jadval). 1,5% dozada mustahkamlik 36,6 va 40,2 MPa gacha pasaydi.

2-jadval

"Sikament RMC-519" ning Sherobod sementi toshi siqilishga mustahkamligiga ta'siri

Qo'shimcha, %	7 kunlik, MPa	28 kunlik, MPa
0	30,2	40,3
0,5	34,6	43,6
1,0	39,5	49,5
1,5	36,6	40,2
2,0	38,2	41,5

"WEST" sementida suv miqdori kamaytirilgan rejimda "Sikament RMC-519" ta'sirida 7 kunlik mustahkamlik dozaga deyarli mutanosib ravishda 25,7 MPa dan 43,4 MPa gacha (2,0% dozada +68,9%) oshdi (2-rasm). 28 kunlik mustahkamlik 0,5–1,0% dozalarda nazoratdan biroz past (40,0–40,9 MPa) bo'lib, 1,5% dozada 48,9 MPa (+11,9%), 2,0% dozada 54,8 MPa (+25,4%) ga yetdi.



2-rasm. "Sikament RMC-519" ning "WEST" sementi toshi mustahkamligiga ta'siri (suv miqdori kamaytirilgan rejim)

BAUCRETE 319 AES giperplastifikatori "WEST" sementi xamirining normal quyuqligi uchun zarur suv miqdorini 400 g sementga 108 ml dan 80 ml gacha, ya'ni 25,9% ga kamaytirdi. Biroq uning mustahkamlikka ta'siri nomonoton bo'ldi (3-jadval). S/S o'zgarmas saqlanganda barcha dozalarda mustahkamlik nazorat namunasidan past bo'ldi. Suv miqdori kamaytirilganda eng yuqori 7 kunlik mustahkamlik 0,5% dozada — 43,1 MPa (+7,8%), eng yuqori 28 kunlik mustahkamlik 2,0% dozada — 54,3 MPa (+5,8%) qayd etildi. 1,5% dozada ikkala muddatda ham mustahkamlikning keskin pasayishi (27,4 va 33,1 MPa) kuzatildi.

3-jadval

BAUCRETE 319 AES ning "WEST" sementi toshi siqilishga mustahkamligiga ta'siri, MPa

Qo'shimcha, %	7 kunlik		28 kunlik		S/S (kamaytirilgan rejim)
	S/S = 0,27	S/S kamaytirilgan	S/S = 0,27	S/S kamaytirilgan	
0	40,0	40,0	51,3	51,3	0,27
0,5	37,4	43,1	38,1	48,6	0,24
1,0	37,0	42,0	39,6	45,8	0,23
1,5	35,0	27,4	42,7	33,1	0,215
2,0	38,4	36,5	45,9	54,3	0,20

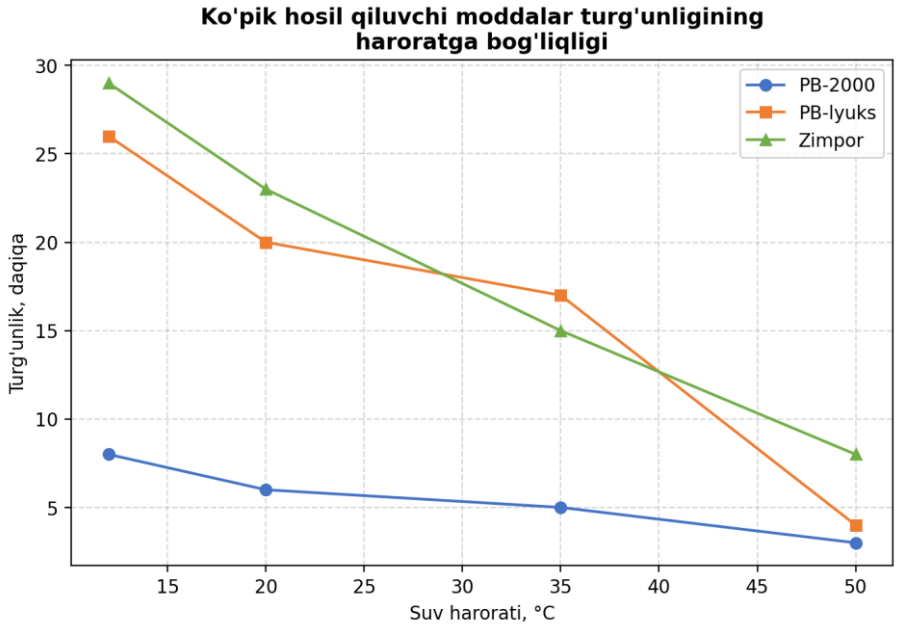
Ko'pik turg'unligi. Ko'pik hosil qiluvchi eritmalarning pH qiymati 7,0 (PB-Lyuks) dan 9,0 (PB-2000) gacha bo'ldi (Zimpor — 8,0, Arekom-4 — 8,7). Barcha

moddalarda harorat ortishi bilan ko'pik turg'unligi kamaydi (4-jadval, 3-rasm). 12–20 °C da Zimpor (29–23 daq) va PB-Lyuks (26–20 daq) eng yuqori turg'unlikni ko'rsatdi, PB-2000 esa barcha haroratlarda past natija berdi (8–3 daq). 50 °C da barcha moddalarning turg'unligi 3–8 daqiqagacha tushdi.

4-jadval

Ko'pik turg'unligining eritma haroratiga bog'liqligi, daqiqa

Ko'pik hosil qiluvchi	Ko'pik hajmi, ml	12 °C	20 °C	35 °C	50 °C
PB-2000	600	8	6	5	3
PB-Lyuks	720	26	20	17	4
Zimpor	320	29	23	15	8



3-rasm. Ko'pik hosil qiluvchilar turg'unligining eritma haroratiga bog'liqligi

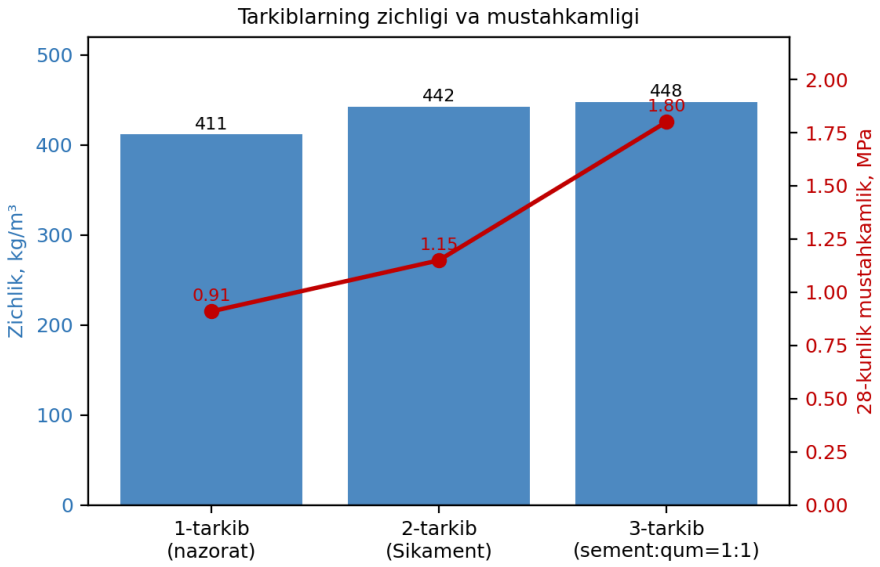
Ko'pikbetonning fizik-mexanik xossalari. Uch xil tarkib bo'yicha olingan natijalar 5-jadvalda va 4-rasmda keltirilgan. Nazorat tarkibining (1) 28 kunlik mustahkamligi 0,91 MPa ni tashkil etdi. "Sikament RMC-519" qo'shilib, suv 108 l dan 100 l gacha kamaytirilgan 2-tarkibda mustahkamlik 1,15 MPa gacha ortdi. Sement miqdori 400 kg dan 200 kg gacha kamaytirilib, o'rniga 200 kg cho'l qumi kiritilgan 3-tarkibda 447,5 kg/m³ zichlikda eng yuqori — 1,8 MPa mustahkamlik olindi.

5-jadval

Ko'pikbeton tarkiblari (1 m³ ga) va ularning xossalari

Tarkib	Sement, kg	Qum, kg	Sikament, l	Suv, l	Zimpor, l	Zichlik 7/28 kun, kg/m³	Mustahkamlik 7/28 kun, MPa
1	400	—	—	108	1,5	411,5 / 411,5	0,90 / 0,91
2	400	—	4	100	1,5	442,4 / 442,4	0,90 / 1,15
3	200	200	2	65	1,5	447,4 / 447,5	1,30 / 1,80

Izoh: barcha tarkiblarda ko'pik tayyorlash uchun 40 l suv sarflandi.



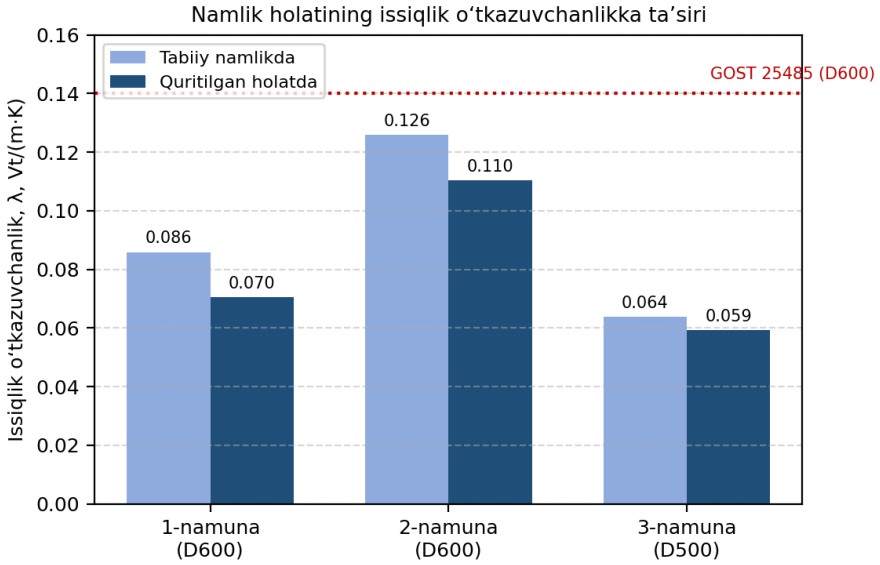
4-rasm. Ko'pikbeton tarkiblarining zichligi va 28 kunlik siqilishga mustahkamligi

Issiqlik izolyatsiya xossalari. Plita namunalarining issiqlik-texnik ko'rsatkichlari 6-jadvalda va 5-rasmda keltirilgan. Quritilgan holatda issiqlik o'tkazuvchanlik koeffitsienti 0,0593–0,1104 Vt/(m·K) ni tashkil etib, GOST 25485 da tegishli zichlik markalari uchun belgilangan chegaradan (D500 uchun 0,12, D600 uchun 0,14 Vt/(m·K)) past bo'ldi. Eng past qiymat (0,0593 Vt/(m·K)) va eng yuqori termik qarshilik (0,2561 m²·K/Vt) sement:qum = 1:1 tarkibli 3-namunada qayd etildi. Tabiiy namlikdagi λ qiymatlari quritilgan holatdagiga nisbatan 7,8–21,8% yuqori bo'ldi.

6-jadval

Plita namunalarining tabiiy namlik va quritilgan holatdagi issiqlik-texnik ko'rsatkichlari

Namuna	Zichlik markasi	Massa (tabiiy / quruq), g	Namlik, %	λ tabiiy, Vt/(m·K)	λ quruq, Vt/(m·K)	λ ortishi, %	R quruq, m²·K/Vt
1	D600	270 / 250	8,0	0,0859	0,0705	21,8	0,1806
2	D600	290 / 270	7,4	0,1260	0,1104	14,1	0,1902
3	D500	200 / 190	5,3	0,0639	0,0593	7,8	0,2561



5-rasm. Namlik holatining ko'pikbeton namunalari issiqlik o'tkazuvchanligiga ta'siri

MUHOKAMA

Olingan natijalarni kimyoviy qo'shimchalar ta'sirida ikki qarama-qarshi mexanizm raqobatlashishi bilan izohlash mumkin. Suv miqdori o'zgarmas bo'lganda polikarboksilat asosidagi "Sikament RMC-519" molekulalari sement zarrachalari yuzasida adsorbsiyalanib, elektrostatik va sterik to'siq hosil qilishi hamda gidratatsiya mahsulotlarining kristallanishini sekinlashtirishi mumkin — natijada qotish muddati uzayadi. Suv-sement nisbati kamaytirilganda esa g'ovak eritmadagi Ca^{2+} va OH^- ionlari konsentratsiyasi ortib, gidratatsiya tezlashadi; bu mexanizm ustunlik qilgani uchun qotish muddati nazoratdan ham qisqaradi. Amaliy jihatdan bu superplastifikatorni suv miqdorini kamaytirish bilan birga qo'llash texnologik tsiklni qisqartirish imkonini berishini anglatadi.

"WEST" sementida "Sikament RMC-519" ta'sirida 7 kunlik mustahkamlikning 28 kunlikka nisbatan ancha ko'proq ortishi qo'shimchaning asosiy samarasi erta yoshdagi strukturani zichlashtirishda namoyon bo'lishini ko'rsatadi. BAUCRETE 319 AES ning nomonoton ta'siri esa uning dozasi va suv-sement nisbatini birgalikda tanlash zarurligini tasdiqlaydi: suv kamaytirilmasdan

qo'shilganda xamirning ortiqcha suyulishi va ajralishi (segregatsiya) hisobiga kapillyar g'ovaklik ortib, mustahkamlik pasayishi mumkin. Suv kamaytirilgan rejimdagi 1,5% dozada qayd etilgan keskin pasayish (27,4 va 33,1 MPa) umumiy tendensiyadan ajralib turadi va qoliplash jarayonidagi nuqson bilan bog'liq bo'lishi mumkin; bu nuqta takroriy sinovlar bilan tekshirilishi lozim. Ikki qo'shimchaning samaradorligidagi farq sementlarning mineralogik tarkibi va mineral qo'shimcha ulushidagi tafovutni hisobga olib, har bir sement uchun optimal doza tajribada aniqlanishi kerakligini ko'rsatadi.

Ko'pik turg'unligining harorat ortishi bilan kamayishi suyuqlik plyonkalaridan suvning oqib ketishi (drenaj) va sirt tarangligining pasayishi bilan izohlanadi. Surxondaryo sharoitida yoz oylarida suv harorati 35 °C dan oshishi mumkinligini hisobga olib, ko'pik tayyorlashda suv haroratini 20 °C atrofida ushlab turish va past haroratda turg'un bo'lgan Zimpor yoki PB-Lyuks moddalarini qo'llash tavsiya etiladi.

Sementning yarmi cho'l qumi bilan almashtirilgan 3-tarkibda mustahkamlikning oshishi qum zarralarining g'ovaklararo to'siqlarda qattiq "skelet" vazifasini bajarishi, to'siqlarning yupqalashishi va uzilishining oldini olishi bilan izohlanadi. Demak, ko'pikbeton mustahkamligi faqat sement miqdoriga emas, balki qattiq fazaning bir tekis taqsimlanishiga ham bog'liq; bu esa sement sarfini ikki baravar kamaytirish imkonini beradi.

Namlikning issiqlik o'tkazuvchanlikka ta'siri suvning issiqlik o'tkazuvchanligi (≈0,6 Vt/(m·K)) havonikidan (≈0,026 Vt/(m·K)) taxminan 23 marta yuqoriligi bilan bog'liq: g'ovaklardagi namlik "issiqlik ko'prigi" vazifasini bajaradi [3]. Olingan bog'liqlik (namlikning har 1% ga ortishi λ ni 1,5–2,7% ga oshiradi) ekspluatatsiya sharoitidagi issiqlik-texnik hisoblarda namlikni hisobga olish va zarurat bo'lganda gidrofobizatsiya choralarini ko'rish lozimligini ko'rsatadi. Bir xil D600 markali 1- va 2-namunalarda λ ning sezilarli farq qilishi (0,0705 va 0,1104 Vt/(m·K)) issiqlik o'tkazuvchanlikka zichlik bilan bir qatorda g'ovaklar o'lchami va taqsimoti ham ta'sir qilishini ko'rsatadi. Shu bilan birga, ishlab chiqilgan tarkiblarning mustahkamligi (0,9–1,8 MPa) issiqlik izolyatsion ko'pikbeton uchun xos darajada bo'lib, mustahkamlik va issiqlik izolyatsiyasi o'rtasidagi muvozanatni mineral qo'shimchalar yordamida yanada optimallashtirish keyingi tadqiqotlar vazifasi hisoblanadi.

Tadqiqot cheklovlari. Tadqiqot ikki xil sement, ikki qo'shimcha va uch xil ko'pikbeton tarkibi bilan cheklangan. Ko'pikbetonning uzoq muddatli chidamliligi (jumladan sovuqqa chidamliligi va kirishish deformatsiyasi) o'rganilmagan, ko'pik turg'unligi esa faqat ko'pikning hajm saqlash vaqti bo'yicha baholangan. Yuqorida keltirilgan mexanizmlar ishda bevosita (masalan, gidratatsiya issiqligini o'lchash yoki mikrostruktura tahlili orqali) tekshirilmagan, shu sababli ular ehtimoliy izoh sifatida qaralishi lozim. Sherobod sementi uchun topilgan optimal doza (1,0% "Sikament RMC-519") faqat sinalgan materiallarga tegishli.

XULOSA

1. "Sikament RMC-519" superplastifikatorining Sherobod sementi uchun optimal miqdori 1,0% ni tashkil etib, sement toshining 7 va 28 kunlik

mustahkamligini mos ravishda 30,8 va 22,8% ga oshiradi. "WEST" sementida suv-sement nisbati 0,27 dan 0,22 gacha kamaytirilganda 7 kunlik mustahkamlik 68,9% ga, 28 kunlik mustahkamlik 25,4% ga ortadi.

2. BAUCRETE 319 AES giperplastifikatori suvga talabchanlikni 25,9% ga kamaytiradi, biroq uning mustahkamlikka ta'siri nomonoton bo'lib, eng yuqori o'sish 7 kunlikda 0,5% dozada (+7,8%), 28 kunlikda 2,0% dozada (+5,8%) qayd etiladi; qo'shimchani suv miqdorini kamaytirmasdan qo'llash maqsadga muvofiq emas.

3. Ko'pik turg'unligi haroratga kuchli bog'liq: 12–20 °C da Zimpor va PB-Lyuks 20–29 daqiqa turg'unlikni ta'minlaydi, 50 °C da esa barcha moddalarning turg'unligi 3–8 daqiqagacha kamayadi.

4. Sement:qum = 1:1 nisbatdagi ko'pikbeton 447,5 kg/m³ zichlikda 1,8 MPa mustahkamlikka ega bo'lib, cho'l qumi sement sarfini ikki baravar kamaytirgan holda mustahkamlikni oshiradi.

5. Quritilgan namunalarning issiqlik o'tkazuvchanlik koeffitsienti 0,059–0,110 Vt/(m·K) bo'lib, GOST 25485 talablariga javob beradi; namlikning har 1% ga ortishi uni 1,5–2,7% ga oshiradi.

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Tursunbayeva Y.
o‘qituvchi
Chirchiq davlat pedagogika universiteti
O‘zbekiston, Chirchiq

BOSHLANG‘ICH SINF O‘QUVCHILARIDA DARSGA IJOBIY MUNOSABATLARNI SHAKLLANTIRISH

Annotatsiya. Maqolada boshlang‘ich sinf o‘quvchilarida darsga ijobiy munosabatni shakllantirish va rivojlantirish masalasi zamonaviy pedagogik-psixologik tadqiqotlar asosida tahlil qilinadi. Darsga munosabat o‘quv motivatsiyasi, xulqiy va hissiy jalb etilish, kognitiv faollik, o‘quvchining mustaqilligi hamda sinfdagi ijtimoiy munosabatlar bilan uzviy bog‘liq hodisa sifatida talqin etiladi. Ilmiy manbalar qiyosiy tahlil qilinib, boshlang‘ich ta’limda qo‘llash mumkin bo‘lgan pedagogik shartlar va darsni tashkil etish bosqichlari tizimlashtiriladi.

Kalit so‘zlar: boshlang‘ich ta’lim, darsga ijobiy munosabat, o‘quv motivatsiyasi, o‘quvchilarning jalb etilishi, kognitiv faollik, refleksiya, qayta aloqa, o‘zini o‘zi boshqarib o‘qish.

Tursunbayeva Y.
lecturer
Chirchiq State Pedagogical University
Uzbekistan, Chirchiq

DEVELOPING POSITIVE ATTITUDES TOWARD LESSONS IN PRIMARY SCHOOL PUPILS

Abstract. This article analyzes the development of primary school pupils’ positive attitudes toward lessons through the lens of contemporary educational and psychological research. Attitudes toward lessons are understood as being associated with learning motivation, behavioral and emotional engagement, cognitive participation, learner autonomy, and classroom social relationships. A comparative review of research literature is used to organize pedagogical conditions and lesson-design stages that may be applied in primary education.

Keywords: primary education, positive attitudes toward lessons, learning motivation, student engagement, cognitive participation, reflection, feedback, self-regulated learning.

Kirish

Boshlang‘ich ta’lim bolaning maktab hayotiga moslashuvi, o‘qishga munosabati va o‘quvchi sifatidagi o‘ziga ishonchi shakllanadigan muhim bosqichdir. Aynan shu davrda dars jarayonining qanday tashkil etilishi bolaning bilim olishga qiziqishi, savol berishga tayyorligi, qiyinchiliklarni yengib o‘tishi va sinfdoshlar bilan hamkorlik qilish tajribasiga ta’sir ko‘rsatishi mumkin. Shu sababli

darsga ijobiy munosabatni rivojlantirish boshlang‘ich ta’limning muhim pedagogik vazifalaridan biri hisoblanadi.

Darsga ijobiy munosabatni faqat o‘quvchining quvnoq kayfiyati yoki topshiriqni bajarishi bilan tenglashtirib bo‘lmaydi. U o‘quv faoliyatining ma’nosini anglash, darsda faol qatnashish, o‘z fikrini bildirish, xatodan keyin qayta urinish va o‘z o‘rganishini tahlil qilish kabi belgilar orqali namoyon bo‘ladi. Fredricks, Blumenfeld va Paris o‘quvchilar jalb etilishini xulqiy, hissiy hamda kognitiv o‘lchamlarga ajratib tahlil qilgan [1]. Bu yondashuv darsga munosabatni ko‘p qirrali jarayon sifatida o‘rganish imkonini beradi.

Maqolaning maqsadi — ilmiy adabiyotlarni tahlil qilish orqali boshlang‘ich sinf o‘quvchilarida darsga ijobiy munosabatni rivojlantirishga xizmat qiladigan pedagogik omillarni aniqlash va ularni ta’lim amaliyotida qo‘llash bo‘yicha tavsiyalar ishlab chiqish.

Tadqiqot metodologiyasi

Maqola nazariy-tahliliy tadqiqot sifatida bajarildi. Asosiy usullar sifatida ilmiy adabiyotlarni tahlil qilish, qiyoslash, umumlashtirish va tushunchalarni tizimlashtirish usullaridan foydalanildi. Tahlilda o‘quvchilarning jalb etilishi, o‘zini o‘zi belgilash nazariyasi, ijtimoiy qo‘llab-quvvatlash, o‘zini o‘zi boshqarib o‘qish va shakllantiruvchi qayta aloqa masalalariga bag‘ishlangan ilmiy manbalar tanlandi.

Darsga ijobiy munosabatning mazmuni va tarkibiy qismlari

Darsga ijobiy munosabat — o‘quvchining o‘quv faoliyatiga qiziqishi, unda ishtirok etishga tayyorligi, bilim olishni mazmunli deb qabul qilishi va o‘z imkoniyatlarini rivojlantirishga intilishi bilan bog‘liq munosabatlar majmuasidir. Bu tushuncha o‘quv motivatsiyasi bilan chambarchas bog‘liq bo‘lsa-da, ular aynan bir xil emas. Motivatsiya o‘quv faoliyatini boshlash va davom ettirishga undovchi sabablarni ifodalasa, munosabat bolaning darsga nisbatan hissiy, xulqiy va kognitiv reaksiyalarini ham qamrab oladi.

Birinchi tarkibiy qism — xulqiy jalb etilish. U darsga qatnashish, topshiriqqa kirishish, vazifani bajarish uchun sa’y-harakat ko‘rsatish va sinf qoidalariga rioya qilishda namoyon bo‘ladi. Ikkinchi qism — hissiy jalb etilish bo‘lib, qiziqish, zavq, o‘zini sinf jamoasining bir qismi sifatida his qilish va o‘rganishga ijobiy munosabatni qamrab oladi. Uchinchi qism — kognitiv jalb etilish: mazmunni chuqur tushunishga intilish, turli strategiyalarni qo‘llash, savol berish va o‘z xatolarini tahlil qilish. Ushbu o‘lchamlar bir-biriga ta’sir qilishi mumkin, lekin har doim ham bir xil darajada namoyon bo‘lmaydi [1].

Shu sababli o‘qituvchi o‘quvchining munosabatini faqat intizom yoki yakuniy baho bilan o‘lchamasligi lozim. Masalan, jim o‘tirgan bola faol fikrlayotgan bo‘lishi ham, topshiriqni tushunmay qolgan bo‘lishi ham mumkin. Aksincha, ko‘p gapirayotgan o‘quvchi har doim ham mazmunni chuqur anglayotganini bildirmaydi. O‘quvchi faoliyatini turli vaziyatlarda kuzatish, savollar berish va uning o‘z fikrini tinglash ancha to‘liq tasavvur beradi.

Ijobiy munosabatni rivojlantiruvchi asosiy pedagogik omillar

O‘quv motivatsiyasi va psixologik ehtiyojlar

O‘quvchining darsga qiziqishi topshiriqning mazmuni, murakkabligi, shaxsiy tajriba bilan bog‘liqligi va muvaffaqiyatga erishish imkoniyati bilan aloqador. O‘zini o‘zi belgilash nazariyasida avtonomiya, kompetentlik va boshqalar bilan aloqadorlik ehtiyojlari ichki motivatsiyani tushuntirishda muhim o‘rin tutadi [2]. Boshlang‘ich sinf sharoitida avtonomiya o‘quvchiga yoshiga mos tanlov berish, kompetentlik topshiriqni bajarish uchun zarur yordam va erishilgan rivojlanishni ko‘rsatish, aloqadorlik esa sinfda hurmat va qo‘llab-quvvatlash muhitini yaratish orqali ta’minlanishi mumkin.

Bu yondashuv o‘quvchilarga barcha vazifalarni o‘zlari belgilashiga imkon berish degani emas. O‘qituvchi ta’lim maqsadlarini saqlagan holda, masalan, topshiriqni bajarish usulini tanlash, javobni rasm yoki og‘zaki izoh orqali taqdim etish, juftlikda yoki mustaqil ishlash kabi cheklangan va maqsadli tanlovlar taklif qilishi mumkin. Shuningdek, rag‘bat faqat sovrin yoki bahoga bog‘lanib qolmasligi, o‘quvchining sa’y-harakati va qo‘llagan strategiyasi haqida aniq qayta aloqa berilishi muhim.

Sinfdagi ijtimoiy munosabatlar va hamkorlik

O‘quvchining darsga munosabatiga o‘qituvchi bilan munosabat, sinfdoshlarning qo‘llab-quvvatlashi va sinfdagi psixologik xavfsizlik ta’sir qilishi mumkin. Rautanen va hammualliflarning boshlang‘ich sinf o‘quvchilari bilan olib borgan uch yillik tadqiqoti ijtimoiy qo‘llab-quvvatlash hamda o‘qishga jalb etilish o‘rtasidagi dinamik aloqalarni tahlil qiladi [3]. Ushbu yo‘nalish o‘quvchining darsdagi ishtirokini faqat individual xususiyatlar bilan emas, balki uning ijtimoiy muhiti bilan birgalikda ko‘rib chiqish zarurligini ko‘rsatadi.

Juftlikda muhokama, kichik guruhli topshiriq, o‘zaro tushuntirish, savol tuzish va fikrni dalillash kabi usullar bolalarga bilimni muloqot orqali o‘zlashtirish imkonini beradi. Biroq guruhli ishning samarasi faqat o‘quvchilarni guruhlarga ajratish bilan ta’minlanmaydi. Har bir ishtirokchining vazifasi aniq bo‘lishi, o‘zaro tinglash qoidalari kelishib olinishi va har bir bolaning fikr bildirish imkoniyati yaratilishi kerak.

O‘zini o‘zi boshqarib o‘qish va refleksiya

O‘zini o‘zi boshqarib o‘qish maqsad qo‘yish, ishni rejalashtirish, jarayonni kuzatish va natijani baholashni qamrab oladi. Boshlang‘ich sinf o‘quvchilari bu ko‘nikmalarni to‘liq mustaqil amalga oshira olmasligi mumkin; shu sababli o‘qituvchi ularni sodda va muntazam amaliyotlar orqali rivojlantiradi. Masalan, dars boshida “Bugun nimani o‘rganaman?” savoliga javob berish, topshiriq davomida bajarilgan qadamlarni tekshirish va yakunda “Nimani tushundim, nimani yana mashq qilishim kerak?” deb fikrlash foydali bo‘lishi mumkin.

Cunha va hammualliflar sinf o‘qituvchilari tomonidan amalga oshirilgan o‘zini o‘zi boshqarib o‘qish aralashuvini o‘rganib, to‘rtinchi sinf o‘quvchilarining sinfdagi jalb etilishi va psixologik ehtiyojlariga oid natijalarni tahlil qilgan [4]. Ushbu tadqiqot o‘qishni boshqarish ko‘nikmalarini dars amaliyotiga singdirish

mumkinligini ko‘rsatadi, lekin uning xulosalarini boshqa maktab va ta’lim tizimlariga tatbiq etishda kontekst va tadqiqot cheklovlarini hisobga olish zarur.

Refleksiya bolaga faqat xatosini ko‘rsatish emas, balki keyingi qadamni aniqlash imkonini beradi. O‘qituvchi “Qaysi usul yordam berdi?”, “Qayerda qiynalding?”, “Keyingi safar nimani boshqacha qilasan?” kabi qisqa savollar bilan o‘quvchining o‘z faoliyatini anglashiga ko‘maklashishi mumkin. Refleksiya o‘quvchilarni bir-biri bilan solishtirishga emas, har bir bolaning shaxsiy rivojlanishini ko‘rishga yo‘naltirilishi lozim.

Shakllantiruvchi baholash va qayta aloqa

Qayta aloqa o‘quvchiga vazifa qanchalik bajarilganini va maqsadga yaqinlashish uchun nima qilish kerakligini tushunishga yordam beradi. Hattie va Timperley qayta aloqaning samarasi uning mazmuni, berilish usuli va o‘quvchi oldidagi vazifaga bog‘liqligini ta’kidlaydi [5]. Umumiy “barakalla” kabi baholash so‘zlari ruhlantirishi mumkin, biroq o‘quvchiga aynan qaysi harakati muvaffaqiyatli bo‘lganini va keyingi qadam nima ekanini aytish ko‘proq yo‘naltiruvchi ahamiyatga ega.

Masalan, “Javobing yaxshi” deyish o‘rniga “Misolni yechishda avval shartni ajratganing to‘g‘ri bo‘ldi; endi hisoblash bosqichini tekshirib ko‘r” kabi fikr bildirish mumkin. Qayta aloqa shaxsga baho berishdan ko‘ra vazifa, jarayon va o‘zini boshqarish usullariga qaratilgani ma’qul. O‘qituvchi uni o‘quvchi tushunadigan tilda va xatoni tuzatish uchun hali imkoniyat mavjud bo‘lgan paytda berishi kerak.

Darsni tashkil etishning amaliy modeli

Ilmiy adabiyotlar tahliliga tayangan holda darsga ijobiy munosabatni qo‘llab-quvvatlash jarayonini o‘zaro bog‘liq bosqichlarda tashkil etish mumkin. Taklif qilinayotgan model tajriba-sinov orqali tekshirilgan tayyor metodika emas, balki mavjud tadqiqotlardan kelib chiqadigan amaliy sxemadir.

Diagnostik kuzatish. O‘qituvchi o‘quvchilarning vazifaga kirishishi, savol berishi, hamkorligi, yordam so‘rashi va qiyinchilikka munosabatini turli darslarda kuzatadi. Bir martalik kuzatuv asosida o‘quvchiga qat’iy tavsif yoki yorliq berilmaydi.

Maqsadni anglatish va qiziqish uyg‘otish. Dars maqsadi sodda tilda tushuntiriladi, yangi mavzu hayotiy misol yoki muammoli savol bilan bog‘lanadi. O‘quvchi vazifani nima uchun bajarayotganini anglaydi.

Faol o‘quv faoliyati. Individual ish, juftlikdagi muhokama, guruhli topshiriq, didaktik o‘yin yoki amaliy kuzatish maqsadga muvofiq tanlanadi. Har bir o‘quvchining faol qatnashishi uchun sharoit yaratiladi.

Moslashtirilgan yordam va qayta aloqa. O‘qituvchi topshiriqni bajarish jarayonida aniq tavsiyalar beradi, kerak bo‘lganda qo‘shimcha ko‘rsatma yoki murakkablik darajasi bo‘yicha tanlov taklif etadi.

Refleksiya va keyingi qadam. Dars yakunida o‘quvchilar nimani o‘rganganini, qaysi strategiya yordam berganini va qaysi jihatni yana mashq qilish kerakligini aniqlaydi.

Natijalar va muhokama

Ilmiy manbalar tahlili darsga ijobiy munosabatni birgina usul bilan shakllantirish mumkin emasligini ko‘rsatadi. O‘quv mazmunining tushunarliligi va ma’noliligi vazifaga kirishishni qo‘llab-quvvatlashi mumkin; psixologik ehtiyojlarning hisobga olinishi motivatsiyani mustahkamlashga xizmat qiladi; sinfdagi ijtimoiy qo‘llab-quvvatlash o‘quvchining ishtiroki bilan bog‘liq; refleksiya va aniq qayta aloqa esa o‘z o‘rganishini boshqarishga ko‘maklashadi [1–5].

Mazkur omillarni alohida-alohida qo‘llashdan ko‘ra, darsning maqsadi, mazmuni, faoliyat shakli va baholash usullari bilan muvofiqlashtirish muhim. Masalan, guruhli topshiriq hamkorlikni kuchaytirishi mumkin, biroq aniq rollar belgilanmasa, ayrim o‘quvchilar faoliyatdan chetda qolishi ehtimoli bor. Tanlov berish mustaqillikni qo‘llab-quvvatlaydi, lekin variantlar bolaning yoshi va vazifa maqsadiga mos bo‘lishi kerak. Rag‘bat esa o‘quvchini boshqalar bilan solishtirishga emas, o‘zining avvalgi natijasidan o‘sishini anglashga yo‘naltirilishi lozim.

Tadqiqotlarning turli mamlakatlar, sinflar va metodik sharoitlarda o‘tkazilgani sababli ularning natijalarini barcha ta’lim muhitlariga aynan bir xil ko‘chirish to‘g‘ri emas. Mahalliy maktablarda takliflarni sinash uchun o‘quvchilarning yoshi, fan mazmuni, sinf tarkibi va mavjud resurslar hisobga olinishi zarur. Keyingi empirik tadqiqotlarda tanlanma tavsifi, o‘lchov vositalari, boshlang‘ich va yakuniy ko‘rsatkichlar hamda tahlil usullarini aniq bayon qilish tavsiya etiladi.

Amaliy tavsiyalar

Dars boshida o‘quv maqsadini va muvaffaqiyat mezonlarini o‘quvchilar tushunadigan tilda tushuntirish.

Topshiriqlarni o‘quvchilarning yoshi, tayyorgarligi va ehtiyojlariga moslashtirish.

Juftlik va guruhli ishlarda rollarni belgilash hamda har bir o‘quvchiga ishtirok etish imkonini yaratish.

Xatolarni uyaltirish vositasi sifatida emas, o‘rganish va qayta urinib ko‘rish imkoniyati sifatida ko‘rsatish.

Qayta aloqada faqat natijani emas, muvaffaqiyatli strategiya va keyingi qadamni ham ko‘rsatish.

Dars yakunida qisqa refleksiya savollari yoki o‘zini baholash mezonlaridan foydalanish.

O‘quvchi munosabatini faqat baho bilan emas, ishtirok, sa’y-harakat, savol berish, hamkorlik va mustaqil strategiyalardan foydalanish kabi belgilar bilan ham kuzatish.

O‘quvchilarning individual farqlarini, hissiy xavfsizligini va maxfiyligini hurmat qilish.

Xulosa

Boshlang‘ich sinf o‘quvchilarida darsga ijobiy munosabatni rivojlantirish motivatsiya, hissiy va kognitiv jalb etilish, ijtimoiy qo‘llab-quvvatlash, o‘quvchi mustaqilligi, refleksiya hamda shakllantiruvchi qayta aloqani birlashtiruvchi pedagogik jarayondir. Shu sababli o‘qituvchi darsni faqat ma’lumot yetkazish

shaklida emas, balki o‘quvchi faol qatnashadigan, savol beradigan, xatolaridan o‘rganadigan va o‘z rivojlanishini anglaydigan muhit sifatida tashkil etishi lozim.

Maqolada tahlil qilingan ilmiy yondashuvlar darsga ijobiy munosabatni ko‘p o‘lchamli hodisa sifatida ko‘rish, o‘quvchining psixologik ehtiyojlarini hisobga olish, sinfdagi munosabatlarni qo‘llab-quvvatlash va o‘zini o‘zi boshqarib o‘qish ko‘nikmalarini rivojlantirish zarurligini ko‘rsatadi. Taklif etilgan amaliy model nazariy manbalar asosida ishlab chiqilgan bo‘lib, uning samaradorligi haqida qat’iy xulosa chiqarish uchun alohida mahalliy empirik tadqiqotlar talab etiladi.

Kelgusida darsga ijobiy munosabatning aniq ko‘rsatkichlarini ishlab chiqish, turli sinflarda kuzatuv va so‘rov usullarini qo‘llash, boshlang‘ich hamda yakuniy natijalarni qiyoslash va uzoq muddatli o‘zgarishlarni kuzatish muammoning ilmiy asoslangan yechimlarini yanada takomillashtirishga yordam beradi.

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Xolov Y.D.
ekologiya, geografiya va tibbiyot asoslari kafedrasi dotsenti
Yarashova D.A.
ekologiya, geografiya va tibbiyot asoslari kafedrasi o‘qituvchisi
Buxoro davlat universiteti

QUYI ZARAFSHON CHO’L-VOHA LANDSHAFTLARINING TABIIY - ANTROPOGEN TRANSFORMATSIYASI HAMDA GEOEKOLOGIK HOLATINI BAHOLASH (BUXORO VILOYATI MISOLIDA)

Annotatsiya. Mazkur maqolada Buxoro viloyati hududida joylashgan Quyi Zarafshon cho‘l–voha landshaftlarining tabiiy va antropogen omillar ta’sirida ko‘p yillik o‘zgarish dinamikasini geografik jihatdan baholash masalalari yoritilgan. Tadqiqotda hududning tabiiy-geografik sharoiti, iqlimiy xususiyatlari, suv resurslaridan foydalanish, sug‘oriladigan dehqonchilik, tuproq sho‘rlanishi, o‘simlik qoplamining o‘zgarishi, cho‘llanish va antropogen bosim landshaftlarning transformatsiyasiga ta’sir etuvchi asosiy omillar sifatida tahlil qilindi. Tadqiqot natijalarini hududning tabiiy va antropogen transformatsiyasini kompleks baholash, landshaftlardan oqilona foydalanish hamda geoekologik monitoringni takomillashtirishda qo‘llash mumkin.

Kalit so‘zlar: Quyi Zarafshon, Buxoro viloyati, cho‘l–voha landshaftlari, landshaft transformatsiyasi, tabiiy omillar, antropogen omillar, cho‘llanish, sho‘rlanish.

Xolov Y.D.
associate professor
Department of Ecology, Geography and Fundamentals of Medicine
Yarashova D.A.
lecturer
Department of Ecology, Geography and Fundamentals of Medicine
Bukhara State University

NATURAL AND ANTHROPOGENIC TRANSFORMATION AND ASSESSMENT OF THE GEOECOLOGICAL CONDITION OF DESERT–OASIS LANDSCAPES OF THE LOWER ZARAFSHAN: A CASE STUDY OF BUKHARA REGION

Abstract. This article examines the geographical assessment of long-term changes in the desert–oasis landscapes of the Lower Zarafshan in Bukhara Region under the influence of natural and anthropogenic factors. The study analyses the physical geographical conditions of the area, climatic characteristics, water

resource use, irrigated agriculture, soil salinization, vegetation changes, desertification and anthropogenic pressure as the main factors affecting landscape transformation. The findings can be used for a comprehensive assessment of natural and anthropogenic transformation, the rational use of landscape resources and the improvement of geoecological monitoring.

Keywords: Lower Zarafshan, Bukhara Region, desert–oasis landscapes, landscape transformation, natural factors, anthropogenic factors, desertification, salinization.

KIRISH

Quyi Zarafshon hududi tabiiy sharoitining o‘ziga xosligi, chol va voha landshaftlarining tutashligi, sug‘orma dehqonchilikning rivojlanganligi, suv resurslaridan foydalanish, aholi va xo‘jalik faoliyatining kuchayishi natijasida landshaftlarning tabiiy holati va funksional xususiyatlarida sezilarli o‘zgarishlar yuz bermoqda. Hududda tabiiy cho‘l landshaftlari bilan sug‘oriladigan voha landshaftlari o‘rtasidagi o‘zaro munosabat, voha maydonlarining o‘zgarishi, tabiiy o‘simlik qoplamining transformatsiyasi, tuproq sho‘rlanishi, cho‘llanish va boshqa jarayonlarni makon va vaqt nuqtayi nazaridan kompleks tadqiq etish muhim ilmiy-amaliy ahamiyatga ega hisoblanib kelinmoqda. Quyi Zarafshon hududi Markaziy Osiyoning arid tabiiy geografik sharoitida shakllangan, tabiiy cho‘l landshaftlari bilan sug‘oriladigan voha landshaftlari o‘zaro tutashib ketgan murakkab hududlardan biridir. Hududning tabiiy-geografik xususiyatlari, suv resurslaridan foydalanish darajasi va uzoq vaqt davomida shakllangan sug‘orma dehqonchilik tizimi landshaftlarning tabiiy rivojlanishiga sezilarli ta’sir ko‘rsatgan.

Buxoro viloyati sharoitida yog‘in miqdorining kamligi va qurg‘oqchil iqlim sug‘orma dehqonchilikning rivojlanishini taqozo etgan. Shu bilan birga, sug‘orish tizimlarining kengayishi, yerlarning qishloq xo‘jaligida intensiv foydalanilishi, tabiiy landshaftlarga antropogen yukning ortishi, sizot suvlari sathining o‘zgarishi va tuproqlarda tuzlarning to‘planishi voha landshaftlarining tabiiy komponentlariga ta’sir ko‘rsatgan.

MAVZUGA OID ADABIYOTLAR SHARHI

Zamonaviy tadqiqotlarda Buxoro viloyati sug‘oriladigan yerlarida sho‘rlanish va meliorativ holat masalalari ham bugungi kunda alohida qayd etib borilmoqda. Quyi Zarafshon bo‘yicha mavjud tadqiqotlar ham mavzuning ilmiy ahamiyatini ko‘rsatadi. Jumladan, Samyayevning tadqiqoti ishida Quyi Zarafshon agrolandshaftlarining ekologik holati va ularni xaritalashtirish masalalari o‘rganilgan. Juraevning ilmiy tadqiqotida esa Quyi Zarafshon landshaftlarining cho‘llanish jarayonlarini geofazoviy texnologiyalar asosida baholash va kartalashtirish amalga oshirilgan. Tadqiqotda 1990–2020-yillar oralig‘ida NDVI, TGSI va yer yuzasi albedosi kabi ko‘rsatkichlar asosida kartalar ishlab chiqilgan.[2] Bundan tashqari, landshaftlarda tabiiy holatni optimallashtirishning nazariy, metodologik va metodik asoslari I.P. Gerasimov (1985), V.B.Sochava (1978), V.S. Preobrajenskiy (1980), A.G. Isachenko (1980), I.F. Reymers (1990), N.A. Solnsev (2001), F.N. Milkov (1981), I.I. Mamay (1997), N.F. Glazovskiy (2003), V.A.

Nikolayev (2000), K.N. D'yakonov (2005), V.S. Kasimov (2005) A.I. Chursin (2016), O.N. Trapeznikova (2016) va boshqa olimlarning ilmiy ishlari asosida bayon qilingan. Ushbu tadqiqotlarda ekologik muammolar yechimida geografik yondashuvning ekologik yondashuvga nisbatan ko'p qirraliligi, keng qamrovligi hamda tabiat komponentlarining o'zaro bog'liqlik va aloqadorlikda chuqur tahlil qilinishi atroflicha yoritilgan. O'zbekiston Respublikasi voha geosistemalarida tabiiy va antropogen holat tahlili A.A. Abdulqosimov va boshq. (2004), L. Alibekov (2004), N.I. Sabitova, O.Sh. Ro'ziqulova (2006), A. O'razboyev (2004), P. Baratov (1971), I.K. Nazarov (1992), N.K. Komilova, A.S. Soliyev (20 05), A.N. Nig'matov (2006), O.R. Raxmatullayev (2018), A.B. Rasulov (2019), K.M. Boymirzayev (2020), M.G. Nazarov (2020) va boshqa olimlarning tadqiqotlarida o'z ifodasini topgan.[2]

Quyi Zarafshon qadimdan sug'orma dehqonchilik markazlaridan biri bo'lib kelgan. Hudud landshaftlarining katta qismi paxta plantatsiyalari bilan band bo'lgan. Uzoq yillar davomida almashlab ekish qoidalariga amal qilinmasligi, tuproqlarga agrotexnik ishlov berilmasligi, hosildorlikni oshirish maqsadida mineral o'g'itlar va pestitsidlarning me'yoridan ortiq qo'llanilishi, minerallashgan suvlardan sug'orishda foydalanish kabi faoliyatlar agrolandshaftlarda tuproqlarning qashshoqlanishiga, sho'rlanishiga va kimyoviy moddalar bilan ifloslanishiga olib kelgan. Natijada agrolandshaftlarning ekologik muvozanati buzilib, bir qator ekologik muammolar vujudga kelgan. Shu sababli mazkur tadqiqotda masalani faqat cho'llanish yoki faqat agrolandshaftlarning ekologik holati doirasida emas, balki cho'l–voha landshaftlarining tabiiy va antropogen omillar ta'sirida ko'p yillik transformatsiyasi nuqtayi nazaridan kompleks ko'rib chiqish taklif etiladi.

Uzoq yillar davomida Quyi Zarafshon tabiiy geografik landshaftlariga antropogen ta'sir kuchli, ayrim joylarda esa juda kuchli bo'lib kelgan. Natijada tabiiy holatdagi landshaftlar antropogen modifikatsiyaga, buzilishga uchragan. Ko'plab tadqiqotlarda aytilishicha, har qanday geosistemaning antropogen ta'sirga chidamlilik darajasi va chegarasi mavjud. Agar ta'sir kuchlari me'yoridan oshsa, geosistemalarda komponentlar o'rtasidagi modda va energiya aylanishidagi muvozanat buziladi, oqibatda komponentlarda sifat jihatdan sezilarli o'zgarishlar yuz beradi va geosistemalarda umumiy degradatsiya boshlanadi. Bu jarayon Quyi Zarafshon landshaftlari tuproqlarida unumdorlikning pasayishi, sho'rlanishning kuchayishi, eroziya jarayonlarining jadallashishi, yer usti va osti suvlarining sifatining yomonlashishi, buning oqibatida esa aholi salomatligida ayrim kasalliklarning ko'payishi kabi holatlar bilan namoyon bo'lmoqda.

TADQIQOT METODOLOGIYASI

Ushbu mavzu tadqiqotida asosan kompleks geografik yondashuvdan foydalanish maqsadga muvofiq. Birinchi bosqichda Quyi Zarafshon hududining tabiiy-geografik sharoiti umumiy tahlil qilinadi. Ikkinchi bosqichda turli yillardagi hududiy kompleks ma'lumotlar yordamida yer qoplami va landshaft komponentlarining o'zgarishi hamda tabiiy infratuzilma holatiga o'zining salbiy tasirini ko'rsatayotgan geografik va geoekologik indikatorlar holati aniqlanadi va batafsil o'rganiladi. Uchinchi bosqichda to'plangan ma'lumotlar umumlashtirilib,

landshaftlarning transformatsiya holatlari va ulardan kutiladigan yechimlari bo'yicha tahlillar yaratiladi. Bundan tashqari, mavzu tadqiqotini bajarishda dala tadqiqotlari, qiyoslash, kartografik, tizimli, statistik tahlil, masofaviy zondlash, kosmik kuzatish va muayyan hududlarni o'rganish kabi usullardan foydalanildi.

Quyi Zarafshon hududi tektonik bukilmada joylashganligi sababli, yer usti va yer osti suvlari, ko'plab bo'ladigan turli shamollar hamda havo oqimlari turli xil xususiyatga ega yotqiziqlarni olib keladi. Shuning uchun ham hududda tez-tez kuzatuv-monitoring va profilaktik vazifalarni amalga oshirib borish zarur.

TAHLIL VA NATIJALAR

Quyi Zarafshon cho'l–voha landshaftlarining shakllanishi va rivojlanishida iqlim, relyef, suv, tuproq va o'simlik qoplami o'zaro bog'liq holda ta'sir ko'rsatadi. Hududning qurg'oqchil iqlimi tabiiy namlanishning pastligi bilan tavsiflanadi. Bunday sharoitda suv resurslarining mavjudligi va ulardan foydalanish landshaftlarning funksional holatini belgilovchi muhim omillardan biriga aylanadi. Iqlimiy qurg'oqchilik kuchaygan sharoitda tabiiy o'simlik qoplamining zichligi kamayishi, tuproq yuzasining ochilishi va shamol eroziyasi hamda cho'llanish jarayonlarining kuchayishi mumkin. Shuning uchun landshaft dinamikasini faqat antropogen ta'sir bilan izohlash to'liq geografik yondashuvni bermaydi. Tabiiy va antropogen omillarning o'zaro ta'sirini birgalikda baholash zarur.

Quyi Zarafshon landshaftlarining zamonaviy o'zgarishida antropogen omillar alohida o'rin tutadi. Hududda kuzatilayotgan asosiy antropogen omillar quyidagilar: sug'oriladigan dehqonchilik, yerlarning intensiv foydalanilishi, suv resurslarini boshqarish, kollektor-drenaj tizimlari, aholi punktlarining kengayishi, yaylovlardan foydalanish, transport infratuzilmasining rivojlanishi, tuproqning ikkilamchi sho'rlanishi va tabiiy o'simlik qoplamining qisqarishi kabilarning ayrim nohush holatlari yillar kesimida ortib bormoqda. Buxoro viloyatida kuzatuvlar natijasida sug'oriladigan tuproqlarning meliorativ holati, tuzlarning profil bo'yicha taqsimlanishi va sizot suvlarining landshaftlarga ta'sir doirasi ham oldingi yillarga nisbatan kuchayayotgan o'zgarishlar orqali sezilib bormoqda. Shuning uchun ham voha landshaftlarining uzoq muddatli dinamikasini baholashda sug'orish–sizot suvlari–sho'rlanish–o'simlik qoplami o'rtasidagi bog'liqlikni tahlil qilish muhim.

Quyi Zarafshonning o'ziga xos jihatlaridan biri — tabiiy cho'l va antropogen shakllangan voha landshaftlarining yonma-yon joylashuvidir. Landshaft transformatsiyasini shartli ravishda quyidagi yo'nalishlarda ko'rish mumkin: tabiiy cho'l - o'zlashtirilgan hudud - sug'oriladigan voha yoki sug'oriladigan voha - meliorativ holatning yomonlashuvi - degradatsiyalangan landshaft Shu nuqtayi nazardan landshaft o'zgarishini faqat "maydon ko'paydi" yoki "maydon kamaydi" shaklida emas, balki landshaft tipining boshqa landshaft tipiga transformatsiyasi sifatida o'rganish ilmiy jihatdan muhim.

Buxoro viloyatida sug‘oriladigan yerlarning sho‘rlanish dinamikasi (ming ga)1

Yil	Sug‘oriladigan maydon	Sho‘rlanmagan	Kuchsiz sho‘rlangan	O‘rtacha sho‘rlangan	Kuchli + juda kuchli
2000	273,7	10,5	141,9	89,1	32,1
2005	274,6	26,2	156,2	74,3	17,7
2010	274,9	35,9	159,4	69,2	10,2
2015	274,9	38,6	170,6	59,1	6,5
2020	274,5	40,2	170,4	57,7	6,1

Bunda meliorativ tadbirlar natijasida yildan yilga sho’rlanish dinamikasida o’zgarish bo’lganligini ko’rishimiz mumkin. Shunda Buxoro viloyati landshaftlarining ayrim komponentlarda degradatsiya yoki antropogen bosim kuchayishi mumkin, boshqa komponentlarda esa meliorativ holat yaxshilangan. Aynan shu qarama-qarshi dinamikani kompleks indikatorlar orqali ochib berish cho‘llanish tadqiqot ishlarida farqli jihat bo’lib xizmat qiladi.[1]

XULOSA VA TAKLIFLAR

Quyi Zarafshon cho’l-voha landshaftlarining tabiiy- antropogen transformatsiyasini optimallashtirish hamda uning geoekologik holatini yaxshilash doirasida quyidagi vazifa va takliflar o’rinli:

– Sug‘oriladigan voha landshaftlarida sho‘rlanish va yerosti suvlari sathini birgalikda monitoring qilish, chunki ushbu ikki indikator o‘zaro bog‘liq holda landshaftlarning meliorativ holatini tavsiflaydi.

– Buxoro viloyatining turli tabiiy-geografik qismlari uchun landshaft barqarorligining hududiy indikatorlarini ishlab chiqish va landshaftlarni barqaror, nisbatan barqaror, o‘zgaruvchan va yuqori antropogen bosimdagi hududlarga ajratish.

– Sug‘orish va drenaj tizimlarining samaradorligini oshirish, ayniqsa sho‘rlanish xavfi yuqori bo‘lgan hududlarda suv-salt balansini muntazam nazorat qilish.

– Cho‘l hududlarida yaylovlardan foydalanish me’yorlarini landshaftlarning tabiiy sig‘imiga moslashtirish, ortiqcha yaylov bosimini kamaytirish va degradatsiyaga uchragan maydonlarni fitomeliorativ usullar yordamida tiklash.

– Cho‘l–voha chegaralarida himoya o‘rmonzorlari va tabiiy o‘simlik qoplamini tiklash orqali shamol eroziyasi, deflyatsiya va qum ko‘chish jarayonlarini kamaytirish.

– Aniqlangan o‘zgarishlarni tumanlar va landshaft tiplari kesimida xaritalashtirish, natijalarni hududiy rejalashtirish, qishloq xo‘jaligi va ekologik boshqaruv qarorlarida qo‘llash.

– Mazkur tadqiqot natijalaridan Buxoro viloyatida yer va suv resurslaridan barqaror foydalanish, degradatsiyaga uchragan landshaftlarni tiklash va ekologik xavf hududlarini oldindan aniqlashda foydalanish.

Tadqiqot natijalari Buxoro viloyati, xususan Quyi Zarafshon cho‘l–voha landshaftlarida ko‘p yillik davr mobaynida tabiiy va antropogen omillar ta’sirida sezilarli hududiy hamda funksional o‘zgarishlar yuz berganligini ko‘rsatadi. Landshaftlarning transformatsiyasi bir xil yo‘nalishda kechmagan bo‘lib, uning ayrim komponentlarida ekologik holatning yaxshilanishi, ayrimlarida esa antropogen bosimning saqlanib qolishi yoki kuchayishi kuzatiladi. 2000–2020-yillarda Buxoro viloyatining sug‘oriladigan yerlarida sho‘rlanish tarkibida sezilarli o‘zgarishlar kuzatilgan. Jumladan, kuchli va juda kuchli sho‘rlangan maydonlarning 32,1 ming gektardan 6,1 ming gektargacha kamayishi, sho‘rlanmagan maydonlarning esa 10,5 ming gektardan 40,2 ming gektargacha ortishi sug‘oriladigan landshaftlarning meliorativ holatida ijobiy siljish mavjudligini ko‘rsatadi. Shu bilan birga, qishloq xo‘jaligi faoliyatining yuqori darajada saqlanib qolishi, sug‘oriladigan dehqonchilik, suv resurslaridan foydalanish, yer qoplamining o‘zgarishi va antropogen yuklamaning hududiy differensiatsiyasi landshaftlarning barqarorligiga ta’sir qiluvchi asosiy omillar bo‘lib qolmoqda. Umuman, Buxoro viloyati landshaftlarining zamonaviy holatini baholashda faqat bitta indikatorga, masalan, cho‘llanish yoki sho‘rlanishga tayanish yetarli emas. Landshaft transformatsiyasini iqlimiy, gidrologik, tuproq, biologik, vegetatsion va antropogen komponentlarning o‘zaro ta’siri asosida kompleks baholash ilmiy jihatdan maqsadga muvofiqdir.

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UDK: 378.147:744:004.8

Xonbabayev X.I., p.f.d. (DSc)
professor
Erkinov J.H.
“Ta’limda axborot texnologiyalari” mutaxassisligi magistranti
Qo‘qon davlat universiteti

MUHANDISLIK-GEOMETRIK TA'LIMDA SUN'IY INTELLEKT IMKONIYATLARI: KO'P DARAJALI MODEL VA UNI AMALIYOTGA TATBIQ ETISH

Annotatsiya. Maqolada chizma geometriya va muhandislik grafikasi fanlarini o'qitishda sun'iy intellekt (SI) imkoniyatlari tahlil qilingan. Adabiyotlar tahlili asosida SI imkoniyatlarini talaba, o'qituvchi, kurs va muassasa darajalarida tizimlashtiruvchi ko'p darajali model taklif etildi. Modelning amaliy qo'llanilishi kesmaning haqiqiy uzunligini aniqlash mavzusidagi dars ssenariysi misolida ko'rsatildi. SI dan foydalanishdagi asosiy xavflar tahlil qilinib, o'qituvchilar va ta'lim muassasalari uchun oltita tavsiya ishlab chiqildi.

Kalit so‘zlar: sun'iy intellekt, muhandislik grafikasi, chizma geometriya, fazoviy tafakkur, intellektual tutorlik tizimlari, generativ sun'iy intellekt, dars ssenariysi.

Xonbabayev X.I., DSc in Pedagogical Sciences
professor
Erkinov J.H.
master’s student in Information Technologies in Education
Kokand State University

OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE IN ENGINEERING-GEOMETRIC EDUCATION: A MULTI-LEVEL FRAMEWORK AND ITS IMPLEMENTATION

Abstract. The article analyses the opportunities of artificial intelligence (AI) in teaching descriptive geometry and engineering graphics. Based on a literature review, a multi-level framework is proposed that organizes AI opportunities at the student, instructor, course and institution levels. The practical application of the framework is illustrated by a lesson scenario on determining the true length of a line segment. The main risks of AI use are analysed, and six recommendations for instructors and institutions are formulated.

Keywords: artificial intelligence, engineering graphics, descriptive geometry, spatial reasoning, intelligent tutoring systems, generative AI, lesson scenario.

KIRISH

Fazoviy tafakkur STEM sohalaridagi muvaffaqiyatning eng ishonchli ko'rsatkichlaridan biri hisoblanadi [17]. Muhandislik ta'limida bu qobiliyat asosan chizma geometriya, muhandislik grafikasi va texnik chizmachilik fanlarida rivojlantiriladi: talabalar fazoviy obyektlarni tekislikda tasvirlash, ortogonal proyeksiyalar bo'yicha shaklni tiklash hamda pozitsion va metrik masalalarni grafik usulda yechishni o'rganadilar [2; 3].

Mazkur fanlar ko'plab birinchi kurs talabalari uchun qiyin kechadi. Fazoviy ko'nikmalari sust talabalar fanni o'zlashtirishda qiynaladi, biroq maqsadli mashg'ulotlar bu tafovutni sezilarli kamaytiradi [12]. 217 ta tadqiqot meta-tahlili fazoviy ko'nikmalarni rivojlantirish mumkinligi va natijalar barqarorligini tasdiqlagan [15]. Asosiy muammo – ko'lam: samarali mashg'ulot har bir chizma bo'yicha tez-tez va individual fikr-mulohaza berishni talab qiladi, katta guruhlarda esa o'qituvchi buni ta'minlay olmaydi. Bir vaqtda bir nechta proyeksiyani muvofiqlashtirish bilan bog'liq kognitiv yuklama ham boshlovchi talabalarga to'sqinlik qiladi [13].

Sun'iy intellekt (SI) bu muammoni hal etishda muhim vosita bo'lishi mumkin. Intellektual tutorlik tizimlari (ITT) samaradorligi inson tutorligiga yaqinlashgan [10; 16], generativ SI esa tabiiy tilda tushuntirish va muloqot imkonini beradi [9]. O'zbekiston Respublikasining 2030-yilgacha sun'iy intellekt texnologiyalarini rivojlantirish strategiyasida ta'limda SI dan foydalanish alohida yo'nalish sifatida belgilangan [1]. Shu bilan birga, oliy ta'limda SI bo'yicha tadqiqotlarning aksariyati texnologiyaga yo'naltirilgan va pedagogik nazariya bilan yetarli bog'lanmagan [19]. Muhandislik grafikasida esa SI bo'yicha ishlar alohida vositalar bilan cheklanib, SI kurs tizimining qaysi bo'g'inlarida foyda berishini yaxlit ko'rsatadigan model mavjud emas.

Tadqiqotning maqsadi – muhandislik-geometrik ta'limda SI imkoniyatlarini talaba, o'qituvchi, kurs va muassasa darajalarida tizimlashtiruvchi ko'p darajali model ishlab chiqish, uni dars ssenariysi misolida asoslash hamda SI dan mas'uliyatli foydalanish bo'yicha tavsiyalar berishdan iborat.

MAVZUGA OID ADABIYOTLAR TAHLILI

Ta'limdagi SI ilovalari odatda talabaga, o'qituvchiga va ta'lim tizimiga yo'naltirilgan turlarga ajratiladi. O. Zawacki-Richter va hammualliflar [19] oliy ta'limdagi SI ning to'rt yo'nalishini ajratgan: profillash va bashorat qilish, baholash, adaptiv tizimlar va intellektual tutorlik. L. Chen va hammualliflar [8] mustaqil o'quv dasturlaridan real vaqtda moslashuvchi platformalarga o'tish tendensiyasini qayd etgan.

Eng kuchli empirik dalillar ITT ga tegishli: K. VanLehn [16] bosqichli tutorlik tizimlari inson tutorligiga yaqin natija berishini aniqlagan, J. Kulik va J. Fletcher [10] esa 50 ta nazoratli tadqiqot bo'yicha median ta'sirni 0,66 standart og'ish deb baholagan. Katta til modellari muloqot va kontent yaratish imkonini qo'shadi, ammo ortiqcha tayanish va faktik xatolar xavfini ham tug'diradi [9].

Muhandislik grafikasida kompyuter texnologiyalari uzoq vaqtdan beri asosan chizish vositasi sifatida qo'llanib kelinmoqda. Maxsus kurslar va multimedia

materiallari [12], shuningdek, to'ldirilgan reallik (AR) vositalari [11] talabalarning fazoviy qobiliyatlarini yaxshilagan. Mahalliy tadqiqotlarda muhandislik grafikasini o'qitish metodikasi [3] hamda talabalarning raqamli kompetensiyasini pedagogik va mahalliy texnologiyalar asosida rivojlantirish [4; 5], amaliy mashg'ulotlar sifatini raqamli texnologiyalar orqali oshirish [6] masalalari yoritilgan.

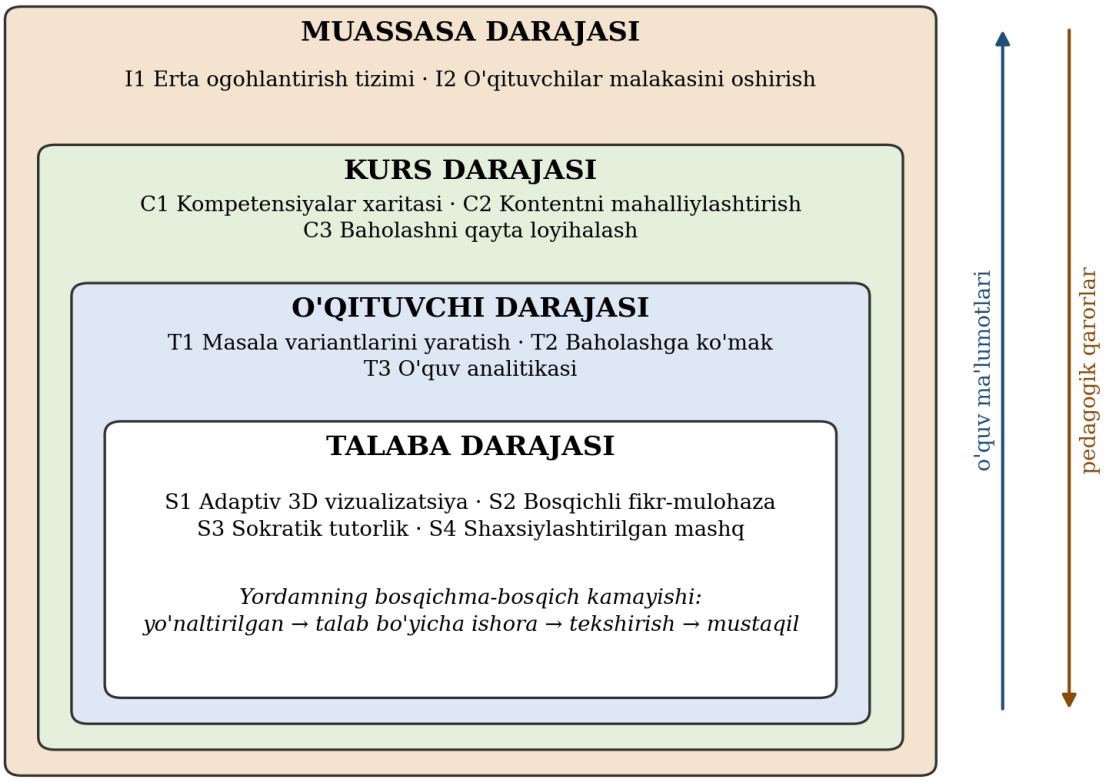
Tadqiqotning nazariy asosini kognitiv yuklama nazariyasi [13] va scaffolding – talaba kompetentligi oshgani sari kamaytirib boriladigan vaqtinchalik yordam nazariyasi [18] tashkil etadi. Tahlil shuni ko'rsatadiki, mavjud ishlar alohida vositalarni (masalan, vizualizatsiya uchun AR yoki chizish uchun CAD) o'rganadi, SI imkoniyatlarini kursning barcha ishtirokchilari va darajalari bo'yicha tizimlashtiruvchi model esa ishlab chiqilmagan.

TADQIQOT METODOLOGIYASI

Tadqiqot loyihaviy-konseptual yondashuv asosida uch bosqichda olib borildi. Birinchi bosqichda Scopus, IEEE Xplore, ERIC va Google Scholar bazalaridan SI ("artificial intelligence", "intelligent tutoring", "generative AI"), fan sohasi ("engineering graphics", "descriptive geometry", "spatial ability") va ta'lim ("education", "learning") tushunchalari bo'yicha manbalar tanlandi; milliy kontekst uchun mahalliy tadqiqotlar va me'yoriy hujjatlar ham o'rganildi. Ikkinchi bosqichda har bir manba SI funksiyasi va undan foyda oluvchi ishtirokchi bo'yicha kodlanib, imkoniyatlar to'rt darajaga taqsimlandi. Uchinchi bosqichda model nazariy izchillik bo'yicha tekshirildi va uning amaliy qo'llanilishi Qo'qon davlat universitetidagi birinchi kurs muhandislik grafikasi fanining bitta darsini loyihalash orqali asoslandi.

TAHLIL VA NATIJALAR

Tahlil natijasida SI ning o'n ikkita imkoniyati aniqlanib, ular to'rtta ichma-ich joylashgan darajaga ajratildi (1-rasm, 1-jadval). Darajalar o'zaro bog'liq: talaba darajasida yig'ilgan ma'lumotlar o'qituvchi analitikasiga, u esa o'z navbatida kursni takomillashtirish va muassasa qarorlariga asos bo'ladi.



1-rasm. Muhandislik-geometrik ta'limda SI imkoniyatlarining ko'p darajali modeli

1-jadval. SI imkoniyatlarining darajalar bo'yicha taqsimlanishi

Daraja va imkoniyat	SI funksiyasi (vositalar)	Kutilayotgan natija
Talaba. S1. Adaptiv 3D vizualizatsiya	Ortogonal proyeksiyalar bilan bog'langan interaktiv modellar (GeoGebra 3D, SI asosidagi CAD, AR)	Kognitiv yuklama kamayadi; fazoviy obraz mustahkamlanadi
S2. Bosqichli fikr-mulohaza	Har bir yasashni tekshirib, xato joyini aniqlaydi (bosqichli ITT, chizmalarni avtomatik tekshirish)	Tezkor, individual tuzatish
S3. Sokratik tutorlik	Tabiiy tilda yo'naltiruvchi savollar va tushuntirishlar (pedagogik promptli til modellari)	Ommaviy tarzda individual yordam
S4. Shaxsiylashtirilgan mashq	Talaba darajasi va xatolariga mos masalalar (adaptiv o'quv platformalari)	Yaqin rivojlanish zonasida mashq qilish
O'qituvchi. T1. Masala variantlarini yaratish	Standart masalalarning parametrik variantlari (til modellari, parametrik CAD skriptlari)	Teng qiyinlikdagi ko'plab topshiriqlar; ko'chirishning kamayishi
T2. Baholashga ko'mak	Chizmalarni mezonlar bo'yicha dastlabki baholash (tasvir va CAD modeli tahlili)	Tez va xolis baholash
T3. O'quv analitikasi	Tipik xatolar va qiynalayotgan talabalarni aniqlash (LMS va ITT panellari)	O'z vaqtida aniq yordam ko'rsatish
Kurs. C1. Kompetensiyalar xaritasi	Topshiriqlarni fazoviy va grafik kompetensiyalar bilan bog'lash	Mavzular bo'yicha izchil rivojlanish
C2. Kontentni mahalliylashtirish	Materiallar va atamalarni tarjima qilish va moslashtirish (glossariy bilan ishlaydigan til modellari)	O'zbek, rus va ingliz tillaridagi materiallar
C3. Baholashni qayta loyihalash	Baholashni jarayon va mulohazaga yo'naltirish (SI qayd etgan yechim tarixi)	SI dan noto'g'ri foydalanishga chidamli baholash
Muassasa. I1. Erta ogohlantirish tizimi	Dastlabki ma'lumotlar asosida o'zlashtira olmaslik xavfini bashorat qilish	Birinchi kursda talabalarni saqlab qolish
I2. O'qituvchilar malakasini oshirish	Pedagogik prompting bo'yicha SI yordamidagi o'quv kurslari	SI ning barqaror va mas'uliyatli joriy etilishi

Modelning barcha darajalari uchun umumiy tamoyil – **SI talabaning fikrlashini almashtirmasligi, balki uni qo'llab-quvvatlashi kerak**. Talaba darajasida bu yordamning to'rt bosqichda kamayib borishi orqali amalga oshiriladi: yo'naltirilgan yordam, talab bo'yicha ishora, faqat tekshirish va mustaqil ishlash [18].

Modelni dars jarayoniga tatbiq etish. Modelning amaliy imkoniyatini asoslash uchun Qo'qon davlat universitetidagi birinchi kurs muhandislik grafikasi

fanidan "Umumiy vaziyatdagi kesmaning haqiqiy uzunligini aniqlash" mavzusidagi 80 daqiqalik dars loyihalandi. Bu metrik masala to'g'ri burchakli uchburchak, aylantirish yoki proyeksiya tekisliklarini almashtirish usullari bilan yechiladi [2]. Dars tuzilmasi 2-jadvalda keltirilgan.

2-jadval. SI funksiyalari qo'llanilgan dars ssenariysi

Bosqich (daq.)	Talaba faoliyati	SI funksiyasi	Model bilan bog'liqligi
1. Faollashtirish (10)	3D kesmani aylantirib, uning proyeksiyalari nima uchun haqiqiy uzunlikdan qisqa ekanini kuzatadi	Frontal va gorizontal proyeksiyalar bilan bog'langan 3D model	S1
2. Yo'naltirilgan yechish (20)	Birinchi masalani savollar beradigan, lekin javobni chizib bermaydigan SI-tutor bilan yechadi	Sokratik tutorlik; bosqichli tekshirish	S3, S2
3. Mustaqil mashq (30)	Uchta parametrik variantni yechadi, faqat qiyinchilikda ishora so'raydi	Variantlar yaratish; talab bo'yicha ishora; qayd etish	T1, S4, S2
4. Tanqidiy tahlil (10)	SI yaratgan, proyeksiyalar farqi noto'g'ri olingan yechimdagi xatoni topadi	Xato SI yechimi o'quv obyekti sifatida	S3
5. Refleksiya (10)	Qaysi usulni nima uchun tanlaganini yozma tushuntiradi	Har bir talabaning ishora va xatolari bo'yicha qisqa hisobot	T3

Ikkinchi bosqichda SI-tutor pedagogik ko'rsatma (prompt) bilan sozlanadi, masalan: "Sen chizma geometriya bo'yicha tutorsan. Hech qachon yakuniy yasash yoki javobni berma. Har safar bitta yo'naltiruvchi savol ber. Talaba xato qilsa, xato qaysi bosqichda ekanini ayt va uni tekshirib ko'rishni so'ra." To'rtinchi bosqichda esa katta til modellarining ishonarli, lekin geometrik jihatdan noto'g'ri yasashlarni tavsiflash kamchiligidan o'quv vositasi sifatida foydalaniladi. Dars yakunida o'qituvchi paneli (T3) guruhda eng ko'p xato qilingan bosqichni ko'rsatadi – masalan, frontal proyeksiyadagi balandliklar farqini gorizontal proyeksiyadagi chuqurliklar farqi bilan adashtirish – va keyingi dars shu xatoni tahlil qilishdan boshlanadi. Ssenariyda GeoGebra va umumiy maqsadli til modeli kabi bepul yoki keng tarqalgan vositalardan foydalanilgani uchun uni maxsus infratuzilmasiz qo'llash mumkin.

Xavflar tahlili. SI dan foydalanishda to'rtta asosiy xavf aniqlandi. Birinchidan, ortiqcha tayanish: generativ SI mashq vaqtidagi natijani yaxshilab, keyinchalik mustaqil ishlash natijasini pasaytirishi mumkin; cheklovlar o'rnatilgan tutor rejimida bu salbiy ta'sir sezilarli kamaygan [7]. Ikkinchidan, geometrik noaniqlik: til modellari fazoviy munosabatlar haqida ravon, ammo ko'pincha noto'g'ri mulohaza yuritadi. Uchinchidan, akademik halollik: SI tayyor chizma

yarata olgani uchun faqat yakuniy natijani baholash o'z ahamiyatini yo'qotadi [14]. To'rtinchidan, teng imkoniyat va til masalasi: qurilma va dasturlardan foydalanish imkoniyati bir xil emas, SI ning o'zbek tilidagi texnik terminologiya bo'yicha aniqligi esa ingliz tilidagiga nisbatan past.

Tadqiqotning asosiy cheklovi uning konseptual xarakteridir: taklif etilgan ssenariy hali empirik jihatdan sinovdan o'tkazilmagan.

XULOSA VA TAKLIFLAR

SI muhandislik-geometrik ta'limning barcha darajalarida imkoniyatlar yaratadi: talabalar adaptiv vizualizatsiya, bosqichli fikr-mulohaza va Sokratik tutorlikdan foydalana oladi; o'qituvchilar masala variantlarini yaratish, baholashni tezlashtirish va xatolarni erta aniqlash imkoniga ega bo'ladi; kurs va muassasa darajasida kompetensiyalarni kuzatish, kontentni mahalliylashtirish va xavf guruhidagi talabalarni aniqlash mumkin bo'ladi. Taklif etilgan model o'n ikkita shunday imkoniyatni tizimlashtiradi, dars ssenariysi esa ularni oddiy mashg'ulotda keng tarqalgan vositalar yordamida uyg'unlashtirish mumkinligini ko'rsatadi.

Tadqiqot natijalari asosida quyidagilar tavsiya etiladi:

1. SI-tutorlarni yakuniy javob bermaydigan pedagogik ko'rsatmalar bilan sozlab qo'llash;

2. aniq o'zlashtirish mezonlari asosida talabalarni yo'naltirilgan ishdan mustaqil ishga bosqichma-bosqich o'tkazish;

3. baholashda yakuniy chizma bilan birga fikrlash jarayoni, ishoralardan foydalanish va xatolarni tuzatishni ham hisobga olish;

4. SI yechimlaridagi xatolardan tanqidiy fikrlashni rivojlantiruvchi topshiriqlar sifatida foydalanish;

5. teng imkoniyatni ta'minlash uchun GeoGebra kabi ochiq va bepul vositalarga ustuvorlik berish;

6. o'qituvchilarning pedagogik prompting, o'quv analitikasi va o'zbek tilidagi terminologiyani mahalliylashtirish bo'yicha malakasini oshirish.

Keyingi bosqichda modelni Qo'qon davlat universitetida nazorat va tajriba guruhlari ishtirokida Purdue Spatial Visualization Test: Rotations testi, masala turlari bo'yicha o'zlashtirish ko'rsatkichlari va SI yordamisiz yechilgan masalalar ulushi asosida empirik tekshirish rejalashtirilgan.

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Xoshimov S.S.
katta o‘qituvchi
Oziq-ovqat texnologiyasi va muhandisligi xalqaro instituti

GLOBALLASHUV DAVRIDA “OMMAVIY MADANIYAT”NING MILLIY O‘ZLIK VA MA’NAVIY QADRIYATLARGA TA’SIRINING IJTIMOIY-FALSAFIY TAHLILI

Annotatsiya. Ushbu maqolada globallashuv jarayonlari ta’sirida ommaviy madaniyatning keng tarqalishi hamda uning milliy qadriyatlar, ma’naviy meros va yoshlar tarbiyasiga ko‘rsatayotgan ta’siri tahlil qilinadi. Ommaviy madaniyatning ijobiy va salbiy jihatlari, milliy o‘zlikni anglash jarayoniga ta’siri hamda yoshlar ongida mafkuraviy immunitetni shakllantirish masalalari yoritilgan. Shuningdek, milliy qadriyatlarni asrashda oila, mahalla va ta’lim muassasalarining o‘rni ochib berilgan.

Kalit so‘zlar: globallashuv, ommaviy madaniyat, milliy qadriyatlar, ma’naviyat, yoshlar, mafkuraviy immunitet, milliy o‘zlik, tarbiya.

Khoshimov S.S.
senior lecturer
International Institute of Food Technology and Engineering

A SOCIO-PHILOSOPHICAL ANALYSIS OF THE IMPACT OF MASS CULTURE ON NATIONAL IDENTITY AND SPIRITUAL VALUES IN THE ERA OF GLOBALIZATION

Abstract. This article analyzes the spread of mass culture under the conditions of globalization and its impact on national values, spiritual heritage, and youth education. The positive and negative aspects of mass culture, its influence on the formation of national identity, and the development of ideological immunity among young people are discussed. The article also highlights the role of family, community institutions, and educational organizations in preserving national values.

Keywords: globalization, mass culture, national values, spirituality, youth, ideological immunity, national identity, education.

Bugungi globallashuv sharoitida ommaviy madaniyat jamiyat hayotining barcha jabhalariga chuqur kirib bormoqda. Internet tarmoqlari, ijtimoiy media platformalari, kino, musiqa va reklama vositalari orqali tarqalayotgan ommaviy madaniyat mahsulotlari yoshlar dunyoqarashi, turmush tarzi va qadriyatlar tizimiga sezilarli ta’sir ko‘rsatmoqda. Bir tomondan, u zamonaviy bilimlar, yangi texnologiyalar va madaniyatlararo muloqotni rivojlantirishga xizmat qilsa, ikkinchi tomondan, milliy an’analar, urf-odatlar va ma’naviy qadriyatlarning zaiflashishiga sabab bo‘lishi mumkin. Ayniqsa, iste’molchilik kayfiyati, individualizm va yengil-

yelpi hayot tarzini targ‘ib qiluvchi g‘oyalar yosh avlodning milliy o‘zligidan uzoqlashish xavfini yuzaga keltirmoqda.

O‘zbek xalqining asrlar davomida shakllangan mehr-oqibat, kattalarga hurmat, oilaparvarlik, mahalla birdamligi kabi qadriyatlari jamiyat barqarorligining muhim omili hisoblanadi. Shu bois ommaviy madaniyatning salbiy ta’sirlariga qarshi kurashishda milliy va umuminsoniy qadriyatlar uyg‘unligini ta’minlash, yoshlarning ma’naviy immunitetini kuchaytirish, ta’lim-tarbiya tizimida milliy meros va madaniyatni keng targ‘ib etish muhim ahamiyat kasb etadi. Milliy qadriyatlarga tayangan holda global axborot makonida faol ishtirok etish, ommaviy madaniyatning ijobiy jihatlaridan oqilona foydalanish va salbiy ko‘rinishlariga tanqidiy yondashish bugungi kunning dolzarb vazifalaridan biridir.

Globallashib borayotgan dunyoda bugungi kunda sodir bo‘layotgan turfa voqea-hodisalarni kuzatgan kishi ma’naviyat aslida insoniyatning qanchalik beqiyos ne’mati ekanligini teran anglaydi. Afsuski, shunday bebaho milliy madaniyat o‘rniga qandaydir “ommaviy madaniyat”ni zo‘rma-zo‘raki tiqishtirayotgan buzg‘unchi kimsalar ham kam emas... Ular “ommaviy madaniyat” niqobi ostida targ‘ib etayotgan turli hayosiz filmlar, suratlar milliy qadriyatlarimizga aslo to‘g‘ri kelmasligini tushunish qiyin emas. Aslida “ommaviy madaniyat” haqiqiy madaniyatning mohiyatiga mutlaqo zid hisoblanadi. Mutaxassislar fikricha, “u insonni ma’nan majruh etadigan, uning ma’naviy dunyosini buzadigan, oxir-oqibat jon saqlashdan o‘zga maqsadi bo‘lmagan bir maxluq darajasiga tushirib qo‘yadigan, xalqni esa olomonga aylantiradigan hodisadir. Shuning uchun ham bunday madaniyatni “olomon madaniyati” deyish mumkin”. Ba’zi mamlakatimizga chetdan kirib kelayotgan tovarlar reklama qilinayotganida e’tibor bersangiz, yonida siyosiy “mahsulot” – qandaydir g‘oya ham bo‘lishi mumkinligini anglaysiz. Bu hol esa asta-sekin milliy madaniyatga yot qadriyatlarga ko‘nikma hosil qildirishi, begona madaniyat bilan “emlanayotgan” odamning etini o‘ldirishi bilan xatarlidir. Bu emlashdan so‘ng “ommaviy madaniyat”ning “og‘ir formalari”dan ham seskanmaslik, begonasiramaslik kayfiyati hukmronlik qila boshlaydi”.

Bunday “ommaviy madaniyat”ni tiqishtirishlaridan maqsadlari moddiy boylik orttirish ekanligi ko‘rinib turibdi. Ruhshunoslar fikricha, bir fikrni tinimsiz uqdirish orqali individga kuchli ta’sir o‘tkazish, uni o‘z yo‘rig‘iga solish mumkin ekan, demak, shu usulda yoshlar ongiga salbiy ta’sir o‘tkazish xavfi yo‘q emas. Yoshlarga qanday tushuntirilsa, ular kutilganidek qabul qilaverishlari mumkin.

“Ommaviy madaniyatning” eng muhim ta’sirlaridan biri milliy o‘zlikni anglash jarayonida namoyon bo‘ladi. Chunki har bir xalqning o‘ziga xos madaniy qiyofasi, tarixiy xotirasi va ma’naviy merosi mavjud. Ommaviy madaniyat vositasida kirib kelayotgan begona qadriyatlar ayrim hollarda yoshlarning milliy madaniyatga bo‘lgan qiziqishini susaytirishi, ona tiliga, milliy adabiyot va san’atga e’tiborning kamayishiga olib kelishi mumkin. Natijada madaniy identifikatsiya inqirozi yuzaga kelib, shaxs o‘z milliy ildizlaridan uzoqlasha boshlaydi.

Ma’naviyati yuksak insonga turli g‘oyalar bilan ta’sir o‘tkazish qiyin. Shuning uchun vayronkor g‘oyalar asosan, yoshlar ongini zaharlashga qaratiladi.

Undan kelajagimiz bo‘lmish yoshlarni asrash uchun ularni yuksak ma’naviyatli qilib tarbiyalashimiz lozim. Yoshlar ommaviy madaniyatning asosiy iste’molchilari hisoblanadi. Ularning ongiga internet, kino, seriallar va ijtimoiy tarmoqlar orqali singdirilayotgan g‘oyalar axloqiy qarashlarning shakllanishiga ta’sir ko‘rsatadi. Zo‘ravonlik, individualizm, yengil hayot tarzi va haddan tashqari moddiy manfaatlarni targ‘ib qiluvchi mahsulotlar yoshlarning ma’naviy kamolotiga salbiy ta’sir qilishi mumkin. Shu sababli yoshlarni tanqidiy fikrlashga o‘rgatish va axborotni saralash madaniyatini shakllantirish muhim ahamiyatga ega.

Milliy qadriyatlarni asrab-avaylashda oila va mahalla muhim ijtimoiy institut hisoblanadi. Oila farzandga dastlabki ma’naviy tarbiyani beradigan maskan bo‘lsa, mahalla esa jamiyatdagi hamjihatlik va birdamlikni mustahkamlovchi omildir. Ommaviy madaniyatning salbiy oqibatlarini kamaytirishda ota-onalar va mahalla faollarining ma’naviy-ma’rifiy faoliyati alohida ahamiyat kasb etadi. Ayniqsa, yoshlarning bo‘sh vaqtini mazmunli tashkil etish va ularni milliy madaniyat namunalariga jalb qilish samarali vositalardan biridir.

Yurtimiz istiqlolga erishgach, milliy ma’naviyat mohiyatini teranroq anglay boshladik. Aytish joizki, sobiq mustabid tuzum davrida ma’naviyat, inson ruhiy olami, adolat, qonun ustuvorligi, milliy-axloqiy qadriyatlar to‘g‘risida asosli fikrlarni eshitish amri mahol edi. Ma’naviy barkamol inson kamoloti uchun suv bilan havodek zarur ma’naviy qadriyatlar qadrini mustaqillik sharofati bilan teran anglab yetdik.

Bugungi globallashuv sharoitida internet, radio va televideniye imkoniyatlari cheksizligi haqida ko‘p gapirilmoqda, asosli maqolalar yoritilmoqda. Bunday imkoniyatlardan aslida yoshlar ongini yot g‘oyalardan asrab qolish yo‘lida samarali foydalanish davr taqozosidir. Ana shundagina “ommaviy madaniyat”ning yoshlar ongiga ta’siri kamayib, asta-sekin barham topib ketishi ham mumkin. Shu bilan bir qatorda yoshlar qalbida milliy qadriyatlarimizga nisbatan mehr uyg‘otib borish maqsadga muvofiqdir. Shunda yoshlar orasida g‘arbona ideallarga ko‘r-ko‘rona ergashish kabi holatlar urchib ketmaydi. Yoshlar qalbida mafkuraviy immunitetni to‘g‘ri shakllantirish imkoniyatlari kengayadi. Mafkuraviy immunitet asosan ta’lim-tarbiya jarayonida hosil qilinadi. Yoshlar ongu shuurida mafkuraviy immunitet puxta bilim olish, his-tuyg‘ular, muayyan ko‘nikmalar vositasida shakllantiriladi. Ayrim mutaxassislar fikricha, taraqqiyotning hozirgi bosqichida xalqlar orasidagi axborot aloqalari jadal kengayib borayotganligi ko‘plab foyda bilan bir qatorda ma’naviy zarar keltirish hollari ham uchrab turganligi asoslab berilayotir. Shu narsa ayonki, bugungi kunda puxta bilim egallamagan yoshlar tanazzulga yuz tutishi mumkin.

Buning uchun oliy ta’lim muassasalarida ta’lim-tarbiya bilan bir qatorda targ‘ibot ishlarini ham to‘g‘ri yo‘lga qo‘yish joizdir. Aytish mumkinki, ayni paytda qator oliy ta’lim muassasalarida bu borada muayyan ishlar amalga oshirilmoqda. Shaxs kamolotining mezoni hisoblangan ma’naviyat va ma’rifat shu tariqa jamiyatimizda o‘ziga xos voqelikka aylanib boraveradi.

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Xudoynazarov M.M.
o‘qituvchi
Toshkent gumanitar fanlar universiteti

O'ZBEKISTON HUDUDIDA TADBIRKORLIK SUBYEKTLARINING BARQARORLIK REYTINGI BO'YICHA TARKIBI

Annotatsiya. Ushbu maqolada O‘zbekiston Respublikasida 2025-yil iyun holatiga ko‘ra tadbirkorlik subyektlarining barqarorlik reytingi statistik ma’lumotlar asosida tahlil qilindi. Reytingning A, B, C va D toifalari bo‘yicha tadbirkorlik subyektlarining taqsimlanishi, ularning iqtisodiy barqarorligi hamda biznes muhitini rivojlantirishdagi ahamiyati yoritildi. Shuningdek, tadbirkorlik faoliyatini rag‘batlantirish va yuqori reytingga ega korxonalar ulushini oshirish bo‘yicha tahlil qilingan.

Kalit so‘zlar: tadbirkorlik, barqarorlik reytingi, A reyting, B reyting, C reyting, D reyting, biznes muhiti, iqtisodiy rivojlanish, statistik tahlil.

Khudoynazarov M.M.
lecturer
Tashkent University of Humanities

COMPOSITION OF BUSINESS ENTITIES IN UZBEKISTAN BASED ON THE SUSTAINABILITY RATING

Abstract. This article analyzes the sustainability rating of business entities in the Republic of Uzbekistan based on statistical data as of June 2025. It examines the distribution of business entities across rating categories A, B, C, and D, as well as their economic stability and significance in the development of the business environment. Furthermore, the article analyzes measures to incentivize entrepreneurial activity and increase the share of enterprises with high ratings.

Keywords: entrepreneurship, sustainability rating, A rating, B rating, C rating, D rating, business environment, economic development, statistical analysis.

Kirish

Bozor iqtisodiyoti sharoitida tadbirkorlik subyektlari mamlakat iqtisodiyotining asosiy tayanchi hisoblanadi. Ular yalpi ichki mahsulot hajmini oshirish, yangi ish o‘rinlarini yaratish, aholi bandligini ta'minlash, eksport salohiyatini kengaytirish hamda davlat byudjeti daromadlarini ko‘paytirishda muhim o‘rin egallaydi. Shu bois dunyoning rivojlangan davlatlarida tadbirkorlik faoliyatini qo‘llab-quvvatlash, uning moliyaviy barqarorligini ta'minlash va biznes muhitini yaxshilash davlat siyosatining ustuvor yo‘nalishlaridan biri hisoblanadi.

So‘nggi yillarda O‘zbekiston Respublikasida ham xususiy mulk daxlsizligini ta'minlash, tadbirkorlik subyektlarini qo‘llab-quvvatlash, investitsiya muhitini yaxshilash hamda iqtisodiyotda raqobatni rivojlantirish bo‘yicha keng ko‘lamli

islohotlar amalga oshirilmoqda. Prezidentimiz tomonidan qabul qilinayotgan farmon va qarorlar orqali kichik biznes va xususiy tadbirkorlikni rivojlantirish, byurokratik to‘siqlarni kamaytirish, davlat xizmatlarini raqamlashtirish hamda tadbirkorlar uchun qulay sharoit yaratishga alohida e'tibor qaratilmoqda.

Mazkur islohotlarning muhim yo‘nalishlaridan biri tadbirkorlik subyektlarining barqarorlik reytingi tizimini joriy etish hisoblanadi. Ushbu tizim korxonalarning moliyaviy holati, soliq intizomi, ishchi-xodimlar soni, ishlab chiqarish samaradorligi, aylanma mablag‘lari, kredit majburiyatlari, faoliyat davomiyligi va boshqa iqtisodiy ko‘rsatkichlar asosida baholanadi. Reyting natijalari korxonalarning iqtisodiy ishonchlilik darajasini aniqlash, ularning rivojlanish istiqbollarini baholash hamda davlat tomonidan qo‘llab-quvvatlash choralarini belgilashda muhim ahamiyat kasb etadi.

Barqarorlik reytingining joriy etilishi davlat organlari, banklar, investorlar hamda xalqaro moliyaviy institutlar uchun ham katta ahamiyatga ega. Chunki yuqori reytingga ega korxonalar moliyaviy jihatdan ishonchli hisoblanib, ularga kredit ajratish, investitsiya kiritish yoki davlat xaridlarida ishtirok etish bo‘yicha qarorlar qabul qilish jarayonida ushbu reyting muhim mezon vazifasini bajaradi. Shu bilan birga, reyting tizimi halol faoliyat yuritayotgan tadbirkorlarni rag‘batlantirish, soliq intizomini mustahkamlash va yashirin iqtisodiyot ulushini qisqartirishga xizmat qiladi.

2025-yil iyun oyidagi statistik ma'lumotlarga ko‘ra, O‘zbekistonda 568 mingdan ortiq tadbirkorlik subyekti barqarorlik reytingi asosida baholangan. Mazkur natijalar tadbirkorlik subyektlarining iqtisodiy holatini tahlil qilish, ularning moliyaviy barqarorligini aniqlash hamda biznes muhitidagi mavjud muammolarni baholash imkonini beradi. Reyting natijalari shuni ko‘rsatadiki, yuqori barqarorlikka ega korxonalar soni nisbatan kam bo‘lib, asosiy ulush o‘rta va past reytingdagi tadbirkorlik subyektlariga to‘g‘ri kelmoqda. Bu esa korxonalarning boshqaruv sifatini oshirish, moliyaviy intizomni kuchaytirish hamda zamonaviy boshqaruv usullarini keng joriy etish zarurligini ko‘rsatadi.

1-jadval

2025-yil iyun holatiga ko'ra tadbirkorlik subyektlarining barqarorlik reytingi[47]

Reyting	Toifa	Korxonalar soni	Ulushi (%)
AA	Eng yuqori	356	0.06
A	yuqori	625	0.11
A-	barqaror	1337	0.24
BB	Yaxshi	8450	1.49
B	O’rta	25200	4.43
B-	Barqaror	47069	8.28
CC	Qonqarli	30814	5.42
C	ortacha	111676	19.65
C-	past	102769	18.08

1-jadval ma'lumotlariga ko‘ra, 2025-yil iyun holatida O‘zbekistonda jami 568 286 ta tadbirkorlik subyekti barqarorlik reytingi asosida baholangan. Shundan 245 259 ta (43,15%) korxona C reytingini, 239 390 ta (42,13%) korxona esa D reytingini egallagan. Bu ko‘rsatkich mamlakatdagi tadbirkorlik subyektlarining katta qismi hali yuqori moliyaviy barqarorlik darajasiga erishmaganini ko‘rsatadi. B reytingiga ega korxonalar soni 80 719 ta (14,20%) bo‘lib, ular faoliyatini yanada takomillashtirish orqali yuqori reytingga chiqish imkoniyatiga ega. A reytingidagi korxonalar esa 2 318 ta (0,41%) ni tashkil etadi. Bu ko‘rsatkich yuqori moliyaviy intizom va samarali boshqaruvga ega korxonalar ulushi hali nisbatan past ekanligini bildiradi.Bugungi kunda barqarorlik reytingi nafaqat tadbirkorlik subyektlarini baholash vositasi, balki mamlakat iqtisodiyotining rivojlanish darajasini aks ettiruvchi muhim indikatorlardan biri sifatida ham qaralmoqda. Ushbu tizim orqali iqtisodiyotning qaysi tarmoqlarida rivojlanish yuqori, qaysilarida esa qo‘shimcha qo‘llab-quvvatlash zarurligi aniqlanadi. Shuningdek, reyting natijalari hududlar kesimida tadbirkorlik faolligini baholash, investitsiya siyosatini shakllantirish va iqtisodiy rivojlanish strategiyalarini ishlab chiqishda ham muhim axborot manbai bo‘lib xizmat qiladi.

Mazkur maqolaning asosiy maqsadi O‘zbekiston Respublikasida tadbirkorlik subyektlarining barqarorlik reytingi tizimini ilmiy jihatdan tahlil qilish, 2025-yil

[47] 2025-yil iyun oyi statistik ma'lumotlari asosida muallif tomonidan tuzilgan.

iyun holatidagi statistik ma'lumotlarni o‘rganish, reyting natijalarining iqtisodiyotga ta'sirini baholash hamda ushbu tizimni yanada takomillashtirish bo‘yicha ilmiy-amaliy takliflar ishlab chiqishdan iborat. 2025-yil iyun holatiga ko‘ra O‘zbekiston Respublikasida jami 568 286 ta tadbirkorlik subyekti barqarorlik reytingi asosida baholangan. Statistik ma'lumotlar shuni ko‘rsatadiki, korxonalarning asosiy qismi C va D reyting toifalarida jamlangan. Xususan, 245 259 ta tadbirkorlik subyekti C reytingini, 239 390 ta subyekt esa D reytingini egallagan. Bu holat mamlakatdagi ko‘plab korxonalar hali yuqori moliyaviy barqarorlik darajasiga erishmaganini hamda ularning iqtisodiy faoliyatini yanada takomillashtirish zarurligini ko‘rsatadi. Yuqori barqarorlikni ifodalovchi A reytingiga jami 2 318 ta tadbirkorlik subyekti kiritilgan. Ushbu toifaga kiruvchi korxonalar moliyaviy intizomga rioya qilishi, soliqlarni o‘z vaqtida to‘lashi, faoliyatida jiddiy kamchiliklarning mavjud emasligi hamda samarali boshqaruv tizimiga ega ekanligi bilan ajralib turadi. Bunday korxonalar investitsiyalarni jalb qilish, bank kreditlarini olish va davlat xaridlarida ishtirok etishda yuqori ishonchga ega hisoblanadi. B reytingidagi 80 719 ta korxona esa iqtisodiy faoliyatini barqaror olib borayotgan bo‘lsa-da, ayrim moliyaviy va boshqaruv ko‘rsatkichlarini yaxshilash orqali yuqori reytingga erishish imkoniyatiga ega. Mazkur toifadagi tadbirkorlik subyektlari mamlakat iqtisodiyotining muhim qismini tashkil etib, ishlab chiqarish va xizmat ko‘rsatish sohalarida faol ishtirok etmoqda. Tahlillar shuni ko‘rsatadiki, yuqori reytingga ega korxonalar ulushining kamligi davlat tomonidan tadbirkorlarni qo‘llab-quvvatlash mexanizmlarini yanada rivojlantirish zarurligini ko‘rsatadi. Shu bilan birga, C va D toifalaridagi korxonalar sonining yuqoriligi moliyaviy boshqaruv, soliq intizomi va zamonaviy boshqaruv texnologiyalarini joriy etish bo‘yicha qo‘shimcha chora-tadbirlarni amalga oshirish lozimligini anglatadi. Barqarorlik reytingi tizimi nafaqat tadbirkorlik subyektlarini baholash vositasi, balki mamlakat iqtisodiy siyosatini shakllantirishda muhim axborot manbai sifatida ham xizmat qiladi. Reyting natijalari asosida iqtisodiyotning qaysi tarmoqlarida rivojlanish sur'atlari yuqori yoki pastligi aniqlanadi, davlat tomonidan qo‘llab-quvvatlash choralari esa aniq yo‘naltiriladi. Natijada tadbirkorlik muhitining jozibadorligi oshib, sog‘lom raqobat muhiti shakllanadi hamda mamlakat iqtisodiyotining barqaror o‘sishi ta'minlanadi. Umuman olganda, tahlil natijalari 2025-yilda transport xizmatlari tarkibida avtomobil transporti mutlaq ustunlik qilganini ko'rsatadi. Shu bilan birga, havo transporti va yordamchi transport faoliyati xizmatlarining salmog'i ham sezilarli darajada bo'lib, transport-logistika tizimining izchil rivojlanganidan dalolat beradi. Quvur va temir yo'l transporti xizmatlari nisbatan kichik ulushga ega bo'lsa-da, ular iqtisodiyotning strategik tarmoqlarini uzluksiz faoliyat bilan ta'minlashda muhim o'rin egallaydi.

2025-yil yakunlari bo'yicha xizmatlar sohasi tarkibida ham savdo xizmatlari eng yuqori ulushni egalladi. Statistik ma'lumotlarga ko'ra, 2025-yil yanvar–dekabr oylarida savdo xizmatlari hajmi 2024-yilga nisbatan 31 962,2 mlrd so'mga ortib, 186 957,3 mlrd so'mni tashkil etdi. Mazkur ko'rsatkich savdo xizmatlarining xizmatlar umumiy hajmidagi ulushi 53,2 foizga yetganini ko'rsatadi. Bu esa xizmatlar sohasida yaratilayotgan qo'shilgan qiymatning yarmidan ko'pi aynan

savdo tarmog'i hissasiga to'g'ri kelganini anglatadi. Savdo xizmatlari tarkibida ulgurji savdo xizmatlari ustunlik qilgani kuzatildi. Ularning ulushi 32,3 foizni tashkil etgan bo'lsa, avtomobillar va mototsikllarning ulgurji hamda chakana savdosi, shuningdek, ularni ta'mirlash bilan bog'liq xizmatlar savdo xizmatlarining 14,5 foizini egalladi. Mazkur ko'rsatkichlar mamlakatda ichki savdo aylanmasining kengaygani, transport vositalariga bo'lgan talabning ortgani hamda avtomobil bozori va servis xizmatlari rivojlanganini ko'rsatadi. Moliyaviy xizmatlar ham xizmatlar sohasining muhim tarkibiy qismi sifatida ijobiy o'sish sur'atlarini namoyon etadi. Tahlil qilinayotgan davrda moliyaviy xizmatlar hajmi 36 034,5 mlrd so'mga oshib, 171 867,0 mlrd so'mni tashkil etadi. Natijada ushbu sohada 24,6 foizlik o'sish qayd etildi. Bunday o'sish bank xizmatlari, kreditlash, elektron to'lov tizimlari hamda boshqa moliyaviy xizmatlarga bo'lgan talabning ortib borayotganidan dalolat beradi. Moliyaviy xizmatlar tarkibida sug'urtalash va nafaqa ta'minoti bilan bog'liq xizmatlar 88,0 foiz ulushni egallab, ushbu yo'nalishning moliyaviy xizmatlar bozorida yetakchi o'rinda ekanligini ko'rsatadi. Sug'urtalash xizmatlarining umumiy xizmatlar tarkibidagi ulushi 7,3 foiz, yordamchi moliyaviy xizmatlar ulushi esa 4,7 foizni tashkil etadi. Ushbu natijalar mamlakatda sug'urta tizimi va moliyaviy infratuzilmaning bosqichma-bosqich rivojlanayotganini tasdiqlaydi. Aloqa va axborotlashtirish xizmatlari ham iqtisodiyotning jadal rivojlanayotgan yo'nalishlaridan biri bo'lib, 2025-yil yanvar–dekabr oylarida mazkur xizmatlar hajmi 79 485,5 mlrd so'mni tashkil etadi. Ushbu ko'rsatkich raqamli texnologiyalarning keng joriy etilishi, telekommunikatsiya infratuzilmasining rivojlanishi hamda dasturiy mahsulotlar va axborot texnologiyalariga bo'lgan talabning ortib borayotganini ifodalaydi. Ayniqsa, davlat xizmatlarini raqamlashtirish, elektron tijoratning rivojlanishi va IT sohasiga qaratilgan investitsiyalar ushbu tarmoqning barqaror o'sishiga ijobiy ta'sir ko'rsatadi.

Xulosa

Xulosa tariqasida shuni aytib o‘tish kerakki, tadbirkorlik subyektlarining barqarorlik reytingi tizimi O‘zbekiston iqtisodiyotida sog‘lom raqobat muhitini shakllantirish, biznes faoliyatining shaffofligini ta'minlash hamda tadbirkorlarni rag‘batlantirishda muhim vosita hisoblanadi. Ushbu tizim orqali korxonalarning moliyaviy barqarorligi, soliq intizomi va iqtisodiy faoliyati kompleks baholanadi, natijada davlat organlari, banklar va investorlar uchun ishonchli axborot bazasi yaratiladi. 2025-yil iyun oyidagi statistik ma'lumotlar tahlili shuni ko‘rsatdiki, respublikada baholangan tadbirkorlik subyektlarining asosiy qismi C va D reyting toifalariga to‘g‘ri kelmoqda. Bu esa ko‘plab korxonalarda moliyaviy boshqaruv, ishlab chiqarish samaradorligi hamda soliq intizomini yanada takomillashtirish zarurligini anglatadi. Shu bilan birga, A va B reytingiga ega korxonalar iqtisodiyotning barqaror rivojlanishiga, investitsiyalarni jalb etishga va yangi ish o‘rinlarini yaratishga salmoqli hissa qo‘shmoqda. Kelgusida tadbirkorlik subyektlarining yuqori reytingga erishishini ta'minlash uchun raqamli texnologiyalarni keng joriy etish, moliyaviy boshqaruv sifatini oshirish, soliq ma'murchiligini yanada soddalashtirish hamda tadbirkorlarni davlat tomonidan

qo‘llab-quvvatlash mexanizmlarini takomillashtirish maqsadga muvofiqdir. Bundan tashqari, tadbirkorlarning moliyaviy savodxonligini oshirish, innovatsion loyihalarni qo‘llab-quvvatlash va xalqaro standartlarga mos boshqaruv tizimlarini joriy etish barqarorlik reytingining yuqori bo‘lishiga xizmat qiladi.

Umuman olganda, tadbirkorlik subyektlarining barqarorlik reytingi tizimini izchil rivojlantirish va uning natijalaridan samarali foydalanish mamlakat iqtisodiyotining barqaror o‘sishini ta'minlash, investitsiyaviy jozibadorlikni oshirish, biznes muhitini yanada yaxshilash hamda O‘zbekistonning xalqaro iqtisodiy maydondagi raqobatbardoshligini mustahkamlashga xizmat qiladi. Bu esa uzoq muddatda aholi farovonligini oshirish, yangi ish o‘rinlarini yaratish va iqtisodiyotning barqaror rivojlanishini ta'minlash uchun muhim omillardan biri bo‘lib qoladi.

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Xusanov U.Sh., kimyo fanlari bo‘yicha falsafa doktori (PhD) dotsent
Andijon davlat tibbiyot instituti

BAZALT MINERAL PAXTA ISHLAB CHIQARISHDA KOKS XOKASIDAN IKKILAMCHI YOQILG‘I SIFATIDA FOYDALANISHNING FIZIK-KIMYOVIY VA TEXNOLOGIK ASOSLARI

Annotatsiya. Maqolada bazalt mineral paxta ishlab chiqarishning vagranka pechida ishlatiladigan koksni tashish va saralash jarayonida hosil bo‘ladigan mayda fraksiyalarni briketlash orqali qayta ishlatish istiqbollari ko‘rib chiqilgan. Koks xokasining dastlabki namlik va yonish issiqligi ko‘rsatkichlari asosida yoqilg‘i resursining texnologik ahamiyati baholangan. Fenol-formaldegid smolasi asosidagi bog‘lovchi bilan briketlash uchun zarur nazorat parametrlarining tizimli sxemasi taklif etilgan. Shuningdek, mavjud xomashyo zaxirasi bo‘yicha shartli iqtisodiy ssenariy ishlab chiqilib, iqtisodiy natijani real tajriba va ishlab chiqarish sinovlari bilan tasdiqlash zarurligi asoslangan. Ish dastlabki tavsiflash va texnologik loyihalash bosqichiga mansub bo‘lib, tayyor briketning vagrankadagi samaradorligi hali isbotlangan deb qaralmaydi.

Kalit so‘zlar: koks xokasi, briketlash, fenol-formaldegid smolasi, vagranka pechi, bazalt mineral paxta, resurs tejamkorlik, yoqilg‘i samaradorligi.

Khusanov U.Sh., PhD in Chemistry
associate professor
Andijan State Medical Institute

PHYSICOCHEMICAL AND TECHNOLOGICAL BASIS FOR REUSING COKE BREEZE AS SECONDARY FUEL IN BASALT MINERAL WOOL PRODUCTION

Abstract. This paper examines the potential reuse of coke breeze generated during handling and screening of coke used in cupola furnaces for basalt mineral wool production. Preliminary moisture and calorific-value data are discussed as indicators of fuel potential. A framework for phenol–formaldehyde resin briquetting is proposed, emphasizing mechanical integrity, permeability, thermal behavior and emissions control. An illustrative economic scenario is presented without claiming verified savings. The study is limited to preliminary characterization and process design; actual briquette performance requires laboratory validation and industrial trials.

Keywords: coke breeze, briquetting, phenol–formaldehyde resin, cupola furnace, basalt mineral wool, resource efficiency, fuel utilization.

KIRISH

Mineral paxta ishlab chiqarish sanoatida xomashyoni eritish bosqichi energiya sarfi yuqori bo‘lgan texnologik jarayonlardan biridir. Bazalt, ohaktosh va boshqa mineral komponentlarni eritishda ishlatiladigan vagranka pechi issiqlik balansining muhim qismi qattiq yoqilg‘i — koks bilan ta’minlanadi. Yoqilg‘ining yirik fraksiyalari pech shaxtasida gaz oqimining o‘tishi, qatlamning mexanik barqarorligi va issiqlik almashinuvi uchun zarur. Shu sababli koksni faqat kimyoviy tarkibi yoki yonish issiqligi bo‘yicha baholash yetarli emas: uning bo‘lak o‘lchami, mustahkamligi va gaz o‘tkazuvchanlikka ta’siri ham hal qiluvchi ahamiyat kasb etadi.

Koksni uzoq masofaga tashish, qayta yuklash, omborlash va ishlab chiqarishga uzatish jarayonlarida mexanik yemirilish tufayli mayda fraksiyalar paydo bo‘ladi. Ularni yirik koks bilan bir xil rejimda pechga yuklash gaz oqimiga qarshilikni oshirishi, chang olib chiqilishini kuchaytirishi va qatlamning notekis ishlashiga olib kelishi mumkin. Shu bois koks xokasini qayta ishlash masalasi oddiy chiqindi utilizatsiyasi emas, balki pechning issiqlik va aerodinamik rejimlari bilan uzviy bog‘langan muhandislik vazifasidir.

Mayda dispersli uglerodli materiallarni briketlash ularni ma’lum shakl va mexanik xossalarga ega bo‘lgan mahsulotga aylantirish imkonini beradi. Ammo har qanday briket pechda yirik koksning to‘liq o‘rnini bosa olmaydi. Briket namlik ta’sirida parchalanmasligi, tashish vaqtida changlanmasligi, qizdirilganda keskin yemirilmasligi va pech shaxtasida yetarli bo‘shliqni saqlashi kerak. Bog‘lovchining kimyoviy tabiati esa issiqlik ta’siridagi parchalanish mahsulotlari, qoldiq kul va emissiyalar bilan bog‘liq yangi cheklovlarni keltirib chiqaradi.

Fenol-formaldegid smolalarining ayrim turlari uglerodli zarrachalarni bog‘lash va termik ishlovdan so‘ng uglerodli qoldiq hosil qilish xususiyati bilan qiziqish uyg‘otadi. Shunga qaramay, fenol-formaldegid asosidagi bog‘lovchining past haroratda mustahkamlik berishi yuqori haroratli vagranka sharoitida tayyor briketning yaxlitligini kafolatlamaydi. Bog‘lovchi parchalanishi, uchuvchan mahsulotlar ajralishi va qoldiq strukturaning mustahkamligi alohida o‘rganilishi shart.

Ushbu maqolaning maqsadi — bazalt mineral paxta ishlab chiqarishda hosil bo‘ladigan koks xokasining dastlabki fizik-kimyoviy ko‘rsatkichlari asosida uni briketlashning ilmiy-texnologik shartlarini aniqlash va keyingi eksperimental tadqiqotlar uchun tekshiriladigan mezonlarni ishlab chiqish. Tadqiqot vazifalari koks xokasining boshlang‘ich holatini tavsiflash, bog‘lovchi tanlashdagi muammolarni ko‘rsatish, briket sifatini baholash dasturini shakllantirish hamda iqtisodiy samaradorlikning hisoblash modelini taklif etishdan iborat.

MATERIALLAR VA TADQIQOT YONDASHUVI

Tadqiqot obyekti sifatida bazalt mineral issiqlik izolyatsiya materiallari ishlab chiqarish texnologiyasida qo‘llanadigan koksni tashish va ishlov berish jarayonlarida hosil bo‘lgan mayda fraksiyali koks xokasi qaraladi. Mavjud dastlabki laboratoriya ma’lumotlariga ko‘ra, namuna namligi 1,17%, yonish issiqligi esa 6530 kkal/kg bo‘lgan. Yonish issiqligi kalorimetrik usulda, namlik esa ST-100A

turidagi tezkor namlik analizatorida aniqlangani qayd etilgan. Tahlil uchun namuna maydalangan va 0,08 mm elakdan o‘tkazilgan. Ushbu qiymatlar mualliflar taqdim etgan dastlabki kuzatuvlardir; ularning takroriy o‘lchovlari, standart og‘ishi va o‘lchash noaniqligi mavjud ma’lumotlarda ko‘rsatilmagan.

Kalorifik ko‘rsatkichni SI birliklarida ifodalash uchun 1 kkal = 4,184 kJ konversiyasi qo‘llanadi. Shunga ko‘ra 6530 kkal/kg taxminan 27,32 MJ/kg ga teng. Ushbu sonning yuqori yoki quyi yonish issiqligiga tegishliligi laboratoriya protokolida aniqlashtirilishi kerak; mazkur maqolada u shunchaki berilgan kalorimetrik natijaning birliklararo qayta hisobidir.

Briketlash uchun bog‘lovchi sifatida fenol-formaldegid smolasining rezol tipidagi tizimlari ilmiy jihatdan ko‘rib chiqiladi. Dastlabki ishlab chiqarish sinovida 1000 kg koks xokasiga 200 kg smola qo‘shish varianti tilga olingan. Bu 20% bog‘lovchi/koks massa nisbati yoki umumiy ho‘l aralashma massasiga nisbatan 16,7% bog‘lovchi ulushiga mos keladi. Biroq smolaning quruq modda miqdori va suv ulushi aniqlanmaganligi sababli mazkur nisbatni quruq bog‘lovchi sarfi sifatida talqin qilib bo‘lmaydi. Ushbu kompozitsiya optimal deb tasdiqlanmagan; u keyingi tajribalar uchun dastlabki solishtirish nuqtasi bo‘lishi mumkin.

Briketlash jarayonini asoslashda zarracha o‘lchamlari taqsimoti, bog‘lovchining qovushqoqligi va quruq qoldig‘i, aralashtirishning bir xilligi, presslash bosimi, ushlab turish davomiyligi, quritish yoki qotirish rejimi kabi omillarni birgalikda hisobga olish zarur. Ularning aniq qiymatlarini tajriba natijalarisiz qat’iy me’yor sifatida keltirish ilmiy jihatdan noto‘g‘ri bo‘ladi. Shu sababli ushbu maqolada ular o‘lchanishi va optimallashtirilishi kerak bo‘lgan omillar sifatida tavsiflanadi.

Taklif etilayotgan tadqiqot dizayni bosqichma-bosqich yondashuvga asoslanadi. Birinchi bosqichda koks xokasining namligi, kul miqdori, uchuvchan moddalari, granulometrik tarkibi va yonish issiqligi o‘lchanadi. Ikkinchi bosqichda bog‘lovchi sarfi va presslash sharoitlari bo‘yicha tajriba seriyalari shakllantiriladi. Uchinchi bosqichda tayyor briketlarning zichligi, siqilishdagi mustahkamligi, zarbaga va ishqalanishga chidamliligi, suv ta’siridagi barqarorligi va termik parchalanishi baholanadi. To‘rtinchi bosqichda laboratoriya natijalari ijobiy bo‘lsa, nazorat qilinadigan sanoat sinovi o‘tkaziladi.

Statistik ishonchlilik uchun har bir tajriba sharoitida mustaqil tayyorlangan namunalar va takroriy o‘lchovlar zarur. Natijalar o‘rtacha qiymat, standart og‘ish va zarur bo‘lsa ishonch oralig‘i bilan ifodalanishi lozim. Biroq hozircha bunday seriyalar bo‘yicha sonli natijalar taqdim etilmaganligi sababli maqolada ularning mavjudligi da’vo qilinmaydi.

1-jadval. Koks xokasining mavjud dastlabki ko‘rsatkichlari

Ko‘rsatkich	Qiymat	Izoh
Namlik	1,17%	Dastlabki o‘lchov; takrorlar soni noma’lum
Yonish issiqligi	6530 kkal/kg	Kalorimetrik natija; yuqori/quyi turi aniqlashtiriladi
SI birlikdagi ekvivalenti	≈27,32 MJ/kg	6530 × 4,184 / 1000
Tahlilga tayyorlash	0,08 mm elak	Laboratoriya namunasini tayyorlash
Kul va uchuvchan moddalar	Ma’lumot yo‘q	Qo‘shimcha tahlil talab etiladi

NATIJALAR VA ULARNING ILMIY MUHOKAMASI

Dastlabki o‘lchovda aniqlangan 1,17% namlik koks xokasining tekshirilgan paytdagi nisbatan quruq holatini ifodalaydi. Biroq namlikning pastligi o‘z-o‘zidan briketlash uchun optimal holatni anglatmaydi. Ayrim bog‘lovchi tizimlarida suv zarrachalar sirtiga taqsimlanish va qotish jarayoniga ta’sir etadi; boshqa sharoitlarda ortiqcha suv zichlashishni qiyinlashtiradi. Demak, briketlashdan oldingi namlik bilan tayyor briketning mustahkamligi orasidagi bog‘lanish tajribaviy aniqlanishi lozim.

Yonish issiqligining 6530 kkal/kg qiymati koks xokasida energiya resursi mavjudligini ko‘rsatadi. Shu bilan birga, energiya zichligi pechga mos yoqilg‘i yaratish uchun yetarli mezon emas. Bir xil issiqlik qiymatiga ega ikki turdagi yoqilg‘i zarracha kattaligi, reaktivligi, kulning erish xususiyati va gaz oqimiga qarshiligi bo‘yicha keskin farqlanishi mumkin. Shu sababli briketni pechga tatbiq etishda faqat laboratoriya kalorimetriyasiga tayanish mumkin emas.

Mayda fraksiyalarni yiriklashtirish natijasida materialning geometrik o‘lchami o‘zgaradi, biroq ichki g‘ovaklik, tashqi shakl va zichlik bir-biriga zid ta’sir ko‘rsatishi mumkin. Juda zich briket tashishga bardoshli bo‘lishi mumkin, ammo gaz bilan kontakt yuzasi va reaksion tezligi kamayishi ehtimoli bor. Aksincha, haddan tashqari g‘ovak briket tez reaksiyaga kirishishi, lekin mexanik yuklanishda yemirilishi mumkin. Shuning uchun maqsad bitta maksimal ko‘rsatkichga erishish emas, balki mexanik barqarorlik va termokimyoviy xususiyatlar o‘rtasidagi muvozanatni topishdir.

Fenol-formaldegid bog‘lovchisining afzalligi zarrachalararo bog‘lanishni kuchaytirish imkoniyati bilan bog‘liq. Biroq smolaning kimyoviy turi, qotish darajasi, tarkibidagi erkin fenol va formaldegid miqdori, namlik hamda boshqa modifikatorlar yakuniy xossalarga ta’sir qiladi. Ayniqsa, vagranka kabi yuqori haroratli qurilmada smolaning organik qismi parchalanadi. Shu sababli briketning '1500°C gacha chidamliligi' kabi ifodalar termik sinov natijasisiz ishlatilmasligi kerak; muhim mezon qizdirish davomida yetarli struktura va qatlam o‘tkazuvchanligini saqlashdir.

Termik barqarorlikni baholashda termogravimetrik tahlil, bosqichma-bosqich qizdirish va qizdirilgandan keyingi mexanik sinovlar o‘zaro to‘ldiruvchi usullardir. Termogravimetrik egri chiziq massa yo‘qotilishining haroratga bog‘liqligini beradi, lekin u sanoat pechida briketning mexanik butunligini to‘liq tavsiflamaydi. Shu bois termik tahlil natijalarini haqiqiy yuklanish sharoitidagi sinovlar bilan birga baholash zarur.

Bog‘lovchining ko‘payishi bilan briketning dastlabki mustahkamligi ortishi mumkin, ammo bu yoqilg‘ining sof energetik ulushini kamaytirishi, xarajatlarni oshirishi va qo‘shimcha emissiya xavfini keltirib chiqarishi mumkin. Shu sababli 200 kg/t kabi dastlabki sarfni iqtisodiy jihatdan ma’qul yoki texnologik optimal deb e’lon qilish mumkin emas. Bog‘lovchining quruq modda bo‘yicha aniq sarfi va bir birlik tayyor briketga to‘g‘ri keladigan energiya hamda xarajatlar birgalikda hisoblanishi kerak.

Vagranka pechida yoqilg‘i sifatini baholashda gaz o‘tkazuvchanlik alohida o‘rin tutadi. Shaxta qatlamining haddan tashqari zichlashuvi havo oqimining notekis taqsimlanishiga, ayrim zonalarda yetarli oksidlanmaslikka va jarayonning beqarorlashishiga olib kelishi mumkin. Briketning shakli va o‘lchami, maydalanishga moyilligi hamda yuklashdagi deformatsiyasi pechning gidravlik qarshiligiga ta’sir etishi ehtimoli bor. Ushbu ta’sir laboratoriya kolonnasi yoki kichik miqyosdagi qatlam sinovlari bilan tekshirilishi maqsadga muvofiq.

Briketlarning sanoat sinovi bosqichida bazalt eritmasining harorati, tarkib barqarorligi, eritish unumdorligi, koksning solishtirma sarfi, chang ajralishi va chiqindi gazlar tarkibi monitoring qilinishi kerak. Nazorat davri bilan tajriba davrida mineral xomashyo tarkibi, havo sarfi va yuklama imkon qadar bir xil bo‘lishi talab etiladi. Aks holda kuzatilgan o‘zgarishlarni aynan briket yoqilg‘isining ta’siri bilan bog‘lash qiyinlashadi.

Fenol-formaldegid smolasidan foydalanish mehnat muhofazasi va ekologik xavfsizlik nuqtayi nazaridan ham tekshiruvni talab qiladi. Aralashtirish va qotirish bosqichida uchuvchan organik moddalar ajralishi mumkin; termik parchalanish bosqichida esa gazsimon mahsulotlar tarkibi bog‘lovchi formulasi va yonish sharoitiga bog‘liq bo‘ladi. Shuning uchun shamollatish, mahalliy aspiratsiya, tegishli shaxsiy himoya vositalari va chiqindi gazlarni nazorat qilish texnologik loyihaning ajralmas qismi bo‘lishi kerak.

Resurs tejamkorlik nuqtayi nazaridan koks xokasini briketlashning muhim jihati avval foydalanilmayotgan uglerodli materialni qayta ishlab chiqarish sikliga qaytarish imkoniyatidir. Biroq resursning qayta ishlatilishi avtomatik ravishda ekologik foyda degani emas. Briket ishlab chiqarish uchun elektr energiyasi, bog‘lovchi, quritish issiqligi va tashish resurslari sarflanadi. To‘liq baholashda ushbu qo‘shimcha sarflar bilan yirik koks xaridining kamayishi va chiqindini boshqarish xarajatlari solishtirilishi zarur.

2-jadval. Taklif etilayotgan tadqiqot dasturida nazorat qilinadigan parametrlar

Bosqich	Nazorat ko‘rsatkichi	Ilmiy vazifasi
Xomashyo	Namlik, kul, granulometriya, yonish issiqligi	Boshlang‘ich sifat va o‘zgaruvchanlik
Briketlash	Bog‘lovchi ulushi, bosim, qotirish rejimi	Struktura hosil bo‘lishini baholash
Mexanik sinov	Siqilish, ishqalanish, zarba, suvga chidamlilik	Tashish va yuklashdagi barqarorlik
Termik sinov	Massa yo‘qotish, qoldiq mustahkamlik	Qizdirishdagi yemirilish xavfi
Pech sinovi	Yoqilg‘i sarfi, gaz qarshiligi, eritish unumdorligi	Sanoat sharoitidagi moslik
Ekologik nazorat	Chang va gazsimon emissiyalar	Xavfsizlik va ekologik baho

IQTISODIY SAMARADORLIKNI BAHOLASHNING HISOBLASH MODELI

Korxona bo‘yicha muhokama qilingan ssenariyda mayda koks xokasi zaxirasi 200–210 tonna, yirik koksning shartli narxi esa 400 AQSH dollari/t deb olingan. Ushbu ko‘rsatkichlar laboratoriya natijasi emas, balki foydalanuvchi tomonidan bildirilgan ishlab chiqarish va narxga oid dastlabki ma’lumotlardir. 200 tonna materialni 400 dollar/t ga ko‘paytirish 80 ming dollar, 210 tonnani shu narxga ko‘paytirish esa 84 ming dollar qiymat beradi. Biroq bu miqdorlar real tejalgan mablag‘ emas, balki nazariy yalpi ekvivalent qiymatdir.

Amaliy iqtisodiy samaradorlikni aniqlash uchun yaroqli briket chiqimi, bog‘lovchi xarajati, presslash va quritish energiyasi, ishchi kuchi, amortizatsiya, ekologik nazorat xarajatlari hamda pechda yirik koksni haqiqiy almashtirish koeffitsiyenti ma’lum bo‘lishi lozim. Masalan, 1 tonna xokasidan 1 tonna tayyor briket olinishi mumkin deb faraz qilish ham to‘g‘ri emas, chunki bog‘lovchi massasi qo‘shiladi va qotirishda suv hamda uchuvchan komponentlar yo‘qolishi mumkin.

Shartli sof iqtisodiy natijani quyidagicha yozish mumkin: $E = M \times \eta \times P - Cb - Ce - Cl - Cq$. Bu yerda M — qayta ishlangan xoka massasi (t); η — sanoat sinovida aniqlanadigan yirik koksni samarali almashtirish koeffitsiyenti; P — yirik koksning narxi (dollar/t); Cb — bog‘lovchi xarajati; Ce — energiya sarfi; Cl — mehnat va texnik xizmat; Cq — sifat nazorati, ekologiya va boshqa qo‘shimcha xarajatlar. Formula briketlashning iqtisodiy foydasi texnologik samaradorlikka bevosita bog‘liqligini ko‘rsatadi.

Shartli ssenariy natijasini ehtiyotkor talqin qilish lozim: $\eta = 1$ va barcha qo‘shimcha xarajatlar nolga teng degan faraz faqat nazariy yuqori chegara bo‘lib, real ishlab chiqarish sharoitida bunday shartlarning bajarilishi kutilmaydi. Shu bois ushbu maqolada korxona uchun aniq sof foyda yoki tasdiqlangan koks tejalishi miqdori keltirilmaydi. Bunday ko‘rsatkichlar faqat pilot ishlab chiqarish va moliyaviy hisob-kitoblar natijasida berilishi mumkin.

3-jadval. Koks xokasi zaxirasining shartli yalpi qiymat ekvivalenti

Zaxira, t	Narx, dollar/t	Nazariy ekvivalent, dollar	Talqin
200	400	80 000	Sof foyda emas
210	400	84 000	Sof foyda emas

XULOSA

Bazalt mineral paxta ishlab chiqarishida hosil bo‘ladigan mayda koks xokasi energiya resursi sifatida qayta foydalanish imkoniyatiga ega bo‘lgan ikkilamchi uglerodli xomashyodir. Dastlabki namuna uchun namlik 1,17% va yonish issiqligi 6530 kkal/kg deb qayd etilgan; bu natijalar materialni chuqurroq o‘rganish uchun asos bo‘lib xizmat qiladi, ammo briketning vagranka pechiga tayyorligini mustaqil tasdiqlamaydi.

Fenol-formaldegid bog‘lovchisi bilan briketlashning texnologik maqsadga muvofiqligi mexanik mustahkamlik, termik parchalanish, gaz o‘tkazuvchanlik va ekologik xavfsizlik ko‘rsatkichlari bo‘yicha tekshirilishi kerak. 1000 kg koks xokasiga 200 kg smola qo‘shish dastlabki variant sifatida qaraladi; optimal sarf ekanligi isbotlanmagan.

200–210 tonna koks xokasining 400 dollar/t narxdagi shartli yalpi ekvivalenti 80–84 ming dollarni tashkil etadi. Biroq real iqtisodiy foyda briket chiqimi, ishlab chiqarish xarajatlari va pechdagi almashtirish koeffitsiyenti aniqlangandan keyingina hisoblanadi. Kelgusidagi ilmiy ishlarning ustuvor yo‘nalishi takrorlanuvchi laboratoriya tajribalari, validatsiyalangan sifat nazorati va nazorat guruhi bilan o‘tkaziladigan sanoat sinovlaridan iborat bo‘lishi lozim.

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Xushmurodov F.M., g.f.f.d. (PhD)
dotsent
Qarshi davlat universiteti
O‘zbekiston, Qarshi
ORCID: 0000-0002-1860-115X
Ilxomova D.Sh.
tyutor
Xalqaro innovatsion universiteti
O‘zbekiston, Qarshi

QASHQADARYO VILOYATI AGROLANDSHAFTLARIDA IQLIM O`ZGARISHI SHAROITIDA YUZAGA KELADIGAN JARAYONLARINING GEOGRAFIK JIHATLARI

Annotatsiya. Maqolada iqlim o`zgarishi sharoitida agrolandshaftlarda tuproq eroziya turlari va eroziya jarayonlari natijasida yuzaga keladigan ba`zi muammolar Qashqadaryo viloyati misolida ko`rib chiqildi. Hududda iqlim o`zgarishi sharoitida sug`oriladigan maydonlarning tuproq unumdorligini saqlash hamda eroziyani yuzaga keltiradigan sharoitlarni, ikkilamchi sho`rlanishni hamda tuproq eroziya oqibatlarini oldini olish chora – tadbirlari haqida bayon etilgan.

Kalit so‘zlar: cho`llashish, degredatsiya, degumizatsiya, deflyatsiya, gravitatsion, ikkilamchi sho`rlanish, yerosti suvlari, eroziya, GAT.

Khushmurodov F.M., PhD in Geographical Sciences
associate professor
Karshi State University
Uzbekistan, Karshi
ORCID: 0000-0002-1860-115X
Ilkhomova D.Sh.
tutor
International Innovative University
Uzbekistan, Karshi

GEOGRAPHICAL ASPECTS OF CLIMATE CHANGE PROCESSES IN AGROLANDSCAPES OF THE KASHKADARYA REGION

Abstract. The article discusses the types of soil erosion and some problems arising from erosion processes in agricultural landscapes in the context of climate change using the example of the Kashkadarya region. It describes measures to maintain soil fertility on irrigated lands in the context of climate change in the region, as well as to prevent conditions that cause erosion, secondary salinization and the consequences of soil erosion.

Keywords: desertification, degradation, dehumization, deflation, gravitational, secondary salinization, groundwater, erosion, GIS.

Kirish. Iqlim o`zgarishi - keng tarqalayotgan, jadal va tezlashib borayotgan jarayondir. Keyingi yillarda dunyo bo`ylab qurg`oqchilik xavfining davriyligi va ko`lami ortib hamda murakkablashib borayotganligi hech kimga sir emas. Iqlim o`zgarishi sharoitida qurg`oqchilik dunyo mamlakatlari aholisining hayoti va dehqonchilik faoliyatiga xavf solmoqda. Hozirgi kunda mintaqamizda kuzatilayotgan iqlim o`zgarishlari bo`yicha, Birlashgan Millatlar Tashkiloti Bosh Assambleyasining 78-sessiyasida O`zbekiston Respublikasi Prizdenti Sh. M. Mirziyoyev ma`ruzasida «Hozirgi vaqtda dunyoda keskin ekologik vaziyat kuzatilmoqda. Sayyoramiz miqyosida uchta inqiroz, ya`ni iqlim o`zgarishi, bioxilma-xillik yo`qolishi va atrof–muhit ifloslanishi kuchaymoqda. Ana shunday murakkab sharoitda Orol dengizi fojiasiga qarshi kurashni davom ettirayotgan Markaziy Osiyo iqlim o`zgarishlari oldida eng zaif mintaqalardan biriga aylanmoqda» deb ta`kidlagan.

Insonning tabiatga bilvosita ta`siri iqlimni, atmosfera va suv havzalarining fizik holati va kimyoviy tarkibini, yerning ustki qatlamini, tuproq strukturasi va boshqalarni o`zgartirish yo`li bilan amalga oshiriladi. Keyingi yillarda iqlim o`zgarishi natijasida global isish bilan bir qatorda, qishda ham ob-havo injiqliklari, yog`ingarchiliklarning bir maromda emasligi, gohida qurg`ochilik bo`lishi, gohida esa birdan yog`ingarchiliklar ko`payib hududlarni suv bosishi ham kiradi.

BMT tomonidan biologik va landshaft xilma-xillik (BLX)ni saqlash bo`yicha strategik rejasida (2010) hamda 2018 yilda qabul qilingan yangi vazifalarni amalga oshirish orqali 2030 yilga kelib ekotizimlar degradatsiyasi va turlarni qisqarishini to`xtata oladigan ijobiy impuls yaratish zarurdir- deb ta`kidlagan. Iqlim o`zgarishi sharoitida qurg`oqchilik dunyo mamlakatlari aholisining hayoti va dehqonchilik faoliyatiga xavf sezilmoqda. Mamlakatimizda agrolandshaftlarda kechadigan o`zgarish va salbiy ta`sir ko`rsatadigan jarayonlarni tadqiq etish hamda uni oldini olish zarur. Binobarin, butun insoniyatning kelajak faoliyatiga tahdid soluvchi suv tanqisligi va qurg‘oqchilik va boshqa jarayonlari arid iqlim mintaqasida joylashgan Qashqadaryo viloyati uchun ham dolzarb masalalardan hisoblanadi. Hudud qishloq xo‘jaligi tizimlaridan samarali foydalanish imkoniyatini oshirish uchun bu muammolarni ilmiy tahlil qilish muhim ahamiyat kasb etadi. Eroziya jarayonlarining agrolandshaftlar holatiga ta'sirini o'rganish katta ahamiyatga ega.

Metodlar va o‘rganilish darajasi.

Mavzuni o`rganishda muhim ilmiy yondoshuv va tamoyillardan ekologik-landshaft tamoyili, tizimli kompleks yondashuv tadqiqotning asosini tashkil etib, geografik-taqqoslash, statistik va boshqa usullardan foydalanish asosiy natijaga erishish imkonini beradi. Agrolandshaftlarning asosiy xususiyatlari va ularning inson faoliyati jarayonida o‘zgarishining asosiy yo‘nalishlari V.A.Kovda (1972), A.I.Kurakova (1976), V.A.Nikolayev (1979), V.M.Chupaxin (1982) va boshqalar tomonidan o‘rganilgan. Qashqadaryo viloyati antropogen landshaftlarini o‘rganish nazariy va uslubiy masalalari S.I.Abdullayev, M.Nazarov (2020) va agrolandshaftlarini F.M.Xushmurodov va R.Usmanova (2020-2023) tomonidan va boshqa tadqiqotchilarning ishlarida yoritilgan.

Asosiy qism. Insonning hayotiy va ishlab chiqarish faoliyati muayyan landshaft doirasida kechadi, ular orasida uzluksiz o`zaro ta`sir sodir bo`ladi. Bu o`zaro ta`sir jarayonida landshaft o`zining tabiiy xossalarini o`zgartiradi va yangi xususiyatlarga ega bo`ladi. Iqlim o`zgarishi sharoitida qishloq xo`jalik yerlaridan foydalanish, tuproq eroziya jarayonlari hamda u bilan bog`liq muammolarni tahlil qilish, agroekotizimlar barqarorligini asrashni ilmiy jihatdan asoslash va o`rganishni talab qilmoqda.

Aholi sonining o`sishi hamda ularni suv va oziq-ovqat resurslari bilan ta`minlash zaruratiga bog`liq holda yerdan intensiv foydalanganda tuproqqa ortiqcha ta`sir etish kuchayishi ro`y beradi. Bu holat uning sho'rlanishi, kimyoviy moddalar bilan zararlanishi (pestitsidlar, og'ir metallar) gumusning kamayishi hamda boshqa salbiy oqibatlarni yuzaga keltiradi. Keyingi yuz yilliklarda qishloq xo`jaligining rivojlantirish maqsadida yerlarning keng miqyosda o`zlashtirilishi tufayli tabiiy landshaftlar agrolandshaftlar bilan almashtirildi. Natijada fanda agrolandshaft, agroekotizim kabi tushunchalar shakllandi va qurg`oqchil hududlarni tubdan o`zgartirilishidan yerlarning unumdor tuproq qoplami butunlay yuvilib ketmoqda.

Agrolandshaftlar - antropogen landshaftlar bo`lib, ularning biotik qismida kishilik jamiyati tomonidan sun`iy ravishda tabiiy fito va zootsenozlar shakllangan bo`lib, hududning ko`p qismida tirik organizmlar jamoalari ustunlik qiladi.

Agroekotizim - bu qishloq xo'jaligi mahsulotlarini ishlab chiqarish maqsadida inson tomonidan sun'iy ravishda yaratilgan va muntazam ravishda qo'llab-quvvatlanadigan beqaror ekotizim.

Qashqadaryo viloyati ekologik-meliorativ holati juda murakkab bo‘lgan hududlardan bo`lib, jumladan, viloyatda agroirrigatsion landshaftlar maydonining kengayishi natijasida meliorativ holatini yaxshilashni talab qiladigan yerlar maydoni ham kengayib borayotganligi sir emas.

Arid mintaqada joylashgan Qashqadaryo viloyati ham qadimdan sug`oriladigan va sug`orma dehqonchilik rivojlana borgan hududlar jumlasiga kiradi. Quruq va issiq iqlimli sharoitlarda qishloq xo`jalik ekinlaridan yuqori hosil olish bevosita sun`iy sug`orish bilan bog`liq. Gidrotexnik inshootlarning barpo etilishi, yer osti suvlaridan foydalanish, sug`orish jarayonida sizot suvlari sathining ko`tarilishi sug`oriladigaan yerlarda o`ziga xos ladshaftlarni vujudga kelishida, ularning tabiiy va iqtisodiy salohiyatining oshishida (hamda ayrim xo`jalik nuqtai nazaridan salbiy jrayonlarning sodir bo`lishi va kuchayishidagi) bosh omillardan biri hisoblanadi [1;30-35 b.].

Eroziya tuproqning buzilishi va uning unumdorligini yo‘qolishidagi eng kuchli omillardan biridir. Tuproqlarning eroziyaga chidamliligining o`zgarishi ularning zonal xususiyatlari bilan bog'liq. Yer eroziyasini o`rganishda tuproq degradatsiyasi-tushunchasi ham ishlatiladi.

Yerlar degradatsiyasi –yerlar sifatining yomonlashish jarayoni, ularning hosildorligi pasayishi, tarkibidagi ozuqa moddalarining kamayishi hisoblanadi. Tuproq eroziyasi-eng keng tarqalgan degradatsiya turi hisoblanadi.U ulkan iqtisodiy va ekologik zarar yetkazadi. Tuproqlarning degradatsiyasini ham bir

nechta turlari mavjud. Bulardan asosiylari: eroziya, sho‘rlanish, botqoqlanish, gumussizlanish, natijada sahrolanish yuzaga keladi. Qurg`oqchil iqlim sharoitida yerlar degradatsiyasi ko‘p hollarda cho‘llanish jarayoniga o‘tib ketadi, bunda hosildor yer sahroga aylanadi.

Cho‘llanish jarayoni–bu qurg`oqchil (arid) mintaqalardagi landshaftlarning unumdorligining kamayishi, degredatsiyalanishi (fr.degredation – asta-sekin yomonlashuvi), yog`in miqdorining kamayib borishi bilan iqlimning quruqlashishi, cho‘l hududlari maydonining kengayishi natijasida yuzaga keladigan tabiiy ekosistemalarning buzilishidir. Mutaxassislarning ma’lumotiga ko‘ra, har soniyada dunyo bo‘ylab 23 gektar yer cho‘llanib boryapti. Bu holat davom etaversa, 2050 yilga borib, Yer yuzining 95 foizi cho‘llanishi va bu 3 milliarddan ziyod odamni oziq-ovqat tanqisligida qoldirishi mumkin. Har daqiqada O‘zbekistonning 9 kvadrat metr hududi cho‘llanib boryapti. Cho‘llanishga asosan tabiiy va antropogen omillar ta’sir ko‘rsatadi.

Eroziya qishloq xo'jaligiga katta zarar etkazadi, chunki uning rivojlanishi tuproq unumdorligini tez yo'qotishiga olib keladi. Bir oz yuvilgan tuproqlarda qishloq xo'jaligi ekinlarining hosildorligi o'rtacha yuvilgan tuproqlarda - 30-50% ga, kuchli yuvilgan tuproqlarda - 50-70% ga kamayadi [2;C.3-12].

Tuproq eroziyasi asosan relyefi notekis rast-baland, eroziya bazisi katta bo`lgan yerlarda boshlanadi. Sug`orish (irrigatsion) eroziya; tuproq agroirrigatsion madaniy qatlamining to`planishi; tuproq-gruntning ikkilamchi sho`rlanishi; grunt va tuproqning zaxlashi (botqoqlashuvi); yer usti va yer osti suvlarining ifloslanishi; daryolarning sayozlashuvi; joy relyefining cho`kishi bilan namoyon bo`ladi. Sug`orish dehqonchilik qilinadigan yerlardagi yuvilish eroziyasi va jarlanish eroziyasiga bo`linadi. Eroziya natijasida yil davomida yuvilib ketadigan oziq moddalar har yili yerga solinadigan o‘g‘itga nibatan 60 martadan ham ko‘proqni tashkil etadi.

Suv eroziyasining rivojlanishida iqlimning roli juda kattadir. Yog‘in-sochin suvlarining eroziy xususiyati uning yog‘ish tezligi (jadalligi) va miqdoriga ham bog‘liq. Qashqadaryo viloyatida sug`orish eroziyasi tog`oldi qiya tekisliklarida va adirlarda (bo`z tuproqlar zonasining sug`oriladigan yerlarida) tarqalgan bo`lib, bunday yerlar ekin uchun yaroqsiz bo`lib qoladi. Kitob-Shahrisabz botig`ida agroirrigatsiya landshaftlarida eroziyaning ushbu turi uchratish mumkin.

Qashqadaryo viloyatida sug‘orish ta’sirida o‘simlik qoplami, tuproq jarayonlari o‘zgara bordi. Qashqadaryo viloyatida agrolandshaftlarga salbiy ta’sir ko`rsatadigan jarayonlar ta’sirida bo`lgan yerlar maydoni ham yildan yilga ortib bordi. Ilgarigi siyrak o‘simliklar o`sadigan cho‘l o‘rnida vohalar o‘simlik qoplami butunlay yangi bo‘lgan geografik landshaft vujudga kelganini Qarshi cho`li misolida ko`rish mumkin. Ammo bugungi kunda Qarshi cho`lida yerlarni sug‘orish yer ostidagi sho‘r suvlar sathini ko‘tarib, tuproqni ikkilamchi sho‘r bosishiga sabab bo‘lmoqda. Qarshi magistral kanali va ariqlar atrofida hamda ayrim pastqam joylarda sizot suvlari yer betiga oqib chiqib, tuproqni botqoq bosishiga, qamishzorlarning kengayishiga sabab bo‘layotganligini kuzatish mumkin.

Bugungi kunda tadqiqotlar shuni ko`rsatmoqdaki, sug`orish eroziyasi agroirrigatsion landshaftlarda suv-fizikaviy va agronomik-kimyoviy xossalarning o`zgarishiga, aniqrog`i, yomonlashuviga olib kelmoqda. Bu jarayonlar tufayli tuproqlardagi chirindi, azot va boshqa oziqlantiruvchi moddalarning miqdori ham kamayib boradi. Mamlakatimizning 643,2 ming ga sug`oriladigan yerlarni irrigatsiya eroziyasiga duchor bo`ladi. Qashqadaryo 159,7 ming ga, Toshkent 138,6 ming ga, Samarqand 121,2 ming ga sug`oriladigan yerlari irrigatsiya eroziyasiga duchor bo`ladi (https://fayllar.org/).

Viloyatda hozirgi kunda sug`oriladigan yerlarning 8 foiziga yaqini yoki 325 ming gektari meliorativ holati yomon yerlar hisoblanadi. Bu tuproqlar sho`rlanish darajasining yuqoriligi hamda yer osti suvlari sathining ko`tarilishi tufayli yuz bergan. Ko`p yillar davomida qishloq xo`jaligi ekin maydonlarida hosildorlikni oshirish maqsadida yerni haddan ziyod ko`p mineral o`g`itlar bilan oziqlantirish, ekinlarni kasallik va zararkunandalardan himoya qilish maqsadida zaharli kimyoviy vositalaridan foydalanilib kelingan. M.Fayzullayevning keltirishicha (2019), qoniqarsiz yerlarning tarkib topishiga sizot suvlarining yaqinligi, tuproqning turli omillar ta’sirida sho‘rlanganligi hamda sizot suvlarining sho‘rlanganlik darajasi asosiy sabab bo‘ladi. [6;246 b.].

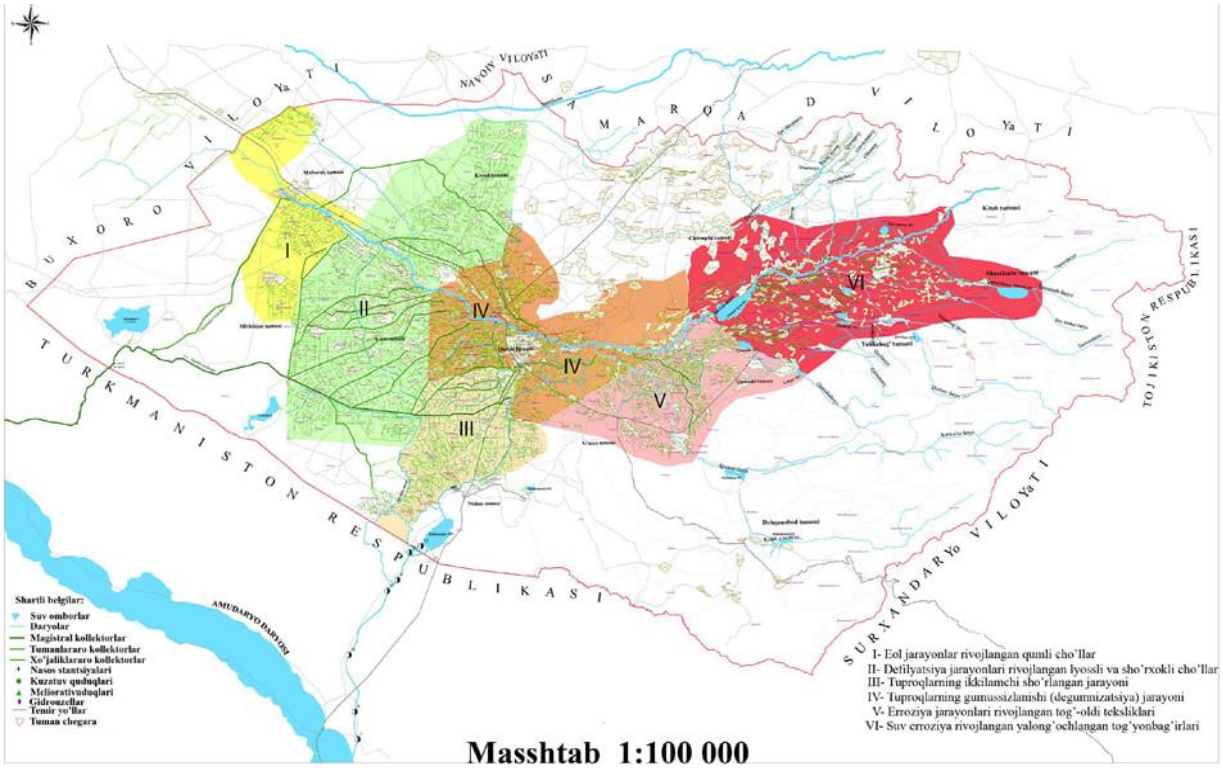
Qashqadaryo viloyatida sug‘oriladigan dehqonchilik zonalarida qishloq xo‘jaligiga suv eroziyasi, shamol eroziyasi, gravitatsion jarayonlar, sel hodisalari, loyqa bosishi, botqoqlanish, sho‘r bosish, qatqaloq hosil bo‘lishi kabi tabiiy geografik jarayonlari eng ko‘p salbiy ta’sir ko‘rsatishini kuzatish mumkin.

Viloyatning tekislik qismida esa yog`inning juda kamligi, tuproqdan namning ko`p bug`lanishi tuproqlarni sho`r bosishini kuchayishiga olib kelgan. Yoz faslining uzoq davom etishi oqibatida hududda yillik haroratning kattaligi natijasida bug‘lanish 1700 mm ga yetadi, bu esa o‘z navbatida namlik taqchilligi (defitsit)ni vujudga keltiradi.

Qayta (ikkilamchi) sho`rlanish – arid iqlim sharoitlarida yerlarni sug`orishning asosiy oqibatlaridan biridir. U minerallashgan grunt suvlarining yer yuzasiga ko`tarilishi bilan bog`liq. Qashqadaryo viloyatida hozirgi kunda sug‘oriladigan yerlarning 45% dan ortiq turli darajada sho`rlangan. Qashqadaryo viloyatining hududiy doirasida 2022 yil yanvar holati ma’lumoti bo‘yicha, viloyatda sho‘rlangan maydon 232389 ming ga bo‘lib, shundan kuchli sho‘rlangan maydon 9650 ming ga, kuchsiz sho‘rlangan maydon 184690 ming ga, o‘rtacha sho‘rlangan maydon 38139 ming ga ni tashkil etadi. Qarshi cho`lida agrolandshaftlarning qayta sho`rlanishi kengayib bormoqda. Jumladan, Mirishkor tumanida u yoki bu darajada sho‘rlangan yerlar maydoni 30,3 ming ga, Koson tumanida 46,9 ming ga, Muborak tumanida 28,8 ming gektarni va Nishon tumanida 34,6 ming ga, Kasbi 31,3 ming ga, Qarshi 23,0 ming ga, G‘uzor 22,7 ming ga, Qamashi 16,2 ming ga yer maydoni sho‘rlangan. Shundan kuchli sho‘rlangan maydonlar Koson tumanda 2700 ga., Muborak tumanda 2840 ga., Nishon tumanda 1834 ga. to‘g‘ri keladi.

Ayniqsa, Qarshi cho‘lining katta maydonlarida tuproq yuvilishi, eroziya hodisalarining turli ko‘rinishlari, yer osti suvlari sathining ko‘tarilishi natijasida

sho‘rtob va sho‘rxoklanish kabi jarayonlar kuzatiladi. Xususan, Muborak, Nishon va Koson tumanlarida tuproqning sho‘rlanish darajasi viloyatning o‘rtacha ko‘rsatkichidan ancha yuqori. Bu hududlarda sho‘rlangan maydonlarning kattaligi Qarshi cho‘lida arid zonada joylashganligi va tuproq tarkibida bug‘lanish miqdorining yuqoriligi bilan bog‘liq.



1-rasm. Qashqadaryo viloyatida shamollar ta’sirida vujudga kelgan cho‘llanish tiplari kartasi. *Manba: F.M. Xushmurodov dissertatsiya ishi 2023 yil.*

Tuproqni shamol (eol) eroziyasi (deflyatsiya) quruq iqlimli, yillik bug‘lanish yillik yog‘in-sochin miqdoridan ortiq, bahor va yoz oylarining harorati yuqori va havoning nisbiy namligi past bo‘lgan yerlarda tarqalgan. Shamol eroziyasini keltirib chiqarishda tezligi kuchli (>15 m/s) | shamollar asosiy orin egallaydi (1-jadval). Tuproqning eol eroziyasining intensivligiga, shamolning tezligi va yo`nalishi, tuproq ustki qatlamining fizik-ximik holati, atmosfera va yer yuzasi oralig`idagi chegara qatlamning harorat va shamol gradiyentlari ta`sir ko`rsatadi. Qashqadaryo viloyatida tezligi kuchli keying ikki yilda shamollar soni meteostansiyasida quyidagicha ko`rinishda: Qarsida 45 kun, Guzorda 35 kun, Chimqo`rg`onda 27 kun, Muborakda 26 kun Oqrabotda va Dehqonobodda 25 kunni tashkil etgan. Agrolandshaftlarni muhofaza qilish va ekologik holatni yaxshilashda shamol eroziyasi jarayonlarini salbiy ta’sirini kamaytirish muhim ahamiyat kasb etadi.

1-jadval.
Qashqadaryo viloyatida tezligi kuchli shamollar soni

№	Meteostansiyalar	Shamollar soni
1.	Muborak	26
2.	Qarshi	45
3.	Chimqo`rg`on	27
4.	Mingchuqur	19
5.	G`uzor	35
6.	Dehqonbod	25
7.	Oqrabot	25

Manba: Ahmedov SH.E. 2018 y. 33 b. O`zgartirib olingan.

Degradatsiyaning turli xillariga duchor bo‘lgan yerlar past unumdorlikka, agrolandshaftlar esa kuchsiz ekologik barqarorlikka ega. Qashqadaryo viloyatida vujudga kelgan degredatsiyalashgan yerlar qishloq xo‘jalik ekin maydonlariga, yaylovlarga va ekosistemalariga katta zarar yetkazmoqda. Shuningdek, hudud tabiatiga antropogen ta’sirning kuchliligi landshaft– ekologik muammolarni keltirib chiqarmoqda hamda ekotizimlarning o‘zaro modda va energiya almashinuvida va muvozanatini buzilishiga sabab bo‘lmoqda.

Xulosa Qishloq xo‘jaligida foydalanish jarayonida landshaftlarning xilma-xilligi va o`zgaruvchanligini kompleks tavsiflash va tizimli baholash uchun asos agroekotizimlar holatini miqdoriy va sifat jihatidan tahlil qilish hisoblanadi. Agrolandshaftda yerdan foydalanish samaradorligini baholashda hozirgi vaqtda nafaqat yer unumdorligi darajasi, ularning ekologik holati, qishloq xo`jaligi yerlarining nisbati, tabiiy va hududiy xususiyatlari, balki vaqt o`tishi bilan ushbu ko`rsatkichlarning o`zgarishi ham hisobga olinishi zarur. Ularning barqarorligi parametrlari tuproqning funktsiyalari, rejimlari va xususiyatlari, agrogeotsenozlarning tuzilishi, tashkil etilishi va unumdorligi, biogeokimyoviy sikllarning intensivligi, muvozanati va boshqalar. Agroekotizimlar va agrolandshaftlarni optimallashtirish masalalarini ko`rib chiqishda ularni majmuali tavsiflash usullari va miqdoriy baholash tizimiga ega bo`lish juda muhimdir. Bu bizga agrolandshaftdagi salbiy jarayonlarning rivojlanishini aniqlash va bashorat qilish va zarur bo`lganda ularni yanada sig`imli va ekologik barqaror agroekotizimlarni yaratishga moslashtirish imkonini beradi.

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Yo‘ldoshev J.O.
umumkasbiy fanlar kafedrasi o‘qituvchisi, turizm fakulteti
Alfraganus universiteti
Safarov E.Y., t.f.d.
geodeziya, kartografiya va kadastr kafedrasi professori
O‘zbekiston Milliy universiteti
Prenov Sh.M.
o‘quv-uslubiy bo‘lim boshlig‘i
Aniq va ijtimoiy fanlar universiteti

TARIXIY-MADANIY MEROS HUDUDLARIDA GEODEZIK MONITORING VA KARTOGRAFIK MODELLASHTIRISHDA SUN'IY INTELLEKT HAMDA NEYRON TARMOQLARNI QO'LLASHNING FUNKSIONAL-TEXNIK IMKONIYATLARI

Annotatsiya. Mazkur maqolada tarixiy-madaniy meros obyektlari joylashgan Toshkent, Samarqand va Xiva shaharlari hududlarining geoekologik barqarorligini ta'minlashda sun'iy intellekt texnologiyalari va neyron tarmoq algoritmlarining geodezik monitoring hamda kartografik modellashtirish jarayonlaridagi funksional-texnik imkoniyatlari tahlil qilingan. Tadqiqotning maqsadi — masofadan zondlash, radar interferometriyasi (InSAR) va geoaxborot tizimlari (GAT) ma'lumotlarini chuqur o'rganish (deep learning) algoritmlari bilan integratsiyalashning ilmiy-uslubiy asoslarini ishlab chiqishdan iborat. Tadqiqot metodikasi sifatida konvolyutsion neyron tarmoqlar (CNN) yordamida yer qoplami va bino zichligini segmentatsiya qilish, uzoq-qisqa muddatli xotira tarmoqlari (LSTM) orqali vaqt qatorlari asosida iqlim va harorat dinamikasini bashoratlash, tasodifiy o'rmon (Random Forest) va gradient buster (LightGBM/GBDT) algoritmlari yordamida cho'kish hamda degradatsiya xavfini tasniflash usullaridan foydalanildi. Natijada, har uch shahar uchun tarixiy yodgorliklarning geotexnik holatini nazorat qilishga xizmat qiluvchi umumlashgan funksional sxema va algoritmlarning qiyosiy jadvali ishlab chiqildi; Xiva ichki shahri uchun namlik va cho'kish, Samarqand me'moriy majmualari uchun tuproq sho'rlanishi va gumbaz deformatsiyasi, Toshkent tarixiy kvartallari uchun esa jadal urbanizatsiya bosimi asosiy geoekologik xavf omillari sifatida aniqlandi. Tadqiqot xulosalari sun'iy intellekt asosidagi monitoring modulini Milliy geoportal va Yagona kadastr tizimiga integratsiyalash bo'yicha amaliy tavsiyalar ishlab chiqishga xizmat qiladi hamda dissertatsiyaning keyingi boblarida qo'llaniladigan uslubiy asosni tashkil etadi.

Kalit so‘zlar: sun'iy intellekt; neyron tarmoqlar; geodezik monitoring; kartografik modellashtirish; geoekologik barqarorlik; tarixiy-madaniy meros; InSAR; masofadan zondlash; chuqur o'rganish; Milliy geoportal.

Yuldoshev J.O.
lecturer
Department of General Professional Disciplines
Faculty of Tourism
Alfraganus University
Safarov E.Y., DSc in Technical Sciences
professor
Department of Geodesy, Cartography and Cadastre
National University of Uzbekistan
Prenov Sh.M.
head of the Educational and Methodological Department
University of Exact and Social Sciences

FUNCTIONAL AND TECHNICAL CAPABILITIES OF ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS IN GEODETIC MONITORING AND CARTOGRAPHIC MODELLING OF HISTORICAL AND CULTURAL HERITAGE AREAS

Abstract. This article analyzes the functional and technical capabilities of artificial intelligence technologies and neural network algorithms—specifically within geodetic monitoring and cartographic modeling processes—for ensuring the geo-ecological stability of the cities of Tashkent, Samarkand, and Khiva, which house significant historical and cultural heritage sites. The study aims to develop scientific and methodological foundations for integrating data from remote sensing, radar interferometry (InSAR), and geographic information systems (GIS) with deep learning algorithms. The research methodology employed techniques such as land cover and building density segmentation using convolutional neural networks (CNN), climate and temperature dynamics forecasting based on time series via long short-term memory (LSTM) networks, and the classification of subsidence and degradation risks using Random Forest and gradient boosting (LightGBM/GBDT) algorithms. As a result, a generalized functional scheme and a comparative table of algorithms were developed to monitor the geotechnical condition of historical monuments in all three cities; specific primary geo-ecological risk factors were identified: moisture and subsidence for the inner city of Khiva; soil salinity and dome deformation for Samarkand's architectural complexes; and rapid urbanization pressure for Tashkent's historical quarters. The research findings serve to develop practical recommendations for integrating the AI-based monitoring module into the National Geoportal and the Unified Cadastre System, and form the methodological basis for the subsequent chapters of the dissertation.

Keywords: artificial intelligence; neural networks; geodetic monitoring; cartographic modeling; geo-ecological stability; historical-cultural heritage; InSAR; remote sensing; deep learning; National Geoportal.

1. Kirish

O'zbekistonning Toshkent, Samarqand va Xiva shaharlari nafaqat milliy, balki jahon tarixiy-madaniy merosining muhim tarkibiy qismi hisoblanadi — Samarqand va Xivaning tarixiy markazlari YUNESKOning Butunjahon merosi ro'yxatiga kiritilgan. Ushbu hududlarda antropogen bosimning kuchayishi (jadal urbanizatsiya, turizm oqimining ortishi, muhandislik-kommunikatsiya tarmoqlarining kengayishi) va tabiiy omillar (tuproq sho'rlanishi, yer osti suvlari sathining o'zgarishi, seysmik faollik, iqlim o'zgarishi) tarixiy obyektlarning geotexnik holatiga uzluksiz salbiy ta'sir ko'rsatmoqda. Shu sababli tarixiy shaharlar hududlarining geoekologik barqarorligini geodezik-kartografik vositalar bilan uzluksiz kuzatib borish dolzarb ilmiy-amaliy ahamiyat kasb etadi.

So'nggi o'n yillikda xalqaro tadqiqotchilar tomonidan masofadan zondlash va geoaxborot texnologiyalarini sun'iy intellekt algoritmlari bilan uyg'unlashtirish borasida keng tajriba to'plangan. Xususan, B. Cuca va hammualliflari Yevropa madaniy meros obyektlaridagi shikastlanishlarni masofadan zondlash va Yer kuzatuvi ma'lumotlari asosida monitoring qilish bo'yicha ilmiy va amaliy adabiyotlarni tizimli tahlil qilib, integratsiyalashgan monitoring tizimlarining ustuvorligini asoslagan [9]. P. Ezquerro va hammualliflari Italiyaning Pistoya tarixiy shahrida InSAR radar interferometriyasi ma'lumotlaridan foydalanib, binolarning cho'kishga nisbatan zaifligini baholovchi modelni ishlab chiqqan [8]. G. Caspari va P. Crespo konvolyutsion neyron tarmoqlar (CNN) yordamida arxeologik obyektlarni sun'iy yo'ldosh tasvirlaridan avtomatik aniqlash imkoniyatini ko'rsatgan [10], L. Ma va hammualliflari esa masofadan zondlash sohasida chuqur o'rganish algoritmlarining qo'llanilish yo'nalishlarini umumlashtirgan meta-tahlil taqdim etgan [11]. Muallifning oldingi tadqiqotlarida ham ushbu yo'nalish rivojlantirilgan: Ugam-Chatkal milliy bog'i hududida iqlim va kriosfera dinamikasini geodezik monitoring qilish tajribasi xalqaro Scopus bazasidagi nashrda yoritilgan [1], milliy geoportalni sun'iy intellekt vositalari bilan takomillashtirish masalalari [2] hamda adaptiv boshqaruv tizimlarida sun'iy intellekt va neyron tarmoqlarni qo'llashning funksional-texnik imkoniyatlari [3] alohida tadqiq etilgan. Bundan tashqari, uch shahar — Toshkent, Samarqand va Xivaning madaniy meros zonalaridagi geoekologik vaziyatning qiyosiy geografik tahlili [4] va ushbu hududlarda yer yuzasi haroratining o'zgarish dinamikasi [5] muallif tomonidan ilgari o'rganilgan bo'lib, mazkur maqola shu tadqiqotlar bilan uzviy bog'liq holda ularning uslubiy asosini kengaytiradi.

Shu bilan birga, xalqaro tajribaning ko'lami kengayib borayotganiga qaramay, O'zbekiston sharoitida — xususan, xom g'isht va paxsa devor konstruksiyalariga ega an'anaviy tarixiy qurilish tipologiyasi, mahalliy iqlim-gidrogeologik sharoit hamda milliy SKS-95 koordinatalar tizimi va Yagona kadastr tizimi doirasida — sun'iy intellekt va neyron tarmoq algoritmlarini geodezik monitoring va kartografik modellashtirish jarayonlariga tizimli integratsiyalash bo'yicha yagona uslubiy yondashuv hali to'liq shakllanmagan. Milliy geoportal va kadastr tizimlari asosan klassik GAT tahlili vositalariga tayanadi, avtomatlashtirilgan o'zgarishlarni aniqlash (change detection) va bashoratli tahlil

funksiyalari amalda cheklangan, bu esa muallifning oldingi qiyosiy tahlilida [4] va harorat dinamikasi tadqiqotida [5] ham qisman ta'kidlangan.

Yuqoridagilardan kelib chiqib, mazkur maqolaning maqsadi — Toshkent, Samarqand va Xiva shaharlarining tarixiy-madaniy meros hududlarida geoekologik barqarorlikni ta'minlash maqsadida geodezik monitoring va kartografik modellashtirish jarayonlarida qo'llanilishi mumkin bo'lgan sun'iy intellekt va neyron tarmoq usullarining funksional-texnik imkoniyatlarini tizimlashtirish, ularning har bir shahar uchun geoekologik xavf omillariga mosligini aniqlash va Milliy geoportalga integratsiyalash uchun umumlashgan funksional sxema taklif etishdan iborat.

2. Materiallar va usullar

Tadqiqot obyekti sifatida Toshkent shahrining tarixiy kvartallari (Eski shahar hududi), Samarqand shahrining Registon, Shohi Zinda va atrofidagi bufer zonalari, hamda Xiva shahrining Ichon-Qal'a tarixiy yadrosi tanlab olindi. Tahlil uchun quyidagi ma'lumot manbalaridan foydalanish nazarda tutildi: Sentinel-1 radar (SAR) va Sentinel-2/Landsat optik sun'iy yo'ldosh tasvirlari, uchuvchisiz uchish apparatlari (UAV) orqali olingan ortofotoplanlar va raqamli relef modeli (RRM) ma'lumotlari, mahalliy geodezik-markshayder o'lchash natijalari hamda Milliy geoportal va kadastr tizimining vektor qatlamlari. Barcha fazoviy ma'lumotlar O'zbekiston Respublikasining SKS-95 koordinatalar tizimiga keltirilgan holda qayta ishlashga mo'ljallangan.

Uslubiy jihatdan tadqiqot to'rt yo'nalishdagi sun'iy intellekt va neyron tarmoq algoritmlarini qamrab oladi. Birinchidan, konvolyutsion neyron tarmoqlar (CNN) yordamida optik tasvirlar asosida yer qoplami sinflari va bino zichligi segmentatsiyasi amalga oshiriladi, bu yondashuv arxeologik va meros obyektlarini aniqlashda xalqaro tajribada o'z samaradorligini ko'rsatgan [10; 11]. Ikkinchidan, uzoq-qisqa muddatli xotira tarmoqlari (LSTM/RNN) ko'p yillik harorat, yog'in va muzlik-iqlim ko'rsatkichlarining vaqt qatorlarini tahlil qilib, kelgusi davr uchun klimatik-kriosferik dinamikani bashoratlashda qo'llaniladi — bu yondashuv muallifning Ugam-Chatkal milliy bog'idagi monitoring tajribasi [1] va yer yuzasi harorati dinamikasi tadqiqotiga [5] tayanadi. Uchinchidan, tasodifiy o'rmon (Random Forest) va gradient buster (LightGBM, GBDT) algoritmlari InSAR orqali aniqlangan cho'kish tezligi ko'rsatkichlarini gidrogeologik, litologik va antropogen omillar bilan birlashtirib, xavf darajasini tasniflash uchun ishlatiladi, bu Pistoya tarixiy shahri misolida sinovdan o'tgan yondashuvga mos keladi [8]. To'rtinchidan, gibrid CNN-BiGRU-Attention tipidagi tarmoqlar fazoviy-vaqtinchalik InSAR seriyalarini birgalikda tahlil qilib, deformatsiyaning kelgusi qiymatlarini bashoratlash imkonini beradi.

1-jadval. Sun'iy intellekt va neyron tarmoq algoritmlarining geodezik monitoringdagi funksional imkoniyatlari

Algoritm turi	Kirish ma'lumotlari	Bajaradigan vazifasi	Manba
CNN (segmentatsiya)	Sentinel-2/UAV optik tasvirlar	Yer qoplami va bino zichligini tasniflash	[10; 11]
LSTM / RNN	Ko'p yillik harorat, iqlim vaqt qatorlari	Klimatik-kriosferik dinamikani bashoratlash	[1; 5]
Random Forest / LightGBM / GBDT	InSAR cho'kish tezligi + gidrogeologik omillar	Cho'kish va degradatsiya xavfini tasniflash	[8]
CNN-BiGRU-Attention (gibrid)	Fazoviy-vaqtinchalik InSAR seriyasi	Deformatsiyani bashoratli monitoring qilish	[8]
Geospatial risk-scoring AI	Ko'p manbali GAT qatlamlari	Meros obyektlari bo'yicha xavf reytingini shakllantirish	[9]

Yuqoridagi algoritmlarni yagona monitoring tsikliga birlashtirish maqsadida quyidagi besh bosqichli funksional sxema ishlab chiqildi (2-jadval): ma'lumot yig'ish, oldindan ishlov berish, sun'iy intellekt asosida tahlil, kartografik modellashtirish va qaror qabul qilish bosqichlari o'zaro ketma-ket va qayta aloqa (feedback) tamoyili asosida bog'langan.

2-jadval. Sun'iy intellekt asosidagi geodezik monitoring va kartografik modellashtirishning funksional sxemasi

Bosqich	Mazmuni	Kutilayotgan natija
1. Ma'lumot yig'ish	SAR/optik sun'iy yo'ldosh tasvirlari, UAV ortofoto, geodezik o'lchash va kadastr qatlamlarini jamlash	Yagona ma'lumotlar bazasi
2. Oldindan ishlov berish	Radiometrik-geometrik tuzatish, SKS-95 tizimiga keltirish, shovqinlarni tozalash	Standartlashtirilgan fazoviy qatlamlar
3. AI/neyron tarmoq tahlili	CNN segmentatsiyasi, LSTM bashorati, RF/GBDT tasniflash, InSAR-AI fuziyasi	Tasniflangan va bashoratlangan ko'rsatkichlar
4. Kartografik modellashtirish	Xavf xaritalari, dinamik qatlamlar, 3D vizualizatsiya shakllantirish	Interaktiv kartografik model
5. Qaror qabul qilish	Milliy geoportal va Yagona kadastr tizimiga natijalarni uzatish, monitoring tsiklini yangilash	Muhofaza chora-tadbirlari bo'yicha tavsiyalar

3. Natijalar

Tadqiqot natijasida sun'iy intellekt va neyron tarmoq algoritmlarining Toshkent, Samarqand va Xiva shaharlaridagi tarixiy-madaniy meros obyektlari uchun tegishliligi shahar kesimida farqlanishi aniqlandi. Bunga sabab har bir shahar

geologik-gidrologik sharoiti, qurilish tipologiyasi va antropogen bosim darajasining o'ziga xosligidir. Xiva shahrining Ichon-Qal'a tarixiy yadrosida paxsa va xom g'ishtdan qurilgan devorlarning namlik ta'sirida yemirilishi va mahalliy cho'kish jarayonlari ustuvor xavf omili hisoblanadi, shu sababli bu yerda CNN asosidagi segmentatsiya usulini Random Forest tasniflagichi bilan birlashtirish devor asos qismidagi namlik zonalarini avtomatik aniqlash imkonini beradi. Samarqand shahridagi Registon va Shohi Zinda majmualarida tuproq sho'rlanishi hamda gumbaz-minoralarning millimetrik darajadagi deformatsiyasi asosiy muammo bo'lib, bunday holatlarda InSAR ma'lumotlarini CNN-BiGRU-Attention gibrid tarmog'i bilan tahlil qilish erta bashoratlash imkoniyatini yaratadi. Toshkent shahrining tarixiy kvartallarida esa jadal urbanizatsiya, yer osti suvlari sathining o'zgarishi va qurilish bosimi ustuvor omil bo'lib, bu yerda LSTM vaqt qatori tahlili va geospatial risk-scoring usullarining birgalikda qo'llanilishi maqsadga muvofiqdir.

3-jadval. Shaharlar kesimida geoekologik xavf omillari va tavsiya etiladigan AI/NN usullari

Shahar / obyekt	Asosiy geoekologik xavf omili	Tavsiya etiladigan AI/NN usul	Kutilayotgan natija
Xiva (Ichon-Qal'a)	Namlik ko'tarilishi, mahalliy cho'kish, paxsa devorlarning yemirilishi	CNN segmentatsiyasi + Random Forest tasniflash	Namlik zonalarini avtomatik aniqlash
Samarqand (Registon, Shohi Zinda)	Tuproq sho'rlanishi, gumbaz va minora deformatsiyasi	InSAR + CNN-BiGRU-Attention	Millimetrik deformatsiyani erta bashoratlash
Toshkent (tarixiy kvartallar)	Jadal urbanizatsiya, qurilish bosimi, yer osti suvlari sathi o'zgarishi	LSTM vaqt qatori tahlili + geospatial risk-scoring	Urbanizatsiya bosimi dinamikasini uzoq muddatli bashoratlash

Shuningdek, ishlab chiqilgan besh bosqichli funksional sxema (2-jadval) har uch shahar uchun umumiy metodologik asos bo'lib xizmat qilishi, biroq uchinchi bosqichdagi (AI/neyron tarmoq tahlili) aniq algoritm tanlovi mahalliy geoekologik sharoitga moslashtirilishi lozimligi aniqlandi. Bu esa milliy geoportal tarkibida yagona, ammo moslashuvchan sun'iy intellekt modulini yaratish imkoniyatini ko'rsatadi.

4. Muhokama

Olib borilgan tahlil kirish qismida ilgari surilgan taxminni — O'zbekistonda tarixiy shaharlar hududlarini geodezik-kartografik monitoring qilishda sun'iy intellekt va neyron tarmoq algoritmlarining tizimli integratsiyasi hali yetarlicha rivojlanmaganligini — tasdiqladi. Shu bilan birga, xalqaro tajriba (Pistoya, Yevropa madaniy meros obyektlari, arxeologik CNN tadqiqotlari) [8; 9; 10; 11] O'zbekiston sharoitiga moslashtirilgan holda qo'llanilishi mumkinligini ko'rsatdi, biroq bunda bir qator cheklovlarni hisobga olish zarur. Birinchidan, xom g'isht va paxsa

konstruksiyali tarixiy binolar uchun maxsus belgilangan (label qilingan) o'quv ma'lumotlar to'plamining yo'qligi CNN va boshqa chuqur o'rganish modellarining aniqligini pasaytirishi mumkin, shu sababli Toshkent, Samarqand va Xiva bo'yicha UAV va InSAR arxividan milliy o'quv ma'lumotlar bazasini shakllantirish ustuvor vazifa hisoblanadi. Ikkinchidan, sun'iy intellekt modulini Milliy geoportal va Yagona kadastr tizimiga integratsiyalash SKS-95 koordinatalar tizimi va "Raqamli O'zbekiston" dasturi doirasida belgilangan texnik-me'yoriy talablarga muvofiqlashtirilishini talab qiladi. Uchinchidan, hisoblash infratuzilmasi va ma'lumotlarni saqlash quvvatiga bo'lgan ehtiyoj, ayniqsa vaqt qatori va radar ma'lumotlarini real vaqt rejimida qayta ishlashda, alohida investitsiya va texnik tayyorgarlikni taqozo etadi.

Amaliy nuqtai nazardan, ishlab chiqilgan funksional sxema va qiyosiy jadval (2- va 3-jadvallar) muallifning ilgari e'lon qilingan tadqiqotlari — milliy geoportalni sun'iy intellekt vositalari bilan takomillashtirish [2], adaptiv boshqaruv tizimlarida neyron tarmoqlarni qo'llash [3], raqamli kadastr texnologiyalari [6] va veb-kartografiya sohasidagi nazariy masalalar [7] — bilan uzviy bog'liq holda, ularni tarixiy-madaniy meros hududlariga nisbatan ixtisoslashtiradi. Kelgusi tadqiqotlarda ushbu funksional sxemaning bitta tanlangan obyekt (masalan, Xiva Ichon-Qal'asi) misolida amaliy sinovdan o'tkazilishi, olingan natijalarning an'anaviy geodezik o'lchash usullari bilan solishtirilishi va aniqlik ko'rsatkichlarining statistik baholanishi dissertatsiyaning navbatdagi boblarida yoritiladi.

5. Xulosa

Sun'iy intellekt va neyron tarmoq algoritmlarini geodezik monitoring va kartografik modellashtirish jarayonlariga integratsiyalash Toshkent, Samarqand va Xiva shaharlaridagi tarixiy-madaniy meros obyektlarining geoekologik barqarorligini ta'minlashda sifat jihatidan yangi bosqichga o'tish imkonini beradi, biroq bu jarayon mahalliy sharoitga moslashtirilgan uslubiy asos, o'quv ma'lumotlar bazasi va institutsional tayyorgarlikni talab etadi.

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Yo‘ldoshev J.O.
umumkasbiy fanlar kafedrasi o‘qituvchisi, turizm fakulteti
Alfraganus universiteti
Safarov E.Y., t.f.d.
geodeziya, kartografiya va kadastr kafedrasi professori
O‘zbekiston Milliy universiteti
Prenov Sh.M.
o‘quv-uslubiy bo‘lim boshlig‘i
Aniq va ijtimoiy fanlar universiteti

TOSHKENT, SAMARQAND VA XIVA SHAHARLARIDAGI MADANIY MEROS ZONALARIDA GEOEKOLOGIK VAZIYATNING QIYOSIY GEOGRAFIK TAHLILI

Annotatsiya. Ushbu maqolada O'zbekistonning uchta yirik tarixiy-madaniy markazi — Toshkent, Samarqand va Xiva shaharlaridagi madaniy meros hududlarining geoekologik barqarorligi qiyosiy geografik nuqtai nazardan tahlil qilingan. Tadqiqotning maqsadi — mazkur shaharlarning tarixiy yadrolarida shakllangan geoekologik vaziyatni belgilovchi tabiiy-iqlimiy, antropogen-urbanistik va institutsional-me'yoriy omillarni aniqlash hamda ularni geoaxborot-kartografik va sun'iy intellekt vositalari yordamida baholash imkoniyatlarini asoslashdan iborat. Tadqiqot metodologiyasi qiyosiy-geografik tahlil, kartografik qatlamlash (overlay) usuli, ko'p mezonli qaror qabul qilish (AHP) yondashuvi hamda mualliflarning ilgari e'lon qilingan geoportal va sun'iy intellekt asosidagi ishlanmalariga tayanadi. Natijalar shuni ko'rsatdiki, uchala shahar ham umumiy muammolarga — himoya (bufer) zonalarining buzilishi, monitoring tizimlarining parchalanganligi va yagona geoaxborot platformasining yo'qligiga — ega bo'lsa-da, har bir shahar o'ziga xos geoekologik xavf profiliga ega: Toshkentda iqlim-mikroiqlim va havo ifloslanishi, Samarqandda urbanizatsiya va bufer zona bosimi, Xivada esa arid iqlim va tuproq sho'rlanishi bilan bog'liq xavflar ustuvorlik qiladi. Xulosa qilib aytganda, tadqiqot natijalari milliy miqyosda yagona geodezik-kartografik monitoring va sun'iy intellektga asoslangan baholash tizimini yaratish zaruratini asoslab beradi va ushbu maqola dissertatsiyaning nazariy-uslubiy asosini tashkil etadi.

Kalit so‘zlar: geoekologik barqarorlik, madaniy meros, geoaxborot tizimlari (GAT), geodezik monitoring, kartografik ta'minot, sun'iy intellekt, qiyosiy tahlil, bufer zona, Toshkent, Samarqand, Xiva.

Yuldoshev J.O.
lecturer
Department of General Professional Disciplines,
Faculty of Tourism
Alfraganus University
Safarov E.Y., DSc in Technical Sciences
professor
Department of Geodesy, Cartography and Cadastre
National University of Uzbekistan
Prenov Sh.M.
head of the Educational and Methodological Department
University of Exact and Social Sciences

COMPARATIVE GEOGRAPHICAL ANALYSIS OF THE GEOECOLOGICAL SITUATION IN CULTURAL HERITAGE ZONES OF TASHKENT, SAMARKAND AND KHIVA

Abstract. This article analyzes the geo-ecological stability of cultural heritage areas in three major historical-cultural centers of Uzbekistan—Tashkent, Samarkand, and Khiva—from a comparative geographical perspective. The study aims to identify the natural-climatic, anthropogenic-urban, and institutional-regulatory factors shaping the geo-ecological conditions within the historical cores of these cities, and to substantiate methods for evaluating them using geoinformation-mapping tools and artificial intelligence. The research methodology relies on comparative geographical analysis, the cartographic overlay method, the multi-criteria decision-making (AHP) approach, and the authors' previously published developments based on geoportals and artificial intelligence. The results indicate that while all three cities share common challenges—such as the encroachment on protection (buffer) zones, fragmented monitoring systems, and the absence of a unified geoinformation platform—each city possesses a distinct geo-ecological risk profile: risks associated with climate/microclimate and air pollution predominate in Tashkent; urbanization and pressure on buffer zones are primary concerns in Samarkand; and arid climate conditions and soil salinization are the dominant issues in Khiva. In conclusion, the research findings substantiate the need to establish a unified national system for geodetic-cartographic monitoring and AI-based assessment, and this article forms the theoretical and methodological basis of the dissertation.

Keywords: geo-ecological stability, cultural heritage, geographic information systems (GIS), geodetic monitoring, cartographic support, artificial intelligence, comparative analysis, buffer zone, Tashkent, Samarkand, Khiva.

1. KIRISH

O'zbekiston hududida joylashgan besh YuNESKO jahon merosi obyektidan to'rttasi — Buxoro tarixiy markazi, Shahrisabz tarixiy markazi, "Samarqand —

madaniyatlar chorrahasi" va Xivadagi Ichan-Qala — mamlakatning tarixiy shaharsozlik merosini namoyon etadi [12, 16]. Ushbu zonalar bir vaqtning o'zida faol turizm, shaharsozlik va ijtimoiy-iqtisodiy rivojlanish jarayonlariga tortilgan bo'lib, bu esa ularning geoekologik barqarorligiga jiddiy bosim o'tkazmoqda. So'nggi yillarda YuNESKO Jahon merosi qo'mitasi Samarqand markazidagi tarixiy turar-joy massivlarining buzilishi va bufer zonalar yaxlitligining buzilishi yuzasidan bir necha bor tashvish bildirgan [16, 17], Shahrisabz esa 2016-yildan buyon xavf ostidagi meros ro'yxatida turibdi. Xiva Ichan-Qalasida esa qurg'oqchil iqlim sharoitida tuproq va gruntlarning tabiiy namlik rejimi hamda drenaj tizimlaridagi kamchiliklar tarixiy inshootlarning barqarorligiga ta'sir ko'rsatmoqda [12]. Bunday vaziyat tarixiy shaharlar hududlarida geoekologik jarayonlarni yagona ilmiy-uslubiy yondashuv asosida, zamonaviy geodezik-kartografik va geoaxborot texnologiyalari yordamida doimiy kuzatib borishni taqozo etadi.

Jahon amaliyotida madaniy meros obyektlarini geoaxborot tizimlari (GAT) va masofadan zondlash (MZ) ma'lumotlari asosida baholash borasida keng tajriba to'plangan. Xususan, Kipr orolidagi Pafos hududi misolida ko'p mezonli tahlil (Analytic Hierarchy Process — AHP) usuli yordamida tabiiy va antropogen xavflarni xaritalashtirish namunasi ishlab chiqilgan [10], Gretsiyaning Rodos oroli tarixiy markazida esa tabiiy ofatlardan kelib chiqadigan zararlarni bosqichma-bosqich baholash metodikasi qo'llanilgan [11]. Xitoyning Szinan shahrida olib borilgan tadqiqotda GAT va AHP integratsiyasi orqali madaniy meros obyektlarining qariyb 29 foizi tabiiy ofatlar bo'yicha o'rta va yuqori xavf guruhiga kiritilgani aniqlangan [11]. So'nggi yillarda esa GAT bilan mashinali o'qitish algoritmlarini (Random Forest, CatBoost, chuqur neyron tarmoqlar) uyg'unlashtirgan gibrid yondashuvlar shahar landshaftlarining iqlimga moslashuvchanligini baholashda samarali vosita sifatida e'tirof etilmoqda [15]. Bu tendensiyalar madaniy meros geoekologiyasi bo'yicha xalqaro tadqiqotlarning umumiy tizimli tahlili orqali ham tasdiqlangan [18].

O'zbekiston shaharlari, xususan Toshkent misolida ham GAT asosidagi geoekologik tadqiqotlar olib borilgan: shahar issiqlik oroli hodisasi, ko'kalamzorlashtirishning mikroiqlimga ta'siri hamda oltingugurt dioksidi (SO_2) tarqalishining fazoviy dinamikasi kartalashtirilgan [13, 14]. Bu tadqiqotlar 2008-yildan keyin issiqlik elektr stanciyalarida mazutdan foydalanishning kamayishi hisobiga markaziy tumanlardagi SO_2 konsentratsiyasi sezilarli pasayganini, biroq shahar issiqlik oroli va chang-changgazsimon ifloslanish muammosi hamon dolzarb ekanini ko'rsatadi [14]. Xiva joylashgan Xorazm vohasi va Samarqand vodiysi bo'yicha esa asosan sug'oriladigan yerlarning meliorativ holati, sho'rlanish jarayonlari va masofadan zondlash ma'lumotlaridan foydalanish masalalari o'rganilgan, jumladan muallifning ilgari Farg'ona va Xorazm viloyatlari sug'oriladigan yerlari bo'yicha olib borgan tadqiqotlari ham shu yo'nalishga mansub [8, 9].

Shu bilan birga, yuqorida sanab o'tilgan tadqiqotlarning aksariyati alohida shahar yoki alohida ekologik omil (masalan, faqat havo ifloslanishi yoki faqat urbanizatsiya bosimi) doirasida chegaralangan. O'zbekistonning uchta tarixiy-

madaniy markazini — Toshkent, Samarqand va Xivani — bir vaqtning o'zida, yagona mezonlar tizimi asosida qiyoslab, ularning geoekologik barqarorligini geodezik-kartografik ta'minot va sun'iy intellekt vositalari nuqtai nazaridan baholaydigan kompleks tadqiqotlar amalda deyarli yo'q. Ayni shu bo'shliq muallifning milliy geoportalni sun'iy intellekt asosida takomillashtirish [2], adaptiv boshqaruv tizimlarida neyron tarmoqlarni qo'llash imkoniyatlari [3] hamda web-kartografiyada geoportal xizmatlarining nazariy asoslari [4] bo'yicha ilgari e'lon qilingan ishlarini davom ettirgan holda, ularni madaniy meros zonalarini monitoring qilish vazifasiga tatbiq etish zaruratini keltirib chiqaradi.

Yuqoridagilardan kelib chiqib, ushbu tadqiqotning maqsadi — Toshkent, Samarqand va Xiva shaharlaridagi madaniy meros zonalarining geoekologik holatini qiyosiy geografik tahlil qilish hamda ularni geodezik-kartografik va sun'iy intellektga asoslangan monitoring tizimiga integratsiya qilishning nazariy-uslubiy asoslarini shakllantirishdan iborat. Ushbu maqsadga erishish uchun quyidagi vazifalar belgilandi: 1) uchala shaharning tarixiy-madaniy zonalarini umumiy geografik va institutsional jihatdan tavsiflash; 2) har bir zona uchun geoekologik xavf omillarini aniqlash va qiyoslash; 3) mavjud milliy va xalqaro tajribani tahlil qilib, integratsiyalashgan monitoring modelining kontseptual asoslarini shakllantirish.

2. TADQIQOT MATERIALLARI VA METODOLOGIYASI

Tadqiqot obyekti sifatida uchta shaharning tarixiy yadrosi — Toshkentning Eski shahar (Chorsu, Xastimom atrofi) qismi, Samarqandning YuNESKO ro'yxatidagi "Samarqand — madaniyatlar chorrahasi" markaziy zonasi (Registon, Shohi Zinda, Go'ri Amir majmualari atrofi) va Xivaning Ichan-Qala devor ichidagi tarixiy shahar qismi tanlab olindi. Tadqiqot uchun quyidagi ma'lumot manbalaridan foydalanildi: O'zbekiston Respublikasi statistik va kadastr fondi ma'lumotlari [6], YuNESKO Jahon merosi qo'mitasining saqlanish holati (State of Conservation) hisobotlari [16, 17], ochiq kosmik suratga olish (Landsat, Sentinel seriyasi) ma'lumotlari asosidagi ilgari e'lon qilingan tadqiqotlar natijalari [13, 14], shuningdek muallifning geoportal, kadastr va kartografik ta'minot bo'yicha ilgari nashr etilgan ishlari [2, 3, 4, 6, 7].

Tadqiqot metodologiyasi quyidagi bosqichlarni o'z ichiga oladi. Birinchi bosqichda qiyosiy-geografik tahlil usuli yordamida uchala shaharning umumiy fizik-geografik, demografik va institutsional xususiyatlari tizimlashtirildi. Ikkinchi bosqichda geoekologik xavf omillari uch guruhga ajratildi: a) tabiiy-iqlimiy omillar (harorat rejimi, namlik, sho'rlanish, seysmik xavf); b) antropogen-urbanistik omillar (qurilish zichligi, turizm yuklamasi, transport-ifloslanish bosimi, bufer zona yaxlitligi); v) institutsional-me'yoriy omillar (monitoring tizimining mavjudligi, raqamli kadastr va geoportal infratuzilmasining darajasi, qonunchilik-boshqaruv mexanizmlari). Uchinchi bosqichda har bir omil guruhi bo'yicha uchala shahar sifat jihatidan (yuqori, o'rta, past darajadagi xavf) baholandi va kartografik qatlamlash (overlay) mantig'iga asoslangan qiyosiy jadval shaklida taqdim etildi. Bunda xalqaro amaliyotda keng qo'llaniladigan ko'p mezonli qaror qabul qilish (Analytic

Hierarchy Process — AHP) yondashuvining mezonlarni guruhlash va vazn berish tamoyillaridan foydalanildi [10, 11, 15].

Kelgusi bosqichlarda (dissertatsiyaning navbatdagi boblarida) ushbu nazariy modelni son jihatidan asoslash uchun geodezik monitoring (takroriy nivelirlash va GNSS kuzatuvlari), masofadan zondlash indekslari (NDVI — o'simlik qoplami indeksi, LST — yer yuzasi harorati, NDBI — qurilgan maydonlar indeksi) hamda mashinali o'qitish algoritmlari (Random Forest, chuqur neyron tarmoqlar) asosida sun'iy intellektga tayangan baholash modelini ishlab chiqish rejalashtirilgan [1, 2, 3, 15]. Ushbu maqola aynan shu keyingi bosqichlar uchun nazariy-uslubiy poydevor vazifasini o'taydi.

3. NATIJALAR.

1-jadvalda uchala tarixiy-madaniy zonaning umumiy qiyosiy tavsifi keltirilgan [12, 16].

Ko'rsatkich	Toshkent (Eski shahar)	Samarqand	Xiva (Ichan-Qala)
YuNESKO holati	Rasmiy ro'yxatga kiritilmagan, milliy ahamiyatga molik	1-2001-yildan Jahon merosi ro'yxatida	1990-yildan Jahon merosi ro'yxatida
Iqlim mintaqasi	Quruq subtropik, kontinental	Kontinental, yarim quruq	Arid (cho'l) iqlim
Asosiy antropogen bosim	Zich qurilish, transport, sanoat chiqindilari	Turizm oqimi, yo'l qurilishi, ko'chirish loyihalari	Turizm mavsumiyligi, cheklangan hudud
Ustuvor geoekologik xavf	Shahar issiqlik oroli, havo ifloslanishi	Bufer zona yaxlitligining buzilishi	Tuproq-grunt namligi, sho'rlanish

2-jadvalda uch guruh omil bo'yicha sifat jihatidan baholangan geoekologik xavf darajalari (yuqori — Y, o'rta — O', past — P) keltirilgan. Baholash mezonlari 2-bo'limda tavsiflangan AHP asosidagi guruhlash tamoyiliga muvofiq shakllantirilgan [10, 11, 15].

Omillar guruhi	Toshkent	Samarqand	Xiva
Tabiiy-iqlimiy (harorat, namlik, sho'rlanish)	O'	O'	Y
Antropogen-urbanistik (qurilish, turizm, transport)	Y	Y	O'
Institutsional-me'yoriy (monitoring, raqamli kadastr)	O'	O'	Y

Toshkent misolida ilgari o'tkazilgan tadqiqotlar shuni ko'rsatadiki, 1998—2003-yillar oralig'ida markaziy tumanlarda SO_2 konsentratsiyasi 30—40 mkg/m³

darajasida bo'lgan bo'lsa, 2008-yildan keyin issiqlik elektr stansiyalarida mazut yoqishning kamayishi hisobiga bu ko'rsatkich 2023-yilga kelib 2—4 mkg/m³ gacha pasaygan [14]. Shunga qaramay, shahar ko'kalamzorlashtirilgan hududlarida ham so'nggi yillarda harorat ko'tarilish tendensiyasi kuzatilmoqda, bu esa shahar issiqlik oroli muammosining hal etilmaganini ko'rsatadi [13]. Demak, Toshkent Eski shahar zonasi uchun institutsional monitoring nisbatan rivojlangan bo'lsa-da, mikroiqlim va havo sifati borasidagi antropogen bosim yuqoriligicha qolmoqda.

Samarqand markazida esa asosiy muammo tarixiy turar-joy massivlarining buzilishi va bufer zona chegaralarining bosqichma-bosqich toraytirilishi bilan bog'liq. 2006-yildayoq YuNESKO Jahon merosi qo'mitasi shahar markazini qayta qurish loyihasi doirasida qurilgan yo'l tarmog'ining tarixiy muhitga va bufer zonaga jiddiy ta'sir ko'rsatganini qayd etgan edi [16]. So'nggi ma'lumotlarga ko'ra, 2025-yilda al-Moturidiy maqbarasi atrofidagi himoyalangan zonada butun bir mahalla buzib tashlangani xalqaro tashkilotlar tomonidan tashvish bilan qayd etilgan [17]. Bu holat Samarqand uchun antropogen-urbanistik omillar guruhini yuqori xavf darajasiga qo'yishga asos bo'ldi.

Xiva Ichan-Qalasi nisbatan ixcham va yaxshi saqlangan devor ichi hududi bo'lgani bois urbanizatsiya bosimi boshqa ikki shaharga nisbatan pastroq, biroq Xorazm vohasining arid iqlimi, yer osti suvlarining yuza joylashuvi va tuproq sho'rlanishi jarayonlari tarixiy xom g'isht va loy suvoqli inshootlarning namlik rejimiga salbiy ta'sir ko'rsatadi [8, 12]. Bundan tashqari, mintaqada raqamli geoaxborot infratuzilmasi va doimiy asosdagi geodezik monitoring tizimi hali yetarli darajada rivojlanmagan, bu esa institutsional-me'yoriy omillar guruhi bo'yicha yuqori xavf darajasini belgilaydi [2, 6].

4. MUHOKAMA

Olingan qiyosiy natijalar uchala shahar uchun bir qator umumiy va farqlanuvchi xususiyatlarni ochib beradi. Umumiy muammo sifatida barcha uchta zonada bufer zonalarni huquqiy-kartografik jihatdan aniq belgilash va nazorat qilish tizimining yetarli darajada mustahkam emasligini, shuningdek yagona milliy geoaxborot platformasining mavjud emasligini ko'rsatish mumkin [16, 17]. Ayni paytda, har bir shahar o'ziga xos ustuvor xavf profiliga ega: Toshkentda mikroiqlim va havo sifati [13, 14], Samarqandda urbanizatsiya-huquqiy bosim [16, 17], Xivada esa tabiiy-iqlimiy (sho'rlanish, namlik) omillar [8, 12] ustuvor ahamiyat kasb etadi. Bu farqlar shuni ko'rsatadiki, yagona, universal monitoring modeli emas, balki umumiy metodologik asosga ega, ammo mahalliy xususiyatlarni hisobga oluvchi moslashuvchan (adaptiv) baholash tizimi zarur.

Muallifning ilgari amalga oshirgan tadqiqotlari ushbu moslashuvchan tizimni shakllantirish uchun aniq texnologik asos yaratadi. Xususan, milliy geoportalni sun'iy intellekt vositalari yordamida takomillashtirish bo'yicha ishlanma [2] geoportal darajasida heritage-qatlamlarini (madaniy meros obyektlari, bufer zonalar, monitoring nuqtalari) integratsiya qilish imkonini beradi; adaptiv boshqaruv tizimlarida neyron tarmoqlarni qo'llash bo'yicha funksional-texnik imkoniyatlarni tahlil qiluvchi ishlanma [3] esa geoekologik ko'rsatkichlarning vaqt bo'yicha o'zgarishini avtomatik aniqlash (change detection) va xavfni bashorat

qilish modullarini yaratishga asos bo'la oladi. Bundan tashqari, web-kartografiyada geoportal va kartografik xizmatlarning nazariy masalalari bo'yicha ilgari e'lon qilingan ish [4] ushbu integratsiyalashgan platformaning kartografik-vizual qatlamini loyihalashtirishda uslubiy tayanch vazifasini o'tashi mumkin, raqamli kadastr tizimlari bo'yicha tadqiqot [6] esa huquqiy-kadastr qatlamining texnik asosini ta'minlaydi.

Xalqaro tajriba, xususan Pafos (Kipr) [10] va Rodos (Gretsiya) [11] misolidagi AHP asosidagi baholash modellari hamda Szinan (Xitoy) shahridagi GAT-AHP integratsiyasi natijalari [11] shuni ko'rsatadiki, ko'p mezonli vaznlashtirilgan yondashuv turli tabiat-iqlim va shaharsozlik sharoitidagi tarixiy zonalarni qiyoslash uchun yetarlicha moslashuvchan vosita hisoblanadi. Shu bilan birga, so'nggi yillarda paydo bo'lgan mashinali o'qitish va AHP uyg'unlashgan gibrid modellar (masalan, arid shahar sharoitida o'simlik qoplami barqarorligini bashorat qilish uchun ishlab chiqilgan ML-AHP freymvorklar) [15] O'zbekistonning arid va yarim arid mintaqalarida joylashgan Samarqand hamda Xiva kabi shaharlar uchun ayniqsa dolzarb bo'lishi mumkin, chunki bunday modellar iqlim o'zgarishi stsenariylari asosida kelajakdagi geoekologik holatni ham bashorat qilish imkonini beradi. Bu yondashuv muallifning Ugam-Chatkal milliy bog'i misolida iqlim va kriosfera dinamikasini monitoring qilish bo'yicha ilgari qo'llagan uslubiy tajribasi bilan ham uyg'undir [1].

Tadqiqotning amaliy ahamiyati shundaki, taklif etilayotgan nazariy-uslubiy model asosida keyingi bosqichda uchala shahar uchun yagona kartografik-me'yoriy asosda madaniy meros geoekologik kadastri qatlamini shakllantirish [6], unga geodezik monitoring natijalarini muntazam yangilab borish hamda sun'iy intellekt asosidagi o'zgarishlarni aniqlash modulini integratsiya qilish [2, 3] mumkin bo'ladi. Bu, o'z navbatida, mas'ul davlat organlari (Madaniy meros agentligi, mahalliy hokimiyat organlari, Yer resurslari, geodeziya, kartografiya va davlat kadastri qo'mitasi) uchun qaror qabul qilishni qo'llab-quvvatlovchi vosita bo'lib xizmat qilishi mumkin.

Tadqiqotning cheklovlari sifatida shuni ta'kidlash lozimki, ushbu maqolada keltirilgan baholar asosan mavjud adabiyotlar va statistik ma'lumotlar tahliliga asoslangan sifat (qualitative) xarakterga ega. Keyingi bosqichlarda GNSS va takroriy geodezik o'lchash natijalari, yuqori ajratilganlikdagi kosmik suratlar (Sentinel-2, WorldView) hamda mahalliy monitoring stansiyalari ma'lumotlari asosida miqdoriy (kvantitativ) baholash zarur bo'ladi [1, 15].

5. XULOSA

O'tkazilgan qiyosiy geografik tahlil Toshkent, Samarqand va Xiva shaharlaridagi madaniy meros zonalarining geoekologik barqarorligi turlicha, ammo o'zaro bog'liq omillar majmuasi bilan belgilanishini ko'rsatdi. Uchala shahar uchun umumiy bo'lgan asosiy muammo — bufer zonalarni himoya qilish mexanizmlarining yetarli emasligi va yagona geoaxborot-kartografik monitoring platformasining mavjud emasligidir. Shu bilan birga, Toshkentda mikroiqlim va havo ifloslanishi, Samarqandda urbanizatsiya-huquqiy bosim, Xivada esa tabiiy-iqlimiy omillar ustuvor xavf sifatida namoyon bo'ladi. Ushbu farqlarni hisobga

olgan holda, geodezik monitoring, masofadan zondlash indekslari va sun'iy intellekt algoritmlarini uyg'unlashtirgan moslashuvchan baholash modelini yaratish maqsadga muvofiqdir [1, 2, 3, 15]. Mazkur maqolada shakllantirilgan nazariy-uslubiy asoslar dissertatsiyaning keyingi boblarida — aynan shunday integratsiyalashgan geoaxborot-kartografik va sun'iy intellektga asoslangan baholash va monitoring tizimini amaliy ishlab chiqish uchun boshlang'ich poydevor vazifasini o'taydi.

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Yusupjanov Q.Q.
tasviriy san'at va dizayn kafedrasi katta o'qituvchisi
Nabiyev A.B., PhD
tasviriy san'at va dizayn kafedrasi dotsenti
Namangan davlat universiteti
O'zbekiston, Namangan

HUNARMANDCHILIK MAHSULOTLARINING XALQARO BOZORLARDAGI RAQOBATBARDOSHLIGINI OSHIRISHNING ILMIY-AMALIY ASOSLARI

Annotatsiya. Mazkur maqolada O'zbekiston xalq xunarmandchilik mahsulotlarining xalqaro bozorlardagi raqobatbardoshligini oshirish masalalari ilmiy jihatdan tahlil qilingan. Shuningdek, milliy hunarmandchilik mahsulotlarini jahon bozoriga olib chiqishda marketing strategiyalari, brend yaratish, innovatsion dizayn va raqamli texnologiyalardan foydalanishning ahamiyati yoritilgan. Tadqiqot natijalariga ko'ra, hunarmandchilik tarmog'ini eksportbop yo'nalishga o'tkazish uchun zarur bo'lgan ilmiy-amaliy taklif va tavsiyalar ishlab chiqilgan.

Kalit so'zlar: Xalq hunarmandchiligi, raqobatbardoshlik, xalqaro bozor, eksport, brending, innovatsiya, marketing strategiyasi, milliy qadriyatlar.

Yusupjanov Q.Q.
senior lecturer
Department of Fine Arts and Design
Nabiyev A.B., PhD
associate professor
Department of Fine Arts and Design
Namangan State University
Uzbekistan, Namangan

SCIENTIFIC AND PRACTICAL FOUNDATIONS FOR ENHANCING THE COMPETITIVENESS OF HANDICRAFT PRODUCTS IN INTERNATIONAL MARKETS

Abstract. This article scientifically analyzes the issues of enhancing the competitiveness of Uzbekistan's folk handicraft products in international markets. Furthermore, it highlights the importance of marketing strategies, branding, innovative design, and the use of digital technologies in introducing national handicraft products to the global market. Based on the research results, scientific and practical proposals and recommendations have been developed to transform the handicraft sector into an export-oriented direction.

Keywords: Folk handicrafts, competitiveness, international market, export, branding, innovation, marketing strategy, national values.

Tadqiqot mavzusining dolzarbligi. Jahon iqtisodiyotining globollashuvi va madaniy integratsiyalashuv jarayonlari kuchayib borayotgan sharoitda milliy o‘ziga xoslikni saqlab qolish hamda an'anaviy xunarmandchilikni iqtisodiy rivojlanish omiliga aylantirish dolzarb vazifalardan biriga aylanmoqda. O‘zbekiston Respublikasida so‘nggi yillarda xalq hunarmandchiligini har tomonlama qo‘llab-quvvatlash, ustalarga qulay shart-sharoitlar yaratish va ularning mahsulotlarini tashqi bozorlarga keng targ‘ib qilish bo‘yicha keng ko‘lamli ishlar amalga oshirilmoqda. Biroq, xalqaro bozor talablari yuqori darajada raqobatbardoshlikni talab etadi. Hunarmandchilik mahsulotlarining dizayni, qadoqlanishi, xalqaro standartlarga muvofiqligi, elektron tijorat platformalarida faol ishtirok etishi kabi yo‘nalishlarda hal etilishi lozim bo‘lgan ilmiy-amaliy muammolar mavjud. Shu bois, xalq hunarmandchiligi mahsulotlarining raqobatbardoshligini oshirish mexanizmlarini ilmiy jihatdan asoslash ushbu tadqiqot mavzusining o‘ta dolzarb ekanini belgilaydi.

Tadqiqotning asosiy maqsadi O‘zbekiston xalq hunarmandchilik mahsulotlarining xalqaro bozorlardagi raqobatbardoshligini oshirishning nazariy va amaliy asoslarini ishlab chiqish hamda eksport salohiyatini yuksaltirishga qaratilgan tavsiyalar berishdan iborat.

Tadqiqot ishining asosiy vazifalari:

- Xalq hunarmandchiligi mahsulotlarining raqobatbardoshligini ta'minlovchi omillarni ilmiy-nazariy jihatdan o‘rganish;
- O‘zbekiston xunarmandchilik mahsulotlarining jahon bozoridagi hozirgi holati va mavjud muammolarni tahlil qilish;
- Xalqaro bozorda milliy mahsulotlarni ilgari surishda zamonaviy marketing va brending strategiyalarining o‘rnini ochib berish;
- Hunarmandchilikni raqamlashtirish va elektron tijorat tizimlariga integratsiya qilish bo‘yicha ilmiy takliflar ishlab chiqish.

Adabiyotlar tahlili. Xalq hunarmandchiligi, amaliy san'at va raqobatbardoshlik masalalari ko‘plab mahalliy va xorijiy olimlar tomonidan o‘rganilgan. Jumladan, O‘zbekiston san'atshunosligida xalq amaliy san'atining tarixiy ildizlari, maktablari va rivojlanish bosqichlari ilmiy tadqiq etilgan. Iqtisodiy adabiyotlarda esa raqobatbardoshlik nazariyasi M.Porter, F.Kotler kabi olimlarning ilmiy ishlarida keng yoritilgan bo‘lib, ular milliy mahsulotlarning xalqaro maydonda o‘z o‘rnini topishida innovatsiyalar, marketing va xaridor talablarini o‘rganish hal qiluvchi ahamiyatga ega ekanligini ta'kidlashgan. Shuningdek, zamonaviy tadqiqotlarda hunarmandchilik klasterlarini tashkil etish va turizm bilan integratsiyalash orqali mahsulot raqobatbardoshligini oshirish mexanizmlari tahlil qilingan. Biroq, xalq hunarmandchilik mahsulotlarini global raqamli bozorlarga olib chiqishning zamonaviy marketing mexanizmlari yetarlicha o‘rganilmagan.

Tadqiqot metodologiyasi. Tadqiqot jarayonida tizimli yondashuv, qiyosiy tahlil, mantiqiy umumlashtirish, statistik ma'lumotlarni tahlil qilish hamda marketing kuzatuvlari usullaridan foydalanildi. Shuningdek, xalqaro bozorlardagi

talab-taklif qonuniyatlari, eksport ko‘rsatkichlari va soha mutaxassislari hamda hunarmandlar o‘rtasida o‘tkazilgan tahliliy ma'lumotlarga tayanildi.

Muhokama va natijalar. O‘tkazilgan tahlillar shuni ko‘rsatdiki, O‘zbekiston xalq hunarmandchiligi mahsulotlari (kulolchilik, gilamdo‘zlik, zargarlik, kashtachilik, yog‘och o‘ymakorligi) o‘zining betakrorligi, qo‘l mehnati bilan bajarilgani va milliy koloriti jihatidan xalqaro bozorda katta qiziqish uyg‘otmoqda. Biroq, raqobatbardoshlikni yanada oshirish uchun quyidagi muammolarni bartaraf etish zarur:

1. Qadoqlash va dizayn uyg‘unligi: Xorijiy xaridorlarning estetik talablariga mos keladigan zamonaviy qadoqlash tizimini yo‘lga qo‘yish.

2. Standartlashtirish va sertifikatsiyalashtirish: Mahsulotlarning xalqaro sifat standartlariga to‘liq javob berishini ta'minlash.

3. Raqamli marketing va e-commerce: Jahon miqyosidagi yirik elektron savdo platformalarida (Amazon, Etsy, Alibaba va boshqalar) milliy hunarmandlarimiz uchun maxsus pavilyonlar yoki sahifalarni faol yuritish.

Natijada, hunarmandchilik mahsulotlarini eksportga yo‘naltirishda 'Usta-shogird' an'analarini zamonaviy dizayn va marketing bilimlari bilan boyitish zarurligi aniqlandi.

Xulosa. Xulosa qilib aytganda, xalq hunarmandchiligi mahsulotlarining xalqaro bozorlardagi raqobatbardoshligini oshirish kompleks yondashuvni talab etadi. Milliy hunarmandchilikni qo‘llab-quvvatlash, zamonaviy axborot texnologiyalari va raqamli marketing vositalarini joriy etish, xalqaro ko‘rgazmalar va yarmarkalarda faol ishtirok etish mamlakatimizning eksport salohiyatini yanada yuksaltiradi. Bu o‘z navbatida, milliy madaniy merosimizni saqlab qolish bilan birga, aholi bandligini ta'minlash va iqtisodiy o‘sishga xizmat qiladi.

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Абдужалилова Н.А.
магистрант 2-го курса
Ташкентский государственный экономический университет
ORCID: 0009-0009-1499-5006
Аскарова М.Т.
научный руководитель, профессор
Ташкентский государственный экономический университет

ОТ РОСТА ЭКОНОМИКИ К РОСТУ БЛАГОПОЛУЧИЯ НАСЕЛЕНИЯ: НОВЫЕ ОРИЕНТИРЫ РАЗВИТИЯ УЗБЕКИСТАНА

Аннотация. Высокие темпы роста ВВП сами по себе не означают, что жизнь населения улучшается в той же мере, поэтому для оценки развития Узбекистана важно учитывать показатели благосостояния. Цель исследования — оценить, в какой мере экономический рост в стране сопровождается повышением благосостояния населения, и обосновать систему показателей, дополняющих ВВП. Методологическую основу составили сравнительный анализ официальных данных Агентства статистики при Президенте Республики Узбекистан за 2021–2026 годы и нормативно-правовых документов, а также методы статистического анализа, включая расчёт коэффициентов вариации и корреляции. Установлено, что рост сопровождался увеличением реальных доходов, снижением бедности и сокращением межрегиональных различий в её уровне, однако сохраняются риски, связанные с зависимостью части населения от денежных переводов, неформальной занятостью и региональным неравенством доходов. Предложена система из шести показателей благосостояния, которая может использоваться при мониторинге реализации Стратегии «Узбекистан – 2030» и совершенствовании государственной социально-экономической политики.

Ключевые слова: экономический рост; благосостояние населения; инклюзивный рост; ВВП; бедность; региональное неравенство; неформальная занятость; Узбекистан.

Abdujalilova N.A.
second-year master's student
Tashkent State University of Economics
ORCID: 0009-0009-1499-5006
Askarova M.T.
academic supervisor, professor
Tashkent State University of Economics

FROM ECONOMIC GROWTH TO IMPROVED PUBLIC WELL-BEING: NEW DEVELOPMENT GOALS FOR UZBEKISTAN

Abstract. High GDP growth rates do not in themselves mean that living standards are improving to the same extent, which makes it essential to take well-being indicators into account when assessing Uzbekistan's development. This study aims to assess the extent to which economic growth in the country has translated into improved population well-being and to substantiate a set of indicators that complement GDP. The research is based on a comparative analysis of official data from the Statistics Agency under the President of the Republic of Uzbekistan for 2021–2026 and of relevant legal and regulatory documents, using statistical methods such as the coefficient of variation and correlation analysis. The results show that growth has been accompanied by rising real incomes, a reduction in poverty and a narrowing of regional disparities in poverty rates; however, risks remain, stemming from the dependence of part of the population on remittances, informal employment and regional income inequality. The study proposes a system of six well-being indicators that may be applied in monitoring the implementation of the "Uzbekistan – 2030" Strategy and in improving national socio-economic policy.

Keywords: economic growth; population well-being; inclusive growth; GDP; poverty; regional inequality; informal employment; Uzbekistan.

Введение

В последние годы экономика Узбекистана демонстрирует устойчивые темпы экономического роста, сопровождающиеся активными структурными реформами, модернизацией отраслей экономики и реализацией масштабных государственных программ. Вместе с тем достижение высоких темпов роста валового внутреннего продукта само по себе не является достаточным основанием для оценки успешности социально-экономического развития страны. В современной экономической науке всё большее внимание уделяется вопросу о том, насколько результаты экономического роста отражаются на повышении благосостояния населения, сокращении бедности, расширении возможностей занятости и снижении региональных диспропорций.

В 2025 году ВВП Узбекистана увеличился на 7,7 %, достигнув 1 849,7 трлн сумов. Одновременно продолжился рост доходов населения и снижение уровня бедности. Однако эти положительные изменения требуют более глубокой оценки, поскольку традиционные макроэкономические показатели не позволяют в полной мере определить качество экономического роста, его устойчивость и степень влияния на уровень жизни населения. В этой связи возникает необходимость использования дополнительных индикаторов, позволяющих комплексно оценивать результаты проводимой социально-экономической политики.

Отдельные аспекты инклюзивного роста уже получили серьёзное освещение в научной литературе Узбекистана: внешняя миграция рассмотрена в работе Абдурахманова и Зокировой (2023), неформальная занятость – у Амирджановой (2024), адресная социальная поддержка – у

Убайдуллаева (2021), влияние роста на образ жизни – у Маматкулова (2023), качество жизни – у Таджиевой (2023). Эти исследования создают основу для следующего шага: на последних официальных данных проследить, в какой мере рост ВВП превращается в благосостояние домохозяйств и насколько устойчив этот результат. Цель статьи – предложить набор показателей благополучия, которые дополняют ВВП. Рабочая гипотеза: рост в Узбекистане доходит до домохозяйств и сокращает бедность, а оценка его устойчивости остаётся направлением для дальнейшего совершенствования. **Научная новизна исследования** состоит в предложенной системе показателей, которая показывает, как рост ВВП Узбекистана превращается в благосостояние населения. Система объединяет пять направлений: рост экономики, доходы, бедность, качество занятости и региональные различия, и может использоваться при оценке результатов социально-экономической политики.

Методы исследования

Эмпирическую базу исследования составили официальные статистические материалы Национального комитета Республики Узбекистан по статистике, включая данные о валовом внутреннем продукте, совокупных доходах населения, уровне бедности и региональных социально-экономических показателях за 2021–2026 годы. В качестве дополнительных источников использованы нормативно-правовые акты Республики Узбекистан, определяющие приоритетные направления государственной политики в сфере экономического развития и повышения благосостояния населения, а также аналитические материалы Всемирного банка, позволяющие сопоставить полученные результаты с международными оценками.

Для достижения поставленной цели использован комплекс общенаучных и статистических методов исследования. Применены сравнительный и системный анализ, методы группировки и обобщения статистической информации, расчёт коэффициента вариации для оценки региональной дифференциации показателей и коэффициентов корреляции Пирсона для выявления взаимосвязей между уровнем доходов, бедностью и долей денежных переводов. Следует отметить, что корреляционный анализ использован исключительно для выявления статистических взаимосвязей и не предполагает установления причинно-следственных зависимостей.

Ограничения исследования обусловлены использованием предварительных статистических данных за 2025–2026 годы, различиями в методиках расчёта отдельных показателей и тем, что часть международных оценок носит аналитический характер. Несмотря на это, применённый подход позволяет получить объективное представление о взаимосвязи экономического роста и благосостояния населения в современных условиях развития Узбекистана.

Результаты и обсуждение

Масштаб: рост дошёл до домохозяйств

По анализу первого условия-результат положительный. Совокупный доход населения в 2025 году составил 1 134,3 трлн сумов и вырос в реальном выражении на 9,2 %; доход на душу населения — 29,9 млн сумов в год, реальный рост 7,2 % (Нацкомитет по статистике, 2026б). Доходы росли не медленнее ВВП, поэтому разрыва между макростатистикой и кошельком здесь нет. Уровень бедности за четыре года снизился с 17,0 до 5,8 %, то есть на 11,2 процентного пункта (Нацкомитет по статистике, 2025а). Всемирный банк связывает около 9 пунктов этого снижения с оплачиваемой занятостью и ростом зарплат (Правительственный портал, 2026). Полученные результаты позволяют сделать вывод о том, что экономический рост в Узбекистане носит инклюзивный характер по масштабу своего воздействия на благосостояние населения.

Вместе с тем полученные результаты свидетельствуют, что высокая динамика макроэкономических показателей сама по себе ещё не гарантирует устойчивого повышения благосостояния населения. Для долгосрочной оценки эффективности экономического роста необходимо учитывать не только темпы увеличения ВВП и доходов, но и качество создаваемых рабочих мест, устойчивость источников доходов населения и степень сокращения региональных различий. Именно совокупная оценка этих факторов позволяет сделать вывод о реальном характере инклюзивного экономического роста.

Источники доходов: на что опирается рост

Второе условие даёт более сложную картину. Трудовые доходы составляют 60,4 % дохода населения, трансферты — 29,6 %, причём трансферты росли быстрее всего: на 23,2 % против 20,3 % у зарплат и 16,2 % у самозанятых. Денежные переводы из-за границы, входящие в трансферты, дают 21,0 % всего дохода (Нацкомитет по статистике, 2026б). По расчёту автора, из 18,9 % номинального роста доходов около 6,6 процентного пункта обеспечили трансферты, остальное — преимущественно труд. Следовательно, переводы нельзя назвать главным двигателем роста, но это существенная и быстро растущая опора.

С макроэкономической точки зрения высокая роль денежных переводов имеет двойственный характер. С одной стороны, они способствуют росту доходов домашних хозяйств и снижению бедности. С другой стороны, значительная зависимость части населения от внешних источников доходов повышает чувствительность экономики к изменениям на международных рынках труда и усиливает необходимость развития внутренних источников устойчивой занятости.

Опора распределена неравномерно (таблица 1). Доля переводов составляет 32,5 % дохода в Ферганской, 31,1 % в Хорезмской и 30,0 % в Андижанской области, а в Ташкентской и Навоийской — лишь 6,2 и 5,3 % (Нацкомитет по статистике, 2026б). Сама по себе высокая доля итог не предопределяет: в Ферганской области реальный доход вырос на 14,8 %, в

Андижанской при близкой доле переводов — на 0,6 %. Часть благополучия создаётся на рынках труда других стран, а Узбекистан остаётся одним из крупнейших в регионе источников трудовой и образовательной миграции (Абдурахманов и Зокирова, 2023). ВВП эти доходы не отражает, а на уровень жизни областей они влияют напрямую.

Качество занятости: количество работы или её отдача

Внутри страны картина зависит от качества занятости. По оценке Всемирного банка, две трети новых рабочих мест возникло в строительстве и торговле, около 85 % новых мест неформальны, а реальная производительность труда стала снижаться (World Bank, 2026). Эти факты нужно читать вместе. Если ВВП растёт, а производительность падает, то рост обеспечивает число занятых, а не отдача каждого рабочего места, и закрепляется он слабее, чем кажется по темпам.

Официальная статистика говорит о другом сечении. По сборнику Нацкомитета, неформальная занятость снизилась с 42,8 % в 2020 году до 37,9 % в 2024-м (Нацкомитет по статистике, 2025б), но цель Постановления № ПП-366 — 33 % к 2025 году (Постановление Президента РУз № ПП-366, 2022) — по этим данным ещё не достигнута. Противоречия с 85 % нет: 37,9 % — доля неформальных среди всех занятых, 85 % — среди новых рабочих мест. Иначе говоря, занятость, накопленная ранее, формализуется медленно, а новая приходит в основном неформальной. Меры по формализации подробно рассмотрены в работе С. С. Амирджановой (Амирджанова, 2024).

Территории: бедность сближается, доходы расходятся

Таблица 1 — Доходы, переводы и бедность по регионам, 2025 год

Регион	Доход на душу, тыс. сумов	Реальный рост дохода, %	Доля переводов, %	Уровень бедности, %
Республика Узбекистан	29 935,5	107,2	21,0	5,8
г. Ташкент	73 910,5	108,5	13,8	3,5
Навоийская	44 694,2	107,1	5,3	4,2
Бухарская	35 176,2	108,0	24,5	6,0
Хорезмская	31 136,0	108,7	31,1	6,7
Ташкентская	29 830,9	104,4	6,2	5,3
Андижанская	26 275,9	100,6	30,0	6,1
Ферганская	24 582,7	114,8	32,5	5,7
Самаркандская	24 471,0	106,2	28,8	6,1
Кашкадарьинская	23 517,5	108,5	24,5	6,5
Сырдарьинская	23 339,5	106,7	13,1	6,2
Джизакская	22 907,4	105,0	9,7	5,8
Сурхандарьинская	22 572,2	106,5	26,7	6,1
Наманганская	21 304,6	105,7	22,8	5,5
Каракалпакстан	20 656,0	103,8	18,3	6,6

Источник: (Нацкомитет по статистике (2026б/2025а).

Наиболее выраженные различия выявлены при анализе третьего условия. Региональный разброс бедности резко сократился: коэффициент вариации уровня бедности по 14 регионам упал с 0,43 в 2021 году до 0,15 в 2025-м, а диапазон значений — с 3,9–30,5 % до 3,5–6,7 % (Нацкомитет по статистике, 2025а). Оговорка: по ряду областей данные 2021 года выглядят нетипично низкими (в Ферганской области — 3,9 %), поэтому вывод о сходимости следует проверять на более длинном ряду. Доходы при этом остаются неравными: коэффициент вариации дохода на душу населения в 2025 году — 0,45. В городе Ташкенте он составляет 73,9 млн сумов в год, в Каракалпакстане — 20,7 млн, то есть в 3,6 раза меньше. Среднее по трём лидерам (Ташкент, Навоийская и Бухарская области) — 51,3 млн, по трём аутсайдерам (Каракалпакстан, Наманганская и Сурхандарьинская области) — 21,5 млн, разрыв 2,38 раза (Нацкомитет по статистике, 2026б). В первом квартале 2026 года Ташкент с 19,1 млн сумов опережает Наманганскую область с 4,6 млн в 4,1 раза (Нацкомитет по статистике, 2026в).

Корреляции по 14 регионам показывают, как связаны эти процессы. Бедность тесно связана с доходом ($r = -0,84$), а доля переводов — с бедностью положительно ($r = +0,55$) и с доходом отрицательно ($r = -0,33$). Иными словами, переводы сосредоточены в областях с более низкими доходами и

более высокой бедностью. Связь доли переводов с реальным ростом доходов слабая (r = +0,27), поэтому утверждать, что переводы определяют региональные различия роста, нельзя. Полученные результаты позволяют предположить, что сближение регионов по уровню бедности при сохранении существенных различий в доходах обусловлено тем, что линия бедности задаёт минимальный порог потребления, тогда как уровень доходов в большей степени определяется территориальной концентрацией рабочих мест и различиями в оплате труда. Зарплаты составляют 48,6 % дохода в Ташкенте и 20,3 % в Самаркандской области (Нацкомитет по статистике, 2026в), а половина высококвалифицированных рабочих мест, по оценке Всемирного банка, находится в Ташкенте и Ташкентской области; высшим образованием охвачено 63 % жителей столицы и 23 % в отдельных регионах (World Bank, 2026). Там же отмечено, что каждый пятый житель страны уязвим к возврату в бедность, а охват домохозяйств основным пособием упал с 26 % в 2022 году до 8 % в 2025-м. По индексу человеческого развития ПРООН за 2025 год Узбекистан занимает 107-е место из 193 (UNDP Uzbekistan, 2025).

Ориентиры: шесть показателей рядом с ВВП

Три линии проверки подсказывают набор показателей, которые стоит публиковать и читать вместе с ВВП (таблица 2). Первые три Нацкомитет уже публикует, остальные три пока встречаются только в оценках Всемирного банка. Практический порядок поэтому такой: сначала свести в одном месте то, что уже измеряется, затем добавить то, что измеряется внешне.

Таблица 2 — Показатели благосостояния, дополняющие оценку ВВП

Показатель	Что показывает	Значение	Кто публикует
Реальный доход на душу населения	Что получили домохозяйства	рост на 7,2 % (2025)	Нацкомитет по статистике (Нацкомитет по статистике, 2026б)
Доля денежных переводов в доходах	Зависимость от внешних рынков труда	21,0 % (2025)	Нацкомитет по статистике (Нацкомитет по статистике, 2026б)
Разрыв доходов трёх богатейших и трёх беднейших регионов	Пространственное неравенство	2,38 раза (2025, расчёт автора)	Нацкомитет по статистике (Нацкомитет по статистике, 2026б)
Доля неформальных мест среди новых	Качество занятости	около 85 %	Всемирный банк (World Bank, 2026)
Рост реальной производительности труда	Основа будущих доходов	отрицательный	Всемирный банк (World Bank, 2026)
Доля уязвимых к возврату в бедность	Прочность результата	каждый пятый	Всемирный банк (World Bank, 2026)

Источник: составлено по данным (Нацкомитет по статистике, 2026б; World Bank, 2026).

Для реализации предлагаемого подхода уже сформирована необходимая институциональная основа. Национальный комитет Республики Узбекистан по статистике публикует наборы данных по доходам, бедности и децильным группам (Нацкомитет по статистике, б. д.). Обновлённая Стратегия «Узбекистан — 2030» вводит мониторинг показателей на цифровой платформе со статусами «зелёный», «жёлтый» и «красный» (Указ Президента РУз № УП-21, 2026). Вместе с тем анализ приложения с целевыми показателями показал, что целевые ориентиры по уровню бедности и доходам населения в нём отсутствуют. Программа, предусмотренная Указом Президента Республики Узбекистан № УП-143, ориентирована на сокращение бедности до 6 % к концу 2025 года и вывод из бедности 1 млн человек (Указ Президента РУз № УП-143, 2024). Таким образом, система мониторинга уже создана, однако измерение благосостояния населения в ней пока представлено недостаточно полно.

У предлагаемого набора есть ограничения. Доля переводов не плоха сама по себе: для семьи это надёжный доход, и сокращать её административно нельзя. Данный показатель целесообразно использовать для оценки уязвимости экономики, а не в качестве целевого ориентира государственной политики. Показатели занятости и уязвимости основаны на оценках Всемирного банка, и до официальной публикации их нужно сопоставлять с данными Нацкомитета. Наконец, региональные корреляции описательны: проверка причинных связей потребует панельных данных за несколько лет.

Заключение

Проведённое исследование показало, что в последние годы экономический рост Узбекистана сопровождался положительными изменениями основных социально-экономических показателей. Рост валового внутреннего продукта сопровождался увеличением реальных доходов населения и существенным снижением уровня бедности, что свидетельствует о положительном влиянии проводимых экономических реформ на благосостояние населения.

Вместе с тем результаты исследования показывают, что использование исключительно показателя ВВП не позволяет в полной мере оценить качество и устойчивость экономического роста. Значительная роль денежных переводов в структуре доходов населения, сохраняющиеся различия в уровне доходов между регионами и высокая доля неформальной занятости указывают на необходимость применения более комплексного подхода к оценке результатов социально-экономического развития.

Научная ценность исследования заключается в предложении системы дополнительных показателей, позволяющих оценивать не только масштабы экономического роста, но и его влияние на благосостояние населения, качество занятости и территориальную сбалансированность развития.

Практическая значимость полученных результатов состоит в возможности их использования органами государственного управления при мониторинге реализации Стратегии «Узбекистан — 2030», разработке мер по повышению уровня жизни населения и совершенствовании системы оценки эффективности государственной социально-экономической политики.

Перспективы дальнейших исследований связаны с расширением временного горизонта анализа, использованием панельных региональных данных и более глубоким изучением факторов, определяющих взаимосвязь экономического роста, занятости, доходов населения и сокращения бедности.

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Абдуназаров У.К.
доцент кафедры физической географии
Национальный университет Узбекистана имени Мирзо Улугбека

ТЕНДЕНЦИИ КЛИМАТИЧЕСКИХ ИЗМЕНЕНИЙ ПЛЕЙСТОЦЕНА В СРЕДНЕЙ АЗИИ ПО ДАННЫМ ЛЁССОВО-ПОЧВЕННЫХ И ЛИТОЛОГИЧЕСКИХ КОМПЛЕКСОВ

Аннотация. В статье рассматриваются закономерности климатических изменений на территории Средней Азии в плейстоцене и голоцене на основе анализа литолого-фациальных, геоморфологических и палеопедологических данных. Особое внимание уделено лёссово-почвенным комплексам как высокоинформативным континентальным архивам палеоклимата. Установлено, что эволюция климата региона характеризовалась не только направленной аридизацией, но и выраженной цикличностью, проявлявшейся в чередовании влажных и засушливых фаз. Эти колебания находят отражение в структуре разрезов, стадийности почвообразования и особенностях осадконакопления. Показано, что современные климатические изменения представляют собой кратковременные флуктуации в рамках долгосрочных природных циклов. Полученные результаты уточняют представления о палеоклиматической динамике аридных внутриконтинентальных регионов и могут быть использованы при прогнозировании будущих климатических изменений.

Ключевые слова: Средняя Азия, плейстоцен, палеоклимат, лёссы, палеопочвы, аридизация, климатические циклы.

Abdunazarov U.K.
associate professor
Department of Physical Geography
National University of Uzbekistan named after Mirzo Ulugbek

TRENDS IN PLEISTOCENE CLIMATE CHANGE IN CENTRAL ASIA BASED ON LOESS–PALEOSOL AND LITHOLOGICAL COMPLEXES

Abstract. This article examines patterns of climate change in Central Asia during the Pleistocene and Holocene based on an analysis of lithofacies, geomorphological, and paleopedological data. Particular attention is paid to loess-soil complexes as highly informative continental paleoclimate archives. It has been established that the evolution of the region's climate was characterized not only by directed aridization but also by pronounced cyclicity, manifested in the alternation of wet and dry phases. These fluctuations are reflected in the structure of sections, the stages of soil formation, and sedimentation patterns. It is shown that modern climate changes represent short-term fluctuations within long-term natural cycles.

The results obtained clarify the understanding of the paleoclimatic dynamics of arid intracontinental regions and can be used to predict future climate change.

Keywords: Central Asia, Pleistocene, paleoclimate, loess, paleosols, aridization, climatic cycles.

Введение. Изменения климата на протяжении геологической истории Земли являются фундаментальным свойством природной системы. Несмотря на значительный объём накопленных данных, причины и механизмы климатической изменчивости остаются предметом научной дискуссии, особенно в отношении внутриконтинентальных аридных регионов [2,6].

Современные климатические изменения, включая рост глобальной температуры, деградацию ледников, снижение водных ресурсов и усиление климатической неоднородности, обуславливают повышенный интерес к реконструкции палеоклиматических условий. В этом контексте Средняя Азия представляет особый научный и практический интерес как регион с высокой чувствительностью к изменениям гидротермического режима [4.

Ключевым направлением исследований является изучение палеоландшафтов, сформированных в различных морфоструктурных зонах – от равнин до горных систем. Особую роль играют лёссово-почвенные комплексы, которые позволяют реконструировать динамику климата с высокой временной разрешающей способностью. Однако, несмотря на значительный вклад классических исследований, выполненных в XX веке, вопросы соотношения направленной аридизации и цикличности климатических процессов остаются недостаточно изученными [1,2,6,11].

Основными методами при решении поставленных задач, в условиях Средней Азии являлись литолого-фациальный анализ – для определения условий осадконакопления, палеопедологический анализ – для реконструкции условий почвообразования, стратиграфический метод – для выделения возрастных горизонтов, сравнительно-географический подход – для сопоставления региональных данных, интерпретационный анализ – для реконструкции климатических трендов. Особое внимание обращено концепции «памяти почв», позволяющая использовать морфологические и химические свойства почв как индикаторы палеоклимата.

Результаты. Палеогеографические исследования показывают, что равнины Узбекистана являются динамичной системой, чутко реагирующей на тектонические поднятия гор и глобальные изменения климата.

Палеогеография равнинной части Средней Азии (Туранская плита, пустыни Кызылкум, Устюрт) характеризуется длительной эволюцией от мезозойских морских бассейнов до континентальных условий кайнозоя. Основные этапы развития равнинной части связана с господством теплого мезозой -палеогенового морского бассейна на дне которого накопились мощные толщи осадочных пород (пески, глины, известняки), формирующий фундамент. Континентальный этап начался с неогена в связи с поднятием гор Тянь-Шаня и отступлением моря. Установились

континентальные условия, началось формирование речных долин и аккумуляция красноцветных отложений.

На основании собранных материалов можно утверждать, что во время позднего палеогена и неогена господствовал аридный климат. Об этом свидетельствует анализ литологических данных, которые показывает, что в конце палеогена и неогене на равнинной части Средней Азии доминировали жаркие и преимущественно сухие климатические условия. Осадконакопление происходило в континентальных условиях с формированием красноцветных глин и мелкообломочных пород. Тектонические процессы привели к смене морского режима осадконакопления на континентальный, что стало важным этапом в формировании современных природных условий региона. Горы Западного Тянь-Шаня в палеогене и неогене характеризовалась переходом от относительно выровненного рельефа с теплыми субтропиками к интенсивному альпийскому горообразованию. В палеогене (66–23 млн лет назад) преобладали процессы денудации и формирования красноцветных отложений в условиях жаркого климата с развитием выровненных поверхностей унаследованных от мезозоя. В неогене (23–2.6 млн лет назад) альпийская складчатость начала активно поднимать Тянь-Шань, формируя современный горный рельеф. Происходило волновое опускание впадин с бурным ростом горных хребтов, формированием межгорных впадин на фоне аридизации климата. К концу неогена Западный Тянь-Шань стал высокоподнятой горной системой, а палеогеновые красноцветы были частично смяты в складки и подняты на значительную высоту [1].

В четвертичный период сформировался современный пустынный ландшафт равнин, образовались древние дельты Амударьи и Сырдарьи, происходили неоднократное, значительные колебания уровня Аральского моря[2].

Начало четвертичного периода характеризуется усилением аридности, известным как «великое остепнение» [5]. Однако полученные данные свидетельствуют о сложной структуре климатических изменений. Одновременно происходило активное накопление пролювиальных и аллювиальных отложений (речные наносы Амударьи, Сырдарьи, Зеравшана).

Сформировались обширные массивы песков (Кызылкум) за счет перевевания древних речных наносов.

Равнинная часть исследуемого региона в настоящее время представляет собой типичную аридную область, развитие которой на протяжении позднего плейстоцена—голоцена определяется сопряженным воздействием процессов аридизации, интенсивной эрозией и аккумуляцией осадочных пород. Современный облик рельефа сформирован под прямым влиянием климатических флуктуаций, определяющих динамику замкнутых водоемов и чередованием гумидных и аридных фаз [7].

Интенсивность осадконакопления характеризуется высокой пространственно-временной неравномерностью. Эрозионные процессы доминируют в периоды аридизации, приводя к дефляции и образованию

дефляционных котловин. Аккумуляция приурочена как к фазам затопления неглубоких замкнутых впадин (накопление тонкодисперсных озерных илов), так и к гумидным эпохам (активизация делювиально-пролювиального смыва с прилегающих возвышенностей). Смена литофаций (например, переход от грубообломочного пролювия к тонким озерным глинам) отражает резкие смены режима осадконакопления, связанные с пульсациями климата [2, 11].

Лёссово-почвенные комплексы (ЛПК) в горных и предгорных районах Средней Азии мощностью до 40–50 м представляют собой уникальные, практически непрерывные архивы палеоклиматических записей, отражающие цикличность климатических процессов континентальных областей в плейстоцене. Анализ структурно-функциональной организации ЛПК позволяет выделить фундаментальную стадийность, включающую: а) накопление пылеватого материала в эпохи аридизации; б). активное педогенетическое преобразование в интергляциалы/интерстадиалы, обусловленное ростом гумидности и температур; в) фазы деградации почвенного профиля связанных с усилением эрозионных процессов ; г) возобновление осадконакопления [12,13]. Отмеченные фазы четко прослеживаются на разрезах четвертичных образований предгорных и горных областях Западного Тян-Шаня (рис.1).



Рисунок 1. Общий вид лессово-почвенных горизонтов Оркутсайского разреза. Более темным цветом выделяются горизонты погребенных почв

Для того чтобы облегчить расчленение лёссов по возрасту, а также выявить закономерности залегания и распространения погребенных почв, И.Н.Степановым и У.К.Абдуназаровым (1975) были обобщены и систематизированы морфологические свойства палеопочв Западного Тянь-Шаня. Каждый горизонт почв обозначены заглавными буквами латинского алфавита. В частности, современная почва обозначена буквой “A”, нижележащие погребенные почвы сверху вниз по разрезу буквами “B”, “C”, “D”, “E”, “F” и т.д., а разделяющие их лессовидные суглинки малыми буквами “a”, “b”, “c”, “d”, “e”, “f” и т.д.

Относительный и абсолютный возраст погребенных почв определены в результате комплексного анализа и по данным палеомагнитных исследований

[9]. Мелкоземистые отложения эоплейстоцена в пределах Узбекистана сохранились весьма фрагментарно и их можно встретить в пределах низко- и среднегорных частей речных долин, где они имеют вид мощной моноклинально залегающей толщи красновато-коричневого цвета. Слои этой толщи образованы чередованием порошистых серовато-коричневых суглинков и комковато-ореховатыми, красновато-коричневыми палеопочвами обозначенные нами как ***Gg, G_1, g_1*** и т.д. Опорных разрезах (Аркутсай, Апартак в пределах Западного Тянь-Шана и в разрезах Каратау в Южном Таджикистане) насчитывается от 5ти до 25ти горизонтов погребенных почв .

Отложения эоплейстоцена от ниже и верхнележащих горизонтов, отличаются мощным, монотонным сложением, почти размеренным чередованием палеопочв, лессовидных суглинков и плотных, карбонатно-глинистых горизонтов. Из-за такого мощного сложения и окраски, до недавнего времени, многие геологи относили их к верхнему неогену. Однако палеомагнитные и другие исследования свидетельствуют о эоплейстоценовом возрасте[10].

Отложения эоплейстоцена, подобные Аркутсайским, вскрываются и на разрезе Апартак, расположенном в долине реки Ангрен на абсолютных высотах 1100-1200 м. Здесь, в отличие от Аркутсайского разреза, в строении почвенно-лессовой толщи карбонатные горизонты, прослойки так называемого «каменного лесса», выражены не особенно четко. Это связано с региональными палеогеографическими различиями между указанными разрезами.

Судя по литологическому и морфологическому строению отложений рассматриваемого возраста, в эоплейстоцене климат оставался теплым и влажным. Смягчающее воздействие на климат оказывали озера, унаследованные от неогена, и низкогорный рельеф Западного Тянь-Шаня в целом, имевший место быть в ту эпоху. Горы были низкими, а потому вертикальная поясность не имела особо чёткой выраженности.С учетом углов наклона слоёв палеопочв и карбонатных горизонтов можно сделать вывод о том, что в то время преобладали склоны крутизной до $10\text{-}12^0$.

По морфологическим признакам палеопочвы данного возраста очень близки друг другу, поэтому их разделение на горизонты ***«G», «G_1», «G_2»*** и т.д. весьма условно и их можно рассматривать как единую серию палеопочв эоплейстоцена. Лессово-почвенные горизонты такого типа могли быть образованы только в результате интенсивного испарения с поверхности пресноводных озер или болот, а также частично являются иллювиальным горизонтом палеопочв.

О резкой смене почвообразования и осадконакопления во время образования почвенно-лессовых комплексов свидетельствует весьма четкий характер перехода горизонтов палеопочв, лессовидных суглинков и карбонатных горизонтов. Палеопочвы эоплейстоцена по своему

морфологическому строению довольно четко отличаются от аналогичных образований более поздних периодов.

Главным отличием является более темная окраска с красноватым оттенком и плотное сложение с вкраплением ореховатых угловатых структур размером от 1,0 до 1,5 см. На гранях структурных комочков имеются тонкие темные налеты окиси марганца, пространство между агрегатами заполнено глинисто-карбонатным веществом, которые при зачистке стенки шурфа издают характерный скрипучий звук.

Широкое распространение грубообломочного материала, в основном конгломератов, на границе эоплейстоцена и плейстоцена свидетельствует о крупных тектонических и климатических изменениях. Наиболее мощные отложения того времени обнаружены у селения Нанай в долине реки Пскем. Здесь мощные толщи конгломератов мощностью около 60 метров сложенная угловатой и угловато-окатанной галькой размером 10-15 см, скрепленной карбонатным цементом, сверху перекрыта лессовидными суглинками толщиной около 40 метров.

Нижняя кровля конгломератов, отнесённая к отложениям нанайской террасы, в настоящее время находится на высоте 800 м над руслом реки, что дало основание для отнесения их к нижнечетвертичным отложениям [8]. Это не противоречит принятой схеме Х.А.Тойчиева (1996), где они отнесены к раннему плейстоцену.

Из всех приведенных сведений следует, что осадконакопление и почвообразование на фоне влажного и теплого климата эоплейстоцена сменилось мощной денудацией под влиянием неотектонических движений на границе эоплейстоцена и раннего плейстоцена. События этого периода четко зафиксированы в осадках данной эпохи в виде грубообломочного материала в горах (с. Нанай) и в виде мелкоземистых отложений с прослойками «каменного лесса» (долина реки Аркутсай) предгорной зоны.

Большая часть предгорных равнин в то время представляла собой обширные озерно-болотистые участки, где насчитывались мощные толщи песчано-супесчаных отложений (низовья рек Чирчик, Келеса и др.).

Палеопочвы раннего и среднего плейстоцена, отмеченные как почвенно-лессовые комплексы ***«E-e» «F-f», «F_1-f_1» «F_2-f_2»*** и т.д., отличаются морфологически от ниже- и вышележащих горизонтов палеопочв рядом свойств. В первую очередь, они отличаются темновато-коричневой (до бурого) окраской, плотностью сложения, наличием характерных структурных комочков и включением карбонатных конкреций продолговато-округлой формы диаметром 4-6 см и длиной до 10-15 см).

Палеопочвы данного возраста встречаются на высоких водораздельных и приводораздельных частях склонов. По механическому составу они тяжелосуглинистые, плотные, комковато-ореховатые, комки угловатые диаметром 1,5 – 2,0 см, на их гранях видны темноватые пятна, карбонаты не выражены, содержание CO_2 до 8-10%, ила – 15 – 20%, содержание общего гумуса – 0,1 – 0,2%.

Лёссовые суглинки, разделяющие палеопочвы, представляют собой комковато-порошистый мелкозем средней плотности, мучнистый, пачкает руки, присутствуют конкреции в виде «погремшей» удлиненно-округлой формы длиной 6 – 10 см, диаметром 4 – 5 см.

Во многих разрезах, особенно приводораздельных частях склонов, часто отсутствуют горизонты почвенно-лессового комплекса верхнего плейстоцена, встречающиеся в разрезах на других участках средне- и низкогорий. Их присутствие, как было выявлено во время полевых исследований, зависит от геолого-геоморфологических условий осадконакопления. К верхнему плейстоцену на основании комплексного анализа отнесены палеопочвенные горизонты, отмеченные как палеопочвы ***«C»*** и ***«D».***

Палеопочва ***«D»*** имеет тяжелосуглинистый состав и от более молодых по возрасту почв отличается более темным, буроватым цветом. Имеет плотное сложение, комковато-ореховатую структуру. «Орехи» округлые, диаметром до 2 см, вокруг них тонкая плесень светло-серых карбонатов; на гранях структурных комочков во влажном состоянии обычны темноватые пятна. Комки плотные, с трудом раздавливаются рукой, при взятии монолита весь горизонт легко распадается на «орехи». Карбонатные конкреции отсутствуют, пор мало. Содержание CO_2 и карбонатов 7 – 8%, гумуса – 0,2 – 0,4%, ила – 13 – 14%. Мощность слоя обычно 1 – 2 м, переход в нижележащий слой постепенный, что свидетельствует о постепенном усилении почвообразования в одно время с интенсивным осадконакоплением.

Лессовидный суглинок ***«d»*** представляет собой средний до тяжёлого суглинок серовато-коричневого во влажном и палево-серого цвета в сухом состоянии; средней плотности, комковато-порошистый, иногда встречаются включения полутвердых структурных комочков, вероятно, являющихся следами реликтового почвообразовательного процесса. Карбонаты выражены в виде отдельных беловатых пятен и карбонатно-глинистых конкреций в виде «трубочек». Содержание CO_2 карбонатов до 15%, общего гумуса – 0,3%, ила – 10 – 17%. Мощность горизонта 1-3 м. Местами в нижних частях склонов имеются включения щебня. Часть горизонта подстилается мощным до 10-20 см шохообразным слоем. Выше в разрезе лессового комплекса ***«D - d»*** залегает почвенно- лессовый комплекс ***«C - c».***

Палеопочва ***«C»*** от других погребённых почв отличается более ярко выраженной структурой, большой мощностью и тяжёлосуглинистым составом. Цвет от серо-коричневого до коричневого во влажном и палево-серый в сухом состоянии, плотный, ореховатой структуры, «орехи» диаметром до 2 см, они плотно прижаты друг другу, с трудом разбиваются рукой. Вокруг структурных комочков карбонатная плесень. Монолиты берутся с трудом, так как почва легко рассыпается по ореховатым отдельностям. Конкреции отсутствуют. Содержание CO_2 карбонатов 5-8%, общего гумуса – 0,3%, ила – до 20%. Мощность почвы 1 – 4 м, переход в нижележащий горизонт обычно постепенный.

Лессовый суглинок ***«c»*** представляет собой средний суглинок желтовато-коричневого во влажном и палево-серого в сухом состоянии; средней плотности, комковато-порошистый, мучнистый, мощность 1 – 2 м. Карбонаты встречаются в виде белых пятен и конкреций в виде «кукол» диаметром до 2 см. На 1 $см^2$ поверхности насчитывается до 30 пор диаметром менее 0,5 мм каждая. Содержание общего гумуса 0,4%, ила – 10 – 15%. Мощность 1 – 2 м. В нижних частях склонов и на конусах выноса суглинок ***«c»*** подстилается песчано-гравийным или грубообломочным материалом, на склонах и приводораздельных частях палеопочвой ***«D».***

Как видно из выше приведенного морфологического описания палеопочв верхнего плейстоцена и геолого-геоморфологического анализа мест залегания лессов и почвенного комплекса природные условия данной эпохи стали более аридными. Однако даже при самой значительной аридизации среднегодовое количество осадков не уменьшалось ниже 700 мм, о чем свидетельствует характер распределения карбонатов и аккумуляция окислов железа, титана и марганца. Все это позволяет почву ***«D»*** сравнивать с современными коричневыми почвами Западного Тянь-Шаня.

К верхней половине позднего плейстоцена относится почва ***«C».*** От других палеопочв она отличается четко выраженной ореховатой структурой, большой мощностью (до 3 – 4 м). Содержание CO_2 карбонатов 5 – 10%, общего гумуса – 0,3%, ила – до 20%. Все это в совокупности с данными других анализов позволяет считать почву ***«C»*** сформированной во время наиболее продолжительного и мощного по силе гипергенного процесса. Несмотря на следы лесного почвообразования, эта палеопочва весьма напоминает мощный чернозем.

В целом можно отметить, что во время верхнего плейстоцена в горных и предгорных областях Средней Азии наблюдалась прогрессирующая аридизация климата на фоне периодов увлажнения и неотектонических движений.

В течение голоцена (10-12 тыс. лет) почвоведы и геоморфологи по почвенно-литологическим реликтам в первой половине голоцена находят признаки увлажнения и потепления [3]. Во второй половине голоцена произошли литологические изменения, связанные с наступлением аридных и прохладных условий на общем сухом континентальном фоне. Климатологи, геоботаники и гидрологи Средней Азии, оперирующие с еще более чувствительными показателями, чем предыдущие исследователи, находят на этом сухом фоне малые фазы увлажнения и аридизации, которые не очень отразились на литологии и почв, но влияли на динамику ледников, повышение и понижение расходов уровней рек и озер.

В литологическом отношении в голоцене отлагались карбонатные, местами засоленные, пылеватые наносы, которые повсеместно кажутся одинаковыми. Однако, если внимательно присмотреться, то можно заметить хорошо развитые палеопочвы как в лессовидных отложениях гор и предгорий, так и в пределах равнин (рис.2).



Рис.2. Голоценовые палеопочвенные горизонты предгорной зоны долины реки Чирчик

Голоценовые мелкоземистые отложения наиболее широко распространены в предгорной равнине и на речных террасах голоценового возраста. Отложения этих террас часто слоистые, различны по литологии, содержат глинистые и гипсовые прослойки, носят следы гидроморфизма, выразившегося в образовании ржавых и бурых пятен, переслаивающихся бурых, розоватых, темноокрашенных слоев. Общая мощность мелкоземнистых отложений 2-5 м, часто они залегают на песчано-галечниковом основании.

На отложениях террас голоцена сформировано несколько горизонтов палеопочв. Палеопочвы среднесуглинистого механического состава с частыми включениями легких суглинков и песка. Почвенная структура почти не выражена, цвет палево-серый со следами гидроморфизма. На более высоких террасах равнин часто прослеживаются два горизонта палеопочв.

В низкогорных и среднегорных пространствах палеопочвы голоцена наиболее четко выражены на низких террасах речных долин, на склонах, а на приводораздельных частях они сохранились фрагментарно в зависимости от условий осадконакопления.

Лессово-почвенный комплекс голоцена обозначенный как ***“B - b”*** является самым верхним в вертикальном разрезе лессовых толщ, часто располагаясь непосредственно под современной почвой обозначенной буквой

“A”. Между ними присутствуют 5-10 см слой “шоха”, который представляет собой горизонтально-слоистую, палево-серую породу с охристыми пятнами.

Палеопочва представляет собой тяжелый суглинок ореховато-порошистой структуры, цвет серовато-коричневый во влажном и палево-серый в сухом состоянии. Плотный при шлифовке стенки шурфа, ножом вырисовывается паутинообразный рисунок светло-серых карбонатов вокруг структурных комочков.

Структурные «орехи» представляют собой зоогенные образования длинной 1-3 см, диаметром до 1.5 см, средней прочности, легко раздавливаются рукой. Палеопочва пористая, на площади в 1 $см^2$ насчитывается до 50 и более мелких пор. Мощность почвы “В” колеблется от 0.3 до 2 м. Содержание карбонатов (CO_2) до 20 %, общего гумуса 0.3 %, ила 10-15%. Переход в нижележащий слой обычно постепенный.

Палеопочва***“B”*** подстилается лессовидным суглинком. “b” представляет собой средний и легкий суглинок коричневатого цвета во влажном и палево-серого в сухом состоянии. В сухом состоянии плотный, комковато-порошистый. Для этого слоя характерно присутствие карбонатных конкреций “журавчиков”. В суглинке много пор, также каналов диаметром до 2 мм. Внутренние стенки пор инкрустированы мелкозернистым кальцитом. Содержание CO_2 12-15%, общего гумуса 0.4%, ила 10-16%. Переход в нижележащий слой обычно заметный, мощность слоя от 2 до 4 м.

Палеопочва ***“B”*** в предгорной равнине, в частности, в пределах г. Ташкента, заметно отличается от вышеописанной. Данную палеопочву можно назвать полугидроморфной. Мощность этой палеопочвы 1-2 м, серовато-бурая с голубовато-сизыми, охристыми пятнами, представлена тяжелым и средним суглинками комковато-ореховатой структуры. Содержание карбонатов (CO_2) до 6-8 %, общего гумуса 1 %, ила 16-18%. Здесь палеопочва ***“B”*** состоит из двух, трех горизонтов, разделенных между собой лессовидными суглинками, их можно отметить как палеопочвы***“B_1”*** и ***“B_2”,*** а лессовидный суглинок ***“b_1”*** и ***“b_2”,*** и т.д. Такое строение отложений связано, по-видимому, с особенностями осадконакопления и почвообразования речных террас предгорий, с частой сменой этого процесса.

Лессовидный суглинок ***“b_1”*** и ***“b_2”*** в предгорной зоне тоже несут следы гидроморфизма. Эти суглинки имеют цвет палевый с охристыми пятнами, средне и легкосуглинистые, плотные, видны соли и часто следы корневой системы растений. При этом в основном палеопочвы ***“B_1”, “B_2”*** голоцена приурочены к пониженным участкам слабохолмистых равнин предгорной зоны и к низам надпойменных террас рек.

Почвенно-лессовый комплекс голоценовых отложений венчается современной почвой. В основном они представляют собой разные типы коричневых и сероземных почв. Все современные почвы обозначенные буквой ***“A”*** характеризуются среднесуглинистым до тяжелого механическим составом комковато-ореховатой структуры. Морфологические признаки соответствуют общепризнанным признакам современных почв.

Современная почва подстилается лессовидным суглинком ***“а”*** светло-бурого до палевого цветом, легким до среднего механическим составом. Часто он в горах замещена погребенной почвой ***“В”.***

Лессовидный суглинок ***“а”,*** вероятно, во многих местах был подвержен смыву. Это подтверждается тем, что в горах часто под современными почвами залегает палеопочва ***“В”,*** а между ними имеется четкая линия размыва и маломощный (до 5-10%) горизонтально-слоистый шохообразный слой.

В предгорной равнине на эволюцию ландшафтов, в том числе на формирование палеопочв, наряду с климатическими факторами, повлияла деятельность рек, вытекающих из гор. Здесь на более низких выровненных участках во время плювиальных эпох, когда увеличивается сток рек, на фоне плохого оттока грунтовых вод, образовывались многочисленные болота и озера, о существовании которых свидетельствуют наличие хорошо выраженных сизых горизонтов или морфологически четко выраженные следы гидроморфизма палеопочв. В направлении от пологих водоразделов к поймам автоморфные почвы повышенного увлажнения переходят в луговые и болотные. Изменение свойств почв идет по следующей схеме: луговые, лугово-болотные, болотно-луговые пойменные.

Выводы. В целом можно отметить, что в четвертичное время формирование ландшафтов и палеопочв равнин и гор Срнедней Азии происходило в условиях неоднократных изменений климата, протекавших на фоне общего тектонического поднятия. Эти события были запечатлены в виде палеопочв эоплейстоцена, плейстоцена, голоцена и разделяющих их лессовидных суглинков. На основании литолого-генетического анализа и изучения палеопочвенных горизонтов установлена неоднократное, циклическое колебание климата Средней Азии. Однако они охватывали длительный период времени исчисляемые тысячилетиями. например, возрасть каждого горизонта палопочв голоцена колеблется от одного до двух тысячи лет, а плейстоценовых почв двадцать-тридцать тысяч лет. Поэтому современные изменнения климата, независимо под влиянием каких факторов она происходит, по геологическим меркам, носят кратковременный характер и отражают общую цикличность природных процессов. Полученные результаты исследования могут быть использованы при моделировании климатических сценариев и оценке устойчивости природных систем аридных регионов, а более детальное исследование литого-генетического строения отложений плейстоцена имеет большое теоретическое и практическое значение.

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Абдураззокова Х.А.
ассистент
Яхшиева С.И.
студент
Улмасова Р.З.
студент
Бердиев Б.К.
студент
Хамидова Ш.Х.
студент
Самаркандский государственный медицинский университет
Узбекистан, г. Самарканд

СОВРЕМЕННЫЙ УРОВЕНЬ ИСПОЛЬЗОВАНИЯ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ, ИХ РОЛЬ В СБОРЕ ДАННЫХ, ДИАГНОСТИКЕ И ЛЕЧЕНИИ В РАЗЛИЧНЫХ ОБЛАСТЯХ МЕДИЦИНЫ

Аннотация. Современные информационные технологии играют важную роль в сборе данных, диагностике и лечении в медицинской сфере. В статье анализируются текущий уровень их использования и влияние на медицину. Рассматриваются история внедрения информационных технологий в медицину и их роль в сборе данных, диагностике и лечении. Показано, что электронные медицинские системы, телемедицина и искусственный интеллект ускоряют обмен информацией и повышают качество медицинских услуг. Отмечается, что автоматизация анализа и хранения медицинских данных снижает количество ошибок, вызванных человеческим фактором.

Ключевые слова: информационные технологии, медицина, сбор данных, диагностика, лечение, телемедицина, электронные медицинские карты.

Abdurazzoqova X.A.
assistant
Yaxshiyeva S.I.
student
Ulmasova R.Z.
student
Berdiyev B.K.
student
Hamidova Sh.H.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE CURRENT LEVEL OF USE OF INFORMATION TECHNOLOGIES AND THEIR ROLE IN DATA COLLECTION, DIAGNOSTICS, AND TREATMENT IN VARIOUS FIELDS OF MEDICINE

Abstract. Modern information technologies play an important role in data collection, diagnostics, and treatment in the medical field. The article analyzes the current level of their use and their impact on medicine. It considers the history of the adoption of information technologies in medicine and their role in data collection, diagnostics, and treatment. It is shown that electronic medical systems, telemedicine, and artificial intelligence accelerate information exchange and improve the quality of medical services. It is noted that the automation of medical data analysis and storage reduces errors caused by the human factor.

Keywords: information technologies, medicine, data collection, diagnostics, treatment, telemedicine, electronic health records.

Введение

Современные информационные технологии вызывают революционные изменения в области медицины. Такие технологии, как электронные медицинские системы, телемедицина и искусственный интеллект, значительно улучшают процесс лечения пациентов [1]. С помощью информационных технологий медицинские данные можно быстро и точно собирать, хранить и анализировать [2]. Это позволяет врачам лучше понимать состояние здоровья пациентов и разрабатывать персонализированные методы лечения. Кроме того, телемедицина становится возможностью оказывать качественную медицинскую помощь пациентам, проживающим в отдаленных районах [1]. В результате информационные технологии повышают эффективность медицины и создают комфортные условия для пациентов. Эти процессы имеют огромное значение для развития медицины.

Материалы и методы

Статья носит обзорный характер: проведены анализ и обобщение научной литературы и открытых источников по применению информационных технологий в медицине.

Результаты и обсуждение

История информационных технологий в медицине

История информационных технологий в медицине насчитывает много лет. На ранних этапах врачи использовали простую бумагу и ручку для записи болезней и их симптомов. В середине XX века в медицинскую сферу начали проникать компьютеры, что позволило повысить эффективность процессов хранения и обработки данных [3]. С созданием медицинских баз данных и электронных систем здравоохранения врачи получили возможность быстро и легко находить информацию о пациентах. Позже важную роль в дальнейшем совершенствовании процессов диагностики и лечения сыграли современные технологии, такие как искусственный интеллект и анализ больших данных. В результате информационные технологии повышают эффективность

медицины и создают комфортные условия для пациентов. Эти процессы имеют огромное значение для развития медицины.

Роль информационных технологий в процессе сбора данных

Информационные технологии играют важную роль в процессе сбора данных, поскольку позволяют ускорить этот процесс и повысить его эффективность. Например, с помощью электронных баз данных и аналитических программ можно автоматически собирать и анализировать большие объемы данных [2]. Это значительно облегчает исследования и статистический анализ. Кроме того, с помощью информационных технологий становится возможным мониторинг и оценка данных в режиме реального времени, что ускоряет процесс принятия решений и помогает добиться более точных результатов. В результате использование информационных технологий делает процесс сбора данных более эффективным и надежным, что имеет большое значение для научных исследований и практики.

Информационные технологии в процессе диагностики

Информационные технологии играют важную роль в современной медицине и других областях. С помощью этих технологий данные собираются, хранятся и анализируются быстро и эффективно. Например, методы визуализационной диагностики, дистанционный мониторинг и системы на основе искусственного интеллекта помогают врачам определять состояние пациентов [4, 5]. На основе данных, проанализированных с помощью информационных технологий, врачи могут принимать точные и эффективные решения. Кроме того, эти технологии помогают экономить время и ресурсы за счет автоматизации и оптимизации процессов. В результате информационные технологии играют важную роль в повышении эффективности и надежности диагностических процессов.

Влияние информационных технологий на процесс лечения

Использование информационных технологий в процессе лечения приносит пациентам ряд преимуществ. Благодаря этим технологиям пациенты получают возможность отслеживать состояние своего здоровья, общаться с врачами онлайн и получать дистанционную помощь при необходимости. Например, телемедицинские услуги упрощают пациентам связь с врачом, что экономит время и расширяет доступ к медицинским услугам [6]. Электронные медицинские карты также позволяют пациентам быстро и точно получать историю болезни, что помогает врачам разрабатывать точные и эффективные планы лечения [7]. В результате интеграции информационных технологий повышается качество и скорость оказания медицинских услуг пациентам, что приводит к улучшению общего состояния здоровья.

Заключение

Основные результаты статьи показывают, что информационные технологии в медицинской сфере не только ускоряют процесс обмена информацией, но и повышают качество медицинских услуг. Эти технологии создают возможность для общения пациентов и врачей в режиме реального

времени, что помогает проводить диагностические и лечебные процессы более качественно и эффективно. С помощью информационных технологий автоматизируются процессы анализа и хранения медицинских данных, что снижает количество ошибок, вызванных человеческим фактором. В результате возрастает значение информационных технологий в медицине, а инновации в этой области в целом способствуют развитию системы здравоохранения.

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Абдурахманова А.Т.
старший преподаватель кафедры «Педагогика
и социальная работа»
Термезский государственный университет
Узбекистан, г. Термез

МИКРОГРУППОВЫЕ И МОТИВАЦИОННЫЕ ФАКТОРЫ ПРОЕКТНОЙ ВОВЛЕЧЁННОСТИ СТУДЕНТОВ: МНОГОКОМПОНЕНТНЫЙ АНАЛИЗ

Аннотация. Актуальность определяется необходимостью отличать формальное участие в проекте от психологической вовлечённости. Цель — выявить связи когнитивного, аффективного и конативного компонентов вовлечённости с мотивационными, микрогрупповыми и профессионально-идентификационными факторами. Выборка составила 376 студентов трёх вузов; применены описательная статистика и корреляции Спирмена. Наиболее выраженные положительные связи обнаружены с мотивом получения знаний, включённостью в микрогруппу, мотивацией успеха, ролевой определённостью и мотивом профессии ($p<0,001$). Результаты подтверждают многоуровневую природу проектной вовлечённости.

Ключевые слова: проектная вовлечённость, студенты, микрогруппа, мотивация, профессиональная идентичность, сотрудничество, высшее образование.

Abdurakhmanova A.T.
senior lecturer
Department of Pedagogy and Social Work
Termez State University
Uzbekistan, Termez

MICROGROUP AND MOTIVATIONAL FACTORS OF STUDENT PROJECT ENGAGEMENT: A MULTICOMPONENT ANALYSIS

Abstract. The study distinguishes formal participation in project work from psychological engagement. The aim is to examine associations of cognitive, affective and conative engagement with motivational, microgroup and professional-identity factors. The sample comprised 376 students from three higher education institutions; descriptive statistics and Spearman correlations were applied. The strongest positive associations were found for knowledge motivation, microgroup inclusion, achievement motivation, role clarity and professional motivation ($p<0.001$). The findings support a multilevel interpretation of project engagement.

Keywords: project engagement, students, microgroup, motivation, professional identity, cooperation, higher education.

Введение

Проектное обучение создаёт условия для самостоятельности и сотрудничества, однако факт участия не тождественен вовлечённости. Современные модели engagement различают когнитивное, эмоциональное, поведенческое и агентное измерения [10–12], а обзоры проектного обучения показывают вариативность результатов в зависимости от организации деятельности [13]. В предыдущих работах автора проектная деятельность и проектная вовлечённость рассматривались как самостоятельные педагогико-психологические проблемы [5; 6]. Психологические аспекты адаптации, защитных механизмов, креативности и профессиональной вовлечённости дополняют эту линию [1–4].

Цель исследования — определить связи интегральной проектной вовлечённости с индивидуальной мотивацией, микрогрупповыми процессами и профессиональной идентичностью. Теоретически предполагается, что проектная вовлечённость возникает на пересечении личностного смысла и социального контекста, поэтому микрогрупповые параметры должны рассматриваться наряду с мотивами и профессиональной направленностью.

Методы и исследования

В исследовании участвовали 376 студентов: 124 из ТДПИ, 127 из БДУ и 125 из ГДУ. Проектная вовлечённость оценивалась интегрально и по трём компонентам: когнитивному, аффективному и конативному; внутренняя согласованность инструмента α=0,89. Дополнительно анализировались мотивация успеха, учебные мотивы, стратегии взаимодействия в конфликте, включённость в микрогруппу, ролевая определённость, признание и профессиональная идентичность. Использованы средние значения, стандартные отклонения, медианы и ранговые корреляции Спирмена; причинные выводы по корреляциям не делались.

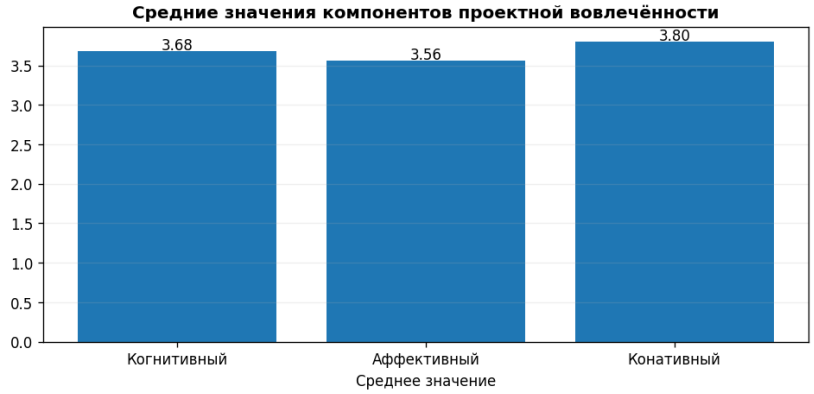


Рисунок 1. Средние значения компонентов проектной вовлечённости студентов

Результаты исследования

Интегральная проектная вовлечённость составила M=3,68 (SD=0,70; Me=3,70). Когнитивный компонент имел M=3,68 (SD=0,79), аффективный —

M=3,56 (SD=0,66), конативный — M=3,80 (SD=0,79). Более высокое среднее конативного компонента показывает, что действие и инициатива могут быть выражены сильнее, чем эмоциональное принятие проекта. Это подтверждает необходимость многокомпонентной интерпретации вовлечённости [3; 6; 10–12].

Наиболее сильная положительная связь обнаружена с мотивом получения знаний (ρ=0,593). Далее следуют включённость в микрогруппу (ρ=0,554), мотивация достижения успеха (ρ=0,539), ролевая определённость (ρ=0,521), мотив овладения профессией (ρ=0,516), признание (ρ=0,498), профессиональная идентичность (ρ=0,487) и сотрудничество (ρ=0,414); все указанные связи p<0,001. Мотив диплома связан слабее (ρ=0,372), что подчёркивает большую значимость содержательных мотивов знания и профессии.



Рисунок 2. Наиболее выраженные положительные связи с интегральной проектной вовлечённостью

Микрогрупповые показатели по величине сопоставимы с индивидуальными мотивами. Ощущение включённости, понятная роль и признание индивидуального вклада образуют социально-психологическое поле участия; значение психологической безопасности в групповой работе согласуется с исследованиями командного обучения [14]. Среди конфликтных стратегий сотрудничество (ρ=0,414) и компромисс (ρ=0,331) связаны с вовлечённостью положительно, тогда как избегание (ρ=-0,295) и соперничество (ρ=-0,238) — отрицательно. Мотивационную интерпретацию этих результатов поддерживает теория самодетерминации [15].

Динамика интегрального показателя

В формирующей части исследования исходные средние экспериментальной и контрольной групп были практически одинаковыми: 3,34 и 3,33. После программы показатель экспериментальной группы составил 4,04, контрольной — 3,43. Итоговые межгрупповые различия статистически значимы (t=9,384; χ^2=96,560; p<0,001; V=0,507). Эти данные используются как подтверждение изменяемости вовлечённости под влиянием образовательной

организации, но не как доказательство причинной роли каждого отдельного коррелята.

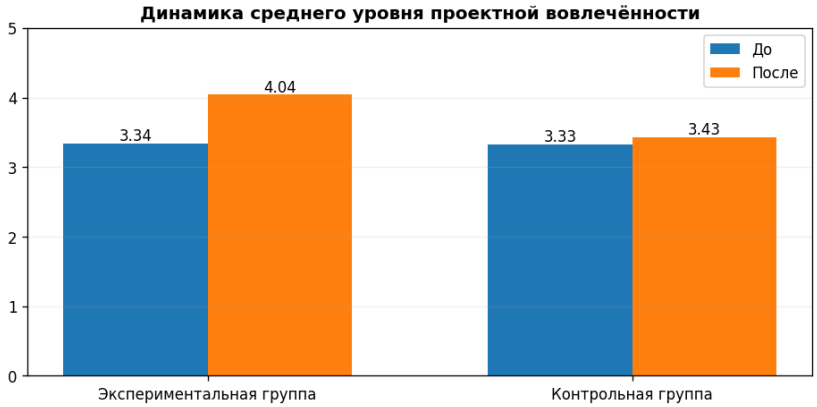


Рисунок 3. Динамика среднего уровня проектной вовлечённости

Обсуждение

Результаты позволяют выделить три уровня факторов: индивидуально-мотивационный, микрогрупповой и профессионально-смысловой. Их следует рассматривать совместно: студент может быть мотивирован, но занимать периферийную позицию в группе; может иметь ясную роль, но не принимать ценность проекта; может быть активен, не связывая работу с профессиональным развитием. Поэтому педагогический дизайн должен включать согласование общей цели, осознанный выбор роли, регулярную обратную связь и признание вклада.

Культурно-ценностный контекст также важен для интерпретации группового участия. Работы по народной педагогике показывают значение национальных ценностей и устного культурного наследия [7; 8], а междисциплинарный анализ менталитета указывает на устойчивые нормы восприятия и поведения [9]. В проектной группе эти нормы могут влиять на понимание лидерства, инициативы и взаимной помощи. Ограничения исследования связаны с корреляционным дизайном и самоотчётными методиками; перспективны компонентная регрессия, лонгитюдное наблюдение и сопоставление опросных данных с реальным вкладом в проект.

Практические следствия для проектного дизайна

Полученные связи позволяют сформулировать несколько требований к проектной организации. Во-первых, групповая задача должна содержать прозрачную общую цель и индивидуально различимый вклад. Во-вторых, распределение ролей целесообразно завершать коротким согласованием ожиданий, чтобы ролевая определённость не превращалась в жёсткое закрепление функций. В-третьих, обратная связь должна включать признание вклада, но не подменять содержательную оценку продукта. В-четвёртых, проекту необходима профессиональная рамка: студенту важно видеть, как результат связан с будущей деятельностью. Эти условия напрямую соотносятся с наиболее выраженными коррелятами вовлечённости.

Ограничения интерпретации

Корреляционный характер основной выборки не позволяет трактовать обнаруженные связи как причинные. Высокая включённость в микрогруппу может поддерживать проектную вовлечённость, но возможна и обратная связь: более вовлечённый студент активнее включается в микрогрупповые отношения. Самоотчётные показатели также чувствительны к социальной желательности и индивидуальному стилю ответа. Поэтому дальнейший анализ целесообразно дополнять компонентной регрессией, наблюдением реального вклада, повторными измерениями и сопоставлением субъективных оценок с данными преподавателя или группы. Эти ограничения не отменяют выявленных ассоциаций, но задают границы их интерпретации.

Перспективы дальнейшего исследования

Следующий этап работы целесообразно строить как компонентную регрессионную проверку, в которой когнитивный, аффективный и конативный компоненты проектной вовлечённости рассматриваются раздельно. Это позволит установить, одинаково ли мотивационные и микрогрупповые параметры связаны с пониманием целей проекта, эмоциональным принятием совместной деятельности и инициативным поведением. Особый интерес представляет сопоставление включённости в микрогруппу, ролевой определённости и признания вклада: близкие по величине корреляции не означают их функциональной взаимозаменяемости.

Второе направление связано с динамическим дизайном. Повторные измерения до начала проекта, в ходе ключевых этапов и после его завершения позволят отделить устойчивую индивидуальную предрасположенность от реакции на конкретную организацию работы. В таком дизайне важно фиксировать изменения ролей, качество обратной связи и распределение реального вклада, поскольку именно эти параметры могут объяснять расхождение между формальным участием и психологической вовлечённостью.

Третье направление — сочетание самоотчётных показателей с наблюдаемыми данными. Перспективно сопоставлять шкалы вовлечённости с выполнением согласованных задач, инициативными предложениями, своевременностью обратной связи и экспертной оценкой индивидуального вклада. Такая триангуляция уменьшит риск социально желательных ответов и позволит проверить, насколько субъективное ощущение включённости соответствует реальному проектному поведению. Это особенно важно для микрогрупп, где высокий групповой результат может маскировать неравномерность участия отдельных студентов.

Заключение

Проектная вовлечённость связана как с индивидуальными мотивами, так и с микрогрупповым контекстом. Наиболее выраженные корреляции обнаружены с мотивом знаний, включённостью в микрогруппу, мотивацией успеха, ролевой определённостью и мотивом профессии. Практически это означает необходимость проектировать не только содержание задания, но и

социально-психологические условия участия: ясность ролей, сотрудничество, признание и профессиональный смысл.

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Авезмуратова М.К., магистр по специальности «Биология»
Сейтназаров С.К., к.б.н.
доцент
Каракалпакский государственный университет имени Бердаха
Республика Узбекистан

ЗНАЧЕНИЕ ФАУНЫ ЭКТОПАРАЗИТОВ ДОМАШНИХ ЖИВОТНЫХ (БЛОХ И КЛЕЩЕЙ) В УСЛОВИЯХ РЕСПУБЛИКИ КАРАКАЛПАКСТАН

Аннотация. Статья посвящена изучению фауны и экологических особенностей эктопаразитов домашних животных Республики Каракалпакстан. Основное внимание уделено иксодовым клещам (Ixodidae) и блохам (Siphonaptera), имеющим важное ветеринарное и эпизоотологическое значение. Установлено, что среди иксодовых клещей существенную роль играют представители родов Hyalomma, Rhipicephalus, Haemaphysalis, Dermacentor и Ixodes, характеризующиеся выраженной сезонной активностью. Блохи преимущественно связаны с собаками, кошками и синантропными животными. Распространение эктопаразитов определяется аридными условиями, пастбищным содержанием животных и экологическими особенностями Южного Приаралья. Полученные результаты подтверждают необходимость мониторинга видового состава, сезонной динамики и хозяинно-паразитарных связей эктопаразитов.

Ключевые слова: эктопаразиты, иксодовые клещи, блохи, домашние животные, Каракалпакстан, сезонная динамика, эпизоотология.

Avezmuratova M.K., master's degree in Biology
Seitnazarov S.K., candidate of biological sciences
associate professor
Berdakh Karakalpak State University
Republic of Uzbekistan

SIGNIFICANCE OF THE ECTOPARASITE FAUNA OF DOMESTIC ANIMALS (FLEAS AND TICKS) IN THE REPUBLIC OF KARAKALPAKSTAN

Abstract. This article examines the fauna and ecological characteristics of ectoparasites infesting domestic animals in the Republic of Karakalpakstan. Particular attention is paid to ixodid ticks (Ixodidae) and fleas (Siphonaptera), which are of significant veterinary and epizootological importance. It was found that representatives of the genera Hyalomma, Rhipicephalus, Haemaphysalis, Dermacentor, and Ixodes play a major role among ixodid ticks, all characterized by distinct seasonal activity. Fleas are primarily associated with dogs, cats, and

synanthropic animals. The distribution of these ectoparasites is determined by arid conditions, pasture-based animal husbandry, and the ecological features of the Southern Aral Sea region. The results confirm the need to monitor the species composition, seasonal dynamics, and host-parasite relationships of these ectoparasites.

Keywords: ectoparasites, ixodid ticks, fleas, domestic animals, Karakalpakstan, seasonal dynamics, epizootology.

Введение

Эктопаразиты домашних животных имеют важное ветеринарное и эпизоотологическое значение. Иксодовые клещи (Ixodidae) и блохи (Siphonaptera) вызывают повреждение кожных покровов, кровопотерю и воспалительные реакции, снижают продуктивность животных, а также могут участвовать в передаче возбудителей инфекционных и паразитарных заболеваний. В Каракалпакстане формирование эктопаразитофауны определяется засушливым климатом, разнообразием природных биотопов, пастбищным животноводством и экологической трансформацией Южного Приаралья. Среди иксодовых клещей существенное значение имеют представители родов Hyalomma и Rhipicephalus, тогда как блохи преимущественно связаны с собаками, кошками и другими животными населённых пунктов. Изучение видового состава, хозяинной приуроченности и сезонной динамики эктопаразитов необходимо для оценки эпизоотологической ситуации и разработки профилактических мероприятий.

Цель исследования — изучить фауну и эпизоотологическое значение блох и иксодовых клещей домашних животных Республики Каракалпакстан, а также определить основные экологические факторы их распространения.

Материалы и методы

Исследования проводились в Нукусском, Караузакском, Чимбайском и других районах Республики Каракалпакстан. Объектами служили иксодовые клещи (Ixodidae) и блохи (Siphonaptera), паразитирующие на крупном рогатом скоте, овцах, козах, верблюдах, собаках и кошках. Эктопаразитов собирали с поверхности тела животных с регистрацией вида хозяина, места и даты сбора. Материал фиксировали в 70%-ном этиловом спирте и определяли по морфологическим признакам в лабораторных условиях. Заражённость животных оценивали по экстенсивности (EI, %) и интенсивности инвазии (II). Сезонную динамику анализировали по периодам сбора с учетом температуры и влажности воздуха, характера растительности, типа пастбищ и условий содержания животных.

Результаты и обсуждение

Иксодовые клещи составляют основную группу эктопаразитов домашних животных Каракалпакстана. В 2023–2025 гг. на крупном рогатом скоте и овцах зарегистрированы представители родов *Hyalomma, Rhipicephalus, Haemaphysalis, Dermacentor и Ixodes, включая H. anatolicum, H. plumbeum, H. detritum, H. scupense, R. bursa, R. turanicus, H. sulcata, H.*

punctata, D. marginatus и I. ricinus. Также выявлены волосоеды *Bovicola ovis* и *B. bovis.* В аридных условиях региона преобладают клещи рода *Hyalomma*: доля *H. anatolicum* в Нукусском районе достигала 76,6 %, а *H. detritum* в Чимбайском районе — 53,3 %, что свидетельствует об их ведущей роли в эктопаразитофауне сельскохозяйственных животных

Зараженность иксодовыми клещами в отдельных хозяйствах Каракалпакстана составляла 70–80 % у крупного рогатого скота и 80–82 % у овец и коз, с преобладанием родов Hyalomma и Rhipicephalus. У верблюдов зараженность достигала 41,8 % при медианной интенсивности 11 клещей на животное. Блохи преимущественно отмечались у собак, кошек и синантропных животных. Наибольшая активность иксодовых клещей наблюдалась в тёплый период года и зависела от температуры, влажности, растительности и условий выпаса. Экстремально высокая температура и низкая влажность ограничивали выживаемость свободноживущих стадий клещей.

В Нукусском и Караузакском районах максимальная зараженность иксодовыми клещами отмечалась в тёплый период года, что определяет важность весенне-летнего мониторинга и профилактических обработок. У блох сезонность выражена слабее, особенно при содержании собак и кошек в помещениях. Патогенное воздействие клещей и блох связано с кровососанием и повреждением кожи. При высокой интенсивности инвазии возможны анемия, воспаление, зуд и дерматиты. Массовое паразитирование вызывает беспокойство животных, может снижать их продуктивность и повышать риск вторичных инфекций.

Иксодовые клещи имеют важное эпизоотологическое значение как переносчики возбудителей трансмиссивных заболеваний. В Каракалпакстане особую роль играют *Hyalomma anatolicum* и *H. detritum*, связанные с циркуляцией возбудителей тейлериоза крупного рогатого скота. Выявление Babesia caballi у клещей с верблюдов подтверждает необходимость контроля переносимых ими патогенов. Блохи также могут участвовать в передаче инфекционных агентов и жизненных циклах отдельных гельминтов.

Формирование эктопаразитофауны региона определяется климатическими, ландшафтными и хозяйственными условиями. Преобладание Hyalomma связано с аридностью территории, а экологическая трансформация Южного Приаралья может изменять распространение эктопаразитов. Полученные данные обосновывают необходимость комплексного мониторинга с применением морфологических и молекулярно-генетических методов для оценки системы «переносчик — хозяин — патоген — среда».

Заключение

Rhipicephalus, Haemaphysalis, Dermacentor и Ixodes, особое значение имеют *H. anatolicum* и *H. detritum*. Их распространение и сезонная активность определяются природно-климатическими условиями и особенностями содержания животных. Блохи преимущественно связаны с собаками,

кошками и синантропными животными. Полученные данные подтверждают необходимость комплексного мониторинга эктопаразитов, их хозяинных связей и эпизоотологического значения.

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Алланов М.П.
стажёр-преподаватель кафедры «Агроэкология
и интродукция лекарственных растений»
Каракалпакский государственный университет имени Бердаха
Республика Узбекистан

СОВЕРШЕНСТВОВАНИЕ ТЕХНОЛОГИИ ВОЗДЕЛЫВАНИЯ РИСА НА ЗАСОЛЁННЫХ ПОЧВАХ В УСЛОВИЯХ ВОДНОГО ДЕФИЦИТА РЕСПУБЛИКИ КАРАКАЛПАКСТАН

Аннотация. В условиях Республики Каракалпакстан производство риса ограничивается дефицитом оросительной воды и засолением почв. Цель исследования — совершенствование технологии возделывания риса за счёт оптимизации способа посева и режима орошения. Рассматриваются водосберегающие приёмы: посев во влажную почву, отсроченное затопление и периодическое орошение. Ожидается, что их комплексное применение позволит снизить расход воды, сохранить благоприятный водно-солевой режим почвы и повысить устойчивость рисоводства в условиях Южного Приаралья.

Ключевые слова: рис, Oryza sativa L., Каракалпакстан, засоление почв, водный дефицит, орошение, водосберегающая технология, урожайность.

Allanov M.P.
trainee lecturer
Department of Agroecology and Introduction of Medicinal Plants
Berdakh Karakalpak State University
Republic of Uzbekistan

IMPROVING RICE CULTIVATION TECHNOLOGY ON SALINE SOILS UNDER WATER SCARCITY CONDITIONS IN THE REPUBLIC OF KARAKALPAKSTAN

Abstract. In the Republic of Karakalpakstan, rice production is constrained by irrigation water shortages and soil salinity. The study aims to improve rice cultivation technology by optimizing sowing methods and irrigation regimes. Water-saving practices—such as sowing in moist soil, delayed flooding, and intermittent irrigation—are examined. It is anticipated that the integrated application of these methods will reduce water consumption, maintain a favorable soil water-salt balance, and enhance the resilience of rice farming in the Southern Aral Sea region.

Keywords: rice, Oryza sativa L., Karakalpakstan, soil salinity, water scarcity, irrigation, water-saving technology, yield.

Введение

Рис (*Oryza sativa L.*) является важной продовольственной культурой, однако его выращивание требует значительных объёмов оросительной воды. Для Республики Каракалпакстан эта проблема особенно актуальна из-за дефицита воды, высокой испаряемости, минерализации оросительной воды и вторичного засоления почв. Засоление ухудшает водное и минеральное питание растений, снижая их рост и продуктивность. Традиционное постоянное затопление рисовых полей способствует вымыванию солей, но сопровождается высоким расходом воды. Перспективным направлением является применение водосберегающих технологий, включая посев во влажную почву, отсроченное затопление и регулируемое орошение.

Цель исследования — обосновать элементы усовершенствованной технологии возделывания риса на засолённых почвах Каракалпакстана, обеспечивающей экономию оросительной воды и сохранение продуктивности растений.

Материалы и методы

Полевой опыт проводится на орошаемых засолённых аллювиально-луговых почвах Каракалпакстана в условиях аридного климата. Перед закладкой опыта в слоях 0–20, 20–40, 40–60 и 60–100 см определяются основные показатели засоления, кислотности и обеспеченности почвы элементами питания. Опыт проводится в четырёхкратной повторности при одинаковой агротехнике и различном режиме орошения. В течение вегетации оцениваются фенологические и биометрические показатели, структура урожая и масса 1000 зёрен, а также динамика содержания водорастворимых солей в почве.

Результаты и обсуждение

Ожидается, что совершенствование водообеспечения риса позволит снизить расход оросительной воды, улучшить водно-солевой режим почвы и сохранить урожайность. Переход от постоянного затопления к регулируемому орошению должен сократить потери воды на испарение, фильтрацию и технологические сбросы. Наибольший расход воды ожидается при традиционном постоянном затоплении.

Посев риса во влажную почву и регулируемое орошение могут снизить водопотребление без существенного уменьшения урожайности. Предполагается, что применение водосберегающих технологий позволит снизить расход оросительной воды с 20,8 до 14,9–17,7 тыс. м³/га, обеспечивая экономию 15–28 %. При этом урожайность может сохраниться на уровне 5,3–5,6 т/га, а водная продуктивность повыситься с 0,25 до 0,30–0,38 кг/м³.

Сокращение поливов не должно приводить к иссушению засолённых почв и усилению вторичного засоления. Поэтому необходимо оптимизировать сроки и нормы орошения с учётом потребностей риса и мелиоративного состояния почвы. Предпосевная промывка позволит снизить содержание легкорастворимых солей в корнеобитаемом слое, а регулируемое

орошение — ограничить вторичное засоление и создать благоприятные условия для развития корневой системы.

Ожидается, что содержание солей в слое 0–40 см снизится с 0,61–0,63 % до 0,37–0,43 %. Наиболее эффективным предполагается сочетание предпосевной промывки и регулируемого орошения, позволяющее одновременно экономить воду и ограничивать вторичное засоление почв.

Ожидается, что оптимизация водно-солевого режима улучшит аэрацию и влагообеспеченность почвы, что будет способствовать увеличению продуктивных стеблей и улучшению формирования метёлки и зерна.

При традиционной технологии количество продуктивных стеблей может составлять около 276 шт./м², тогда как при оптимизированном водном режиме данный показатель потенциально может увеличиваться до 284–302 шт./м². Одновременно ожидается увеличение длины метёлки примерно с 17,8 до 18,2–19,1 см и количества зёрен в одной метёлке с 94 до 98–108 штук. Масса 1000 зёрен также может возрастать примерно с 28,1 до 28,4–29,0 г.

Регулируемое орошение может улучшить водный, воздушный и солевой режимы почвы, активизировать развитие корней и повысить использование питательных веществ. Поддержание оптимальной влажности в критические фазы развития риса позволит снизить риск водного стресса. В условиях дефицита воды важным показателем является водная продуктивность. Ожидается, что применение водосберегающей технологии повысит её с 0,250 до 0,377 кг/м³, обеспечивая более эффективное использование оросительной воды.

Таким образом, эффективность усовершенствованной технологии следует оценивать по экономии оросительной воды, снижению вторичного засоления, улучшению водно-солевого режима почвы, сохранению урожайности и повышению водной продуктивности риса.

Ожидается обоснование эффективной технологии возделывания риса на засолённых почвах Каракалпакстана. Сочетание предпосевной промывки и регулируемого орошения должно обеспечить экономию воды, улучшение водно-солевого режима почвы, снижение риска вторичного засоления и повышение водной продуктивности. По итогам исследований планируется определить оптимальный режим орошения и разработать практические рекомендации по водосберегающему выращиванию риса в условиях Южного Приаралья.

Заключение

Традиционная технология выращивания риса с постоянным затоплением эффективна для регулирования засоления, но требует большого объёма воды. Для условий Каракалпакстана перспективен посев во влажную почву с отсроченным затоплением и периодическим орошением. Водосбережение должно сочетаться с контролем засоления, грунтовых вод и состояния дренажа. Такая технология может снизить расход оросительной воды на 25–30 % при сохранении урожайности. Основными критериями

эффективности должны быть урожайность, водная продуктивность и устойчивость солевого режима почвы.

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Артикова Э., магистр
Университет мировой экономики и дипломатии
Узбекистан, г. Ташкент

ЦИФРОВАЯ ТРАНСФОРМАЦИЯ ЭКОНОМИКИ УЗБЕКИСТАНА: ПЕРСПЕКТИВЫ, ПРОБЛЕМЫ И МЕХАНИЗМЫ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ

Аннотация. В статье рассматриваются основные направления цифровой трансформации экономики Республики Узбекистан, а также перспективы повышения эффективности экономических процессов посредством внедрения современных информационно-коммуникационных технологий. Особое внимание уделяется автоматизации управленческих процессов, развитию электронных услуг, цифровизации предпринимательской деятельности и формированию современной цифровой инфраструктуры. Анализируются ключевые проблемы, препятствующие полноценному использованию цифровых решений, включая недостаточный уровень цифровых компетенций, различия в доступности технологических ресурсов и необходимость обеспечения информационной безопасности. Предлагаются практические направления совершенствования механизмов цифровой трансформации, ориентированные на повышение производительности труда, конкурентоспособности национальной экономики и качества государственных услуг.

Ключевые слова: цифровая трансформация, цифровая экономика, информационно-коммуникационные технологии, инновации, автоматизация, электронные услуги, цифровая инфраструктура, предпринимательство, экономическая эффективность, Узбекистан.

Artikova E., master's degree
University of World Economy and Diplomacy
Uzbekistan, Tashkent

DIGITAL TRANSFORMATION OF UZBEKISTAN'S ECONOMY: PROSPECTS, CHALLENGES AND MECHANISMS FOR IMPROVING EFFICIENCY

Abstract. The article examines the main directions of digital transformation in the economy of the Republic of Uzbekistan and the prospects for improving the efficiency of economic processes through the introduction of modern information and communication technologies. Particular attention is paid to the automation of management processes, the development of electronic services, the digitalization of business activities, and the formation of modern digital infrastructure. The study identifies key challenges hindering the effective adoption of digital solutions, including insufficient digital competencies, disparities in access to technological resources, and the need to ensure information security. Practical measures are

proposed to improve digital transformation mechanisms, increase labor productivity, strengthen national economic competitiveness, and enhance the quality of public services.

Keywords: digital transformation, digital economy, information and communication technologies, innovation, automation, electronic services, digital infrastructure, entrepreneurship, economic efficiency, Uzbekistan.

Введение. Современное развитие мировой экономики характеризуется активным внедрением цифровых технологий в производственные, финансовые, управленческие и социальные процессы. Цифровизация постепенно становится одним из важнейших факторов экономического роста, повышения производительности труда и формирования новых моделей предпринимательской деятельности. Использование информационных систем, облачных платформ, технологий искусственного интеллекта и электронных платежей способствует ускорению обмена информацией, сокращению операционных расходов и повышению качества принимаемых решений.

Для Республики Узбекистан цифровая трансформация имеет особое значение в условиях модернизации национальной экономики, расширения предпринимательской активности и совершенствования государственного управления. Реализация стратегии «Цифровой Узбекистан — 2030» предусматривает развитие цифровых технологий в различных отраслях экономики и социальной сферы, совершенствование электронных государственных услуг и расширение технологических возможностей регионов. В этих условиях цифровая трансформация рассматривается не только как техническое обновление, но и как комплексное изменение методов управления, организации труда и взаимодействия между государством, бизнесом и населением.

Актуальность исследования обусловлена необходимостью определения наиболее эффективных направлений цифрового развития экономики Узбекистана, выявления существующих ограничений и разработки практических рекомендаций по совершенствованию цифровых механизмов.

Материалы и методы. Методологическую основу исследования составляют системный и сравнительный подходы, методы анализа и синтеза, обобщения научных представлений о цифровой экономике, а также изучение нормативно-правовых документов Республики Узбекистан, регулирующих развитие цифровых технологий. В качестве информационной основы использованы положения стратегии «Цифровой Узбекистан — 2030», материалы государственных информационных ресурсов и концептуальные подходы к цифровой трансформации экономических систем.

Исследование организовано вокруг трех взаимосвязанных направлений: анализа влияния цифровых технологий на экономическую деятельность, определения институциональных и технологических препятствий цифровизации и разработки рекомендаций по повышению результативности цифровых преобразований. Для систематизации полученных положений

применен аналитический подход, позволяющий рассматривать цифровую трансформацию как совокупность технологических, организационных и кадровых изменений.

Результаты. Проведенный анализ позволяет выделить несколько основных направлений влияния цифровой трансформации на развитие национальной экономики. Первым направлением является повышение эффективности управления. Использование цифровых платформ и автоматизированных информационных систем позволяет ускорять обработку документов, сокращать количество повторяющихся операций и улучшать координацию между подразделениями организаций. Применение электронного документооборота способствует повышению прозрачности административных процедур и уменьшению временных затрат.

Вторым направлением выступает цифровизация предпринимательской деятельности. Электронная торговля, безналичные платежи, цифровые системы учета и аналитические инструменты расширяют возможности предприятий по взаимодействию с потребителями и деловыми партнерами. Для малого и среднего бизнеса цифровые решения особенно важны, поскольку позволяют выходить на новые рынки без необходимости значительного увеличения физических ресурсов. Вместе с тем практическая результативность таких инструментов зависит от доступности качественного интернета, стоимости программного обеспечения и уровня цифровой грамотности предпринимателей.

Третье направление связано с развитием электронных государственных услуг. Перевод административных процедур в цифровую форму может сократить временные и финансовые издержки граждан и организаций, повысить доступность государственных сервисов и улучшить качество взаимодействия между населением и государственными учреждениями. Для достижения устойчивого результата необходимо обеспечивать совместимость информационных систем различных ведомств, регулярно обновлять цифровые сервисы и учитывать потребности пользователей с различным уровнем технической подготовки.

Четвертым направлением является развитие человеческого капитала. Цифровая трансформация повышает спрос на специалистов в области информационных технологий, анализа данных, кибербезопасности и цифрового управления. Одновременно традиционные профессии требуют освоения новых инструментов и методов работы. Следовательно, повышение квалификации сотрудников и интеграция цифровых компетенций в систему образования становятся необходимыми условиями адаптации трудовых ресурсов к изменяющимся требованиям рынка.

Обсуждение. Полученные результаты позволяют рассматривать цифровую трансформацию как стратегический фактор повышения конкурентоспособности экономики Узбекистана. При этом следует разграничивать цифровизацию отдельных операций и полноценную цифровую трансформацию организации. В первом случае традиционные

действия переводятся в электронный формат, тогда как во втором изменяются структура управления, способы взаимодействия с клиентами, механизмы принятия решений и принципы распределения ресурсов.

Для обеспечения устойчивого эффекта предприятиям целесообразно предварительно оценивать собственные потребности, определять процессы, требующие автоматизации, и устанавливать измеримые показатели эффективности. К таким показателям могут относиться сокращение времени выполнения операций, снижение административных расходов, увеличение объема электронных продаж, уменьшение количества ошибок и повышение удовлетворенности потребителей. Сопоставление показателей до и после внедрения технологий позволит объективнее оценивать экономическую целесообразность цифровых проектов.

Особого внимания заслуживает региональный аспект. Различия в доступности интернета, техническом оснащении организаций и уровне цифровой грамотности могут усиливать экономическое неравенство между территориями. Для уменьшения подобных различий необходимы целевые программы развития инфраструктуры, образовательные инициативы и поддержка цифровизации малого предпринимательства. Важным направлением также является сотрудничество образовательных учреждений, государственных органов и частного сектора при подготовке специалистов, обладающих востребованными цифровыми компетенциями.

Заключение. Цифровая трансформация является одним из значимых условий модернизации экономики Республики Узбекистан, повышения эффективности управления и расширения возможностей предпринимательской деятельности. Внедрение цифровых платформ, автоматизированных систем и электронных услуг создает предпосылки для сокращения операционных издержек, ускорения экономических процессов и повышения качества обслуживания населения.

Вместе с тем результативность цифровых преобразований определяется совокупностью взаимосвязанных факторов, среди которых особое место занимают развитие инфраструктуры, повышение цифровой грамотности, подготовка квалифицированных кадров, защита информации и совершенствование механизмов государственного и корпоративного управления. Простое внедрение технологий без организационных изменений не гарантирует достижения устойчивых экономических результатов.

Для дальнейшего развития цифровой экономики Узбекистана необходимо расширять доступ к современным технологическим ресурсам, стимулировать цифровизацию малого и среднего бизнеса, совершенствовать электронные государственные сервисы и внедрять систему оценки эффективности цифровых проектов. Реализация указанных мер позволит сформировать более гибкую и конкурентоспособную экономическую среду, способную адаптироваться к современным технологическим изменениям. Перспективы дальнейших исследований связаны с количественной оценкой

влияния цифровых технологий на производительность труда, инвестиционную активность и региональное экономическое развитие.

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Ауезов О.Т.
стажёр-преподаватель кафедры географии
Олжабаева Г.А.
студент географической специальности
Нукусский государственный педагогический
институт имени Ажинияза

АНАЛИЗ РОСТА НАСЕЛЕНИЯ И ТРУДОВЫХ РЕСУРСОВ НУКУССКОГО РАЙОНА

Аннотация. В данной статье рассматривается демографическая ситуация и динамика ее изменения в Нукусском районе Республики Каракалпакстан. В исследовании основное внимание уделяется таким основным демографическим показателям, как общая численность населения, половой состав, доля городского и сельского населения, а также изменение численности населения по годам. В ходе исследования анализируется демографический состав населения района, тенденции роста численности населения и оценивается влияние демографических изменений на социально-экономическое развитие района. Полученные результаты послужат важным источником информации при разработке соответствующих решений по развитию населения, трудовых ресурсов и социальной инфраструктуры региона.

Ключевые слова: рождаемость, смертность, рост населения, трудовые ресурсы, миграция.

Auezov O.T.
trainee lecturer
Department of Geography
Oljabaeva G.A.
student of Geography Education
Nukus State Pedagogical Institute named after Ajiniyaz

ANALYSIS OF POPULATION GROWTH AND LABOUR RESOURCES IN THE NUKUS DISTRICT

Abstract. This article examines the demographic situation and the dynamics of its change in the Nukus district of the Republic of Karakalpakstan. The study focuses on key demographic indicators such as the total population, gender composition, share of urban and rural populations, and population change over the years. The study analyses the demographic composition of the district's population, population growth trends, and assesses the impact of demographic changes on the socio-economic development of the district. The results obtained will serve as an important source of information when developing appropriate solutions for the development of the region's population, labour resources, and social infrastructure.

Keywords: birth rate, mortality, population growth, labour resources, migration.

По мнению У. Айзарта, одного из основоположников региональной экономической науки, экономика данного региона представляет собой сложный вывод, и его решение должно начинаться именно с уровня населения. Действительно, население - сложная социально-экономическая категория, и производство неразрывно связано с ним "от начала до конца." Причина в том, что без трудовых ресурсов не может быть производства, а производство необходимо для народа; создатель и потребитель материальных и духовных благ в первую очередь необходим для этого народа; создатель материальных и духовных благ в первую очередь представляет собой единство этого народа, то есть людей, на определенной территории; создатель благ в первую очередь представляет собой единство этого народа, то есть людей, на определенной территории.

Нукусский район Республики Каракалпакстан занимает площадь 944 км2 и имеет общую протяженность границ (358,2 км), в том числе граничит с Республикой Туркменистан (9,2 км), Ходжейлийским (59,9 км), Амударьинским (11,4 км), Караузякским (25,4 км), Кегейлийским (90,3 км), Канлыкульским (40,7 км) районами и городом Нукус (121,3 км).

Площадь района составляет 0,94 тысячи квадратных километров. Плотность населения в районе составляет 58 человек на квадратный километр. Этот показатель составляет 12 человек в Республике Каракалпакстан. В Нукусском районе Октерек занимает первое место среди сельских общин, в то время как Дарсон имеет самый низкий показатель.

Населенные пункты разделены на 43 махаллинских схода граждан и 6 сельских сходов граждан.

Нукусский район был образован 25 декабря 1968 года и является административно-территориальной единицей Республики Каракалпакстан. В районе насчитывается 43 населенных пункта, 13 махаллинских и сельских сходов граждан и 13,8 тысяч семей.

По состоянию на 1 января 2024 года численность населения Нукусского района составляет 2,7 процента от постоянного населения Республики Каракалпакстан - 2002,7 тысяч человек, или 53,9 тысяч человек. Из них 10,9 тысяч проживают в городских районах, а 43,0 тысяч - в сельской местности. Плотность населения составляет 57,1 человека на квадратный километр.

В Нукусском районе есть один посёлок городского типа.

Нукусский район граничит с Республикой Туркменистан на 9 км, Ходжейлийским районом - на 59,9 км, Амударьинским районом - на 11,4 км, Карозакским районом - на 25,4 км, Кегейлийским районом - на 90,3 км, Канлыкульским районом - на 40,7 км и городом Нукусом - на 121,3 км.

По состоянию на 1 января 2024 года постоянное население района составляло 53,9 тысячи человек, увеличившись на 1,0 тысячи человек или 1,9 процента по сравнению с прошлым годом.

По состоянию на 1 января 2024 года средний возраст всего населения составлял 28,5 года, из которых средний возраст мужчин составил 27,8 года, а средний возраст женщин - 29,1 года.

2023 году численность трудовых ресурсов составит 28,3 тысячи человек, при этом численность экономически активного населения составит 22,6 тысячи человек, или 79,9% от численности трудовых ресурсов, а численность занятого населения - 21,0 тысячи человек. Уровень занятости по отношению к экономически активному населению составил 93,0%, а число безработных составило 1,6 тысячи человек, а уровень безработицы по отношению к экономически активному населению составил 7,0%.

Население Нукусского района в основном растет естественным путем. Роль этого фактора всегда была высокой и является единственным источником роста населения. В частности, в январе-декабре 2024 года в Нукусском районе число родившихся составило 1110 детей, число умерших - 346 человек, что на 149 человек меньше по сравнению с аналогичным периодом 2020 года (1259 детей). В 2024 году коэффициент рождаемости составил 17,4, смертей - 5,4, а естественный прирост - 12 промилле. Эти показатели в 2019 году составили 20,2; 5,4; Было равно 15,4 промилле[4]. В период с 2019 по 2024 год естественный прирост населения района был ниже республиканского показателя.

На рост населения района влияет внешняя миграция. Например, в 2024 году уехало 814 человек, а прибыло 1041 человек, сальдо миграции составило плюс 227 человек. В 2023 году этот показатель составил 778, 966 и 188 человек соответственно. Основная часть мигрантов переехала в Республику Казахстан и город Нукус.

С ростом населения возникает необходимость создания дополнительных рабочих мест, особенно в областях, требующих участия женщин. Это связано с тем, что изменения в естественном и физическом движении населения Нукусского района влияют на его национальный, половой и возрастной состав. В структуре половозрастного состава населения Нукусского района также имеются отличительные особенности. Анализ гендерных и возрастных особенностей населения на районном уровне имеет большое значение для определения объема трудовых ресурсов и решения вопросов обеспечения рабочей силой отраслей экономики. Поэтому для определения уровня обеспеченности производственного процесса трудовыми ресурсами был проведен анализ численности населения по возрастным особенностям.

Нукусский район занимает 11-е место среди районов Республики Каракалпакстан по численности населения и 15-е место по доле города. По данным на 1 января 2024 года, население района составляет 53,9 тысячи человек, что составляет 2,7% от общей численности населения республики (2002,7 тысячи человек). Население в основном растет естественным путем.

По данным на 1 января 2025 года, население района составляет 54,9 тысячи человек, что составляет 3,7% от общей численности населения

республики (2029,7 тысячи человек). Из них трудоспособное население (трудовые ресурсы) составляет 30,4 тысячи, экономически активное население - 24,3 тысячи, а число занятых в экономике - 23,0 тысячи. Численность безработных составляет 1,2 тысячи человек, уровень безработицы - 5%.

В заключение, в ходе изучения демографических процессов, устойчивый рост населения района и возрастной состав трудовых ресурсов были оценены как значительный экономический потенциал. Данные за 2025-2026 годы показывают, что большая часть населения проживает в сельской местности, что подтверждает правильность модели аграрно-индустриального развития. В целях обеспечения занятости молодежи и женщин открытие новых малых производственных зон в таких регионах, как "Дехкан арна," "Саманбай," "Шортанбай" и "Акмангыт," позволит эффективно использовать местные трудовые ресурсы.

Рост населения и формирование трудовых ресурсов в Нукусском районе играют важную роль в социально-экономическом развитии района. Рост населения увеличивает спрос на труд и усиливает требования к количеству и качеству трудовых ресурсов. Поэтому обеспечение занятости населения, создание новых рабочих мест и эффективное использование трудовых ресурсов являются одними из приоритетных задач.

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Бегимкулов Ж.Н.
преподаватель
Самаркандский государственный педагогический институт
Абдурахманов Э.
профессор
Самаркандский государственный университет
Абдурахманов Г.
доцент
Национальный университет Узбекистана
Эшкобилова М.Э.
доцент
Самаркандский государственный медицинский университет

РАЗРАБОТКА ИОНОСЕЛЕКТИВНОЙ МЕМБРАНЫ ДЛЯ ОБНАРУЖЕНИЯ ИОНОВ КОБАЛЬТА ИЗ СЛОЖНЫХ СМЕСЕЙ С НЕСКОЛЬКИМИ КОМПОНЕНТАМИ

Аннотация. Результаты разработки ионоселективной мембраны для определения ионов кобальта в многокомпонентных сложных смесях. На основе проведённых исследований установлен оптимальный состав мембранного материала, определены соотношения его компонентов и оптимизированы условия синтеза. С использованием современных физико-химических и аналитических методов исследованы состав, структура и основные характеристики полученных материалов. Разработанная мембрана позволяет повысить селективность и надёжность потенциометрического определения ионов кобальта в присутствии сопутствующих компонентов.

Ключевые слова: ионоселективный электрод, ион кобальта, селективная мембрана, декавольфрамовая кислота, электроактивное соединение.

Begimkulov J.N.
lecturer
Samarkand State Pedagogical Institute
Abdurakhmanov E.
professor
Samarkand State University
Abdurakhmanov G.
associate professor
National University of Uzbekistan
Eshqobilova M.E.
associate professor
Samarkand State Medical University

DEVELOPMENT OF AN ION-SELECTIVE MEMBRANE FOR THE DETECTION OF COBALT IONS IN COMPLEX MULTICOMPONENT MIXTURES

Abstract. The results of the development of an ion-selective membrane for the determination of cobalt ions in complex multicomponent mixtures are presented. Based on the conducted studies, the optimal composition of the membrane material was established, the ratios of its components were determined, and the synthesis conditions were optimized. Using modern physicochemical and analytical methods, the composition, structure, and principal characteristics of the synthesized materials were investigated. The developed membrane provides enhanced selectivity and reliability for the potentiometric determination of cobalt ions in the presence of interfering components.

Keywords: ion-selective electrode, cobalt ion, selective membrane, decatungstic acid, electroactive compound.

Введение. В настоящее время разработка селективных мембранных материалов для ионоселективных электродов является одним из перспективных направлений аналитической химии. Особое внимание уделяется созданию высокоселективных сенсорных систем для определения ионов металлов в сложных многокомпонентных объектах. В этом направлении активно исследуются различные ионофорные соединения и мембранные композиции, обеспечивающие высокую чувствительность, селективность и стабильность аналитического сигнала [1–5].

Целью настоящего исследования является разработка ионоселективной мембраны и потенциометрического сенсора для селективного определения ионов кобальта(II) в многокомпонентных сложных смесях. Для достижения поставленной цели были синтезированы и исследованы электроактивные (ионофорные) соединения на основе додекавольфрамофосфорной и додекамолибдофосфорной кислот, предназначенные для формирования чувствительного элемента кобальт-селективного электрода. Определены состав и условия получения мембранных материалов, а также изучены их физико-химические и аналитические характеристики.

Экспериментальная методология. В качестве электроактивного ионофорного соединения для формирования чувствительного элемента кобальт-селективного электрода был выбран кобальт(II)фосфовольфрамат. Фосфовольфраматный анион типа Кеггина $[PW_{12}O_{40}]^{3-}$ характеризуется высокой молекулярной массой, выраженной липофильностью, низкой склонностью к вымыванию из полимерной мембранной фазы и способностью к устойчивому образованию ионных ассоциатов с двухвалентными катионами металлов. Совокупность указанных свойств обусловливает перспективность использования данного соединения в качестве электроактивного компонента ионоселективной мембраны. Синтез кобальт(II)фосфовольфрамата осуществляли в две стадии. На первой стадии в кислой среде формировали

фосфовольфраматный анион типа Кеггина $[PW_{12}O_{40}]^{3-}$ из вольфрамата натрия и ортофосфорной кислоты. Процесс проводили при температуре 70–80 °C при интенсивном перемешивании 0,2 М раствора $Na_2WO_4 \cdot 2H_2O$ в присутствии H_3PO_4 и HCl. Значение pH реакционной среды поддерживали в интервале 1,2–1,8. Образование фосфовольфраматного аниона в кислой среде в упрощённом виде можно представить следующим уравнением:

$$12WO_4^{2-} + PO_4^{3-} + 24H^+ \rightarrow [PW_{12}O_{40}]^{3-} + 12H_2O.$$

На второй стадии проводили осаждение кобальт(II)фосфовольфрамата путём взаимодействия образовавшегося фосфовольфраматного аниона с ионами Co^{2+}. Раствор $CoCl_2 \cdot 6H_2O$ добавляли по каплям к раствору фосфовольфрамата при интенсивном перемешивании. С учётом электронейтральности образующегося ионного ассоциата его состав соответствует общей формуле:

$$3M^{2+} + 2[PW_{12}O_{40}]^{3-} + nH_2O \rightarrow M_3[PW_{12}O_{40}]_2 \cdot nH_2O\downarrow.$$

При использовании ионов Co^{2+} образуется кобальт(II)фосфовольфрамат состава $Co_3[PW_{12}O_{40}]_2 \cdot nH_2O$.

Для синтеза использовали соли и реагенты квалификации «чистый для анализа»: $Na_2WO_4 \cdot 2H_2O$, H_3PO_4, HCl и $CoCl_2 \cdot 6H_2O$. После завершения реакции образовавшийся осадок выдерживали при постоянном перемешивании в течение 24 ч для обеспечения полноты формирования ионного ассоциата. Затем осадок отделяли фильтрованием и сушили при температуре 60 °C в течение 6–8 ч.

Таким образом, при оптимальных условиях синтеза (pH 1,2–1,8; температура 70–80 °C) был получен устойчивый кобальтсодержащий фосфовольфраматный ионофор, предназначенный для использования в составе ионоселективной мембраны для потенциометрического определения ионов Co^{2+} в многокомпонентных сложных смесях.

Результаты исследования и их анализ

В ходе исследования на основе фосфовольфрамовой кислоты $H_3[PW_{12}O_{40}]$ и соли кобальта $CoCl_2 \cdot 6H_2O$ был синтезирован электроактивный компонент для кобальт-селективной мембраны. В качестве ионофорного соединения использовали кобальт(II)фосфовольфрамат, формирующийся в результате взаимодействия фосфовольфраматного аниона с ионами Co^{2+}.

Процесс синтеза можно представить следующим уравнением:

$$\mathbf{2H_3[PW_{12}O_{40}] + 3CoCl_2 \cdot 6H_2O \rightarrow Co_3[PW_{12}O_{40}]_2 \cdot nH_2O\downarrow + 6HCl + (18-n)H_2O.}$$

Стехиометрическое соотношение фосфовольфрамовой кислоты и хлорида кобальта(II) подбирали с учётом состава образующегося ионного ассоциата. Теоретически молярное соотношение $H_3[PW_{12}O_{40}]_2$ составляет **2:3**. В эксперименте данное соотношение корректировали с учётом полноты осаждения и формирования устойчивого кобальтсодержащего ионофора.

Для изучения влияния условий синтеза использовали стандартные растворы соответствующих солей металлов и 0,2 М растворы исходных реагентов. Особое внимание уделяли влиянию температуры реакционной

среды на выход и свойства образующегося соединения. С этой целью синтез проводили в интервале температур **20–70 °C** при постоянном перемешивании.

Результаты исследования влияния температуры на процесс синтеза кобальт(II)фосфовольфрамата представлены в **таблице 1**. Анализ полученных данных показал, что температура оказывает существенное влияние на процесс образования и выделения ионного ассоциата. Повышение температуры способствует ускорению взаимодействия исходных компонентов и более полному формированию фосфовольфраматного соединения кобальта. Оптимальный температурный режим был установлен на основании выхода продукта и его физико-химических характеристик.

Таблица 1

Результаты исследования влияния температуры на синтез ионофоров на основе додекавольфрамовой кислоты и хлорида кобальта (II) (состав исходных материалов, г: $H_3[PWo_{12}O_{40}]$-10,00 ; $CoCl_2 \cdot 6H_2O$ – 1,22).

Технологическая температура, ^{0} °C	Продукт реакции			
	Полученный продукт, г	Полученный продукт, % X±Δx	S	Sr *10 ^{2}
20	9.77	75,9 ± 0,9	0,72	0,55
30	8.89	86,5 ±0,8	0,64	0,56
40	9.53	92,7 ±0,9	0,72	0,67
50	9.94	96,6 ±1,1	0,88	0,85
60	9.94	97,0 ±1,3	1.05	1.01
70	9.70	94,3 ±1,2	0,96	0,91

Согласно данным, представленным в таблице 1, установлено, что температура оказывает существенное влияние на процесс синтеза кобальт(II)фосфовольфрамата. При повышении температуры от 20 до 50–60 °C наблюдается увеличение выхода синтезируемого соединения и улучшение условий формирования фосфовольфраматного ионного ассоциата. Дальнейшее повышение температуры не приводит к существенному увеличению выхода продукта. На основании полученных результатов в качестве оптимального температурного интервала синтеза $Co_3[PW_{12}O_{40}]_2 \cdot nH_2O$ выбран диапазон 50–60 °C. Для подтверждения состава синтезированного фосфовольфраматного электроактивного соединения, предназначенного для кобальт-селективного электрода, был проведён элементный анализ. При расчёте теоретического элементного состава в качестве исходных формул рассматривались безводные формы соответствующих соединений. Теоретические значения содержания кобальта, фосфора и вольфрама рассчитывали исходя из стехиометрического состава синтезированного соединения $Co_3[PW_{12}O_{40}]_2$. Экспериментальное определение элементного состава проводили с использованием комплекса аналитических методов, включающего гравиметрический, фотоколориметрический и рентгенофлуоресцентный анализ (РФА).

Применение нескольких независимых методов позволило повысить достоверность установления химического состава полученного электроактивного соединения. Полученные экспериментальные значения содержания основных элементов сопоставляли с теоретически рассчитанными значениями. Результаты элементного анализа представлены в таблице 2. Сопоставление теоретических и экспериментальных данных позволяет оценить соответствие фактического состава синтезированного соединения предполагаемой стехиометрической формуле и подтвердить образование кобальтсодержащего фосфовольфраматного ионофора.

Таблица 2

Экспериментально определенные и теоретически рассчитанные значения элементного состава синтезированных электроактивных веществ

Задача выполнена	Компоненты			
	Ион металла	Фосфор	Вольфрам (молибден)	Кислород
Со 3 [P (W 3 O 1 0) 4] 2				
Рассчитано , %	2.9 8	1, 04	74.40	21 , 60
Выявлено , %	2.83	0,99	70.54	25.07
Итак , 3 [R (Mo 3 O 10) 4]				
Рассчитано , %	4, 63	1.62	6 0 , 30	33.50
Выявлено , %	4.27	1.50	55.61	37.8

Сравнение расчётных и экспериментально определённых значений элементного состава электроактивного соединения, представленных в таблице 2, показывает хорошее соответствие полученных результатов теоретически рассчитанным значениям. Полученные данные подтверждают соответствие состава синтезированного ионофорного соединения предполагаемой стехиометрической формуле **$Co_3[PW_{12}O_{40}]_2 \cdot nH_2O$**.

Для дополнительного подтверждения химического состава и изучения структуры синтезированного электроактивного соединения были использованы современные инструментальные методы анализа. Элементный состав определяли комплексом независимых методов, включающим рентгенофлуоресцентный (РФА), фотоколориметрический и гравиметрический анализы. Комплексное применение указанных методов позволило повысить достоверность идентификации и количественной оценки основных компонентов синтезированного ионофора.

Рентгенофлуоресцентный анализ проводили на спектрометре **Rigaku NEX-DE**. В спектре синтезированного кобальт(II)фосфовольфрамата были зарегистрированы характерные аналитические линии элементов **P, W и Co**, что подтверждает наличие фосфора, вольфрама и кобальта в составе полученного соединения. Наиболее интенсивные аналитические линии соответствуют вольфраму, что связано с его высоким содержанием в составе фосфовольфраматного аниона $[PW_{12}O_{40}]^{3-}$. Наличие характерных линий фосфора подтверждает присутствие фосфатного фрагмента в структуре

гетерополисоединения. Регистрация аналитических линий кобальта свидетельствует о присутствии катионов Co^{2+} в составе синтезированного ионного ассоциата.

Таким образом, результаты рентгенофлуоресцентного анализа в совокупности с данными гравиметрического и фотоколориметрического определения подтверждают формирование кобальтсодержащего фосфовольфраматного соединения и согласуются с предполагаемым составом $Co_3[PW_{12}O_{40}]_2 \cdot nH_2O$. Полученные результаты служат основанием для дальнейшего исследования структурных и электрохимических характеристик данного ионофора и его применения в составе ионоселективной мембраны для определения ионов Co^{2+}.

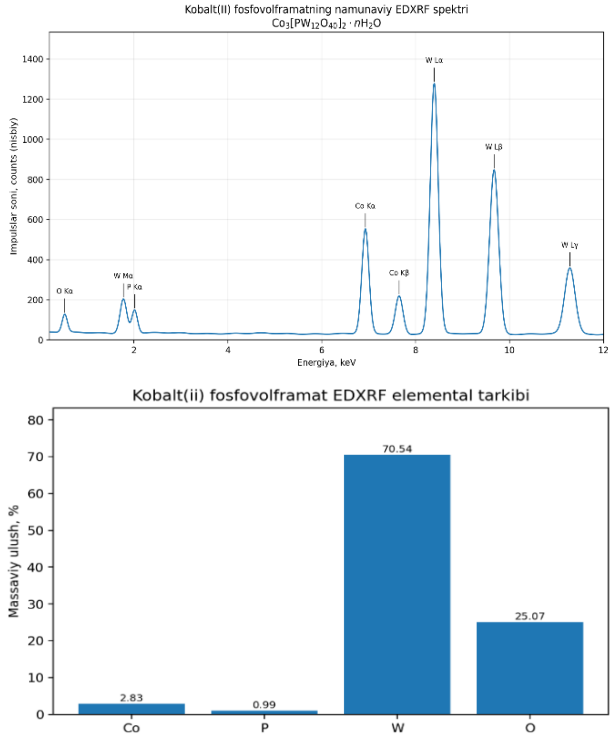


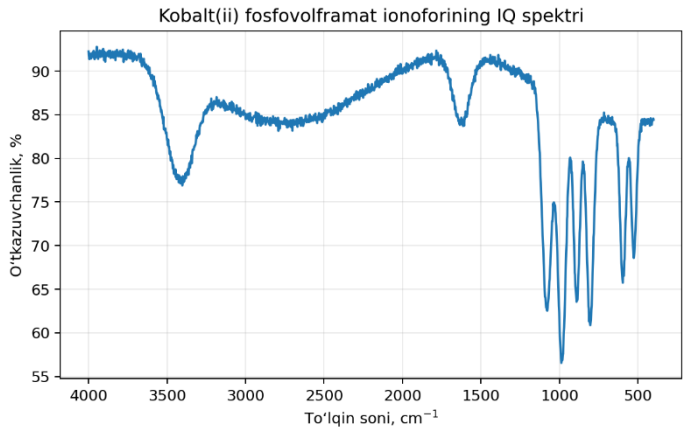
Рисунок 1. Кобальт (II) в фосфовольфрамате методом РФ . элемент состав .

Для подтверждения формирования фосфовольфраматного аниона типа Кеггина и идентификации синтезированного электроактивного соединения был проведён анализ его ИК-спектра. ИК-спектроскопия является одним из основных методов подтверждения сохранения структурного каркаса гетерополисоединений типа Кеггина.

В ИК-спектре синтезированного кобальт(II)фосфовольфрамата наблюдаются характерные полосы поглощения, соответствующие основным типам колебаний в структуре аниона $[PW_{12}O_{40}]^{3-}$. Согласно литературным данным, для фосфовольфраматов типа Кеггина диагностическими являются полосы, относящиеся к валентным и деформационным колебаниям связей **P–O, W=O и W–O–W**.

Полоса в области **1077–1080 см⁻¹** соответствует валентным колебаниям связи **P–O**, характеризующей центральный фосфатный тетраэдр. Интенсивная полоса около **984 см⁻¹** связана с валентными колебаниями терминальных связей **W=O**. Полосы поглощения в областях около **889 и 804 см⁻¹** относятся к колебаниям мостиковых связей **W–O–W**, формирующих каркас структуры Кеггина.

Наличие указанных характерных полос в ИК-спектре синтезированного соединения согласуется с литературными данными для фосфовольфраматов типа Кеггина и подтверждает сохранение структурного фрагмента $[PW_{12}O_{40}]^{3-}$ в составе полученного кобальт(II)фосфовольфрамата. Таким образом, результаты ИК-спектроскопического исследования совместно с данными элементного и рентгенофлуоресцентного анализа подтверждают образование целевого электроактивного ионофорного соединения.



Картина 2. Фосфорольфрамат кобальта (II) ИК- спектр ионофора .

В ИК-спектре синтезированного кобальт(II)фосфовольфрамата наблюдается полоса поглощения около **1080 см⁻¹**, относящаяся к валентным колебаниям связи **P–O** центрального фосфатного тетраэдра. Интенсивная полоса в области **984 см⁻¹** соответствует валентным колебаниям терминальной связи **W=O**. Полосы около **889 и 804 см⁻¹** обусловлены колебаниями мостиковых связей **W–O–W**, характерных для структуры фосфовольфраматного аниона типа Кеггина. Широкие полосы поглощения в областях около **3420 и 1625 см⁻¹** связаны соответственно с валентными и деформационными колебаниями групп **O–H** молекул кристаллизационной воды. Наличие указанных полос подтверждает присутствие связанной воды в составе синтезированного соединения и согласуется с предполагаемой гидратированной формой кобальт(II)фосфовольфрамата.

Таким образом, совокупность характерных полос в области 400–1200 см⁻¹ подтверждает наличие фосфовольфраматного каркаса типа Кеггина, тогда как полосы в области 1625–3420 см⁻¹ указывают на присутствие молекул воды в структуре синтезированного соединения.

Заключение

В результате проведённых исследований разработана ионоселективная мембрана для потенциометрического определения ионов Co^{2+} в многокомпонентных сложных смесях. Установлены оптимальный состав мембранной композиции и условия синтеза электроактивного кобальтсодержащего фосфовольфраматного ионофора. С использованием комплекса современных аналитических методов исследованы элементный состав, структурные и физико-химические характеристики синтезированного ионофорного соединения. Результаты рентгенофлуоресцентного, гравиметрического, фотоколориметрического и ИК-спектроскопического анализа подтвердили формирование кобальт(II)фосфовольфраматного соединения и наличие характерного фосфовольфраматного каркаса типа Кеггина. На основе разработанного ионофора и ПВХ-мембранной композиции изготовлен лабораторный прототип кобальт-селективного ионоселективного электрода. Установлено, что разработанная мембрана характеризуется высокой чувствительностью к ионам Co^{2+}, а потенциометрический отклик имеет линейную зависимость от концентрации определяемого иона в диапазоне **10^{-1}–10^{-5} моль/л**. Полученные результаты показывают перспективность использования синтезированного фосфовольфраматного ионофора в составе ионоселективных мембран для селективного потенциометрического определения ионов кобальта в многокомпонентных объектах.

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Бердиева Х.Б., PhD
и. о. доцента
Термезский государственный университет
Узбекистан, г. Термез

СОЦИОКУЛЬТУРНАЯ КОМПЕТЕНТНОСТЬ БУДУЩЕГО УЧИТЕЛЯ В ЦИФРОВО-ГИБРИДНОЙ СРЕДЕ: РЕФЛЕКСИВНО-СЦЕНАРНАЯ ТЕХНОЛОГИЯ

Аннотация. Актуальность определяется цифровизацией педагогической коммуникации. Цель — обосновать рефлексивно-сценарную технологию. Использованы теоретический анализ и моделирование профессиональных ситуаций. Результат — схема «контекст — ценности — решение — последствия».

Ключевые слова: социокультурная компетентность, будущий учитель, цифровая коммуникация, педагогический сценарий, ценности, рефлексия.

Berdieva Kh.B., PhD
acting associate professor
Termez State University
Uzbekistan, Termez

SOCIOCULTURAL COMPETENCE OF A FUTURE TEACHER IN A DIGITAL-HYBRID ENVIRONMENT: REFLECTIVE SCENARIO TECHNOLOGY

Abstract. The study addresses the digitalisation of pedagogical communication. The aim is to substantiate reflective scenario technology. The methods are theoretical analysis and professional-situation modelling. The result is a context-values-decision-consequences scheme.

Keywords: sociocultural competence, future teacher, digital communication, pedagogical scenario, values, reflection.

Введение

Социокультурная компетентность будущего учителя объединяет ценностный, семейный, коммуникативный и профессиональный контексты [10–13]. Работы о социальном интеллекте и нравственно-ценностной подготовке дополняют эту линию способностью понимать другого и учитывать культурный смысл взаимодействия [14; 15]. Психолого-педагогические исследования адаптации, защитных механизмов, креативности, проектной деятельности и вовлечённости задают деятельностную основу подготовки [1–6], а народная педагогика и

исследования менталитета показывают культурную обусловленность коммуникации [7–9].

Методы и исследования

Использованы понятийный анализ, сравнительно-сопоставительное рассмотрение научных позиций, моделирование профессиональных ситуаций и структурирование критериев оценивания. Теоретическая модель рассматривается как основание для последующей эмпирической апробации, а не как доказанный причинный эффект.

Результаты исследования

Единицей подготовки является краткий сценарий цифровой или очной педагогической коммуникации. Студент определяет контекст, ценности, варианты решения и возможные последствия. При этом внешняя активность в групповом задании не отождествляется с содержательной вовлечённостью: учитываются понимание задачи, самостоятельность решения и рефлексия [3; 5; 6].

Культурная неоднородность и цифровая этика

Цифрово-этическое измерение социокультурной компетентности включает понимание границ публичного и частного, допустимости распространения сведений о ребёнке, риска стигматизации семьи и необходимости профессиональной дистанции. Народно-педагогические ценности могут поддерживать уважительное взаимодействие [7; 8], но требуют контекстной интерпретации; междисциплинарный анализ менталитета подчёркивает устойчивость и историческую изменчивость культурных схем восприятия [9].



Рисунок 1. Контекстные поля социокультурного профессионального решения

Сценарное моделирование профессионального решения

Сценарная технология целесообразно строится по трём уровням сложности. Репродуктивный сценарий проверяет знание профессиональных норм; интерпретативный содержит культурно неоднозначную ситуацию и несколько допустимых ответов; проектный требует коллективно разработать решение и представить его адресату — семье, классу или педагогическому сообществу. Переход между уровнями сопровождается рефлексией и оценкой реального вклада студента [5; 6].

Критерии оценивания и обратная связь

Для стандартизации результата предлагаются пять шкал: полнота фактов, учёт культурного контекста, этическая аргументация, коммуникативная адекватность и рефлексивная корректировка решения. Каждая шкала может оцениваться по четырёхуровневой рубрике от фрагментарного ответа до интегративного профессионального решения.

Такой формат соотносится с требованиями к развитию социокультурной компетентности и семейно-педагогического взаимодействия [10–14].



Рисунок 2. Последовательность рефлексивно-сценарного анализа

Обсуждение

Сильная сторона модели состоит в соединении культурного и деятельностного уровней. Будущий учитель учится не просто знать особенности семьи или традиции, а принимать решение в условиях частичной неопределённости.

Это особенно важно в цифровом взаимодействии, где сообщение может быть сохранено, переслано и прочитано вне исходного контекста. Поэтому социокультурная компетентность включает способность прогнозировать вторичные эффекты коммуникации. Практическая апробация может проводиться в курсах педагогики, методики начального образования и педагогической практики с единым банком сценариев и сопоставимой рубрикой оценивания.

Цифровая этика взаимодействия с семьёй

Отдельного внимания требует цифровая этика взаимодействия с родителями. Будущий учитель должен различать сообщение, которое допустимо направить индивидуально, и информацию, которую нельзя выносить в общий чат.

Профессиональный сценарий может включать ситуацию, где родитель публично задаёт вопрос об успеваемости ребёнка, а студент выбирает форму ответа, учитывая конфиденциальность и необходимость сохранить доверие. Важен не только текст ответа, но и решение о канале коммуникации. Такая задача позволяет сделать цифровую составляющую социокультурной компетентности наблюдаемой.

Конструирование банка сценариев

Банк сценариев должен охватывать не случайный набор конфликтов, а несколько устойчивых групп: различия семейных ожиданий; культурно маркированные формы общения; конфликт между публичностью и конфиденциальностью; неоднозначные воспитательные нормы; цифровые недоразумения; взаимодействие с родителями при учебной трудности ребёнка. Для каждого сценария фиксируются контекст, скрытый риск,

несколько допустимых решений и критерии оценивания. Это позволяет использовать технологию не только как упражнение, но и как стандартизируемый диагностический инструмент.

Практическая апробация

В пилотной апробации целесообразно сравнивать решение студента до и после группового обсуждения. Если после получения новой информации он способен изменить первоначальную позицию и объяснить причину, это указывает на рефлексивную гибкость. Если же ответ остаётся неизменным при игнорировании существенного контекста, можно говорить о нормативном или формальном стиле решения. Такая динамическая процедура информативнее обычного теста на знание правил, поскольку приближает оценивание к реальной профессиональной ситуации.

Ssenariy javobini baholash rubrikasi

	Past daraja → yuqori daraja	Nima baholanadi
Faktlar	to‘liq emas / to‘liq	Dalillilik
Kontekst	bir tomonlama / ko‘p omilli	Talqin
Etika	normativ / asoslangan	Kasbiy mas’uliyat
Kommunikatsiya	reaktiv / moslashuvchan	Muloqot
Refleksiya	yo‘q / tuzatish bor	O‘zini boshqarish

Рисунок 3. Рубрика оценки профессионального сценария

Интеграция сценарной технологии в подготовку будущего учителя

Рефлексивно-сценарная технология может включаться не в отдельную дисциплину, а в несколько взаимосвязанных модулей профессиональной подготовки. В курсах общей и социальной педагогики сценарии помогают анализировать ценностные основания решения; в методике начального обучения — переводить их в конкретное взаимодействие с ребёнком; в педагогической практике — сопоставлять модельную ситуацию с реальным профессиональным опытом. Такая вертикальная интеграция позволяет увидеть, переносит ли студент способ анализа из учебной аудитории в практическую деятельность. Существенным условием является повторяемость структуры сценария: факты, участники, ценности, решение, последствия. При сохранении этой логики меняется содержание ситуации, но способ профессионального рассуждения постепенно становится устойчивым.

Отдельного внимания требует цифровой канал взаимодействия с родителями. В очной беседе педагог получает невербальную обратную связь и может сразу уточнить смысл высказывания, тогда как сообщение в мессенджере фиксируется, пересылается и читается вне первоначального контекста. Поэтому в сценариях следует специально моделировать риск публичности, двусмысленность короткого текста, эмоциональную реакцию

адресата и необходимость разделять факты о ребёнке и оценочные характеристики. Оценивание такого решения должно учитывать не только вежливость формулировки, но и соблюдение профессиональных границ, конфиденциальность, уважение к семье и способность выбрать более подходящий канал для сложного разговора.

Для повышения надёжности оценивания полезно использовать два уровня рубрики. Первый отражает качество конкретного решения: точность фактов, этическая корректность и коммуникативная реализуемость. Второй фиксирует рефлексию: способен ли студент объяснить, почему отклонил альтернативу, какая новая информация могла бы изменить решение и какие риски остаются после выбранного действия. Именно второй уровень позволяет отличить воспроизведение нормы от профессионального суждения. В дальнейшем такие рубрики могут использоваться для сравнительной оценки динамики студентов на разных этапах обучения и во время педагогической практики.

Заключение

Технология переводит социокультурную компетентность в наблюдаемую процедуру профессионального решения. Перспектива — эмпирическая проверка банка сценариев.

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Бозорова М.К., к.п.н.
и. о. профессора кафедры «Педагогика и социальная работа»
Термезский государственный университет
Узбекистан, г. Термез

НАРОДНАЯ ПЕДАГОГИКА В ПРОЕКТНО-ОРИЕНТИРОВАННОМ ОБУЧЕНИИ: МОДЕЛЬ ЦЕННОСТНО-СМЫСЛОВОЙ ВОВЛЕЧЁННОСТИ БУДУЩЕГО ПЕДАГОГА

Аннотация. Актуальность связана с современным использованием народной педагогики в профессиональной подготовке. Цель — обосновать модель ценностно-смысловой проектной вовлечённости. Использованы теоретический анализ и структурное моделирование. Результат — связь культурного смысла, профессиональной задачи, вклада и рефлексии.

Ключевые слова: народная педагогика, национальные ценности, будущий педагог, проектное обучение, вовлечённость, рефлексия.

Bozorova M.K., candidate of pedagogical sciences
acting professor
Department of Pedagogy and Social Work
Termez State University
Uzbekistan, Termez

FOLK PEDAGOGY IN PROJECT-ORIENTED LEARNING: A MODEL OF FUTURE TEACHERS' VALUE-MEANING ENGAGEMENT

Abstract. The study addresses the modern use of folk pedagogy in teacher education. The aim is to substantiate value-meaning project engagement. The methods are theoretical analysis and structural modelling. The result links cultural meaning, professional task, contribution, and reflection.

Keywords: folk pedagogy, national values, future teacher, project-based learning, engagement, reflection.

Введение

Народная педагогика передаёт национальные ценности через социальный опыт и устное творчество [7; 8]. Междисциплинарное понимание менталитета позволяет рассматривать культурную норму как устойчивую, но исторически изменчивую систему интерпретаций [9]. Учебно-методические работы М. К. Бозоровой создают основу для переноса народно-педагогического материала в современную профессиональную подготовку [10–12], а исследования проектного обучения и вовлечённости уточняют требования к деятельностной стороне такого переноса [3; 5; 6; 13; 14].

Методы и исследования

Использованы теоретический анализ, сравнительная интерпретация этнопедагогических источников и структурное моделирование проектной деятельности. Дополнительно учитывались психологические механизмы адаптации, защитного реагирования и креативного решения учебной задачи [1; 2; 4], а культурно-историческая перспектива рассматривалась как основание смыслового присвоения опыта [15].

Результаты исследования

Проект строится вокруг профессиональной задачи: занятия по пословице, анализа обычая или методической карты фольклорного текста. Студент определяет культурный смысл, адресата, собственный вклад и границы применения нормы. Проектная форма не гарантирует вовлечённость без инициативы и рефлексии [10; 11].

Устное творчество как механизм, а не иллюстрация

Устное народное творчество рассматривается не только как источник содержания, но и как самостоятельный механизм учебной деятельности. Пословицы, сказки, предания и другие формы устного наследия могут выполнять функции проблемной ситуации, культурного источника, объекта сравнительного анализа и материала для создания профессионального продукта [7; 8; 10–12].

Бозоровой показывают педагогическую значимость пословиц, сказок, преданий и других форм устного наследия [1; 14]. В проектном обучении они могут выполнять функции проблемной ситуации, культурного источника, объекта сравнительного анализа и материала для создания профессионального продукта. Например, будущий педагог может сопоставить смысл нескольких пословиц, выявить воспитательную норму, определить границы её современного применения и разработать возрастно адекватное задание.

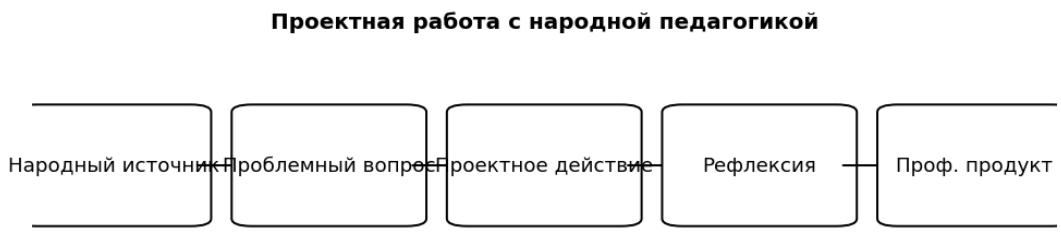


Рисунок 1. Логика проектно-рефлексивной работы с материалом народной педагогики

Ментальность и критическая интерпретация традиции

Соотношение традиции и современной педагогической нормы требует критической интерпретации. Менталитет объединяет устойчивые способы восприятия, нормы и ценностные ориентации [9], однако традиционная форма не должна автоматически превращаться в современное предписание. Студенту необходимо различать ценностное ядро, исторический контекст и педагогическую допустимость.

Отсюда следует, что народно-педагогический материал не должен автоматически превращаться в предписание. Студенту необходимо различать ценностное ядро, историческую форму и современную педагогическую допустимость. Такой анализ предотвращает как некритическое идеализирование традиции, так и её необоснованное отрицание.

Проектный продукт и содержательная вовлечённость

Проектный продукт сам по себе не доказывает внутренней вовлечённости. Методическая разработка, сценарий занятия или цифровой ресурс оцениваются по корректности источника, педагогической аргументации, самостоятельному вкладу и рефлексивному объяснению выбора. Исследования проектного обучения и вовлечённости позволяют отделить внешнее выполнение от осмысленного профессионального участия [3; 5; 6; 13; 14].

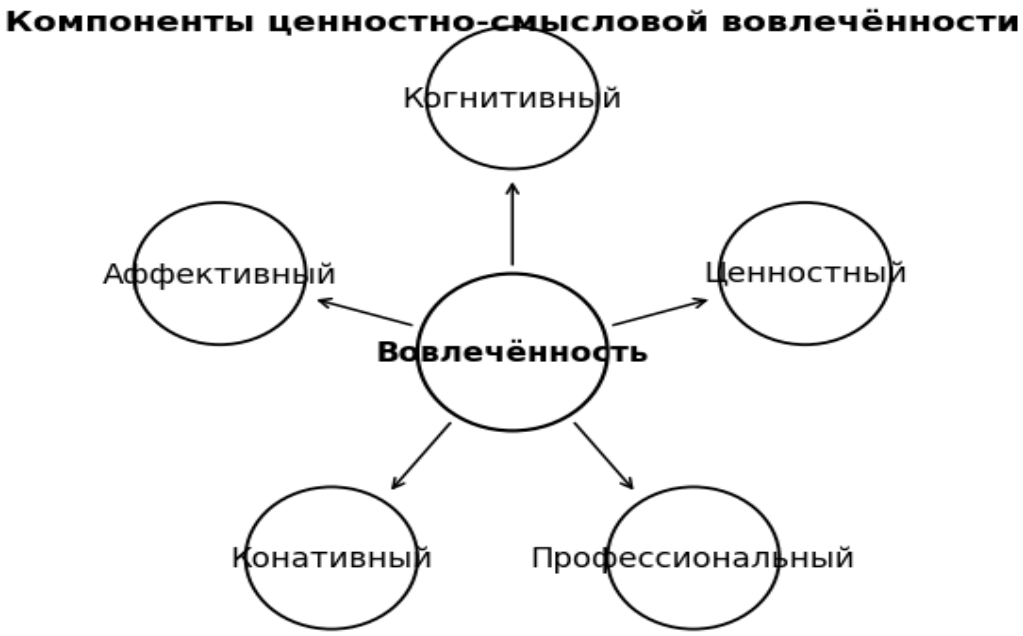


Рисунок 2. Компоненты ценностно-смысловой проектной вовлечённости

Обсуждение и применение

Предлагаемая модель особенно продуктивна в подготовке педагогов, поскольку связывает культурный источник с реальной профессиональной задачей. Проект начинается не с требования «сделать презентацию», а с вопроса, требующего решения: как использовать традиционную норму без стереотипизации; как перевести пословицу в учебную ситуацию; как объяснить семье воспитательный смысл задания; как сопоставить народный опыт с современными принципами педагогической этики. Такая постановка поддерживает креативное мышление, проектную инициативу и профессиональную рефлексию, сохраняя научно-культурную корректность.

Три формата проектной работы

Проектно-ориентированная работа с народной педагогикой может быть организована в трёх форматах. Аналитический проект предполагает сопоставление источников и выявление педагогического смысла.

Методический проект завершает анализ разработкой занятия, задания или памятки. Социально-коммуникативный проект адресован конкретной аудитории — студентам, школьникам или семье — и требует адаптировать культурный материал к возрасту и ситуации. Переход от первого формата к третьему увеличивает профессиональную сложность и позволяет постепенно развивать самостоятельность будущего педагога.

Критерии качества проектного решения

Качество проекта должно определяться не декоративностью презентации, а пятью критериями: достоверность культурного источника; ясность воспитательного смысла; соответствие возрасту адресата; этическая корректность; рефлексивное объяснение границ применимости традиции. Отдельно фиксируется индивидуальный вклад студента. Такая рубрика помогает преподавателю избежать ситуации, когда высокий балл получает внешне привлекательный продукт с поверхностным содержанием, и связывает оценивание с ценностно-смысловой вовлечённостью.

Профессиональная перспектива

Расширенная модель позволяет включать народную педагогику не только в курс истории воспитания, но и в методику, педагогическую практику и проектную деятельность. Будущий педагог получает возможность проверить культурный материал на реальной профессиональной задаче: сформулировать цель, выбрать возрастную группу, разработать вопрос, спрогнозировать риск стереотипизации и подготовить рефлексивное обоснование. Такой подход соединяет традицию и современную педагогическую технологию без их искусственного противопоставления.

Xalq pedagogikasi loyihasini baholash mezonlari

	Talab	Natija
Manba	Tekshirilgan xalqona material	Ilmiy-madaniy to‘g‘rilik
Muammo	Kasbiy savol	Mazmunli vazifa
Mahsulot	Metodik ishlanma	Amaliy qiymat
Hissa	Individual dalil	Jalb etilganlik
Refleksiya	Chegara va risklar	Etik asos

Рисунок 3. Критерии оценки проекта по народной педагогике

Этапы реализации проектной модели

Проектно-рефлексивная работа может разворачиваться в четырёх этапах. На первом студент проверяет происхождение и контекст народно-педагогического материала. На втором формулирует профессиональную проблему и определяет адресата будущего продукта. На третьем разрабатывает решение — занятие, методическую карту, памятку или учебный ресурс — и получает обратную связь. На четвёртом объясняет, какое ценностное содержание сохранено, что адаптировано к современной образовательной ситуации и какие ограничения применения материала остаются. Такая последовательность делает рефлексию частью продукта, а не формальным завершающим комментарием.

Перспектива эмпирической апробации

Проверка модели может строиться на сравнении репродуктивного задания и проектно-рефлексивного формата. Оцениваться должны не только качество итогового материала, но и точность источников, глубина педагогической аргументации, самостоятельность вклада и способность обозначить границы применимости традиционной нормы. Дополнительным показателем может выступать изменение профессионального смысла: способен ли студент объяснить, как конкретный элемент народной педагогики связан с задачами будущей профессии. Такой дизайн позволит отделить культурную информированность от содержательной проектной вовлечённости.

Заключение

Народная педагогика становится современным ресурсом, когда включается в проблемную и проектно-рефлексивную деятельность. Модель может быть проверена эмпирически.

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Бурхонов И.М.
преподаватель
Международный медицинский университет САМУ
Узбекистан, г. Фергана
ORCID: 0009-0002-5801-5566

НАУЧНЫЙ ВКЛАД АКАДЕМИКА ДИЛОРОМ ЮСУПОВОЙ В ИЗУЧЕНИЕ ИСТОРИИ ВОСТОКА

Аннотация. В статье рассматривается научная деятельность академика Академии наук Республики Узбекистан, доктора исторических наук, профессора Дилором Юсуповой в области изучения истории Средневековья, в особенности периода правления Амира Тимура и Тимуридов. Основное внимание уделяется её исследованиям персидско-таджикских письменных источников, источниковедческому и текстологическому анализу исторических произведений, подготовке научно-критических текстов и введению рукописного наследия в научный оборот. Анализируются исследования Дилором Юсуповой, посвящённые трудам Фасеха Хавафи, Мирхонда, Хондамира и научному наследию Гиясиддина Коши. Показано значение её исследований для изучения политической истории, социально-экономических отношений, городской культуры, литературной среды и развития науки в Центральной Азии в эпоху Тимуридов.

Ключевые слова: Дилором Юсупова, источниковедение, текстология, Амир Тимур, Тимуриды, Фасех Хавафи, Мирхонд, Хондамир, Гиясиддин Коши, «Муджмали Фасихи», письменные источники, востоковедение.

Burkhonov I.M.
lecturer
Central Asian Medical University (CAMU)
Uzbekistan, Ferghana
ORCID: 0009-0002-5801-5566

THE SCIENTIFIC CONTRIBUTION OF ACADEMICIAN DILOROM YUSUPOVA TO THE STUDY OF EASTERN HISTORY

Abstract. The article examines the scholarly activity of Academician of the Academy of Sciences of the Republic of Uzbekistan, Doctor of Historical Sciences, Professor Dilorom Yusupova in the field of medieval history, particularly the history of the reign of Amir Timur and the Timurids. Particular attention is paid to her studies of Persian-Tajik written sources, source studies and textual analysis of historical works, the preparation of scholarly critical texts, and the introduction of manuscript heritage into academic circulation. The article analyzes Dilorom Yusupova's research devoted to the works of Faseh Khavafi, Mirkhwand, Khwandamir, and the scholarly legacy of Ghiyath al-Din al-Kashi. The significance

of her research for the study of political history, socio-economic relations, urban culture, the literary environment, and the development of science in Central Asia during the Timurid era is demonstrated.

Keywords: Dilorom Yusupova, source studies, textual criticism, Amir Timur, Timurids, Faseh Khavafi, Mirkhwand, Khwandamir, Ghiyath al-Din al-Kashi, Mujmal-i Fasihi, written sources, Oriental studies.

Введение

Изучение истории Средневековья на Востоке, в частности государственности, социально-экономических отношений, культурной жизни и развития науки в Центральной Азии в период правления Амира Тимура и Тимуридов, является одним из важных направлений современной историографии. Объективное и научно обоснованное освещение истории данного периода предполагает всестороннее изучение письменных источников, определение их содержания и исторического значения, а также сопоставление сведений различных источников.

Особое место в изучении богатого рукописного наследия Центральной Азии занимает узбекская школа востоковедения. Благодаря многолетним исследованиям её представителей в научный оборот введён значительный корпус исторических произведений, подготовлены научно-критические тексты и осуществлены переводы на различные языки.

В данном контексте особого внимания заслуживает научная деятельность академика Академии наук Республики Узбекистан, доктора исторических наук, профессора Дилором Юсуповой. Её многолетние исследования посвящены преимущественно персидско-таджикским письменным источникам по истории Тимуридского периода, их источниковедческому изучению, определению исторической достоверности и научной значимости.

Материалы и методы исследования

Основу исследования составляют письменные источники по истории Тимуридского периода, в том числе «Муджмали Фасихи» Фасеха Хавафи, «Равзат ус-сафо» Мирхонда, исторические труды Хондамира, а также письма Гиясиддина Коши, связанные с научной жизнью Самарканда и Кошана.

В работе применяются историко-источниковедческий, сравнительно-аналитический, текстологический и хронологический методы. Особое внимание уделяется сопоставлению различных рукописных копий, выявлению текстуальных различий, сравнению содержащихся в них исторических сведений с другими письменными источниками и определению степени достоверности представленной информации.

Важным направлением исследования является также изучение деятельности Дилором Юсуповой по подготовке научно-критических текстов, переводу исторических произведений, их комментированию и введению рукописных источников в научный оборот.

Результаты исследования

Формирование научного пути Дилором Юсуповой

Дилором Юсупова родилась 21 июля 1941 года в Ташкенте в семье интеллигенции. В 1958 году она успешно окончила среднюю школу и поступила на Восточный факультет Среднеазиатского государственного университета. В период обучения получила знания в области восточных языков, филологии и истории народов Востока. Изучение языка и литературы пушту способствовало формированию навыков работы с древними письменными источниками.

После окончания университета в 1963 году Дилором Юсупова начала научную деятельность в Институте востоковедения имени Абу Райхана Беруни Академии наук Узбекистана. В этот период институт являлся одним из ведущих научных центров по изучению исторического и культурного наследия Востока.

Важное влияние на формирование научного мировоззрения молодой исследовательницы оказала научная среда, в которой работали академик Убайдулла Каримов, историк Борибой Ахмедов, текстолог и источниковед Асомиддин Оринбоев и другие известные специалисты.

На начальном этапе научной деятельности Дилором Юсупова занималась описанием, систематизацией и каталогизацией рукописей. Работа с рукописными материалами позволила ей приобрести значительный опыт в изучении письменных источников, выявлении текстологических особенностей и проведении сравнительного анализа.

Первоначально её исследования были связаны преимущественно с филологией, однако впоследствии научные интересы расширились и охватили проблемы источниковедения и историографии. В 1974 году она защитила кандидатскую диссертацию, а в 2001 году — докторскую диссертацию по историческим наукам.

Источниковедческое изучение «Муджмали Фасихи»

Особое место в научном наследии Дилором Юсуповой занимает исследование исторического произведения Фасеха Хавафи «Муджмали Фасихи»[1,2.]. Этот труд XIV–XV веков является важным письменным источником для изучения истории Амира Тимура и Тимуридов.

Наряду с политическими событиями, произведение содержит сведения о социальной жизни, экономических отношениях, истории городов и культурных процессах. При изучении данного труда Дилором Юсупова уделяла внимание исследованию его рукописных копий, выявлению текстуальных различий и сопоставлению исторической информации с данными других источников.

Перевод произведения на узбекский и русский языки, его научное издание и снабжение соответствующими комментариями способствовали расширению возможностей использования этого источника в исторических исследованиях.

Хронологическая структура «Муджмали Фасихи» позволяет исследователям уточнять даты исторических событий и сопоставлять сведения различных источников[1: 160.]. Исследования Дилором Юсуповой показали значение этого произведения не только для политической истории Тимуридов, но и для изучения городской жизни, экономических отношений и культурных процессов.

3.3. Исследование исторического наследия Мирхонда и Хондамира

Значительное место в научной деятельности Дилором Юсуповой занимает изучение исторического наследия Мирхонда и Хондамира. Их труды являются важными памятниками восточной историографии и содержат сведения о политических событиях, деятельности правителей, государственном управлении и культурной жизни Центральной Азии и Хорасана.

При изучении произведений этих авторов особое внимание уделялось содержанию исторической информации, её происхождению и взаимосвязи с другими письменными источниками[2,3,4.]. Сравнительный анализ позволил рассматривать сведения данных произведений в контексте более широкого комплекса исторических источников.

Особое значение эти труды имеют для изучения Герата как политического и культурного центра эпохи Тимуридов. Представленные в них сведения позволяют также исследовать литературную среду, духовную жизнь и развитие науки в период, связанный с деятельностью Алишера Навои и его современников.

Исследование научного наследия Гиясиддина Коши

Отдельное направление научной деятельности Дилором Юсуповой связано с изучением развития науки в эпоху Мирзо Улугбека. В этом отношении особый интерес представляют её исследования писем Гиясиддина Коши, направленных из Самарканда в Кошан[16: 226-227.].

Гиясиддин Коши был выдающимся математиком и астрономом XV века и одним из представителей научной школы Мирзо Улугбека. Его письма содержат ценные сведения о научной атмосфере Самарканда, деятельности учёных, научных связях и особенностях развития астрономических и математических исследований.

Изучение этих письменных материалов с источниковедческой точки зрения позволило расширить представления о научной жизни эпохи Тимуридов. Письма дают возможность исследовать отношение Мирзо Улугбека к развитию науки, взаимодействие между учёными и особенности организации научной деятельности в Самарканде[18: 112.].

Введение этих материалов в научный оборот и их публикация на различных языках расширили возможности их использования в исследованиях истории науки и культуры Тимуридского периода.

Обсуждение

Исследования Дилором Юсуповой демонстрируют важность комплексного использования письменных источников при изучении истории

Тимуридского периода. В рамках её источниковедческого подхода историческое произведение рассматривается не только как описание событий, но и как совокупность исторических свидетельств, отражающих политические, социальные, экономические и культурные процессы определённой эпохи.

Сопоставление рукописных копий, выявление текстуальных различий и сравнение содержащихся в них сведений с другими источниками позволяют глубже исследовать историческую действительность. В этом отношении изучение «Муджмали Фасихи», «Равзат ус-сафо», трудов Хондамира и писем Гиясиддина Коши создаёт важную источниковедческую основу для комплексного исследования эпохи Тимуридов.

Результаты исследований позволяют рассматривать историю данного периода не только в контексте политических событий, но и с точки зрения развития городов, экономических отношений, культуры, литературы и науки[2, 4, 5.].

При этом критическое изучение источников требует учитывать время их создания, особенности авторской позиции, происхождение приводимых сведений и их соответствие данным других исторических произведений. Такой подход позволяет более обоснованно оценивать историческую информацию и формировать научные выводы.

Заключение

Многолетняя научная деятельность академика Дилором Юсуповой имеет существенное значение для развития узбекского источниковедения и текстологии. Её исследования письменного наследия Фасеха Хавафи, Мирхонда, Хондамира и Гиясиддина Коши способствовали введению в научный оборот важных источников по истории средневековой Центральной Азии. Особое значение имеют её исследования, связанные с подготовкой научно-критических текстов исторических произведений, изучением рукописных вариантов, их сравнительным анализом, переводом и научным комментированием.

Научное наследие Дилором Юсуповой создаёт важную источниковую базу для изучения не только политической истории Тимуридов, но и социально-экономических отношений, истории городов, культурной среды, литературного процесса и развития науки в Центральной Азии.

Таким образом, её исследования способствуют дальнейшему развитию источниковедческих и текстологических методов изучения средневековой истории Востока и расширяют возможности научного осмысления историко-культурного наследия эпохи Тимуридов.

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Данилина Д.Д.
студент
Финансовый университет
при Правительстве Российской Федерации
Россия, г. Москва

ЦИФРОВЫЕ ФИНАНСОВЫЕ АКТИВЫ В СИСТЕМЕ ФИНАНСИРОВАНИЯ РОССИЙСКОГО БИЗНЕСА

Аннотация. В статье рассмотрена роль цифровых финансовых активов (ЦФА) в системе финансирования российского бизнеса. Анализируется регуляторная основа и инфраструктура рынка, новые корпоративные эмитенты, а также основные риски и перспективы развития рынка. На основе приведенных данных оценивается значения ЦФА как инструмента преимущественно краткосрочного финансирования и выявляются ограничения, связанные с кредитным риском, концентрацией рынка и недостаточной ликвидностью.

Ключевые слова: цифровые финансовые активы, ЦФА, финансирование бизнеса, финансовый рынок, инвестиции, цифровые технологии.

Danilina D.D.
student
Financial University under the Government
of the Russian Federation
Russia, Moscow

DIGITAL FINANCIAL ASSETS IN THE RUSSIAN BUSINESS FINANCING SYSTEM

Abstract. The article examines the role of digital financial assets (DFAs) in the financing system for Russian businesses. It analyses the regulatory framework and market infrastructure, new corporate issuers and key market risks and development prospects. Based on the data presented, the study assesses the significance of DFAs as a primarily short-term financing instrument and identifies limitations related to credit risk, market concentration and insufficient liquidity.

Keywords: digital asset, DFAs, business financing, financial market, investment, digital technologies

Введение

Цифровые финансовые активы (ЦФА) представляют собой цифровые права, включающие денежные требования, возможность осуществления прав по эмиссионным ценным бумагам, права участия в капитале непубличного акционерного общества, а также право требовать передачи эмиссионных ценных бумаг. Их важной особенностью является использование

информационных систем на базе распределенных реестров и возможность автоматизации отдельных операций с помощью смарт-контрактов. В соответствии с российским законодательством ЦФА не являются средством платежа [1].

Цель исследования заключается в оценке роли цифровых финансовых активов (ЦФА) в системе финансирования российского бизнеса и выявлении факторов, которые ограничивают дальнейшее развитие рынка. Для этого рассматриваются регулирование и инфраструктура рынка, динамика выпусков, состав инструментов и участников, а также основные риски и перспективы.

Методы исследования

Использованы анализ и обобщение данных о рынке ЦФА, сравнительный анализ показателей 2024-2026 годов, анализ нормативной базы и структурный анализ участников и инструментов рынка. Материалы исследования Банка России, аналитических агентств и деловых СМИ стали основой исследования.

Результаты исследования

Выпуск и обращение ЦФА регулируются Федеральным законом от 31.07.2020 №259-ФЗ. Инфраструктуру формируют операторы информационных систем, которые обеспечивают выпуск и учет ЦФА, и операторы обмена. По состоянию на сентябрь 2026 года в реестре Банка России находилось 25 операторов информационных систем [1;2].

С 1 января 2026 года действует новая система доступа инвесторов к ЦФА. Для неквалифицированных инвесторов расширен доступ к наиболее простым инструментам, тогда как более рискованные продукты имеют дополнительные ограничения [3].

Количественные параметры рынка

Рынок ЦФА демонстрирует быстрый рост. Объем ЦФА в обращении увеличился с 276,2 млрд. рублей в 2024 году до 683,7 млрд. рублей к концу 2025 года. В 2025 году объем размещений составил 1,65 трлн. рублей, а за первое полугодие 2026 года около 2,1 трлн. рублей. Совокупный объем средств, которые привлечены через ЦФА за всю историю рынка, превысил 4,4 трлн. рублей [5;8].

Новые участники и продукты

В 2026 году на рынок вышли крупные корпоративные эмитенты. Например, «Росатом» разместил на платформе «А-Токен» Альфа-Банка дебютный выпуск ЦФА на 5 млрд. рублей в рамках программы объемом 50 млрд. рублей. Выпуск был полностью выкуплен менее чем за сутки, его доходность составила 15% годовых, срок обращения 6 месяцев [9].

Также расширяется предложение ЦФА с фиксированной доходностью, что повышает их привлекательность для частных инвесторов и увеличивает возможности компаний по привлечению финансирования [2;7].

Риски и проблемы рынка

Основным риском остается кредитный риск эмитентов. В 2025 году 11 эмитентов не смогли своевременно погасить 12 выпусков ЦФА общим объемом около 1,4 млрд. рублей. Проблемы преимущественно возникали у компаний без кредитного рейтинга и значительного опыта публичных заимствований [7].

Сохраняется высокая концентрация рынка, так как значительная часть выпусков приходится на несколько крупных операторов. Еще одной проблемой можно выделить ликвидность, поскольку долговые ЦФА пока дополняют, а не заменяют традиционные облигации из-за ограниченных возможностей вторичного обращения и меньшего уровня раскрытия информации [6;7].

Кроме того, число активных пользователей заметно ниже общего числа зарегистрированных. Это показывает, что потенциал массового розничного инвестирования пока раскрыт не полностью. Поэтому важными условиями развития остается оценка финансового состояния эмитентов, прозрачность информации и управление кредитным риском [3;7].

Перспективы развития

Несмотря на различные прогнозы, перспективы рынка оцениваются положительно. Эксперты ожидают дальнейшего роста новых размещений в 2026-2028 годах. Отдельные оценки объема размещений на 2026 год находятся в диапазоне около 1,4-1,5 трлн. рублей [4;7].

Дальнейшему развитию может способствовать расширение обращения цифровых прав на организованных торгах и повышение доступности рынка для инвесторов. При этом необходимо сохранять баланс между стимулированием финансовых инноваций и защитой инвесторов [1;7].

Заключение

Таким образом, к 2026 году ЦФА стали заметным сегментом российского финансового рынка. Совокупный объем привлеченных через них средства превысил 4,4 трлн. рублей, а инфраструктура включает 25 операторов информационных систем. В настоящий момент основная роль ЦФА связана с краткосрочным финансированием бизнеса [1;5].

Вместе с тем рынок сталкивается с кредитным риском, высокой концентрацией и недостаточной ликвидностью. Первые дефолты показали необходимость более тщательной оценки эмитентов, а низкая доля активных пользователей свидетельствует о сохраняющихся ограничениях регулирования, прозрачности информации и развития вторичного обращения [6;7].

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Джумаева Х.М., PhD
доцент кафедры «Педагогика и социальная работа»
Термезский государственный университет
Узбекистан, г. Термез

УЧЕБНЫЙ ДИЗАЙН КАК ФАКТОР ПРОФИЛАКТИКИ ИНФОРМАЦИОННОЙ АДДИКЦИИ СТУДЕНТОВ: МОДЕЛЬ ЦИФРОВОЙ САМОРЕГУЛЯЦИИ

Аннотация. Актуальность обусловлена цифровой фрагментацией учебной среды. Цель — определить элементы дизайна, поддерживающие саморегуляцию. Использованы теоретический анализ и структурное моделирование. Результат — модель цифровой определённости, концентрации, автономии и рефлексии.

Ключевые слова: информационная аддикция, цифровая саморегуляция, учебный дизайн, студенты, цифровая гигиена, вовлечённость.

Djumayeva Kh.M., PhD
associate professor
Department of Pedagogy and Social Work
Termez State University
Uzbekistan, Termez

INSTRUCTIONAL DESIGN AS A FACTOR IN PREVENTING STUDENTS' INFORMATION ADDICTION: A DIGITAL SELF-REGULATION MODEL

Abstract. The study addresses digital fragmentation of the learning environment. The aim is to identify design elements supporting self-regulation. The methods are theoretical analysis and structural modelling. The result is a model of digital clarity, concentration, autonomy, and reflection.

Keywords: information addiction, digital self-regulation, instructional design, students, digital hygiene, engagement.

Введение

Исследования Х. М. Джумаевой развивают линию от вариативных и инвариантных угроз к анализу информационной аддикции и социально-педагогической профилактики [10–15]. Психологические работы об адаптации, защитных реакциях, креативности и вовлечённости позволяют рассматривать цифровое поведение в связи с саморегуляцией и содержательной учебной активностью [1–6]. Народно-педагогические исследования и междисциплинарная трактовка менталитета дополнительно

указывают, что нормы цифрового поведения формируются в конкретном культурном и образовательном контексте [7–9].

Методы и исследования

Использованы сравнительный анализ, понятийное разграничение педагогических и клинических интерпретаций, структурно-функциональное моделирование и анализ организационных факторов цифровой среды. Термин «информационная аддикция» применяется только в педагогическом смысле; медицинская диагностика не является предметом статьи.

Результаты исследования

Предлагаются пять принципов: единый официальный канал, отказ от лишнего дублирования, блоки непрерывной работы, частичная автономия и метарефлексия. В проектном обучении активность на платформе не должна подменять содержательную вовлечённость; оцениваться должны понимание цели, самостоятельность, качество продукта и рефлексия [3; 5; 6].

Граница между проблемным использованием и педагогической категорией риска

В педагогическом исследовании необходимо разграничивать проблемное информационное поведение и клиническую диагностику зависимости. Анализируются наблюдаемые признаки: навязчивые проверки, трудность удержания внимания, информационная фрагментация, откладывание сложной задачи и субъективная перегрузка. Такой подход продолжает исследования информационной аддикции и вариативных угроз, но ограничивает выводы образовательной средой [10–15].



Рисунок 1. Предполагаемый педагогический механизм цифровой фрагментации

Механизм цифровой фрагментации

Механизм цифровой фрагментации связан с организацией самого курса: параллельные каналы, частые уведомления, неопределённые сроки и ожидание постоянной доступности создают внешние триггеры переключения. Поэтому цифровая гигиена должна начинаться с уменьшения структурно избыточных сигналов и повышения предсказуемости учебного маршрута, а не с морального требования к студенту «быть дисциплинированнее».

Вовлечённость вместо цифровой активности

Цифровая активность не тождественна учебной вовлечённости. Большое число входов на платформу, сообщений или быстрых ответов может отражать тревожную проверку среды. Содержательная проектная вовлечённость предполагает понимание цели, принятие роли, инициативу и ответственность [3; 5; 6]. Поэтому цифровые метрики следует интерпретировать вместе с качеством продукта, рефлексией и самостоятельностью решения.



Рисунок 2. Модель цифрово-гигиеничного учебного дизайна

Институциональный уровень профилактики

Профилактически ориентированный дизайн целесообразно закреплять на уровне образовательной программы: унифицировать официальный канал заданий, согласовывать ожидания по времени ответа, уменьшать дублирование сообщений, выделять периоды непрерывной работы и обучать студентов метакогнитивной саморегуляции. В этом случае ответственность распределяется между студентом и средой. Такая логика согласуется с теориями саморегулируемого обучения и когнитивной нагрузки: сложная задача эффективнее решается, когда организационная структура прозрачна и не потребляет лишние когнитивные ресурсы.

Институциональные правила цифровой коммуникации

Профилактически ориентированный учебный дизайн требует согласованных решений не только отдельного преподавателя, но и образовательной организации. Если разные дисциплины используют множество параллельных платформ, несовпадающие правила уведомлений и различные ожидания относительно скорости ответа, студент получает противоречивый информационный режим. Институциональная политика может включать единый основной канал официальных сообщений, типовые сроки обратной связи, разграничение срочной и несрочной коммуникации, рекомендации по цифровым окнам концентрации и общие принципы оформления заданий. Это уменьшает организационно создаваемую неопределённость, не ограничивая необходимую цифровую доступность.

Параметры эмпирической проверки

При последующей апробации важно измерять не экранное время само по себе, а педагогически интерпретируемые показатели: число незапланированных переключений во время учебного блока, субъективную перегрузку уведомлениями, ясность цифрового маршрута курса, длительность сосредоточенной работы и качество выполненного продукта. Сопоставление этих показателей до и после изменения дизайна позволит оценить, какие элементы информационной архитектуры реально связаны с саморегуляцией. Квазиэкспериментальный дизайн должен учитывать исходные различия студентов и не переводить педагогические наблюдения в клинические диагнозы.

Педагогические индикаторы цифровой саморегуляции

Для практической диагностики цифровой саморегуляции необходимо отделять легко измеряемые технические показатели от педагогически значимых. Само по себе экранное время не показывает, был ли студент вовлечён в учебную деятельность: продолжительная работа с цифровым источником может быть продуктивной, тогда как короткие, но частые переключения между сообщениями способны разрушать концентрацию. Поэтому целесообразно фиксировать структуру поведения: число незапланированных переключений в течение учебного блока, частоту проверки уведомлений без учебной необходимости, способность завершить сложную задачу без смены канала, субъективное ощущение перегрузки и ясность понимания следующего шага. Эти индикаторы могут дополняться качеством конечного продукта и рефлексивным самоотчётом.

Важным показателем выступает способность студента самостоятельно регулировать информационный маршрут. На низком уровне он действует реактивно и отвечает на каждый внешний сигнал независимо от его значимости. На среднем уровне способен временно отключать отвлекающие каналы, но нуждается во внешней структуре задания. На более высоком уровне студент заранее планирует периоды концентрации, выбирает необходимые источники, различает срочную и несрочную коммуникацию и оценивает, какие цифровые действия действительно продвигают учебную

задачу. Такая градация позволяет описывать развитие навыка без медицинской терминологии и использовать её в педагогическом наблюдении.

Самооценку целесообразно сочетать с объективируемыми данными, но без избыточного контроля. Краткий дневник цифровых переключений, отметка времени начала и завершения блока работы, анализ истории версий проектного документа или наблюдение преподавателя дают информацию о процессе, не требуя тотального мониторинга устройства. Этическим принципом является минимизация собираемых данных: фиксируется только то, что необходимо для образовательной задачи. Это особенно важно, поскольку профилактика проблемного цифрового поведения не должна сама создавать ситуацию постоянного надзора и повышенной тревожности.

Связь цифровой организации курса с проектной деятельностью

Проектная работа особенно чувствительна к информационной архитектуре, поскольку включает длительный цикл, распределённые роли, совместные документы и множество источников. Если коммуникация не структурирована, группа может поддерживать постоянный поток сообщений, не повышая качество решения. Поэтому проекту полезен единый официальный канал, краткая карта ролей, фиксированные окна синхронизации и правило: сообщение должно либо уточнять задачу, либо фиксировать решение, либо запрашивать необходимую помощь. Такая организация уменьшает информационный шум и делает вклад участников наблюдаемым.

Цифровая определённость не означает жёсткой регламентации каждого действия. Напротив, после установления общего маршрута студентам можно предоставлять выбор инструментов, способов поиска и формы промежуточного продукта. Автономия становится развивающей тогда, когда соединена с ясными критериями результата. Если требования расплывчаты, свобода быстро превращается в неопределённость и увеличивает число проверок и переключений. Поэтому оптимальный дизайн сочетает стабильность основных правил с вариативностью способов решения. Это соответствует логике проектной вовлечённости, где инициатива и ответственность дополняют понимание общей цели [3; 5; 6].

В эмпирической проверке можно сравнить два учебных модуля с одинаковым содержанием, но различной информационной организацией. В одном сохраняется обычная многоканальная коммуникация, в другом вводятся единый маршрут задания, окна обратной связи и рефлексивный контроль переключений. Сравнение следует проводить по нескольким результатам одновременно: ясность цифровой среды, незапланированные переключения, качество продукта, учебная саморегуляция и содержательная вовлечённость. Такой дизайн позволит оценить именно педагогический эффект информационной архитектуры, не сводя исследование к простому учёту времени использования устройств.

Заключение

Профилактика информационной аддикции включает оптимизацию информационной архитектуры курса. Модель задаёт параметры для последующей квазиэкспериментальной проверки.

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Дилшодова М.Д.
магистрант 2-го курса по специальности 70530301 «Геология»
факультет геологии и инженерной геологии
Национальный университет Узбекистана имени Мирзо Улугбека
Узбекистан, г. Ташкент

СТРАТИГРАФИЧЕСКИЙ ПОТЕНЦИАЛ РАННЕАПТСКИХ УСТРИЦ ЮГО-ЗАПАДНЫХ ОТРОГОВ ГИССАРСКОГО ХРЕБТА (ЯККАБАГСКИЕ ГОРЫ, ЛАНГАР)

Аннотация. В статье рассматривается стратиграфическое значение раннеаптских устриц юго-западных отрогов Гиссарского хребта, в частности района Якабагских гор и Лангара. Особое внимание уделяется возможностям использования двустворчатых моллюсков семейства Ostreidae для определения относительного возраста нижнемеловых отложений, сопоставления геологических разрезов и уточнения региональных стратиграфических подразделений. Рассматриваются основные факторы, влияющие на достоверность биостратиграфических интерпретаций, включая таксономическую изменчивость, фациальную приуроченность и условия сохранности ископаемых раковин. На основе опубликованных исследований по аптско-альбским устрицам Гиссарского региона обосновывается необходимость детального изучения раннеаптских комплексов с точной стратиграфической привязкой образцов.

Ключевые слова: ранний апт, нижний мел, устрицы, двустворчатые моллюски, биостратиграфия, Гиссарский хребет, Якабагские горы, Лангар, корреляция разрезов, палеонтология.

Dilshodova M.D.
second-year master's student, specialization 70530301 Geology
Faculty of Geology and Engineering Geology
National University of Uzbekistan named after Mirzo Ulugbek
Uzbekistan, Tashkent

STRATIGRAPHIC POTENTIAL OF EARLY APTIAN OYSTERS IN THE SOUTHWESTERN SPURS OF THE GISSAR RANGE (YAKKABAG MOUNTAINS, LANGAR)

Abstract. This article examines the stratigraphic significance of Early Aptian oysters from the southwestern spurs of the Gissar Range, particularly in the Yakkabag Mountains and the Langar area. Special attention is given to the potential use of bivalve mollusks of the family Ostreidae for determining the relative age of Lower Cretaceous deposits, correlating geological sections, and refining regional stratigraphic subdivisions. The main factors affecting the reliability of biostratigraphic interpretations are discussed, including taxonomic variability,

facies dependence, and the preservation conditions of fossil shells. Based on published studies of Aptian–Albian oysters from the Gissar region, the article highlights the need for detailed investigation of Early Aptian assemblages with precise stratigraphic documentation of specimens.

Keywords: Early Aptian, Lower Cretaceous, oysters, bivalve mollusks, biostratigraphy, Gissar Range, Yakkabag Mountains, Langar, stratigraphic correlation, paleontology.

Введение

Меловые отложения Центральной Азии представляют значительный интерес для региональной стратиграфии и палеонтологии. Их изучение позволяет реконструировать историю развития морских бассейнов, установить последовательность геологических событий и уточнить возраст осадочных толщ. Одной из важных групп ископаемых организмов, используемых при исследовании нижнемеловых отложений, являются устрицы — двустворчатые моллюски, обладающие прочными известковыми раковинами и широким спектром морфологических адаптаций.

Юго-западные отроги Гиссарского хребта характеризуются разнообразием нижнемеловых отложений и богатым палеонтологическим материалом. Исследования меловых двустворчатых моллюсков данного региона проводились ранее, в том числе Х. Х. Миркамаловым и Е. Г. Винокуровой. В современных работах Е. К. Метелкина и И. Н. Косенко пересматриваются систематический состав и стратиграфическое распространение аптско-альбских устриц Гиссарского региона, что способствует уточнению их значения для региональной стратиграфии [1–3]

Раннеаптские комплексы представляют особый интерес, поскольку их изучение позволяет уточнить нижнюю часть аптского интервала и оценить возможности применения отдельных таксонов для сопоставления разрезов. При этом стратиграфическое значение устриц должно рассматриваться с учетом их экологических особенностей и геологического положения вмещающих пород.

Цель настоящей статьи — охарактеризовать стратиграфический потенциал раннеаптских устриц юго-западных отрогов Гиссарского хребта и определить основные направления их использования при расчленении и корреляции нижнемеловых отложений Якабагских гор и района Лангара.

Материалы и методы исследования

Теоретической основой исследования послужили опубликованные работы по систематике, стратиграфии и палеобиогеографии меловых устриц Центральной Азии, а также исследования аптско-альбских комплексов юго-западных отрогов Гиссарского хребта. Особое значение имеют публикации, посвященные пересмотру рода Amphidonte и других групп устриц, встречающихся в аптских и альбских отложениях региона [1, 2].

Для оценки стратиграфического потенциала раннеаптских устриц применимы следующие методы: сравнительно-морфологический анализ

раковин, таксономическая идентификация, изучение вертикального распространения видов, сопоставление палеонтологических комплексов и анализ литологических характеристик вмещающих пород.

При исследовании конкретных разрезов необходимо фиксировать положение каждого образца относительно литологических границ, мощность и состав слоев, характер залегания раковин, степень их сохранности и наличие других ископаемых организмов. Подобный подход позволяет отделить собственно стратиграфические закономерности от изменений, обусловленных условиями осадконакопления.

Следует подчеркнуть, что настоящая работа основана на анализе опубликованных исследований и не представляет результатов самостоятельного изучения новой коллекции образцов из Якабагских гор и Лангара. Поэтому конкретные видовые определения и локальные стратиграфические границы требуют подтверждения материалами соответствующих геологических разрезов.

Основные результаты и обсуждение

Устрицы обладают рядом признаков, которые делают их важным объектом биостратиграфических исследований. К ним относятся сравнительно высокая вероятность сохранения раковин, разнообразие морфологических форм и возможность установления закономерностей вертикального распространения отдельных видов. При наличии надежных таксономических определений эти признаки позволяют использовать комплексы устриц для уточнения возраста осадочных толщ.

Вместе с тем присутствие устриц само по себе не обеспечивает точного определения геологического возраста. Многие представители группы были приспособлены к определенным условиям среды и могли существовать в течение значительных временных интервалов. Поэтому наиболее надежные результаты достигаются при изучении комплексов нескольких таксонов и их сопоставлении с другими группами ископаемых, прежде всего аммонитами, имеющими самостоятельное значение для расчленения меловых отложений.

Исследования аптско-альбских устриц юго-западных отрогов Гиссарского хребта показывают, что ревизия систематического состава имеет непосредственное значение для уточнения стратиграфического распространения отдельных видов. Например, в работе Е. К. Метелкина и И. Н. Косенко, посвященной роду Amphidonte, рассмотрены представители этого рода из аптских и альбских отложений региона [1]. Полученные авторами результаты подтверждают необходимость точного определения таксонов при использовании устриц в стратиграфических построениях.

Для раннеаптских комплексов Якабагских гор и Лангара особое значение имеет установление нижних и верхних границ распространения каждого определенного вида. Если вид надежно идентифицирован и его положение в разрезе документировано, сведения о его распространении могут использоваться для сопоставления отдельных участков разреза. Однако

границы распространения должны устанавливаться по фактическому материалу, а не переноситься автоматически из других районов.

Одной из основных проблем при изучении ископаемых устриц является значительная изменчивость формы раковин. На их внешний облик влияют условия прикрепления к субстрату, характер грунта, гидродинамический режим, плотность поселения и особенности индивидуального развития. В результате представители одного вида могут различаться по степени выпуклости, очертаниям створок, выраженности ребер и характеру роста.

Дополнительные трудности возникают при деформации раковин в процессе диагенеза и последующих тектонических преобразований. Сдавливание, разрушение краев створок и минеральное замещение могут затруднять определение диагностических признаков. В связи с этим таксономическая идентификация должна основываться на совокупности морфологических характеристик и сравнении с описаниями типового материала.

Для повышения достоверности определений целесообразно изучать серии экземпляров, а не отдельные раковины. Необходимо учитывать индивидуальную изменчивость и возможные различия между молодыми и взрослыми особями. Подобная процедура позволяет уменьшить риск необоснованного выделения новых видов и ошибочного расширения стратиграфических диапазонов уже известных таксонов.

Ревизия ранее опубликованных определений также имеет большое значение. Если первоначально установленный видовой состав изменяется после повторного изучения коллекции, это может повлиять на интерпретацию возраста содержащих его слоев. Следовательно, систематическое исследование устриц должно предшествовать окончательным выводам об их биостратиграфическом значении.

Возможности корреляции разрезов Якабагских гор и Лангара

Сопоставление геологических разрезов является одной из основных задач региональной стратиграфии. Для ее решения необходимо установить, какие слои имеют сопоставимый возраст и как изменяются их литологические и палеонтологические характеристики в пространстве.

Раннеаптские устрицы могут использоваться в качестве одного из элементов такой корреляции. Наиболее перспективным является сопоставление комплексов, содержащих одинаковые диагностические виды, при условии надежного определения их возраста и точной фиксации стратиграфического положения. Дополнительную доказательность обеспечивают совпадения последовательности появления и исчезновения таксонов, а также согласованность полученных результатов с литологическими данными и распространением других ископаемых организмов.

При этом необходимо учитывать возможность фациальных различий между отдельными участками. Изменения глубины бассейна, солености, характера субстрата и гидродинамических условий могли приводить к смене

комплексов устриц даже в отложениях близкого возраста. Поэтому отсутствие определенного вида в одном разрезе не обязательно свидетельствует о перерыве в осадконакоплении или различии возраста.

Для Якабагских гор и Лангара целесообразно составить сопоставительные колонки, в которых будут отражены литологический состав пород, положение находок, видовой состав устриц и присутствие других групп фауны. При наличии аммонитов и других стратиграфически значимых организмов их данные следует использовать для независимой проверки возрастных интерпретаций.

Подобная методика позволит оценить, насколько устойчиво раннеаптские комплексы прослеживаются в пределах исследуемой территории, а также выявить участки, где стратиграфические выводы ограничены неполнотой палеонтологического материала.

Устрицы являются не только источником стратиграфической информации, но и показателями условий существования древних морских сообществ. Особенности их прикрепления, форма раковин и характер скоплений могут отражать условия субстрата и особенности среды осадконакопления. Массовые скопления раковин способны указывать на благоприятные условия существования организмов, однако их происхождение необходимо оценивать с учетом седиментологических признаков.

При интерпретации таких скоплений важно различать раковины, сохранившиеся непосредственно в месте обитания, и остатки, перемещенные течениями. Переотложение ископаемого материала способно привести к появлению в одном слое раковин разного возраста. В подобных случаях определение возраста слоя только по устрицам может дать ошибочный результат.

Для исключения подобных ошибок необходимо исследовать степень сохранности раковин, наличие следов истирания, фрагментации и сортировки, а также взаимное расположение створок. Совместное изучение палеонтологических и литологических признаков позволяет более обоснованно интерпретировать условия формирования отложений.

Таким образом, стратиграфический потенциал раннеаптских устриц реализуется наиболее полно при комплексном подходе, объединяющем систематику, палеоэкологию, седиментологию и сопоставление независимых биостратиграфических данных.

Заключение

Раннеаптские устрицы юго-западных отрогов Гиссарского хребта представляют перспективный объект для уточнения стратиграфии нижнемеловых отложений. Их изучение позволяет расширить сведения о распространении двустворчатых моллюсков в раннемеловых морских бассейнах Центральной Азии и определить возможности использования отдельных таксонов при сопоставлении геологических разрезов.

Основными условиями надежного применения устриц в биостратиграфии являются точная систематическая идентификация,

документирование положения находок, учет морфологической изменчивости и анализ возможного переотложения раковин. Не менее важным является сопоставление палеонтологических данных с литологическими характеристиками пород и сведениями о распространении других ископаемых организмов.

Для районов Якабагских гор и Лангара перспективным направлением дальнейших исследований является детальное описание разрезов, формирование коллекций с точной стратиграфической привязкой и построение сопоставительных таблиц вертикального распространения видов. Это позволит оценить реальную корреляционную ценность раннеаптских комплексов и уточнить их роль в региональной стратиграфической схеме.

Следовательно, раннеаптские устрицы следует рассматривать не как самостоятельный и универсальный инструмент определения возраста, а как важный компонент комплексных биостратиграфических исследований. Такой подход обеспечивает более высокую надежность стратиграфических выводов и создает основу для дальнейшего изучения нижнемеловых отложений юго-западных отрогов Гиссарского хребта.

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Дилшодова Д.М.
Маркаев Б.У.
Стратиграфическая партия, ЦГСЭ «Регионал»
Сатторова С.О.
сотрудник
Государственный музей геологии

СТРАТИГРАФИЧЕСКИЙ ПОТЕНЦИАЛ РАННЕАПТСКИХ УСТРИЦ ЮГО-ЗАПАДНЫХ ОТРОГОВ ГИССАРСКОГО ХРЕБТА (ЯККАБАГСКИЕ ГОРЫ, ЛАНГАР)

Аннотация. В данной статье освещается стратиграфическое значение нижнемеловых отложений Лангара юго-западной части Гиссарского хребта. В исследовании охарактеризованы литологические и фаунистические особенности нижнеаптских отложений, их стратиграфическое положение в составе кундалянгтауской свиты. Проанализировано присутствие представителей класса Bivalvia, таких как Ceratostreon vinokurovae Mirkamalov, Gyrostrea pennata Mirkamalov, Exogyra tortilla Vinok, Gyrostrea sagita Mirkamalov, Ostrea eos Coquand и Exogyra tuberculifera Koch et Dunk., распространённых в Лангар. Обоснованы возможности использования остатков моллюсков для детального стратиграфического расчленения нижнемеловых отложений Лангара и юго-западной части Гиссарского хребта, а также для корреляции естественных обнажений.

Ключевые слова: нижний мел, ранний апт, кундалянгтауская свита, устрицы, Ceratostreon vinokurovae, Exogyra tuberculifera, аммониты, стратиграфическое расчленение, корреляция разрезов, Гиссарский хребет, Лангар.

Dilshodova D.M.
Markayev B.U.
Stratigraphic Party, Central Geological Survey Expedition “Regional”
Sattorova S.O.
staff member
State Museum of Geology

STRATIGRAPHIC POTENTIAL OF EARLY APTIAN OYSTERS OF THE SOUTHWESTERN SPURS OF THE HISSAR RANGE (YAKKABAG MOUNTAINS, LANGAR)

Abstract. This article examines the stratigraphic significance of Lower Cretaceous deposits in the Langar area of the southwestern part of the Hissar Range. The study characterizes the lithological and faunal features of the Lower Aptian deposits and their stratigraphic position within the Kundalyangtau

Formation. The occurrence of representatives of the class Bivalvia, including Ceratostreon vinokurovae Mirkamalov, Gyrostrea pennata Mirkamalov, Exogyra tortilla Vinok, Gyrostrea sagita Mirkamalov, Ostrea eos Coquand, and Exogyra tuberculifera Koch et Dunk., which are widespread in the Langar area, is analyzed. The study substantiates the potential use of mollusk remains for the detailed stratigraphic subdivision of Lower Cretaceous deposits in Langar and the southwestern part of the Hissar Range, as well as for the correlation of natural outcrops.

Keywords: Lower Cretaceous, Early Aptian, Kundalyangtau Formation, oysters, Ceratostreon vinokurovae, Exogyra tuberculifera, ammonites, stratigraphic subdivision, stratigraphic correlation, Hissar Range, Langar.

ВВЕДЕНИЕ

Нижнемеловые отложения юго-западных отрогов Гиссарского хребта представляют значительный интерес для детального стратиграфического расчленения и корреляции отдельных разрезов. Особое значение в этом отношении имеют нижнеаптские образования, которые в разрезе юго-западных отрогов Гиссарского хребта (Лангар) четко выделяются по своим литологическим и фаунистическим особенностям и представлены в объеме кундалянгтауской свиты.

Изучение литологических особенностей кундалянгтауской свиты в сочетании с анализом содержащихся в ней фаунистических остатков позволяет более детально охарактеризовать стратиграфическое положение нижнеаптских отложений. Особый интерес представляют устрицы, широко встречающиеся в известняках-ракушняках и представленные различными видами, часть которых имеет распространение на определенном стратиграфическом уровне Афгано-Таджикской впадины.

В разрезе нижнемеловых отложений юго-западных отрогов Гиссарского хребта (Лангар) (рис.1.) нижнеаптские образования четко выделяются по своим литологическим и фаунистическим особенностям, в объеме кундалянгтауской свиты.

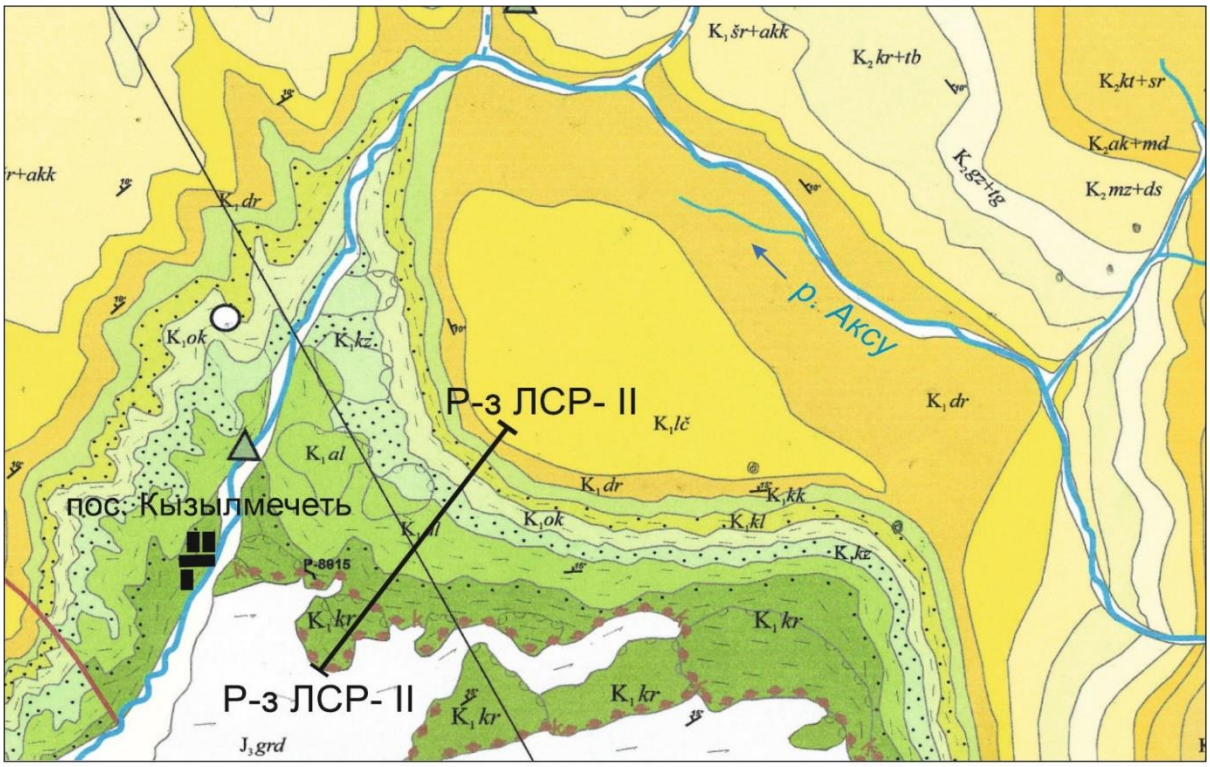


Рис-1. Выкопировка из геологической карты масштаба 1:50000 (Д.Р. Расулов, Л.А. Мориц и др., 1973ф)

Свита впервые выделена Х.Х.Миркамаловым в 1971 г [3, 278.].

АНАЛИЗ ЛИТЕРАТУРЫ И МЕТОДОЛОГИЯ

В стратотипе свита согласно залегает на лагунно-пестроцветных отложениях мачайской свиты. В стратотипе свита сложена снизу вверх: мергелями темно-серыми с зеленоватым оттенком, плотными с прослоями глин мергелистых темно-серых и известняков-ракушняков с устрицами *Lopha* ex gr. *eos* Coq., *L. multicostata* Mirk., *Exogyra trigonalis* Mirk., *Ceratostreon vinokurovae* Mirk. и др. Вверху - глины темно-серые с зеленоватым оттенком с прослоями песчаников и известняков серых. Мощность 73,4 м [2, 62-63].

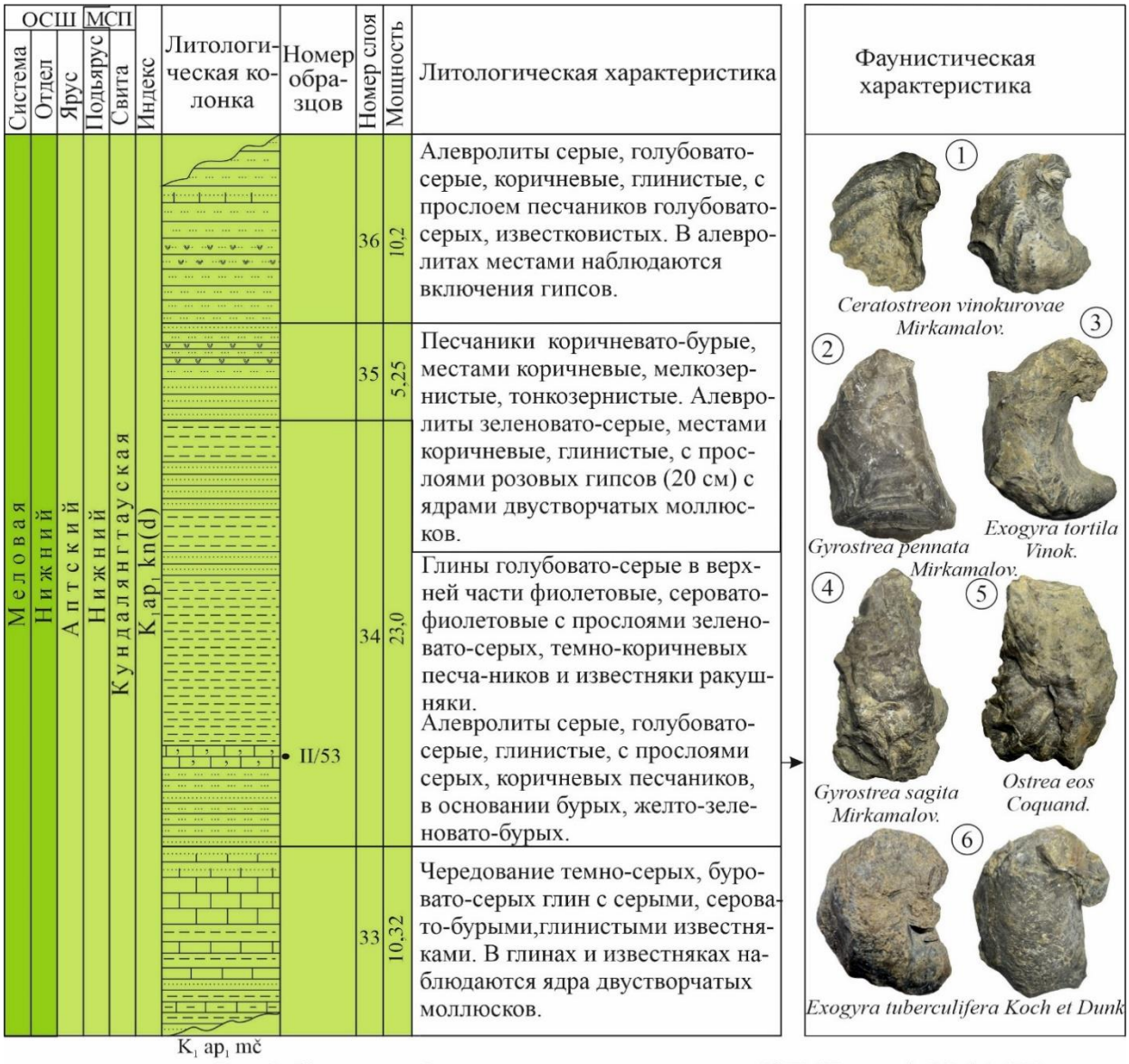


Рис-2. Стратиграфическая колонка к разрезу №II (Лангар). М-б 1:300 (Устрицы (1-6) отобраны из уровне II/53)

В разрезе II, составленном в районе Камашы, кишлака Кызылмечеть (Лангар) наблюдается несколько иное литологическое строение свиты. На этом участке свиту слагают в нижней части глины темно-серые, голубовато-серые, алевролиты серые, голубовато-серые с прослоями известняков, песчаников и известняков-ракушняков (обр.II/53), содержащих многочисленные створки устриц: *Ceratostreon vinokurovae* Mirkamalov, *Gyrostrea pennata* Mirkamalov, *Exogyra tortilla* Vinok, *Gyrostrea sagita* Mirkamalov, *Ostrea eos* Coquand, *Exogyra tuberculifera* Koch et Dunk. (рис.2).

Верхняя часть свиты сложена песчаниками коричневыми, коричневато-бурыми мелкозернистыми; алевролитами серыми, голубовато-серыми, коричневыми с прослоями голубовато-серых песчаников. Мощность 48,8 м. Характерной особенностью свиты является массовое захоронение в известняках-ракушняках мелких размеров устриц, которые сцементированы

глинистым цементом. Порода легко разрушается, образуя на склонах россыпи, протягивающиеся на значительные расстояния, что способствует корреляции естественных обнажений при геологической съемке.

ОБСУЖДЕНИЕ И РЕЗУЛЬТАТЫ

Изучение устричной фауны кундалянгтауской свиты в районе Лангара показало, что в исследованных отложениях присутствуют несколько видов двустворчатых моллюсков, в том числе *Ceratostreon vinokurovae* Mirkamalov, *Gyrostrea pennata* Mirkamalov, *Exogyra tortilla* Vinok, *Gyrostrea sagita* Mirkamalov, *Ostrea eos* Coquand и *Exogyra tuberculifera* Koch et Dunker.

Особое значение имеет *Ceratostreon vinokurovae*, многочисленные находки которого известны также в других разрезах юго-западных отрогов Гиссарского хребта, включая Кундалянгтау, Кампгрекское ущелье и Кансай. В литературе этот вид отмечен совместно с раннеаптскими аммонитами *Deshayesites orientalis* Bogdanova и *Deshayesites* sp. (ex gr. *euglyphus* Casey) [1, с. 50–60]. Такое сочетание ископаемых организмов представляет интерес для уточнения стратиграфического положения вмещающих отложений. В отличие от видов, распространение которых может быть ограничено определёнными стратиграфическими интервалами, *Exogyra tuberculifera* характеризуется более широким диапазоном геологического распространения согласно приведённым литературным данным. Поэтому использование данного вида для установления конкретного возраста отложений требует сопоставления с другими палеонтологическими свидетельствами.

Время существования и географическое распространение.

Валанжинский-готеривский век, Мангышлак; валанжинский - барремский век, Западная Туркмения, Северный Кавказ, Дагестан; валанжинский - аптский век, Швейцария, Франция, Северная ГДР и ФРГ, барремский и аптский века, Южная Англия. Юго-западные отроги Гиссарского хребта, кишлаки Уря-Дарья, Окузбулак, Тобе-Гатан, Тойчисай, Сайроб; верхний баррем (нижняя окузбулакская подсвита).

Местонахождение: Юго-западные отроги Гиссарского хребта, Нижний апт, кундалянгтауская свита.

Таким образом, *Exogyra tuberculifera* входит в состав устричной фауны, установленной в рассматриваемом районе. При этом приведённые литературные данные свидетельствуют о более широком стратиграфическом диапазоне данного вида. Поэтому его значение для определения конкретного раннеаптского уровня целесообразно рассматривать в совокупности с другими представителями устричной фауны и, прежде всего, с аммонитами.

В целом фаунистический комплекс кундалянгтауской свиты представляет интерес для стратиграфического расчленения нижнемеловых отложений. Наиболее перспективным в этом отношении является *Ceratostreon vinokurovae*, поскольку его находки отмечены в нескольких разрезах юго-западных отрогов Гиссарского хребта и связаны с комплексом раннеаптских аммонитов. Совместное нахождение устричных раковин и аммонитов позволяет использовать данные комплексы как дополнительный

критерий при установлении стратиграфического положения отложений и их корреляции

ЗАКЛЮЧЕНИЕ

В результате изучения устричной фауны нижнемеловых отложений района Лангара установлено, что кундалянгтауская свита содержит разнообразный комплекс двустворчатых моллюсков, представленный несколькими родами и видами устриц. Их находки дополняют литологическую характеристику разрезов и могут использоваться при сопоставлении отдельных обнажений юго-западных отрогов Гиссарского хребта.

Наибольший интерес для биостратиграфических исследований представляет *Ceratostreon vinokurovae*, отмеченный в нескольких разрезах региона. Его совместное нахождение с раннеаптскими аммонитами, в частности с *Deshayesites orientalis* Bogdanova и *Deshayesites* sp. (ex gr. *euglyphus* Casey), служит дополнительным основанием для уточнения стратиграфического положения соответствующих отложений.

Установленный в литературе широкий стратиграфический диапазон *Exogyra tuberculifera* не позволяет рассматривать этот вид как самостоятельный надёжный показатель конкретного раннеаптского уровня. Его стратиграфическое значение следует оценивать в составе комплекса ископаемой фауны

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Ермекбаев М.А., к.п.н.
профессор
Южно-Казахстанский университет имени М. Ауэзова
Казахстан, г. Шымкент
Чай З.С.
доцент кафедры «Высшая математика»
Ташкентский университет информационных технологий имени Мухаммада аль-Хорезми
Ахмедов Б.А., PhD
и. о. доцента
Чирчикский государственный педагогический университет

МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ ЭКОНОМИЧЕСКИХ ПРОЦЕССОВ В УСЛОВИЯХ НЕОПРЕДЕЛЁННОСТИ

Аннотация. В статье рассматриваются теоретические основы и методические подходы к математическому моделированию экономических процессов в условиях неопределённости. Цель работы заключается в систематизации способов представления неопределённости и формировании последовательности выбора, построения и проверки моделей, ориентированной на математическую подготовку студентов технических вузов. Исследование имеет теоретико-методический характер и не предполагает эмпирического подтверждения преимуществ отдельных подходов. Рассматриваются вероятностные модели, сценарный анализ, стохастическая и робастная оптимизация, а также методы нечётких множеств. Разграничиваются ситуации, в которых возможно оценивание вероятностных распределений, и случаи, когда доступная информация позволяет задать только сценарии, интервалы или качественные экспертные характеристики. Предлагаемая последовательность моделирования включает постановку экономической задачи, определение источников неопределённости, формализацию переменных и ограничений, выбор критерия решения, анализ чувствительности и проверку устойчивости результатов. Применительно к экономическим задачам Узбекистана учитываются доступность и сопоставимость данных, возможные структурные изменения и ограничения переноса моделей между различными условиями. Результатом работы является концептуальная схема согласования математического аппарата с характером информации и целями принятия решений. Практическая значимость заключается в организации воспроизводимого анализа, выявлении границ применимости моделей и содержательной интерпретации альтернативных решений.

Ключевые слова: Математическое моделирование, экономические процессы, неопределённость, вероятностные модели, сценарный анализ,

стохастическая оптимизация, робастная оптимизация, нечёткие множества, анализ чувствительности, устойчивость решений.

Yermekbayev M.A., candidate of pedagogical sciences
professor
M. Auezov South Kazakhstan University
Kazakhstan, Shymkent
Chay Z.S.
associate professor
Department of Higher Mathematics
Muhammad al-Khwarizmi Tashkent University
of Information Technologies
Akhmedov B.A., PhD
acting associate professor
Chirchik State Pedagogical University

MATHEMATICAL MODELING OF ECONOMIC PROCESSES UNDER UNCERTAINTY

Abstract. This article examines the theoretical foundations and methodological approaches to mathematical modeling of economic processes under uncertainty. Its purpose is to systematize methods for representing uncertainty and establish a sequence for selecting, constructing, and validating models, intended to support mathematics education for students at technical universities. The study is theoretical and methodological in nature and does not provide empirical confirmation of the advantages of individual approaches. It considers probabilistic models, scenario analysis, stochastic and robust optimization, and fuzzy set methods. A distinction is drawn between situations in which probability distributions can be estimated and cases in which the available information supports only scenarios, intervals, or qualitative expert assessments. The proposed modeling sequence includes formulating the economic problem, identifying sources of uncertainty, formalizing variables and constraints, selecting a decision criterion, conducting sensitivity analysis, and assessing the robustness of results. In relation to economic problems in Uzbekistan, the study considers data availability and comparability, potential structural changes, and limitations on transferring models between different conditions. The outcome is a conceptual framework for aligning mathematical methods with the nature of available information and decision-making objectives. Its practical significance lies in organizing reproducible analysis, identifying the limits of model applicability, and providing substantive interpretations of alternative decisions.

Keywords: Mathematical modeling, economic processes, uncertainty, probabilistic models, scenario analysis, stochastic optimization, robust optimization, fuzzy sets, sensitivity analysis, decision robustness.

ВВЕДЕНИЕ

Математическое моделирование экономических процессов позволяет формализовать взаимосвязи между ресурсами, решениями и результатами хозяйственной деятельности. Его применение становится особенно значимым, когда будущие условия функционирования системы известны лишь частично. Изменения спроса, цен, производственных затрат и доступности финансирования затрудняют однозначное определение параметров модели. В таких обстоятельствах исследователь должен не только описать экономический механизм, но и обосновать способ представления неопределённости. Для студентов технических вузов эта задача объединяет знания математического анализа, теории вероятностей, статистики и оптимизации. Она также требует понимания того, что вычислительная точность решения не устраняет ограничений исходных предпосылок и не обеспечивает достоверности экономической интерпретации без дополнительной проверки соответствия модели изучаемому процессу и целям принимаемого решения.

Неопределённость имеет различные источники, которые необходимо разграничивать до выбора математического аппарата. Часть изменений обусловлена случайной вариацией наблюдаемых величин и может описываться вероятностными распределениями при наличии достаточной информации. Другие затруднения связаны с недостатком данных, ошибками измерения, неизвестными параметрами или неполнотой представлений о структуре процесса. Дополнительную сложность создают изменения экономических механизмов, вследствие которых закономерности прошлого перестают сохраняться. Поэтому неопределённость нельзя автоматически сводить к случайной ошибке. Способ её формализации должен отражать содержание имеющихся сведений. Необоснованное назначение вероятностей способно создавать видимость количественной определённости там, где фактически доступны только интервальные оценки, альтернативные сценарии либо экспертные суждения, требующие самостоятельного анализа согласованности, обоснованности и возможных ограничений их практического использования.

Различные подходы к моделированию предлагают неодинаковые способы работы с указанными ситуациями. Вероятностные модели описывают распределения возможных исходов, а стохастическая оптимизация связывает выбор решений с характеристиками этих распределений. Сценарный анализ позволяет исследовать последствия нескольких согласованных вариантов изменения внешних условий. Робастная оптимизация ориентируется на допустимое множество значений неопределённых параметров и выбранное требование защищённости решения. Методы нечётких множеств применяются для формализации расплывчатых понятий и оценок, когда принадлежность определённой категории выражается степенью. Перечисленные инструменты не являются взаимозаменяемыми: каждый предполагает собственную интерпретацию

информации, критериев и ограничений. Их сопоставление требует оценки содержательной уместности, вычислительной реализуемости и чувствительности результатов к принятым допущениям в конкретной исследовательской или учебной экономической задаче.

Для экономических задач Узбекистана выбор модели должен учитывать особенности рассматриваемой отрасли, временного горизонта и доступного информационного массива. При анализе производства, инвестиций или распределения ресурсов необходимо проверять сопоставимость показателей, различать номинальные и реальные величины, учитывать возможные изменения определений и условий наблюдения. При этом региональная направленность исследования сама по себе не определяет предпочтительный метод. Его выбор зависит от характера неопределённости и назначения решения. В образовательной практике технического вуза подобные задачи позволяют показать связь абстрактных математических конструкций с ограничениями реального анализа. Особое значение приобретает объяснение того, какие сведения использованы, какие предположения приняты и насколько выводы сохраняются при их изменении в пределах содержательно допустимых исследователем условий.

Цель настоящей статьи заключается в систематизации подходов к математическому моделированию экономических процессов при неполной определённости параметров и разработке последовательности их обоснованного применения. Рассмотрение охватывает постановку задачи, выявление источников неопределённости, формализацию переменных, выбор критерия, построение ограничений и проверку устойчивости решений. Отдельное внимание уделяется разграничению прогноза, сценарного расчёта и оптимизационной рекомендации. Работа имеет теоретико-методический характер и предлагает концептуальную основу учебного исследования. Она не устанавливает превосходство отдельных методов и не содержит эмпирически подтверждённых оценок эффективности. Проверка предложенной последовательности предполагает последующее применение к конкретным данным, сопоставление альтернативных спецификаций и документирование ограничений, влияющих на интерпретацию получаемых результатов и возможность их использования при подготовке экономически обоснованных управленческих решений.

МЕТОДЫ

Исследование основано на теоретико-методической систематизации подходов к представлению неопределённости в экономических моделях. Сопоставление проводится по характеру исходной информации, способу задания неизвестных величин, критерию выбора решения и требованиям к проверке результатов. Рассматриваются вероятностное моделирование, сценарный анализ, стохастическая и робастная оптимизация, методы нечётких множеств. Эмпирическая выборка не формируется, численные эксперименты не выполняются. Поэтому методика определяет последовательность последующего исследования, а не процедуру подтверждения заранее

установленного преимущества конкретного инструмента. Единицей рассмотрения является экономическая задача с заданными управляемыми переменными, внешними условиями, ограничениями и показателями результата. Такое представление позволяет отделить математическую структуру задачи от дополнительных предположений, необходимых для описания неизвестных параметров и обоснования допустимости получаемых рекомендаций на практике.

Первый этап включает определение цели моделирования, временного горизонта и состава решений, доступных исследуемому субъекту. Устанавливаются показатели результата, ресурсные ограничения и момент получения информации. Отдельно выделяются величины, выбираемые до раскрытия неопределённости, и действия, которые допускается корректировать позднее. Затем составляется описание источников неопределённости: случайных колебаний, ошибок измерения, неизвестных параметров и возможных изменений структуры процесса. Для каждого источника фиксируются доступные наблюдения и основания экспертных оценок. При использовании экономических данных Узбекистана проверяются методология расчёта показателей, периодичность, территориальный охват и ценовая сопоставимость. Неполнота информации отражается явно, без замены отсутствующих сведений произвольно выбранными распределениями. Все допущения документируются, чтобы дальнейшие расчёты можно было воспроизвести и независимо проверить содержательную обоснованность.

Второй этап предусматривает выбор формы представления неопределённости. При достаточных данных исследуется возможность оценивания вероятностных распределений с учётом зависимости между переменными. Сценарии формируются как внутренне согласованные сочетания условий; вероятности назначаются только при наличии обоснования. Для интервального описания задаются границы параметров и допустимые совместные изменения. В робастной постановке определяется множество неопределённости, относительно которого проверяется выполнение ограничений. При использовании нечётких величин устанавливаются функции принадлежности и объясняется содержательный смысл их формы. Степени принадлежности не интерпретируются как вероятности событий. Выбранная формализация должна соответствовать качеству сведений и не создавать необоснованной детализации. Альтернативные представления сохраняются для последующей проверки чувствительности решений к способу описания неизвестных условий изучаемого экономического процесса.

Третий этап связан с построением целевой функции и системы ограничений. Критерий определяется назначением задачи: максимизацией ожидаемого результата, ограничением неблагоприятных исходов либо обеспечением приемлемого результата при допустимых условиях. При вероятностных ограничениях отдельно задаётся требуемый уровень

надёжности. В многоэтапных моделях вводится условие неупреждаемости, исключающее использование будущей информации при выборе текущих действий. Сценарные расчёты выполняются при сопоставимых правилах принятия решений. Робастные решения оцениваются вместе с возможными потерями эффективности вследствие выбранной защищённости. Для нечётких постановок документируется процедура перехода к вычислимой задаче. Способ решения выбирается согласно размерности, линейности и доступным вычислительным ресурсам. Проверяются допустимость найденного решения, выполнение ограничений и точность численного алгоритма в пределах установленного вычислительного допуска.

Заключительный этап включает анализ чувствительности, проверку устойчивости и интерпретацию результатов. Последовательно изменяются параметры, границы интервалов, сценарные предпосылки и характеристики распределений. Исследуется влияние этих изменений на целевую функцию, выбранные действия и выполнение ограничений. Вероятностные модели при наличии данных проверяются на наблюдениях, не использованных при оценивании. Для сценарных и робастных постановок анализируются дополнительные условия за пределами основного набора расчётов, без утверждения абсолютной защищённости. Сопоставляются исходная детерминированная модель и варианты учёта неопределённости. В учебной работе сохраняются данные, допущения, настройки и последовательность вычислений. Итоговый отчёт разграничивает вычисленный результат, условную рекомендацию и ограничения применимости модели. Выводы формулируются относительно заданной информации, выбранного критерия и рассмотренного множества возможных условий.

РЕЗУЛЬТАТЫ

Результатом теоретико-методического исследования стала концептуальная схема согласования экономической задачи, доступной информации и математического способа представления неопределённости. В её основе находится последовательное разграничение управляемых переменных, внешних параметров, ограничений и критериев оценки. Схема показывает, какие предпосылки необходимо сформулировать до вычислений и какие проверки требуются после получения решения. Полученные результаты представлены методическими положениями, а не численными оценками. Исследование не содержит экспериментального сравнения моделей и не устанавливает их фактическую эффективность. Предложенная организация предназначена для последующего применения к определённым экономическим задачам с документированием информационных оснований, вычислительных процедур и границ интерпретации. Тем самым сформирована структура анализа, позволяющая проследить связь между исходными допущениями и содержанием каждой получаемой условной рекомендации.

Первым содержательным результатом является классификация ситуаций выбора математического аппарата по характеру сведений о

неизвестных величинах. Вероятностные модели соотнесены с задачами, где распределения могут быть содержательно обоснованы и оценены. Сценарное представление соотнесено с анализом согласованных вариантов изменения условий, которым необязательно приписывать вероятности. Интервальные и робастные постановки связаны с заданием допустимых значений параметров и требований к выполнению ограничений. Нечёткие модели выделены как способ формализации расплывчатых характеристик, выражаемых функциями принадлежности. Такая классификация предотвращает смешение различных смыслов неопределённости.

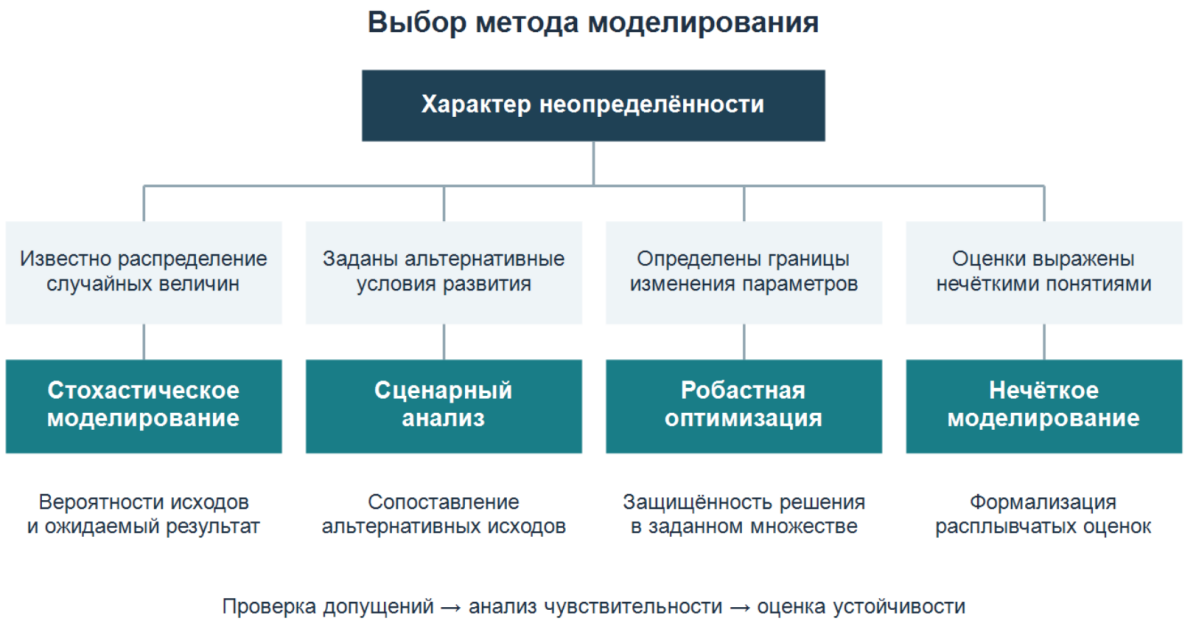


Рис. 1 Выбор метода математического моделирования в зависимости от характера неопределённости

Она также позволяет обозначить случаи, когда имеющихся данных недостаточно для выбранной формализации и требуется пересмотр постановки задачи либо дополнительный сбор информации перед переходом к расчётам и интерпретации результатов.

Вторым результатом стало включение информационной последовательности решений в структуру модели. Разграничены действия, принимаемые до получения дополнительных сведений, и корректировки, доступные после их поступления. Это различие позволяет определить допустимую зависимость управляемых переменных от наблюдаемых условий. Для многоэтапных задач сформулировано требование неупреждаемости: текущие действия не должны опираться на информацию, которая появится позднее. В результате сценарный расчёт с заранее известным исходом отделён от практически реализуемой стратегии. Предложенная структура делает возможным обсуждение ценности дополнительной информации, хотя её количественная оценка требует конкретной модели. В учебном применении соответствующее разграничение служит основанием для проверки того,

действительно ли предложенное решение может быть реализовано при установленном порядке раскрытия неопределённых внешних условий.

Третьим результатом является система критериев проверки, объединяющая допустимость, качество и устойчивость решения. Допустимость связывается с выполнением ограничений при принятых предпосылках. Качество определяется выбранной целевой функцией, а устойчивость исследуется посредством изменения исходных условий. Отдельно предусмотрено сопоставление защищённости решения и возможных потерь эффективности. Для вероятностных постановок выделена необходимость проверки распределительных предположений и результатов на независимых наблюдениях при их наличии. Для сценарных моделей предусмотрен анализ дополнительных сочетаний параметров. Такая организация позволяет обнаруживать зависимость рекомендации от отдельных допущений. Однако успешное прохождение указанных проверок не рассматривается как гарантия результата при любых будущих обстоятельствах, поскольку область проверки ограничена доступной информацией и выбранным описанием исследуемого экономического процесса в модели.

Четвёртым результатом стала организация предложенной схемы в форме проверяемых учебных действий для студентов технических вузов. Каждому этапу соответствует результат: постановка задачи, описание источников неопределённости, формализованная модель, обоснование критерия и материалы проверки устойчивости. При рассмотрении экономики Узбекистана предусмотрено документирование сопоставимости показателей и ограничений доступного массива. Вычислительная сложность может изменяться без отказа от общих требований прозрачности. Оценивание предполагает объяснение различий между расчётным исходом, прогнозом и условной рекомендацией. Полученная структура задаёт основу практического занятия или самостоятельного проекта. Вместе с тем её влияние на математическую подготовку, самостоятельность обучающихся и качество экономических решений остаётся вопросом последующего эмпирического исследования с заранее определёнными критериями и сопоставимыми условиями проведения проверки.

ОБСУЖДЕНИЕ

Предложенная схема позволяет рассматривать математическое моделирование как процесс согласования экономического содержания задачи с формой представления неизвестных условий. Её значение состоит в необходимости объяснять происхождение допущений, а не ограничиваться получением оптимального значения целевой функции. Для технического вуза такой подход связывает математическую строгость с содержательной интерпретацией вычислений. Вместе с тем сама последовательность этапов не обеспечивает качества исследования автоматически. Необоснованные ограничения, неполные данные или неверно выбранный критерий могут привести к практически неприемлемому решению даже при безошибочной

работе алгоритма. Поэтому оценка модели должна охватывать постановку задачи и информационные основания наряду с вычислительной процедурой, а также учитывать возможность независимого воспроизведения расчётов и обсуждения альтернативных исходных предположений исследователя.

Важный вопрос касается различия между вероятностным описанием и другими способами формализации неопределённости. Оценённое распределение позволяет вычислять ожидаемые значения и вероятности неблагоприятных исходов, однако достоверность этих характеристик зависит от репрезентативности наблюдений и устойчивости изучаемого механизма. Сценарии позволяют исследовать альтернативные условия без обязательного назначения вероятностей, но полнота сценарного набора требует самостоятельного обоснования. Робастные постановки защищают решение относительно заданного множества параметров, границы которого также определяются исследователем. Нечёткие модели формализуют расплывчатость оценок, однако не заменяют проверку качества экспертной информации. Следовательно, каждый подход переносит часть неопределённости в собственные предпосылки, которые необходимо раскрывать и анализировать при интерпретации результата, особенно если он используется для обоснования конкретного экономического решения практически.

Сопоставление моделей требует внимания к критериям, поскольку различные постановки могут отвечать на разные вопросы. Максимизация ожидаемого дохода, ограничение вероятности убытка и обеспечение допустимости при неблагоприятных условиях выражают неодинаковые предпочтения принимающего решение субъекта. Поэтому различия найденных решений не всегда свидетельствуют о превосходстве одного метода. Они могут отражать различия целей и отношения к риску. Для корректного сравнения необходимо согласовать ограничения, доступную информацию и временную последовательность действий. Дополнительно следует оценивать цену выбранной защищённости, выраженную изменением результата относительно менее консервативной постановки. Экономический смысл такого изменения определяется условиями конкретной задачи, а не только величиной вычисленной целевой функции, особенно при наличии нескольких заинтересованных сторон с различающимися приоритетами решений.

В исследованиях, ориентированных на экономику Узбекистана, применимость предложенной схемы следует оценивать через свойства конкретных данных и институциональные условия задачи. Различия отраслевого охвата, пересмотр статистики или изменение порядка формирования показателей могут влиять на оценивание параметров и построение сценариев. Эти особенности необходимо устанавливать по документации источников, не предполагая их наличие заранее. При ограниченном числе наблюдений оправданность сложной вероятностной модели требует особого внимания. Однако переход к экспертным интервалам

также нуждается в проверке оснований. В учебной практике полезно сопоставлять несколько формализаций одной задачи, объясняя причины расхождений. Такое сопоставление помогает обсуждать последствия предпосылок без утверждения универсальной применимости определённого математического аппарата к национальной экономике или отдельной её отрасли.

Ограничения настоящей работы связаны с отсутствием численного эксперимента и проверки в образовательной среде. Нельзя установить, насколько предложенная последовательность улучшает качество решений или понимание студентами неопределённости, пока не определены соответствующие показатели и условия сравнения. Последующие исследования могут включать задачи распределения ресурсов, планирования производства и выбора инвестиционных вариантов с одинаковой исходной информацией. Следует анализировать устойчивость рекомендаций, вычислительную трудоёмкость и чувствительность к ошибкам задания параметров. Образовательные результаты целесообразно проверять через индивидуальное объяснение допущений и интерпретацию альтернатив. Такая проверка позволит уточнить границы применения схемы и отделить предполагаемые преимущества от наблюдаемых эффектов, учитывая подготовку участников, поддержку преподавателя и сложность предлагаемых заданий при организации последующего сравнительного учебного исследования.

ЗАКЛЮЧЕНИЕ

Математическое моделирование экономических процессов в условиях неопределённости требует согласования целей исследования, доступной информации и способов формализации неизвестных величин. Проведённая систематизация позволила объединить постановку задачи, описание источников неопределённости, выбор математического аппарата и проверку решений в последовательную методическую схему. Её назначение состоит в обеспечении прозрачности перехода от экономического вопроса к вычислимой модели и содержательной интерпретации результата. Работа имеет теоретико-методический характер, поэтому полученные положения не устанавливают эмпирического преимущества отдельных подходов. Их применимость определяется свойствами конкретной задачи, обоснованностью предпосылок и результатами последующей проверки. Такой подход позволяет рассматривать математическую модель как инструмент условного анализа, качество которого зависит от соответствия исследуемому процессу и информационным основаниям принимаемого экономического решения.

Разграничение источников неопределённости является необходимым условием выбора модели. Случайная изменчивость, недостаток наблюдений, неточность измерений и неизвестность структуры процесса требуют различных способов описания. Вероятностные распределения должны опираться на содержательные и статистические основания. Сценарии

предполагают внутреннюю согласованность рассматриваемых условий, интервальные постановки требуют обоснования границ, а нечёткие модели — объяснения функций принадлежности. Ни один способ формализации не устраняет неопределённость полностью. Поэтому исследователь должен раскрывать, какие особенности задачи отражены математически и какие остаются за пределами рассмотрения. Это требование ограничивает необоснованную точность выводов и позволяет оценить зависимость рекомендаций от принятых допущений. Документирование таких оснований также обеспечивает возможность воспроизведения анализа и пересмотра модели при поступлении дополнительной экономической информации впоследствии.

Выбор критерия решения необходимо отделять от выбора способа представления неизвестных условий. Ожидаемый доход, вероятность неблагоприятного исхода и защищённость относительно допустимых изменений параметров характеризуют различные стороны экономической задачи. Их использование предполагает явное определение предпочтений и ограничений принимающего решение субъекта. Особое значение имеет временной порядок получения информации: текущие действия не должны зависеть от сведений, недоступных в момент выбора. Анализ чувствительности и устойчивости дополняет оптимизационный расчёт, показывая, насколько рекомендация меняется при пересмотре предпосылок. При этом устойчивость в рассмотренных условиях не означает гарантированной эффективности за их пределами. Интерпретация должна сохранять связь с заданным критерием, информационной структурой и областью допустимых изменений параметров исследуемого экономического процесса в модели.

Для технических вузов предложенная схема создаёт основу практических заданий, объединяющих математическую формализацию, вычисления и объяснение результатов. Учебное оценивание целесообразно связывать с обоснованием допущений, корректностью ограничений и способностью различать прогноз, сценарный исход и условную рекомендацию. При рассмотрении экономических задач Узбекистана следует проверять сопоставимость показателей, доступность наблюдений и соответствие модели конкретным условиям. Сложность вычислительного аппарата может изменяться согласно подготовке студентов, однако требования прозрачности должны сохраняться. Образовательная ценность такой организации пока не подтверждена экспериментально и требует самостоятельной проверки. Она может исследоваться посредством сопоставимых заданий, индивидуальных объяснений и анализа ошибок, позволяющих установить, какие элементы методики способствуют пониманию неопределённости и самостоятельному выбору обоснованных способов решения экономических задач.

Дальнейшая проверка представленных положений предполагает построение конкретных моделей при одинаковых исходных данных и

сопоставимых условиях принятия решений. Необходимо заранее определить критерии качества, допустимые изменения параметров, порядок раскрытия информации и вычислительные ограничения. Полезно исследовать последствия ошибочного задания распределений, неполного набора сценариев и чрезмерно широких интервалов. Полученные результаты должны сопровождаться объяснением ограничений и проверкой воспроизводимости. До выполнения такого анализа преимущества предложенной схемы остаются методическими предположениями. Её непосредственный вклад заключается в установлении последовательных требований к обоснованию модели и интерпретации решений. Это формирует основу для применения математических инструментов к экономическим процессам с явным учётом неопределённости, доступной информации и ответственности за содержание выводов в конкретной исследовательской практике.

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Жумомуродов И.Д.
стажёр-преподаватель кафедры «Экология и почвоведение»
Каракалпакский государственный университет имени Бердаха
Республика Узбекистан

БИОАКУСТИЧЕСКИЕ И ПОВЕДЕНЧЕСКИЕ ПОКАЗАТЕЛИ ФИЗИОЛОГИЧЕСКОГО СОСТОЯНИЯ ДИКИХ МЛЕКОПИТАЮЩИХ ЮЖНОГО ПРИАРАЛЬЯ

Аннотация. Перспективным направлением оценки физиологического состояния диких млекопитающих является использование неинвазивных биоакустических и поведенческих методов. Цель предполагаемого исследования — оценить возможности их применения для мониторинга млекопитающих Южного Приаралья. Объектами планируется выбрать бухарского оленя (Cervus hanglu bactrianus), золотистого шакала (Canis aureus), волка (Canis lupus) и представителей Rodentia. Предполагается анализировать характеристики вокализаций, суточную и сезонную активность, а также территориальное, кормовое, социальное и репродуктивное поведение. Сочетание акустического мониторинга, фотоловушек и метеорологических наблюдений позволит оценить перспективность этих показателей как неинвазивных индикаторов функционального состояния животных.

Ключевые слова: физиологическое состояние, биоакустика, поведение, дикие млекопитающие, Южное Приаралье, бухарский олень, шакал, волк, грызуны.

Jumomurodov I.D.
trainee lecturer
Department of Ecology and Soil Science
Berdakh Karakalpak State University
Republic of Uzbekistan

BIOACOUSTIC AND BEHAVIORAL INDICATORS OF THE PHYSIOLOGICAL STATE OF WILD MAMMALS OF THE SOUTHERN ARAL SEA REGION

Abstract. A promising direction for assessing the physiological state of wild mammals is the use of non-invasive bioacoustic and behavioral methods. The purpose of the proposed study is to evaluate the possibilities of their use for monitoring mammals of the Southern Aral Sea region. It is planned to select the Bukhara deer (Cervus hanglu bactrianus), golden jackal (Canis aureus), wolf (Canis lupus) and representatives of Rodentia as objects. It is expected to analyze the characteristics of vocalizations, daily and seasonal activity, as well as territorial, feeding, social and reproductive behavior. The combination of acoustic

monitoring, camera traps and meteorological observations will allow us to assess the prospects of these indicators as non-invasive indicators of the functional state of animals.

Keywords: physiological state, bioacoustics, behavior, wild mammals, Southern Aral Sea region, Bukhara deer, jackal, wolf, rodents.

Введение

Физиологическое состояние диких животных связано с энергетическим обменом, репродуктивной активностью, терморегуляцией, стрессовыми реакциями и сезонными биологическими ритмами. Его изучение у свободноживущих млекопитающих затруднено, поскольку традиционные методы часто требуют отлова и иммобилизации, способных изменять физиологические показатели. Поэтому перспективным направлением являются неинвазивные методы — пассивный акустический мониторинг, фотоловушки и поведенческие наблюдения. Вокализация и особенности поведения могут отражать изменения функционального состояния животных, связанные с репродукцией, социальной активностью и воздействием факторов среды. Для Южного Приаралья такие исследования особенно актуальны вследствие аридного климата, высокой летней температуры, дефицита влаги и трансформации природных экосистем. Перспективными модельными объектами являются бухарский олень (Cervus hanglu bactrianus), золотистый шакал (Canis aureus), волк (Canis lupus) и представители Rodentia.

Цель исследования — разработать подход к использованию биоакустических и поведенческих показателей как неинвазивных индикаторов физиологического состояния диких млекопитающих Южного Приаралья.

Материалы и методы

Перспективные исследования планируется проводить в экосистемах Южного Приаралья, включая Нижне-Амударьинский биосферный резерват. Модельными объектами будут бухарский олень (Cervus hanglu bactrianus), золотистый шакал (Canis aureus), волк (Canis lupus) и представители Rodentia.

Биоакустический мониторинг предполагается проводить автоматическими регистраторами с анализом частоты, продолжительности и спектральных характеристик вокализаций, а также их суточной и сезонной динамики. Поведенческую активность планируется оценивать с помощью фотоловушек и визуальных наблюдений, учитывая двигательные, кормовые, территориальные, социальные и репродуктивные реакции. Особое внимание будет уделено гону бухарского оленя, вокализациям шакала и волка и активности грызунов. Акустические и поведенческие показатели предполагается сопоставлять с метеорологическими факторами и использовать как косвенные индикаторы функционального состояния животных.

Результаты и обсуждение

Предполагается, что биоакустические и поведенческие показатели будут характеризоваться выраженной видовой, сезонной и суточной изменчивостью. Наиболее информативными могут оказаться периоды повышенной репродуктивной, социальной и территориальной активности животных.

Для бухарского оленя особый интерес представляет период гона. В это время у самцов закономерно возрастает роль брачных вокализаций, двигательной активности, территориального поведения и внутривидовой конкуренции. Поэтому предполагается, что частота рёва, продолжительность акустических серий, интервалы между сигналами и их спектральные характеристики могут быть использованы как косвенные показатели изменения функционального состояния самцов. Перспективным является также сопоставление интенсивности вокализации с временем суток и метеорологическими условиями.

У золотистого шакала и волка предполагается изучать одиночные и групповые вои как показатели социальной и территориальной активности. Их интерпретацию следует проводить с учётом структуры группы, плотности животных и характера социальных взаимодействий. Совмещение акустических записей с данными фотоловушек позволит оценить связь вокализации с численностью, перемещениями и сезонными особенностями поведения животных.

Для представителей Rodentia биоакустические данные целесообразно дополнять оценкой двигательной, кормовой и норной активности, поскольку часть грызунов издаёт слабые или высокочастотные сигналы. В условиях дефицита воды и высоких температур Южного Приаралья активность млекопитающих может смещаться на вечерние и ночные часы, что способствует снижению тепловой нагрузки и потерь воды.

Поскольку акустический сигнал не является прямым физиологическим показателем, его следует анализировать совместно с поведением, условиями среды и, по возможности, независимыми физиологическими маркерами. Такой комплексный подход позволит более обоснованно оценивать функциональное состояние животных.

В перспективе биоакустический мониторинг целесообразно сочетать с анализом фекальных метаболитов глюкокортикоидов и репродуктивных гормонов, что позволит оценить связь акустических и поведенческих реакций с физиологическим состоянием животных. Предлагаемая схема исследования включает взаимосвязь: факторы среды → физиологическое состояние → поведенческие реакции → акустическая активность. Комплексная регистрация этих компонентов позволит проводить неинвазивную оценку функционального состояния диких млекопитающих без их отлова.

Заключение

Биоакустические и поведенческие показатели представляют перспективный неинвазивный подход к оценке физиологического состояния

диких млекопитающих Южного Приаралья. Для бухарского оленя наиболее информативным может быть период гона, для шакала и волка — одиночные и групповые вокализации в сочетании с территориальным и социальным поведением, а для грызунов — акустическая, двигательная, кормовая и норная активность. Комплексное использование акустических регистраторов, фотоловушек, метеорологических наблюдений и физиологических маркеров в перспективе позволит разработать систему неинвазивного мониторинга функционального состояния животных и оценки их адаптации к условиям аридных экосистем Южного Приаралья.

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Жумомуродов И.Д.
стажёр-преподаватель кафедры «Экология и почвоведение»
Каракалпакский государственный университет имени Бердаха
Республика Узбекистан

СЕЗОННЫЕ ИЗМЕНЕНИЯ ФИЗИОЛОГИЧЕСКОГО СОСТОЯНИЯ ДИКИХ МЛЕКОПИТАЮЩИХ ЮЖНОГО ПРИАРАЛЬЯ ПО ДАННЫМ БИОАКУСТИЧЕСКОГО МОНИТОРИНГА

Аннотация. Статья посвящена перспективам использования биоакустического мониторинга для оценки сезонных изменений физиологического состояния диких млекопитающих Южного Приаралья. В качестве модельных объектов рассматриваются бухарский олень (Cervus hanglu bactrianus), золотистый шакал (Canis aureus), волк (Canis lupus) и представители Rodentia. Предполагается анализировать вокализации, суточную и сезонную активность, а также сопоставлять биоакустические данные с поведенческими и метеорологическими показателями.

Ключевые слова: физиологическое состояние, биоакустический мониторинг, дикие млекопитающие, Южное Приаралье, бухарский олень, волк, шакал, грызуны.

Jumomurodov I.D.
trainee lecturer
Department of Ecology and Soil Science
Berdakh Karakalpak State University
Republic of Uzbekistan

SEASONAL CHANGES IN THE PHYSIOLOGICAL STATE OF WILD MAMMALS IN THE SOUTHERN ARAL SEA REGION BASED ON BIOACOUSTIC MONITORING DATA

Abstract. This article examines the prospects of using bioacoustic monitoring to assess seasonal changes in the physiological state of wild mammals in the Southern Aral Sea region. The study focuses on the Bukhara deer (Cervus hanglu bactrianus), golden jackal (Canis aureus), wolf (Canis lupus), and representatives of the order Rodentia as model species. The research involves analyzing vocalizations and patterns of daily and seasonal activity, as well as correlating bioacoustic data with behavioral and meteorological indicators.

Keywords: physiological state, bioacoustic monitoring, wild mammals, Southern Aral Sea region, Bukhara deer, wolf, jackal, rodents.

Введение

Физиологическое состояние диких животных зависит от биологических ритмов и факторов среды. В условиях Южного Приаралья особое значение

имеют высокая температура, дефицит воды и сезонные изменения активности. Перспективными неинвазивными методами являются биоакустический мониторинг, фотоловушки и поведенческие наблюдения. В качестве модельных объектов рассматриваются бухарский олень (*Cervus hanglu bactrianus*), золотистый шакал (*Canis aureus*), волк (*Canis lupus*) и представители Rodentia.

Цель исследования — оценить возможности биоакустических и поведенческих показателей для изучения сезонных изменений физиологического состояния диких млекопитающих Южного Приаралья.

Материалы и методы

Перспективные исследования планируется проводить в экосистемах Южного Приаралья, включая Нижне-Амударьинский биосферный резерват. Модельными объектами будут бухарский олень, золотистый шакал, волк и представители Rodentia. Биоакустический мониторинг предполагается осуществлять автоматическими регистраторами с анализом частоты, продолжительности и спектральных характеристик вокализаций, а также их суточной и сезонной динамики. Поведенческие показатели будут регистрироваться с помощью фотоловушек и визуальных наблюдений. Особое внимание планируется уделить гону бухарского оленя, одиночным и групповым вокализациям шакала и волка, а у грызунов — двигательной, кормовой и норной активности. Полученные показатели предполагается сопоставлять с метеорологическими условиями и рассматривать как косвенные индикаторы функционального состояния животных.

Результаты и обсуждение

Предполагается, что сезонные изменения биоакустической и поведенческой активности будут различаться между экологическими группами млекопитающих. У бухарского оленя наиболее информативным периодом может стать сезон гона, когда возрастает частота вокализаций, двигательная и территориальная активность самцов. Предполагается, что частота рёва, серийность сигналов и их спектральные характеристики могут использоваться как косвенные показатели изменения репродуктивного и функционального состояния.

У золотистого шакала и волка перспективным является анализ одиночных и групповых вокализаций. Их сезонная и суточная динамика может отражать изменения социальной организации, территориальной активности и интенсивности внутригрупповых взаимодействий. Для более обоснованной интерпретации акустические записи необходимо сочетать с данными фотоловушек и наблюдениями за перемещением животных.

Для представителей Rodentia использование только биоакустических данных может быть недостаточным. Поэтому предполагается комплексировать акустический мониторинг с регистрацией кормовой, двигательной и норной активности. В условиях высокой температуры и дефицита воды активность мелких млекопитающих может смещаться на

вечерние и ночные часы, что связано с уменьшением тепловой нагрузки и потерь воды.

Особое значение предполагается уделить климатическим факторам. Температура воздуха, дефицит воды и сезонная изменчивость кормовой базы могут оказывать существенное влияние на активность животных и должны учитываться при физиологической интерпретации акустических сигналов.

В перспективе биоакустический мониторинг целесообразно сочетать с независимыми физиологическими маркерами, включая анализ фекальных метаболитов глюкокортикоидов и репродуктивных гормонов. Это позволит проверить статистическую связь между вокализацией, поведением и функциональным состоянием организма. Предлагаемая схема исследования может быть представлена как система: факторы среды → физиологическое состояние → поведенческие реакции → акустическая активность. Такой подход позволит проводить неинвазивную оценку функционального состояния животных без их непосредственного отлова.

Заключение

Биоакустический мониторинг является перспективным методом оценки сезонных изменений физиологического состояния диких млекопитающих Южного Приаралья. Для бухарского оленя наиболее информативен период гона, для шакала и волка — динамика одиночных и групповых вокализаций, а для грызунов — сочетание акустической, двигательной и кормовой активности. Комплексное использование акустических регистраторов, фотоловушек, метеорологических наблюдений и физиологических маркеров позволит развивать систему неинвазивного мониторинга функционального состояния млекопитающих региона.

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Иклясбаев А.П., магистр по специальности
«Технология выращивания и переработки
лекарственных растений»
Каракалпакский институт сельского
хозяйства и агротехнологий
Республика Узбекистан

РАЗРАБОТКА СПОСОБОВ ИСПОЛЬЗОВАНИЯ БИОХИМИЧЕСКИХ И ЛЕКАРСТВЕННЫХ СВОЙСТВ ШИПОВНИКА (ROSA CANINA L.), ПРОИЗРАСТАЮЩЕГО НА ЗАСОЛЕННЫХ ПОЧВАХ КАРАКАЛПАКСТАНА

Аннотация. Статья посвящена изучению биохимических и потенциальных лекарственных свойств шиповника (Rosa canina L.), произрастающего на засоленных почвах Каракалпакстана. Рассмотрены содержание основных биологически активных веществ, антиоксидантные свойства плодов и перспективы их использования для получения лекарственного сырья, экстрактов и функциональных продуктов. Показана необходимость стандартизации сырья по содержанию аскорбиновой кислоты, фенольных соединений и флавоноидов. Результаты исследования могут быть использованы для рационального освоения растительных ресурсов засоленных территорий региона.

Ключевые слова: шиповник, засоление, Каракалпакстан, аскорбиновая кислота, флавоноиды, фенольные соединения, антиоксидантная активность.

Iklasbaev A.P., master's degree in Technology
of Cultivation and Processing of Medicinal Plants
Karakalpak Institute of Agriculture and Agrotechnologies
Republic of Uzbekistan

DEVELOPMENT OF METHODS FOR UTILIZING THE BIOCHEMICAL AND MEDICINAL PROPERTIES OF ROSEHIP (ROSA CANINA L.) GROWING ON SALINE SOILS IN KARAKALPAKSTAN

Abstract. This article examines the biochemical and potential medicinal properties of rosehip (Rosa canina L.) growing on the saline soils of Karakalpakstan. It analyzes the content of key biologically active substances and the antioxidant properties of the fruit, as well as prospects for their use in producing medicinal raw materials, extracts, and functional products. The study highlights the necessity of standardizing the raw material based on its content of ascorbic acid,

phenolic compounds, and flavonoids. The research findings can be utilized for the rational exploitation of plant resources in the region's saline areas.

Keywords: rosehip, soil salinity, Karakalpakstan, ascorbic acid, flavonoids, phenolic compounds, antioxidant activity.

Введение

Лекарственные растения являются важным источником биологически активных веществ. Шиповник (*Rosa canina L.*) богат аскорбиновой кислотой, фенольными соединениями, флавоноидами, каротиноидами и органическими кислотами. В условиях Каракалпакстана его изучение особенно актуально из-за засоления почв, аридного климата и дефицита влаги, которые влияют на обмен веществ и накопление антиоксидантных соединений. Биохимический состав плодов зависит от условий произрастания и состояния почвы, поэтому их оценка имеет научное и практическое значение.

Цель исследования — разработать подходы к использованию биохимических и потенциальных лекарственных свойств *Rosa canina L.*, произрастающего на засолённых почвах Каракалпакстана.

Материалы и методы

Объектом исследования служили плоды *Rosa canina L.*, собранные на территориях Каракалпакстана с различной степенью засоления почв. Отбор растительного материала проводили в одинаковую фазу зрелости, одновременно отбирая образцы почвы из прикорневой зоны. Для оценки засоления определяли pH, электропроводность и содержание основных ионов (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-). Биохимический анализ плодов включал определение аскорбиновой кислоты, фенольных соединений, флавоноидов, каротиноидов, сахаров и органических кислот. Антиоксидантную активность оценивали с использованием DPPH-, ABTS- или FRAP-тестов. Для определения перспектив практического использования исследовали различные способы подготовки сырья: сушку, измельчение и получение водных и водно-спиртовых экстрактов. Статистическую обработку проводили с расчетом средних значений и стандартного отклонения, а взаимосвязь между степенью засоления и биохимическими показателями оценивали методом корреляционного анализа.

Результаты и обсуждение

Биохимическая ценность плодов Rosa canina определяется прежде всего содержанием аскорбиновой кислоты и комплекса антиоксидантных соединений. Аскорбиновая кислота участвует в окислительно-восстановительных процессах и относится к основным природным антиоксидантам. Фенольные соединения и флавоноиды также выполняют защитные функции и способны связывать активные формы кислорода.

Произрастание в условиях засоленных почв может сопровождаться перестройкой обменных процессов растения. Солевой стресс приводит к снижению водного потенциала, накоплению натрия и хлоридов, нарушению минерального питания и усилению образования активных форм кислорода. В

ответ растения активируют антиоксидантную защиту, частью которой являются аскорбиновая кислота, фенольные соединения, каротиноиды и ряд других метаболитов.

Наиболее вероятно, что реакция шиповника на засоление имеет нелинейный характер. При слабом и умеренном солевом стрессе возможно усиление синтеза некоторых вторичных метаболитов, тогда как при сильном засолении физиологическое состояние растения ухудшается, снижаются рост побегов, размер плодов и общая продуктивность. Поэтому повышение концентрации отдельных биологически активных веществ не всегда означает улучшение общего качества урожая.

С практической точки зрения перспективно использование зрелых плодов шиповника для получения высушенного лекарственного сырья. Плоды очищают, сортируют и высушивают в условиях, обеспечивающих максимальное сохранение витамина С, фенольных соединений и других антиоксидантных компонентов.

Вторым направлением является получение порошка из высушенных плодов шиповника для использования в функциональных продуктах, витаминных смесях и растительных добавках. При этом необходим контроль влажности, микробиологической чистоты и содержания основных биологически активных веществ.

Третьим перспективным направлением является получение жидких и сухих экстрактов из плодов шиповника с использованием воды и водно-спиртовых растворов. Эффективность экстракции зависит от соотношения сырья и растворителя, температуры, продолжительности процесса и степени измельчения материала.

Особое значение имеет стандартизация сырья *Rosa canina L.* по содержанию аскорбиновой кислоты, фенольных соединений и антиоксидантной активности. Это позволит обеспечить стабильное качество продукции независимо от места произрастания растений.

Перспективным является сравнение *Rosa canina L.*, произрастающей на почвах с различной степенью засоления, для выявления условий, обеспечивающих высокую биохимическую ценность плодов и достаточную продуктивность растений. Биохимические показатели характеризуют потенциальную фармакологическую ценность сырья, однако подтверждение конкретных лечебных свойств требует дополнительных исследований биологической активности.

Заключение

Шиповник *(Rosa canina L.)*, произрастающий на засолённых почвах Каракалпакстана, является перспективным лекарственным сырьём, богатым аскорбиновой кислотой, фенольными соединениями, флавоноидами и каротиноидами. Степень засоления влияет на накопление биологически активных веществ, поэтому должна учитываться при оценке качества плодов. Перспективными направлениями использования являются получение высушенного сырья, порошков и экстрактов. Изучение *Rosa canina*

способствует рациональному использованию лекарственных растительных ресурсов Каракалпакстана.

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Исламова С.Т., PhD по техническим наукам
доцент кафедры медицинской химии
Андижанский государственный медицинский институт

ЛЕЧЕНИЕ МЕЖПОЗВОНОЧНОЙ ГРЫЖИ С ПОМОЩЬЮ ЛАЗЕРНОЙ ТЕРАПИИ

Аннотация. В статье рассматриваются современные подходы к лечению межпозвоночной грыжи с применением лазерной терапии. Особое внимание уделяется принципу действия лазерного излучения, его влиянию на болевой синдром, воспалительные процессы и восстановление функционального состояния позвоночника. Рассматриваются возможности использования лазерной терапии в составе комплексного лечения, её потенциальные преимущества, показания и ограничения. Отмечается, что эффективность данного метода зависит от клинической картины заболевания, степени выраженности грыжи и индивидуальных особенностей пациента. Подчёркивается необходимость выбора метода лечения специалистом с учётом результатов клинического обследования. Лазерная терапия может рассматриваться как один из вспомогательных методов лечения межпозвоночной грыжи, однако её применение не исключает необходимости использования других консервативных или хирургических методов при наличии соответствующих показаний.

Ключевые слова: межпозвоночная грыжа, лазерная терапия, лазерное излучение, лечение позвоночника, болевой синдром, воспаление, физиотерапия, восстановление, консервативное лечение, реабилитация.

Islamova S.T., PhD in Medical Sciences
associate professor
Department of Medical Chemistry
Andijan State Medical Institute

TREATMENT OF INTERVERTEBRAL DISC HERNIATION USING LASER THERAPY

Abstract. This article examines modern approaches to the treatment of intervertebral disc herniation using laser therapy. Particular attention is paid to the principles of laser radiation, its effects on pain relief, inflammatory processes, and the restoration of spinal function. The study discusses the potential applications of laser therapy as part of a comprehensive treatment program, as well as its advantages, indications, and limitations. The effectiveness of this method depends on the clinical presentation of the disease, the severity of the herniation, and the individual characteristics of the patient. The importance of selecting an appropriate treatment method based on a specialist's clinical assessment is emphasized. Laser therapy may be considered an adjunctive treatment for intervertebral disc

herniation; however, it does not eliminate the need for other conservative or surgical interventions when clinically indicated.

Keywords: intervertebral disc herniation, laser therapy, laser radiation, spinal treatment, pain syndrome, inflammation, physiotherapy, recovery, conservative treatment, rehabilitation.

Позвоночник является одним из важнейших органов для здоровья человека. Позвоночник является основой скелета и позволяет человеку ходить прямо. Малые и большие мышцы живота и поясницы связаны с позвоночником. Если позвоночник искривлен, мы видим, что он затрагивает кости, мышцы и суставы. В результате они сжимаются. В результате внутренние органы заболевают по всему телу. Основой амортизирующей функции позвоночника являются диски между позвонками. Эти крошечные полосы состоят из ядра, состоящего из гликозамингликанов (6 типов полисахаридов), обернутых в оболочку. Когда человеческое тело изгибается, диски позвоночника изгибаются в этом направлении и толкают ядро в противоположную сторону.

Лечение грыжи межпозвонкового диска является одной из основных задач народной медицины и современной медицины. Уже известно, что применение противовоспалительных препаратов и различных обезболивающих малоэффективно, а при тяжелых патологических состояниях нет гарантии отсутствия рецидива заболевания даже после операции. В большинстве случаев консервативное лечение эффективно, и пациенты избавляются от болей в спине и ногах.

Современные методы лечения грыж позвоночника включают: медикаментозную терапию; физиотерапевтические процедуры; диету; массаж; лазерная терапия. Чтобы получить максимально выраженный эффект лечения грыжи без операции у мужчин и женщин необходимо сочетание всех методов.

Только такое комплексное воздействие на проблему будет способствовать получению хорошего результата. Каждый пациент должен понимать, что консервативная терапия не способна привести к полному регрессу заболевания и восстановлению нормальной анатомии позвоночника. В ее силах лишь остановить рост межпозвоночной грыжи и предотвратить развитие осложнений. Полностью устранить патологическое выпячивание можно только оперативным путем.

Целью хирургического вмешательства является проведение декомпрессии спиномозгового нерва, руководствуясь неврологической симптоматикой и данными нейровизуализационных методов (МРТ, КТ). Поскольку средний диаметр спино-мозгового нерва варьирует от 3 до 5 мм выполнение декомпрессии без систем увеличения (операционный микроскоп (стандарт), операционный эндоскоп (рекомендация)) сопряжено с высоким риском повреждения, находящихся в зоне хирургического интереса, образований, в связи с чем не рекомендуется.

Лазерная терапия грыж межпозвоночных дисков основана на использовании низкоинтенсивного лазерного излучения или лазерной вапоризации (удаления тканей) для уменьшения размеров поврежденного диска, снижения давления на нервные узлы и облегчения боли. Существует несколько основных методов лазерной терапии. Чрескожная лазерная декомпрессия диска — это минимально инвазивная процедура, при которой лазерное волокно вводится через иглу в пораженный диск и вызывает его частичную вапоризацию.

Лазерная шлифовка диска используется для стимуляции регенерации поврежденных тканей, увеличения синтеза коллагена и улучшения гидратации диска. Низкоинтенсивная лазерная терапия применяется для облегчения боли, устранения воспаления, стимуляции обменных процессов в тканях позвоночника.

В странах СНГ лазерная терапия активно применяется в крупных медицинских центрах. Лазерная терапия применяется в России с 1999 года. По данным Московского НИИ нейрохирургии им. Бурденко, лазерная декомпрессия диска эффективна в 80% случаев при небольших грыжах (до 6 мм).

В Казахстане и Беларуси лечение грыж дисков лазером включено в стандарты и доступно в ведущих клиниках. В Украине сообщается об успешном применении лазерной терапии, особенно в сочетании с физиотерапией и медикаментозным лечением. Лазерное лечение грыж дисков развивается в Узбекистане с 2010-х годов.

Метод чрескожной лазерной декомпрессии диска активно применяется в Республиканском центре специализированной неврологии и нейрохирургии Министерства здравоохранения Узбекистана. По статистическим данным центра, 78% пациентов значительно улучшили свое состояние после лазерного лечения.

В США лазерное лечение грыж межпозвоночных дисков является популярной альтернативой традиционной хирургии. По данным Американской ассоциации нейрохирургов, лазерная декомпрессия применяется у пациентов с грыжами до 6 мм. По данным исследования Университета Джонса Хопкинса, лазерное лечение значительно уменьшает боль и улучшает качество жизни у 85% пациентов. Специалисты американских клиник подчеркивают, что эффективных результатов можно добиться, применяя лазерную терапию совместно с физиотерапией, введением богатой тромбоцитами плазмы и лекарств.

В Германии, Франции и Великобритании лазерная терапия является стандартной процедурой лечения грыж позвоночника. Кроме того, лазерная декомпрессия активно применяется в таких клиниках, как Schön Klinik и Charité – Universitätsmedizin Berlin в Германии. По данным Немецкого общества ортопедов и травматологов, особенно эффективна лазерная терапия у молодых пациентов и составила 82%. Во Франции лазерную терапию часто сочетают с физиотерапией и мануальной терапией. В Великобритании

уделяется внимание реабилитации после применения методов кинезиотерапии и остеопатии.

Благодаря сочетанию лазерного лечения с регенеративной медициной в США достигнут самый высокий показатель успеха. В Европе активно внедряются роботизированные технологии, что повышает точность процедур. Технологии активно развиваются в России и странах СНГ, но они пока не предусматривают широкого применения биотехнологий. Узбекистан показывает хорошие результаты, но пока не достиг уровня высокотехнологичных методов США и Германии.

Одним из перспективных направлений являются индивидуализированные подходы к лечению, основанные на данных исследований генетического анализа. Это позволяет предсказать, какие пациенты лучше отреагируют на лазерное лечение, а какие потребуют более инвазивного вмешательства. Будущее лазерной терапии зависит от ее сочетания с биомедицинскими технологиями, роботизированными системами, искусственным интеллектом для мониторинга процесса диагностики и лечения, а также малоинвазивными хирургическими методами.

Лазерная терапия – не единственное решение для всех пациентов с грыжами. Наиболее эффективен в следующих случаях: грыжа размером до 6 мм без секвестрации (отрыва диска). Значительного стеноза позвоночного канала нет. Умеренная компрессия нервных корешков без полной блокады позвоночного канала.

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Каландарова М.К., PhD по педагогическим наукам
доцент
Узбекский национальный педагогический
университет имени Низами
ORCID: 0009-0003-7540-2346

ВЛИЯНИЕ СОЦИАЛЬНО-ЭКОЛОГИЧЕСКИХ УСЛОВИЙ ГОРНЫХ ТЕРРИТОРИЙ УЗБЕКИСТАНА НА СОСТОЯНИЕ ЗДОРОВЬЯ НАСЕЛЕНИЯ И СТРУКТУРУ ЗАБОЛЕВАЕМОСТИ (ТЕРРИТОРИАЛЬНЫЙ АНАЛИЗ)

Аннотация. В данной статье в территориальном разрезе анализируются особенности социально-экологической среды в горных и предгорных районах Узбекистана, образ жизни населения, обеспеченность инфраструктурой и их влияние на структуру заболеваемости болезнями сердечно-сосудистой системы, эндокринной системы и органов дыхания. Кроме того, с эколого-социальной точки зрения оцениваются качество медицинского обслуживания в отдалённых районах и возможности его улучшения.

Ключевые слова: здоровье населения, социально-экологические факторы, географическое положение, территориальный анализ, горная болезнь, кислородная недостаточность, горно-долинные территории, горнодобывающая промышленность, медико-географический анализ, высотные уровни гор, факторы, определяющие состояние здоровья населения, ведущие факторы.

Qalandarova M.K., PhD in Pedagogical Sciences
associate professor
Nizami National Pedagogical University of Uzbekistan
ORCID: 0009-0003-7540-2346

THE IMPACT OF SOCIO-ECOLOGICAL CONDITIONS IN UZBEKISTAN'S MOUNTAINOUS REGIONS ON POPULATION HEALTH AND MORBIDITY PATTERNS (A REGIONAL ANALYSIS)

Abstract. This article provides a regional analysis of the socio-ecological environment, lifestyle, and infrastructure in the mountainous and foothill districts of Uzbekistan, examining their influence on the prevalence of cardiological, endocrine, and respiratory diseases. Furthermore, the quality of medical services in remote areas-along with potential improvements-is evaluated from a socio-ecological perspective.

Keywords: population health, socio-ecological factors, geographical location, regional analysis, mountain sickness, oxygen deficiency, mountain-valley

regions, mining industry, medical-geographical analysis, mountain altitudes, factors determining the state of population health, primary factors

ВВЕДЕНИЕ. Около 21,4 процента территории Узбекистана занимают горные и предгорные районы. Горные районы Кашкадарьи (Китоб, Шахрисабз), Сурхандарьи (Бойсун, Сариосийо), Ташкентской области (Бостонлык, Паркент, Ахангарон) и Ферганской долины отличаются своей уникальностью. Объектом нашего исследования является анализ структуры заболеваемости в этих регионах с точки зрения географических факторов, что имеет особое значение для обеспечения устойчивого социально-демографического развития. Сегодня обеспечение устойчивого развития и сохранение человеческого капитала напрямую зависят от качества жизни и показателей здоровья населения отдаленных, горных и труднодоступных регионов.

ОБЗОР СООТВЕТСТВУЮЩЕЙ ЛИТЕРАТУРЫ.

Болезнь, которая в горных регионах называется «горной болезнью», и первые сведения о ней были зафиксированы испанским путешественником Акостой. По его словам, встречаются случаи учащенного сердцебиения, головокружения, одышки, носовых кровотечений и звона в ушах. Однако это состояние было определено еще в 1887 году французским ученым Бертом, и его основной причиной была отмечена нехватка кислорода. Заболевания также имеют специфическую высотную (гипсометрическую) зональность, которую следует учитывать в социально-географических исследованиях (Чаклин А.В., 1986). В последние годы в результате изучения сердечной деятельности людей, живущих в горах, было обнаружено, что сердца людей, живущих в этом регионе, значительно отличаются от сердец людей, живущих в других регионах, а именно, толщиной их правых желудочков (гипертрофия). Наблюдения также показывают, что это состояние встречается у всех людей, живущих на высоте 3500-4000 метров (Чаклин А.В., 1986). Из исследований А. П. Виноградова известно, что человеческий организм должен получать 120 г йода в день, только тогда будет удовлетворена нормальная физиологическая потребность организма. Из них 70 г поступает из растений и 40 г из продуктов животного происхождения. Таким образом, основную часть йода организм получает из растений. Растения, в свою очередь, получают йод из почвы через воду (Виноградов А. П., 1946). По теории учёного, в горных и серопочвенных регионах наблюдается дефицит йода, поэтому необходимо проводить соответствующие исследования в таких регионах.

Методология исследования. Климат разных горных высот по-разному влияет на здоровье человека. Низменные и средние горы имеют большое значение для отдыха, туризма и лечения некоторых заболеваний. Люди, живущие в высоких горах (выше 2500 метров), адаптировали свой организм к жизни в этих условиях благодаря постоянному воздействию этих условий. В Альпах горная болезнь начинается на высоте 2500 м, на Кавказе — на 3000 м, а в Гималаях — на 4000 м.

Горные районы Ташкентской области, Кашкадарьинской, Сурхандарьинской, Джизакской и Ферганской долин, составляющие около четверти территории нашей республики, образуют уникальную социально-экологическую экосистему. Здесь природные и экологические факторы; гипоксия, климатические экстремумы, социально-экономические условия; рассеянное расположение относительно равнины, логистические проблемы, в сочетании с традиционным питанием, формируют внутрибольничную ситуацию со специфическим составом заболеваемости среди населения.

Результаты и обсуждение. При оценке состояния здоровья населения в территориальном контексте целесообразно разделить основные геоэкологические факторы на три группы:

Во-первых, гипоксия, т.е. недостаток кислорода; при этом с увеличением высоты атмосферное давление и парциальное давление кислорода в воздухе снижаются. Люди, живущие на высотах 1000–2500 метров над уровнем моря, живут в условиях хронической гипоксии, что, в свою очередь, заставляет сердечно-сосудистую систему работать в условиях постоянного стресса. В качестве естественной защитной реакции организма на изменения внутренней или внешней среды, заболевания, повреждения органов и для компенсации утраченной функции наблюдается увеличение количества эритроцитов в крови, повышение плотности крови и высокое давление в легочных артериях.

Во-вторых, суровость микроклимата, для которого горный климат характеризуется высокими суточными и сезонными температурными контрастами, сильным ультрафиолетовым излучением и сухими воздушными потоками. Резкие холодные волны могут вызывать внезапное сужение кровеносных сосудов;

В-третьих, эндемичные факторы, а именно тот факт, что распределение микроэлементов, включая минералы, в почве и питьевой воде в горных районах принципиально отличается от такового на равнинах, и в большинстве случаев горные реки и родниковые воды мягкие, имеют низкий уровень минерализации и бедны йодом.

Если дыхание не интенсифицировать, содержание кислорода снижается в большей степени, чем на высоте; Организм стремится пропустить через легкие больше воздуха, чтобы поглотить хотя бы нормальное количество кислорода из воздуха, поступающего в легкие. Если здоровый человек обычно пропускает через легкие около 6-8 литров воздуха в минуту (вдох и выдох), то на высоте этот минутный объем вентиляции может увеличиться в 2-3 раза и более. Следовательно, насыщение крови кислородом снижается в меньшей степени. Например, на высоте 3000 м гемоглобин в артериальной крови насыщен примерно на 90-92% вместо 96-100%. Доказано, что снижение насыщения крови кислородом является основным раздражителем специальных нервных окончаний, расположенных в начальной части аорты и недалеко от места отхождения сонных артерий от аорты. Поэтому нервный

импульс, вызванный гипоксией, по соответствующим нервным путям усиливает дыхание.

Средняя высота земной поверхности составляет 750 метров над уровнем моря, и значительная часть населения мира проживает в высокогорных районах. Более 30 миллионов человек в мире живут еще выше, то есть выше 3000 метров. Поэтому важно изучать степень адаптации людей, живущих в таких ландшафтах, к существующим условиям.

Паркентский район, расположенный в северном горном регионе нашей страны, находится на склонах Чаткальского хребта, отличается относительно влажным воздухом и развитыми лесными и садовыми ландшафтами. Однако из-за близости к столичной агломерации он характеризуется высокой антропогенной нагрузкой и туристическим потоком. В районе особенно развиты виноградарство и экотуризм. Уровень жизни населения относительно высок, а доступ к медицинской инфраструктуре проще, чем в Бойсуне и Ургуте, например, благодаря близости к столичным кардиологическим центрам. Увеличение так называемого остаточного объема воздуха способствует насыщению крови кислородом. Увеличение объема воздуха увеличивает площадь контакта крови, протекающей через легочные капилляры, с наружным воздухом. Кроме того, из-за таких изменений наиболее часто наблюдается уменьшение возможных изменений парциального давления кислорода в альвеолярном воздухе, которое происходит в результате углубления дыхания.

Район Байсун расположен на хребте Байсунтог и характеризуется резко континентальным, сухим климатом, сильными ветрами, высоким уровнем ультрафиолетового излучения из-за влияния афганского ветра. Источники воды геохимически сильно минерализованы, жесткие и резко бедны йодом. Население рассеяно по деревням, в регионе преобладает животноводство. Для потребления населением традиционно характерно большое количество высококалорийного мяса, животных жиров и соленых продуктов. Под воздействием кислородного дефицита в тумане повышается активность фермента, расщепляющего углекислый газ, в результате чего легкие работают интенсивнее, чтобы его вывести, и последний выводится из легких в больших количествах, что также способствует лучшему насыщению крови кислородом. Поэтому наблюдается возникновение кислородного голодания тканей, а) ускоряющее прохождение крови через ткани и повышающее их гидратацию; б) увеличивающее количество кислорода, растворенного в крови, за счет увеличения количества гемоглобина; в) наиболее распространенной областью является изменение окислительных процессов в тканях.

Помимо вышесказанного, снижение заболеваемости различными аллергическими заболеваниями в горных районах обусловлено низкой концентрацией различных примесей в воздухе и увеличением продолжительности зимы с увеличением высоты. В этом отношении большое значение имеет также меньшее распространение растений, играющих

ключевую роль в возникновении некоторых форм аллергических заболеваний в условиях низменности.

ЗАКЛЮЧЕНИЕ. В заключение следует отметить, что при оценке физиологических механизмов горных районов с точки зрения адаптации, положительного или отрицательного воздействия на здоровье целесообразно учитывать, помимо биологических характеристик горных районов, которые оказывают существенное влияние на физиологические функции организма человека, геохимические характеристики, т.е. химический состав почвы, питьевой воды, пищи и т.д. В то же время другие специфические особенности – ландшафт, характер растительности и т.д. – определяют территориальные характеристики горных районов, включая важность и серьезность терапевтических и физиологических эффектов. Поэтому мы наблюдаем, что воздействие горных районов на разных высотах, но в разных горных регионах, на организм человека может значительно различаться.

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Карпец О.А.
студент
Аралбаева Г.Г., д.э.н.
научный руководитель, профессор кафедры
государственного и муниципального управления
Оренбургский государственный
университет имени В.А. Бондаренко
Россия, г. Оренбург

РОЛЬ ГОСУДАРСТВА В РАЗВИТИИ СЕЛЬСКОГО ХОЗЯЙСТВА В РЕГИОНАХ В НАСТОЯЩЕЕ ВРЕМЯ

Аннотация. Исследование посвящено вопросам роли государства в развитии сельского хозяйства в настоящее время. В рамках статьи проводится сравнение условий развития современного сельского хозяйства в Оренбургской, Самарской и Ульяновской областях. Выделяются ключевые проблемы и особенности поддержки развития сельского хозяйства в регионах со стороны государства.

Ключевые слова: сельское хозяйство, инновационные технологии, человеческий фактор, ресурсы, объем производства, климатические условия.

Karpets O.A.
student
Aralbaeva G.G., doctor of economic sciences
scientific supervisor, professor
Department of State and Municipal Administration
Orenburg State University named after V.A. Bondarenko
Russia, Orenburg

THE ROLE OF THE STATE IN THE DEVELOPMENT OF AGRICULTURE IN THE REGIONS AT PRESENT

Abstract. The study is devoted to the issues of the state's role in the development of agriculture in the present day. The article compares the conditions for the development of modern agriculture in the Orenburg, Samara, and Ulyanovsk regions. The key problems and features of state support for the development of agriculture in the regions are highlighted.

Keywords: agriculture, innovative technologies, human factor, resources, production volume, climatic conditions.

Основу продовольственной безопасности государства определяет, в первую очередь, сельское хозяйство. Поэтому важна роль органов власти в поддержке отраслей сельского хозяйства. В свою очередь, отрасли сельского

хозяйства подвержены влиянию множества факторов, которые способствуют уменьшению, либо увеличению темпов роста объемов произведенной сельскохозяйственной продукции. Эти факторы могут зависеть от местонахождения того или иного региона на территории Российской Федерации.

Объектами нашего внимания являются регионы Приволжского федерального округа: Оренбургская, Самарская и Ульяновская области. Выбор этих регионов обусловлен следующими факторами:

- схожие климатические условия – резко континентальный климат (холодная зима, жаркое лето);
- расположение на территории России;
- набор возделываемых культур определен для данных климатических условий.

Эти факторы являются общими для рассматриваемых регионов.

Рассмотрим, каким образом государство оказывает влияние на развитие сельского хозяйства в этих регионах.

Несомненно, развитие многих отраслей сельского хозяйства связано с частным бизнесом, так как он принимает активное участие в выращивании многих культур и воздействует на стоимость этой продукции. Но, в то же время государство оказывает существенное влияние на развитие отраслей сельского хозяйства. Это наблюдается в том, как государственная поддержка по этому направлению достаточно полно представлена различными видами субсидий.

Климатические условия в выбранных регионах формируют повышенные риски неурожая, влияя, таким образом, на активное применение различных механизмов страхования сельхозпроизводителей. Помимо неурожаев для субъектов предпринимательства регионов возникает потребность в поддержке превентивных мер по обеспечению противопожарной безопасности. Эти меры реализуются совместно с государственными и местными службами в рамках освоения различных новых технологий. Например, в Самарской и Оренбургской областях активно применяют дроны для контроля за противопожарной безопасностью, что позволяет своевременно выявлять очаги пожаров и снижать ущерб.

Для сравнения условий развития современного сельского хозяйства в Оренбургской, Самарской и Ульяновской областях были выделены соответствующие характеристики, представленные в таблице 1. Общим для выделенных регионов является действующая государственная программа, направленная на развитие отраслей сельского хозяйства.

Лидером среди выделенных областей по площади и доли земель сельскохозяйственного назначения является Оренбургская область, что выделяет этот регион в сельском хозяйстве в Приволжском федеральном округе. Несмотря на то, что область является лидером, объем продукции сельского хозяйства в Самарской области выше, что указывает на

эффективность использования площадей, занимаемых под отрасли сельского хозяйства.

Ключевыми особенностями этих программ по регионам выступает охват отраслей, количество мер и задач, направления по развитию отраслей сельского хозяйства, а также объем финансирования представленных направлений.

Таблица 1 – Ключевые характеристики развития современного сельского хозяйства в Оренбургской, Самарской и Ульяновской областях [3, 4, 5]

Характеристика	Ед. изм.	Регион		
		Оренбургская область	Самарская область	Ульяновская область
Площадь	тыс. км.	123,7	53,6	37,2
Доля с/х угодий	%	88,5	75,8	60,2
Объем производства с/х продукции	млр д. руб.	204,9	245,5	95,4
Программный документ поддержки с/х	–	Государственная программа «Развитие сельского хозяйства и регулирование рынков сельскохозяйственной продукции, сырья и продовольствия Оренбургской области»	Государственная программа «Развитие сельского хозяйства и регулирование рынков сельскохозяйственной продукции, сырья и продовольствия Самарской области»	Государственная программа «Развитие агропромышленного комплекса, сельских территорий и регулирование рынков сельскохозяйственной продукции, сырья и продовольствия в Ульяновской области»
Объем поддержки с/х	млн. руб.	2609	3653	221,6

В качестве основного отличия, возможно, выделить ряд отраслей, так как в случае с Самарской областью, программа развития направлена, в том числе, на регулирование рынков сельхозпроизводителей, а в Ульяновской области соответствующая программа является частью направлений по развитию агропромышленного комплекса. В последнем случае проявляется комплексный подход, направленный на интеграцию усилий производителей, укрупнение субъектов предпринимательства и создание условий для производства полного цикла.

Анализ содержания государственных программ, направленных на развитие современного сельского хозяйства в регионах позволил выделить

три ключевых направления. Эти направления можно разделить на блоки по регионам, в рамках которых каждый субъект имеет определенные меры поддержки сельскохозяйственных отраслей. Схематично ключевые направления развития современного сельского хозяйства в регионах представлены на рисунке 1.



Рисунок 1 – Ключевые направления развития современного сельского хозяйства в регионах

При рассмотрении каждого направления, формирующего соответствующий блок, необходимо отметить, что в аспекте регионов они представляют примеры практик поддержки развития отраслей сельского

хозяйства со стороны государства. Возможности применения идентичных практик и опыта других регионов также активно используются субъектами.

Ключевым направлением в сельском хозяйстве является развитие технологий. Это направление охватывает большинство задач и мер, способных повысить эффективность и решить существующие проблемы отраслей сельского хозяйства. В Оренбургской области одним из направлений по применению технологий стало использование достижений селекции, разработка новых сортов сельскохозяйственных растений, которые оптимально подходили бы под климатические условия региона.

В Самарской области одним из направлений по применению современных технологий выступает использование дронов для контроля посевов, а также субсидирование приобретения новой сельскохозяйственной техники для субъектов предпринимательства. Модернизация техники выступает ключевым направлением, которое находит свое отражение в государственных программах каждого региона.

В Ульяновской области одним из направлений развития технологий выступает цифровая платформа «Аналитический центр Минсельхоза Ульяновской области», которая позволяет реализовать комплекс функций по мониторингу и контролю состояния объектов отраслей сельского хозяйства региона.

С точки зрения направления по удержанию добавленной стоимости в регионе, необходимо отметить, что основная мера по этому блоку относится к созданию условий кооперации между сельскохозяйственными и перерабатывающими отраслями. В Оренбургской области данные процессы затронуты в формате программы поддержки «Агростартап», предусматривающей возможности субсидирования создания субъектов малого бизнеса с полным циклом производства в сельском хозяйстве. В Ульяновской области данному направлению посвящен региональный проект «Развитие отраслей и техническая модернизация агропромышленного комплекса».

Развитие мер поддержки, направленных на человеческий фактор в сельском хозяйстве имеет общие характеристики для выделенных регионов, что проявляется в содержании соответствующих программных мер. В первую очередь важно выделить меры по поддержке кадров на рынке труда, что в Оренбургской области реализуется с помощью модернизации системы образования.

Основным решением в этом регионе является углубление интеграции образования, науки и бизнеса, что может реализовываться как в рамках прохождения практик, так и в формате более глубоких интеграционных процессов, включая создание стартапов.

В Самарской области активно используются различные выплаты для работников, занятых в сельском хозяйстве. Подобное направление предусмотрено на государственном уровне и призвано снизить отток кадров из отраслей сельского хозяйства.

В Ульяновской области применяются схожие меры, которые содержатся в региональном проекте «Кадры в агропромышленном комплексе (Ульяновская область)».

Таким образом, по многим направлениям поддержки развития современного сельского хозяйства в регионах наблюдаются схожие решения, но при этом акцент делается на отдельных мерах, способных решить наиболее острые проблемы отраслей. Выделенные направления поддержки сельского хозяйства способствуют совершенствованию отрасли, увеличивает конкурентоспособность сельскохозяйственных предприятий. Через призму этих направлений государство играет ключевую роль в обеспечении условий для трансформации сельского хозяйства в этих регионах и стране в целом.

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Кевбрин И.В.
студент
научный руководитель: Алиев А.А., к.э.н.
доцент по специальности «Финансы»
Российский экономический университет имени Г.В. Плеханова
Россия, г. Москва

РИСК ЛИКВИДНОСТИ СТРАХОВОЙ КОМПАНИИ В УСЛОВИЯХ ОГРАНИЧЕНИЯ ДОСТУПА К ОТДЕЛЬНЫМ ФИНАНСОВЫМ АКТИВАМ

Аннотация. Цель работы – разграничить платежеспособность и ликвидность страховщика при ограниченном доступе к части активов. Предмет – превращение активов в денежные средства при блокировке, приостановке торгов и ограничениях расчётов. Метод – сценарный стресс-тест модельного страховщика с учётом дисконтов, сроков реализации и доли недоступных активов. Показано, что при формальном покрытии обязательств 1,22 возникает разрыв ликвидности до 12 млрд руб. Предложены показатели доступной платежеспособности и горизонтной ликвидности.

Ключевые слова: риск ликвидности; платежеспособность страховщика; заблокированные активы; стресс-тестирование; страховые резервы; разрыв ликвидности; горизонт реализации активов; финансовая устойчивость.

Kevbrin I.V.
student
Aliyev A.A., candidate of economic sciences
scientific supervisor, associate professor in Finance
Plekhanov Russian University of Economics
Russia, Moscow

LIQUIDITY RISK OF AN INSURANCE COMPANY UNDER RESTRICTED ACCESS TO CERTAIN FINANCIAL ASSETS

Abstract. The aim is to distinguish between the solvency and the liquidity of an insurer whose access to part of its assets is restricted. The subject is the conversion of assets into cash under blocking, trading suspension and settlement restrictions. The method is a scenario stress test of a model insurer accounting for haircuts, liquidation periods and the share of inaccessible assets. With a formal liability coverage of 1.22, a liquidity gap of up to RUB 12 bn arises. Indicators of accessible solvency and horizon liquidity are proposed.

Keywords: liquidity risk; insurer solvency; blocked assets; stress testing; insurance reserves; liquidity gap; asset liquidation horizon; financial stability.

Введение

Устойчивость страховой компании традиционно оценивается через призму платежеспособности: достаточности собственных средств и покрытия страховых резервов активами установленного качества. Такой подход неявно предполагает, что активы, отражённые в балансе по справедливой или амортизированной стоимости, могут быть при необходимости реализованы и превращены в денежные средства. События 2022 г. показали, что это допущение не всегда выполняется. Приостановка биржевых торгов на Московской бирже почти на месяц, блокировка ценных бумаг, учитываемых через иностранные депозитарии, ограничения на операции с контрагентами из недружественных государств [6; 7] и санкции против отдельных банков сформировали ситуацию, в которой активы существуют и учитываются в балансе, но не могут быть использованы для расчётов с кредиторами в требуемые сроки. По оценке Банка России, «Всего под блокировку попали иностранные активы на сумму около 6 трлн рублей», при этом «Инвесторы не могут продать эти бумаги на бирже и получить по ним доход», а «Быстрого способа разблокировки не существует» [2]. Страховой сектор был затронут непосредственно: регулятор констатировал, что «проблемы, возникшие в I квартале 2022 года, связанные прежде всего с заморозкой иностранных активов у ряда ПИФ и страховщиков жизни, сохраняются» [11].

Для страховщика данная проблема имеет особое значение. В отличие от банка, страховая компания не располагает доступом к рефинансированию центрального банка как к штатному источнику ликвидности, а её обязательства носят вероятностный характер и могут резко возрасти при массовых страховых событиях или при досрочном расторжении договоров страхования жизни. Российское регулирование учитывает ликвидность главным образом косвенно – через требования к составу и структуре активов, принимаемых для покрытия страховых резервов и собственных средств [9]; количественный норматив краткосрочной ликвидности, аналогичный банковскому показателю краткосрочной ликвидности (LCR) [13], для страховщиков в явном виде не установлен.

Цель исследования – обосновать необходимость раздельной оценки платежеспособности и ликвидности страховщика и предложить инструментарий стресс-тестирования, учитывающий ограничение доступа к отдельным финансовым активам. Для достижения цели решаются следующие задачи: систематизировать подходы к определению риска ликвидности страховщика; формализовать параметр доступности актива, отличный от рыночного дисконта и срока реализации; провести сценарный анализ на данных модельной страховой компании; сформулировать рекомендации для управления риском ликвидности.

Объект исследования – страховые организации, осуществляющие инвестирование средств страховых резервов и собственных средств на финансовом рынке. Предмет – механизм возникновения разрыва ликвидности при формально достаточном объёме активов. Гипотеза исследования состоит

в том, что стандартный стресс-тест рыночного риска, основанный на переоценке активов, не выявляет риск ограничения доступа, поскольку последний проявляется не в уменьшении стоимости активов, а в увеличении времени их превращения в денежные средства. Научная новизна заключается во введении в модель ликвидности страховщика отдельного параметра недоступности актива и в построении на его основе показателей доступной платежеспособности и горизонтной ликвидности.

Теоретический обзор

В экономической литературе разграничение платежеспособности и ликвидности является устоявшимся, однако применительно к страховому сектору оно разработано слабее, чем для банков. Платежеспособность характеризует соотношение стоимости активов и обязательств, то есть способность организации в принципе расплатиться по всем обязательствам. Ликвидность характеризует способность исполнять обязательства своевременно, не неся при этом неприемлемых потерь. Первая категория является стоковой и оценивается на момент времени, вторая – потоковой и всегда связана с горизонтом.

Это различие закреплено и в российском праве. Федеральный закон «О несостоятельности (банкротстве)» разграничивает недостаточность имущества – «превышение размера денежных обязательств и обязанностей по уплате обязательных платежей должника над стоимостью имущества (активов) должника» – и неплатежеспособность, то есть «прекращение исполнения должником части денежных обязательств или обязанностей по уплате обязательных платежей, вызванное недостаточностью денежных средств. При этом недостаточность денежных средств предполагается, если не доказано иное» [8]. Первое понятие соответствует утрате платежеспособности в балансовом смысле, второе – утрате ликвидности. Для финансовых организаций, к которым относятся и страховщики, закон устанавливает оба признака банкротства раздельно: наряду с тем, что «стоимость имущества (активов) финансовой организации недостаточна для исполнения денежных обязательств финансовой организации перед ее кредиторами и обязанности по уплате обязательных платежей», признаком банкротства служит и неисполнение требований кредиторов, если они «не исполнены в течение четырнадцати дней» [8]. Следовательно, страховщик с достаточными активами может быть признан неспособным удовлетворить требования кредиторов исключительно по причине нехватки денежных средств.

В отечественной литературе по страхованию ликвидность также рассматривается как самостоятельная характеристика. Л.В. Агаркова и В.В. Агарков подчёркивают, что «Ликвидность является одним из важнейших показателей, отражающих уровень финансовой устойчивости страховой компании» [1]. Т.С. Будилова указывает на временной аспект этого понятия: «Показатели ликвидности отражают достаточность по суммам и возможность по времени для покрытия средствами, находящимися в распоряжении

страховой организации, имеющихся обязательств» [3]. Там же отмечается, что «Состояние устойчивости страховщика состоит в его способности выполнения обязательств по заключенным договорам страхования при влиянии неблагоприятных факторов» [3]. Вместе с тем применяемые на практике коэффициенты ликвидности строятся по балансовым данным и не учитывают, доступен ли актив для распоряжения: вывод о том, что «у компании недостаточно наиболее ликвидных активов для покрытия наиболее срочных страховых обязательств» [3], делается исходя из классификации активов, а не из их фактической доступности.

М. Бруннермайер и Л. Педерсен выделили рыночную ликвидность (возможность продать актив без существенного влияния на цену) и ликвидность фондирования (возможность привлечь средства под залог активов) и показали, что их взаимное усиление порождает «спирали ликвидности» [14]. Ценовая сторона неликвидности исследована в работах Я. Амихуда, предложившего показатель неликвидности на основе отношения доходности к объёму торгов [12]. А. Шлейфер и Р. Вишни описали механизм вынужденных продаж, при котором активы реализуются ниже фундаментальной стоимости, поскольку естественные покупатели сами ограничены в ресурсах [19]. Для страхового сектора Р. Койен и М. Його показали, что в кризис 2008–2009 гг. американские страховщики жизни были готовы продавать полисы с существенным дисконтом ради укрепления капитала, что свидетельствует о высокой цене финансовых ограничений [18].

Во всех этих работах неликвидность выражается через цену: актив можно продать, но дешевле. При ограниченном доступе актив нельзя продать ни по какой цене, и риск смещается из плоскости оценки в плоскость времени.

В международном регулировании страхования риск ликвидности признаётся самостоятельным. Директива Solvency II требует включать управление риском ликвидности и концентрации в систему управления рисками и инвестировать активы в соответствии с принципом разумного инвестора, обеспечивая их надёжность, качество, ликвидность и доходность [15]. Международная ассоциация органов страхового надзора (IAIS) в Ключевых принципах страхования рассматривает ликвидность в составе системы управления рисками для целей платежеспособности [17], а в рамках Целостной концепции системного риска предусмотрела усиленные требования к планированию ликвидности [16]. В банковском регулировании Базельский комитет закрепил показатель LCR – отношение запаса высококачественных ликвидных активов к чистому оттоку денежных средств за 30 дней [13].

В российской практике требования к финансовой устойчивости и платежеспособности страховщиков определяются Законом «Об организации страхового дела в Российской Федерации», согласно которому «Гарантиями обеспечения финансовой устойчивости и платежеспособности страховщика являются экономически обоснованные страховые тарифы; сформированные страховые резервы; средства страховых резервов, достаточные для

исполнения обязательств по страхованию, сострахованию, перестрахованию, взаимному страхованию; собственные средства (капитал); перестрахование» [10]. Закон также устанавливает, что «Страховщики должны инвестировать собственные средства (капитал) на условиях диверсификации, ликвидности, возвратности и доходности» [10]. Эти положения конкретизируются Положением Банка России № 781-П [9], которое устанавливает требования к структуре активов, лимиты концентрации и нормативное соотношение собственных средств и принятых обязательств. Мониторинг ликвидности отражается в аналитических материалах регулятора [11], однако регуляторный показатель, учитывающий именно доступность актива, отсутствует. Таким образом, исследовательская ниша состоит в формализации риска, при котором платежеспособность сохраняется, а ликвидность утрачивается вследствие внешних ограничений на распоряжение активами.

Методы и данные

Исследование основано на сценарном стресс-тестировании модельной страховой компании. Использование модельной, а не реальной компании обусловлено тем, что сведения о составе заблокированных активов конкретных страховщиков не раскрываются в публичной отчётности в необходимой детализации. Структура баланса задана таким образом, чтобы отражать характерные для российского рынка пропорции: преобладание государственных и корпоративных облигаций и банковских депозитов в портфеле, наличие доли ценных бумаг, учитываемых через иностранную инфраструктуру, и существенной доли перестраховщиков в резервах; наличие у страховщиков активов и требований, затронутых блокировкой, отмечено регулятором [4; 11].

Формальная платежеспособность оценивается как коэффициент покрытия обязательств активами:

$$N = \frac{\sum_{i=1}^{n} A_i}{L}, \quad (1)$$

где A_i – балансовая стоимость i-го класса активов, млрд руб.; n – число классов активов; L – обязательства страховщика, включая страховые резервы, млрд руб.

Для учёта ограничения доступа каждому классу активов присваиваются три параметра: h_i – дисконт при реализации (доля потерь стоимости); τ_i – срок превращения актива в денежные средства, дней; b_i – доля актива, недоступная для распоряжения вследствие блокировки или правовых ограничений. Ключевое методическое допущение состоит в том, что параметр b_i не сводится к дисконту: недоступный актив не теряет балансовой стоимости, но исключается из источников ликвидности. На этой основе вводится показатель доступной платежеспособности:

$$N_{\text{дост}} = \frac{\sum_{i=1}^{n} A_i(1-b_i)}{L}, \quad (2)$$

Разность $N - N_{\text{дост}}$ характеризует разрыв доступности, то есть ту часть формального покрытия, которая обеспечена активами, недоступными для расчётов.

Объём доступной ликвидности на горизонте t дней определяется как сумма активов, которые с учётом дисконта и доли недоступности могут быть превращены в денежные средства не позднее t:

$$LA(t) = \sum_{i=1}^{n} A_i(1 - b_i)(1 - h_i) \cdot 1(\tau_i \le t), \qquad (3)$$

где $1(\cdot)$ – индикаторная функция, равная единице при выполнении условия в скобках и нулю в противном случае.

Горизонтный коэффициент ликвидности страховщика и разрыв ликвидности рассчитываются следующим образом:

$$LCR_{\text{стр}}(t) = \frac{LA(t)}{NCO(t)}, \; G(t) = LA(t) - NCO(t), \qquad (4)$$

где $NCO(t)$ – накопленный чистый отток денежных средств (страховые выплаты, выкупные суммы, расходы на ведение дела за вычетом поступлений страховых премий) на горизонте t, млрд руб.; $G(t)$ – разрыв ликвидности, млрд руб. Страховщик считается ликвидным на горизонте t при $LCR_{\text{стр}}(t) \ge 1$.

В отличие от банковского LCR, рассчитываемого на одном горизонте 30 дней, в модели используются горизонты 7, 30 и 90 дней, а также непрерывный расчёт $G(t)$ для каждого дня. Это позволяет выявить разрывы, возникающие внутри горизонта, но не заметные на его границе.

Баланс модельного страховщика составляет 100 млрд руб. активов при обязательствах 82 млрд руб., из которых большая часть приходится на страховые резервы, в том числе по страхованию жизни. Структура активов и параметры сценариев приведены в табл. 1. Значения параметров являются экспертными допущениями, откалиброванными по качественным характеристикам событий 2022 г.: продолжительности приостановки торгов, блокировки активов в иностранных депозитариях и затруднения расчётов с иностранными перестраховщиками [11].

Таблица 1

Структура активов модельного страховщика и параметры сценариев

Класс активов	A_i, млрд руб.	S0: h_i; τ_i, дн.	S1: h_i	S2, S3: h_i; τ_i, дн.; b_i
Денежные средства на расчётных счетах	2	0,00; 0	0,00	0,00; 0; 0,00
Банковские депозиты	12	0,01; 1	0,01	0,01; 1; 0,25
ОФЗ	30	0,02; 2	0,08	0,08; 21; 0,00
Корпоративные облигации	22	0,05; 5	0,15	0,20; 45; 0,00
Акции российских эмитентов	6	0,10; 2	0,35	0,40; 30; 0,00
Ценные бумаги в иностранных депозитариях	14	0,05; 3	0,20	0,20; 3; 1,00
Доля перестраховщиков в резервах	5	0,05; 60	0,05	0,05; 60; 0,60
Дебиторская задолженность	5	0,10; 45	0,20	0,20; 45; 0,00
Недвижимость и прочие активы	4	0,20; 180	0,30	0,30; 180; 0,00
Итого активы	100			

Рассматриваются четыре сценария. Сценарий S0 (базовый) предполагает нормальное функционирование рынка и умеренный отток: 2, 6 и 14 млрд руб. на горизонтах 7, 30 и 90 дней. Сценарий S1 (классический рыночный стресс) моделирует падение цен активов (повышенные дисконты) при одновременном росте оттока до 12, 30 и 45 млрд руб. вследствие массового досрочного расторжения договоров страхования жизни и роста выплат. Сценарий S2 (ограничение доступа) предполагает блокировку ценных бумаг в иностранных депозитариях, недоступность четверти банковских депозитов, размещённых в банке, в отношении которого введены ограничения, неисполнение 60 % обязательств иностранных перестраховщиков и приостановку биржевых торгов на 21 день при базовом оттоке. Сценарий S3 (комбинированный) сочетает ограничения доступа сценария S2 со стрессовым оттоком сценария S1.

В сценариях S2 и S3 предполагается, что заблокированные активы сохраняют балансовую оценку, что соответствует практике временных регуляторных послаблений, применявшихся в 2022 г. В частности, было установлено, что «страховым организациям до 31 декабря 2022 года не потребуется дополнительный капитал на покрытие рыночных рисков», а страховщики получили возможность «учитывать при расчете капитала попавшие под санкции платежи от некоторых европейских расчетных центров и от международных перестраховщиков» [4]. В дальнейшем финансовым организациям было предоставлено «право использовать льготные подходы к формированию резервов по заблокированным активам, предусматривающее поэтапное резервирование таких активов в течение 10 лет» [11], а для страховщиков в 2023 г. было продлено «смягчение требований по

резервированию капитала для покрытия рисков» [5]. Именно это допущение формирует ситуацию, при которой формально активов достаточно, а фактически использовать их для расчётов невозможно.

Результаты

Результаты расчётов по формулам (1)–(4) представлены в табл. 2. В базовом сценарии страховщик одновременно платежеспособен и ликвиден: коэффициент покрытия обязательств составляет 1,22, а доступная ликвидность многократно превышает отток на всех горизонтах.

Таблица 2

Показатели платежеспособности и ликвидности модельного страховщика по сценариям

Сценарий	***N***	$N_{дост}$	$LCR_{стр}$**(7)**	$LCR_{стр}$**(30)**	$LCR_{стр}$**(90)**	**Макс. разрыв, млрд руб.**
S0 – базовый	1,22	1,22	41,44	13,81	6,58	–
S1 – рыночный стресс	1,09	1,09	6,27	2,51	1,87	–
S2 – ограничение доступа	1,22	0,98	5,46	7,02	4,69	–
S3 – комбинированный	1,22	0,98	0,91	1,40	1,46	12,0

В сценарии классического рыночного стресса S1 переоценка портфеля снижает рыночный коэффициент покрытия до 1,09, то есть платежеспособность ухудшается. Однако ликвидность сохраняется: даже с учётом повышенных дисконтов на горизонте 7 дней страховщик располагает 75,3 млрд руб. доступных средств при оттоке 12 млрд руб. Иными словами, стандартный стресс-тест фиксирует потери капитала, но не обнаруживает проблемы своевременности расчётов.

В сценарии S2 картина принципиально меняется. Формальный коэффициент покрытия остаётся равным 1,22, однако доступная платежеспособность снижается до 0,98: из-за блокировки 20 млрд руб. активов страховщик, строго говоря, не может покрыть обязательства теми активами, которыми реально распоряжается. Объём ликвидности, доступной в течение 7 дней, сокращается с 82,9 до 10,9 млрд руб., то есть в 7,6 раза. При базовом оттоке этого достаточно, и компания остаётся ликвидной.

Наиболее показателен комбинированный сценарий S3. На горизонте 7 дней коэффициент $LCR_{стр}$ составляет 0,91, а разрыв ликвидности – 1,1 млрд руб. На горизонтах 30 и 90 дней коэффициент превышает единицу (1,40 и 1,46), что при оценке только по границам горизонтов создаёт впечатление кратковременной и незначительной проблемы. Непрерывный, по дням, расчёт разрыва показывает иное (см. последний столбец табл. 2): дефицит средств возникает на 7-й день и нарастает вплоть до возобновления торгов

государственными облигациями на 21-й день, достигая 12,0 млрд руб., что составляет две трети собственных средств компании. Таким образом, показатель, рассчитанный на фиксированном горизонте, занижает масштаб разрыва более чем в 10 раз.

Полученные результаты позволяют выделить четыре состояния страховщика по сочетанию платежеспособности и ликвидности (табл. 3). Ограничение доступа к активам переводит компанию из устойчивого состояния в состояние «платежеспособной неликвидности», минуя зону снижения капитала, в которую её переводит классический рыночный стресс.

Таблица 3

Состояния страховщика по сочетанию платежеспособности и ликвидности

Состояние	Платежеспособность	Ликвидность	Характеристика и сценарий модели
I. Устойчивое состояние	обеспечена	обеспечена	Активов достаточно, и они могут быть реализованы в требуемые сроки (сценарий S0)
II. Платежеспособная неликвидность	обеспечена	не обеспечена	Активов формально достаточно, но они недоступны или не могут быть быстро реализованы (сценарий S3)
III. Скрытая неплатежеспособность	не обеспечена	обеспечена	Обязательства исполняются за счёт притока средств, но капитала недостаточно; к этой зоне смещает классический рыночный стресс (сценарий S1)
IV. Кризисное состояние	не обеспечена	не обеспечена	Недостаточность и капитала, и денежных средств

Обсуждение

Результаты подтверждают выдвинутую гипотезу: риск ограничения доступа к активам качественно отличается от рыночного риска и не выявляется стресс-тестом, основанным на переоценке. В терминах работы [14] ограничение доступа одновременно разрушает рыночную ликвидность (активы нельзя продать) и ликвидность фондирования (их нельзя использовать в качестве обеспечения), но без ценового сигнала, который в обычных условиях предупреждает участников рынка о нарастании напряжения.

Полученный результат имеет и правовое измерение. Поскольку для финансовой организации признаком банкротства является неисполнение требований кредиторов в течение четырнадцати дней [8], разрыв ликвидности

продолжительностью около двух недель, выявленный в сценарии S3, создаёт для страховщика правовой риск даже при формально достаточных активах.

Второй вывод касается методики. Использование единственного горизонта, как в банковском LCR [13], оправдано для банка, который получает доступ к рефинансированию в течение 30 дней. Для страховщика, лишённого такого канала, критичным становится профиль разрыва во времени. Если бы в модели торги возобновились не на 21-й, а на 35-й день, показатель на горизонте 30 дней также указал бы на дефицит, однако при 21-дневной приостановке он маскирует разрыв. Следовательно, для страховщиков целесообразен расчёт максимального разрыва на всём интервале, а не только на его границах.

Третий вывод связан с поведением страховщика в условиях разрыва. Для его покрытия компания будет вынуждена реализовать активы, остающиеся доступными, – прежде всего ликвидные государственные облигации и депозиты, – что сопряжено с эффектом вынужденных продаж [19] и ухудшает качество оставшегося портфеля: в нём непропорционально возрастает доля заблокированных и труднореализуемых активов. Эту проблему подтверждает и позиция Банка России: поскольку «Быстрого способа разблокировки не существует» [2], доля таких активов в портфеле может сохраняться годами. Если ограничения носят не единичный характер, а затрагивают многих страховщиков одновременно, синхронные продажи способны усилить ценовое давление на рынке государственного долга, что соответствует системному измерению риска ликвидности, отмеченному IAIS [16].

На практике выявленный механизм может быть снижен несколькими способами. Во-первых, целесообразно раскрывать во внутренней отчётности показатель доступной платежеспособности $N_{\text{дост}}$ наряду с формальным коэффициентом покрытия. Во-вторых, лимиты концентрации следует устанавливать не только по эмитентам и контрагентам, но и по инфраструктуре: депозитариям, расчётным банкам, юрисдикциям. В-третьих, запас ликвидности должен рассчитываться исходя из максимального разрыва $G(t)$ в комбинированном сценарии; для модельного страховщика это означает поддержание дополнительного буфера денежных средств и депозитов до востребования в размере около 12 млрд руб.

Исследование имеет ограничения. Параметры модели заданы экспертно, а не оценены эконометрически, и результаты носят иллюстративный характер. Не учитываются поведенческая обратная связь (информация о заблокированных активах может ускорить расторжение договоров) и налоговые последствия реализации активов. Направлениями дальнейших исследований являются калибровка параметров доступности на данных надзорной отчётности, эндогенизация оттока и оценка системного эффекта на уровне страхового сектора.

Заключение

По итогам исследования можно сформулировать следующие выводы.

1. Платежеспособность и ликвидность страховщика являются самостоятельными характеристиками; ограничение доступа к активам способно лишить компанию ликвидности без снижения формальных показателей платежеспособности.

2. Риск ограничения доступа не сводится к рыночному: он проявляется не в падении стоимости активов, а в увеличении срока их превращения в денежные средства, поэтому не выявляется стресс-тестами, основанными на переоценке.

3. Предложенный параметр недоступности актива и показатель доступной платежеспособности позволяют количественно оценить разрыв между формальным и фактическим покрытием обязательств: для модельного страховщика он составил 0,24 при формальном коэффициенте 1,22 и доступном 0,98.

4. Оценка ликвидности на фиксированных горизонтах занижает масштаб проблемы: в комбинированном сценарии максимальный разрыв (12,0 млрд руб.) более чем в 10 раз превышает разрыв на границе семидневного горизонта (1,1 млрд руб.).

5. Практическая значимость работы состоит в возможности использовать предложенный инструментарий в системе управления рисками страховщика и при разработке надзорных подходов к регулированию риска ликвидности в страховом секторе.

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Кобилов А.У.
профессор кафедры «Цифровая экономика
и информационная безопасность»
Ишанходжаева Д.Э.
профессор кафедры «Цифровая экономика
и информационная безопасность»
Ташкентский государственный экономический университет

РОЛЬ ИСКУСТВЕННОГО ИНТЕЛЛЕКТА В ЦИФРОВОЙ ЭКОНОМИКЕ

Аннотация. В статье «Роль искусственного интеллекта в цифровой экономике» рассматриваются значение и основные направления применения технологий искусственного интеллекта в условиях цифровой трансформации экономики. Раскрываются преимущества использования искусственного интеллекта, включая автоматизацию бизнес-процессов, повышение производительности труда, совершенствование финансовых операций и персонализацию услуг. Особое внимание уделяется развитию искусственного интеллекта в Республике Узбекистан и его применению в образовании, здравоохранении, сельском хозяйстве, транспорте и логистике. Анализируются основные проблемы внедрения ИИ, связанные с доступностью качественных данных, развитием технической инфраструктуры, недостаточным финансированием исследований, а также обеспечением конфиденциальности и безопасности информации. Обосновывается, что эффективное использование искусственного интеллекта способствует ускорению цифровой трансформации, экономическому росту, повышению качества государственных услуг и улучшению качества жизни населения.

Ключевые слова: искусственный интеллект, цифровая экономика, цифровая трансформация, автоматизация, инновации, машинное обучение, информационные технологии, Узбекистан, защита данных, экономическое развитие.

Kobilov A.U.
professor
Department of Digital Economy and Information Security
Ishankhodzhaeva D.E.
professor
Department of Digital Economy and Information Security
Tashkent State University of Economics

THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE DIGITAL ECONOMY

Abstract. The article "The Role of Artificial Intelligence in the Digital Economy" examines the significance and key application areas of artificial intelligence (AI) technologies within the context of the economy's digital transformation. It highlights the benefits of using AI, including business process automation, increased labor productivity, improved financial operations, and service personalization. Particular attention is paid to the development of AI in the Republic of Uzbekistan and its application in sectors such as education, healthcare, agriculture, transport, and logistics. The article analyzes key challenges associated with AI implementation, such as the availability of high-quality data, technical infrastructure development, insufficient research funding, and the assurance of information privacy and security. It argues that the effective use of artificial intelligence fosters accelerated digital transformation and economic growth, while also enhancing the quality of public services and the population's standard of living.

Keywords: artificial intelligence, digital economy, digital transformation, automation, innovation, machine learning, information technology, Uzbekistan, data protection, economic development.

Цифровая экономика в последние годы быстро развивалась и стала основным двигателем технологической революции. Искусственный интеллект становится основным направлением цифровой экономики. Технологии искусственного интеллекта играют важную роль в цифровой экономике и оказывают широкое влияние: от оптимизации бизнес-процессов до создания новых инноваций. В этой статье мы остановимся на роли искусственного интеллекта в цифровой экономике, его преимуществах и проблемах.

Искусственный интеллект - это способность компьютерных систем воспроизводить умственную деятельность человека. С помощью этих технологий большие объемы обработки данных и процессов принятия решений автоматизируются с помощью программного обеспечения, баз данных и аналитических инструментов. Цифровая экономика относится к экономическим системам, основанным на Интернете и информационных технологиях. Он осуществляет большую часть экономической деятельности в цифровом формате.

Преимущества искусственного интеллекта. Искусственный интеллект экономит рабочую силу и повышает эффективность за счет автоматизации монотонных и повторяющихся задач. Например, в этой сфере широко используются чат-боты для обслуживания клиентов, автоматическая финансовая отчетность и автоматизация производственных процессов. В первом полугодии 2024 года объем автоматизированной торговли на мировом финансовом рынке достиг 70%.

Технологии искусственного интеллекта эффективно помогают в обнаружении финансового мошенничества. Банки и финансовые учреждения повышают эффективность обнаружения мошенничества на 50% с помощью искусственного интеллекта.

Уровень индивидуализации рекламных и маркетинговых кампаний повысился с помощью искусственного интеллекта. В первой половине 2024 года расходы на индивидуальную рекламу составляли 60% мировых рекламных расходов.

Развитие технологий искусственного интеллекта создаст новые рабочие места. Например, в первой половине 2024 года количество рабочих мест, связанных с технологиями искусственного интеллекта, увеличится на 10% во всем мире.

Количество стартапов, использующих технологии искусственного интеллекта, увеличивается с каждым годом. В первой половине 2024 года стартапы, связанные с ИИ, занимали 25% мирового рынка стартапов.

Расцвет искусственного интеллекта в Узбекистане: возможности и проблемы

В последние годы Узбекистан добился значительного прогресса в сфере искусственного интеллекта (ИИ). Учитывая растущий интерес к технологическим инновациям и видение цифровой трансформации, страна использует искусственный интеллект для стимулирования прогресса в различных областях. В этой статье рассматривается текущее состояние искусственного интеллекта в Узбекистане, его применение, а также предстоящие проблемы и возможности.

Внедрение искусственного интеллекта в Узбекистане отражает более широкую глобальную тенденцию, в которой страны все больше признают потенциал ИИ для ускорения экономического развития, улучшения государственных услуг и решения социальных проблем. Правительство Узбекистана продемонстрировало приверженность интеграции искусственного интеллекта в свои национальные стратегии и активно работает над политикой и инициативами по поддержке этого технологического развития.

Области применения ИИ в Узбекистане

Образование:

Персонализированное обучение. Внедряются обучающие платформы на базе искусственного интеллекта, обеспечивающие учащимся персонализированный опыт обучения. Эти платформы используют анализ данных для адаптации учебного контента и методов обучения к индивидуальным потребностям учащихся.

Поддержка учителей. Также разрабатываются инструменты искусственного интеллекта, которые помогут учителям создавать эффективные планы уроков, оценивать успеваемость учащихся и осуществлять целевые вмешательства.

Здравоохранение:

Диагностика и лечение: приложения искусственного интеллекта повышают точность диагностики и планирования лечения. Алгоритмы машинного обучения анализируют медицинские данные, чтобы выявить

заболевания на ранней стадии и рекомендовать персонализированные планы лечения.

Мониторинг здоровья: системы мониторинга здоровья на основе искусственного интеллекта используются для отслеживания показателей здоровья пациентов и прогнозирования потенциальных проблем со здоровьем до того, как они станут серьезными.

Сельское хозяйство:

Точное земледелие: ИИ меняет сельское хозяйство с помощью методов точного земледелия. Системы искусственного интеллекта анализируют состояние почвы, погодные условия и здоровье сельскохозяйственных культур, чтобы оптимизировать стратегии посадки и повысить урожайность.

Управление животноводством: инструменты искусственного интеллекта также используются для мониторинга и управления домашним скотом, повышения продуктивности и обеспечения благополучия животных.

Транспорт и логистика:

Интеллектуальное управление дорожным движением. Искусственный интеллект используется для оптимизации транспортных потоков и уменьшения заторов с помощью интеллектуальных систем управления дорожным движением.

Оптимизация логистики. Решения искусственного интеллекта улучшают управление логистикой и цепочками поставок за счет прогнозирования спроса, оптимизации маршрутов и улучшения управления запасами.

Задачи, стоящие перед развитием искусственного интеллекта в Узбекистане

Несмотря на многообещающие изменения, Узбекистану предстоит решить ряд задач и проблем в развитии искусственного интеллекта. То есть:

Доступность данных. Доступ к высококачественным данным необходим для обучения моделей ИИ. Отсутствие полных и надежных наборов данных может препятствовать разработке и внедрению технологий искусственного интеллекта.

Техническая инфраструктура. Для разработки и внедрения решений искусственного интеллекта требуется надежная техническая инфраструктура, включая вычислительные ресурсы и высокоскоростной Интернет. Некоторые регионы Узбекистана не имеют необходимой инфраструктуры.

Исследования и разработки. Инвестиции в исследования и разработки имеют решающее значение для стимулирования инноваций. Страна должна поддерживать и поощрять исследования и разработки в области искусственного интеллекта.

Конфиденциальность данных. Поскольку системы искусственного интеллекта полагаются на большие объемы данных, обеспечение конфиденциальности и безопасности данных имеет решающее значение. Необходимо создать четкие правила и основы защиты данных. Поскольку системы искусственного интеллекта полагаются на большие объемы данных,

обеспечение конфиденциальности и безопасности данных имеет решающее значение. Необходимо создать четкие правила и рамки защиты данных. Поскольку системы ИИ полагаются на большие объемы данных, очень важно обеспечить конфиденциальность и безопасность данных. Необходимо создать четкие правила и основы защиты данных.

Искусственный интеллект - неотъемлемая часть цифровой экономики, которая помогает сделать экономические процессы более эффективными и индивидуализированными. Однако необходимо учитывать проблемы, связанные с развитием технологий искусственного интеллекта и их широким распространением.

Положительное влияние технологий искусственного интеллекта можно максимизировать, решая вопросы конфиденциальности данных, занятости, технологической зависимости и этических проблем. Будущее цифровой экономики тесно связано с тем, как искусственный интеллект преодолеет эти проблемы и создаст новые возможности. Развитие искусственного интеллекта в Узбекистане является важным шагом на пути к цифровой трансформации и технологическому развитию. Хотя проблемы остаются, приверженность страны интеграции искусственного интеллекта в различные отрасли открывает многообещающие возможности для экономического роста, улучшения государственных услуг и улучшения качества жизни. Решая существующие проблемы и используя возможности сотрудничества и инноваций, Узбекистан сможет использовать весь потенциал искусственного интеллекта и проявить себя как лидер цифровой эпохи.

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Комилова Н.Х., магистр
Вестминстерский международный университет в Ташкенте
Узбекистан, г. Ташкент

ВЛИЯНИЕ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА НА РЫНОК ТРУДА УЗБЕКИСТАНА: ИЗМЕНЕНИЕ СТРУКТУРЫ ЗАНЯТОСТИ, ПРОФЕССИОНАЛЬНАЯ ТРАНСФОРМАЦИЯ И СПРОС НА НОВЫЕ НАВЫКИ

Аннотация. В статье рассматривается влияние технологий искусственного интеллекта на рынок труда Республики Узбекистан, анализируются возможные изменения структуры занятости, трансформация профессиональной деятельности и формирование спроса на новые компетенции. Актуальность исследования обусловлена активным развитием цифровой экономики, расширением возможностей автоматизации и внедрением интеллектуальных систем в различные сферы общественной и экономической жизни. Особое внимание уделяется воздействию искусственного интеллекта на характер трудовых функций, содержание профессий и требования работодателей к квалификации работников. Методологическую основу исследования составляют системный и сравнительный анализ, изучение научных публикаций, контент-анализ и логическое обобщение. Обосновывается положение о том, что внедрение искусственного интеллекта не следует рассматривать исключительно как фактор сокращения рабочих мест, поскольку оно также способствует повышению производительности труда, изменению профессиональных функций и появлению новых направлений занятости.

Ключевые слова: искусственный интеллект, рынок труда, занятость, профессиональная трансформация, цифровая экономика, автоматизация, цифровая грамотность, профессиональные компетенции, человеческий капитал, Узбекистан.

Komilova N.Kh., master's degree
Westminster International University in Tashkent
Uzbekistan, Tashkent

THE IMPACT OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES ON THE LABOR MARKET OF UZBEKISTAN: CHANGES IN EMPLOYMENT STRUCTURE, PROFESSIONAL TRANSFORMATION, AND DEMAND FOR NEW SKILLS

Abstract. This article examines the impact of artificial intelligence technologies on the labor market of the Republic of Uzbekistan, analyzing potential changes in the employment structure, the transformation of professional activities, and the emergence of demand for new competencies. The relevance of the study is

обусловлена by the rapid development of the digital economy, the expansion of automation capabilities, and the integration of intelligent systems into various spheres of social and economic life. Particular attention is paid to the influence of artificial intelligence on job functions, the content of professions, and employers' requirements regarding workers' qualifications. The methodological framework of the study includes systematic and comparative analysis, a review of scientific publications, content analysis, and logical generalization. The article substantiates the view that the introduction of artificial intelligence should not be considered solely a factor contributing to job losses, as it can also increase labor productivity, transform professional functions, and create new employment opportunities.

Keywords: artificial intelligence, labor market, employment, professional transformation, digital economy, automation, digital literacy, professional competencies, human capital, Uzbekistan.

ВВЕДЕНИЕ (INTRODUCTION)

Современный этап экономического развития характеризуется ускоренным внедрением цифровых технологий, автоматизированных систем и инструментов искусственного интеллекта. Технологические изменения оказывают существенное влияние на организацию производства, предоставление услуг, управление предприятиями и взаимодействие между работодателями и работниками. Искусственный интеллект становится одним из факторов, определяющих направления модернизации экономики и формирующих новые требования к профессиональной подготовке кадров.

Применение интеллектуальных систем позволяет обрабатывать значительные объёмы информации, автоматизировать повторяющиеся операции, анализировать данные, формировать прогнозы и поддерживать принятие управленческих решений. В результате изменяются не только способы выполнения отдельных трудовых операций, но и содержание многих профессий. Работникам всё чаще необходимо сочетать традиционные профессиональные знания с цифровыми компетенциями, аналитическим мышлением и умением использовать современные технологические инструменты.

Влияние искусственного интеллекта на рынок труда имеет неоднозначный характер. С одной стороны, автоматизация определённых функций способна уменьшать потребность в ручном выполнении стандартных операций и изменять спрос на работников отдельных профессиональных групп. С другой стороны, внедрение новых технологий создаёт возможности для повышения производительности, развития инновационных услуг и формирования новых направлений профессиональной деятельности.

В исследовании Международной организации труда, опубликованном в 2025 году, отмечается, что примерно четверть мировой занятости в той или иной степени связана с профессиями, потенциально подверженными воздействию генеративного искусственного интеллекта. При этом

воздействие технологии на содержание профессиональных задач представляется более вероятным сценарием, чем полное исчезновение большинства соответствующих профессий. Данный показатель отражает потенциальную технологическую подверженность, а не фактически произошедшее сокращение рабочих мест (ILO, 2025).

Для Республики Узбекистан изучение данной проблемы имеет особое значение. Развитие цифровой экономики, расширение применения информационных технологий и внедрение искусственного интеллекта в различные отрасли требуют соответствующего развития человеческого капитала. Технологическая модернизация может способствовать повышению эффективности предприятий, однако её результаты во многом зависят от готовности работников осваивать новые инструменты и адаптироваться к изменяющимся условиям профессиональной деятельности.

МЕТОДОЛОГИЯ ИССЛЕДОВАНИЯ (METHODS)

Методологическую основу исследования составляет комплексный подход к изучению взаимосвязи технологического развития, занятости и человеческого капитала. В рамках работы искусственный интеллект рассматривается не только как технологический инструмент, но и как фактор изменения организации труда, требований к квалификации работников и механизмов профессиональной адаптации.

Системный анализ применён для рассмотрения влияния искусственного интеллекта на рынок труда во взаимосвязи с экономическими, социальными, образовательными и технологическими факторами. Такой подход позволяет учитывать, что последствия автоматизации определяются не только техническими возможностями интеллектуальных систем, но и уровнем цифровой инфраструктуры, стоимостью внедрения технологий и готовностью организаций к организационным изменениям.

Сравнительный анализ использован для сопоставления выводов международных исследований о потенциальном воздействии искусственного интеллекта на профессиональную деятельность с приоритетами цифрового развития Республики Узбекистан. В качестве информационной основы рассмотрены материалы Международной организации труда, Всемирного экономического форума и нормативные документы Республики Узбекистан, посвящённые развитию технологий искусственного интеллекта.

Контент-анализ научных и аналитических источников позволил выделить основные тенденции изменения профессиональных функций, развития цифровых компетенций и формирования новых направлений занятости. При рассмотрении профессий основное внимание уделялось не их названиям, а конкретным трудовым задачам, которые могут выполняться с использованием интеллектуальных технологий.

Логическое обобщение применялось для систематизации результатов анализа и формирования практических рекомендаций, направленных на повышение готовности работников к технологическим изменениям.

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ (RESULTS)

Результаты проведённого анализа позволяют выделить три взаимосвязанных направления воздействия искусственного интеллекта на рынок труда: автоматизацию отдельных операций, дополнение человеческого труда интеллектуальными инструментами и формирование новых профессиональных направлений.

Первое направление связано с автоматизацией стандартизированных и повторяющихся операций. Современные интеллектуальные системы способны помогать в обработке документов, классификации информации, подготовке типовых отчётов, первоначальном анализе данных и формировании стандартных ответов на запросы клиентов. Применение таких инструментов может уменьшать время выполнения определённых операций и изменять распределение трудовых ресурсов внутри организаций.

Однако возможность автоматизации отдельной задачи не означает неизбежного исчезновения соответствующей профессии. Большинство профессиональных видов деятельности включает несколько различных функций, в том числе коммуникацию, принятие решений, контроль качества и решение нестандартных проблем. Поэтому технологическое воздействие необходимо оценивать на уровне отдельных трудовых задач.

Второе направление предполагает использование искусственного интеллекта для повышения эффективности человеческого труда. Например, экономисты могут применять интеллектуальные системы для предварительного анализа информации, преподаватели — для разработки учебных материалов, переводчики — для подготовки черновых вариантов перевода, а специалисты по информационным технологиям — для анализа программного кода и выявления возможных ошибок.

В подобных случаях искусственный интеллект выполняет вспомогательную функцию, тогда как человек сохраняет ответственность за проверку результатов, интерпретацию информации и принятие окончательных решений. Эффективность такого взаимодействия зависит от профессиональной квалификации работника и его способности критически оценивать результаты работы алгоритмов.

Третье направление связано с развитием новых профессиональных функций. Расширение использования искусственного интеллекта повышает значимость задач по обработке данных, интеграции программных решений, обеспечению информационной безопасности, контролю качества алгоритмов и управлению цифровыми продуктами. Это может способствовать развитию спроса на специалистов по анализу данных, машинному обучению, информационной безопасности и внедрению интеллектуальных систем.

Профессиональная трансформация представляет собой изменение содержания трудовых обязанностей, методов выполнения работы и требований к квалификации специалистов. Под воздействием искусственного интеллекта отдельные операции могут выполняться быстрее, в то время как

возрастает значение аналитических, коммуникативных и контрольных функций.

В сфере информационных технологий интеллектуальные инструменты могут ускорять подготовку программного кода, тестирование программ и поиск ошибок. Одновременно возрастает значение проектирования архитектуры программных решений, обеспечения безопасности и контроля качества.

В журналистике, издательской деятельности и переводе искусственный интеллект позволяет создавать первоначальные версии текстов, выполнять предварительный перевод и структурировать информационные материалы. Однако проверка фактов, сохранение смысловых оттенков, учёт культурного контекста и соблюдение авторских прав требуют внимательного участия специалиста.

В государственном управлении интеллектуальные системы могут использоваться для классификации обращений, анализа документов и систематизации данных. При этом решения, затрагивающие права граждан, должны приниматься с учётом законодательства, принципов прозрачности, защиты персональных данных и возможности человеческого контроля.

Для анализа перспектив развития рынка труда целесообразно выделить три условных сценария.

Первый сценарий — постепенная технологическая адаптация. Внедрение искусственного интеллекта происходит относительно медленно вследствие ограниченности ресурсов, недостаточной цифровой инфраструктуры или нехватки подготовленных специалистов. В результате технологические изменения распространяются неравномерно между секторами экономики и регионами.

Второй сценарий — развитие сотрудничества человека и искусственного интеллекта. Предприятия внедряют интеллектуальные инструменты одновременно с обучением работников и модернизацией организационных процессов. В таком случае автоматизация повторяющихся операций может позволить специалистам уделять больше времени аналитической, творческой и управленческой деятельности.

Третий сценарий — ускоренная автоматизация. Интеллектуальные технологии быстро внедряются в значительное количество трудовых процессов, однако система профессиональной переподготовки не успевает адаптироваться к новым требованиям. Это может привести к трудностям у работников, чьи обязанности в значительной степени состоят из стандартизированных операций.

Указанные сценарии не являются статистическими прогнозами. Они отражают возможные направления развития рынка труда и подчёркивают значимость образовательной политики, профессиональной мобильности и готовности организаций к технологическим изменениям.

ОБСУЖДЕНИЕ РЕЗУЛЬТАТОВ (DISCUSSION)

Полученные результаты позволяют утверждать, что влияние искусственного интеллекта на рынок труда необходимо оценивать с учётом взаимосвязи технологических возможностей, экономических условий и человеческого капитала. Само наличие технологии, способной выполнять определённую операцию, не означает её немедленного внедрения в реальную профессиональную деятельность. На практике значение имеют стоимость внедрения, качество исходных данных, организационная готовность предприятия, требования законодательства и необходимость контроля результатов.

Выводы Международной организации труда о преимущественном изменении профессиональных задач, а не полном исчезновении большинства профессий, имеют важное значение для анализа перспектив занятости в Узбекистане. Они указывают на необходимость изучать не только численность рабочих мест, но и изменение содержания трудовых функций, квалификационных требований и условий профессиональной деятельности.

При этом международные оценки нельзя автоматически переносить на национальный рынок труда. Структура занятости, уровень цифровизации предприятий, распространённость технологий и доступность профессионального образования в разных странах отличаются. Поэтому для определения фактического масштаба воздействия искусственного интеллекта на рынок труда Узбекистана необходимы дополнительные национальные исследования.

Первое направление практического применения результатов связано с совершенствованием образовательной системы. Учебные программы целесообразно дополнять практическими заданиями по анализу данных, использованию интеллектуальных инструментов, проверке информации и решению профессиональных задач с применением цифровых технологий. При этом развитие цифровых компетенций должно сопровождаться формированием критического мышления и пониманием этических ограничений использования искусственного интеллекта.

Второе направление касается профессиональной переподготовки. Изменение требований к квалификации затрагивает не только молодых специалистов, но и работников, имеющих значительный профессиональный опыт. Для повышения их адаптивности необходимо расширять доступ к краткосрочным курсам, практическим программам повышения квалификации, стажировкам и обучению непосредственно на рабочем месте.

Третье направление связано с развитием взаимодействия работодателей и образовательных организаций. Предприятия располагают информацией о практических задачах и требованиях к специалистам, тогда как образовательные учреждения обеспечивают систематизированную подготовку кадров. Сотрудничество между ними позволяет своевременно корректировать содержание образовательных программ и формировать компетенции, соответствующие потребностям экономики.

Четвёртое направление предполагает совершенствование механизмов социальной адаптации. Работникам, чьи профессиональные функции изменяются вследствие автоматизации, необходимо предоставлять возможности для приобретения новых навыков и перехода к другим видам деятельности. Приоритетное значение имеют доступность обучения, профессиональное консультирование и содействие трудоустройству.

Отдельного внимания требуют вопросы этики и безопасности. Использование алгоритмов при подборе персонала, оценке эффективности работников и распределении трудовых задач должно сопровождаться контролем достоверности результатов, соблюдением законодательства и предотвращением необоснованной дискриминации. Решения, затрагивающие права и законные интересы работников, должны предусматривать надлежащие механизмы проверки и обжалования.

ЗАКЛЮЧЕНИЕ (CONCLUSION)

Проведённое исследование показывает, что технологии искусственного интеллекта выступают значимым фактором трансформации современного рынка труда. Их внедрение влияет на содержание профессиональных функций, способы организации трудовых процессов и требования к квалификации работников. При этом воздействие искусственного интеллекта не ограничивается автоматизацией: оно также связано с повышением производительности, изменением профессиональных задач и формированием новых направлений деятельности.

Установлено, что анализ влияния искусственного интеллекта на занятость должен учитывать три взаимосвязанных процесса: автоматизацию отдельных операций, дополнение человеческого труда интеллектуальными инструментами и развитие новых профессиональных функций. Такой подход позволяет более объективно оценивать потенциальные риски и возможности технологических изменений.

Для Республики Узбекистан особое значение имеет развитие человеческого капитала, способного адаптироваться к новым условиям цифровой экономики. Устойчивость рынка труда будет зависеть не только от скорости внедрения интеллектуальных технологий, но и от доступности качественного образования, возможностей профессиональной переподготовки и готовности предприятий инвестировать в развитие работников.

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Косимов Н.
старший преподаватель кафедры географии
Холботаев Г.Ш.
стажёр-преподаватель кафедры географии
Джизакский государственный педагогический университет

ТЕНДЕНЦИИ ПОТЕПЛЕНИЯ КЛИМАТА В БАССЕЙНЕ РЕКИ САНГЗАР (НА ПРИМЕРЕ БАХМАЛЬСКОГО РАЙОНА)

Аннотация. В статье проанализированы многолетние изменения температуры воздуха и атмосферных осадков за 1991–2020 гг. в части бассейна реки Сангзар, относящейся к Бахмальскому району. Среднегодовая температура составила 16,4 °C и повышалась на 0,58 °C за 10 лет. Среднегодовое количество осадков составило 434,5 мм; тенденция к их сокращению статистически незначима, однако в 2011–2020 гг. в девяти годах из десяти осадков выпало меньше нормы. Дана оценка благоприятности климата бассейна для сельского хозяйства по высотным поясам.

Ключевые слова: бассейн реки Сангзар, Бахмальский район, потепление климата, температура воздуха, атмосферные осадки, агроклиматическая оценка.

Kosimov N.
senior lecturer
Department of Geography
Xolbotayev G.Sh.
trainee lecturer
Department of Geography
Jizzakh State Pedagogical University

CLIMATE WARMING TRENDS IN THE SANGZOR RIVER BASIN: A CASE STUDY OF BAKHMAL DISTRICT

Abstract. The article analyses long-term changes in air temperature and precipitation over 1991–2020 in the part of the Sangzor River basin within the Bakhmal district. The annual mean temperature was 16.4 °C and increased by 0.58 °C per decade. Mean annual precipitation was 434.5 mm; its decreasing trend is not statistically significant, but in nine of the ten years of 2011–2020 precipitation was below the norm. The climatic suitability of the altitudinal zones of the basin for agriculture was assessed.

Keywords: Sangzor River basin, Bakhmal district, climate warming, air temperature, precipitation, agroclimatic assessment.

Введение. По данным МГЭИК, в 2011–2020 гг. средняя температура приземного воздуха превысила уровень 1850–1900 гг. на 1,09 °C, а над сушей

– на 1,59 °C [1]. В Центральной Азии потепление происходит быстрее, чем в среднем по земному шару [2, 3]. В Узбекистане в 1991–2016 гг. скорость потепления в центральных районах достигала 0,52 °C/10 лет [4], а среднегодовая температура по стране повысилась на 1,6 °C [5, 6].

Река Сангзар является одним из основных источников воды Джизакской области; верхняя и средняя части её бассейна расположены на территории Бахмальского района [7]. Имеющиеся работы по бассейну посвящены преимущественно гидрологическому режиму Джизакского водохранилища [8], тогда как тенденции изменения температуры и осадков изучены недостаточно. Цель исследования – выявить изменения температуры воздуха и осадков в Бахмальской части бассейна реки Сангзар за 1991–2020 гг. и оценить благоприятность климата для сельского хозяйства.

Материалы и методы. Бассейн реки Сангзар расположен между 39°30′–40°15′ с.ш. и 67°15′–68°15′ в.д.; с юга он ограничен Туркестанским хребтом и горами Чумкартау, с севера – Мальгузарскими горами (рис. 1). Абсолютные высоты изменяются от 714 м до более чем 2786 м.

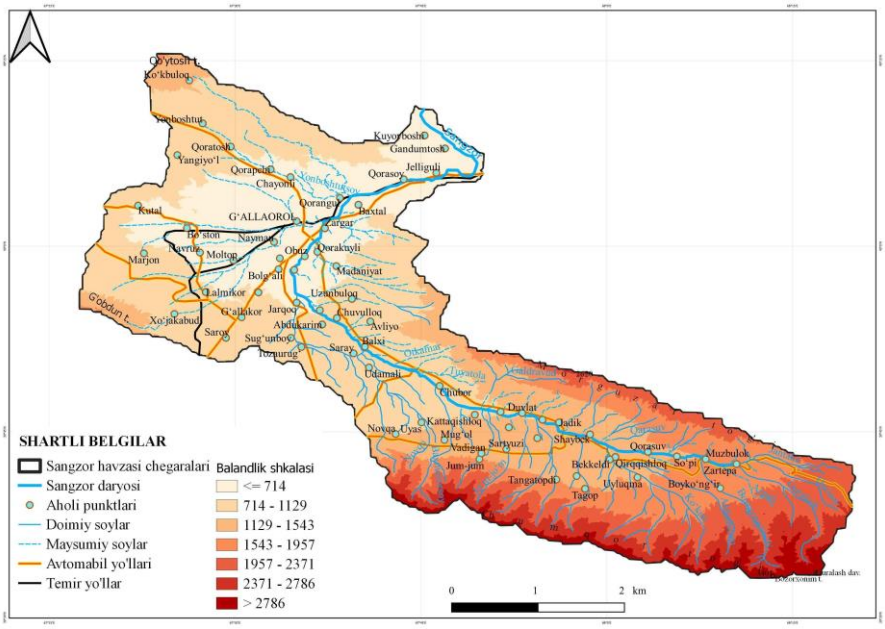


Рис. 1. Гипсометрическая карта бассейна реки Сангзар (составлена автором)

В исследовании использованы ряды среднегодовой температуры воздуха и годовых сумм осадков по Бахмальскому району за 1991–2020 гг. . Этот период соответствует действующей климатической норме [9]. Для каждого года определено отклонение от 30-летнего среднего (аномалия), многолетние изменения оценены с помощью линейного тренда, а его значимость проверена тестом Манна–Кендалла [10]. Для агроклиматической оценки территория бассейна разделена на шесть высотных зон по высоте, температуре, осадкам, потребности в орошении и опасности эрозии.

Результаты. *Температура воздуха.* В 1991–2020 гг. среднегодовая температура составила 16,4 °C. Самым холодным был 1993 г. (14,4 °C), самым тёплым – 2016 г. (18,0 °C). Температура повышалась на 0,58 °C за 10 лет, а за 30 лет – примерно на 1,7 °C (рис. 2). Тест Манна–Кендалла подтвердил значимость тренда (p = 0,003). Если в 1991–1998 гг. восемь лет подряд температура была ниже нормы, то десятилетие 2011–2020 гг. оказалось на 1,1 °C теплее периода 1991–2000 гг.

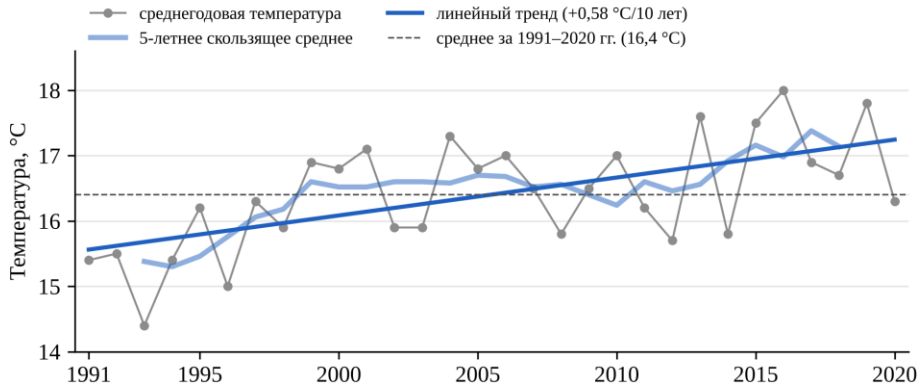


Рис. 2. Среднегодовая температура воздуха в Бахмальском районе и её тренд (1991–2020 гг.)

Атмосферные осадки. Среднегодовое количество осадков составило 434,5 мм, изменяясь по годам от 300,0 мм (1995 г.) до 681,3 мм (2003 г.). Тенденция к сокращению осадков (–19 мм/10 лет) статистически незначима (p = 0,29). Однако в 2011–2020 гг. в девяти годах из десяти осадков выпало меньше нормы, а многоводные годы не наблюдались (рис. 3, табл. 1).

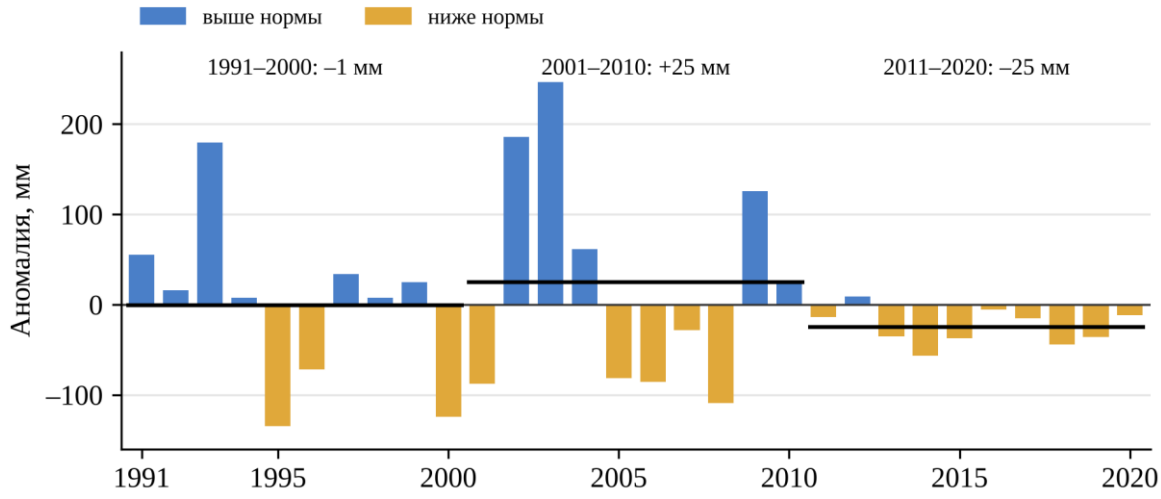


Рис. 3. Аномалии годовых сумм осадков в Бахмальском районе (1991–2020 гг.)

Таблица 1.
Основные показатели температуры воздуха и осадков (1991–2020 гг.)

Показатель	Температура	Осадки
Среднее за 30 лет	16,4 °C	434,5 мм
Изменение за 10 лет	+0,58 °C	–19,4 мм
Среднее за 1991–2000 гг.	15,8 °C	433,9 мм
Среднее за 2011–2020 гг.	16,9 °C	409,9 мм
Значимость тренда	значим (p = 0,003)	незначим (p = 0,29)

Агроклиматическая оценка. Благоприятность климата бассейна для сельского хозяйства снижается с высотой (табл. 2). Нижние части бассейна на высотах 400–700 м наиболее благоприятны, однако при осадках 250–350 мм земледелие здесь зависит от орошения. На адырах и склонах на высотах 700–2000 м количество осадков достигает 400–500 мм, что позволяет вести богарное земледелие. Территории выше 2000 м используются преимущественно как пастбища.

Таблица 2.
Оценка климата бассейна реки Сангзар для сельского хозяйства

Зона	Высота, м	Температура (январь / июль), °C	Осадки, мм	Оценка	Использование
Нижние равнины (Галляарал)	400–500	–1…–2 / +26…+28	250–350	наиболее благоприятная	зерновые, овощи, бахчевые
Среднее течение Сангзара	500–700	–2…–3 / +22…+25	300–350	благоприятная	сады, овощи, бахчевые
Предгорные адыры	700–1200	–3…–4 / +18…+20	400–450	средняя	богарные зерновые, сады
Горные склоны	1200–2000	–3…–5 / +22…+25	450–500	ниже средней	богара, животноводство
Высокогорья	2000–2500	–6…–8 / +15…+18	500–700	неблагоприятная	пастбища
Водораздельные части	2500–3400	–8…–10 / +15…+16	500–700	непригодная	летние пастбища

Обсуждение. Выявленная в Бахмальском районе скорость потепления (0,58 °C/10 лет) несколько выше показателя центральных районов Узбекистана (0,52 °C/10 лет) и почти вдвое превышает значение по метеостанции Джизак (0,27 °C/10 лет), установленные Холматжановым и др. (2020) [4]. Это согласуется с выводами об интенсивном потеплении в Центральной Азии [2, 3].

Дефицит осадков в последнее десятилетие на фоне роста температуры свидетельствует об ухудшении условий увлажнения в бассейне. Это отражается и на режиме стока Сангзара и Джизакского водохранилища [8].

Наиболее уязвимой является зона богарного земледелия на высотах 700–2000 м, непосредственно зависящая от осадков. Здесь целесообразно возделывать засухоустойчивые сорта и применять влагосберегающие агротехнические приёмы.

Заключение. В 1991–2020 гг. температура воздуха в Бахмальском районе повышалась на 0,58 °C за 10 лет, а десятилетие 2011–2020 гг. было на 1,1 °C теплее периода 1991–2000 гг. Среднегодовое количество осадков составило 434,5 мм; тенденция к их сокращению незначима, однако в 2011–2020 гг. в девяти годах из десяти осадков выпало меньше нормы. Нижние части бассейна (400–700 м) наиболее благоприятны для сельского хозяйства, а зона богарного земледелия (700–2000 м) наиболее чувствительна к изменению климата. Полученные результаты следует учитывать при управлении водными ресурсами и размещении сельскохозяйственных культур.

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Косимова К.Ё.
ассистент кафедры «Экология и охрана окружающей среды»
Каршинский государственный технический университет
Узбекистан

ГЕОЭКОЛОГИЧЕСКОЕ ВОЗДЕЙСТВИЕ КАЛИЙНОЙ ПРОМЫШЛЕННОСТИ НА ЛАНДШАФТНЫЕ СИСТЕМЫ И ПОЧВЕННЫЕ РЕСУРСЫ

Аннотация. В статье рассматривается геоэкологическое воздействие калийной промышленности на ландшафтные системы и почвенные ресурсы на примере АО «Дехканабадский калийный завод». На основе полевых наблюдений и комплексного геоэкологического анализа рассмотрены процессы техногенной трансформации ландшафтов и вторичного засоления почв. Выделены основные природные и антропогенные факторы воздействия, предложена концептуальная модель их взаимодействия и определены направления снижения экологических рисков.

Ключевые слова: калийная промышленность, деградация ландшафтов, засоление почв, геоэкология, техногенные ландшафты.

Kosimova K.Y.
assistant lecturer
Department of Ecology and Environmental Protection
Karshi State Technical University
Uzbekistan

GEOECOLOGICAL IMPACT OF THE POTASH INDUSTRY ON LANDSCAPE SYSTEMS AND SOIL RESOURCES

Abstract. This article examines the geoecological impact of the potash industry on landscape systems and soil resources, using the Dehkanabad Potash Plant as a case study. Based on field observations and integrated geoecological analysis, the study considers technogenic landscape transformation and secondary soil salinization. The main natural and anthropogenic factors are identified, a conceptual model of their interaction is proposed, and measures to reduce environmental risks are outlined.

Keywords: potash industry, landscape degradation, soil salinization, geoecology, technogenic landscapes.

Введение. Калийные удобрения имеют важное значение для сельского хозяйства, однако добыча и переработка калийных руд сопровождаются нарушением земель, накоплением отходов и риском засоления почв [1, 2]. В Узбекистане ключевым объектом отрасли является АО «Дехканабадский калийный завод» в Кашкадарьинской области. Цель работы – оценить

воздействие калийной промышленности на ландшафты и почвенные ресурсы и определить основные направления снижения геоэкологических рисков.

Научная новизна состоит в комплексном рассмотрении техногенной трансформации ландшафтов, процессов засоления и их природно-антропогенных факторов, а также в предложении концептуальной модели и природоохранных рекомендаций.

Анализ литературы. Изменение ландшафтов при горных работах описано Bell и Donnelly [3]; экологическое воздействие отходов – Lottermoser [4]. Вопросы минерализации вод и техногенного воздействия рассмотрены Труфановым и Михайловым [5, 6]. Региональные геоэкологические проблемы освещены в исследованиях [7-11]. Вместе с тем особенности взаимодействия калийного производства, аридного климата и почвенного засоления требуют комплексной оценки.

Материалы и методы. Объект исследования – производственные и прилегающие природно-техногенные территории Дехканабадского района Кашкадарьинской области. Для региона характерны аридные и полуаридные условия, малое количество осадков, высокая испаряемость и ветровая активность. Применены полевые наблюдения, лабораторный анализ, сравнительная ландшафтно-экологическая оценка и обобщение геоэкологических данных. Рассмотрены изменения рельефа, почвенного покрова, вод и растительности.

Засоление почв интерпретировалось как результат совместного влияния солесодержащих промышленных отходов (M), минерализации поверхностных и подземных вод (W), атмосферного переноса солевых частиц (A) и испарения в аридных условиях (E). Эти переменные использованы как концептуальные факторы, без количественной калибровки модели. Деградация ландшафта рассматривалась в последовательности: промышленное воздействие → нарушение земной поверхности → сокращение растительного покрова → изменение свойств почв → техногенный ландшафт.

Для объяснения формирования процессов засоления почв была использована упрощённая концептуальная модель:

$$S = f(M + W + A + E)$$

где: S – степень засоления почвы; M – влияние промышленных отходов и солесодержащих материалов; W – степень минерализации подземных и поверхностных вод; A – перенос солевых частиц атмосферным путём, в частности под воздействием ветра; E – интенсивность испарения и влияние аридных климатических условий.

Результаты и обсуждение. Наблюдения свидетельствуют о наиболее выраженных изменениях природной среды в пределах промышленных площадок и прилегающих территорий. Горные работы и строительство инфраструктуры изменяют морфологию поверхности, нарушают почвенный профиль, способствуют уплотнению грунтов и повышению эрозионной

уязвимости. Формируются техногенные формы рельефа, связанные с горнопромышленными площадками и накоплением отходов.

Существенным фактором является размещение солесодержащих отходов. Их воздействие может изменять химические свойства почв и способствовать вторичному засолению. Вблизи промышленных объектов и мест хранения отходов отмечены признаки накопления солей в верхних почвенных горизонтах. Ограниченные осадки и интенсивное испарение усиливают этот процесс; ветровой перенос пылевых и солевых частиц создаёт дополнительный путь миграции загрязняющих веществ.

Предложенная геоэкологическая модель объединяет горнопромышленную нагрузку, нарушение поверхности, трансформацию почв, изменение гидрогеологических условий и миграцию солей. При этом транспортная инфраструктура способствует фрагментации ландшафтов, уплотнению почв и дополнительному пылеобразованию. Совокупное действие указанных факторов снижает устойчивость природных комплексов и может ухудшать состояние растительности и почвенных ресурсов.

Выявленные закономерности согласуются с исследованиями экологических последствий горной промышленности [3-6, 9-11]. Однако приведённые выводы носят преимущественно качественный характер: в исходных материалах отсутствуют численные ряды концентраций солей и статистические оценки пространственного градиента, поэтому количественная атрибуция вклада каждого фактора требует дальнейшего мониторинга.

Для снижения рисков целесообразны безопасное хранение и изоляция отходов, технологии ограничения пыления, рациональное использование и повторное применение технологических вод, рекультивация нарушенных земель и регулярный контроль засоления почв. Мониторинг должен учитывать почвенные, гидрогеологические и атмосферные факторы, особенно вблизи объектов хранения отходов.

Для систематизации выявленных геоэкологических процессов разработана концептуальная модель воздействия калийной промышленности на ландшафтные системы и почвенные ресурсы (рис. 1). Модель отражает взаимосвязь горнодобывающей деятельности, накопления промышленных отходов, природно-климатических факторов и процессов трансформации окружающей среды. Особое внимание уделено механизмам миграции и накопления солей, способствующим вторичному засолению почв и деградации природных ландшафтов.



Рисунок 1. Геоэкологическая модель воздействия калийной промышленности на ландшафтные системы и почвенные ресурсы.

Как показано на рисунке 1, геоэкологическое воздействие калийной промышленности формируется в результате взаимодействия техногенных и природных факторов. Основными источниками воздействия являются нарушение земной поверхности, накопление солесодержащих отходов, пылевые выбросы и промышленные стоки. В условиях аридного климата высокая испаряемость и ветровая активность могут усиливать миграцию солей и процессы вторичного засоления почв.

Представленная модель позволяет выделить основные направления снижения экологической нагрузки: рекультивацию нарушенных земель, ограничение распространения пыли, безопасное размещение промышленных отходов и систематический мониторинг состояния почв и водных ресурсов. Реализация указанных мероприятий способствует сохранению устойчивости ландшафтных систем и снижению риска деградации земель.

Заключение. Добыча и переработка калийных руд сопровождаются комплексным воздействием на ландшафтные системы. Основные механизмы включают механическое нарушение земель, накопление солесодержащих отходов, перенос пыли и солей, а также изменение почвенно-гидрогеологических условий. Аридный климат усиливает вероятность вторичного засоления. Предложенная концептуальная модель обосновывает необходимость сочетания экологического мониторинга, безопасного

обращения с отходами, пылеподавления и рекультивации. Для количественной оценки масштаба воздействия необходимы дополнительные измерения.

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Кубаев А.Э.
ассистент
Тухтамишова Ф.А.
талаба
Мирзолимова Ж.Г.
талаба
Эшмирзаев А.А.
талаба
Норпулатова М.А.
талаба
Самарқанд давлат тиббиёт университети

ТИББИЁТДА СУНЪИЙ ИНТЕЛЛЕКТДАН ФОЙДАЛАНИШ: ЗАМОНАВИЙ ИМКОНИЯТЛАР, МУАММОЛАР ВА РИВОЖЛАНИШ ИСТИҚБОЛЛАРИ

Аннотация. Ушбу мақолада замонавий тиббиётда сунъий интеллект (СИ) технологияларидан фойдаланишнинг асосий йўналишлари, имкониятлари, чекловлари ва истиқболлари илмий-аналитик жиҳатдан таҳлил қилинади. Сунъий интеллектнинг тиббий диагностика, тиббий тасвирларни қайта ишлаш, клиник қарорларни қўллаб-қувватлаш, индивидуал даволаш, дори воситаларини ишлаб чиқиш, эпидемиологик прогнозлаш, тиббий ҳужжатларни автоматлаштириш ва тиббий таълимдаги қўлланилиши ёритилади. Замонавий тадқиқотлар таҳлили сунъий интеллект тиббий маълумотларни катта ҳажмда қайта ишлаш, мураккаб боғланишларни аниқлаш ва клиник жараёнларни оптималлаштириш имконини беришини кўрсатади. Шу билан бирга, маълумотлар сифати, алгоритмик хатолар, моделларнинг умумлаштирилиши, шаффофлик, шахсий маълумотларни ҳимоя қилиш, алгоритмик адолат ва клиник масъулият каби муаммолар мавжуд. Айниқса, катта тил моделлари (LLM) ва мультимодал сунъий интеллект тизимларининг тиббиётда қўлланилиши янги имкониятлар билан бирга янги хавфларни ҳам юзага келтирмоқда. Мақолада сунъий интеллектдан самарали фойдаланиш учун "инсон–сунъий интеллект" ҳамкорлиги, клиник валидация, далилларга асосланган ёндашув, этик бошқарув ва рақамли компетенцияларни ривожлантириш зарурлиги асосланади.

Калит сўзлар: сунъий интеллект, тиббиёт, машинали ўқитиш, чуқур ўрганиш, тиббий диагностика, клиник қарорларни қўллаб-қувватлаш, катта тил моделлари, ChatGPT, тиббий тасвирлар, рақамли тиббиёт, персоналлаштирилган тиббиёт, тиббий таълим.

Kubaev A.E.
assistant
Tukhtamishova F.A.
student
Mirzolimova J.G.
student
Eshmirzaev A.A.
student
Norpulatova M.A.
student
Samarkand State Medical University

ARTIFICIAL INTELLIGENCE IN MEDICINE: CURRENT OPPORTUNITIES, CHALLENGES AND DEVELOPMENT PROSPECTS

Abstract. This article presents a scientific and analytical review of the main applications, opportunities, limitations and prospects of artificial intelligence (AI) in modern medicine. It examines AI applications in medical diagnosis, medical image processing, clinical decision support, individualized treatment, drug development, epidemiological forecasting, automation of medical documentation and medical education. An analysis of recent studies shows that AI can process large volumes of medical data, identify complex relationships and optimize clinical processes. At the same time, challenges remain concerning data quality, algorithmic errors, model generalizability, transparency, protection of personal data, algorithmic fairness and clinical responsibility. In particular, large language models (LLMs) and multimodal AI systems create new opportunities and risks in medicine. The article substantiates the need for human–AI collaboration, clinical validation, an evidence-based approach, ethical governance and the development of digital competencies for the effective use of AI.

Keywords: artificial intelligence, medicine, machine learning, deep learning, medical diagnosis, clinical decision support, large language models, ChatGPT, medical images, digital medicine, personalized medicine, medical education.

КИРИШ

XXI асрда тиббиёт соҳасининг жадал рақамлашуви натижасида тиббий маълумотларни йиғиш, сақлаш, қайта ишлаш ва таҳлил қилиш жараёнлари тубдан ўзгармоқда. Электрон тиббий карталар, лаборатория маълумотлари, компьютер томографияси, магнит-резонанс томографияси, ультратовуш текширувлари, геном маълумотлари, физиологик сенсорлар ва бошқа рақамли манбалар тиббиётда улкан маълумотлар массивини шакллантирмоқда. Бундай маълумотларни инсон томонидан анъанавий усулларда қайта ишлаш вақт ва ресурс нуқтаи назаридан мураккаб вазифага айланмоқда. Шу нуқтаи назардан сунъий интеллект технологияларининг тиббиётга интеграциялашуви

замонавий рақамли соғлиқни сақлашнинг муҳим йўналишларидан бири сифатида шаклланмоқда.

Сунъий интеллект тиббий соҳада янги ҳодиса эмас. Машинали ўқитиш ва эксперт тизимлари аввалдан клиник қарорларни қўллаб-қувватлаш, диагностика ва прогнозлашда тадқиқ этилган. Бироқ сўнгги йилларда ҳисоблаш қувватининг ортиши, катта маълумотлар базаларининг шаклланиши ва чуқур нейрон тармоқларнинг ривожланиши сунъий интеллектнинг амалий имкониятларини сезиларли даражада кенгайтирди. Rajpurkar ва ҳаммуаллифлар сунъий интеллект тиббиётда клиник ва диагностик жараёнларни ўзгартириш салоҳиятига эга эканини, бироқ маълумотлар етишмаслиги, алгоритмик оғишлар ва этик масалалар каби жиддий муаммолар мавжудлигини таъкидлайдилар [1].

Сунъий интеллектнинг замонавий тиббиётдаги асосий вазифаси инсон шифокорини тўлиқ алмаштириш эмас, балки унинг қарор қабул қилиш жараёнини қўллаб-қувватлаш, маълумотларни тезкор таҳлил қилиш ва мураккаб клиник вазифаларни ҳал этиш имкониятларини кенгайтиришдан иборат. Шу маънода “инсон–сунъий интеллект” ҳамкорлиги тиббий технологияларни жорий этишнинг муҳим концептуал асосига айланмоқда.

Жаҳон соғлиқни сақлаш ташкилоти сунъий интеллект диагностика, даволаш, тиббий тадқиқотлар, дори воситаларини ишлаб чиқиш, эпидемиологик кузатув ва соғлиқни сақлаш тизимини бошқаришда катта имкониятларга эга эканини қайд этади. Бироқ СИ хавфсиз, ахлоқий, тенг ва инсон манфаатларига йўналтирилган тарзда жорий қилиниши керак.

Шу сабабли тиббиётда сунъий интеллектдан фойдаланишни фақат технологик масала сифатида эмас, балки тиббий, педагогик, ҳуқуқий, ахлоқий ва ижтимоий жиҳатларни қамраб олган комплекс жараён сифатида тадқиқ этиш зарур.

ТАДҚИҚОТ МЕТОДОЛОГИЯСИ

Мазкур мақола илмий адабиётларни таҳлил қилиш, қиёсий таҳлил, системалаштириш ва умумлаштириш усулларига асосланган назарий-аналитик тадқиқот сифатида шакллантирилди.

Тадқиқотда асосан 2022–2026 йилларда эълон қилинган халқаро илмий мақолалар, систематик шарҳлар, юқори импакт-факторли тиббий журналлардаги тадқиқотлар ҳамда WHO ва FDA каби халқаро ва миллий регулятор ташкилотларнинг расмий материалларидан фойдаланилди.

AI ва тиббиёт кесишмасидаги адабиётлар ҳажмининг тез ўсиши мазкур йўналишни мунтазам таҳлил қилиш заруратини оширмоқда. Масалан, Meng ва ҳаммуаллифлар ўтказган scoping review тадқиқотида PubMed, Embase, Web of Science ва Scopus маълумотлар базаларидан 4323 та материал сараланган ва якунда 550 та тадқиқот таҳлил қилинган [2].

Тадқиқот доирасида сунъий интеллектнинг қуйидаги қўлланиш йўналишлари алоҳида таҳлил қилинди:

1. тиббий диагностика;
2. тиббий тасвирларни интеллектуал таҳлил қилиш;

3. клиник қарорларни қўллаб-қувватлаш;
4. персоналлаштирилган тиббиёт;
5. дори воситаларини ишлаб чиқиш;
6. эпидемиологик прогнозлаш;
7. тиббий ҳужжатларни автоматлаштириш;
8. катта тил моделларидан фойдаланиш;
9. тиббий таълим;
10. телемедицина ва рақамли соғлиқни сақлаш.

3. ТИББИЙ ДИАГНОСТИКАДА СУНЪИЙ ИНТЕЛЛЕКТ

Тиббий диагностика сунъий интеллект технологиялари энг кўп қўлланилаётган соҳалардан биридир. Машинали ўқитиш алгоритмлари катта ҳажмдаги клиник маълумотлар асосида касалликларга хос белгиларни аниқлаш, хавф омилларини баҳолаш ва эҳтимолий диагнозларни шакллантиришда қўлланилмоқда.

Чуқур ўрганиш алгоритмлари, айниқса convolutional neural networks (CNN), тиббий тасвирларни таҳлил қилишда муҳим аҳамият касб этмоқда. Рентген, КТ, МРТ, маммография, дерматоскопия ва кўз туби тасвирларини таҳлил қилишда нейрон тармоқлардан фойдаланиш бўйича кўплаб тадқиқотлар ўтказилган.

2024 йилда чоп этилган шарҳларда сунъий интеллект тиббий тасвирлар асосидаги компьютер ёрдамида диагностика тизимларини ривожлантиришда муҳим роль ўйнаётгани кўрсатилган [3]. AI катта маълумотлар асосида тасвирларни саралаш, патологик ўзгаришларни аниқлаш ва шифокорга қўшимча маълумот тақдим этиш имконини беради.

Бироқ алгоритмнинг лаборатория ёки тест маълумотларида юқори аниқлик кўрсатиши уни автоматик равишда реал клиник шароитда самарали бўлишини англатмайди. Dataset shift, яъни модел ўқитилган маълумотлар билан амалиётда учрайдиган маълумотларнинг фарқ қилиши, клиник натижаларга салбий таъсир кўрсатиши мумкин [4].

Шу сабабли диагностик СИ тизимларини ишлаб чиқишда маълумотлар турли беморлар гуруҳларини қамраб олиши, ташқи валидация ўтказилиши ва реал клиник муҳитда синовдан ўтказилиши муҳимдир.

ТИББИЙ ТАСВИРЛАРНИ ҚАЙТА ИШЛАШДА СУНЪИЙ ИНТЕЛЛЕКТ

Радиология сунъий интеллектнинг тиббиётдаги энг фаол ривожланаётган йўналишларидан биридир. КТ, МРТ, рентген ва ультратовуш тасвирларининг катта ҳажми AI алгоритмлари учун маълумот манбаи бўлиб хизмат қилади.

AI тизимлари тасвирларни автоматик сегментация қилиш, патологик ўчоқларни белгилаш, тасвирларни классификация қилиш ва эҳтимолий касалликларни аниқлаш каби вазифаларни бажариши мумкин.

2024 йилдаги тадқиқотлар сунъий интеллектнинг тиббий тасвирлар асосида диагностикадаги имкониятлари кенгайиб бораётганини кўрсатади. Шу билан бирга, клиник маълумотлар, аввалги тасвирлар ва беморнинг индивидуал тарихи билан биргаликда таҳлил қилиш имконияти ҳали ҳам муҳим муаммолардан бири бўлиб қолмоқда [5].

Бундан ташқари, тиббий тасвирларда алгоритмик адолат масаласи ҳам муҳимдир. Турли аҳоли гуруҳлари, ёш, жинс, этник хусусиятлар, тиббий муассаса ва қурилмалардаги фарқлар модел натижасига таъсир қилиши мумкин. Nature Medicine журналида эълон қилинган тадқиқотлар реал шароитда тиббий тасвир AI тизимларининг умумлаштирилиши ва адолатлилигига оид муаммолар мавжудлигини кўрсатган [6].

Шу нуқтаи назардан тиббий тасвирлар билан ишловчи AI тизимлари учун катта ва хилма-хил маълумотлар базасини шакллантириш, ташқи валидация ва турли клиник муҳитларда синов ўтказиш зарур.

КЛИНИК ҚАРОР ҚАБУЛ ҚИЛИШДА СУНЪИЙ ИНТЕЛЛЕКТ

Клиник қарорларни қўллаб-қувватлаш тизимлари сунъий интеллектнинг тиббиётдаги муҳим амалий йўналишларидан ҳисобланади. Бундай тизимлар беморнинг симптомлари, лаборатория натижалари, тиббий тарихи, тасвирлари ва бошқа маълумотларни комплекс таҳлил қилиб, шифокорга эҳтимолий диагнозлар ёки даволаш вариантлари ҳақида қўшимча маълумот бериши мумкин.

Катта тил моделларининг ривожланиши клиник қарор қабул қилиш жараёнида янги имкониятларни пайдо қилди. Thirunavukarasu ва ҳаммуаллифлар LLMларнинг тиббий коммуникация, клиник ҳужжатлаш, таълим ва тадқиқот жараёнларидаги потенциалини таҳлил қилганлар [7].

Бироқ клиник қарорни тўлиқ автоматлаштириш жиддий хавфларни келтириб чиқариши мумкин. LLMлар баъзи ҳолларда ишончли кўринадиган, аммо нотўғри маълумотни шакллантириши мумкин. Шунинг учун AI томонидан берилган натижа клиник мутахассис томонидан текширилиши керак.

2024 йилги Nature Medicine тадқиқотида LLMларнинг клиник қарор қабул қилишдаги имкониятлари билан бир қаторда, уларнинг клиник маълумотларни интеграциялаш, тавсияларга амал қилиш ва реал иш жараёнига мослашиш каби чекловлари қайд этилган [8].

Шу сабабли энг мақбул ёндашув “AI physician” эмас, балки “AI-assisted physician”, яъни сунъий интеллект воситалари билан кучайтирилган шифокор модели ҳисобланади. Бунда якуний клиник қарор инсон мутахассиси зиммасида қолади.

КАТТА ТИЛ МОДЕЛЛАРИ ВА ГЕНЕРАТИВ СУНЪИЙ ИНТЕЛЛЕКТ

2022 йил охиридан бошлаб ChatGPT каби генератив сунъий интеллект тизимларининг кенг оммалашуви тиббиёт соҳасида ҳам янги илмий йўналишларни юзага келтирди.

LLMлар тиббий матнларни қисқартириш, беморлар учун тушунарли ахборот тайёрлаш, тиббий ҳужжатларни шакллантириш, таржима, илмий адабиётлар билан ишлаш ва тиббий таълимда симуляцион вазифаларни яратишда қўлланилмоқда.

Meng ва ҳаммуаллифларнинг 2024 йилги scoping review тадқиқоти LLMлар тиббий диагностика, тиббий ёзиш, таълим ва коммуникацияда қўлланилаётганини кўрсатади. Бироқ муаллифлар контекстни тўлиқ тушуниш, ишончлилик ва ҳаддан ташқари ишонч билан фойдаланиш хавфларини ҳам қайд этадилар [2].

2024 йилдаги клиник синовлар таҳлилида LLMлар бўйича 27 та клиник тадқиқот аниқланган бўлиб, улар беморларга ёрдам кўрсатиш, маълумотларни бошқариш, қарорларни қўллаб-қувватлаш ва тадқиқот ишларида ёрдам бериш каби йўналишларни қамраб олган [9].

2025 йилги систематик шарҳда эса беморларга хизмат кўрсатишда LLMлардан фойдаланиш бўйича 89 та тадқиқот, 29 та тиббий мутахассислик кесимида таҳлил қилинган. Тадқиқотларда маълумотларни умумлаштириш, таржима, клиник ҳужжатлаш ва беморларга ахборот бериш каби вазифалар устун бўлган. Шу билан бирга, нотўғрилик, хавфсизлик ва алгоритмик оғиш каби муаммолар қайд этилган [10].

Демак, генератив AI тиббий ахборот билан ишлаш жараёнини тезлаштириши мумкин, аммо уни клиник ҳақиқатнинг мустақил манбаси сифатида қабул қилиш илмий ва амалий нуқтаи назардан тўғри эмас.

СУНЪИЙ ИНТЕЛЛЕКТ ВА ПЕРСОНАЛЛАШТИРИЛГАН ТИББИЁТ

Персоналлаштирилган тиббиёт беморнинг генетик, физиологик, клиник ва турмуш тарзига оид маълумотларни ҳисобга олган ҳолда индивидуал профилактика ва даволаш стратегияларини шакллантиришга йўналтирилган.

Сунъий интеллект катта ҳажмдаги маълумотлар ўртасидаги мураккаб боғланишларни аниқлаш имкони туфайли ушбу йўналишда муҳим восита бўлиши мумкин. Геномика, фармакогеномика, клиник маълумотлар ва тасвирларни биргаликда таҳлил қилиш орқали индивидуал хавф профилларини шакллантириш имкониятлари кенгаймоқда.

Бироқ персоналлаштирилган тиббиётда маълумотларнинг махфийлиги алоҳида аҳамиятга эга. Геном маълумотлари ва электрон тиббий карталар шахсий ва юқори сезгир маълумотлар ҳисобланади. Шу сабабли AI тизимларида маълумотларни минималлаштириш, хавфсиз сақлаш, кириш ҳуқуқларини назорат қилиш ва беморнинг розилиги каби принципларга амал қилиш зарур.

WHO сунъий интеллектни соғлиқни сақлашда жорий этишда инсон ҳуқуқлари, автономия, хавфсизлик, шаффофлик, масъулият, тенглик ва барқарорликни асосий тамойиллар сифатида белгилаган [11].

СУНЪИЙ ИНТЕЛЛЕКТНИНГ ДОРИ ВОСИТАЛАРИНИ ИШЛАБ ЧИҚИШДАГИ ЎРНИ

Фармацевтика соҳасида дори воситаларини яратиш кўп вақт ва катта молиявий ресурс талаб қилади. Сунъий интеллект молекуляр тузилишларни таҳлил қилиш, эҳтимолий дори номзодларини аниқлаш, биологик нишонларни танлаш ва клиник тадқиқот жараёнларини оптималлаштиришда қўлланилмоқда.

WHO 2024 йилги таҳлилий ҳужжатида сунъий интеллект фармацевтик маҳсулотларни ишлаб чиқиш ва етказиб бериш жараёнининг турли босқичларида қўлланилаётганини қайд этади. Шу билан бирга, технологиядан фойдаланишнинг тижорий манфаатлари билан бир қаторда, унинг жамоат саломатлиги учун фойдаси ва тегишли бошқарув механизмлари таъминланиши зарурлиги таъкидланган [12].

AI асосидаги дори дизайни анъанавий экспериментал жараённи қисқартириш имкониятини бериши мумкин. Аммо алгоритм томонидан аниқланган потенциал молекула клиник самарадорлик ва хавфсизликни автоматик равишда кафолатламайди. Шунинг учун AI натижалари биологик экспериментлар ва клиник синовлар билан тасдиқланиши керак.

ЭПИДЕМИОЛОГИК ПРОГНОЗЛАШ ВА ЖАМОАТ САЛОМАТЛИГИДА AI

Сунъий интеллект эпидемиологик маълумотларни таҳлил қилиш ва касалликлар тарқалиш динамикасини прогнозлашда ҳам қўлланилиши мумкин. Электрон тиббий маълумотлар, лаборатория натижалари, географик маълумотлар ва аҳоли ҳаракатига оид маълумотларни комплекс таҳлил қилиш эпидемиологик хавфларни эрта аниқлаш имконини оширади.

Машинали ўқитиш алгоритмлари катта маълумотлар массивида инсон томонидан осон аниқланмайдиган тенденцияларни топиши мумкин. Бу эпидемик жараёнларни мониторинг қилиш, хавф гуруҳларини аниқлаш ва ресурсларни тақсимлашда ёрдам бериши мумкин.

Бироқ эпидемиологик прогноз моделлари маълумотларнинг тўлиқлиги ва ишончлилигига кучли боғлиқ. Нотўғри ёки кечиктирилган маълумотлар алгоритм прогнозларининг ишончлилигини пасайтириши мумкин.

Шу нуқтаи назардан математик моделлаштириш ва сунъий интеллектнинг интеграцияси алоҳида аҳамиятга эга. Математик моделлар касаллик динамикасининг назарий механизмларини ифодаласа, машинали ўқитиш алгоритмлари катта эмпирик маълумотлардан яширин боғланишларни аниқлаши мумкин. Уларнинг биргаликда қўлланилиши эпидемиологик жараёнларни тушунтириш ва прогнозлаш имкониятларини кенгайтириши мумкин.

ТИББИЙ ТАЪЛИМДА СУНЪИЙ ИНТЕЛЛЕКТ

Сунъий интеллектнинг тиббий таълимга кириб келиши бўлажак шифокорларни тайёрлаш методикасига ҳам таъсир кўрсатмоқда. AI асосидаги таълим воситалари индивидуал ўқиш траекториясини шакллантириш, клиник

вазиятларни моделлаштириш, тест топшириқларини яратиш ва талабаларнинг билимларини таҳлил қилиш имконини беради.

LLMлар талабаларга тиббий матнларни тушунтириш, клиник кейсларни муҳокама қилиш ва саволларга жавоб беришда ёрдамчи восита бўлиши мумкин. Бироқ талаба AI берган жавобни тайёр билим сифатида қабул қилмаслиги, уни манбалар билан текшириши ва клиник фикрлашни мустақил шакллантириши зарур.

Шу сабабли тиббий таълимда AIдан фойдаланиш “AIдан фойдаланиш” эмас, балки “AI билан ишлаш компетенцияси”ни шакллантиришга йўналтирилиши керак.

Бўлажак шифокорлар қуйидаги компетенцияларга эга бўлишлари мақсадга мувофиқ:

- сунъий интеллектнинг асосий принципларини тушуниш;
- тиббий маълумотлар сифатини баҳолаш;
- AI натижаларининг ишончлилигини текшириш;
- алгоритмик хатоларни аниқлаш;
- тиббий маълумотларни ҳимоя қилиш;
- AI натижаларини клиник контекстда талқин қилиш;
- инсон ва AI ўртасидаги масъулият чегараларини англаш.

Бу ёндашув tibbiyotda математик моделлаштириш фанини ўқитиш билан ҳам узвий боғлиқ. Математик модел, статистик таҳлил ва сунъий интеллект алгоритмларининг ўзаро алоқасини тушунтириш талабаларнинг рақамли ва аналитик компетенцияларини шакллантириши мумкин.

СУНЪИЙ ИНТЕЛЛЕКТДАН ФОЙДАЛАНИШДАГИ ЭТИК ВА ҲУҚУҚИЙ МУАММОЛАР

AI технологияларининг тиббиётда кенг қўлланилиши билан бир қаторда этик ва ҳуқуқий муаммолар ҳам долзарблашмоқда.

Биринчи муаммо — **махфийлик**. AI моделларини ўқитиш учун катта ҳажмдаги бемор маълумотлари талаб қилинади. Бу маълумотларнинг рухсатсиз тарқалиши ёки нотўғри ишлатилиши бемор ҳуқуқларига зарар етказиши мумкин.

Иккинчи муаммо — **алгоритмик адолат**. Агар AI модели маълум бир аҳоли гуруҳларига оид маълумотлар билан етарли даражада ўқитилмаган бўлса, унинг натижалари айрим гуруҳлар учун паст сифатли бўлиши мумкин [6], [13].

Учинчи муаммо — **шаффофлик**. Айрим чуқур нейрон тармоқларининг қарор қабул қилиш механизмини инсон учун тушунтириш қийин. Клиник соҳада эса шифокор қарорнинг асосини тушуниши муҳим.

Тўртинчи муаммо — **масъулият**. AI тизими нотўғри тавсия берган ҳолатда масъулият кимга тегишли бўлиши масаласи ҳуқуқий жиҳатдан мураккабдир. Mello ва Guha AI воситаларидан фойдаланиш билан боғлиқ тиббий-ҳуқуқий жавобгарлик масалаларини алоҳида таҳлил қилганлар [14].

Бешинчи муаммо — **генератив AI томонидан нотўғри маълумот шакллантирилиши**. AI яратган тиббий матн грамматик жиҳатдан ишончли кўриниши мумкин, аммо мазмунан нотўғри бўлиши эҳтимоли мавжуд [15].

WHO томонидан ишлаб чиқилган тавсияларда AI тизимларида инсон автономияси, хавфсизлик, шаффофлик, масъулият, тенглик ва барқарорлик каби принципларга амал қилиш зарурлиги таъкидланган [11]. 2025 йилги WHO қўлланмасида эса катта мультимодал моделларни тиббиётда жорий этиш билан боғлиқ махсус бошқарув ва хавфсизлик масалалари кўриб чиқилган [16].

СУНЪИЙ ИНТЕЛЛЕКТНИ КЛИНИК АМАЛИЁТГА ЖОРИЙ ЭТИШ МОДЕЛИ

Тиббиётда AIдан самарали фойдаланишни шартли равишда беш босқичли модел асосида ташкил этиш мумкин:

1-босқич — маълумотларни тайёрлаш.

Тиббий маълумотлар йиғилади, тозаланади, стандартлаштирилади ва анонимлаштирилади.

2-босқич — алгоритмни ишлаб чиқиш.

Машинали ўқитиш, чуқур ўрганиш ёки генератив AI модели танланади ва ўқитилади.

3-босқич — техник валидация.

Модел аниқлик, сезгирлик, спецификлик, F1-score, AUC каби кўрсаткичлар орқали баҳоланади.

4-босқич — клиник валидация.

AI тизими реал клиник маълумотлар ва клиник сценарийларда текширилади.

5-босқич — инсон назорати ва мониторинг.

AI натижалари тиббий мутахассис томонидан баҳоланади ва тизимнинг реал амалиётдаги ишлаши мунтазам мониторинг қилинади.

Бундай ёндашув AIни бир марта ишлаб чиқариб, ўзгаришсиз қўллаш эмас, балки уни доимий равишда баҳолаш ва такомиллаштиришни назарда тутади.

FDA маълумотларига кўра, АҚШда маркетингга рухсат олган AI-enabled medical devices бўйича махсус очиқ рўйхат юритилади ва ушбу рўйхат мунтазам янгиланиб боради. Бу тиббий AI технологияларининг клиник ва регулятор муҳитга тобора чуқур кириб бораётганини кўрсатади.

СУНЪИЙ ИНТЕЛЛЕКТ ВА МАТЕМАТИК МОДЕЛЛАШТИРИШ ИНТЕГРАЦИЯСИ

Тиббиётда сунъий интеллект ва математик моделлаштиришнинг интеграцияси истиқболли илмий йўналишлардан биридир. Математик моделлаштириш биологик жараёнларнинг ички механизмларини формаллаштириш имконини берса, сунъий интеллект катта ҳажмдаги эмпирик маълумотлардан қонуниятларни аниқлаш имкониятини яратади.

Масалан, эпидемиологик жараёнларни моделлаштиришда SIR, SEIR каби математик моделлар касалликнинг тарқалиш динамикасини назарий

жиҳатдан ифодалайди. Машинали ўқитиш алгоритмлари эса реал статистик маълумотлар асосида модел параметрларини баҳолаш ёки прогноз натижаларини яхшилашда қўлланилиши мумкин.

Юрак-қон томир тизими, нафас олиш, фармакокинетика, ўсма ўсиши ва инфекцион касалликлар динамикасини ўрганишда ҳам ушбу икки ёндашувни бирлаштириш мумкин.

Бундай интеграция tibbiyotda математик моделлаштириш фанини ўқитиш нуқтаи назаридан ҳам муҳимдир. Талаба математик тенглама, статистик маълумот ва AI алгоритми ўртасидаги боғланишни амалий мисоллар орқали ўзлаштириши мумкин.

Шунинг учун замонавий tibbiyot ta'limida математик моделлаштиришни фақат формулалар ва ҳисоблашлар мажмуаси сифатида эмас, балки **"математик модел + маълумот + алгоритм + тиббий интерпретация"** тизими сифатида ўргатиш мақсадга мувофиқ.

МУҲОКАМА

Тадқиқотлар таҳлили шуни кўрсатадики, сунъий интеллектнинг тиббиётдаги қўлланилиши учта асосий тенденция асосида ривожланмоқда.

Биринчи тенденция — **диагностик AI**. Бунда тиббий тасвирлар ва клиник маълумотлар асосида касалликларни аниқлашга ёрдам берувчи алгоритмлар ривожланмоқда.

Иккинчи тенденция — **генератив ва мультимодал AI**. LLM ва LMM технологиялари матн, тасвир ва бошқа маълумот турларини биргаликда қайта ишлаш имконини кенгайтирмоқда. WHO 2025 йилги қўлланмасида катта мультимодал моделларнинг соғлиқни сақлаш, илмий тадқиқотлар ва дори воситаларини ишлаб чиқишдаги потенциали билан бирга, уларни масъулиятли бошқариш зарурати ҳам таъкидланган .

Учинчи тенденция — **инсон–AI ҳамкорлиги**. Клиник қарорни тўлиқ автоматлаштиришдан кўра, шифокорга катта ҳажмдаги маълумотни таҳлил қилишда ёрдам бериш модели амалиёт учун муҳим аҳамият касб этмоқда.

Бироқ адабиётлар таҳлили AIнинг юқори техник кўрсаткичлари унинг клиник самарадорлигини автоматик равишда исботламаслигини кўрсатади. 2024 йилда клиник амалиётдаги рандомизацияланган назоратли тадқиқотларни ўрганган scoping review AI бўйича реал клиник синовлар ҳали ҳам чекланган эканини кўрсатган .

Шунинг учун келажакда AI тадқиқотлари техник аниқликдан ташқари клиник натижалар, бемор хавфсизлиги, иқтисодий самарадорлик ва инсон–AI ҳамкорлигини ҳам баҳолаши зарур.

ХУЛОСА

Тиббиётда сунъий интеллектдан фойдаланиш рақамли соғлиқни сақлашнинг муҳим йўналишига айланиб бормоқда. Машинали ўқитиш, чуқур ўрганиш, компьютер кўриш, катта тил моделлари ва мультимодал AI технологиялари диагностика, тиббий тасвирларни таҳлил қилиш, клиник қарорларни қўллаб-қувватлаш, дори воситаларини ишлаб чиқиш,

эпидемиологик прогнозлаш ва тиббий таълимда янги имкониятларни яратмоқда.

Тадқиқот натижалари шуни кўрсатадики, AIнинг асосий қиймати уни инсон шифокорининг ўрнини босишида эмас, балки шифокорнинг ахборотни таҳлил қилиш ва қарор қабул қилиш имкониятларини кенгайтиришида намоён бўлади.

Шу билан бирга, AIни тиббиётга жорий қилиш маълумотлар сифати, алгоритмик адолат, шаффофлик, махфийлик, ҳуқуқий жавобгарлик ва бемор хавфсизлиги каби масалаларни ҳал қилишни талаб қилади. WHO ҳам сунъий интеллектдан фойдаланишда этика, инсон ҳуқуқлари ва хавфсизликни марказий ўринга қўйиш зарурлигини таъкидлайди [11],.

Тиббиёт таълими учун эса сунъий интеллектдан фойдаланиш алоҳида аҳамиятга эга. Бўлажак шифокорлар нафақат тиббий билимларни, балки AI натижаларини танқидий баҳолаш, математик ва статистик моделларни тушуниш, рақамли маълумотлар билан ишлаш ҳамда алгоритмларнинг чекловларини англаш компетенцияларига ҳам эга бўлишлари керак.

Айниқса, **математик моделлаштириш ва сунъий интеллект интеграцияси** тиббий таълимни модернизация қилишнинг истиқболли йўналиши ҳисобланади. Математик моделлар биологик жараёнларнинг назарий асосини ифодаласа, AI катта ҳажмдаги маълумотлардан амалий қонуниятларни аниқлаш имконини беради. Шу сабабли ушбу технологияларни интеграциялаш асосида ташкил этилган таълим жараёни талабаларнинг математик, ахборот-технологик ва касбий компетенцияларини комплекс шакллантиришга хизмат қилиши мумкин.

Келгусида сунъий интеллектни тиббиётда қўллаш бўйича тадқиқотлар клиник валидация, мультимодал маълумотларни интеграциялаш, алгоритмларнинг адолатлилиги, инсон–AI ҳамкорлиги ва миллий тиббий маълумотлар базаларини шакллантиришга кўпроқ йўналтирилиши мақсадга мувофиқ.

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Кулдашев С.Ф.
ассистент
Мухамадиева Л.А.
заведующий кафедрой педиатрии № 3 и медицинской генетики
Самаркандский государственный медицинский университет

МИНЕРАЛЬНАЯ ПЛОТНОСТЬ КОСТНОЙ ТКАНИ И ФАКТОРЫ РИСКА ЕЁ СНИЖЕНИЯ У ДЕТЕЙ С ОСТРОЙ РЕВМАТИЧЕСКОЙ ЛИХОРАДКОЙ

Аннотация. Остеопения в детстве повышает риск остеопороза во взрослом возрасте, однако у детей с острой ревматической лихорадкой (ОРЛ) состояние костного метаболизма изучено недостаточно. Обследованы 157 детей 5–15 лет с ОРЛ, находившихся на лечении в многопрофильной клинике Самаркандского государственного медицинского университета в 2021–2025 гг. Оценивали клинико-анамнестические данные, физическое и половое развитие, уровни кальция, фосфора, цинка, щелочной фосфатазы, альбумина, витамина D и цитокинов, экскрецию кальция и фосфора с мочой, потребление кальция с пищей и физическую активность. Минеральную плотность кости (МПК) определяли методом двухэнергетической рентгеновской абсорбциометрии (DXA) в поясничном отделе позвоночника, шейке бедра, лучевой и локтевой костях. Дефицит или недостаточность витамина D выявлены у 78,4% детей. Низкая МПК чаще регистрировалась в дистальных отделах предплечья и в поясничном отделе (L1–L4), особенно в пубертатном периоде, и зависела от индекса массы тела. Адекватное потребление кальция отмечено лишь у 27,6% мальчиков и 29,4% девочек, низкая физическая активность — у 47,8% детей. Разработанный алгоритм диагностики и коррекции позволил снизить число обострений в год с 3,05 до 1,58 и увеличить длительность ремиссии с 118,7 до 230 дней.

Ключевые слова: острая ревматическая лихорадка, дети, минеральная плотность кости, остеопения, витамин D, кальций, денситометрия.

Kuldeshev S.F.
assistant
Mukhamadieva L.A.
head of the Department of Pediatrics No. 3 and Medical Genetics
Samarkand State Medical University

BONE MINERAL DENSITY AND RISK FACTORS FOR ITS REDUCTION IN CHILDREN WITH ACUTE RHEUMATIC FEVER

Abstract. Osteopenia in childhood increases the risk of osteoporosis in adulthood; however, bone metabolism in children with acute rheumatic fever (ARF) remains insufficiently studied. A total of 157 children aged 5–15 years with ARF who received treatment at the Multidisciplinary Clinic of Samarkand State Medical University between 2021 and 2025 were examined. Clinical and medical history data, physical and sexual development, serum levels of calcium, phosphorus, zinc, alkaline phosphatase, albumin, vitamin D, and cytokines, urinary calcium and phosphorus excretion, dietary calcium intake, and physical activity were assessed. Bone mineral density (BMD) was measured using dual-energy X-ray absorptiometry (DXA) at the lumbar spine, femoral neck, radius, and ulna. Vitamin D deficiency or insufficiency was identified in 78.4% of the children. Low BMD was more frequently observed in the distal forearm and lumbar spine (L1–L4), particularly during puberty, and was associated with body mass index. Adequate calcium intake was reported in only 27.6% of boys and 29.4% of girls, while low physical activity was observed in 47.8% of the children. The developed diagnostic and corrective algorithm reduced the annual number of exacerbations from 3.05 to 1.58 and increased the duration of remission from 118.7 to 230 days.

Keywords: acute rheumatic fever, children, bone mineral density, osteopenia, vitamin D, calcium, densitometry.

Введение

Накопление костной массы в детском и подростковом возрасте определяется генетическими особенностями, гормональным фоном, питанием, уровнем физической активности и сопутствующими заболеваниями. Данные последних лет свидетельствуют, что истоки остеопороза взрослых лежат в детстве, поэтому проблема нарушения минерализации костной ткани у детей становится всё более актуальной. Нарушения костного метаболизма описаны при многих хронических заболеваниях, однако у детей с ОРЛ надёжные, обоснованные и простые критерии отнесения к группе высокого риска остеопении и недостижения пиковой костной массы не разработаны. Практически не изучены и особенности минерализации кости в зависимости от физического развития.

Цель исследования — совершенствование диагностики и лечения у детей с ОРЛ путём изучения изменений костного метаболизма в зависимости от возраста, пола и физического развития.

Задачи: определить клинические особенности течения ОРЛ у детей; оценить результаты лабораторных и инструментальных исследований; выявить взаимосвязи биохимических показателей; проанализировать денситометрические показатели и данные анкетирования; оценить факторы, приводящие к остеопении, и разработать тактику ведения и лечения.

Материал и методы

В 2021–2025 гг. обследованы 157 детей 5–15 лет с ОРЛ, находившихся на лечении в детском отделении многопрофильной клиники Самаркандского государственного медицинского университета. Мальчиков было 82 (54%),

девочек — 71 (46%); преобладали дети 5–10 лет. Сельские жители составили 132 (84%), городские — 25 (16%). Первичная атака выявлена у 64 (40,8%), повторная — у 93 (59,2%) детей.

Определяли общий кальций (с пересчётом на альбумин-скорректированный), фосфор, цинк, щелочную фосфатазу и альбумин в сыворотке крови и моче спектрофотометрическим методом. Экскрецию кальция нормировали на массу тела и рассчитывали кальций-креатининовое соотношение (ККС). Цитокины (IL-1β, IL-6, IFN-γ) определяли твердофазным иммуноферментным «сэндвич»-методом с использованием тест-систем «Вектор-Бест» (Россия), индикаторный фермент — пероксидаза хрена.

МПК оценивали методом двухэнергетической рентгеновской абсорбциометрии (DXA) на остеоденситометре DPX MD+ (Lunar, США). Анализировали содержание костного минерала (BMC, г), минеральную плотность (BMD, г/см²) и Z-критерий, отражающий отклонение показателей пациента от среднего значения референтной базы для данного возраста и пола. Для сравнения использованы данные здоровых детей (n=30), опубликованные Л.М. Гарифуллиной и М.Ж. Ашуровой (2022). Потребление кальция оценивали по анкете и пятидневному дневнику питания (содержание кальция в молочных продуктах + 350 мг от прочих продуктов).

Физическую активность оценивали в баллах: 2 балла — занятия спортом 2–3 раза в неделю, регулярное посещение уроков физкультуры, ежедневные подвижные игры на воздухе, работа за компьютером и просмотр телевизора не более 2 ч в сутки; 1 балл — малоподвижный образ жизни (отсутствие спорта, более 2 ч в сутки у экрана, редкие прогулки, освобождение от физкультуры или занятия в подготовительной группе).

Статистическую обработку проводили методом вариационной статистики с расчётом средней арифметической (M) и ошибки средней (m); достоверность различий оценивали по t-критерию Стьюдента, для качественных бинарных признаков — по критерию χ^2 с поправкой Йетса; связь показателей — по коэффициенту корреляции Пирсона. Различия считали значимыми при $p<0,05$.

Результаты

Клиническая характеристика обследованных детей

Среди больших критериев ОРЛ наиболее часто встречалась хорея (44 ребёнка, 28%), на втором месте — кардит (35 детей, 22,3%), включая субклинический, выявленный только при ЭхоКГ. Артрит диагностирован у 3 (1,91%) детей и протекал классически (поражение коленных суставов, увеличение, локальная гипертермия, боль, нарушение функции, быстрый регресс на фоне пенициллина и ибупрофена). Кольцевидная эритема и ревматические узелки не выявлены. Сочетание хореи и кардита отмечено у 8 (5%). Из малых критериев чаще всего регистрировалась полиартралгия (88 детей, 56%). Интервал от стрептококковой инфекции до начала болезни составил в среднем 12 дней, при хорее — 19 дней.

Таблица 1. Клинико-анамнестическая характеристика детей с ОРЛ (n=157)

Показатель	Абс.	%
Мальчики	82	54
Девочки	71	46
Сельские жители	132	84
Городские жители	25	16
Первичная атака ОРЛ	64	40,8
Повторная атака ОРЛ	93	59,2
Хорея	44	28
Кардит (в т.ч. субклинический)	35	22,3
Артрит	3	1,91
Сочетание хореи и кардита	8	5
Полиартралгия (малый критерий)	88	56
ОРЛ/ревматические пороки у родственников 1-й линии	40	25,4
То же, с учётом 2-й и 3-й линий родства	97	61,7

У большинства детей (98%) состояние при поступлении расценено как средней тяжести, у 5% — как тяжёлое; тяжёлое состояние было связано с выраженными проявлениями кардита в сочетании с хореей. По данным ЭКГ в обеих группах чаще выявлялись метаболические изменения миокарда желудочков, при ЭхоКГ в основной группе обнаружено сочетанное поражение митрального и трикуспидального клапанов. При УЗИ органов брюшной полости выявлены сопутствующие пиелонефрит, дискинезия желчевыводящих путей и перегиб желчного пузыря. У всех детей диагностирована анемия I–II степени, у 7% — пиелонефрит.

Лабораторные показатели и обеспеченность витамином D

В общем анализе крови отмечено снижение гемоглобина, эритроцитов и цветового показателя. Уровень СРБ был повышен в 2–3 раза, выявлены высокие титры АСЛО, во всех возрастных группах повышено содержание IL-1β, IL-6 и IFN-γ. Концентрации альбумина, меди, магния и цинка оставались в пределах референтных значений, тогда как содержание кальция и фосфора было ниже нормы.

Таблица 2. Распределение детей с ОРЛ по обеспеченности витамином D

Обеспеченность витамином D	Доля детей, %
Выраженный дефицит	21,7
Недостаточность	56,7
Адекватный уровень	21,7
Дефицит + недостаточность (суммарно)	78,4

Корреляционный анализ выявил высокую положительную связь между витамином D и IL-6, что подчёркивает роль витамина D в воспалительных изменениях при ОРЛ и необходимость его коррекции при недостаточности. С другими цитокинами (IL-1β, IFN-γ) связь была слабой. Между кальцием и щелочной фосфатазой установлена статистически значимая корреляция (r=−0,48); остальные изученные показатели (витамин D, альбумин, медь, IL-1, IL-6, кальцитонин) имели слабые, статистически недостоверные связи.

Минеральная плотность костной ткани

Денситометрия поясничного отдела позвоночника (L1–L4) выполнена у 53 детей с ОРЛ. По уровню физического развития они разделены на основную группу (n=21; выявлены остеопения/остеопороз) и контрольную группу (n=32; МПК в норме). Для сравнения использованы данные 30 здоровых детей. По критериям ВОЗ отклонение показателей до −1 SD принимается за норму, от −1,0 до −2,5 SD — остеопению, ниже −2,5 SD — остеопороз; при сочетании с переломом — выраженный (тяжёлый) остеопороз.

Таблица 3. Денситометрические показатели поясничного отдела позвоночника у обследованных детей (M±m)

Область исследования	Основная группа (n=21)	Контрольная группа (n=32)	Здоровые дети (n=30)
L1, Z-score	0,45±0,19	0,44±0,15	0,65±0,33
L2, Z-score	0,18±0,23	0,21±0,19	0,47±0,32
L3, Z-score	0,42±0,19	0,45±0,16	0,66±0,28
L4, Z-score	0,50±0,19	0,51±0,15	0,71±0,28
L1, BMD, г/см²	0,93±0,01	0,92±0,01	0,906±0,01
L2, BMD, г/см²	0,90±0,01	0,88±0,01	0,876±0,01
L3, BMD, г/см²	0,93±0,01	0,92±0,01	0,905±0,01
L4, BMD, г/см²	0,92±0,01	0,91±0,01	0,899±0,02

Примечание: Z-score — безразмерная величина; p — по данным автора указано в оригинале таблицы.

Наиболее выраженное снижение Z-критерия в основной группе отмечено в области L2 (0,18±0,23 против 0,47±0,32 у здоровых детей, то есть почти в 2,6 раза ниже). В областях L3 и L4 показатели основной и

контрольной групп практически не различались и были ниже, чем у здоровых детей.

Таблица 4. Денситометрические показатели шейки бедра (M±m)

Область исследования	Основная группа (n=21)	Контрольная группа (n=32)	Здоровые дети (n=30)
Шейка бедра, Z-score	1,17±0,17	1,21±0,14	1,43±0,23
Шейка бедра, BMD, г/см²	0,95±0,04	0,92±0,03	0,94±0,03

В шейке бедра различий между основной и контрольной группами не выявлено, при этом показатели Z-критерия в обеих группах были ниже, чем у здоровых детей. Это указывает на более позднее вовлечение проксимального отдела бедра.

Таблица 5. Денситометрические показатели дистальных отделов костей предплечья (M±m)

Область исследования	Основная группа (n=21)	Контрольная группа (n=32)	Здоровые дети (n=30)
Локтевая кость, Z-score	−0,72±0,21	−0,63±0,17	−0,39±0,30
Локтевая кость, BMD, г/см²	0,72±0,04	0,74±0,03	0,77±0,03
Лучевая кость, Z-score	−0,75±0,20	−0,67±0,17	−0,51±0,29
Лучевая кость, BMD, г/см²	0,71±0,04	0,72±0,03	0,77±0,03

В дистальных отделах лучевой и локтевой костей Z-критерий был самым низким именно в основной группе; показатели контрольной группы занимали промежуточное положение между основной группой и здоровыми детьми. Таким образом, нарушения МПК у обследованных детей чаще всего локализовались в дистальных отделах костей предплечья и в поясничном отделе (L1–L4), а изменения в шейке бедра выявлялись позже и были более выражены в основной группе.

Анализ в зависимости от стадии полового развития показал, что самые низкие значения BMD (г/см²) у детей с ОРЛ регистрировались в пубертатном, а затем в препубертатном возрасте. В области L4 отмечено сближение показателей больных препубертатного и пубертатного возраста с показателями здоровых пубертатных детей. По Z-критерию различия выявлены по всем исследованным зонам; в L1 и L4 патология у больных ОРЛ выражена сильнее, чем у здоровых. По BMD различия более значимы в L2 и лучевой кости.

Установлена зависимость МПК от антропометрических показателей, в частности от индекса массы тела: чем выше физическое развитие ребёнка, тем выше Z-критерий.

Таблица 6. Денситометрические показатели у мальчиков и девочек (M±m)

Показатель	Основная + контрольная: мальчики (n=25)	Основная + контрольная: девочки (n=28)	Здоровые: мальчики (n=14)	Здоровые: девочки (n=16)
L1, Z-score	0,35±0,15	0,70±0,14‡	0,41±0,45	0,87±0,35
L2, Z-score	0,03±0,18	0,67±0,12‡	0,06±0,51	0,83±0,40
L3, Z-score	0,24±0,14	0,85±0,25	0,38±0,45	0,91±0,36
L4, Z-score	0,32±0,11	0,80±0,16	0,48±0,45	0,91±0,35
L1, BMD, г/см²	0,864±0,01	0,903±0,02‡	0,862±0,03*	0,943±0,01
L2, BMD, г/см²	0,796±0,02	0,824±0,02‡	0,839±0,03*	0,908±0,01
L3, BMD, г/см²	0,833±0,01*	0,928±0,03‡	0,864±0,03*	0,942±0,01
L4, BMD, г/см²	0,832±0,03	0,880±0,02‡	0,850±0,03**	0,942±0,01
Шейка бедра, Z-score	1,02±0,15	1,12±0,23†	1,27±0,40	1,56±0,28
Шейка бедра, BMD, г/см²	0,881±0,02	0,954±0,02	0,897±0,04	0,986±0,02
Лучевая кость, Z-score	−0,992±0,10	−0,013±0,10‡	−0,825±0,46	−0,009±0,39
Лучевая кость, BMD, г/см²	0,701±0,03	0,787±0,01†	0,692±0,06*	0,836±0,02
Локтевая кость, Z-score	−0,96±0,20	−0,33±0,15‡	−0,90±0,46	−0,15±0,36
Локтевая кость, BMD, г/см²	0,671±0,01**	0,786±0,01	0,681±0,05*	0,803±0,03

*Примечание: † — p<0,05; ‡ — p<0,01 (различия между девочками и мальчиками основной и контрольной групп); *, ** — отметки достоверности по данным автора.*

Темпы накопления МПК у мальчиков и девочек различались. Достоверные различия касались преимущественно L2, L3 и L4 BMD, а также BMD локтевой и лучевой костей: у девочек с ОРЛ МПК поясничного отдела была достоверно выше, чем у мальчиков, аналогичная закономерность отмечена и у здоровых детей. В шейке бедра МПК также была выше у девочек. По Z-критерию L1–L4 достоверных различий между группами не выявлено.

Факторы риска снижения минеральной плотности кости

Потребление кальция. Анкетирование проведено у детей с ОРЛ (мальчики n=76, девочки n=51). Адекватное потребление кальция (800–1000 мг/сут) отмечено менее чем у трети детей, при этом у 38% выявлен выраженный дефицит.

Таблица 7. Потребление кальция с пищей у детей с ОРЛ

Потребление кальция	Мальчики, абс.	Мальчики, %	Девочки, абс.	Девочки, %
Адекватное (800–1000 мг/сут)	21	27,6	15	29,4
Умеренный дефицит (500–800 мг/сут)	26	34,2	17	33,3
Выраженный дефицит (≤500 мг/сут)	29	38,2	19	37,3
Всего	76	100	51	100

Дисбаланс питания у детей 5–9 лет обусловлен в основном дефицитом молочных продуктов, у детей 10–15 лет — недостаточным потреблением молочных продуктов в сочетании с некоторым дефицитом белка. Для получения 1000 мг кальция в день необходимо употреблять 1 л молока, 200 г сыра или 300 г творога. Суточное потребление рассчитывали по формуле: кальций молочных продуктов (мг/сут) + 350 мг. Пример для подростка 15 лет (норма 1200 мг/сут): молоко 240 мг, кефир 96 мг, сыр 70 мг, прочие молочные продукты 161,6 мг, плюс 350 мг — итого 917,6 мг/сут; дефицит составил 282,4 мг/сут и может быть восполнен дополнительным стаканом кефира (240 мг) или двумя йогуртами (272 мг).

Физическая активность. Уровень активности определён у 157 детей. Адекватная активность выявлена у 82 (52,2%), низкая — у 75 (47,8%), то есть почти у половины обследованных.

Таблица 8. Распределение детей с ОРЛ по уровню физической активности

Уровень активности	Мальчики (n=76), абс.	Мальчики, %	Девочки (n=81), абс.	Девочки, %
Адекватная (n=82)	36	47,4	46	56,8
Низкая (n=75)	40	52,6	35	43,2

Экскреция кальция и фосфора с мочой

До лечения у детей основной группы экскреция кальция с мочой была несколько ниже нормальных значений, за исключением 14-летних, у которых она соответствовала показателям здоровых детей; наибольшие различия со здоровыми отмечены в 7 и 11 лет. После лечения наблюдалась положительная динамика: количество кальция, выделяемого с мочой, увеличивалось и

приближалось к нормативным значениям, особенно в 10 и 12 лет. Экскреция фосфора достоверно не отличалась от показателей здоровых детей. Величина ККС в обеих группах (0,341±0,02; 0,3348±0,04; 0,3088±0,03) указывает на отсутствие признаков резорбции костной ткани.

Эффективность коррекции кальциевого обмена

При постоянном отказе от молочных продуктов или недостаточном их потреблении назначали препарат «Жемчужный кальций»: 1 капсула содержит 300 мг порошка натурального жемчуга (карбонат кальция 0,27 г; микроэлементы — магний, медь, цинк, железо — и аминокислоты 0,03 г). Препарат выбран с учётом содержания микроэлементов и аминокислот, необходимых детям в препубертатном и пубертатном периодах. Положительная динамика уровня кальция в крови отмечена уже через 1 месяц.

Таблица 9. Динамика общего кальция крови (ммоль/л) на фоне приёма препарата «Жемчужный кальций» (M±m)

Возраст, лет	До лечения (n=81)	Через 1 мес. (n=53)	Через 3 мес. (n=35)
5–10	2,0±0,08	2,2±0,03	2,4±0,03*
11–15	1,8±0,04	2,1±0,06	2,3±0,04*

*Примечание: * — p<0,05 по сравнению с исходным уровнем.*

На основании полученных данных разработаны схема коррекции гипокальциемии и гиповитаминоза D, а также алгоритм диагностики, лечения и профилактики остеопении у детей с ОРЛ. Согласно алгоритму, всем детям с ОРЛ помимо стандартного обследования необходимо оценивать физическое развитие, а при его отставании проводить углублённое обследование; при отнесении ребёнка к группе риска остеопении проводится соответствующая коррекция терапии.

Клиническая эффективность комплексной коррекции

Таблица 10. Анализ обострений, антибактериальной терапии и ремиссии у детей с ОРЛ

Показатель	Контрольная группа (n=46)	Основная группа (n=35)
Число обострений за год	3,05±0,12	1,58±0,62
Длительность обострения, дни	10,01±0,42	6,06±0,12*
Курс антибактериальной терапии, дни	8,77±0,27	6,41±0,13*
Длительность ремиссии, дни	118,65±3,66	229,97±57*

*Примечание: * — достоверность различий между контрольной и основной группами p<0,001.*

Применение комплекса диагностики и коррекции остеопении привело к уменьшению числа обострений с 3,05±0,12 до 1,58±0,62 в год, сокращению длительности обострения и курса антибактериальной терапии и удлинению ремиссии.

Экономическая эффективность

Таблица 11. Экономическая эффективность предложенного комплекса (на одного ребёнка)

Показатель	Стоимость, сум
Один койко-день (все затраты, включая лекарства)	52 460
10-дневное лечение в стационаре	524 600
3 госпитализации в год	1 573 800
2 госпитализации в год	1 049 200
Экономический эффект на одного ребёнка	524 600

Примечание: по данным катамнеза 78 детей (2020–2025 гг.); у 45 больных число госпитализаций снизилось с 3 до 2 в год.

Обсуждение

У детей с ОРЛ формируется неблагоприятный фон для накопления костной массы: хроническое воспаление с повышением провоспалительных цитокинов, дефицит или недостаточность витамина D более чем у 3/4 детей, гипокальциемия, недостаточное поступление кальция с пищей и сниженная физическая активность. Преимущественное поражение дистальных отделов предплечья и поясничного отдела позвоночника согласуется с представлением о большей уязвимости участков с высокой долей трабекулярной кости и интенсивным ремоделированием, а более позднее изменение шейки бедра отражает последовательность вовлечения скелета. Зависимость МПК от ИМТ показывает значение оценки физического развития как простого скринингового критерия. Низкие значения ККС при гипокальциемии говорят о том, что снижение МПК связано в большей степени с недостаточным поступлением и усвоением кальция, чем с усиленной резорбцией.

Ограничения. Исследование одноцентровое; различия МПК между основной и контрольной группами в ряде зон не достигали статистической значимости; группа здоровых детей сформирована по литературным данным.

Выводы

1. Наиболее частые жалобы — полиартралгия и гиперкинезы. Среди больших критериев преобладали хорея (28%) и кардит (22,3%), нередко субклинический (митральная и трикуспидальная регургитация); артрит — 1,91%. У всех детей выявлена анемия I–II степени, у 7% — пиелонефрит. ОРЛ чаще встречалась у мальчиков 5–10 лет.

2. Характерны гипокальциемия, гипофосфатемия, повышение СРБ в 2–3 раза, высокие титры АСЛО, повышение IL-1β, IL-6 и IFN-γ; дефицит или недостаточность витамина D выявлены у 78,4% детей.

3. Наиболее низкие значения BMD отмечены в пубертатном, затем в препубертатном периоде. Изменения наиболее выражены в L2 и лучевой кости; МПК зависит от индекса массы тела — чем выше физическое развитие, тем выше Z-критерий.

4. Факторами риска остеопении являются низкое физическое развитие, дефицит кальция в рационе (адекватное потребление лишь у 27,6–29,4%), низкая физическая активность (47,8%) и дефицит витамина D.

5. Ведение детей с ОРЛ по разработанному алгоритму позволяет рано выявлять и корригировать нарушения костного метаболизма, снижает число обострений (с 3,05 до 1,58 в год), сокращает их длительность и удлиняет ремиссию; экономический эффект составил 524 600 сум на одного ребёнка.

Практические рекомендации

6. При поступлении оценивать физическое развитие. Низкое физическое развитие, низкий рост, дефицит массы тела, недостаточное потребление кальция, кариес, изменения ногтей, низкая кальциурия и низкая физическая активность определяют высокий риск остеопении/остеопороза и требуют углублённого обследования, включая денситометрию по показаниям.

7. Для выявления нарушений минерального обмена определять уровень кальция, скорректированного на альбумин, уровень витамина D, суточную экскрецию кальция и фосфора с мочой.

8. Если по анкете содержание кальция в рационе менее 500 мг/сут, целесообразно дополнительно назначать препараты кальция.

9. При низкой физической активности и отсутствии сердечной недостаточности рекомендовать повышение активности за счёт дополнительных занятий физкультурой сверх школьной программы.

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Курпаяниди К.И., к.э.н.
профессор кафедры «Экономика и управление»
Международный институт пищевых технологий и инженерии
Узбекистан, г. Фергана
ORCID: 0000-0001-8354-1512

ЗЕЛЁНАЯ ЭНЕРГЕТИКА ЦЕНТРАЛЬНОЙ АЗИИ И КАЧЕСТВО ЭНЕРГЕТИЧЕСКОГО ПЕРЕХОДА

Аннотация. Рост возобновляемой мощности в Центральной Азии требует оценки технологической структуры и ограничений энергосистем. Цель исследования состоит в выявлении различий между наращиванием мощности и диверсификацией энергетического портфеля пяти стран. На данных IRENA за 2023–2025 годы выполнены динамический и структурный анализ, декомпозиция прироста и расчёт индекса технологической концентрации. Установлено, что региональная мощность выросла на 44,5%, Узбекистан обеспечил 86,4% прироста, а Казахстан имеет наиболее сбалансированную структуру ВИЭ среди рассмотренных стран. Предложена типология национальных траекторий и обоснованы меры по развитию сетей, гибкости и региональной торговли.

Ключевые слова: энергетический переход, возобновляемая энергетика, энергетическая безопасность, Центральная Азия, диверсификация, солнечная энергетика, гидроэнергетика.

Kurpayanidi K.I., candidate of economic sciences
professor
Department of Economics and Management
International Institute of Food Technologies and Engineering
Uzbekistan, Fergana
ORCID: 0000-0001-8354-1512

GREEN ENERGY IN CENTRAL ASIA AND THE QUALITY OF ENERGY TRANSITION

Abstract. Expanding renewable capacity in Central Asia calls for an assessment of technology mixes and power system constraints. This study identifies differences between capacity growth and renewable portfolio diversification across five countries. IRENA data for 2023–2025 are analysed using growth decomposition, structural comparison and a technology concentration index. Regional capacity increased by 44.5%, Uzbekistan accounted for 86.4% of additions, and Kazakhstan had the most balanced renewable technology mix among the countries examined. A typology of national pathways is proposed, together with policy priorities for grids, flexibility and regional electricity trade.

Keywords: energy transition, renewable energy, energy security, Central Asia, diversification, solar energy, hydropower.

Введение

Развитие возобновляемых источников энергии (ВИЭ) в Центральной Азии связано с ростом спроса, обновлением инфраструктуры и изменением водопользования. Казахстан и Узбекистан диверсифицируют системы, ориентированные на ископаемое топливо. Кыргызстан и Таджикистан снижают зависимость от гидрологического режима. Туркменистан сохраняет газовую основу электроснабжения. Различия исходных условий требуют отдельных критериев оценки прогресса.

Установленная мощность отражает масштаб активов, но не объём надёжно поставляемой электроэнергии. Крупные ГЭС повышают долю ВИЭ горных стран независимо от развития новых технологий. Влияние солнечных станций на вечерний максимум нагрузки зависит от накопителей и резервов. Научная проблема состоит в выявлении структурных изменений, которые сопровождают количественный рост.

Исследования 2020–2021 годов раскрывают институциональные барьеры негидроэнергетических ВИЭ [2], ресурсный потенциал [3] и ограничения регулирования [4]. Их эмпирические периоды предшествуют ускоренному вводу новых станций в Узбекистане.

Другой блок литературы охватывает сельские энергетические услуги [5], региональную интеграцию водных и энергетических интересов [6], межсекторные диспропорции Узбекистана [7]. Он обосновывает включение социальных и водных ограничений в оценку перехода.

Работы 2024–2026 годов исследуют институциональные перспективы [8], энергоёмкость и углеродоёмкость [9], финансовые факторы [10], инфраструктурные ограничения [11] и реализацию международных норм [12]. Последняя структура мощности требует самостоятельного сопоставления.

Цель статьи состоит в оценке структурных изменений ВИЭ пяти стран за 2023–2025 годы. Авторский вклад включает декомпозицию прироста, сравнение технологической концентрации и типологию национальных траекторий. Причинное влияние отдельных реформ на ввод станций не оценивается.

Материалы и методы исследования

Использованы данные Renewable Capacity Statistics 2026 [1] по мощности пяти стран на конец 2023–2025 годов в мегаваттах. Выделены ГЭС, солнце, ветер и прочие ВИЭ. Литература 2020–2026 годов отобрана по релевантности. Обзор не является исчерпывающим систематическим поиском.

По классификации IRENA крупные ГЭС включены, атомная генерация исключена. Накопители рассматриваются как средство интеграции. Округлённый ноль не доказывает отсутствия малых установок.

Национальные сообщения не объединяются с рядом IRENA без согласования охвата.

Темп роста рассчитан как $g_i = (R_{i,2025} / R_{i,2023} - 1) \times 100\%$. Вклад страны определён как $c_i = \Delta R_i / \Sigma_i \Delta R_i \times 100\%$, где R обозначает мощность ВИЭ, ΔR её прирост за 2023–2025 годы. Показатели разделяют национальную динамику и происхождение регионального расширения.

Диверсификация оценена по $D_i = (S_i + W_i) / R_i \times 100\%$, где S и W обозначают солнце и ветер. Концентрация рассчитана как $HHI_i = \Sigma_k s_{ik}^2$ для четырёх технологических групп, s_{ik} является долей группы. Низкий HHI означает более равномерную структуру, но не измеряет надёжность энергосистемы.

Округление выполнено после расчётов. Для проверки устойчивости регионального темпа исключён Узбекистан. Типология не содержит интегрального рейтинга. IEA раскрывает национальные ограничения [13, 14], OECD рассматривает водно-энергетическую координацию [15].

Короткий период и неоднородность источников IRENA ограничивают выводы. Без выработки, ограничений отпуска и затрат нельзя оценить сокращение выбросов, стоимость балансирования и вероятность отключений. Исследование характеризует структуру активов.

Результаты оригинального авторского исследования

За 2023–2025 годы мощность ВИЭ выросла с 17 636 до 25 482 МВт, на 7 846 МВт, или 44,5%. В 2024 году добавлено 3 058 МВт, в 2025 году 4 788 МВт. Динамика представлена в таблице 1.

Таблица 1. Динамика мощности ВИЭ и вклад в прирост

Страна	2023, МВт	2024, МВт	2025, МВт	Рост, %	Вклад, %
Казахстан	5 504	5 561	6 084	10,5	7,4
Кыргызстан	3 143	3 314	3 527	12,2	4,9
Таджикистан	5 737	5 738	5 842	1,8	1,3
Туркменистан	2	2	2	0,0	0,0
Узбекистан	3 250	6 079	10 027	208,5	86,4
Регион	17 636	20 694	25 482	44,5	100,0

Источник: расчёты автора по [1]. Рост и вклад рассчитаны за 2023–2025 годы.

Узбекистан обеспечил 6 777 МВт прироста. Его доля региональной мощности выросла с 18,4 до 39,3%. Без него мощность увеличилась с 14 386 до 15 455 МВт, на 7,4%. Общий темп 44,5% скрывает неравномерность перехода.

В Узбекистане солнце достигло 5 934 МВт, ветер 1 652 МВт, ГЭС 2 441 МВт. Доля солнца и ветра выросла с 26,7 до 75,7%. Эти технологии обеспечили 6 718 МВт, или 99,1% национального прироста.

Казахстан достиг 6 084 МВт ВИЭ. На ГЭС приходится 2 848 МВт, ветер 1 909 МВт, солнце 1 325 МВт, прочие источники 2 МВт. Крупнейшая технология занимает менее половины портфеля. Страна демонстрирует более равномерное распределение между основными технологиями при меньшем темпе расширения.

В Кыргызстане из 3 527 МВт на ГЭС приходится 3 427 МВт, на солнце 100 МВт. В Таджикистане гидроэнергетическая мощность составляет 5 841 МВт при общем итоге 5 842 МВт. Остаток в 1 МВт не означает сформированного негидроэнергетического сектора. Обе страны сохраняют концентрацию на технологии, связанной с водными ресурсами.

В сопоставимом ряду Туркменистан имеет 2 МВт ВИЭ без прироста. Для столь малого портфеля индекс концентрации характеризует лишь учтённые возобновляемые активы, а не всю энергосистему. Отсутствие изменения показателя не равнозначно отсутствию инвестиционных планов.

Таблица 2. Технологическая структура ВИЭ в 2025 году

Страна	ГЭС, МВт	Солнце, МВт	Ветер, МВт	D, %	HHI
Казахстан	2 848	1 325	1 909	53,2	0,365
Кыргызстан	3 427	100	0	2,8	0,945
Таджикистан	5 841	0	0	0,0	1,000
Туркменистан	2	0	0	0,0	1,000
Узбекистан	2 441	5 934	1 652	75,7	0,437

Источник: [1], расчёты автора. D отражает долю солнца и ветра. HHI рассчитан с остаточной группой прочих ВИЭ. Расхождения итогов технологических групп обусловлены округлением и остаточной категорией.

HHI Казахстана равен 0,365, Узбекистана 0,437. Высокая доля солнца и ветра не гарантирует равномерности: солнце составляет 59,2% ВИЭ Узбекистана. HHI Кыргызстана равен 0,945, Таджикистана после округления 1,000. Масштаб и концентрация дают разные оценки.

Выделены диверсифицированная траектория Казахстана, ускоренная солнечно-ветровая Узбекистана, гидрозависимая Кыргызстана и Таджикистана и минимальный учтённый сектор Туркменистана. Типология описывает активы, а не качество управления.

Выявлены два вида концентрации: географическая концентрация прироста в Узбекистане и технологическая концентрация гидрогенерации в горных странах. Они требуют разных мер: расширения инвестиционных условий в остальных государствах и дополнения ГЭС другими технологиями.

Обсуждение результатов

Расширение негидроэнергетических ВИЭ изменило картину исследований 2020–2021 годов [2, 3]. Значение регулирования сохраняется [4, 8]. Новые расчёты согласуются с обсуждением инфраструктурных ограничений [11, 12], не доказывая причинного эффекта отдельных реформ.

Для Узбекистана приоритетны сетевое усиление, прогноз производства и согласование дневного выпуска с вечерним спросом. Накопители следует сравнивать по мощности и продолжительности разряда. Экономический критерий включает стоимость энергии с подключением и балансированием.

В Казахстане сбалансированный портфель ВИЭ не устраняет угольной зависимости всей системы и недостатка маневренности [14]. Закупки новых станций должны соответствовать срокам усиления сетей между ресурсными районами и центрами нагрузки.

В Кыргызстане и Таджикистане солнце и ветер дополняют ГЭС. Комбинация определяется спросом и водным притоком. Наращивание ГЭС сохраняет зависимость от маловодья. Региональные решения требуют согласования орошения и межгосударственных обязательств [6, 15].

Договоры покупки электроэнергии снижают неопределённость доходов, создавая обязательства покупателя. Валютная индексация переносит риски на энергокомпанию. Нужны открытые правила подключения и компенсации ограничений. IEA связывает реформу Узбекистана с финансовой устойчивостью и поддержкой населения [13].

Исторические оценки финансовых факторов [9, 10] не доказывают экологического эффекта вводов 2025 года. Одновременный рост спроса и ВИЭ не гарантирует сокращения потребления топлива. Требуются выработка и данные о замещении тепловых станций.

Поддержка распределённой генерации должна учитывать доходы получателей и местную сеть. Исследования сельской энергетики [5] и межсекторных связей [7] обосновывают оценку конечных услуг и водопользования.

Мониторинг должен охватывать мощность, выработку, ограничения отпуска, потери, резервы и перерывы снабжения. Накопители учитываются в МВт и МВт·ч, торговля по перетокам и пропускной способности. Единый балл скрывает отдельные ограничения.

Заключение

Региональная мощность ВИЭ выросла на 44,5%, без Узбекистана прирост составляет 7,4%. Узбекистан обеспечил 86,4% расширения. Региональный темп необходимо сопровождать декомпозицией по странам, чтобы отразить неравномерность изменений.

Казахстан имеет наиболее равномерную структуру ВИЭ с HHI 0,365. Узбекистан достиг доли солнца и ветра 75,7% при HHI 0,437. Кыргызстан и Таджикистан сохраняют гидроэнергетическую концентрацию. Малый сектор ВИЭ Туркменистана требует отдельной интерпретации. Эти показатели не заменяют оценку надёжности энергосистемы.

Результаты позволяют дифференцировать инвестиции: Узбекистану нужны сети, Казахстану гибкость, горным странам дополнение ГЭС и согласование водных режимов. Туркменистану необходимы прозрачный учёт и условия отбора проектов. Региону требуются совместные резервы и правила торговли.

Типология отделяет увеличение мощности от диверсификации. Оценка влияния структуры на снабжение и углеродоёмкость требует данных о выработке, ограничениях и затратах. Доказательство такого эффекта остаётся задачей дальнейшего исследования.

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Курпаяниди К.И., к.э.н.
профессор кафедры «Экономика и управление»
Международный институт пищевых технологий и инженерии
Узбекистан, г. Фергана
ORCID: 0000-0001-8354-1512

ИНСТИТУЦИОНАЛЬНАЯ АДАПТАЦИЯ ЦИФРОВОЙ ПОЛИТИКИ В УЗБЕКИСТАНЕ

Аннотация. Расширение цифровой инфраструктуры требует механизмов, которые связывают технологические вложения с результатами работы предприятий. Цель исследования состоит в определении условий адаптации инструментов цифровой политики к институциональной среде Узбекистана на основе опыта Франции. Применены сравнительный институциональный анализ, целевой обзор научных публикаций 2020–2026 гг. и анализ официальных материалов 2024–2026 гг. Разработаны матрица переноса шести институциональных функций, процедура допуска проектов к финансированию и система проверки экономического эффекта. Результаты обосновывают приоритет диагностики предприятий, поэтапного софинансирования, совместимости данных и независимой оценки перед расширением программ поддержки.

Ключевые слова: цифровая экономика, институциональная адаптация, цифровая политика, технологический суверенитет, искусственный интеллект, Франция, Узбекистан.

Kurpayanidi K.I., candidate of economic sciences
professor
Department of Economics and Management
International Institute of Food Technologies and Engineering
Uzbekistan, Fergana
ORCID: 0000-0001-8354-1512

INSTITUTIONAL ADAPTATION OF DIGITAL POLICY IN UZBEKISTAN

Abstract. Expanding digital infrastructure requires mechanisms that link technology investment to enterprise performance. This study identifies conditions for adapting digital policy instruments to Uzbekistan's institutional environment using France as a comparative case. The methods combine comparative institutional analysis, a targeted review of academic publications from 2020–2026, and analysis of official materials from 2024–2026. The study develops a matrix covering six transferable institutional functions, a project funding eligibility procedure, and a framework for assessing economic outcomes. The findings support

prioritising enterprise diagnostics, staged co-financing, data interoperability, and independent evaluation before expanding support programmes.

Keywords: digital economy, institutional adaptation, digital policy, technological sovereignty, artificial intelligence, France, Uzbekistan.

Введение

Цифровая политика требует разграничивать технологические вложения и результаты их использования. Для Узбекистана поддержку следует связывать с производительностью и устойчивой эксплуатацией решений. OECD рассматривает неравномерность распространения технологий как самостоятельную проблему развития [13].

Verhoef и соавторы разграничивают оцифровку, цифровизацию и трансформацию бизнес-модели [1]. Hanelt и соавторы раскрывают организационную адаптацию и цифровые экосистемы [2]. Kraus и соавторы систематизируют управленческие исследования [3]. Эти подходы связывают цифровые результаты с устройством организации, а не только с характеристиками технологии.

Mikalef и Gupta связывают способность применять ИИ с техническими, человеческими и организационными ресурсами [4]. Jöhnk, Weißert и Wyrtki предлагают оценивать готовность до внедрения [5]. Эти условия определяют отбор получателей поддержки: необходимы ответственный владелец процесса, пригодные данные и правила проверки результата.

Франция выбрана как страна с развитой инфраструктурой и опытом цифровой политики. Доклад Европейской комиссии 2026 г. отмечает сильную инфраструктуру и внедрение технологий бизнесом ниже среднего уровня ЕС [17]. Сравнение поэтому рассматривает функции институтов внедрения, а не воспроизведение французских организационных форм.

Научная проблема состоит в определении правил перехода от зарубежной практики к национальному инструменту с проверяемым результатом. Цель работы состоит в разработке процедуры институциональной адаптации цифровой политики для Узбекистана. Исследуются переносимые функции, условия их применения и показатели проверки. Основной вопрос касается сохранения назначения инструмента в среде с иной исполнительской способностью и бюджетными ограничениями.

Методы исследования

Применён сравнительный институциональный анализ вторичных источников. Единицей анализа выступает функция инструмента цифровой политики. Французский опыт используется для выделения функций, Узбекистан рассматривается как среда адаптации. Равенство стран по доходу, масштабу рынка и цифровой зрелости не предполагается.

База включает 18 источников: 12 статей 2021–2025 гг. из журналов, представленных в Scopus, и 6 официальных материалов OECD, Eurostat, ARCEP, ООН, Европейской комиссии и Узбекистана. Поиск охватывал 2020–

2026 гг. Отбор учитывал релевантность, установленное авторство, сведения об издании и DOI либо официальный адрес документа.

Обзор носит целевой характер и не является исчерпывающим обзором Scopus. Публикации отбирались по связи с готовностью предприятий, управлением технологиями и устойчивостью. Правовой документ изучается в доступной актуальной редакции [18].

Анализ устанавливает функцию инструмента, национальное ограничение, условия внедрения и показатели результата. Проверка их согласованности формирует матрицу адаптации для проектирования пилотной программы.

Переносимость оценивается по сохранению функции, административной соразмерности, исполнительской готовности и измеримости результата. Шкала каждого критерия составляет 0–2: отсутствие подтверждённого условия, необходимость подготовки, документально подтверждённая готовность. Такой подход структурирует экспертизу проекта и не представляет статистическую оценку качества национальных институтов.

Индекс переносимости $S = (F + A + E + M) / 8$ использует равные веса четырёх критериев. F обозначает сохранение функции, A обозначает соразмерность, E обозначает готовность исполнителя, M обозначает измеримость. Предлагаемый допуск к пилоту: $S \geq 0{,}75$ без нулевых оценок. Порог является авторским правилом, требующим испытания. Оценки конкретных проектов не рассчитываются.

EGDI характеризует государственное управление, а не предприятия. Показатели ЕС не переносятся на Узбекистан. Без микроданных и контрольной группы причинные эффекты не оцениваются. В выбранной базе не найден национальный показатель внедрения, сопоставимый с Eurostat.

Результаты исследования

Инфраструктура, корпоративное внедрение и государственное управление учитываются раздельно. Показатели таблицы 1 характеризуют среду цифровой политики, но не формируют общий рейтинг стран.

Таблица 1. Показатели цифрового развития и границы их интерпретации

Объект наблюдения	Значение и период	Что характеризует показатель
Предприятия ЕС с 10 и более занятыми	ИИ используют 20,0% в 2025 г., 13,5% в 2024 г. [14]	Распространение ИИ в обследуемой совокупности
Помещения во Франции	42,4 млн доступны для подключения к оптоволокну, 94,3% на конец 2025 г. [15]	Техническую доступность фиксированной инфраструктуры
Цифровая политика Франции	33 меры, 18,6 млрд евро общего бюджета, доклад 2026 г. [17]	Масштаб дорожной карты, а не достигнутый эффект
Электронное правительство Узбекистана	EGDI 0,7999, место 63 в 2024 г. [16]	Развитие электронного правительства
Стратегические ориентиры Узбекистана	Стратегия ИИ до 2030 г., ПП-358, редакция 2026 г. [18]	Направления государственной политики

Источник: составлено автором по [14–18]. Показатели не образуют единой сопоставимой шкалы.

Матрица шести функций связывает условия внедрения с наблюдаемым результатом. Предложенные механизмы предназначены для разработки пилотов и не описывают действующую программу Узбекистана.

Таблица 2. Авторская матрица институциональной адаптации

Функция	**Условие внедрения**	**Предлагаемый механизм**	**Показатель проверки**
Диагностика	Описание процесса и исходных затрат	Аудит до выбора решения	Наличие исходных данных и владельца процесса
Софинанси-рование	Проверяемый вклад предприятия	Оплата по этапам с независимой приёмкой	Дополнительные частные вложения и эффект
Качество связи	Измерения на площадке предприятия	Контроль скорости, задержки и отказов	Стабильность работы прикладной системы
Совместимость данных	Единые форматы и права доступа	Открытые интерфейсы и тест миграции	Стоимость и срок смены поставщика
Управление рисками ИИ	Классификация задач и ответственности	Оценка воздействия и контроль человеком	Ошибки, инциденты и срок их устранения
Оценка результата	Исходное наблюдение и группа сравнения	Проверка через 6 и 12 месяцев	Изменение затрат, качества и производительности

Источник: разработано автором. Условия требуют проверки до начала пилота.

Диагностика предшествует выбору технологии. Предприятие описывает процесс, устанавливает исходные затраты и выявляет ограничение. Например, прогнозирование запасов требует сначала устранить ошибки учёта и согласовать справочники. Проверяются пригодность данных, полномочия владельца процесса и связь решения с хозяйственной задачей. Такая последовательность предотвращает автоматизацию решений на ненадёжной информационной базе.

Софинансирование охватывает диагностику, прототип, пилот и расширение эксплуатации. Каждый этап имеет результат, допустимые расходы и условия перехода. Независимая приёмка проверяет работу решения. Последующая оценка устанавливает сохранение эффекта после прекращения поддержки. Критерии остановки фиксируются до заключения договора, поскольку вклад предприятия сам по себе не доказывает эффективность.

Совместимость данных снижает зависимость от поставщика. При отборе проекта проверяются документированные форматы выгрузки, интерфейсы, права доступа, стоимость миграции и порядок удаления копий. Эта проверка необходима и для отечественного, и для зарубежного продукта.

Национальность поставщика не заменяет оценку его технической и договорной архитектуры.

Управление рисками ИИ включается в общую систему управления организацией. Mäntymäki и соавторы раскрывают связь с корпоративным управлением [6], Birkstedt и соавторы систематизируют исследовательские направления [7], Papagiannidis и соавторы анализируют практики создания устойчивых приложений [8]. До эксплуатации предлагается закреплять владельца модели, мониторинг ошибок и полномочия человека при пересмотре решения.

Второй результат представляет паспорт цифрового проекта. Он фиксирует проблему, владельца процесса, исходное значение показателя, ожидаемое изменение и срок наблюдения. Дополнительно описываются первоначальные и текущие расходы, источники данных, интеграция, миграция, ответственность и критерии остановки. Паспорт сохраняет условия первоначальной оценки и связывает финансирование с проверкой результата.

Стоимость владения: TCO = C0 + Σ(t = 1…T) C(t) / (1 + r)^t. Здесь C0 обозначает первоначальные затраты, C(t) обозначает расходы периода t, T обозначает горизонт, r обозначает ставку дисконтирования. При одинаковых T и r учитываются данные, лицензии, интеграция, обучение, мониторинг, исправление ошибок и завершение эксплуатации.

Третий результат представляет система проверки эффекта. Производительность измеряется выпуском на единицу труда, качество измеряется долей брака и возвратов, устойчивость измеряется простоями. Для сервиса учитываются срок исполнения и повторные обращения. Проверка структуры выпуска, спроса и загрузки оборудования предотвращает приписывание проекту внешних изменений.

Для пилота предлагается разность изменений: $\Delta = (Y_{1,после} - Y_{1,до}) - (Y_{0,после} - Y_{0,до})$. Индекс 1 обозначает участников, индекс 0 обозначает сопоставимые предприятия без поддержки. Применение требует проверки предшествующих тенденций и одновременных вмешательств. Формула описывает будущий дизайн оценки. В настоящей работе значение Δ не рассчитывается.

Обсуждение результатов

Технологический суверенитет означает управляемость критических зависимостей. Предприятие сохраняет доступ к данным, процедуры восстановления и альтернативы для ключевых компонентов. Государство закрепляет эти условия в закупках и оценке. Проверяемые права и процедуры включаются в паспорт и техническую приёмку.

Raisch и Krakowski раскрывают взаимосвязь автоматизации и расширения человеческих компетенций [9]. Поэтому экономия времени оценивается вместе с расходами на обучение, проверку и изменение обязанностей. Ускорение операции без сохранения качества переносит затраты на следующие стадии. Оценка проекта должна охватывать весь процесс, включая исправление ошибок и работу с исключениями.

Feuerriegel и соавторы рассматривают приложения и ограничения генеративного ИИ в информационных системах [10]. Для предприятия существенны качество ответа, происхождение данных и повторяемость проверки. Уровень контроля определяется назначением системы и последствиями ошибки. При финансовых и правовых решениях экономическая оценка включает расходы на проверку человеком и пересмотр результата.

Fura, Karasek и Hysa, а также Vărzaru исследуют связь цифровизации и устойчивости в ЕС [11, 12]. Межстрановые зависимости не переносятся автоматически на предприятие Узбекистана. Для производственного проекта предлагается учитывать энергию на единицу выпуска, материальные потери и вычислительные расходы. Каждый показатель требует исходного наблюдения и сопоставимого периода оценки.

Матрица требует эмпирической валидации. Равные веса упрощают применение, но их пригодность проверяется на разных проектах. Необходимо оценить согласованность экспертов, чувствительность отбора к порогу и связь оценок с результатами эксплуатации. До проверки индекс используется для структурирования экспертизы, а не как доказанный предиктор успеха.

Заключение

Шесть функций адаптации охватывают диагностику, софинансирование, качество связи, совместимость данных, риски ИИ и оценку результата. Их перенос требует соразмерной нагрузки, ответственного исполнителя и измеримых показателей. Французский опыт определяет функции для проектирования инструментов Узбекистана.

Авторский вклад объединяет матрицу, паспорт и проверку эффекта, связывая финансирование с хозяйственной проблемой и результатами эксплуатации. Индекс задаёт критерии допуска к пилоту. Его веса и порог требуют испытания.

Результаты предназначены для отраслевых пилотов с исходными наблюдениями и независимой оценкой. Приоритетом выступают измерения на предприятиях и права доступа к данным, совместимости и смены поставщика. Последующее исследование должно проверить экспертные оценки и установить их связь с изменением затрат, качества и производительности. Микроданные и интервью исполнителей необходимы для перехода к причинной оценке.

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Леонова В.В.
студент
научный руководитель: Алиев А.А., к.э.н.
доцент по специальности «Финансы»
Российский экономический университет имени Г.В. Плеханова
Россия, г. Москва

КЛЮЧЕВАЯ СТАВКА БАНКА РОССИИ КАК ИНСТРУМЕНТ ДЕНЕЖНО-КРЕДИТНОЙ ПОЛИТИКИ И ЕЁ ВЛИЯНИЕ НА РЫНОЧНЫЕ ПРОЦЕНТНЫЕ СТАВКИ

Аннотация. в статье рассматривается ключевая ставка Банка России как основной инструмент денежно-кредитной политики в режиме таргетирования инфляции. Актуальность темы обусловлена тем, что в 2022–2026 годах ставка изменялась в диапазоне от 7,5 до 21% годовых. Цель работы — раскрыть экономическое содержание ключевой ставки, механизм её передачи на рыночные ставки и связь с инфляцией на основе анализа официальных данных Банка России и Росстата. В результате обоснованы три сценария уровня ключевой ставки (высокий, базовый и низкий) для последующих финансовых расчётов.

Ключевые слова: денежно-кредитная политика, центральный банк, инфляция, процентные ставки, трансмиссионный механизм, ключевая ставка.

Leonova V.V.
student
Aliyev A.A., candidate of economic sciences
scientific supervisor, associate professor in Finance
Plekhanov Russian University of Economics
Russia, Moscow

THE KEY RATE OF THE BANK OF RUSSIA AS AN INSTRUMENT OF MONETARY POLICY AND ITS IMPACT ON MARKET INTEREST RATES

Abstract. the article examines the key rate of the Bank of Russia as the main instrument of monetary policy under inflation targeting. The relevance of the topic is determined by the fact that in 2022–2026 the rate ranged from 7.5 to 21% per annum. The purpose of the study is to reveal the economic nature of the key rate, the mechanism of its transmission to market rates and its relationship with inflation based on official data of the Bank of Russia and Rosstat. As a result, three scenarios of the key rate level (high, baseline and low) are substantiated for subsequent financial calculations.

Keywords: monetary policy, central bank, inflation, interest rates, transmission mechanism, key rate.

Введение

Ключевая ставка Банка России служит ориентиром для стоимости кредитов и доходности вкладов. За 2022–2026 годы она менялась от 7,5 до 21% годовых, поэтому понимание её логики важно для финансовых вычислений. Цель исследования — раскрыть содержание ключевой ставки, механизм её трансмиссии и связь с инфляцией и сформировать сценарии её уровня.

Материалы и методы исследования

Использованы нормативные акты, документы и статистика Банка России и Росстата; применялись анализ временных рядов, расчёт реальной ставки и сценарный подход.

Результаты исследования

Ключевая ставка введена в 2013 году; это ставка по основным операциям Банка России — недельным аукционам репо и депозитным аукционам. Процентный коридор ±1 п.п. удерживает межбанковские ставки, прежде всего RUONIA, вблизи ключевой [3]. Согласно закону № 86-ФЗ, основная цель Банка России — защита и обеспечение устойчивости рубля [1]; с 2014 года действует режим таргетирования инфляции с целью 4%.

Если прогноз инфляции превышает цель, Банк России повышает ставку, удорожая кредит и сдерживая спрос; при замедлении инфляции ставка снижается [2]. Ориентиром служит правило Тейлора [7]:

$$i = r^* + \pi + 0{,}5 \cdot (\pi - \pi^*) + 0{,}5 \cdot y, \quad (1)$$

где i — ставка центрального банка; r^* — нейтральная реальная ставка; π и π^* — фактическая и целевая инфляция; y — разрыв выпуска. Значит, при ускорении инфляции ставка должна расти сильнее неё.

Трансмиссионный механизм передаёт решение по ставке на денежный рынок, ставки по вкладам и кредитам и через спрос — на инфляцию за три–шесть кварталов; выделяют процентный, кредитный, валютный каналы и канал ожиданий [2; 8]. Долгосрочные ставки зависят от ожиданий: в декабре 2025 года средневзвешенная ставка по краткосрочным вкладам составила 15,3%, по долгосрочным — 12,2% при ключевой ставке 16–16,5%, а ипотечная ставка из-за льготных программ — лишь 7,6% [5], что ослабляет процентный канал.

В 2022 году ставка повышалась до 20% и снижалась до 7,5%, затем выросла до 21% к октябрю 2024 года, а с июня 2025 года снижалась до 14%, на которых сохранена 11 сентября 2026 года [3; 4]. Соотношение ставки и инфляции приведено в таблице 1.

Таблица 1

Ключевая ставка, инфляция и реальная ставка, %

Период	Ключевая ставка на конец периода	Годовая инфляция	Реальная ставка
2022 год	7,50	11,94	−4,44
2023 год	16,00	7,42	8,58
2024 год	21,00	9,52	11,48
2025 год	16,00	5,59	10,41
2026 год (сентябрь)	14,00	6,30	7,70

Источник: рассчитано автором по данным Банка России и Росстата [3; 4; 6].

Высокая реальная ставка 2023–2025 годов снизила инфляцию до 5,59% [6], но в 2026 году она вновь ускорилась до 6,3% [4]. Сценарии для расчётов приведены в таблице 2.

Таблица 2

Сценарии уровня ключевой ставки

Сценарий	Ставка, %	Обоснование
Высокий	21,0	Максимум 2024–2025 гг.: жёсткая политика при инфляции 9–10%
Базовый	14,0	Уровень осени 2026 г.: умеренно жёсткая политика при инфляции 6–7%
Низкий	7,5	Минимум 2022–2023 гг.: мягкая политика при инфляции около цели

Источник: составлено автором.

Заключение

Ключевая ставка — центральный инструмент политики Банка России, влияющий через трансмиссионный механизм на кредиты, вклады и инфляцию. Предложенные сценарии ключевой ставки — 21, 14 и 7,5% — опираются на реально наблюдавшиеся периоды и могут служить исходными условиями для расчётов наращения, дисконтирования и сравнения финансовых инструментов.

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Мадаминов А.А., PhD по философским наукам
заведующий кафедрой «Фундаментальные
и общественные науки»
Эргашева З.Х.
студент
Международный институт пищевых
технологий и инженерии
Узбекистан, г. Фергана

РОЛЬ КОНЦЕПЦИИ HECI В ФОРМИРОВАНИИ ЧЕЛОВЕЧЕСКОГО КАПИТАЛА В УСЛОВИЯХ ТЕХНОЛОГИЧЕСКОЙ ТРАНСФОРМАЦИИ

Аннотация. в статье рассматривается концепция HECI (Humanity, Ethics, Creativity, Imagination) как современная гуманитарная модель развития человеческого капитала в условиях цифровизации и ускоренного технологического прогресса. Анализируются современные вызовы, связанные с распространением искусственного интеллекта, автоматизации, изменением ценностных ориентиров общества и трансформацией профессиональной подготовки специалистов.

Ключевые слова: HECI, человечность, нравственность, креативность, воображение, человеческий капитал, цифровизация, STEM, образование, устойчивое развитие, инновации, искусственный интеллект.

Madaminov A.A., PhD in Philosophical Sciences
head of the Department of Fundamental and Social Sciences
Ergasheva Z.Kh.
student
International Institute of Food Technologies and Engineering
Uzbekistan, Fergana

THE ROLE OF THE HECI CONCEPT IN FORMING HUMAN CAPITAL UNDER CONDITIONS OF TECHNOLOGICAL TRANSFORMATION

Abstract. The article examines the HECI (Humanity, Ethics, Creativity, Imagination) concept as a modern humanitarian model for human capital development in the context of digitalization and accelerated technological progress. Modern challenges related to the spread of artificial intelligence, automation, changes in society's value orientations, and the transformation of professional training for specialists are analyzed.

Keywords: HECI, humanity, morality, creativity, imagination, human capital, digitalization, STEM, education, sustainable development, innovation, artificial intelligence.

Введение

XXI век характеризуется масштабными преобразованиями, вызванными ускоренным развитием технологий, цифровых коммуникаций, искусственного интеллекта и глобальных процессов модернизации. Современные инновационные системы создают новые возможности для повышения качества жизни, одновременно формируя сложные социальные и нравственные вызовы.

Современное общество всё чаще сталкивается с противоречием между технологическим развитием и сохранением гуманистических ценностей. На этом фоне особое значение приобретает концепция HECI (Humanity, Ethics, Creativity, Imagination), рассматриваемая как интегративная модель формирования личности нового поколения.

Концепция HECI представляет собой объединение четырёх взаимосвязанных компонентов:

- Humanity — человечность;
- Ethics — нравственность;
- Creativity — креативность;
- Imagination — воображение.

Именно данные компоненты рассматриваются как фундаментальные условия устойчивого развития современного общества.

Цель исследования — определить значение концепции HECI в развитии человеческого капитала и обосновать её интеграцию в образовательные процессы.

Задачи исследования:

- раскрыть теоретические основы HECI;
- определить влияние цифровизации на ценностные установки общества;
- исследовать возможности интеграции HECI и STEM-подходов;
- выявить перспективы развития образовательных систем.

Теоретические основы концепции HECI

HECI выступает как гуманистическая образовательная парадигма, направленная на преодоление последствий технократического мышления и укрепление человеческого потенциала.

Согласно материалам исследования, стремительное развитие технологий сопровождается усилением социальных рисков: ростом индивидуализма, снижением уровня социальной ответственности, ослаблением моральных ориентиров и возникновением новых форм цифровой зависимости.

В этих условиях образование должно выполнять не только функцию подготовки профессиональных кадров, но и обеспечивать развитие нравственного сознания личности.

Человечность как фактор устойчивого развития

Компонент Humanity рассматривается как совокупность духовных качеств личности, обеспечивающих социальную устойчивость и сохранение человеческого достоинства.

Человечность включает:

- уважение личности;
- социальную ответственность;
- эмпатию;
- стремление к общественному благу;
- межкультурный диалог.

В современных условиях гуманизм приобретает глобальное значение и становится инструментом преодоления кризисов, связанных с социальным неравенством, конфликтами и экологическими угрозами.

Нравственность как основа общественной стабильности

Этическое измерение HECI направлено на формирование системы ценностей, регулирующей поведение человека.

Нравственность включает:

- ответственность;
- справедливость;
- честность;
- профессиональную этику;
- уважение общественных интересов.

Философское понимание морали связывает её не только с системой норм, но и с механизмом внутреннего саморегулирования личности.

В эпоху искусственного интеллекта вопросы этики приобретают особую значимость, поскольку технологические системы не обладают собственными моральными основаниями.

Креативность как источник инновационного развития

Креативность рассматривается как способность создавать новые идеи, находить нестандартные решения и адаптироваться к быстро меняющимся условиям.

Современная экономика требует специалистов нового типа:

- аналитически мыслящих;
- способных к междисциплинарному взаимодействию;
- ориентированных на инновации;
- готовых к постоянному обучению.

Креативность становится ключевым элементом конкурентоспособности государств и образовательных систем.

Воображение и развитие будущих компетенций

Воображение представляет собой интеллектуальный механизм проектирования будущего.

Его значение проявляется через:

- моделирование сценариев развития;
- способность к прогнозированию;
- стратегическое мышление;
- формирование инновационных решений.

Современные образовательные программы должны развивать способность студентов к комплексному восприятию процессов и формированию новых моделей взаимодействия человека и технологий.

Интеграция STEM и HECI

Одним из наиболее перспективных направлений современного образования выступает интеграция STEM и HECI.

STEM обеспечивает:

- технологические компетенции;
- инженерное мышление;
- научный подход.

HECI обеспечивает:

- гуманизацию знаний;
- развитие ценностного мышления;
- воспитание социальной ответственности.

Их объединение создаёт модель образования, ориентированную на устойчивое развитие общества.

Современные вызовы и перспективы

К основным вызовам относятся:

- цифровизация общественных отношений;
- распространение искусственного интеллекта;
- трансформация рынка труда;
- изменение культурных моделей поведения.

Ответом на данные вызовы становится переход от технократической модели образования к человекоцентричной образовательной системе.

HECI способствует формированию интеллектуально развитой, нравственно устойчивой и социально ответственной личности.

Заключение

Концепция HECI представляет собой современную гуманитарную модель развития человеческого капитала в условиях технологической трансформации.

Её внедрение позволяет преодолеть ограничения исключительно технологического подхода и создать образовательную среду, ориентированную на гармоничное развитие личности.

Интеграция человечности, нравственности, креативности и воображения должна стать одним из стратегических направлений развития современного образования и подготовки специалистов будущего.

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Мамадалиев М.А.
ассистент
Андижанский государственный технический институт

ИССЛЕДОВАНИЕ УСТОЙЧИВОСТИ СВЕТОДИОДОВ К ВОЗДЕЙСТВИЮ МЕХАНИЧЕСКИХ И КЛИМАТИЧЕСКИХ НАГРУЗОК

Аннотация. В статье рассмотрены вопросы эксплуатационной устойчивости светодиодов и светодиодных модулей при воздействии механических и климатических факторов. Проанализировано влияние температуры, влажности, температурного циклирования, вибрации и механических нагрузок на электрические, оптические и тепловые характеристики. Систематизированы основные механизмы деградации кристалла, межсоединений, паяных соединений, люминофора и корпуса. Предложен комплексный подход к оценке надежности, включающий ускоренные испытания, тепловой анализ, контроль параметров и моделирование комбинированных воздействий.

Ключевые слова: светодиод, надежность, климатические воздействия, механические нагрузки, температура, влажность, вибрация, термоциклирование, тепловой менеджмент.

Mamadaliyev M.A.
assistant
Andijan State Technical Institute

INVESTIGATION OF LED RESISTANCE TO MECHANICAL AND CLIMATIC LOADS

Abstract. The paper considers the operational reliability of light-emitting diodes and LED modules under mechanical and climatic stresses. The influence of temperature, humidity, thermal cycling, vibration and mechanical loads on electrical, optical and thermal characteristics is analyzed. The main degradation mechanisms of the LED chip, interconnections, solder joints, phosphor and package are systematized. A comprehensive reliability assessment approach combining accelerated testing, thermal analysis, parameter monitoring and modeling of combined stresses is proposed.

Keywords: LED, reliability, climatic effects, mechanical loads, temperature, humidity, vibration, thermal cycling, thermal management.

Введение

Светодиодные источники света широко применяются в промышленном, транспортном, бытовом и уличном освещении благодаря высокой световой эффективности, длительному сроку службы, малым габаритам и возможности

цифрового управления. Однако достижение заявленных характеристик определяется не только параметрами полупроводникового кристалла, но и надежностью всего светодиодного устройства.

В реальных условиях светодиоды подвергаются одновременному воздействию температуры, влажности, вибрации, ударов, загрязнения и электрических перегрузок. Деградация может происходить на уровне кристалла, контактов, межсоединений, паяных соединений, люминофора, оптических элементов и корпуса.

Актуальность исследования связана с расширением области применения LED-систем в условиях, где температура, влажность и механические воздействия изменяются в широких пределах. Поэтому оценка устойчивости должна учитывать совокупность воздействий и их взаимное влияние.

Материалы и методы исследования

Для анализа устойчивости светодиодов внешние воздействия разделены на климатические и механические. К климатическим относятся повышенная и пониженная температура, влажность, температурные циклы и конденсация. К механическим относятся вибрация, ударные нагрузки, циклические деформации и напряжения, возникающие вследствие различия коэффициентов теплового расширения материалов.

Температурное воздействие является одним из наиболее существенных факторов надежности. При повышении температуры ускоряются физические и химические процессы старения материалов и изменяются электрические параметры p-n-перехода. Недостаточный отвод тепла повышает температуру перехода и ускоряет деградацию.

Для оценки температурной устойчивости применяются длительные испытания при заданной температуре, температурное циклирование и ускоренные испытания. При циклировании образцы последовательно выдерживаются при высоких и низких температурах с контролируемыми скоростями нагрева и охлаждения.

Влажность может изменять свойства материалов, ускорять коррозионные процессы и ухудшать состояние металлических контактов. При температурных градиентах возможно образование конденсата, что повышает вероятность электрических утечек и коррозии.

Механическая устойчивость исследуется с помощью вибрационных и ударных испытаний. Вибрация вызывает повторяющиеся механические напряжения в паяных соединениях и местах крепления компонентов, а длительное воздействие может приводить к усталостным повреждениям.

Для количественной оценки деградации используются прямое напряжение, рабочий ток, световой поток, цветовые координаты, температура корпуса и температура p-n-перехода. Критерием отказа может быть заданное снижение светового потока либо выход электрических параметров за установленные пределы.

Результаты исследования

Анализ механизмов отказа показывает, что устойчивость LED определяется взаимодействием нескольких конструктивных и эксплуатационных факторов. При повышенной температуре необходимо контролировать тепловое сопротивление между p-n-переходом и окружающей средой.

Конструкция корпуса и теплового интерфейса имеет большое значение. Металлическая подложка, теплопроводящий материал, радиатор и способ монтажа должны обеспечивать эффективный отвод тепла. Воздушные зазоры и ухудшение теплового контакта увеличивают температуру устройства и сокращают ресурс.

Температурное циклирование опасно для многослойных LED-конструкций. Различие коэффициентов теплового расширения кристалла, металлов, припоя, подложки и корпуса приводит к механическим напряжениям. При многократном повторении циклов они способны инициировать усталостные повреждения.

Воздействие влажности усиливает деградацию при наличии загрязнений и электрического потенциала между проводящими участками. Для повышения устойчивости применяются герметизация, защитные покрытия, влагостойкие материалы и конструктивные решения, препятствующие проникновению влаги.

Механические воздействия особенно важны для светодиодных систем на транспортных объектах, промышленных установках и конструкциях, подверженных вибрации. Механические и термические факторы следует рассматривать совместно: температура изменяет свойства материалов, а вибрация и деформация могут ухудшать тепловой контакт.

Наиболее информативным является комплексный подход, при котором после каждого этапа климатических или механических испытаний измеряются электрические, световые и тепловые характеристики. Это позволяет определить скорость деградации и наиболее критичный фактор.

Обсуждение

Надежность LED-систем определяется не только характеристиками полупроводникового материала. Существенную роль играют технология сборки, качество паяных соединений, конструкция корпуса, оптические материалы и система теплового управления.

Для практической оценки целесообразно применять последовательность испытаний: предварительное измерение параметров, воздействие заданного фактора, промежуточный контроль, повторное воздействие и итоговая оценка. Такой подход позволяет определить постепенное ухудшение характеристик.

Перспективным направлением является математическое моделирование. Тепловые и механические модели позволяют определить распределение температуры и напряжений в корпусе LED, подложке и паяных

соединениях. Совместное применение расчетов и эксперимента позволяет оптимизировать конструкцию.

Для промышленных и наружных LED-систем целесообразен цифровой мониторинг температуры и электрических параметров. Эти данные могут использоваться для выявления деградации и прогнозирования остаточного ресурса.

Заключение

Устойчивость светодиодов к механическим и климатическим нагрузкам является комплексной характеристикой, зависящей от конструкции, материалов, технологии сборки и условий эксплуатации. Наиболее значимыми факторами являются температура, температурное циклирование, влажность, вибрация и ударные воздействия.

Для повышения надежности необходимо совершенствовать систему теплового отвода, обеспечивать защиту от влаги, повышать механическую прочность соединений и применять материалы с согласованными коэффициентами теплового расширения.

Практическая эффективность комплексного подхода заключается в возможности выявления наиболее уязвимых элементов LED-конструкции до начала массовой эксплуатации. В дальнейшем целесообразно разработать экспериментальную методику ускоренного испытания LED-модулей с одновременным воздействием температуры, влажности и вибрации.

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Махамадалиев Р.Ю., к.г.н.
доцент кафедры экономической и социальной географии
Национальный университет Узбекистана имени Мирзо Улугбека
Узбекистан, г. Ташкент

РАЗМЕЩЕНИЕ ПРОИЗВОДИТЕЛЬНЫХ СИЛ В УЗБЕКИСТАНЕ: ТЕРРИТОРИАЛЬНАЯ СТРУКТУРА, ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ

Аннотация. В статье рассматриваются теоретические основы размещения производительных сил и современная территориальная организация населения и хозяйства Узбекистана. На основе официальных статистических данных за 2025–2026 гг., рассчитаны плотность населения, доли регионов в валовом внутреннем продукте, валовой региональный продукт на душу населения и отраслевая структура. Выделены основные проблемы (диспропорции между плотностью населения и ресурсами, дефицит воды, последствия высыхания Аральского моря, зависимость от столичного региона) и обоснованы направления совершенствования размещения производительных сил.

Ключевые слова: размещение производительных сил; экономическая и социальная география; Узбекистан; территориальная структура хозяйства; региональные диспропорции; валовой региональный продукт.

Makhamadaliev R.Yu., candidate of geographical sciences
associate professor
Department of Economic and Social Geography
National University of Uzbekistan named after Mirzo Ulugbek
Uzbekistan, Tashkent

LOCATION OF PRODUCTIVE FORCES IN UZBEKISTAN: TERRITORIAL STRUCTURE, PROBLEMS AND PROSPECTS

Abstract. The article examines the theoretical foundations of the location of productive forces and the current territorial organization of the population and economy of Uzbekistan. Using official statistics for 2025–2026, the author calculates population density, regional shares in gross domestic product, gross regional product per capita and sectoral structure. The main problems (mismatch between population density and resources, water scarcity, consequences of the Aral Sea desiccation, dependence on the capital region) are identified, and directions for improving the location of productive forces are substantiated.

Keywords: location of productive forces; economic and social geography; Uzbekistan; territorial structure of the economy; regional disparities; gross regional product.

Введение. Размещение производительных сил — одна из центральных категорий экономической и социальной географии: она описывает, как население, трудовые ресурсы, предприятия и инфраструктура распределены по территории и чем объясняются различия между регионами [1, 2]. Для Узбекистана эта проблема особенно актуальна. На 1 апреля 2026 г. в стране проживало 38,4 млн человек, около 51 % из них — в городах [3], а средняя плотность населения составляла 85,5 чел./км² [4]. Однако за средним значением скрываются различия на два порядка: от 7352 чел./км² в г. Ташкенте до 10 чел./км² в Навоийской области [4]. Одновременно Стратегия «Узбекистан — 2030» ставит целью повышение благосостояния населения на основе устойчивого экономического роста [5], что невозможно без учёта пространственных диспропорций.

Цель статьи — оценить современную территориальную структуру населения и хозяйства Узбекистана и определить направления совершенствования размещения производительных сил. Использованы статистический, сравнительно-географический и историко-географический методы, а также группировка регионов по макрозонам. Информационной базой послужили данные Национального комитета по статистике за 2025–2026 гг. [6, 7].

1. Теоретические основы изучения размещения производительных сил

Зарубежная традиция опирается на теорию размещения. А. Вебер объяснял выбор места для предприятия минимизацией транспортных и трудовых издержек [8], У. Изард обобщил методы пространственно-экономического анализа [9]. Ф. Перру выдвинул идею «полюсов роста»: развитие концентрируется в отдельных центрах и распространяется от них на окружающую территорию [10]. П. Кругман показал, что при возрастающей отдаче от масштаба производство тяготеет к крупным рынкам, формируя ядро и периферию [11], а М. Портер связал успех регионов с кластерами — территориальными концентрациями взаимосвязанных компаний [12].

Отечественная и советская школа опирается на труды Н.Н. Колосовского, разработавшего учение о территориально-производственных комплексах и теорию экономического районирования [2], а также Ю.Г. Саушкина [13]. В Узбекистане эти подходы развиваются в учебной и научной литературе по региональной экономике [14]. Так, С.Л. Янчук и Р. Худайберганова при анализе Нижнеамударьинского района рассматривают сочетание факторной и регулярной (кристаллеровской) схем размещения, формирование кластеров, полюсов и линий роста [15]; Д.Р. Розметов и Ф.М. Комилова изучают отраслевую специализацию экономических районов республики [16]. Размещение производительных сил определяется совокупностью факторов: природными условиями и водными ресурсами, демографическим потенциалом, транспортной доступностью, эффектами агломерации и государственной политикой.

2. Историко-географические предпосылки

До революции Узбекистан был поставщиком хлопка и шелковичных коконов; в советский период началось планомерное размещение промышленности по республикам Союза [17]. Хлопковая специализация, развитие ирригации и создание индустриальных узлов закрепили аграрно-индустриальный профиль, а транспортная сеть не учитывала республиканских границ и тяготела к Ташкентскому узлу [18]. После 1991 г. страна избрала «узбекскую модель» постепенных реформ [19, 20]. Исследования 1990-х гг. показали, что пространственное неравенство в Узбекистане было наименьшим среди стран Центральной Азии, а выделялись лишь г. Ташкент и малонаселённая, богатая минеральными ресурсами Навоийская область: их ВРП на душу (в паритете покупательной способности) составлял в 1999 г. 185 и 132 % среднего по стране [18].

В 2025 г. аналогичные отношения составили 239 % для г. Ташкента (116,7 млн сумов на душу при среднем 48,8 млн) и 312 % для Навоийской области (152,2 млн), тогда как в Сурхандарьинской области показатель снизился с 74 до 46 % [6]. Данные несопоставимы по методике (паритет покупательной способности в 1999 г. и текущие цены в 2025 г.), однако направление изменений очевидно: разрыв между лидерами и остальными регионами вырос.

3. Современная территориальная структура населения и хозяйства

На 1 апреля 2026 г. численность постоянного населения составила 38 382,7 тыс. человек [7]. Наиболее многочисленны Самаркандская (4396,8 тыс.), Ферганская (4239,4 тыс.) и Кашкадарьинская (3731,8 тыс.) области; в г. Ташкенте проживает 3195,9 тыс. человек [7]. Плотность населения (табл. 1) снижается от 7352,4 чел./км² в столице и 821,4 в Андижанской области до 12,4 в Республике Каракалпакстан и 10,2 в Навоийской области [4].

Три области Ферганской долины (Андижанская, Ферганская, Наманганская) концентрируют 28,6 % населения при 4,1 % территории, тогда как Каракалпакстан и Навоийская область занимают около 61 % территории при 8,3 % населения (расчёт по [7, 4]). Это согласуется с характеристикой Ферганской долины как самого плотно населённого и плодородного района Центральной Азии [18].

Валовой внутренний продукт за 2025 г. составил 1849,7 трлн сумов, рост — 7,7 %. В его структуре на услуги приходилось 46,5 %, на промышленность — 25,6 %, на сельское, лесное и рыбное хозяйство — 16,6 %, на строительство — 7,0 % (расчёт по [6]). Региональная картина резко отличается от средней. Г. Ташкент даёт 19,9 % ВВП при 8,3 % населения, причём 63 % его добавленной стоимости создают услуги. Ташкентская и Навоийская области формируют 9,7 и 9,1 % ВВП; в Навоийской области промышленность даёт 76,0 % добавленной стоимости, а доля малого бизнеса минимальна — 21,1 % [6]. Напротив, Джизакская (39,5 %) и Сурхандарьинская (37,4 %) области имеют выраженный аграрный профиль, а ВРП на душу в Сурхандарье (22,2 млн сумов) составляет лишь 46 % среднего по республике. Доля малого

бизнеса в ВРП наиболее высока в Сурхандарьинской (76,4 %), Наманганской (73,6 %) и Ферганской (73,0 %) областях [6], что указывает на существенную роль малого бизнеса в этих регионах.

Таблица 1.
Население и валовой региональный продукт регионов Узбекистана

Регион	Население, тыс. чел.	Плотность, чел./км²	Доля в ВВП, %	ВРП на душу, млн сумов	Промышл. в ВДС, %	Сельск. хоз-во в ВДС, %
г. Ташкент	3 195,9	7 352,4	19,9	116,7	26,2	—
Андижанская	3 533,9	821,4	5,8	30,9	29,2	29,0
Ферганская	4 239,4	627,8	6,0	26,6	19,5	26,0
Наманганская	3 202,7	430,9	4,6	27,0	16,8	27,9
Хорезмская	2 075,0	341,2	3,4	30,7	15,3	32,6
Самаркандская	4 396,8	262,1	6,6	28,0	17,4	28,5
Сырдарьинская	949,6	222,1	1,9	38,1	29,1	30,5
Ташкентская	3 174,6	209,6	9,7	57,5	44,2	17,2
Сурхандарьинская	3 024,9	150,5	3,6	22,2	9,9	37,4
Кашкадарьинская	3 731,8	130,6	5,3	26,9	17,7	31,5
Джизакская	1 573,2	74,3	2,9	34,1	18,2	39,5
Бухарская	2 112,2	50,5	4,7	41,4	21,7	32,5
Каракалпакстан	2 057,7	12,4	2,9	26,5	19,6	23,1
Навоийская	1 115,0	10,2	9,1	152,2	76,0	8,6
Республика Узбекистан	**38 382,7**	**85,5**	**100,0**	**48,8**	**26,7**	**17,3**

Источник: составлено и рассчитано автором по [7, 4, 6]. ВДС — валовая добавленная стоимость; сумма долей регионов в ВВП меньше 100 %, так как часть ВВП не распределена по регионам.

Для обобщения регионы сгруппированы в шесть макрозон по мотивам традиционного экономического районирования [2, 15] (табл. 2).

Ташкентский макрорегион (г. Ташкент, Ташкентская и Сырдарьинская области) создаёт 31,5 % ВВП при 19,1 % населения и 4,4 % территории — это ярко выраженное ядро. Бухаро-Навоийская зона даёт 13,8 % ВВП на 8,4 % населения, но этот результат определяется Навоийской областью. Ферганская долина, где проживает более четверти населения, создаёт лишь 16,5 % ВВП, а ВРП на душу в ней составляет около 57 % среднего по стране; в Южной зоне — около 50 %. Таким образом, наибольшая концентрация населения не совпадает с наибольшей концентрацией экономической активности.

Таблица 2.
Территориальные макрозоны Узбекистана

Макрозона	Население, %	Территория, %	Доля в ВВП, %	ВРП на душу, млн сумов	Особенность
Ташкентский (г. Ташкент, Ташкентская, Сырдарьинская обл.)	19,1	4,4	31,5	79,7	ядро: услуги, промышленность
Ферганская долина (Андижанская, Ферганская, Наманганская обл.)	28,6	4,1	16,5	27,7	высокая плотность, малый бизнес
Самаркандско-Джизакский	15,6	8,5	9,4	29,2	сельское хозяйство, услуги
Бухаро-Навоийский	8,4	33,7	13,8	78,9	добыча, промышленность
Южный (Кашкадарьинская, Сурхандарьинская обл.)	17,6	10,9	8,9	24,4	аграрный профиль
Нижнеамударьинский (Каракалпакстан, Хорезмская обл.)	10,8	38,4	6,3	28,3	агропромышленный, услуги
Республика Узбекистан	**100,0**	**100,0**	**100,0**	**48,8**	**—**

Источник: рассчитано автором по [7, 4, 6]. ВРП на душу — расчётная оценка (ВРП 2025 г. к населению на 1 апреля 2026 г.); территория оценена по отношению населения к плотности.

4. Проблемы размещения производительных сил

Первая проблема — диспропорция между плотностью населения и природно-ресурсным потенциалом. Наиболее плотно заселены оазисы с орошаемым земледелием, а наиболее богатые минеральными ресурсами территории малонаселённы [18]. Вторая — моноцентричность: столичный макрорегион создаёт около трети ВВП, что усиливает приток инвестиций и населения в одну зону. Третья — монопрофильность отдельных территорий: Навоийская область с 2,9 % населения даёт 9,1 % ВВП, но опирается на добывающую промышленность и слабо диверсифицирована. Четвёртая — ограниченная диверсификация аграрных регионов: в Джизакской и Сурхандарьинской областях более трети добавленной стоимости приходится на сельское хозяйство, а доходы на душу заметно ниже среднего.

Отдельную группу составляют экологические и водные ограничения. Высыхание Аральского моря оказало тяжёлые последствия для здоровья и хозяйства прилегающих территорий [21]; среди пострадавших регионов

называют Каракалпакстан и Хорезмскую область [18]. Не менее важна транспортная изолированность: Ферганская долина отделена от остальной части страны горными преградами [18]. Наконец, внутренняя мобильность населения была ограниченной, и миграция не снижала пространственного неравенства [18].

5. Направления совершенствования размещения производительных сил

Первое направление — формирование полицентричной системы расселения и хозяйства на основе «полюсов роста» [10, 15]. Помимо Ташкента, такими центрами могут стать Самарканд, Бухара, Фергана, Андижан, Карши, Нукус и Ургенч; для этого необходимы транспортные связи, образовательная и деловая инфраструктура. Второе — кластерный подход [12]: объединение сельского хозяйства, переработки и торговли в Ферганской долине, Самаркандской и Кашкадарьинской областях, где велика доля аграрного сектора и малого бизнеса.

Третье — диверсификация ресурсных территорий. Определение всей территории Навоийской области свободной экономической зоной [22] создаёт условия для развития обрабатывающих производств, чтобы добавленная стоимость создавалась не только при добыче, но и при переработке сырья. Четвёртое — водосбережение и экологическая реабилитация Приаралья [21], без которых невозможно устойчивое развитие Каракалпакстана и Хорезма. Пятое — совершенствование информационной основы: регулярная оценка ВРП, уточнение схемы экономического районирования и мониторинг показателей выравнивания [2, 16]. Теория экономической географии показывает, что полностью устранить концентрацию невозможно [11], поэтому цель политики состоит в сокращении разрывов в доходах и доступе к услугам, а не в равномерном размещении предприятий.

Заключение

Проведённый анализ показывает, что размещение производительных сил в Узбекистане отличается высокой неравномерностью. Население концентрируется в оазисах (Ферганская долина — 28,6 % населения на 4,1 % территории), экономическая активность — в столичном макрорегионе (около трети ВВП), а добывающая промышленность — в малонаселённой Навоийской области. По сравнению с 1990-ми гг. разрыв между лидерами и аграрными регионами вырос. Совершенствование размещения требует полицентричного развития, кластеризации, диверсификации ресурсных территорий, решения водных и экологических проблем и более полной регионально-статистической базы.

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Морозов С.А., к.т.н.
доцент
Московский государственный технический университет имени Н.Э. Баумана
Исламова О.А.
доцент кафедры «Высшая математика»
Ташкентский университет информационных технологий имени Мухаммада аль-Хорезми
Ахмедов Б.А., PhD
и. о. доцента
Чирчикский государственный педагогический университет

ПРИМЕНЕНИЕ МЕТОДОВ МАТЕМАТИЧЕСКОЙ СТАТИСТИКИ ДЛЯ АНАЛИЗА И ПРОГНОЗИРОВАНИЯ ЭКОНОМИЧЕСКИХ ПОКАЗАТЕЛЕЙ

Аннотация. В статье рассматриваются теоретические основы и возможности применения методов математической статистики для анализа и прогнозирования экономических показателей. Цель работы заключается в систематизации статистических подходов и формировании методической последовательности их использования при исследовании экономических данных. Исследование носит теоретико-методический характер и ориентировано на математическую подготовку студентов технических вузов. Рассматриваются описательная статистика, корреляционный и регрессионный анализ, методы исследования временных рядов и оценка точности прогнозов. Особое внимание уделяется качеству исходных данных, проверке предпосылок моделей, разграничению статистической зависимости и причинной связи, а также количественной оценке неопределённости. Предлагаемая последовательность анализа включает постановку задачи, подготовку данных, исследование структуры показателей, построение моделей, диагностическую проверку и оценку прогнозов на наблюдениях, не использованных при обучении. Применительно к экономике Узбекистана учитывается необходимость согласования периодичности наблюдений, единиц измерения и методологии расчёта показателей, а также разграничения номинальных и реальных величин. Результатом работы является концептуальная схема выбора и проверки статистических моделей, предназначенная для учебных и прикладных исследований. Её практическая значимость состоит в организации воспроизводимого анализа и обоснованной интерпретации прогнозов. Преимущества отдельных методов не считаются установленными без проверки на конкретных данных.

Ключевые слова: Математическая статистика, экономические показатели, описательная статистика, корреляционный анализ,

регрессионный анализ, временные ряды, прогнозирование, статистическая диагностика, неопределённость, точность прогноза.

Morozov S.A., candidate of technical sciences
associate professor
Bauman Moscow State Technical University
Islamova O.A.
associate professor
Department of Higher Mathematics
Muhammad al-Khwarizmi Tashkent University
of Information Technologies
Akhmedov B.A., PhD
acting associate professor
Chirchik State Pedagogical University

APPLICATION OF MATHEMATICAL STATISTICS METHODS FOR THE ANALYSIS AND FORECASTING OF ECONOMIC INDICATORS

Abstract. This article examines the theoretical foundations and potential applications of mathematical statistics in the analysis and forecasting of economic indicators. Its purpose is to systematize statistical approaches and establish a methodological sequence for their application to economic data. The study is theoretical and methodological in nature and is intended to support mathematics education for students at technical universities. It considers descriptive statistics, correlation and regression analysis, time series methods, and forecast accuracy assessment. Particular attention is paid to data quality, verification of model assumptions, the distinction between statistical association and causation, and the quantitative assessment of uncertainty. The proposed analytical sequence includes problem formulation, data preparation, investigation of indicator structure, model construction, diagnostic checking, and forecast evaluation using observations excluded from model training. In relation to the economy of Uzbekistan, the study considers the need to harmonize observation frequencies, measurement units, and indicator calculation methodologies, as well as to distinguish nominal from real values. The outcome is a conceptual framework for selecting and validating statistical models in educational and applied research. Its practical significance lies in organizing reproducible analysis and supporting justified interpretations of forecasts. The advantages of individual methods are not regarded as established without evaluation using specific data.

Keywords: Mathematical statistics, economic indicators, descriptive statistics, correlation analysis, regression analysis, time series, forecasting, statistical diagnostics, uncertainty, forecast accuracy.

ВВЕДЕНИЕ

Математическая статистика занимает важное место в исследовании экономических процессов, поскольку позволяет переходить от отдельных наблюдений к обоснованным оценкам закономерностей и возможных изменений показателей. Экономические данные отражают взаимодействие множества факторов, включающих производственные условия, потребительское поведение, инвестиционные решения и внешние воздействия. Их анализ требует методов, способных учитывать случайную изменчивость, ограниченность информации и неоднородность наблюдений. Для студентов технических вузов освоение таких методов представляет особую значимость: оно объединяет математическую подготовку, вычислительные навыки и содержательную интерпретацию результатов. При этом корректность исследования определяется не только выполнением расчётов, но и соответствием используемой модели поставленной задаче, структуре данных и условиям получения наблюдений, а также прозрачностью принятых исследователем допущений и ограничений.

Экономический показатель представляет собой количественную характеристику определённого процесса, содержание которой зависит от методологии расчёта, единиц измерения и временных границ наблюдения. Объём производства, уровень цен, заработная плата и инвестиции описывают различные стороны хозяйственной деятельности, поэтому требуют содержательной интерпретации ещё до применения статистических процедур. Сравнение номинальных величин без учёта изменения цен может приводить к ошибочным представлениям о динамике. Аналогичные затруднения возникают при смешении абсолютных и относительных показателей, месячных и годовых наблюдений, предварительных и уточнённых оценок. Следовательно, подготовка сопоставимых данных является самостоятельной исследовательской задачей, от решения которой зависит достоверность последующего анализа и прогнозирования, особенно при изучении длительных периодов и сравнении территорий с различающимися экономическими условиями.

Арсенал математической статистики включает взаимодополняющие инструменты описания, проверки гипотез и построения моделей. Описательные характеристики позволяют оценивать центральную тенденцию, разброс и особенности распределения наблюдений. Корреляционный анализ используется для исследования тесноты определённых форм статистической связи, тогда как регрессионные модели позволяют количественно описывать зависимость показателя от выбранных факторов. Методы анализа временных рядов направлены на исследование последовательных наблюдений с учётом тренда, сезонности и временной зависимости. Однако наличие статистической связи само по себе не устанавливает причинного механизма. Высокое качество описания имеющихся наблюдений также не гарантирует точности будущих прогнозов, поскольку структура экономического процесса может изменяться под

воздействием новых обстоятельств, не представленных в использованной выборке и первоначальных предпосылках модели.

Для экономических исследований, ориентированных на Узбекистан, существенное значение имеет согласование содержательной постановки задачи с особенностями доступной информации. При работе с национальными и региональными показателями необходимо проверять определения переменных, полноту наблюдений и сопоставимость методик за рассматриваемый период. Использование международных данных дополнительно требует внимания к валютным пересчётам, ценовым основаниям и различиям статистического охвата. В образовательной практике технического вуза подобные задачи позволяют показать, почему математически правильное вычисление может сопровождаться экономически некорректным выводом. Поэтому обучение должно включать обсуждение происхождения данных, оснований выбора модели и границ интерпретации наряду с освоением формул, алгоритмов и программных средств, используемых для проведения воспроизводимых расчётов и проверки устойчивости полученных результатов исследования.

Цель настоящей статьи заключается в систематизации методов математической статистики, применимых к анализу и прогнозированию экономических показателей, и разработке последовательности их обоснованного использования. Рассмотрение охватывает подготовку данных, предварительное исследование, выбор модели, диагностическую проверку и оценку прогнозной точности на последующих наблюдениях. Особое внимание уделяется разграничению объяснительных и прогнозных задач, соблюдению временного порядка проверки и представлению неопределённости результатов. Работа имеет теоретико-методический характер: предлагаемые положения рассматриваются как основа учебного и прикладного исследования, а не как подтверждение эффективности конкретного метода. Проверка такой эффективности предполагает самостоятельный эмпирический анализ с определённой выборкой, прозрачными критериями сравнения и документированными ограничениями, позволяющими оценить применимость результатов к поставленной экономической задаче и выбранному горизонту прогнозирования.

МЕТОДЫ

Исследование построено на теоретико-методическом сопоставлении статистических подходов, применяемых при анализе экономических показателей. Основным методом является систематизация процедур по их назначению, предпосылкам и способам проверки результатов. Рассматриваются описательная статистика, корреляционный и регрессионный анализ, моделирование временных рядов и оценка прогнозной точности. Эмпирическая выборка в настоящей работе не формируется, численные эксперименты не проводятся. Предлагаемая последовательность предназначена для последующего применения к конкретным данным. Выбор инструментов определяется исследовательским вопросом: описание

динамики, изучение статистической зависимости и прогнозирование рассматриваются как связанные, но самостоятельные задачи, требующие различных оснований для интерпретации результатов. Такое разграничение позволяет заранее определить допустимые выводы и избежать подмены содержательного объяснения формальным соответствием модели исходным наблюдениям исследуемого экономического процесса.

Первый этап предусматривает определение показателя, единицы наблюдения, временного интервала и горизонта прогнозирования. Для каждой переменной фиксируются источник, периодичность, единицы измерения и методология расчёта. Затем проверяются пропуски, дублирование записей, изменения определений и возможные ошибки ввода. Необычные значения исследуются содержательно: их автоматическое исключение не допускается, поскольку они могут отражать реальные экономические события. При необходимости выполняются дефлирование, преобразование масштаба и согласование частоты наблюдений. Все преобразования документируются. При анализе временных рядов заполнение пропусков и оценивание параметров преобразований осуществляются внутри обучающей выборки, чтобы сведения из будущих периодов не влияли на подготовку модели. Сопоставимость территориальных данных проверяется отдельно с учётом охвата наблюдений и различий в составе изучаемых совокупностей.

На втором этапе применяются графическое представление и описательные характеристики: среднее, медиана, дисперсия, стандартное отклонение и квантили. Их интерпретация учитывает асимметрию распределения и чувствительность отдельных оценок к экстремальным значениям. Для временных рядов дополнительно исследуются тренд, сезонность и автокорреляция. Корреляционные коэффициенты используются с учётом формы зависимости и свойств наблюдений. Коэффициент Пирсона характеризует линейную связь, тогда как ранговые показатели позволяют исследовать монотонные зависимости. Полученные связи рассматриваются как основание для дальнейшего моделирования, но не как доказательство причинности. Совместное движение показателей проверяется на возможность возникновения вследствие общего тренда. При необходимости исследуются разности, темпы изменения и другие преобразования, экономический смысл которых сохраняется и объясняется до последующего оценивания моделей.

Третий этап включает построение моделей, сложность которых соотносится с объёмом и структурой данных. Регрессионный анализ сопровождается проверкой спецификации, мультиколлинеарности, неоднородности дисперсии ошибок и остаточной автокорреляции. Выбор оценивания и статистических поправок определяется выявленными особенностями. Для временных рядов рассматриваются наивные прогнозы, сезонные ориентиры, экспоненциальное сглаживание и авторегрессионные модели при выполнении необходимых условий. Нестационарные переменные требуют отдельного исследования; использование регрессии в уровнях обосновывается, в частности, наличием соответствующих долгосрочных

связей. Набор факторов ограничивается содержательными соображениями и доступностью информации на момент прогноза. Параметры моделей оцениваются только по обучающим наблюдениям. Подбор настроек проводится отдельно от итоговой проверки, чтобы снизить риск переобучения и завышения ожидаемого качества прогнозирования экономического показателя.

Заключительный этап предусматривает последовательную проверку прогнозов с сохранением временного порядка наблюдений. Используются расширяющееся или скользящее окно оценивания и одинаковые горизонты сравнения. Точность характеризуется средней абсолютной ошибкой и корнем средней квадратической ошибки; процентные показатели применяются осторожно при нулевых либо близких к нулю значениях. Результаты сопоставляются с простыми базовыми прогнозами. Помимо точечных оценок рассматриваются прогнозные интервалы, их покрытие и ширина. Проверяется устойчивость выводов к изменению периода обучения и спецификации. Для учебного воспроизведения сохраняются исходные данные, последовательность преобразований и настройки расчётов. Итоговая интерпретация учитывает экономический смысл ошибок, ограничения информации и возможные структурные изменения. Выбор предпочтительной модели основывается на совокупности диагностических результатов и проверок прогнозной точности.

РЕЗУЛЬТАТЫ

Результатом теоретико-методического исследования стала последовательность статистического анализа, объединяющая постановку экономической задачи, подготовку информации, исследование зависимостей, построение моделей и проверку прогнозов. Полученная схема определяет связь между содержанием каждого этапа и условиями обоснованности последующих действий. Она позволяет разграничить описание наблюдавшихся изменений, оценивание статистических взаимосвязей и прогнозирование будущих значений. При этом результаты работы имеют концептуальный характер: они представлены в виде методических положений и критериев выбора процедур. Численные оценки параметров, показатели прогнозной точности и эмпирические подтверждения преимуществ отдельных моделей отсутствуют, поскольку исследование не предусматривает обработки конкретной выборки. Поэтому предложенная схема рассматривается как основа последующего анализа, применимость которой должна проверяться с учётом данных и поставленной исследовательской задачи.

Первым содержательным результатом является выделение сопоставимости данных в качестве обязательного условия моделирования. Систематизация процедур показала необходимость совместного рассмотрения единиц измерения, периодичности, статистического охвата и ценовой основы показателей. Для исследования динамики предложено различать изменения номинальных величин и изменения реального объёма соответствующего

процесса. При объединении источников необходимо фиксировать различия определений и порядок согласования наблюдений. Пропуски и необычные значения включены в отдельный этап проверки, предшествующий оцениванию моделей. Такая организация делает преобразования информации прозрачными и позволяет установить, какие особенности результатов связаны с экономическим процессом, а какие могут определяться подготовкой исходного массива. Для учебных исследований предусмотрено сохранение первоначальных значений вместе с документированными основаниями внесённых изменений и корректировок.

Вторым результатом стало разграничение критериев выбора методов согласно структуре исследовательского вопроса. Описательные характеристики соотнесены с задачами изучения распределения и изменчивости. Корреляционные показатели соотнесены с оцениванием определённых форм связи, а регрессионные модели — с количественным описанием условной зависимости. Для последовательных наблюдений предусмотрено исследование временной структуры, включая сезонность и автокорреляцию. Отдельно установлено методическое требование проверять, не объясняется ли обнаруженная связь общим трендом. Выбор более сложной модели предлагается обосновывать дополнительной информацией, которую она предоставляет относительно простого ориентира. Тем самым сформирована последовательность решений, позволяющая связывать математический инструмент с содержанием экономической задачи. Она также задаёт основания для отказа от процедур, предпосылки которых не согласуются со свойствами рассматриваемых данных.

Третьим результатом является включение независимой прогнозной проверки в обязательную структуру исследования. Для временных рядов предложено сохранять хронологический порядок и оценивать модель исключительно по информации, доступной к моменту формирования прогноза. Настройка спецификации отделена от итоговой проверки. Сравнение организуется при одинаковых горизонтах и условиях доступности факторов. В качестве ориентиров предусмотрены наивный и, при наличии сезонности, сезонный наивный прогнозы. Критерии точности дополнены анализом прогнозных интервалов и устойчивости ошибок во времени. Полученная структура позволяет оценивать не только среднюю величину отклонений, но и зависимость качества от периода наблюдения.

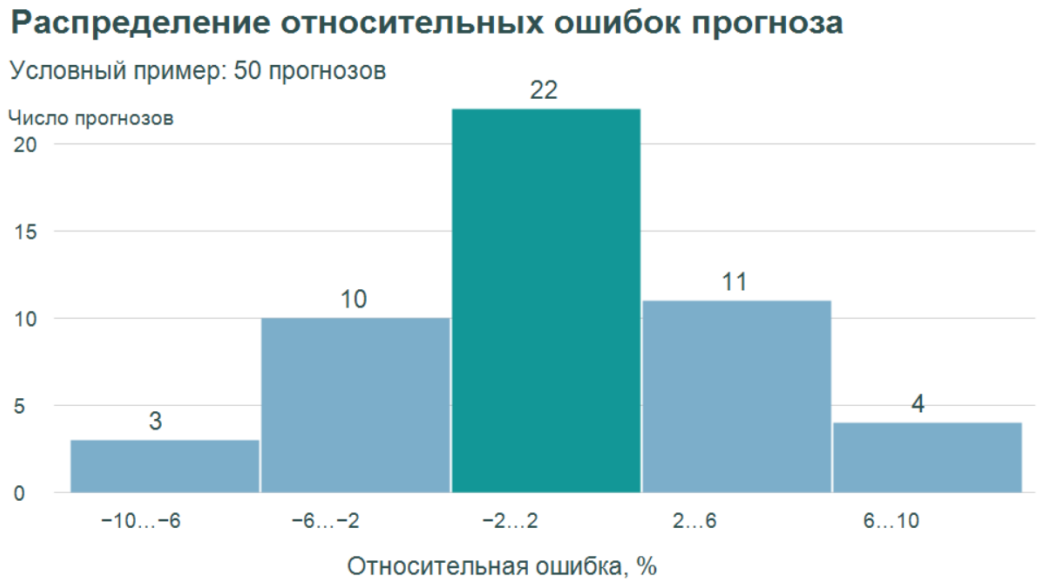


Рис 1. Распределение относительных ошибок прогноза на условном примере из 50 наблюдений.

Однако она не устанавливает, какой метод окажется предпочтительным без проведения соответствующих расчётов на конкретном наборе данных и выбранном горизонте.

Четвёртым результатом стала адаптация аналитической последовательности к математической подготовке студентов технического вуза. Каждому этапу сопоставлен проверяемый учебный результат: описание показателя, подготовленный массив, диагностические материалы, оценённая модель и отчёт о прогнозной проверке. Предусмотрено объяснение выбора преобразований, ограничений интерпретации и причин расхождения прогнозов с наблюдениями. Для задач, связанных с экономикой Узбекистана, отдельно обозначена проверка сопоставимости национальных и региональных данных. Сформированные положения позволяют организовать воспроизводимое исследование с доступным уровнем вычислительной сложности. Вместе с тем влияние предложенной организации на учебные достижения, самостоятельность студентов и качество прикладных решений остаётся предметом последующей эмпирической оценки. Такая проверка потребует заранее определённых критериев, сопоставимых заданий и документирования условий проведения учебной работы.

ОБСУЖДЕНИЕ

Предложенная последовательность анализа позволяет рассматривать статистическое моделирование как систему обоснованных решений, каждое из которых влияет на интерпретацию экономических показателей. Её методическое значение заключается в согласовании исследовательского вопроса, свойств данных и критериев проверки. Такой подход особенно важен в математической подготовке студентов технического вуза, поскольку

вычислительная доступность методов может создавать иллюзию достаточности автоматического расчёта. Получение коэффициентов или построение прогнозного графика ещё не свидетельствует о корректности исследования. Необходимо объяснить, почему выбранная процедура соответствует задаче, какие предпосылки использованы и какие выводы допускают результаты. Однако образовательная полезность предложенной последовательности пока остаётся предположением, требующим проверки в реальном учебном процессе с учётом подготовки студентов, характера заданий и условий преподавания.

Существенный вопрос связан с разграничением объяснительной и прогнозной ценности моделей. Статистически значимый коэффициент может представлять интерес для описания условной зависимости, но сам по себе не гарантирует повышения точности будущих оценок. Аналогично хорошее прогнозирование не устанавливает причинного механизма. Для причинной интерпретации необходимы дополнительные основания, связанные с устройством исследования, идентификацией воздействий и контролем смешивающих факторов. В учебной практике это различие следует раскрывать через сопоставление вопросов, на которые отвечает каждая модель. Иначе возникает риск приписать математическому результату более широкий экономический смысл, чем позволяет использованная информация. Поэтому качество исследования целесообразно оценивать также по точности формулировок и соответствию утверждений фактически выполненным процедурам анализа и доступным эмпирическим основаниям.

Другой аспект касается соотношения сложности и устойчивости моделей. Увеличение числа параметров может улучшать описание обучающей выборки, одновременно повышая чувствительность к случайным особенностям наблюдений. При небольшом объёме экономических данных эта проблема приобретает особую значимость. Сравнение с простыми прогнозными ориентирами помогает определить, оправдывает ли усложнение дополнительные вычислительные и информационные затраты. Вместе с тем простота не является безусловным преимуществом: недостаточно гибкая спецификация способна пропускать существенную сезонность или изменение зависимости. Предпочтение следует отдавать модели, которая демонстрирует приемлемое качество при корректной проверке и допускает содержательное объяснение своих ограничений. Такая позиция требует учитывать горизонт прогнозирования, доступность факторов и последствия ошибок, а не руководствоваться исключительно удобством выбранного программного инструмента.

В контексте экономических исследований Узбекистана применимость методов зависит от характеристик конкретного массива, а не только от общих свойств алгоритма. Изменения статистических определений, пересмотр опубликованных значений и различия территориального охвата необходимо проверять по документации источника. Если исследователь использует уточнённые данные для имитации прошлого прогноза, оценка может

оказаться благоприятнее реально достижимой. Поэтому желательно различать информацию, доступную в момент принятия решения, и сведения, опубликованные позднее. При отсутствии исторических версий данных соответствующее ограничение должно быть раскрыто. Для образовательных проектов это создаёт возможность обсуждать информационные условия прогнозирования, воспроизводимость расчётов и ответственность за интерпретацию результатов. Конкретные требования определяются выбранным показателем, периодом исследования и назначением получаемых оценок его динамики.

Ограничения работы обусловлены отсутствием эмпирической проверки и количественного сопоставления методов. Предложенная схема не позволяет установить универсальные преимущества регрессии, сглаживания или авторегрессионных моделей. Дополнительного изучения требуют её трудоёмкость, понятность студентам и устойчивость результатов при различных учебных условиях. Последующие исследования могут включать анализ нескольких показателей, сравнение горизонтов прогнозирования и проверку чувствительности к структурным изменениям. Образовательную составляющую целесообразно оценивать посредством сопоставимых практических заданий, единых критериев и индивидуального объяснения решений. При этом улучшение итоговой работы следует отделять от влияния преподавательской поддержки и предварительных навыков. Такая организация проверки позволит уточнить область применимости предложенных положений и определить, какие элементы последовательности действительно способствуют качеству анализа в конкретных исследовательских условиях.

ЗАКЛЮЧЕНИЕ

Применение методов математической статистики к экономическим показателям требует согласования математических процедур с содержанием исследуемых процессов и характеристиками исходной информации. Выполненная теоретико-методическая систематизация позволила представить анализ и прогнозирование как последовательность взаимосвязанных решений, охватывающую постановку задачи, подготовку данных, исследование зависимостей, оценивание моделей и проверку результатов. Основной результат работы заключается в организации этих решений в единую воспроизводимую схему. Она предназначена для учебных и прикладных исследований, однако не подтверждает превосходство конкретного метода. Обоснованность выбора определяется соответствием инструмента задаче, выполнением необходимых предпосылок и качеством проверки на наблюдениях, которые не использовались при оценивании. Такая постановка связывает вычисления с ответственностью за содержание выводов и обозначение границ их практической применимости.

Качество исходной информации выступает необходимым условием содержательной интерпретации статистических результатов. До построения моделей требуется установить определения показателей, единицы измерения,

периодичность наблюдений и сопоставимость методологии расчёта. Разграничение номинальных и реальных величин, проверка пропусков и исследование необычных значений должны предшествовать оцениванию зависимостей. Преобразования необходимо документировать, сохраняя возможность восстановить последовательность действий. Для временных рядов особое значение имеет предотвращение использования будущей информации при подготовке обучающей выборки. Эти требования не устраняют неопределённость экономического исследования, но создают условия для выявления источников ошибок и независимого воспроизведения расчётов. Их соблюдение позволяет точнее отделять особенности изучаемого процесса от последствий обработки данных и ограничений доступного статистического материала при решении поставленной исследовательской задачи.

Рассмотренные методы выполняют различные функции и должны использоваться с учётом этих различий. Описательная статистика характеризует распределение и изменчивость, корреляционный анализ исследует определённые формы связи, регрессия описывает условные зависимости, а методы временных рядов учитывают последовательность наблюдений. Ни высокая корреляция, ни статистическая значимость коэффициентов сами по себе не устанавливают причинность. Аналогично точное описание прошлого не гарантирует успешного прогнозирования. Поэтому предпочтительность модели следует оценивать посредством диагностики, сравнения с простыми ориентирами и проверки устойчивости результатов. Выбор критериев должен учитывать горизонт прогноза и экономические последствия ошибок. Представление прогнозных интервалов дополняет точечные оценки, позволяя обсуждать неопределённость будущих значений в пределах предпосылок и ограничений принятой модели исследуемого экономического процесса.

Для математической подготовки студентов технических вузов предложенная последовательность представляет основу организации практических заданий, объединяющих теорию, вычисления и интерпретацию. Оценивание учебной работы целесообразно связывать с объяснением выбора методов, прозрачностью преобразований и корректностью проверки, а не только с получением численного ответа. Применительно к исследованиям экономики Узбекистана необходимо учитывать сопоставимость национальных и региональных показателей, особенности публикации данных и доступность исторических наблюдений. Сложность заданий может изменяться в зависимости от подготовки обучающихся и ресурсов образовательной организации. При этом общие требования к воспроизводимости и обоснованности выводов должны сохраняться. Такая организация позволяет сформулировать проверяемые учебные результаты, но её влияние на компетенции студентов требует отдельного эмпирического исследования в соответствующих условиях.

Дальнейшее развитие предложенных положений предполагает их применение к конкретным экономическим рядам и сопоставление результатов при одинаковых условиях прогнозирования. Необходимо заранее определить периоды обучения, горизонты оценки, базовые модели и показатели ошибок. Отдельного внимания заслуживают структурные изменения, пересмотр данных и чувствительность выводов к спецификации. Образовательную эффективность следует проверять с использованием сопоставимых заданий и прозрачных критериев индивидуального оценивания. До проведения таких исследований ожидаемые преимущества остаются методическими предположениями. Практическая ценность представленной схемы состоит в установлении последовательных требований к исследованию, которые помогают связать математическую корректность с экономическим смыслом. Это формирует основу для обоснованного выбора инструментов, критической оценки прогнозов и дальнейшего совершенствования аналитической работы на проверяемых эмпирических основаниях.

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Муродова М.М.
самостоятельный соискатель кафедры народной медицины, профессиональных болезней и аллергологии
научный руководитель: Каюмов Х.Н., д.м.н. доцент
Бухарский государственный медицинский институт имени Абу Али ибн Сино

МЕДИКО-СОЦИАЛЬНАЯ ХАРАКТЕРИСТИКА ПАЦИЕНТОВ С ПТОЗОМ ВЕРХНЕГО ВЕКА, ПЕРЕНЕСШИХ БЛЕФАРОПЛАСТИКУ, В БУХАРСКОЙ ОБЛАСТИ

Аннотация. Изучены социально-демографические характеристики и частота медико-социальных факторов у 146 пациентов с птозом верхнего века, которым выполнена блефаропластика в многопрофильном медицинском центре Бухарской области. Среди пациентов преобладали женщины (78,8%), лица в возрасте 45–74 лет (88,4%) и жители городов (70,5%). Чаще всего регистрировались длительное использование компьютера и цифровых устройств (59,6%), нарушение режима сна (35,6%) и профессиональные факторы (26,7%). Вредные привычки у мужчин встречались в 3,2 раза чаще, чем у женщин (41,9% и 13,0%; p<0,001), по остальным факторам половых различий не выявлено. Полученные данные целесообразно учитывать при предоперационном обследовании и консультировании пациентов.

Ключевые слова: птоз верхнего века, блефаропластика, медико-социальные факторы, вредные привычки, цифровые устройства, Бухарская область.

Murodova M.M.
independent researcher
Department of Folk Medicine, Occupational Diseases and Allergology
Kayumov Kh.N., DSc in Medicine
scientific supervisor, associate professor
Bukhara State Medical Institute named after Abu Ali ibn Sino

MEDICAL AND SOCIAL CHARACTERISTICS OF PATIENTS WITH UPPER EYELID PTOSIS WHO UNDERWENT BLEPHAROPLASTY IN THE BUKHARA REGION

Abstract. The study describes the socio-demographic profile and the frequency of medical and social factors in 146 patients with upper eyelid ptosis who underwent blepharoplasty at a multidisciplinary medical center in the Bukhara region. Women (78.8%), persons aged 45–74 years (88.4%) and urban residents (70.5%) predominated. The most frequent factors were prolonged use of computers and digital devices (59.6%), sleep disturbances (35.6%) and occupational factors

(26.7%). Harmful habits were 3.2 times more common in men than in women (41.9% vs 13.0%; p<0.001); no sex differences were found for the other factors. These data should be taken into account during preoperative assessment and patient counselling.

Keywords: upper eyelid ptosis, blepharoplasty, medical and social factors, harmful habits, digital devices, Bukhara region.

Введение.

Блефаропластика относится к наиболее востребованным вмешательствам эстетической и реконструктивной хирургии. По данным Международного общества эстетической пластической хирургии (ISAPS), в 2024 году операции на веках вышли на первое место среди эстетических хирургических вмешательств в мире: выполнено 2 115 360 операций, что на 13,4% больше, чем в 2023 году; около 77% из них пришлось на женщин [1]. Значительную часть пациентов составляют лица с птозом верхнего века, у которых наряду с косметическим дефектом нередко имеются функциональные нарушения: сужение верхнего поля зрения, чувство тяжести век, компенсаторное напряжение лобной мышцы [2, 3].

Приобретённый птоз в большинстве случаев имеет апоневротическую (инволюционную) природу и связан с растяжением, истончением или дезинсерцией апоневроза мышцы, поднимающей верхнее веко [3, 4]. Механистическая классификация, разделяющая птоз на апоневротический, миогенный, неврогенный, механический и травматический, позволяет связать клиническую картину с уровнем поражения [5]. В популяционном исследовании в Иране распространённость птоза верхнего века среди лиц 45–69 лет составила 4,7% и возрастала с 3,1% в 45–49 лет до 5,8% в 65–69 лет; у женщин птоз выявлялся чаще, чем у мужчин (5,2% и 4,0%), а сахарный диабет (ОШ 1,53) и артериальная гипертензия (ОШ 1,41) оказались независимо связаны с птозом [6]. Среди внешних факторов обсуждаются длительное ношение контактных линз, перенесённые офтальмологические операции и инъекции ботулотоксина [3, 7].

Вместе с тем вклад образа жизни, профессиональной нагрузки и социальных условий в формирование птоза изучен недостаточно, а данные для населения Узбекистана в доступной литературе практически отсутствуют. Между тем именно региональный профиль пациентов определяет содержание предоперационной беседы, объём обследования и рекомендации на период реабилитации [8].

Цель исследования — изучить социально-демографическую характеристику и частоту медико-социальных факторов у пациентов с птозом верхнего века, перенесших блефаропластику, в условиях Бухарской области.

Материал и методы.

Обследовано 146 пациентов с птозом верхнего века, которым выполнена блефаропластика в отделении челюстно-лицевой хирургии Бухарского областного многопрофильного медицинского центра. Сведения

собирали по единому алгоритму с помощью специально разработанной анкеты и медицинской документации. Регистрировали возраст, пол, место проживания, социальный статус, профессию и условия труда, продолжительность рабочего дня, время использования компьютера и других цифровых устройств, режим сна, физическую активность, курение и употребление алкоголя. Из анамнеза учитывали травмы и воспалительные заболевания век, эндокринные и метаболические нарушения (в том числе сахарный диабет), неврологические и сердечно-сосудистые заболевания, перенесённые офтальмологические операции.

Для верификации диагноза и определения показаний к операции проводили офтальмологическое обследование: определяли остроту зрения, подвижность глазных яблок, высоту глазной щели и складки верхнего века, функцию леватора и расстояние от рефлекса роговицы до края верхнего века (MRD-1). Наличие медико-социальных факторов устанавливали по данным анкеты и медицинской документации; для анализа они были сгруппированы в демографический, профессиональный, поведенческий блоки и блок медицинских факторов.

Статистическую обработку проводили в IBM SPSS Statistics v.26. Качественные признаки представлены абсолютными числами и долями (%). Возраст представлен как M±m. Различия оценивали с помощью критерия χ^2 Пирсона; при ожидаемых частотах менее 5 для таблиц 2×2 применяли точный критерий Фишера, для таблиц большей размерности рассчитывали точное значение p методом Монте-Карло. Различия считали статистически значимыми при $p<0,05$.

Результаты и обсуждение.

Среди 146 пациентов было 115 женщин (78,8%) и 31 мужчина (21,2%); соотношение составило 3,7:1 ($\chi^2=48,33$; $p<0,001$). Средний возраст мужчин — 56,1±2,18 года, женщин — 55,8±1,06 года. Наиболее многочисленной оказалась группа 45–59 лет — 68 человек (46,6%), пациенты 60–74 лет составили 61 человек (41,8%), 18–44 лет — 17 (11,6%). Возрастная структура у мужчин и женщин не различалась ($\chi^2=0,34$; $p=0,844$) (табл. 1, рис. 1).

Таблица 1

Распределение пациентов по возрасту и полу

Возраст	**Мужчины (n=31)**	**Женщины (n=115)**	**Всего (n=146)**
18–44 лет, n (%)	4 (12,9)	13 (11,3)	17 (11,6)
45–59 лет, n (%)	13 (41,9)	55 (47,8)	68 (46,6)
60–74 лет, n (%)	14 (45,2)	47 (40,9)	61 (41,8)
Средний возраст, лет (M±m)	56,1±2,18	55,8±1,06	–

Примечание: доли рассчитаны внутри каждой половой группы; $\chi^2=0,34$; $p=0,844$.

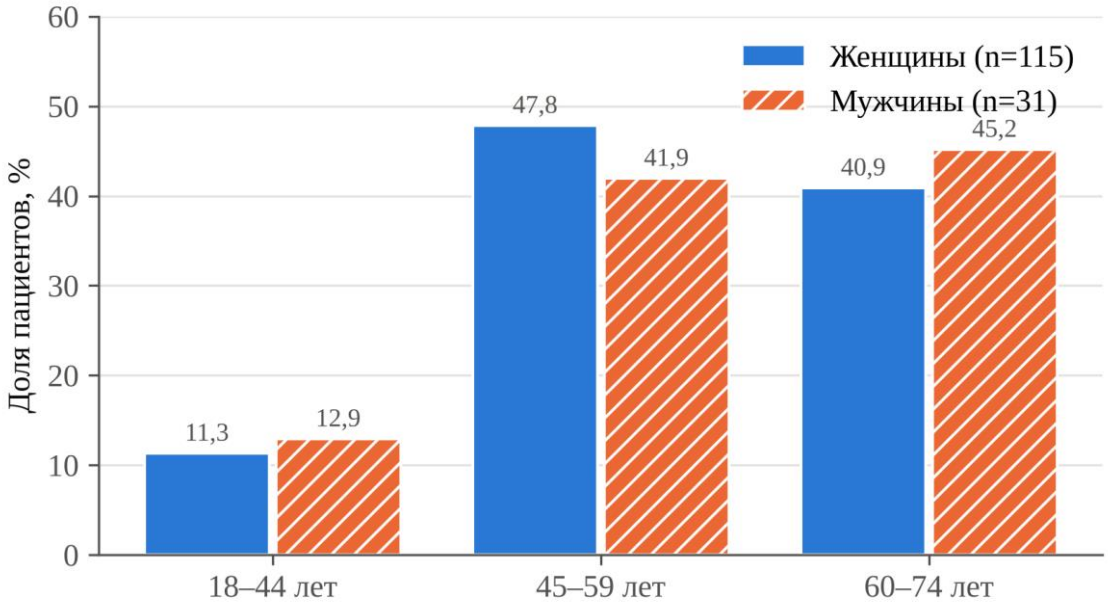


Рис. 1. Возрастная структура пациентов с птозом верхнего века в зависимости от пола, %

В городе проживали 103 пациента (70,5%), в сельской местности — 43 (29,5%). Доля городских жителей среди мужчин и женщин была практически одинаковой (71,0% и 70,4%; χ^2=0,003; p=0,954). Социальный статус, напротив, существенно различался по полу (χ^2=23,47; p<0,001): среди женщин преобладали домохозяйки (45,2%), рабочие (21,7%) и пенсионеры (17,4%), среди мужчин — рабочие (38,7%), пенсионеры (32,3%) и предприниматели (22,6%) (табл. 2, рис. 2).

Таблица 2

Распределение пациентов по месту проживания и социальному статусу, n (%)

Показатель	Мужчины (n=31)	Женщины (n=115)	Всего (n=146)
Место проживания:			
Город	22 (71,0)	81 (70,4)	103 (70,5)
Село	9 (29,0)	34 (29,6)	43 (29,5)
Социальный статус:			
Безработные	2 (6,5)	8 (7,0)	10 (6,8)
Домохозяйки	0	52 (45,2)	52 (35,6)
Рабочие	12 (38,7)	25 (21,7)	37 (25,3)
Предприниматели	7 (22,6)	10 (8,7)	17 (11,6)
Пенсионеры	10 (32,3)	20 (17,4)	30 (20,5)

Примечание: место проживания — χ^2=0,003; p=0,954; социальный статус — χ^2=23,47; p<0,001 (точное значение методом Монте-Карло).

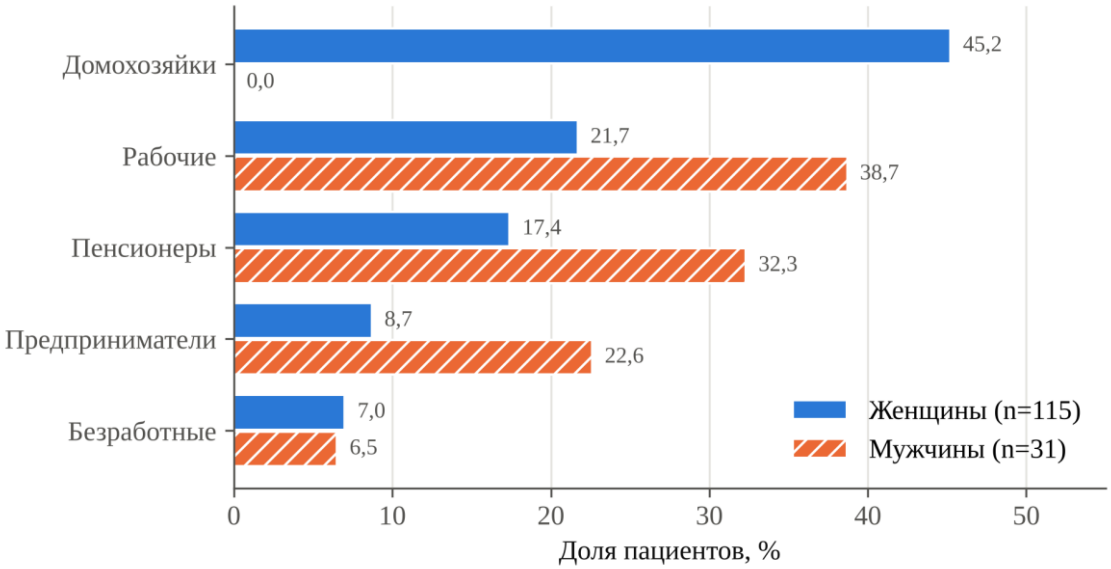


Рис. 2. Социальный статус пациентов с птозом верхнего века в зависимости от пола, %

Доля женщин в нашей выборке (78,8%) близка к мировому показателю для операций на веках (около 77%) [1]. Поскольку в популяции птоз у женщин встречается лишь немного чаще, чем у мужчин [6], столь выраженное преобладание женщин, вероятно, отражает прежде всего различия в обращаемости за хирургической коррекцией. Концентрация пациентов в возрасте 45–74 лет (88,4%) соответствует представлению об инволюционном характере приобретённого птоза [3, 4]. Высокая доля домохозяек и пенсионеров объясняется возрастным и социальным составом выборки и сама по себе не может рассматриваться как фактор риска.

Частота медико-социальных факторов представлена в таблице 3 и на рисунке 3. Чаще всего пациенты сообщали о длительном использовании компьютера и цифровых устройств (59,6%), нарушениях режима сна (35,6%) и профессиональных вредностях (26,7%). Эндокринно-метаболические нарушения выявлены у 16,4% пациентов, воспалительные заболевания век — у 12,3%, травмы век — у 5,5%.

Таблица 3

Частота медико-социальных факторов у пациентов с птозом верхнего века, n (%)

Фактор	Мужчины (n=31)	Женщины (n=115)	Всего (n=146)	p
Травмы век	3 (9,7)	5 (4,3)	8 (5,5)	0,367*
Воспалительные заболевания век	5 (16,1)	13 (11,3)	18 (12,3)	0,538*
Эндокринно-метаболические нарушения	6 (19,4)	18 (15,7)	24 (16,4)	0,622
Использование компьютера / цифровых устройств	18 (58,1)	69 (60,0)	87 (59,6)	0,845
Нарушение режима сна	11 (35,5)	41 (35,7)	52 (35,6)	0,986
Профессиональные факторы	8 (25,8)	31 (27,0)	39 (26,7)	0,898
Вредные привычки	13 (41,9)	15 (13,0)	28 (19,2)	<0,001
Прочие медицинские факторы	5 (16,1)	12 (10,4)	17 (11,6)	0,360*

*Примечание: p — значимость различий между мужчинами и женщинами (χ^2 Пирсона; * — точный критерий Фишера).*

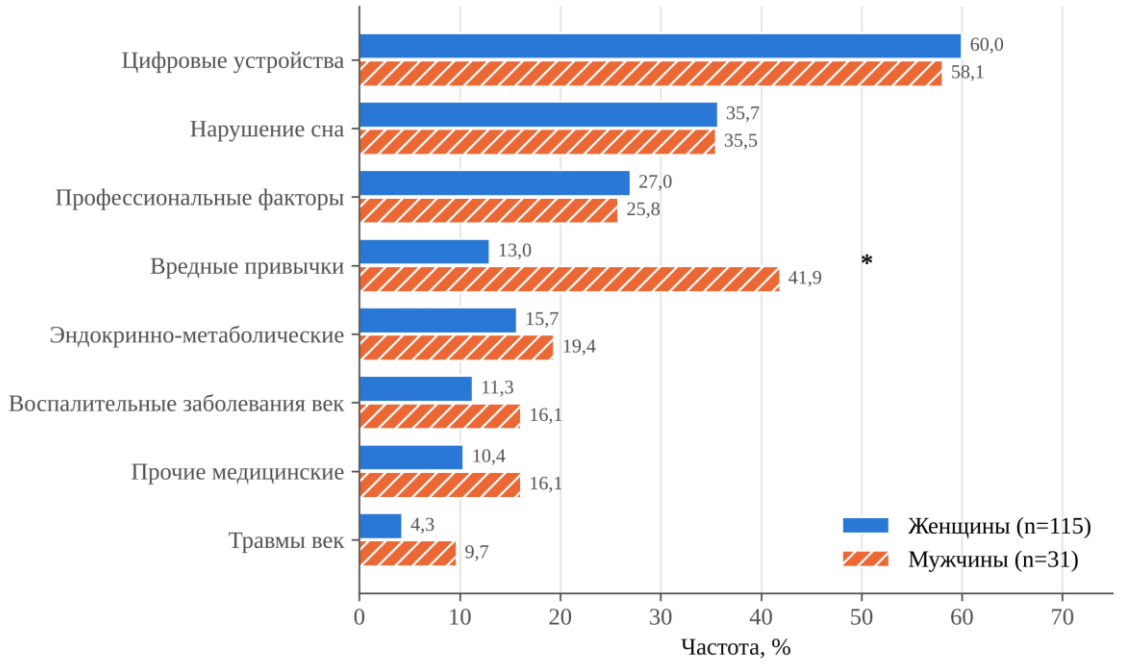


Рис. 3. Частота медико-социальных факторов у мужчин и женщин с птозом верхнего века, %. * — различие между полами статистически значимо (p<0,001)

Единственным фактором, по которому мужчины и женщины статистически значимо различались, оказались вредные привычки (курение, употребление алкоголя): они встречались у 41,9% мужчин и 13,0% женщин

(χ^2=13,15; p<0,001), то есть в 3,2 раза чаще. По остальным факторам различия между полами не достигали уровня значимости (p>0,05).

Высокая частота длительной работы с цифровыми устройствами заслуживает внимания, однако интерпретировать её следует осторожно. Исследование не включало группу сравнения без птоза, поэтому полученные доли характеризуют профиль обратившихся пациентов, а не силу связи фактора с заболеванием. Сходным образом нарушения сна и профессиональные нагрузки могут усиливать субъективные жалобы (усталость, отёчность век) и тем самым повышать обращаемость, не будучи причиной птоза. Для оценки их самостоятельного вклада необходимы исследования типа «случай–контроль» с учётом возраста, пола и сопутствующих заболеваний [6, 7].

Практическое значение полученных данных состоит в том, что при подготовке к блефаропластике у жителей региона целесообразно уточнять не только офтальмологический и соматический анамнез, но и режим сна, зрительную нагрузку и вредные привычки. Эти сведения важны для дифференциальной диагностики птоза и для индивидуальных рекомендаций на период реабилитации [8, 9].

Ограничениями работы являются одноцентровой характер исследования, отсутствие группы сравнения без птоза и опора на сведения, сообщённые самими пациентами. Связь отдельных факторов со степенью птоза в настоящей работе не анализировалась.

Выводы.

1. Среди пациентов с птозом верхнего века, перенесших блефаропластику в Бухарской области, преобладают женщины (78,8%), лица 45–74 лет (88,4%) и жители городов (70,5%).

2. Наиболее часто у пациентов регистрируются длительное использование компьютера и цифровых устройств (59,6%), нарушения режима сна (35,6%) и профессиональные факторы (26,7%).

3. Вредные привычки у мужчин встречаются в 3,2 раза чаще, чем у женщин (41,9% и 13,0%; p<0,001); по другим изученным факторам половых различий не выявлено.

4. Медико-социальный профиль пациента целесообразно учитывать при предоперационном обследовании, консультировании и планировании реабилитации после блефаропластики.

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Муродова М.М.
самостоятельный соискатель кафедры народной медицины, профессиональных болезней и аллергологии
научный руководитель: Каюмов Х.Н., д.м.н. доцент
Бухарский государственный медицинский институт имени Абу Али ибн Сино

ИГЛОРЕФЛЕКСОТЕРАПИЯ В КОМПЛЕКСНОМ КУПИРОВАНИИ ПОСЛЕОПЕРАЦИОННОГО БОЛЕВОГО СИНДРОМА ПОСЛЕ БЛЕФАРОПЛАСТИКИ

Аннотация. Оценено влияние иглорефлексотерапии, добавленной к стандартному послеоперационному ведению, на динамику болевого синдрома, потребность в анальгетиках, периорбитальный отёк и гематому у 146 пациентов после блефаропластики. Основная группа (n=79) дополнительно получала курс иглорефлексотерапии, группа сравнения (n=67) — только стандартное лечение. Исходная интенсивность боли по шкале NRS не различалась (4,8±0,2 и 4,7±0,2 балла). На 3-и, 5–7-е и 10–14-е сутки боль в основной группе была ниже (p<0,01–0,001), болевой синдром сохранялся меньше (3,2±0,2 и 4,5±0,3 сут; p<0,001), а дополнительные анальгетики потребовались вдвое реже (22,8% и 46,3%; p=0,003). Отёк и гематома регрессировали быстрее. Иглорефлексотерапию можно рассматривать как дополнительный немедикаментозный компонент послеоперационного обезболивания.

Ключевые слова: блефаропластика, иглорефлексотерапия, акупунктура, послеоперационная боль, шкала NRS, анальгетики, периорбитальный отёк.

Murodova M.M.
independent researcher
Department of Folk Medicine, Occupational Diseases and Allergology
Kayumov Kh.N., DSc in Medicine
scientific supervisor, associate professor
Bukhara State Medical Institute named after Abu Ali ibn Sino

ACUPUNCTURE IN THE COMPREHENSIVE MANAGEMENT OF POSTOPERATIVE PAIN AFTER BLEPHAROPLASTY

Abstract. The effect of acupuncture added to standard postoperative care on pain dynamics, analgesic requirements, periorbital oedema and haematoma was assessed in 146 patients after blepharoplasty. The main group (n=79) additionally received a course of acupuncture, the comparison group (n=67) received standard care only. Baseline pain on the NRS did not differ (4.8±0.2 and 4.7±0.2 points). On

days 3, 5–7 and 10–14 pain was lower in the main group (p<0.01–0.001), pain persisted for a shorter time (3.2±0.2 vs 4.5±0.3 days; p<0.001), and additional analgesics were needed half as often (22.8% vs 46.3%; p=0.003). Oedema and haematoma resolved faster. Acupuncture may be considered an additional non-pharmacological component of postoperative analgesia.

Keywords: blepharoplasty, acupuncture, postoperative pain, NRS, analgesics, periorbital oedema.

Введение.

Боль, периорбитальный отёк и гематома — наиболее частые проявления раннего периода после блефаропластики. Хотя они, как правило, носят преходящий характер, именно эти симптомы определяют самочувствие пациента в первые дни, сроки возвращения к обычной активности и его первое впечатление о результате операции. Высокая чувствительность периорбитальной зоны, иннервируемой ветвями тройничного нерва, обусловливает выраженность болевых ощущений даже при относительно небольшом объёме вмешательства.

Медикаментозное обезболивание после блефаропластики эффективно, однако при назначении нестероидных противовоспалительных средств приходится учитывать риск кровоточивости, а у части пациентов — сопутствующие заболевания. Поэтому интерес вызывают немедикаментозные методы, способные уменьшить потребность в анальгетиках. В мета-анализе рандомизированных исследований акупунктура и родственные методы уменьшали интенсивность боли в 1-е сутки после операций различного профиля; снижение потребления опиоидов было показано для чрескожной электростимуляции акупунктурных точек, но не для классической акупунктуры [1]. Нейрофизиологической основой этого эффекта считают активацию афферентных волокон, модуляцию ноцицептивной передачи на сегментарном уровне, высвобождение эндогенных опиоидных пептидов и локальные аденозин-зависимые механизмы [2–4].

Вместе с тем данных об эффективности иглорефлексотерапии именно после блефаропластики мало: результаты, полученные при абдоминальных, ортопедических или стоматологических вмешательствах, нельзя механически переносить на периорбитальную область. Поучителен опыт изучения других вспомогательных средств: например, гомеопатическая арника в плацебо-контролируемом исследовании не уменьшила экхимозы после блефаропластики верхних век [5]. Следовательно, каждый метод требует собственной клинической проверки [6].

Цель исследования — оценить влияние иглорефлексотерапии, включённой в стандартное послеоперационное ведение, на динамику болевого синдрома, потребность в анальгетиках, периорбитальный отёк и гематому после блефаропластики.

Материал и методы.

В сравнительное клиническое исследование включено 146 пациентов, которым выполнена блефаропластика в отделении челюстно-лицевой хирургии Бухарского областного многопрофильного медицинского центра. Операции проводили под местной инфильтрационной анестезией 1% раствором лидокаина; кожу ушивали внутрикожным швом (полипропилен 6/0). Пациенты были распределены на две группы. Основную группу составили 79 человек (54,1%), которые наряду со стандартным послеоперационным ведением получали курс иглорефлексотерапии. В группу сравнения вошли 67 пациентов (45,9%), получавших только стандартное лечение. Анальгетики в обеих группах назначали по требованию.

Иглорефлексотерапию проводил специально подготовленный врач с использованием стерильных одноразовых игл и ручной стимуляции. Применяли сочетание локальных периорбитальных точек — Цзаньчжу (BL2), Сычжукун (TE23), Сыбай (ST2) — и дистальных точек Хэгу (LI4), Нэйгуань (PC6) и Чжигоу (TE6), симметрично с двух сторон. В периорбитальной зоне использовали только поверхностное введение игл с учётом расположения сосудисто-нервных образований. Первый сеанс проводили после оценки состояния на 1-е сутки, далее курс продолжали в раннем послеоперационном периоде по единой для всех пациентов схеме. Сеанс прекращали при появлении головокружения, выраженной вегетативной реакции, резкой боли или кровоточивости. Характеристика использованных точек приведена в таблице 1.

Таблица 1

Точки акупунктуры, использованные в основной группе

Точка	Локализация	Назначение
Цзаньчжу (BL2)	Углубление у медиального конца брови	Локальное действие в периорбитальной зоне
Сычжукун (TE23)	Углубление у латерального конца брови	Локальное действие в латеральной периорбитальной зоне
Сыбай (ST2)	Подглазничная область, над подглазничным отверстием	Локальное действие в периорбитальной зоне
Хэгу (LI4)	Тыл кисти, между I и II пястными костями	Общее анальгезирующее действие
Нэйгуань (PC6)	Передняя поверхность предплечья, проксимальнее лучезапястной складки	Уменьшение вегетативных реакций и дискомфорта
Чжигоу (TE6)	Тыльная поверхность предплечья, между лучевой и локтевой костями	Дистальное действие в реабилитационном комплексе

Примечание: все точки использовали симметрично с двух сторон; в периорбитальной зоне — только поверхностное введение игл.

Оценку проводили на 1-е сутки (до начала иглорефлексотерапии — исходный уровень), на 3-и, 5–7-е и 10–14-е сутки. Интенсивность боли определяли по числовой рейтинговой шкале NRS от 0 до 10 баллов, где 1–3 балла соответствуют слабой, 4–6 — умеренной и 7–10 — сильной боли [7]. Учитывали продолжительность болевого синдрома, долю пациентов, которым потребовались дополнительные анальгетики, и кратность их приёма. При осмотре фиксировали наличие периорбитального отёка и гематомы.

Статистическую обработку проводили в IBM SPSS Statistics v.26. Количественные данные представлены как M±m, сравнение проводили с помощью t-критерия Стьюдента. Для качественных признаков использовали критерий χ^2 Пирсона, при ожидаемых частотах менее 5 — точный критерий Фишера. Различия считали значимыми при $p<0,05$.

Результаты.

На 1-е сутки интенсивность боли в группах была сопоставимой: 4,8±0,2 балла в основной группе и 4,7±0,2 балла в группе сравнения ($p=0,724$). Далее боль снижалась в обеих группах, но в основной группе — быстрее. К 3-м суткам показатель уменьшился на 39,6% (до 2,9±0,2 балла), тогда как в группе сравнения — на 19,1% (до 3,8±0,2 балла; $t=3,18$; $p=0,002$). На 5–7-е сутки значения составили 1,6±0,1 и 2,5±0,2 балла (снижение на 66,7% и 46,8%; $t=4,02$; $p<0,001$), на 10–14-е сутки — 0,6±0,1 и 1,4±0,1 балла (снижение на 87,5% и 70,2%; $t=5,66$; $p<0,001$) (табл. 2, рис. 1).

Таблица 2

Динамика интенсивности боли по шкале NRS, баллы (M±m)

Срок наблюдения	Основная группа (n=79)	Группа сравнения (n=67)	t	p
1-е сутки (исходно)	4,8±0,2	4,7±0,2	0,35	0,724
3-и сутки	2,9±0,2 (−39,6%)	3,8±0,2 (−19,1%)	3,18	0,002
5–7-е сутки	1,6±0,1 (−66,7%)	2,5±0,2 (−46,8%)	4,02	<0,001
10–14-е сутки	0,6±0,1 (−87,5%)	1,4±0,1 (−70,2%)	5,66	<0,001

Примечание: в скобках — снижение относительно исходного уровня.

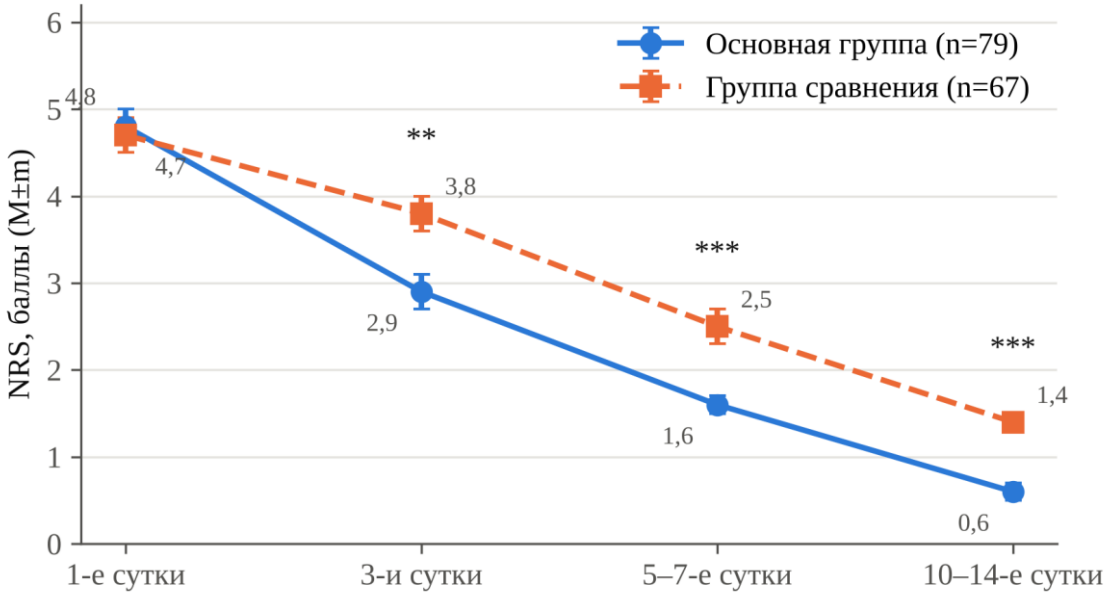


Рис. 1. Динамика интенсивности боли по шкале NRS в группах (M±m). ** — p<0,01; *** — p<0,001 между группами

Болевой синдром в основной группе сохранялся в среднем 3,2±0,2 суток, в группе сравнения — 4,5±0,3 суток, то есть на 1,3 суток дольше (t=3,61; p<0,001). Дополнительные анальгетики потребовались 18 пациентам основной группы (22,8%) и 31 пациенту группы сравнения (46,3%) (χ^2=8,97; p=0,003). Кратность приёма анальгетиков также была ниже в основной группе: 1,4±0,2 и 2,3±0,3 раза соответственно (t=2,50; p=0,014) (табл. 3, рис. 2).

Таблица 3

Продолжительность болевого синдрома и потребность в анальгетиках

Показатель	**Основная группа (n=79)**	**Группа сравнения (n=67)**	**p**
Продолжительность болевого синдрома, сут (M±m)	3,2±0,2	4,5±0,3	<0,001
Потребовались дополнительные анальгетики, n (%)	18 (22,8)	31 (46,3)	0,003
Кратность приёма анальгетиков, раз (M±m)	1,4±0,2	2,3±0,3	0,014

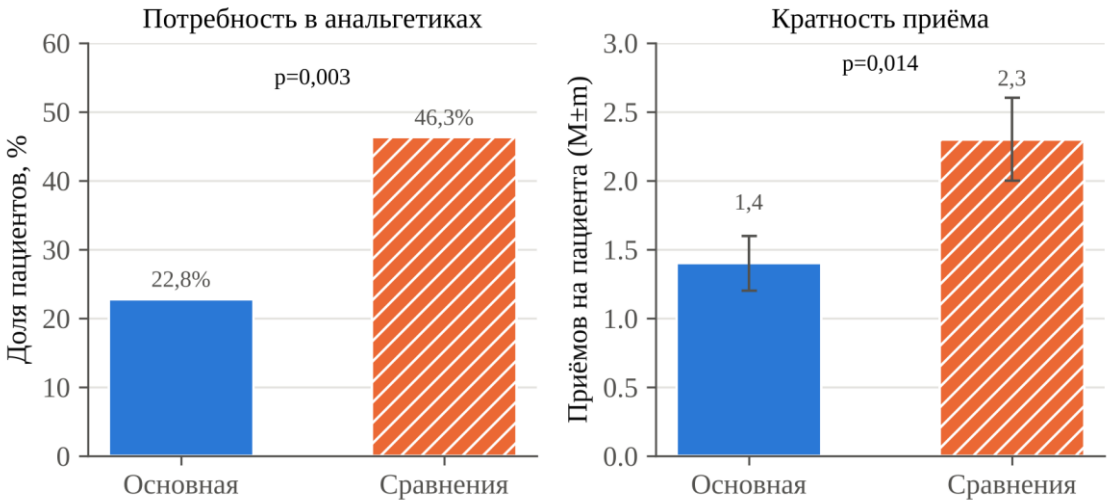


Рис. 2. Доля пациентов, которым потребовались дополнительные анальгетики, и кратность их приёма в группах

На 1-е сутки периорбитальный отёк отмечался почти у всех пациентов обеих групп (86,1% и 91,0%; p=0,351). Гематома в основной группе исходно встречалась несколько реже (75,9% против 92,5%; p=0,007), что необходимо учитывать при интерпретации дальнейшей динамики. На 3-и сутки отёк сохранялся у 60,8% и 82,1% пациентов (p=0,005), гематома — у 48,1% и 74,6% (p=0,001); на 5–7-е сутки — у 25,3% и 50,7% (p=0,002) и у 15,2% и 40,3% (p<0,001) соответственно. К 10–14-м суткам отёк определялся у 5,1% пациентов основной группы и 17,9% группы сравнения (p=0,017), гематома — у 2,5% и 11,9% (p=0,044) (табл. 4, рис. 3).

Таблица 4

Частота периорбитального отёка и гематомы, n (%)

Срок / признак	Основная группа (n=79)	Группа сравнения (n=67)	p
1-е сутки: отёк	68 (86,1)	61 (91,0)	0,351
1-е сутки: гематома	60 (75,9)	62 (92,5)	0,007
3-и сутки: отёк	48 (60,8)	55 (82,1)	0,005
3-и сутки: гематома	38 (48,1)	50 (74,6)	0,001
5–7-е сутки: отёк	20 (25,3)	34 (50,7)	0,002
5–7-е сутки: гематома	12 (15,2)	27 (40,3)	<0,001
10–14-е сутки: отёк	4 (5,1)	12 (17,9)	0,017*
10–14-е сутки: гематома	2 (2,5)	8 (11,9)	0,044*

*Примечание: χ^2 Пирсона; * — точный критерий Фишера.*

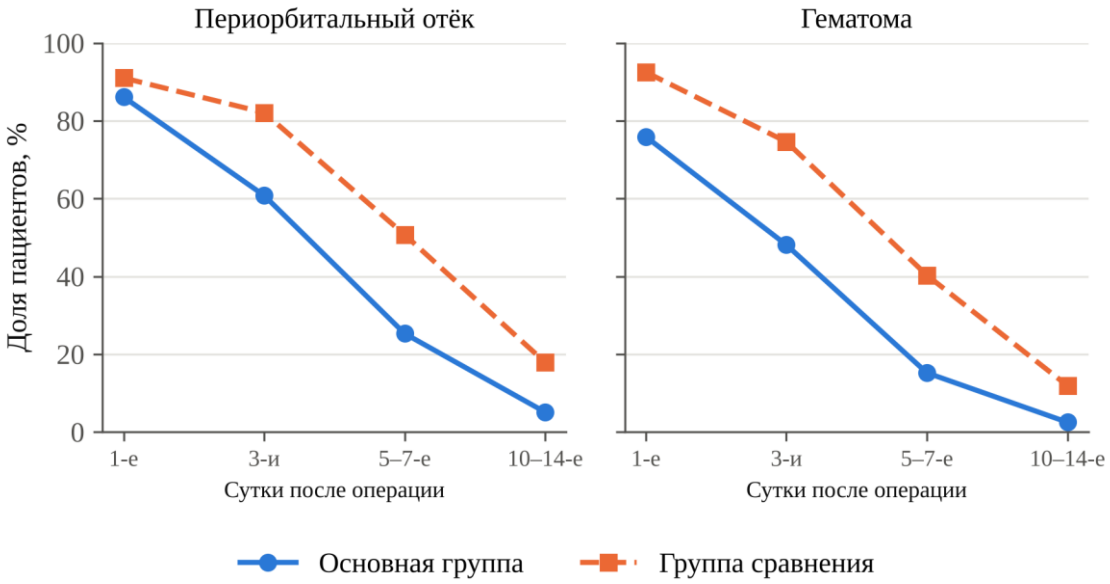


Рис. 3. Динамика частоты периорбитального отёка и гематомы в группах, % пациентов

Обсуждение.

Включение иглорефлексотерапии в послеоперационное ведение сопровождалось более быстрым снижением боли, сокращением продолжительности болевого синдрома на 1,3 суток и уменьшением вдвое доли пациентов, которым понадобились дополнительные анальгетики. Различия проявлялись уже к 3-м суткам и сохранялись до конца наблюдения. Снижение боли согласуется с данными мета-анализа, в котором акупунктура уменьшала боль в 1-е послеоперационные сутки [1], и с результатами применения акупунктурной аналгезии в других областях хирургии [8]. Уменьшение потребности в анальгетиках при классической акупунктуре в указанном мета-анализе подтверждено не было, поэтому наш результат требует проверки в рандомизированных исследованиях.

Выбор точек сочетал два принципа. Локальные точки BL2, TE23 и ST2 расположены в зонах иннервации надглазничного и подглазничного нервов, то есть в той же области тригеминальной иннервации, откуда поступает ноцицептивная импульсация после операции. Дистальные точки LI4, PC6 и TE6 традиционно используются для обезболивания и уменьшения вегетативных реакций; их действие связывают с супраспинальной модуляцией боли и активацией эндогенной опиоидной системы [2, 3]. Обсуждается и локальный механизм: при стимуляции точки в тканях высвобождается аденозин, который через A1-рецепторы снижает ноцицептивную передачу [4].

Более быстрая регрессия отёка и гематомы в основной группе представляет практический интерес, однако этот результат требует осторожной трактовки, поскольку гематома в основной группе исходно встречалась реже. Кроме того, исследование не было рандомизированным, не

включало имитационной (sham) процедуры и ослепления, распределение видов блефаропластики по группам не анализировалось, а оценка боли по шкале NRS субъективна. Для подтверждения эффекта необходимы рандомизированные исследования с подробным описанием протокола в соответствии с рекомендациями STRICTA [6].

Выводы.

1. Включение иглорефлексотерапии в стандартное ведение после блефаропластики сопровождается более быстрым снижением боли: на 3-и, 5–7-е и 10–14-е сутки интенсивность боли по NRS в основной группе ниже, чем в группе сравнения ($p<0,01–0,001$).

2. В основной группе продолжительность болевого синдрома короче (3,2±0,2 против 4,5±0,3 суток), дополнительные анальгетики требуются вдвое реже (22,8% против 46,3%), а кратность их приёма ниже (1,4 против 2,3 раза).

3. На фоне иглорефлексотерапии периорбитальный отёк и гематома регрессируют быстрее: к 10–14-м суткам они сохраняются у 5,1% и 2,5% пациентов против 17,9% и 11,9% в группе сравнения; с учётом исходного различия по частоте гематомы этот результат требует подтверждения.

4. Иглорефлексотерапию с использованием локальных периорбитальных и дистальных точек можно рассматривать как дополнительный немедикаментозный компонент послеоперационного обезболивания после блефаропластики.

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Мухаммадиев Н.А.
преподаватель кафедры международного туризма и экономики
Кокандский университет

ОЦЕНКА ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ ЦИФРОВЫХ ФИНАНСОВЫХ ТЕХНОЛОГИЙ В ФИНАНСИРОВАНИИ МАЛОГО БИЗНЕСА

Аннотация. В статье исследуется эффективность использования цифровых финансовых технологий (FinTech) в финансировании малого бизнеса. Анализируется влияние цифрового кредитования, альтернативного скоринга и электронных платежей на доступ к финансовым ресурсам. Критерии оценки эффективности FinTech разработаны на основе нормативно-правовых документов Узбекистана, международных статистических данных и научных исследований. Исследование демонстрирует потенциал цифровых финансовых технологий в ускорении процесса кредитования, снижении транзакционных издержек и повышении финансовой доступности для малого бизнеса.

Ключевые слова: малый бизнес, FinTech, цифровое кредитование, финансовая доступность, альтернативный скоринг, экономическая эффективность.

Mukhammadiev N.A.
lecturer
Department of International Tourism and Economics
Kokand University

ASSESSING THE EFFECTIVENESS OF USING DIGITAL FINANCIAL TECHNOLOGIES IN SMALL BUSINESS FINANCING

Abstract. The article studies the effectiveness of using digital financial technologies (FinTech) in financing small businesses. The impact of digital lending, alternative scoring and electronic payments on access to financial resources is analyzed. Criteria for assessing the effectiveness of FinTech are developed based on the regulatory and legal documents of Uzbekistan, international statistical data and scientific research. The study demonstrates the potential of digital financial technologies to accelerate the lending process, reduce transaction costs and increase the financial inclusion of small businesses.

Keywords: small business, FinTech, digital lending, financial inclusion, alternative scoring, economic efficiency.

ВВЕДЕНИЕ. Развитие цифровой экономики создает новые возможности для финансирования малого бизнеса. Однако отсутствие залога, ограниченная кредитная история и высокие затраты на финансовые услуги

препятствуют развитию предпринимательской деятельности. Цифровые финансовые технологии (FinTech) позволяют снизить эти проблемы за счет автоматизации процессов кредитования, альтернативного скоринга и электронных платежей.

Постановление Президента Республики Узбекистан № ПК-359 от 27 ноября 2025 года является одной из важных правовых основ развития финансовых технологий. Цель исследования – оценить экономическую эффективность FinTech-технологий в финансировании малого бизнеса и определить области для ее улучшения.

МАТЕРИАЛЫ И МЕТОДЫ. В исследовании использовались сравнительный анализ, статистический анализ, систематический подход, а также методы экономико-математической оценки. Информационная база сформирована на основе данных Всемирного банка за 2025–2026 годы, постановлений Президента Республики Узбекистан и научных исследований отечественных и зарубежных ученых.

Основными критериями оценки эффективности финтех-компаний были срок кредитования, стоимость финансирования, транзакционные издержки и доступ к кредитным ресурсам.

РЕЗУЛЬТАТЫ. По данным Всемирного банка, потребности микро-, малых и средних предприятий Узбекистана в кредитах на 2025 год оцениваются в 13 миллиардов долларов, при этом дефицит финансирования составляет 6 миллиардов долларов. Это составляет приблизительно 46,2 процента от общей потребности в кредитах.

Таблица 1. Основные показатели доступности финансирования малого бизнеса в Узбекистане

Показатель	Значение
Совокупная потребность микро-, малых и средних предприятий в кредитовании	13 млрд долл. США
Оценочный дефицит финансирования	6 млрд долл. США
Дефицит в процентах от совокупной потребности	46,2 %
Доля малых предприятий, сообщивших о наличии доступа к кредиту	10 %
Доля средних предприятий, сообщивших о наличии доступа к кредиту	16 %

Согласно данным Всемирного банка за 2025 год, потребность малого и среднего бизнеса Узбекистана в кредитных ресурсах составляет 13 млрд долларов США, тогда как дефицит финансирования достигает 6 млрд долларов, или 46,2% от общей потребности. При этом доступ к кредитованию имеют лишь 10% малых и 16% средних предприятий. Полученные результаты свидетельствуют о необходимости расширения цифровых финансовых услуг. Внедрение FinTech-технологий, включая цифровое кредитование и альтернативный скоринг, может способствовать повышению доступности

финансирования, сокращению операционных затрат и ускорению кредитных процедур.

ОБСУЖДЕНИЕ. Исследования международных ученых А. Демиргуч-Кунта и Т. Филиппона подчеркивают важность цифровых финансовых услуг для финансовой инклюзии и эффективности финансового посредничества. Научные подходы узбекских экономистов Ш. Абдуллаевой и А. Омонова к банковскому кредитованию обеспечивают основу для изучения вопросов эффективного использования кредитных ресурсов в национальной финансовой системе.

Технологии FinTech могут ускорить обработку заявок на кредиты и снизить операционные издержки. Однако их эффективность должна оцениваться в сочетании с полной стоимостью кредита, безопасностью данных и платежеспособностью заемщика.

ВЫВОДЫ. На основе проведенного исследования были сделаны следующие выводы:

1. Технологии FinTech способствуют расширению доступа малого бизнеса к финансовым ресурсам и упрощению процесса кредитования.

2. Дефицит финансирования малого бизнеса в Узбекистане в размере 6 миллиардов долларов указывает на необходимость развития цифровых механизмов кредитования.

3. При оценке эффективности цифрового финансирования важно всесторонне учитывать скорость получения кредита, стоимость финансирования и кредитные риски.

4. Расширение альтернативных систем оценки кредитоспособности и электронных платежных систем поможет повысить финансовую прозрачность предпринимателей.

5. Для эффективного использования FinTech в малом бизнесе рекомендуется улучшить цифровую инфраструктуру, повысить финансовую грамотность и обеспечить безопасность данных.

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Мухаммадкулова М.К.
ассистент
Бекмуродов О.А.
талаба
Алимуродов А.С.
талаба
Нарзуллаев Э.Э.
талаба
Рахимов С.М.
талаба
Самарқанд давлат тиббиёт университети

ТИББИЁТДА СУНЪИЙ ИНТЕЛЛЕКТ: АНИҚЛИК, САМАРАДОРЛИК ВА ИННОВАЦИЯЛАР

Аннотация. Ушбу мақолада тиббиёт соҳасида сунъий интеллект технологияларидан фойдаланишнинг замонавий йўналишлари, диагностика ва даволаш жараёнларини индивидуаллаштириш имкониятлари ҳамда тиббий хизмат сифатини оширишдаги аҳамияти таҳлил қилинади. Шунингдек, уникаллик сари ёндашув тушунчаси беморнинг индивидуал хусусиятларини ҳисобга олиш, шахсийлаштирилган тиббиётни ривожлантириш, тиббий маълумотларни интеллектуал таҳлил қилиш ва илмий тадқиқотларда янги ечимларни ишлаб чиқиш нуқтаи назаридан ёритилади. Сунъий интеллект тизимларини жорий этишда маълумотлар хавфсизлиги, алгоритмик холислик, натижаларнинг ишончлилиги ва шифокор масъулияти масалалари ҳам кўриб чиқилади.

Калит сўзлар: сунъий интеллект, тиббиёт, уникаллик, шахсийлаштирилган тиббиёт, машинали ўқитиш, нейрон тармоқлар, тиббий диагностика, рақамли соғлиқни сақлаш, тиббий маълумотлар, алгоритмик таҳлил.

Mukhammadkulova M.K.
assistant
Bekmurodov O.A.
student
Alimurodov A.S.
student
Narzullayev E.E.
student
Rakhimov S.M.
student
Samarkand State Medical University

ARTIFICIAL INTELLIGENCE IN MEDICINE: ACCURACY, EFFICIENCY, AND INNOVATION

Abstract. This article analyzes current trends in the application of artificial intelligence technologies in medicine, their potential for personalizing diagnostic and therapeutic processes, and their role in improving the quality of healthcare services. Furthermore, the concept of an individualized approach is examined in terms of considering each patient's unique characteristics, advancing personalized medicine, performing intelligent analysis of medical data, and developing innovative solutions in scientific research. Particular attention is paid to the potential of artificial intelligence to enhance diagnostic accuracy, improve treatment effectiveness, and optimize healthcare processes. The article also addresses important challenges associated with the implementation of artificial intelligence systems in clinical practice, including data security, algorithmic fairness, reliability of results, and the professional responsibility of healthcare practitioners.

Keywords: artificial intelligence, medicine, uniqueness, personalized medicine, machine learning, neural networks, medical diagnostics, digital healthcare, medical data, algorithmic analysis.

Кириш

Бугунги кунда рақамли технологияларнинг жадал ривожланиши тиббиёт тизимида янги илмий ва амалий имкониятларни юзага келтирмоқда. Айниқса, сунъий интеллект технологиялари тиббий маълумотларни қайта ишлаш, касалликларни эрта аниқлаш, диагностик қарорларни қўллаб-қувватлаш ва даволаш жараёнларини такомиллаштиришда муҳим аҳамият касб этмоқда. Сунъий интеллектнинг тиббиётга кириб келиши нафақат тиббий хизмат кўрсатиш тезлигини ошириш, балки ҳар бир беморга индивидуал ёндашувни шакллантириш учун ҳам янги имкониятлар яратмоқда [1; 2].

Тиббиётда «уникаллик сари ёндашув» деганда беморнинг ёши, жинси, ирсий хусусиятлари, физиологик кўрсаткичлари, касаллик тарихи, ҳаёт тарзи ва даволашга индивидуал жавобини ҳисобга олган ҳолда тиббий қарорларни шакллантириш тушунилади. Бу ёндашув шахсийлаштирилган тиббиётнинг асосий тамойиллари билан узвий боғлиқдир. Чунки бир хил ташхисга эга бўлган икки беморда касалликнинг кечиши, асоратлар хавфи ва муайян даволаш усулининг самарадорлиги бир хил бўлмаслиги мумкин.

Э. Тополнинг тадқиқотида инсон ва сунъий интеллект имкониятларини уйғунлаштириш юқори самарали тиббиётни ривожлантиришнинг муҳим йўналишларидан бири сифатида кўрсатилган [1]. Бунда сунъий интеллект шифокорнинг ўрнини тўлиқ эгалловчи восита эмас, балки унинг касбий қарорларини маълумотлар асосида қўллаб-қувватловчи технология сифатида намоён бўлади.

Мақоланинг долзарблиги тиббий хизматларни рақамлаштириш шароитида сунъий интеллектдан фойдаланиш орқали беморга индивидуал ёндашувни ривожлантириш, диагностика сифатини ошириш ва тиббий қарорларнинг асосланганлигини кучайтириш зарурати билан белгиланади.

Тадқиқотнинг мақсади — тиббиётда сунъий интеллект технологияларининг имкониятларини таҳлил қилиш ва уникаллик, яъни беморнинг индивидуал хусусиятларини ҳисобга олишга асосланган ёндашувни ривожлантиришнинг илмий-амалий жиҳатларини асослаш.

Тадқиқот вазифалари:

- тиббиётда сунъий интеллектнинг асосий қўлланиш йўналишларини ёритиш;
- шахсийлаштирилган тиббиётда интеллектуал таҳлилнинг аҳамиятини очиб бериш;
- сунъий интеллект асосида тиббий қарорларни қўллаб-қувватлаш имкониятларини таҳлил қилиш;
- алгоритмларни қўллашдаги ахлоқий, ҳуқуқий ва технологик муаммоларни аниқлаш;
- тиббий амалиётда индивидуал ёндашувни такомиллаштиришга қаратилган таклифларни ишлаб чиқиш.

1. Тиббиётда сунъий интеллектнинг назарий асослари

Сунъий интеллект — компьютер тизимларининг маълумотларни таҳлил қилиш, муайян қонуниятларни аниқлаш, таснифлаш, башорат қилиш ва қарор қабул қилиш жараёнларини қўллаб-қувватлаш имкониятларини ифодаловчи технологиялар мажмуасидир. Тиббиётда сунъий интеллект машинали ўқитиш, чуқур ўқитиш, нейрон тармоқлар, компьютер кўриши ва табиий тилни қайта ишлаш каби йўналишлар орқали қўлланилади.

Машинали ўқитиш алгоритмлари катта ҳажмдаги тиббий маълумотлардан қонуниятларни ўрганиб, янги маълумотлар асосида муайян натижаларни прогноз қилишга ёрдам беради. Масалан, лаборатория таҳлиллари, қон босими, юрак уриш частотаси ва бошқа клиник кўрсаткичлардан фойдаланиб, беморнинг муайян касалликка чалиниш хавфини баҳолаш мумкин. Бироқ бундай прогнознинг аниқлиги маълумотларнинг сифати, алгоритмнинг хусусиятлари ва унинг муайян беморлар гуруҳида текширилганлигига боғлиқ.

Чуқур ўқитиш ва компьютер кўриши тиббий тасвирларни таҳлил қилишда муҳим аҳамиятга эга. Рентген, компьютер томографияси, магнит-резонанс томографияси ва кўз тўр пардаси тасвирларини таҳлил қилувчи алгоритмлар шифокорга патологик ўзгаришларни аниқлашда ёрдам бериши мумкин. АҚШнинг Овқат маҳсулотлари ва дори воситалари сифатини назорат қилиш бошқармаси (FDA) сунъий интеллектдан фойдаланувчи тиббий қурилмалар бўйича очиқ маълумотлар рўйхатини юритади. Унда радиология, кардиология ва бошқа йўналишларга тегишли технологиялар мавжуд [3].

Табиий тилни қайта ишлаш технологиялари эса электрон тиббий карталар, шифокор қайдлари, лаборатория хулосалари ва илмий адабиётлардан керакли маълумотларни ажратиб олиш имконини беради. Бу клиник маълумотларни тизимлаштириш ва тиббий ахборот билан ишлаш самарадорлигини оширишга хизмат қилиши мумкин.

Шу билан бирга, сунъий интеллект алгоритмлари мустақил равишда ҳар қандай ташхисни ишончли белгилайди, деган хулоса нотўғри. Алгоритм натижалари клиник контекст, беморнинг умумий ҳолати ва мутахассис баҳоси билан биргаликда кўриб чиқилиши лозим [2; 3].

2. Уникаллик сари ёндашув ва шахсийлаштирилган тиббиёт

Замонавий тиббиётнинг муҳим вазифаларидан бири — ҳар бир беморнинг индивидуал хусусиятларини ҳисобга олган ҳолда самарали ва хавфсиз тиббий ёрдам кўрсатишдир. Анъанавий ёндашувда муайян касаллик учун умумий клиник тавсиялар қўлланилса, шахсийлаштирилган тиббиётда ушбу тавсиялар беморнинг клиник ҳолати, лаборатория кўрсаткичлари, ирсий омиллари ва даволашга жавоби билан боғлиқ ҳолда баҳоланади.

Сунъий интеллект ушбу жараёнда турли манбалардан олинган маълумотларни биргаликда таҳлил қилиш орқали индивидуал хусусиятларни аниқлашга ёрдам бериши мумкин. Масалан, қандли диабет билан касалланган беморларда қондаги глюкоза даражаси, ёш, тана вазни, жисмоний фаоллик, овқатланиш хусусиятлари ва ҳамроҳ касалликлар каби кўрсаткичлар ўзаро боғлиқ ҳолда таҳлил қилиниши мумкин. Бундай таҳлил шифокорга беморнинг ҳолатини комплекс баҳолаш ва кузатув тактикасини белгилашда кўмаклашади.

Онкология соҳасида сунъий интеллект тиббий тасвирларни таҳлил қилиш, ўсмаларнинг хусусиятларини баҳолаш ва муайян даволаш усулига жавобни ўрганиш учун қўлланилиши мумкин. Кардиологияда эса электрокардиограмма, юрак уриш ритми ва бошқа физиологик кўрсаткичларни таҳлил қилиш орқали айрим хавфли ҳолатларни эртароқ аниқлаш имконияти мавжуд.

Уникалликка асосланган ёндашувни амалга оширишда қуйидаги босқичлар муҳим ҳисобланади:

1. **Маълумотларни йиғиш.** Беморнинг клиник тарихи, лаборатория натижалари ва зарур физиологик кўрсаткичлари тўпланади.
2. **Маълумотларни тайёрлаш.** Хатолар, такрорий ёзувлар ва етишмаётган қийматлар текширилади.
3. **Интеллектуал таҳлил.** Алгоритмлар маълумотлардаги қонуниятларни аниқлаш ва хавфларни баҳолаш учун қўлланилади.
4. **Индивидуал баҳолаш.** Олинган натижалар беморнинг клиник ҳолати ва бошқа муҳим омиллари билан солиштирилади.
5. **Клиник қарор қабул қилиш.** Шифокор алгоритм натижалари, илмий далиллар ва беморнинг эҳтиёжларини ҳисобга олган ҳолда қарор қабул қилади.
6. **Натижаларни кузатиш.** Даволаш самарадорлиги баҳоланади ва зарурат бўлганда тиббий тактика қайта кўриб чиқилади.

Ушбу жараёнда сунъий интеллект беморга мос келадиган эҳтимолий вариантларни таҳлил қилишга ёрдам беради. Аммо шахсийлаштирилган даволаш режаси фақат алгоритм тавсияси асосида эмас, балки клиник

далиллар, тиббий стандартлар ва мутахассиснинг касбий баҳоси асосида белгиланиши керак.

Демак, тиббиётда уникаллик сари ёндашув ҳар бир беморни алоҳида клиник ҳолат сифатида кўриб чиқишни, маълумотларга асосланган таҳлилни ва инсон манфаатларини биринчи ўринга қўйишни талаб этади.

3. Сунъий интеллектнинг тиббий диагностика ва даволашдаги имкониятлари

Тиббий диагностикада сунъий интеллектдан фойдаланишнинг асосий афзалликларидан бири катта ҳажмдаги маълумотларни қисқа вақт ичида таҳлил қилиш имкониятидир. Айрим диагностик жараёнларда алгоритмлар шифокор эътиборидан четда қолиши мумкин бўлган майда белгиларни аниқлашга ёрдам бериши мумкин. Бироқ бу имкониятлар муайян алгоритм, касаллик тури, маълумотлар сифати ва текширув шароитига боғлиқ [1; 3].

Масалан, радиологик тасвирларни таҳлил қилишда сунъий интеллект шубҳали соҳаларни белгилаши, уларни устуворлик бўйича саралаши ёки мутахассисга қўшимча маълумот тақдим этиши мумкин. Кўз тўр пардаси тасвирларини таҳлил қилиш диабетик ретинопатия каби ҳолатларни аниқлашга кўмаклашувчи йўналишлардан биридир. Кардиологияда эса физиологик сигналларни автоматик таҳлил қилиш айрим юрак ритми бузилишларини аниқлаш ва бемор ҳолатини кузатишда фойдали бўлиши мумкин.

Даволаш жараёнида сунъий интеллект беморнинг клиник маълумотларини умумлаштириш, дори воситалари ўртасидаги эҳтимолий ўзаро таъсирларни аниқлаш ва даволаш натижаларини прогноз қилишни қўллаб-қувватлаши мумкин. Бундай тизимлар клиник қарорларни қўллаб-қувватлаш тизимлари (Clinical Decision Support Systems — CDSS) деб аталади.

Ушбу технологиялар шифокорга ташхис қўйишда, қўшимча текширувларни белгилашда ёки хавф омилларини баҳолашда ёрдам бериши мумкин. Шу билан бирга, алгоритм томонидан берилган тавсияни автоматик равишда қабул қилиш тўғри эмас. Ҳар бир тавсия беморнинг индивидуал ҳолати, қарши кўрсатмалар, клиник қўлланмалар ва мавжуд илмий далиллар асосида текширилиши зарур.

Соғлиқни сақлашда сунъий интеллектдан фойдаланишнинг яна бир йўналиши — масофавий мониторинг. Ақлли сенсорлар, тақиладиган қурилмалар ва рақамли платформалар орқали юрак уриш частотаси, жисмоний фаоллик ва айрим бошқа физиологик кўрсаткичларни кузатиш мумкин. Ушбу маълумотларни таҳлил қилиш бемор ҳолатидаги ўзгаришларни аниқлаш ва ўз вақтида тиббий кўрикка йўналтиришга кўмаклашиши мумкин.

Шу тариқа, сунъий интеллектнинг тиббиётдаги аҳамияти нафақат ташхислаш тезлигини ошириш, балки маълумотларни тизимли таҳлил қилиш, хавфларни баҳолаш ва беморга индивидуал ёндашувни қўллаб-қувватлаш билан ҳам белгиланади.

4. Тиббиётда сунъий интеллектни қўллашнинг муаммолари ва хавфсизлик масалалари

Сунъий интеллект технологияларининг тиббиётга жорий этилиши катта имкониятлар билан бирга муайян хавф ва чекловларни ҳам келтириб чиқаради. Уларнинг энг муҳимларидан бири тиббий маълумотларнинг сифати ва етарли даражада репрезентатив бўлишидир. Агар алгоритм фақат муайян ҳудуд, ёш гуруҳи ёки аҳоли қатламига мансуб беморлар маълумотлари асосида ўқитилса, унинг бошқа гуруҳлардаги натижалари ишончсиз бўлиши мумкин [4].

Д. Швабе ва ҳаммуаллифлар томонидан 2024 йилда эълон қилинган тадқиқотда тиббий сунъий интеллект тизимларининг ишончлилиги маълумотлар сифатини баҳолаш билан узвий боғлиқ эканлиги таъкидланган. Муаллифлар маълумотлар таркиби, тўлиқлиги, репрезентативлиги ва хатоларини тизимли текшириш зарурлигини кўрсатганлар [4].

Иккинчи муҳим муаммо — алгоритмик тарафкашлик. Агар дастлабки маълумотларда муайян гуруҳлар етарлича қамраб олинмаган бўлса, алгоритм айрим беморлар учун нотўғри прогноз ёки камроқ аниқ натижалар бериши мумкин. Шу сабабли сунъий интеллект тизимларини турли ёш, жинс, ижтимоий ва клиник гуруҳларда синовдан ўтказиш зарур [2; 4].

Учинчи муаммо беморларнинг шахсий маълумотларини муҳофаза қилиш билан боғлиқ. Тиббий маълумотлар инсоннинг саломатлиги, касаллик тарихи ва бошқа махфий ахборотларни қамраб олади. Уларни сунъий интеллект тизимларида қайта ишлашда қонуний асос, маълумотларни минималлаштириш, рухсатсиз киришдан ҳимоя қилиш ва ахборот хавфсизлиги чораларига риоя этилиши керак.

Жаҳон соғлиқни сақлаш ташкилоти сунъий интеллектдан тиббиётда фойдаланишда инсон мустақиллигини ҳимоя қилиш, хавфсизликни таъминлаш, шаффофлик, масъулият, тенглик ва барқарорликни муҳим тамойиллар сифатида белгилаган [2]. Бу тамойиллар сунъий интеллектни фақат технологик самарадорлик нуқтаи назаридан эмас, балки инсон ҳуқуқлари ва бемор манфаатлари нуқтаи назаридан ҳам баҳолаш зарурлигини кўрсатади.

Шунингдек, сунъий интеллект натижаларини клиник амалиётда қўллашдан олдин уларни мустақил маълумотлар тўпламида текшириш, аниқ белгиланган вазифа доирасида баҳолаш ва амалиётга жорий этилгандан кейин ҳам кузатиб бориш лозим. ЖССТнинг 2023 йилдаги тавсияларида ҳам тиббий сунъий интеллект тизимларини тартибга солишда хавф ва фойдани баҳолаш, шаффоф ҳужжатлаштириш, ташқи текширув ҳамда маълумотлар сифатини таъминлаш масалаларига эътибор қаратилган [5].

Демак, тиббиётда уникалликка интилиш маълумотларнинг кўплиги билан чекланмайди. Асосий вазифа — бемор ҳақидаги ишончли маълумотлардан фойдаланиб, хавфсиз, тушунарли ва клиник жиҳатдан асосланган қарорларни қўллаб-қувватлашдан иборат.

5. Тиббиётда уникаллик сари ёндашувни ривожлантириш бўйича таклифлар

Тиббиётда сунъий интеллект технологияларини самарали жорий этиш ва индивидуал ёндашувни ривожлантириш учун қуйидаги илмий-амалий йўналишларни устувор деб ҳисоблаш мумкин.

Биринчидан, интеграциялашган тиббий маълумотлар тизимларини ривожлантириш. Электрон тиббий карталар, лаборатория таҳлиллари, диагностик тасвирлар ва физиологик мониторинг натижаларини ўзаро боғлиқ ҳолда таҳлил қилиш имкониятини яратиш зарур. Бунда маълумотларнинг сифати, бир хил форматда сақланиши ва махфийлиги таъминланиши керак.

Иккинчидан, маҳаллий маълумотлар асосида алгоритмларни баҳолаш. Ўзбекистон аҳолисининг клиник ва демографик хусусиятларини ҳисобга олиш учун сунъий интеллект моделларини маҳаллий тиббий муассасалар маълумотларида текшириш муҳим. Бошқа мамлакатларда ишлаб чиқилган алгоритмларни маҳаллий амалиётга тўғридан-тўғри татбиқ этишдан олдин уларнинг мослиги ва ишончлилиги баҳоланиши лозим.

Учинчидан, шифокор ва сунъий интеллект ҳамкорлигини таъминлаш. Тиббий қарор қабул қилиш жараёнида алгоритм натижалари қўшимча ахборот ва тавсия сифатида ишлатилиши, якуний клиник қарор эса масъул мутахассис томонидан қабул қилиниши зарур. Бундай ёндашув технология имкониятларини инсоннинг касбий тажрибаси билан бирлаштиради [1; 2].

Тўртинчидан, тиббий кадрларнинг рақамли компетенцияларини ривожлантириш. Шифокорлар ва тиббиёт талабалари сунъий интеллект алгоритмларининг ишлаш тамойиллари, имкониятлари, чекловлари, маълумотлар хавфсизлиги ва натижаларни танқидий баҳолаш усулларини билишлари керак.

Бешинчидан, илмий натижаларнинг ишончлилигини таъминлаш. Сунъий интеллект асосида таклиф этилаётган янги усуллар клиник текширувлар, статистик таҳлил ва мавжуд стандартлар билан солиштириш орқали баҳоланиши лозим. Илмий мақолаларда маълумотлар манбаси, танланма хусусиятлари, алгоритмнинг қўлланиш чегаралари ва олинган натижаларнинг чекловлари очиқ баён қилиниши керак.

Олтинчидан, бемор манфаатларини марказга қўйиш. Технологик янгиликнинг қиймати фақат алгоритмнинг тезлиги ёки ҳисоблаш аниқлиги билан эмас, балки бемор хавфсизлиги, тиббий хизматдан фойдаланиш имконияти ва клиник натижаларга таъсири билан ҳам баҳоланиши зарур.

Мазкур таклифлар сунъий интеллектни тиббий амалиётга масъулият билан жорий этиш, беморга индивидуал ёндашувни такомиллаштириш ва илмий асосланган қарорларни қўллаб-қувватлаш учун методологик асос бўлиб хизмат қилиши мумкин.

Хулоса

Олиб борилган адабиётлар таҳлили тиббиётда сунъий интеллект технологияларидан фойдаланиш диагностика, клиник маълумотларни қайта ишлаш, касаллик хавфини баҳолаш ва шахсийлаштирилган тиббиётни ривожлантириш учун муҳим имкониятлар яратишини кўрсатади. Машинали ўқитиш, чуқур ўқитиш, нейрон тармоқлар ва компьютер кўриши каби технологиялар тиббий ахборотни тизимли таҳлил қилишга ёрдам беради.

Уникаллик сари ёндашувнинг моҳияти ҳар бир беморнинг индивидуал хусусиятларини ҳисобга олиш, умумий клиник тавсияларни шахсий маълумотлар билан биргаликда баҳолаш ва тиббий қарорларнинг асосланганлигини кучайтиришдан иборат. Бунда сунъий интеллект беморнинг барча хусусиятларини мустақил равишда тўлиқ англайдиган восита эмас, балки шифокорга қўшимча таҳлилий имконият берувчи технология сифатида қаралиши лозим.

Тадқиқотнинг амалий аҳамияти шундаки, унда тиббиётда сунъий интеллектдан фойдаланишни такомиллаштиришга қаратилган олтита йўналиш — интеграциялашган маълумотлар тизимлари, маҳаллий алгоритмларни текшириш, инсон ва сунъий интеллект ҳамкорлиги, рақамли компетенциялар, илмий натижаларни валидация қилиш ҳамда бемор манфаатларини устувор қўйиш таклиф этилди.

Шу билан бирга, сунъий интеллект технологияларининг самарадорлиги маълумотлар сифати, ташқи валидация, алгоритмнинг тушунарлилиги ва клиник амалиётдаги ишончлилигига боғлиқ. Беморларнинг шахсий маълумотларини ҳимоя қилиш, алгоритмик тарафкашликни камайтириш ва шифокор масъулиятини сақлаш технологияларни жорий этишнинг ажралмас шартлари ҳисобланади.

Хулоса қилиб айтганда, тиббиётда сунъий интеллект ва уникаллик сари ёндашувнинг уйғунлиги — ҳар бир беморга индивидуал, илмий асосланган, хавфсиз ва инсон манфаатларига йўналтирилган тиббий ёрдам кўрсатишни такомиллаштиришнинг муҳим йўналишидир.

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Мухаммадкулова М.
ассистент
Каримов Н.
талаба
Хайдаров А.
талаба
Хасанов С.
талаба
Мардиев Э.
талаба
Самарқанд давлат тиббиёт университети

ТИББИЁТДА СУНЪИЙ ИНТЕЛЛЕКТДАН ФОЙДАЛАНИШ: ЗАМОНАВИЙ ИМКОНИЯТЛАР, МУАММОЛАР ВА РИВОЖЛАНИШ ИСТИҚБОЛЛАРИ

Аннотация. Мазкур мақолада сунъий интеллект технологияларининг замонавий тиббиёт тизимида қўлланилиши, уларнинг диагностик, прогностик, профилактик ва таълимий имкониятлари комплекс тарзда таҳлил қилинади. Тиббиётда рақамли маълумотлар ҳажмининг ортиб бориши, электрон тиббий карталар, тиббий тасвирлар, лаборатория натижалари ва узлуксиз мониторинг маълумотларининг кўпайиши клиник ахборотни қайта ишлашнинг янги ёндашувларини талаб қилмоқда. Шу нуқтаи назардан, сунъий интеллект катта ҳажмдаги маълумотларни таҳлил қилиш, улар орасидаги яширин қонуниятларни аниқлаш ва қарор қабул қилиш жараёнини қўллаб-қувватлаш воситаси сифатида муҳим аҳамият касб этмоқда. Тадқиқотда сунъий интеллектнинг тиббий диагностика, тиббий тасвирларни таҳлил қилиш, клиник қарорларни қўллаб-қувватлаш, персоналлаштирилган тиббиёт, фармацевтик тадқиқотлар, эпидемиологик таҳлил ва тиббий таълимдаги имкониятлари кўриб чиқилди. Шунингдек, сунъий интеллектни математик моделлаштириш билан интеграция қилиш масаласига алоҳида эътибор қаратилди. Таҳлил натижасида тиббиётда сунъий интеллектдан самарали фойдаланиш фақат алгоритм яратиш билан эмас, балки маълумотлар сифати, моделнинг ташқи муҳитда ишлаш қобилияти, инсон назорати, этик меъёрлар ва мутахассисларни тайёрлаш билан узвий боғлиқ эканлиги асосланди.

Калит сўзлар: сунъий интеллект, тиббиёт, машинали ўқитиш, тиббий диагностика, тиббий тасвирлар, клиник қарорларни қўллаб-қувватлаш, генератив сунъий интеллект, математик моделлаштириш, персоналлаштирилган тиббиёт, рақамли тиббиёт.

Mukhammadkulova M.
assistant
Karimov N.
student
Khaydarov A.
student
Khasanov S.
student
Mardiev E.
student
Samarkand State Medical University

APPLICATION OF ARTIFICIAL INTELLIGENCE IN MEDICINE: MODERN OPPORTUNITIES, CHALLENGES, AND FUTURE PROSPECTS

Abstract. This article examines the contemporary applications of artificial intelligence in medicine, with particular attention to diagnostic, prognostic, preventive and educational opportunities. The rapid growth of electronic health records, medical images, laboratory data and continuous monitoring systems requires new approaches to processing and interpreting complex medical information. Artificial intelligence provides tools for identifying patterns in large datasets and supporting clinical decision-making. The study analyzes the application of artificial intelligence in medical diagnosis, medical image interpretation, clinical decision support, personalized medicine, pharmaceutical research, epidemiology and medical education. Particular attention is given to the integration of artificial intelligence with mathematical modeling. The analysis indicates that effective implementation of AI in healthcare depends not only on algorithmic performance but also on data quality, external validity, transparency, human oversight, ethical governance and professional training.

Keywords: artificial intelligence, medicine, machine learning, medical diagnosis, medical imaging, clinical decision support, generative AI, mathematical modeling, personalized medicine, digital healthcare.

КИРИШ

Сўнгги йилларда тиббиёт соҳасининг рақамлашуви натижасида клиник жараёнларда ишлатиладиган маълумотларнинг тури ва ҳажми кескин ортди. Электрон тиббий карталар, компьютер томографияси, магнит-резонанс томографияси, ультратовуш текширувлари, лаборатория таҳлиллари, геномик маълумотлар ҳамда беморларни масофавий мониторинг қилиш тизимлари тиббий ахборотнинг катта массивларини шакллантирмоқда. Бундай шароитда мутахассис учун барча маълумотларни анъанавий усулда бир вақтнинг ўзида таҳлил қилиш тобора мураккаблашмоқда.

Шу нуқтаи назардан сунъий интеллект тиббиётда инсон мутахассисининг ўрнини босувчи технология сифатида эмас, балки мураккаб ахборотни қайта ишлаш ва клиник қарорларни қўллаб-қувватлаш имкониятини кенгайтирувчи технологик восита сифатида қаралиши лозим. Жаҳон соғлиқни сақлаш ташкилоти сунъий интеллектни тиббиётга жорий этишда хавфсизлик, адолатлилик, инсон ҳуқуқлари ва бошқарув механизмларига алоҳида эътибор қаратиш зарурлигини таъкидлайди.

Масаланинг долзарблиги яна шундаки, тиббий сунъий интеллект тизимининг лаборатория ёки тест муҳитида юқори натижа кўрсатиши уни реал клиник амалиётда ҳам худди шундай самара беради, дегани эмас. Реал клиник муҳитда беморлар таркиби, тиббий ускуналар, маълумотларнинг тўлиқлиги ва шифокорларнинг иш жараёни фарқ қилиши мумкин. Шу сабабли сунъий интеллект тизимларини баҳолашда алгоритмнинг техник кўрсаткичлари билан бир қаторда унинг реал клиник шароитга мослиги ҳам ўрганилиши керак.

ТАДҚИҚОТНИНГ МАҚСАДИ ВА МЕТОДОЛОГИЯСИ

Мақоланинг асосий мақсади тиббиётда сунъий интеллект технологияларидан фойдаланишнинг замонавий йўналишларини таҳлил қилиш, уларнинг амалий имкониятлари ва мавжуд чекловларини тизимлаштириш ҳамда сунъий интеллектни математик моделлаштириш билан уйғунлаштиришнинг илмий-амалий аҳамиятини асослашдан иборат.

Тадқиқотда илмий адабиётларни таҳлил қилиш, қиёсий таҳлил, тизимлаштириш, умумлаштириш ва концептуал моделлаштириш усулларидан фойдаланилди. Халқаро илмий манбалар, жумладан Nature Medicine, NEJM, BMJ, Lancet Digital Health ҳамда Жаҳон соғлиқни сақлаш ташкилоти материалларида ёритилган ёндашувлар таҳлил қилинди.

ТИББИЙ ДИАГНОСТИКАДА СУНЪИЙ ИНТЕЛЛЕКТ

Сунъий интеллектнинг тиббиётда энг кўп муҳокама қилинаётган йўналишларидан бири диагностика жараёнидир. Диагностик жараёнда шифокор беморнинг шикоятлари, анамнези, объектив кўрик натижалари, лаборатория кўрсаткичлари ва инструментал текширувларини биргаликда баҳолайди. Машинали ўқитиш алгоритмлари эса катта миқдордаги аввалги маълумотлар асосида муайян белгилар билан касалликлар ўртасидаги статистик боғлиқликларни аниқлаш имкониятига эга.

Айниқса, тиббий тасвирларни автоматик таҳлил қилишда нейрон тармоқлардан кенг фойдаланиш имкониятлари мавжуд. Рентгенография, компьютер томографияси, магнит-резонанс томографияси ва бошқа визуал маълумотлар алгоритмлар ёрдамида сегментация қилиниши, таснифланиши ёки шубҳали соҳалар ажратиб кўрсатилиши мумкин.

Бироқ бундай тизим натижасини тўғридан-тўғри клиник диагноз билан тенглаштириш методологик жиҳатдан нотўғри бўлади. Алгоритм муайян маълумотлар тўпламида юқори аниқликка эришган бўлса ҳам, бошқа муассаса ёки бошқа аҳоли гуруҳида унинг натижаси ўзгариши мумкин.

Шунинг учун тиббий AI тизимларида ташқи валидация муҳим босқич ҳисобланади.

ТИББИЙ ТАСВИРЛАРНИ ҚАЙТА ИШЛАШДА AI

Тиббий тасвирларни қайта ишлаш сунъий интеллектнинг амалий қиймати юқори бўлган соҳаларидан биридир. Компьютер томографияси ва МРТ тасвирларида патологик ўзгаришларни аниқлаш, органлар чегараларини белгилаш ва касаллик билан боғлиқ морфологик хусусиятларни ажратиш учун чуқур ўрганиш усулларидан фойдаланиш мумкин.

Бу жараённи қуйидаги кетма-кетликда ифодалаш мумкин:

Тиббий тасвир → олдиндан қайта ишлаш → хусусиятларни ажратиш → AI модели → натижани баҳолаш → шифокор қарори.

Бунда AI модели якуний қарорни мустақил равишда белгилаши шарт эмас. Аксинча, унинг натижаси шифокор учун қўшимча аналитик маълумот вазифасини бажариши мумкин. Шу ёндашув инсон назоратини сақлаб қолиш ва нотўғри автоматик қарорлар хавфини камайтириш нуқтаи назаридан аҳамиятлидир.

КЛИНИК ҚАРОРЛАРНИ ҚЎЛЛАБ-ҚУВВАТЛАШ

Клиник қарорларни қўллаб-қувватлаш тизимларида сунъий интеллектнинг вазифаси турли манбалардан келган маълумотларни бирлаштириш ва шифокорга қарор қабул қилиш жараёнида қўшимча ахборот тақдим этишдан иборат.

Бундай тизимларда:

- беморнинг анамнези;
- лаборатория натижалари;
- тиббий тасвирлар;
- дори воситалари тарихи;
- хавф омиллари;
- физиологик кўрсаткичлар

каби маълумотлар биргаликда таҳлил қилиниши мумкин.

Бироқ клиник қарор қабул қилиш инсон ҳаёти ва саломатлиги билан бевосита боғлиқ бўлгани учун алгоритм натижасини мутлақ ҳақиқат сифатида қабул қилиш мумкин эмас. 2024 йилда Nature Medicine журналида эълон қилинган тадқиқотда катта тил моделларининг имтиҳонлардаги юқори натижалари реал клиник қарор қабул қилишда зарур бўлган барча кўникмаларни тўлиқ ифодаламаслиги қайд этилган.

Демак, AI тизимини клиник жараёнга жорий этишда “алгоритм нима дейди?” деган савол билан чекланмасдан, “алгоритм қайси маълумот асосида бундай натижага келди?”, “натижа қайси шароитда ишончли?” ва “қарор учун инсон назорати қай даражада сақланади?” каби саволларга ҳам жавоб излаш талаб этилади.

ГЕНЕРАТИВ СУНЪИЙ ИНТЕЛЛЕКТНИНГ ТИББИЁТДАГИ ЎРНИ

Сўнгги даврда генератив сунъий интеллект ва катта тил моделларининг ривожланиши тиббиётда янги имкониятларни юзага келтирди. Катта тил

моделлари табиий тилдаги саволларга жавоб бериш, тиббий ҳужжатларни умумлаштириш, маълумотларни структуралаштириш ва таълимий материалларни тайёрлаш каби вазифаларда қўлланиши мумкин. Nature Medicine журналидаги шарҳларда ушбу моделларнинг тиббий соҳадаги имкониятлари билан бирга уларни реал клиник муҳитда қўллашдаги чекловлари ҳам муҳокама қилинган.

Генератив AI тиббий таълимда ҳам қўшимча имкониятлар яратади. Масалан, талаба клиник вазиятни тавсифлаб, унинг асосида дифференциал диагностика вариантларини муҳокама қилиши, математик модел натижаларини шарҳлатиши ёки маълум бир мавзуда индивидуал ўқув сценарийси тузиши мумкин.

Шу билан бирга, генератив моделлар нотўғри ёки мавжуд бўлмаган маълумотни ишончли услубда тақдим этиши эҳтимоли мавжуд. Шу сабабли тиббий таълимда AI томонидан берилган маълумотни мустақил манбалар билан текшириш кўникмаси ҳам шакллантирилиши лозим.

СУНЪИЙ ИНТЕЛЛЕКТ ВА МАТЕМАТИК МОДЕЛЛАШТИРИШ ИНТЕГРАЦИЯСИ

Тиббиётда сунъий интеллектнинг имкониятларини математик моделлаштириш билан бирлаштириш алоҳида илмий аҳамиятга эга. Математик моделлаштириш тиббий-биологик жараёнларни математик ифодалаш, уларнинг динамикасини тушунтириш ва эҳтимолий сценарийларни баҳолаш имконини беради.

Масалан, инфекцион касалликларнинг тарқалишини ўрганишда SIR модели:

S → I → R

кўринишидаги популяцион динамикани ифодалаши мумкин.

Бу ерда:

S — касалликка мойил аҳоли;
I — инфекцияланган аҳоли;
R — инфекциядан чиққан ёки иммунитет ҳосил қилган аҳоли.

Сунъий интеллект эса реал маълумотлар асосида ушбу моделнинг параметрларини баҳолаш, катта маълумотлардан қонуниятларни ажратиш ва прогноз сценарийларини шакллантиришда қўлланилиши мумкин.

Шундай қилиб, математик моделлаштириш ва AI ўртасида вазифалар тақсимоти пайдо бўлади:

Технология	Асосий вазифа
Математик моделлаштириш	Жараённинг назарий ва математик механизмларини ифодалаш
Машинали ўқитиш	Маълумотлардан қонуниятларни аниқлаш
Чуқур ўрганиш	Мураккаб ва кўп ўлчамли маълумотларни қайта ишлаш
Генератив AI	Маълумотни табиий тилда тушунтириш ва янги контент яратиш
Клиник қарорларни қўллаб-қувватлаш	Таҳлил натижаларини амалиётга етказиш

Муаллиф нуқтаи назаридан, ушбу интеграция тиббий таълимда ҳам муҳим методик имконият яратади. Талаба аввал биологик жараённи ўрганади, кейин уни математик моделга айлантиради, модел параметрларини ҳисоблайди ва ниҳоят AI воситалари ёрдамида олинган натижаларни таҳлил қилади. Бундай ёндашув математик, ахборот-технологик ва касбий компетенцияларни бир вақтда шакллантириш имконини беради.

ТИББИЙ ТАЪЛИМДА СУНЪИЙ ИНТЕЛЛЕКТ

Тиббий таълим тизимида AI технологияларидан фойдаланиш келажакдаги шифокорларнинг рақамли компетенцияларини шакллантириш билан бевосита боғлиқ.

Талабалар:

- клиник вазиятларни моделлаштириш;
- виртуал бемор сценарийларини таҳлил қилиш;
- тиббий маълумотларни статистик қайта ишлаш;
- математик моделларни қуриш;
- AI натижаларини танқидий баҳолаш;
- тиббий ахборотни визуаллаштириш

каби вазифаларни бажаришлари мумкин.

Бундай таълим моделида AI тайёр жавоб берувчи восита эмас, балки талабанинг мустақил фикрлашини рағбатлантирувчи инструмент сифатида қаралиши лозим.

Айниқса, “математик моделлаштириш + AI + тиббий фанлар” интеграцияси келажак шифокори учун бир нечта компетенцияларни параллел равишда ривожлантириш имконини беради.

ЭТИК, ҲУҚУҚИЙ ВА АМАЛИЙ МУАММОЛАР

Тиббиётда сунъий интеллектдан фойдаланишнинг ижобий жиҳатлари билан бирга бир қатор муаммолари ҳам мавжуд. Биринчи навбатда, бемор маълумотларининг махфийлиги масаласи муҳимдир. Тиббий маълумотлар шахсий ва сезгир ахборот ҳисобланган сабабли уларни йиғиш, сақлаш ва қайта ишлаш жараёнларида ахборот хавфсизлиги таъминланиши керак.

Иккинчи масала — алгоритм қарорининг тушунтирила олиши. Шифокор муайян натижанинг қандай шаклланганини тушуниш имконига эга бўлса, AI тизимига ишонч ҳам ортиши мумкин.

Учинчи масала — жавобгарлик. Агар AI тизими тавсияси нотўғри бўлса, масъулиятнинг шифокор, тиббий муассаса, дастур ишлаб чиқувчи ёки бошқа иштирокчилар ўртасида қандай тақсимланиши ҳуқуқий жиҳатдан аниқ белгилаб қўйилиши талаб этилади.

WHO AI тизимларини тиббиётга жорий этишда инсон ҳуқуқлари, хавфсизлик, шаффофлик, масъулият ва тенглик тамойилларини ҳисобга олиш зарурлигини таъкидлайди. 2025 йилги WHO йўриқномаси катта мультимодал моделлар учун ҳам ушбу масалаларни янада аниқлаштиради.

МУҲОКАМА

Тадқиқот натижалари шуни кўрсатадики, тиббиётда сунъий интеллектнинг ривожланиши учта ўзаро боғлиқ йўналишни қамраб олмоқда: маълумотларни автоматик таҳлил қилиш, клиник қарорларни қўллаб-қувватлаш ва интеллектуал тиббий таълим муҳитини шакллантириш.

Шу билан бирга, технологиянинг ривожланиши унинг клиник амалиётга автоматик равишда муваффақиятли кириб боришини англатмайди. Реал амалиётда маълумотларнинг сифати, клиник иш жараёни, инфратузилма, кадрлар тайёргарлиги ва ҳуқуқий механизмлар биргаликда ишлаши зарур.

WHOнинг 2025 йилги Европа минтақаси бўйича таҳлили ҳам AI жорий этилишида бошқарув, кадрлар тайёргарлиги, маълумотлар бошқаруви, ҳуқуқий муҳит ва молиявий имкониятлар каби омиллар муҳимлигини кўрсатади.

Шу сабабли тиббиётда AI бўйича келгуси тадқиқотлар фақат “қайси алгоритм юқори аниқлик беради?” саволига эмас, балки “қайси шароитда, қайси аҳоли гуруҳида ва қайси клиник жараёнда ушбу технология хавфсиз ва фойдали ишлайди?” деган комплекс саволларга ҳам йўналтирилиши мақсадга мувофиқ.

ХУЛОСА

Тиббиётда сунъий интеллектдан фойдаланиш рақамли трансформациянинг муҳим йўналишларидан бирига айланмоқда. AI технологиялари тиббий тасвирларни таҳлил қилиш, клиник маълумотларни қайта ишлаш, қарорларни қўллаб-қувватлаш, персоналлаштирилган тиббиёт, фармацевтика, эпидемиология ва тиббий таълимда янги имкониятларни шакллантирмоқда.

Таҳлиллар асосида шуни таъкидлаш мумкинки, сунъий интеллектнинг тиббиётдаги қиймати фақат алгоритмнинг техник аниқлиги билан белгиланмайди. Маълумотлар сифати, ташқи валидация, инсон назорати, шаффофлик, ахборот хавфсизлиги ва этик бошқарув ҳам технологиянинг амалий натижасига таъсир кўрсатади.

Мақолада таклиф этилган ёндашувда математик моделлаштириш ва сунъий интеллект ўзаро бир-бирини тўлдирувчи технологиялар сифатида қаралади. Математик модел тиббий жараённинг назарий-математик

ифодасини таъминласа, сунъий интеллект реал маълумотларни қайта ишлаш ва прогнозлаш имкониятларини кенгайтиради.

Айниқса, ушбу ёндашув тиббий таълим учун муҳим методик аҳамиятга эга. Талабанинг тиббий муаммони математик модель кўринишида ифодалаши, маълумотларни компьютерда қайта ишлаши, AI натижаларини таҳлил қилиши ва уларни клиник мазмун билан боғлаши интеграциялашган касбий компетенцияларни шакллантиришга хизмат қилиши мумкин.

Шундай қилиб, келажакда тиббиётда сунъий интеллектдан самарали фойдаланишнинг асосий шарти технологиянинг ўзи эмас, балки **инсон, тиббий билим, математик моделлаштириш, рақамли технологиялар ва этик бошқарувнинг ягона тизимда уйғунлашуви** ҳисобланади.

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Номозов Б.Ю.
доцент кафедры нефтегазового дела и технологии переработки нефти и газа
Каршинский государственный технический университет

СРАВНИТЕЛЬНЫЙ АНАЛИЗ И ОЦЕНКА ЭФФЕКТИВНОСТИ ТЕХНОЛОГИЙ ПОВЫШЕНИЯ НЕФТЕОТДАЧИ НА ЗАВЕРШАЮЩЕЙ СТАДИИ РАЗРАБОТКИ МЕСТОРОЖДЕНИЙ

Аннотация. Настоящая работа посвящена систематическому анализу и критическому осмыслению научно-методических материалов в области применения классических и инновационных ГТМ. На основе собранных данных дается оценка технологического потенциала методов МУН, применяемых в условиях глубокой истощенности и высокой обводненности месторождений.

Ключевые слова: геолого-техническим мероприятиям, остаточные запасы нефти, интенсификация добычи, месторождение.

Nomozov B.Yu.
associate professor
Department of Oil and Gas Engineering and Oil and Gas Processing Technology
Karshi State Technical University

COMPARATIVE ANALYSIS AND EVALUATION OF THE EFFECTIVENESS OF ENHANCED OIL RECOVERY TECHNOLOGIES AT THE FINAL STAGE OF FIELD DEVELOPMENT

Abstract. This paper is about a systematic analysis and critical review of scientific and methodological materials on the use of classical and innovative EOR techniques. Based on the collected data, it assesses the technological potential of EOR methods used in conditions of deep depletion and high water cut in reservoirs.

Keywords: well operation, stage of falling production, well self-suppression, well watering.

Обоснование актуальности исследования связано с тем, что в процессе освоения месторождений существенная доля запасов переходит в разряд трудноизвлекаемых (ТРИЗ). На фоне естественного падения дебитов на зрелых стадиях разработки это заставляет недропользователей внедрять методы повышения нефтеотдачи (МПН) для сохранения экономической эффективности проектов. Категория ТРИЗ традиционно разделяется на две ключевые группы: геологические (обусловленные низкой проницаемостью, высокой расчлененностью, малой толщиной и невыдержанностью пластов) и флюидные (связанные с высоковязкими и битуминозными нефтями). Фундаментальной причиной этого выступает геологическая неоднородность сред: уникальность каждого объекта исключает возможность создания единой

системы эксплуатации, полностью предотвращающей образование не охваченных выработкой зон. Существенное влияние на коэффициенты извлечения нефти (КИН) оказывает стратегия управления: ошибочный выбор методов МПН на ранних этапах либо приоритет форсирования добычи в ущерб окончательной нефтеотдаче на завершающих стадиях негативно сказываются на итоговой нефтеотдаче. Неравномерность заводнения, колебания темпов отбора и рост вязкости флюида определяют необходимость проведения геолого-технических мероприятий (ГТМ). Данный комплекс работ направлен на интенсификацию добычи и увеличение пластовой нефтеотдачи, что позволяет операторам не только выполнять плановые показатели, но и максимизировать итоговый КИН по объекту разработки.

Ключевым отличием ГТМ от прочих технологических операций является их прямая ориентация на получение прироста дебита нефти. Каждая добывающая компания осуществляет квалификацию видов работ в качестве ГТМ самостоятельно, опираясь на собственную локальную нормативную документацию (ЛНД). В зависимости от степени освоенности и опыта применения методы делятся на традиционные (широко апробированные и долгое время применяемые в отрасли) и инновационные (находящиеся на стадии опытно-промысловых испытаний (ОПИ) либо недавно внедренные в производство).

Традиционные ГТМ реализуются на всех этапах разработки месторождения. На 3-й и 4-й стадиях их проведение позволяет существенно сдерживать темпы падения добычи. В связи с этим ключевой задачей геологических и технологических служб предприятия является подбор наиболее эффективных ГТМ, соответствующих актуальным техническим стандартам и обеспечивающих максимальную нефтеотдачу. Общий план геолого-технических мероприятий утверждается в рамках бизнес-плана компании, однако подвергается ежемесячной оперативной корректировке.

К числу наименее рискованных и наиболее эффективных технологий относятся гидравлический разрыв пласта (ГРП), бурение горизонтально-направленных скважин (ГНС) и зарезка боковых стволов (ЗБС). Анализ исследований показывает, что для коллекторов с низкими фильтрационно-емкостными свойствами (ФЕС) проведение ГРП фактически стало обязательной операцией уже на 1-й стадии разработки. Кроме того, данный метод активно применяется для приобщения вышележащих интервалов и объединения объектов разработки.

В научных трудах, посвященных повышению рентабельности и наработки на отказ, сформулирована унифицированная методология моделирования ГРП [4]. Практические результаты контроля разработки путем заводнения доказывают, что поддержание пластового давления остается одним из наиболее действенных способов повышения нефтеотдачи [5].

Анализ применения ГТМ показывает прямую зависимость успешности заводнения от качества проведения как первичного ГРП, так и повторных обработок (рефраков). Соответственно, грамотное проектирование и

численное моделирование ГРП на стартовом этапе эксплуатации позволяет предотвратить возникновение осложнений на поздних стадиях. Данный вывод подтверждается статистическими данными по довыработке запасов.

Строительство горизонтально-направленных скважин также демонстрирует высокую эффективность в части вовлечения запасов в разработку. Согласно статистике:

- Средний прирост дебита при реализации данной технологии составил 42,2 т/скв.-опер.;
- Объемы бурения горизонтальных и наклонно-направленных скважин ежегодно увеличиваются, несмотря на эксплуатационные сложности (низкие притоки, рост фонда осложненных скважин/АПВ).

В сравнении с предыдущими периодами фонд горизонтальных скважин вырос практически вдвое, что привело к кратному (более чем двукратному) увеличению объемов дополнительной добычи [9].

При этом стандартные технологии, включая классический ГРП, не всегда решают проблему падения продуктивности скважин в долгосрочной перспективе, что делает поиск решений по эффективной довыработке крайне актуальным. К основным факторам снижения добычи относятся: солеотложение, образование асфальтено-смоло-парафиновых отложений (АСПО), вынос механических примесей (включая залповый вынос пропанта), а также ухудшение состояния призабойной зоны пласта (ПЗП), сопровождающееся ростом скин-фактора (S).

Решение данной проблемы лежит в плоскости применения инновационных ГТМ. Исследования (в частности, Moritis G.) показывают, что значительная часть мировой запасоемкой базы представлена зрелыми месторождениями, темпы замещения которых снижаются. Для удовлетворения энергопотребления необходима выработка остаточных запасов за счет внедрения передовых технологий [10].

В качестве одного из таких решений был предложен комплексный виброволновой метод воздействия на ПЗП, комбинируемый с химическими и депрессионными обработками. Метод обеспечивает очистку призабойной зоны за счет передачи упругих колебаний низкой частоты и различной амплитуды через радиально-направленные потоки жидкости. Промысловые испытания подтвердили высокую эффективность импульсного воздействия, однако для достижения максимального эффекта его рекомендуется сочетать с классическими обработками ПЗП (ОПЗ). Виброволновой метод эффективен при водоизоляционных работах (ВИР), на скважинах с низким пластовым давлением, в терригенных коллекторах с низкой проницаемостью, а также на объектах после повторных кислотных обработок или ГРП.

Отдельное внимание уделяется совершенствованию ремонтно-изоляционных работ (РИР) [13]. Основными задачами РИР являются: восстановление герметичности цементного камня для изоляции интервалов от межпластовых перетоков; ликвидация дефектов эксплуатационной колонны, вызывающих резкий рост обводненности; обеспечение надежной изоляции

при возврате на вышележащие горизонты. В числе наиболее актуальных инноваций в сфере РИР выделяются современные конструкции мостовых пробок: извлекаемая ПМ-И, электромеханическая ПМЭ, а также заливочная пробка для открытого ствола ПМЗ-ОС.

Данные инженерно-технологические решения применяются при закачке тампонажных составов, установке цементных мостов, проведении МГРП, а также при ликвидации или консервации скважин. Посадка пробок осуществляется с помощью гидравлических установочных компоновок (ГУК) путем создания избыточного давления в НКТ.

Таким образом, систематизация теоретических и практических материалов по применению традиционных и инновационных ГТМ позволяет сформулировать следующие выводы:

- Главным отличительным признаком ГТМ является прямой прирост объемов добываемой нефти;
- ГТМ классифицируются на традиционные и инновационные исходя из степени их освоенности и условий применения;
- К категории наиболее эффективных традиционных методов довыработки относятся ГРП, бурение ГНС и ЗБС;
- Среди инновационных ГТМ высокими перспективами обладают комплексное виброволновое воздействие и технологические решения в области РИР (пробки ПМ-И, ПМЭ, ПМЗ-ОС).

В качестве итогового резюме следует отметить критическую важность качественного планирования ГТМ на самых ранних этапах освоения. Любые технологические решения — от первичного вскрытия до проведения ГРП при освоении — оказывают определяющее влияние на дальнейшую динамику разработки. Форсирование отбора флюида на начальных стадиях вопреки принципам рационального недропользования неизбежно ведет к снижению итоговой нефтеотдачи, КИН и суммарной накопленной добычи.

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Номозов Б.Ю.
доцент кафедры нефтегазового дела
и технологии переработки нефти и газа
Юлдашев Ж.Б.
старший преподаватель кафедры нефтегазового
дела и технологии переработки нефти и газа
Каршинский государственный технический университет

СПОСОБЫ ОЦЕНКИ ПРОСТРАНСТВЕННОГО РАСПРЕДЕЛЕНИЯ И ВЫДЕЛЕНИЯ ЗОН ОСТАТОЧНОЙ НЕФТЕНАСЫЩЕННОСТИ

Аннотация. Учитывая текущие тенденции развития нефтегазового сектора и вызовы, связанные с обнаружением остаточных углеводородных ресурсоносных зон на истощенных залежях, подтверждена целесообразность применения рассматриваемого расчетного подхода. В основе предложенного алгоритма «Дренирование» лежит вычисление наименьшего объема породы, обусловливающего фактическую суммарную добычу нефти по конкретной скважине. В качестве вертикального параметра данной геометрической модели выступает эффективная (либо фактически эксплуатируемая) нефтенасыщенная мощность пласта, установленная по данным промыслово-геофизических изысканий.

Ключевые слова: аналитические методы, геолого-промысловая информация, подсчет запасов, остаточные запасы, зона консолидации.

Nomozov B.Yu.
associate professor
Department of Oil and Gas Engineering
and Oil and Gas Processing Technology
Yuldashev J.B.
senior lecturer
Department of Oil and Gas Engineering
and Oil and Gas Processing Technology
Karshi State Technical University

METHODS FOR ASSESSING SPATIAL DISTRIBUTION AND IDENTIFYING AREAS OF RESIDUAL OIL SATURATION

Abstract. Given the current trends in the development of the oil and gas sector and the challenges associated with discovering remaining hydrocarbon-bearing zones in depleted reservoirs, the feasibility of using the considered calculation approach has been confirmed. The proposed "Drainage" algorithm is based on calculating the minimum rock volume that determines the actual total oil production for a specific well. The vertical parameter of this geometric model is the effective (or actually exploited) oil-saturated thickness of the reservoir, established based on field geophysical survey data.

Keywords: analytical methods, geological and field information, reserve calculation, remaining reserves, consolidation zone.

Реализация подобного рода проектов предполагает привлечение серьезных объемов финансирования и внедрение передовых технологий. В современных условиях ограниченного доступа к зарубежным решениям из-за санкционных ограничений первостепенное значение приобретает развитие собственного технологического суверенитета. Для стимулирования инвесторов требуется сформировать благоприятную среду, при которой освоение сложных и новых объектов будет гарантировать окупаемость вложений и нормативный уровень рентабельности. Достижение этих целей невозможно без совершенствования инструментария локализации застойных и невыработанных зон.

Разведанные геологические ресурсы углеводородов традиционно подразделяются на извлекаемую и остаточную (неизвлекаемую) части. Применяемое заводнение, с одной стороны, обеспечивая вытеснение углеводородов, с другой стороны, способствует блокировке значительных объемов сырья в менее проницаемых блоках. Главный недостаток стандартных схем разработки заключается в преобладании неизвлекаемой части над извлекаемой [1]: последняя обычно составляет лишь 20–50 %, тогда как на долю остаточной нефти приходится от 50 до 80 %.

В дальнейшем полнота выработки неоднородных пластов будет определяться геометрией и пространственным размещением зоны застойного насыщения, не охваченных фильтрацией. Современные цифровые комплексы для построения карт остаточных запасов опираются на полномасштабные геолого-гидродинамические модели, адаптированные к истории разработки. Однако из-за высокой изменчивости фильтрационно-емкостных свойств (ФЕС) точно отразить реальные траектории потоков флюида бывает крайне затруднительно. В таких условиях эффективным решением становится интерпретация обратных задач подземной гидродинамики. Опираясь на фактические показатели дебитов и давлений, этот подход позволяет определять ключевые параметры пласта (проницаемость, пьезопроводность, упругоемкость). Расчет комплекса неизвестных величин методом минимизации невязки между фактическими и теоретическими данными базируется на алгоритмах нелинейного программирования, что дает возможность существенно повысить качество локализации запасов и выдержать проектные показатели нефтеотдачи.

Зачастую аналитика выработки ресурсов проводится в отрыве от методик оценки их локализации, что приводит к методологическому расхождению. Эффективность заводнения во многом зависит от полноты энергетического воздействия на залежь и характера вытеснения: если на начальных этапах преобладает поршневой режим, то на поздних — струйный, способствующий образованию изолированных целиков нефти. Определение режима вытеснения имеет определяющее значение для динамики добычи и

полноты извлечения. Последняя напрямую коррелирует с коэффициентом охвата по площади и разрезу, а также зависит от свойств вытесняющего агента и интерференции между добывающим и нагнетательным фондом.

В рамках геолого-промыслового анализа ключевое внимание следует уделять вопросам охвата залежи, оценивая долю дренируемых запасов и специфику фильтрации флюидов. К определяющим геолого-физическим факторам относятся фильтрационные характеристики коллектора, степень его анизотропии, реологические и физико-химические свойства пластовых и закачиваемых агентов. В числе основных технологических параметров выступают: 1) геометрия и плотность сетки скважин; 2) конфигурация системы поддержания пластового давления (ППД); 3) темпы нагнетания и отбора; 4) применяемые технологии заводнения; 5) динамика гидродинамических связей между пластами; 6) характер и качество вскрытия продуктивного разреза [1].

В 2015 году Д.А. Баталовым был математически описан и обоснован подход к определению полей нефтенасыщенности на основе топологических схем взаимодействия скважин с учетом их режимов в системе «нефть – вода». Согласно его выводам, данная методика обеспечивает точность свыше 75 % при условии, что история разработки объекта составляет не менее 46 % от предельного срока или достигнут КИН более 82 % от проектного [2].

Наиболее распространенным способом поддержания разработки остается заводнение. При этом базовым критерием для оценки потенциального извлечения выступает коэффициент вытеснения нефти водой, отражающий долю остаточного насыщения порового пространства при предельной промывке [3]. Данная величина позволяет прогнозировать потенциально подвижные объемы сырья.

Для определения остаточной нефтенасыщенности традиционно применяется лабораторное экспериментирование на керновом материале. На основе полученных результатов выстраиваются корреляции остаточной нефтенасыщенности с ФЕС коллектора, используемые при выборе проектных решений. Тем не менее, по мнению ряда исследователей, стандартная методика оценки коэффициента вытеснения требует введения корректировочных коэффициентов для повышения её информативности [4].

С целью рационального планирования выработки разнородных эксплуатационных объектов, находящихся на разных стадиях эксплуатации, требуется простой и экспрессный метод локализации невыработанных зон, не предъявляющий высоких требований к квалификации исполнителя [5].

Для решения этой задачи автором предложена концепция методики, базирующаяся на количественной интерпретации имеющейся информации. Поскольку проведение масштабных промысловых и гидродинамических исследований требует существенных временных и финансовых затрат, неэффективные изыскания целесообразно исключать, заменяя их аналитическими расчетами [6, 7].

В условиях нестабильного режима работы фонда регулярное гидродинамическое моделирование не всегда возможно из-за высокой трудоемкости, дефицита исходных данных и аппаратных ограничений. При этом любые простои скважин перед проведением геолого-технических мероприятий (ГТМ) снижают их конечную эффективность [5, 8, 9]. Оперативная оценка концентрации запасов в объемах, достаточных для окупаемости затрат, позволяет своевременно принимать решения о переводе скважин, выполнивших свою задачу на одном объекте, на другие горизонты в качестве добывающих или нагнетательных [10].

Предлагаемый подход основан на модификации классической формулы объемного метода подсчета запасов за счет перерасчета отдельных её составляющих или вычисления неизвестных параметров [5].

Апробация метода была проведена на четырех различных объектах разработки. В ходе анализа выявлены зоны локализации остаточных запасов, а полученные результаты сопоставлены с данными геолого-гидродинамических моделей и альтернативных аналитических методов, что позволило сформировать программу адресных ГТМ [6, 9].

Учитывая, что комплексный анализ выработки не может опираться исключительно на один метод [1, 11], возникла необходимость в универсальном инструменте, применимом для различных геологических условий.

Авторский метод «Дренирование» основан на определении минимального объема породы для каждой скважины, обеспечивающего фактически полученный накопленный отбор углеводородов. В качестве высоты данного объема используется эффективная (или фактически работающая) нефтенасыщенная толщина пласта. В основании фигуры лежит эллипс, оси которого сопоставимы с векторным изменением проницаемости (рекомендуется учитывать направления наибольшей изменчивости). Этот подход также применим для низкопроницаемых пластов, осваиваемых с применением гидравлического разрыва пласта (ГРП). При отсутствии специализированных программных средств для построения эллипса допускается упрощенный расчет через круговую площадь, где радиус определяется по формуле (1).

$$R = v(Q/(h*К_п*К_{нн}*\rho*К_{пер}* *К_{охв}*К_{выт}*\pi)), \quad (1)$$

где R – радиус круга;

Q – накопленная добыча нефти / накопленная закачка воды (для добывающих / нагнетательных скважин);

h – эффективная нефтенасыщенная (работающая) толщина;

$К_п$ – коэффициент пористости;

$К_{нн}$ – коэффициент нефтенасыщенности;

ρ – плотность нефти в поверхностных условиях;

$К_{пер}$ – пересчетный коэффициент для перевода нефти из поверхностных условий в пластовые;

$К_{охв}$ – коэффициент охвата;

$К_{выт}$ – коэффициент вытеснения.

Эффективная нефтенасыщенная толщина, коэффициенты пористости и нефтенасыщенности могут быть приняты по скважинным данным или по данным утвержденной геологической модели. Плотность нефти в поверхностных условиях, пересчетный коэффициент – значения, принятые при проектировании, соответствуют актуальной геологической модели. Коэффициент охвата также может быть выбран в качестве утвержденного или рассчитан по отдельным блокам соответствующими методиками и алгоритмами.

Коэффициент вытеснения рассчитывается по стандартной формуле

$$К_{выт} = (К_{нн_нач} – К_{нн_ост}) / (К_{нн_нач}), \quad (2)$$

где $К_{ннач}$ – коэффициент начальной нефтенасыщенности, $К_{нност}$ – коэффициент остаточной нефтенасыщенности.

В качестве показателя остаточной нефтенасыщенности применяется нормативное значение, зафиксированное в утвержденной проектной документации на разработку месторождения, либо величина, рассчитанная по принятым петрофизическим зависимостям.

Следующим этапом является визуализация сформированных контуров для каждой скважины. Построенные области отражают объемы породы, дальнейшая выработка которых экономически нецелесообразна, в связи с чем они не рассматриваются как первоочередные объекты для проведения геолого-технических мероприятий (ГТМ). Уточнение данных зон возможно путем итерационного перерасчета вышеуказанных параметров в пределах полученных площадей. Использование усредненных показателей позволяет адаптировать геометрические границы: проведение нескольких итераций обеспечивает сходимость расчетной площади с фактическими параметрами пласта в ее контуре. Данный процедурный шаг является опциональным, но его алгоритмизация позволяет повысить точность построений и сократить время вычислений.

Поскольку рассматриваемый подход определяет минимальный объем выработанного пласта, планирование ГТМ в зонах с граничными значениями трудноизвлекаемых запасов (ТРИЗ) (на уровне окупаемости) не рекомендуется из-за более высокой погрешности метода по сравнению с полномасштабным геолого-гидродинамическим моделированием.

Для валидации методики на конкретном эксплуатационном объекте рекомендуется на этапе построения исключить из исходной базы результаты последних геофизических исследований текущей нефтенасыщенности, а также данные по новым скважинам и боковым стволам. Последующее сопоставление полученных расчетных площадей с фактическими входными параметрами исключенных скважин и результатами ГИС позволяет оценить достоверность построений. При необходимости масштаб отображения корректируется введением поправочного коэффициента к радиусам зон дренирования. К примеру, если по контрольной скважине зафиксирована высокая начальная обводненность, но она не перекрывается расчетными

ареалами соседних скважин, производителю работ следует скорректировать радиусы влияния таким образом, чтобы охватить данную точку как неперспективную, тем самым повысив рентабельность планируемых ГТМ.

Карта с нанесенными ареалами дренирования интегрируется для выделения перспективных участков проведения геолого-технических мероприятий. С использованием утвержденной геолого-гидродинамической модели проводится перерасчет остаточных запасов по выделенным сегментам: это позволяет ранжировать объекты по степени привлекательности и исключить из программы те участки, объем ресурсоносности которых не сопоставим с текущими затратами на их извлечение. Данная процедура существенно снижает результирующую погрешность метода.

Выводы: Как отмечалось ранее, ни один из существующий экспресс-методов аналитической оценки не способен с абсолютной точностью локализовать остаточные запасы нефти, в связи с чем необходим комплексный подход с использованием не менее двух независимых методик. Вероятность успешности ГТМ существенно возрастает в зонах перекрытия (коинциденции), выделенных несколькими методами одновременно. Комплексирование аналитических подходов позволяет нивелировать погрешности отдельных алгоритмов и с высокой надежностью установить наиболее перспективные участки для вовлечения в разработку слабодренируемых и недренируемых зон залежи.

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Ортикбоева Н.Т.
ассистент кафедры терапии
Университет «Зармед»
Узбекистан, г. Самарканд

МОРФОЛОГИЯ БРОНХИАЛЬНЫХ АРТЕРИЙ В ЛЁГКИХ ЧЕЛОВЕКА В НОРМЕ И ПРИ ПАТОЛОГИИ

Аннотация. Представлены результаты исследования морфологических особенностей бронхиальных артерий в лёгких человека в норме, в возрастном аспекте (32–85 лет, n = 40) и при злокачественных новообразованиях (n = 111). Установлено, что бронхиальные артерии проходят в парабронхиальной соединительной ткани и достигают конечных бронхиол. Характерной особенностью их стенки является наличие внутреннего продольного мышечного слоя («сосуды замыкающего типа»). После 40 лет, а также при развитии патологических процессов (пневмосклероз, эмфизема, злокачественные опухоли) наблюдается компенсаторная перестройка сосудов с резким утолщением продольного мышечного слоя. Специфических патоморфологических изменений бронхиальных артерий при раке и саркоме (за исключением прямого воздействия опухолевых клеток) не выявлено: происходящая перестройка носит универсальный характер и отражает реакцию микроциркуляторного русла на нарушения кровообращения и сопутствующие воспалительно-склеротические процессы.

Ключевые слова: бронхиальные артерии, морфология лёгких, внутренний продольный мышечный слой, артерии замыкающего типа, возрастные изменения, злокачественные новообразования лёгких, микроциркуляторное русло, пневмосклероз.

Ortikboyeva N.T.
assistant
Department of Internal Medicine
Zarmed University
Uzbekistan, Samarkand

MORPHOLOGY OF BRONCHIAL ARTERIES IN HUMAN LUNGS UNDER NORMAL AND PATHOLOGICAL CONDITIONS

Abstract. The study presents the results of investigating the morphological features of bronchial arteries in human lungs in health, in an age-related aspect (ages 32–85, n = 40), and in malignant neoplasms (n = 111). It was established that the bronchial arteries pass through the parabronchial connective tissue and reach the terminal bronchioles, with a characteristic feature of their wall structure being the presence of an internal longitudinal smooth muscle layer (“closure-type vessels”). After 40 years of age and during the development of pathological processes (pulmonary sclerosis, emphysema, malignant tumors), a compensatory

remodeling of the vessels is observed, accompanied by a sharp thickening of the longitudinal muscle layer. No specific pathomorphological changes in the bronchial arteries were identified in carcinoma and sarcoma (excluding the direct effect of tumor cells): the ongoing remodeling is universal in nature and reflects the response of the microvascular bed to circulatory disorders and accompanying inflammatory-sclerotic processes.

Keywords: bronchial arteries, lung morphology, internal longitudinal muscle layer, closure-type arteries, age-related changes, malignant lung neoplasms, microvascular bed, pulmonary sclerosis.

Введение. Проблема визуализации органов в пульмонологии сопряжена с необходимостью уменьшения повреждающего влияния диагностических воздействий на человека, усугубляемого вредными последствиями испытаний на ядерных полигонах, авариями на АЭС и другими негативными техногенными факторами [1,2]. Наиболее детально изучено микроциркуляторное русло бронхиального дерева. Однако данных в литературе о расположении бронхиальных артерий и, особенно, о строении их стенки в норме, в возрастном аспекте и при патологических состояниях лёгких человека практически нет [3, 4]. Большинство авторов принимают ветви бронхиальных артерий за другие анатомические образования. Так, ряд исследователей, обнаруживая на препаратах ветви бронхиальных артерий с выраженным внутренним продольным мышечным слоем в стенке, описывали эти сосуды как артериовенозные анастомозы между большим и малым кругами кровообращения, именуя их «артериями замыкающего типа» [5]. Поэтому была поставлена задача уточнить расположение бронхиальных артерий по ходу бронхиального дерева, изучить строение их стенки в норме, при старении человека и при патологических состояниях органа.

Цель исследования. Изучить морфологические особенности бронхиальных артерий в лёгких человека в норме и выявить их структурные изменения при различной патологии.

Материалы и методы исследования. С помощью анатомических (полихромная инъекция кровеносного русла парижской синей в хлороформе, берлинской лазурью и тушью в желатине, свинцовыми белилами и киноварью в бензине с последующим приготовлением серийных гистотопографических срезов на роторном микротоме), общегистологических и морфометрических методов было изучено 40 интактных лёгких людей различных возрастных групп (от 32 до 85 лет) и 111 лёгких, поражённых злокачественными новообразованиями различного происхождения, локализации, формы роста и гистологической принадлежности.

Результаты исследования. Ветви бронхиальных артерий проходят автономно в парабронхиальной соединительной ткани; иногда они сопровождаются одной или несколькими одноимёнными венами. Эти сосуды кровоснабжают долевые, сегментарные и субсегментарные бронхи, стенку ветвей лёгочной артерии и притоков лёгочных вен, достигают только

конечных бронхиол и не участвуют в кровоснабжении респираторных бронхиол. Особенностью стенки ветвей бронхиальных артерий является наличие на всём протяжении сосуда внутреннего продольного мышечного слоя различной толщины. Просвет артерий, сопровождающих долевые и сегментарные бронхи, всегда открыт и значительно меньше, чем у ветвей лёгочных артерий тех же порядков, составляя от 10 до 60 % толщины мышечной стенки сосуда. Мелкие ветви бронхиальных артерий, а также сосуды, сопровождающие субсегментарные бронхи, иногда штопорообразно извиты, их просвет часто закрыт. На продольном разрезе такой сосуд напоминает извилистый мышечный тяж, в котором мышечные клетки расположены спиралевидно. Артерии с закрытым просветом встречаются в любом возрасте. При открытом просвете внутренний продольный мышечный слой чаще всего по толщине преобладает над наружным циркулярным мышечным слоем в 1,5–6 раз. Однако встречаются артерии, у которых продольный мышечный слой тоньше наружного циркулярного и состоит из 1–2 рядов мышечных клеток. Такие бронхиальные сосуды в молодом возрасте встречаются в 5,3 раза чаще, чем после 40 лет. После 40 лет в стенке ветвей бронхиальных артерий отмечается утолщение внутреннего продольного мышечного слоя. Причём чем старше возрастная группа, тем заметнее такая перестройка стенки. Изменения тканей и кровеносных сосудов, наступающие по мере старения человека, обусловлены влиянием экзогенных факторов, а также острыми и хроническими воспалительными процессами в органе, ведущими к развитию пневмосклероза, эмфиземы, макро- и микроателектазов, что приводит к повышению давления в малом круге кровообращения. Нами также отмечено, что возрастные изменения морфологии тканевых элементов и кровеносных сосудов лёгкого (в частности, бронхиальных) являются, по-видимому, результатом не только прожитых лет, поскольку между этими изменениями и календарным возрастом не всегда имеется прямая зависимость. На препаратах иногда хорошо видно, как в лёгких человека 50–55-летнего возраста степень выраженности изменений может быть идентична таковой у 70–75-летних и, наоборот, у лиц более старшего возраста эти изменения выражены не так ярко. При поражении лёгких злокачественными новообразованиями морфология бронхиальных артерий была изучена в очаге опухоли, перифокальной зоне, а также во всех остальных участках органа. В опухолях центральной локализации размером 1–2 см в диаметре при всех формах роста в центре ракового узла среди предсуществующих сосудов в подавляющем большинстве случаев выявляются ветви бронхиальных артерий, изменённые по «замыкающему типу», с сохранившейся в той или иной степени структурой стенки. При узловатой форме роста опухоли, когда узел имеет чёткие границы, в нём выявляются исключительно ветви бронхиальных артерий, которые определяются по наличию красителя в просвете и по структуре стенки, изменённой по «замыкающему типу». При инфильтративной форме роста рака центрального расположения в центре узла в основном находятся ветви

бронхиальных артерий, а по мере удаления от него обнаруживается всё большее количество ветвей лёгочных артерий и вен. В перифокальной зоне узла опухоли всегда наблюдаются ателектаз и эмфизема, пневмосклероз и кровоизлияния, а также воспалительные процессы. Те же процессы различной степени выраженности отмечаются в участках, отдалённых от узла новообразования, а зачастую и во всём лёгком. Вокруг кровеносных сосудов обоих кругов кровообращения значительно утолщается прослойка соединительной ткани. Происходит резкое утолщение внутреннего продольного мышечного слоя в стенке ветвей бронхиальных артерий, который становится в несколько раз толще наружного циркулярного. В штопорообразно извитых ветвях бронхиальных артерий клетки спирали продольного мышечного слоя часто располагаются под разным углом к оси сосуда, что хорошо видно на продольных, косых и поперечных срезах. Просвет артерий открыт, однако иногда он исключительно мал по отношению к общей толщине стенки и может составлять 3–5 % от последней. Часто просвет артерий смещён к периферии сосуда. Степень выраженности тканевых и сосудистых изменений в перифокальной зоне и во всём органе зависит от возраста больного, предсуществующих изменений в лёгком, давности возникновения опухоли, локализации очага и гистологической принадлежности. Возникновение опухолевого очага в лёгком усиливает развитие воспалительных процессов, пневмосклероза и эмфиземы в органе, что в ещё большей степени обусловливает утолщение продольного мышечного слоя в стенке бронхиальных артерий.

Выводы. В кровеносной системе лёгкого (в частности, в бронхиальных артериях) при поражении его злокачественными новообразованиями специфических изменений не наблюдается (исключая непосредственное воздействие клеток опухоли на сосуд). Комплекс изменений кровеносного русла может возникнуть при любой патологии, влияющей на кровообращение в малом круге и вызывающей пневмосклероз, ателектазы, эмфизему и т. д.

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Путренко Е.В.
доцент кафедры конституционного и административного права
Севастопольский государственный университет

МЕСТНОЕ САМОУПРАВЛЕНИЕ И НАРОД КАК СУБЪЕКТЫ ПРАВОТВОРЧЕСТВА

Аннотация. в статье рассматриваются народ и органы местного самоуправления как субъекты правотворчества. Указывается, что участие данных субъектов обеспечивает не только реализацию принципа народовластия, но и повышает легитимность правовых норм.

Ключевые слова: народ; органы местного самоуправления; правотворчество; муниципальное правотворчество; публичная власть.

Putrenko E.V.
associate professor
Department of Constitutional and Administrative Law
Sevastopol State University

LOCAL SELF-GOVERNMENT AND THE PEOPLE AS SUBJECTS OF LAWMAKING

Abstract. the article examines the people and local self-government bodies as subjects of law-making. It is stated that the participation of these subjects not only ensures the implementation of the principle of popular sovereignty but also enhances the legitimacy of legal norms.

Keywords: people; local self-government bodies; law-making; municipal law-making; public authority.

В рамках современной модели правового государства значительное внимание уделяется децентрализации власти и расширению участия населения в осуществлении публичных функций, в том числе правотворческой.

В этом контексте важнейшими субъектами правотворчества в конституционно-правовой сфере, наряду с государственными органами, выступают народ как носитель суверенитета и институты местного самоуправления как форма непосредственного управления населением на местах.

Н.П. Алешкова предлагает муниципальное правотворчество рассматривать в качестве «деятельности населения муниципального образования, органов местного самоуправления и их должностных лиц (в том числе в прямо предусмотренных законодательством случаях) по принятию (изданию) муниципальных правовых актов и (или) заключению договоров

(соглашений), содержащих правовые предписания, а также по совершению юридически значимых действий в отношении действующих муниципальных правовых актов и договоров (соглашений)»[1, с.19].

В.В. Швыдкова при рассмотрении муниципального правотворчества указывает, что оно является одним из видов правотворчества в России и имеет следующие преимущества:

- во-первых, тесная связь населения муниципального образования с соответствующими органами публичной власти;

- во-вторых, ориентированность органов местного самоуправления на контакт с населением конкретных муниципальных образований по вопросам совершенствования муниципального законодательства[2, с.109].

Местное самоуправление как институт публичной власти, не входящий в систему органов государственной власти, также наделено правотворческими полномочиями.

Органы местного самоуправления вправе принимать муниципальные нормативные правовые акты, регулирующие вопросы местного значения. Эти акты подлежат обязательному исполнению на соответствующей территории и имеют юридическую силу в пределах муниципального образования.

Правовое регулирование организации муниципального управления в Российской Федерации представляет собой сложную и многокомпонентную систему, основанную на положениях различных нормативных правовых актов, центральное место среди которых отводится Конституции РФ. В нормах Конституции (статья 12) признается и гарантируется самостоятельность местного самоуправления. Кроме того, законодатель уточняет, что органы местного самоуправления в систему органов государственной власти не входят.

Местное самоуправление на самом высшем – конституционном уровне – признается в качестве формы осуществления народовластия, не входящую в систему органов государственной власти. Данное положение закладывает фундаментальную основу для институциональной и функциональной автономии муниципальных образований в России.

Конституция РФ определяет общие принципы организации местного самоуправления в России, устанавливает вопросы формирования органов муниципального самоуправления определяет вопросы самостоятельного решения населением вопросов местного значения, устанавливает нормы о владении, пользовании и распоряжении муниципальной собственностью (статья 130). обеспечивает самостоятельное решение населением вопросов местного значения, владение, пользование и распоряжение муниципальной собственностью.

Федеральный закон от 6 октября 2003 г. № 131-ФЗ «Об общих принципах организации местного самоуправления в Российской Федерации»[3] закрепляет, что представительные органы муниципалитетов обладают правом законодательной инициативы в пределах своей компетенции. Кроме того, граждане муниципального образования могут

участвовать в правотворчестве посредством собраний, конференций, общественных слушаний, опросов, инициативных предложений, а также в порядке местной правотворческой инициативы.

Также необходимо указать на некоторые изменения, внесенные конституционными поправками в статьи 131 Конституции РФ в 2020 году[4].

«Органы государственной власти могут участвовать в формировании органов местного самоуправления, назначении на должность и освобождении от должности должностных лиц местного самоуправления в порядке и случаях, установленных федеральным законом. Изменение границ территорий, в пределах которых осуществляется местное самоуправление, допускается с учетом мнения населения соответствующих территорий в порядке, установленном федеральным законом. Особенности осуществления публичной власти на территориях городов федерального значения, административных центров (столиц) субъектов Российской Федерации и на других территориях могут устанавливаться федеральным законом»[5].

Тем самым, конституционные положения задают своеобразный вектор развития всего дальнейшего законодательства в данной сфере, в том числе, Федерального закона от 06.10.2003 № 131-ФЗ «Об общих принципах организации местного самоуправления в Российской Федерации» и иных нормативных правовых актов. С учетом этого можно сделать вывод о том, что Конституция РФ не только формирует правовую основу для муниципального управления в России, но также играет ключевую роль в обеспечении его устойчивости, легитимности и соответствия демократическим принципам.

Федеральный закон «Об общих принципах организации местного самоуправления в Российской Федерации» определяет принципы, формы, структуру организации муниципальной власти в России, а также полномочия органов местного самоуправления, механизмы их взаимодействия с органами государственной власти в стране. Вместе с тем отметим, что данный Закон утрачивает свою силу с 1 января 2027 года в связи с принятием нового Федерального закона от 20 марта 2025 года № 33-ФЗ «Об общих принципах организации местного самоуправления в единой системе публичной власти»[6]. Данный закон был принят в целях реализации конституционной реформы 2020 года и концепции единой системы публичной власти в стране, закрепленной в Конституции РФ после внесенных поправок.

Новый закон устраняет прежнюю концепцию «отдельности» местного самоуправления от государственной власти. С учетом нововведений местное самоуправление рассматривается в качестве общей системы публичной власти в стране, что, по сути, позволяет выстроить более управляемую вертикаль власти. Законодатель уточняет само понятие «местное самоуправление» и его виды. Вводятся новые формы координации, согласования решений, а также механизмы контроля за деятельностью органов местного самоуправления со стороны региональной власти.

Принятый закон предусматривает одноуровневую систему организации местного самоуправления с возможностью сохранения двухуровневой системы.

Ключевой остается нормотворческая функция муниципального управления, в рамках осуществления которой представительные органы муниципалитета разрабатывают и принимаю уставы муниципальных образований, нормативные правовые акты, регулирующие вопросы местного значения, а также акты, касающиеся регулирования муниципальной службы, муниципального бюджета, местных налогов и сборов. Муниципальные правовые акты регламентируют муниципальные общественные отношения с учетом интересов населения, исторических и иных местных традиций и подлежат обязательному исполнению на всей территории муниципального образования[7, с.27].

Отметим, что принятие Федерального закона от 20 марта 2025 года № 33-ФЗ существенно трансформирует правотворческую деятельность органов местного самоуправления, направляя её в сторону большей централизации и унификации. Закон закрепляет одноуровневую модель местного самоуправления, устанавливая три вида муниципальных образований: городской округ, муниципальный округ и внутригородское муниципальное образование города федерального значения. Субъекты Российской Федерации могут сохранить двухуровневую систему (поселения и муниципальные районы) только в случае наличия специфических социально-экономических или историко-культурных особенностей. Такое изменение ведет к укрупнению муниципальных образований и уменьшению числа представительных органов, что сокращает количество субъектов, обладающих правом принятия муниципальных правовых актов.

Вместо прежнего понятия «вопросы местного значения» введено новое — «вопросы непосредственного обеспечения жизнедеятельности населения». Полномочия органов местного самоуправления теперь делятся на три группы:

- непосредственно муниципальные (не подлежат перераспределению);
- передаваемые органам государственной власти субъектов РФ;
- передаваемые органам местного самоуправления законами субъектов РФ.

Сказанное означает, что правотворчество органов местного самоуправления ограничивается рамками установленного перечня полномочий, а любые изменения возможны только через поправки в федеральный закон.

Таким образом, Федеральный закон №33-ФЗ существенно изменяет правовую архитектуру местного самоуправления в России, направляя её в сторону большей централизации и унификации, что оказывает значительное влияние на правотворческую деятельность органов местного самоуправления.

Народ как субъект правотворчества занимает центральное место в соответствии с положениями статьи 3 Конституции Российской Федерации, где провозглашено, что носителем суверенитета и единственным источником

власти в Российской Федерации является её многонациональный народ. Народ осуществляет свою власть как непосредственно – через референдум и иные формы прямой демократии, так и опосредованно – через органы государственной власти и местного самоуправления. Наиболее яркой формой непосредственного правотворчества народа выступает всероссийский референдум, в ходе которого принимаются нормативные решения высшего уровня, в том числе об утверждении и изменении Конституции РФ (ст. 135, 136 Конституции). Также возможны референдумы субъектов РФ и муниципальные референдумы, что подтверждает многоуровневую природу народного правотворчества.

Конституционный Суд РФ в Постановлении 10.10.2013 № 20-П указал, что непосредственное волеизъявление народа обладает высшей юридической силой по сравнению с иными актами, поскольку выражает суверенную волю граждан[8].

Таким образом, народ и органы местного самоуправления выступают самостоятельными и значимыми субъектами правотворчества. Их участие обеспечивает не только реализацию принципа народовластия, но и повышает легитимность правовых норм, учитывая местные условия, интересы населения и специфику регионального и муниципального управления.

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Рагимова А.А., бакалавр по направлению «Менеджмент»
Дагестанский государственный университет
Россия, г. Махачкала

ДОЛГОВЕЧНОСТЬ КАК ФАКТОР УСТОЙЧИВОГО ПОТРЕБЛЕНИЯ В ИНДУСТРИИ ТОВАРОВ КЛАССА ЛЮКС: АНАЛИЗ ПРАКТИК БРЕНДОВ

Аннотация. В условиях развития устойчивых моделей потребления особое значение приобретает продление фактического срока использования уже произведенных товаров. Цель статьи состоит в определении роли долговечности в устойчивом потреблении товаров класса люкс и выявлении практик, посредством которых люксовые бренды поддерживают длительное использование продукции. Методологическую основу составили анализ российских и зарубежных исследований и сравнительный контент-анализ открытых материалов пяти брендов – Hermès, Louis Vuitton, Gucci, Chanel и Prada – по критериям физической, сервисной и эстетико-эмоциональной долговечности. Установлено, что длительный срок использования люксового товара зависит не только от качества и ремонтопригодности, но и от доступности сервисов ухода и ремонта, а также от способности дизайна сохранять актуальность для владельца. Сделан вывод, что долговечность может выступать фактором устойчивого потребления только тогда, когда потенциально длительный срок службы товара сопровождается его длительным фактическим использованием.

Ключевые слова: устойчивое развитие, устойчивое потребление, товары класса люкс, долговечность, жизненный цикл товара, циркулярная экономика, ремонт.

Ragimova A.A., bachelor's degree in Management
Dagestan State University
Russia, Makhachkala

DURABILITY AS A FACTOR OF SUSTAINABLE CONSUMPTION IN THE LUXURY GOODS INDUSTRY: AN ANALYSIS OF BRAND PRACTICES

Abstract. The transition toward more sustainable consumption models increases the importance of extending the actual use phase of already manufactured goods. The purpose of this article is to determine the role of durability in sustainable luxury consumption and to identify the practices through which luxury brands support prolonged product use. The study combines a review of Russian and

international research with a comparative content analysis of publicly available materials from five brands – Hermès, Louis Vuitton, Gucci, Chanel and Prada – using physical, service-related and aesthetic-emotional durability as analytical dimensions. The findings show that long-term product use depends not only on quality and repairability, but also on the availability of care and repair services and on design characteristics that help products remain relevant to owners over time. The article concludes that durability contributes to sustainable consumption when a product's potentially long service life is accompanied by a long period of actual use.

Keywords: sustainable development, sustainable consumption, luxury goods, durability, product life cycle, circular economy, repair.

ВВЕДЕНИЕ

Вопрос устойчивости потребления в последние годы все чаще рассматривается не только через происхождение сырья или экологические характеристики производства, но и через продолжительность использования готового товара. Чем дольше изделие сохраняет функциональность и остается востребованным владельцем, тем ниже потребность в его быстрой замене новым продуктом. Для индустрии моды вопрос долговечности особенно важен: устойчивость здесь связана и с тем, сколько изделие может прослужить физически, и с тем, как долго потребитель продолжает им пользоваться. В русскоязычной исследовательской традиции долговечность рассматривается как одна из базовых практик устойчивой моды, связанная не только с прочностью материалов, но и с повседневным поведением владельца, уходом за вещью и отказом от ускоренного морального устаревания [1].

Отдельный интерес представляет сегмент товаров класса люкс. С одной стороны, роскошь исторически связана с высокой ценой, символическим потреблением, эксклюзивностью и демонстрацией статуса. С другой стороны, к традиционным характеристикам люксового продукта относятся высокое качество исполнения, сложные ремесленные технологии, сервисное сопровождение и длительный срок службы. Российские исследования также фиксируют изменение восприятия роскоши в условиях распространения осознанного потребления: качество, длительность эксплуатации и возможность вторичного обращения все чаще рассматриваются как свойства, которые потенциально сближают отдельные формы люксового потребления с устойчивой моделью [2].

Для российского контекста важен и потребительский аспект. В исследовании поведения российских потребителей товаров класса люкс, опубликованном в 2026 г., высокое качество оказалось одним из центральных атрибутов роскоши, а значимость гарантийного и постпродажного обслуживания была отмечена подавляющим большинством респондентов [3]. Это позволяет рассматривать долговечность не как исключительно экологический параметр, а как характеристику, находящуюся на пересечении устойчивого развития, маркетинга и потребительской ценности.

Одновременно в литературе по роскошной моде подчеркивается, что экологическая и этическая трансформация сегмента остается неоднозначной: сама принадлежность товара к люксу не делает его автоматически устойчивым, поскольку производство может быть ресурсоемким, а экологические преимущества одной практики не компенсируют весь жизненный цикл продукта [4].

В рамках циркулярной экономики продление срока службы относится к стратегиям сохранения ценности уже произведенного товара. Для текстильной продукции это предполагает проектирование с учетом длительной эксплуатации, возможность ремонта, повторного использования и более позднего перехода к переработке [5]. В сегменте товаров класса люкс продление срока службы имеет дополнительное экономическое основание: высокая стоимость и потенциальная ремонтопригодность создают стимулы к уходу, восстановлению и сохранению изделия.

Зарубежные исследования показывают, что между люксом и устойчивым потреблением действительно существует связь через долговечность, однако она не является автоматической. Д. Сан, С. Беллецца и Н. Пахария установили, что потребители склонны недооценивать долговечность при выборе между несколькими товарами среднего ценового сегмента и меньшим числом более дорогих изделий, хотя именно длительный срок службы способен снижать частоту замены [6]. Тем самым возникает парадокс: характеристика, которая может обеспечивать экологический эффект, не всегда становится значимой в момент покупки.

Срок службы товара нельзя свести только к физической прочности. Х. Ванакер, А. Лемье и С. Бонье предлагают рассматривать долговечность люксовой моды многомерно и учитывать как внутренние свойства изделия, так и внешние факторы, влияющие на продолжительность его жизненного цикла [7]. Более свежие исследования подтверждают потребительскую сторону этой проблемы. Исследование К. Грауэль, К. Бурманна и М. Шаде показывает, что устойчивость сама по себе не является главным мотивом покупки для опрошенных люксовых потребителей, однако качество и длительность службы воспринимаются ими как свойства, органично связанные с дорогими изделиями [8].

Особое место в продлении жизненного цикла занимает ремонт. Исследование М. Мрада и соавторов рассматривает ремонт люксовых товаров как стратегию «замедления цикла» (slowing the loop): вместо немедленной замены изделия потребитель сохраняет его ценность посредством восстановления [9]. Одновременно исследования эстетики люксовых продуктов показывают, что физическая сохранность недостаточна. В серии из пяти экспериментов А. Д’Аньелло и соавторы показали, что восприятие дизайна как вневременного способно увеличивать как предполагаемую, так и фактическую продолжительность использования люксового товара [10]. Поэтому в рамках данной работы долговечность рассматривается как сочетание физической, сервисной и эстетико-эмоциональной составляющих.

Актуальность исследования определяется необходимостью уточнить, при каких условиях долговечность люксового товара действительно может превращаться в фактор устойчивого потребления. Цель статьи – определить роль долговечности в устойчивом потреблении товаров класса люкс и выявить практики, посредством которых бренды поддерживают длительное фактическое использование продукции. Исследовательская гипотеза состоит в том, что устойчивый потенциал люксового товара реализуется не только за счет исходного качества изделия, но и через комплекс послепродажных сервисов и механизмов сохранения его функциональной и символической ценности во времени.

МЕТОДЫ ИССЛЕДОВАНИЯ

Исследование выполнено в два этапа. На первом этапе проведен анализ российских и зарубежных публикаций, посвященных устойчивому потреблению, долговечности продукции, циркулярной экономике и устойчивому развитию люксового сегмента. В литературный массив включены работы, позволяющие раскрыть три аспекта: физическую долговечность товара, фактическую продолжительность его использования потребителем и роль сервисных практик в продлении жизненного цикла.

На втором этапе проведен сравнительный контент-анализ открытых материалов пяти международных брендов класса люкс: Hermès, Louis Vuitton, Gucci, Chanel и Prada. Выборка сформирована целевым способом. Критериями отбора стали принадлежность к люксовому сегменту, наличие публичной информации об уходе или ремонте продукции и доступность актуальных материалов на официальном сайте по состоянию на 4 октября 2026 г. Официальные сайты компаний использовались как источник сведений о действующих сервисах ухода и ремонта, гарантийных программах и других практиках, направленных на продление срока службы изделий.

Единицей анализа выступала конкретная практика, направленная на сохранение товара в использовании. Для сопоставления брендов были выделены четыре аналитических направления, представленные в таблице 1.

Таблица 1. Критерии сравнительного контент-анализа практик долговечности

Направление	Содержание критерия	Индикаторы в публичных материалах
Физическая долговечность	Способность изделия сохранять функциональные характеристики	Указания на качество, тестирование, прочность, ремонтопригодность
Сервисная долговечность	Поддержание срока службы после покупки	Уход, ремонт, реставрация, замена элементов, специализированные мастерские
Закрепление сервиса	Закрепление продления срока службы в устойчивой бизнес-практике	Гарантийные программы, долгосрочные или пожизненные сервисы, масштаб инфраструктуры
Эстетико-эмоциональная долговечность	Сохранение желания пользоваться вещью в течение длительного времени	Вневременность дизайна, межпоколенческая передача, эмоциональная привязанность, сохранение аутентичности

Контент-анализ носит качественный характер и не используется для построения рейтинга экологичности брендов. Наличие ремонта или гарантийного сервиса само по себе не позволяет оценить совокупное воздействие компании на окружающую среду. Задача исследования ограничена более узким вопросом: какими инструментами выбранные бренды поддерживают длительное использование уже произведенного товара.

На основе научной литературы и результатов контент-анализа далее сопоставляются две категории: потенциальный срок службы изделия и реализованный срок использования. Это различие принципиально важно, поскольку долговечный по конструкции товар не создает эффекта устойчивого потребления, если быстро выходит из активного использования по причинам модного устаревания, неудобства ремонта или снижения эмоциональной ценности.

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ

Анализ официальных материалов показал, что все пять рассмотренных брендов предлагают практики, способные продлевать срок использования изделий, однако их набор и масштаб различаются. В одних случаях акцент делается на развитой инфраструктуре ремонта и сохранении товара между поколениями, в других – на формализованной гарантии или специальном пожизненном сервисе. Отдельные бренды непосредственно связывают долговечность с циркулярной экономикой и устойчивым развитием.

Hermès наиболее последовательно объединяет физическую, сервисную и эстетико-эмоциональную долговечность. На официальной странице устойчивого развития компания описывает свои изделия как объекты, которые ремонтируются и передаются из поколения в поколение. Владельцам доступен уход и ремонт для разных категорий продукции по всему миру. В 2024 г., по данным компании, было отремонтировано и обслужено более 200 тыс. изделий [12]. Такая сервисная модель поддерживает длительное использование изделий и их передачу между поколениями.

Louis Vuitton также рассматривает ремонт как механизм обеспечения долговечности. Компания указывает, что история ее ремонтного сервиса насчитывает более 160 лет, а ежегодно восстанавливается свыше 600 тыс. изделий. В 12 специализированных ремонтных ателье 98% ремонтов выполняются локально, что, по данным бренда, дополнительно сокращает транспортные перемещения [13]. Важно, что ремонт рассматривается не только как послепродажная услуга: компания заявляет об анализе экологического воздействия на этапе создания изделия и об оптимизации ремонтопригодности и продолжительности его жизненного цикла.

Gucci в материалах о циркулярной экономике рассматривает как физическую, так и эмоциональную долговечность. Компания сообщает о тестировании изделий на устойчивость к износу и других характеристик, а также о глобальной сети центров ухода и ремонта. Кроме того, бренд связывает длительное использование с внесезонными и вневременными элементами ассортимента, которые дольше сохраняют привлекательность для владельца [14]. Это показывает связь между качеством вещи и готовностью потребителя продолжать ее носить.

Chanel реализует программу Chanel & moi, которая включает уход, ремонт, восстановление и подгонку изделий. Для сумок и кошельков на цепочке, приобретенных с апреля 2021 г., предусмотрен пятилетний гарантированный ремонтный сервис [15]. Для исследуемой темы важно, что послепродажный сервис закреплен в виде формального пятилетнего обязательства бренда, а не ограничивается разовой возможностью ремонта.

Наиболее свежий пример представлен Prada. С 10 сентября 2026 г. компания ввела дополнительный сервис пожизненного ремонта Lifetime Repair Service для отдельных моделей сумок, которые на момент первоначальной покупки обозначены как участвующие в программе. Сервис предусматривает бесплатный ремонт, включая доставку, при нормальном износе от обычного использования и содержит ограничения, связанные с неправильной эксплуатацией [16]. В этом случае пожизненный ремонт становится конкретным сервисным обязательством, а не только заявленной характеристикой качества товара.

Таблица 2. Практики продления срока использования у выбранных брендов

Бренд	Физическая долговечность	Сервисная модель	Эстетико-эмоциональный аспект
Hermès [12]	Качество материалов и ремесленное исполнение	Уход и ремонт разных категорий изделий; более 200 тыс. изделий обслужено и отремонтировано в 2024 г.	Передача изделий между поколениями; вневременная элегантность
Louis Vuitton [13]	Дизайн с учетом долговечности и ремонтопригодности	Ремонт и полное восстановление; более 600 тыс. изделий в год; 12 ремонтных ателье; 98% ремонтов выполняются локально	Сохранение изделий и их истории для передачи между поколениями
Gucci [14]	Тестирование прочности, износостойкости и сохранения формы	Глобальная сеть центров ухода и ремонта; практики встроены в стратегию циркулярности	Связь с изделием; сезонно независимый и вневременный дизайн
Chanel [15]	Сохранение целостности и аутентичности изделия при восстановлении	Уход, ремонт, восстановление, подгонка; пятилетняя гарантия на ремонт ряда сумок с апреля 2021 г.	Поддержание связи владельца с изделием на протяжении срока службы
Prada [16]	Ремонт изделий при нормальном износе	Сервис пожизненного ремонта (Lifetime Repair Service) для отдельных моделей сумок; дополнительный пожизненный бесплатный ремонт для участвующих в программе изделий с 10.09.2026	В публичных условиях сервиса отдельно не акцентируется

Сопоставление практик позволяет выделить несколько закономерностей. Во-первых, в люксовом сегменте ремонт постепенно выходит за рамки обычного гарантийного обслуживания и становится частью ценностного предложения бренда. Hermès и Louis Vuitton демонстрируют масштабную постоянную инфраструктуру восстановления; Chanel закрепляет сервис через пятилетнюю гарантию; Prada предлагает более сильную форму обязательства – пожизненный сервис для отдельных продуктов. Это свидетельствует о переходе от декларации качества к его поддержанию на стадии эксплуатации.

Во-вторых, сервисная долговечность зависит от изначальной ремонтопригодности изделия. Современный систематический обзор

устойчивого дизайна в люксовой промышленности показывает, что жизненный цикл должен учитываться уже на ранних этапах проектирования, включая долговечность, модульность, эффективность материалов и возможность последующего обслуживания [11]. С этой точки зрения ремонт после продажи не является изолированной услугой: он эффективнее в тех случаях, когда конструкция продукта изначально позволяет заменять изношенные элементы и восстанавливать функциональность.

В-третьих, результаты подтверждают необходимость отделять физическую долговечность от длительности фактического использования. Если потребитель перестает использовать вещь до окончания ее технического срока службы, экологический потенциал качества реализуется лишь частично. Исследование Д'Аньелло и соавторов показывает, что эстетическая вневременность влияет на продолжительность использования даже тогда, когда функциональная долговечность товара остается неизменной [10]. В практиках Gucci это различие отражается особенно явно: бренд одновременно заявляет о физических тестах продукции и об эмоциональной долговечности, связанной с сохранением привлекательности изделия [14].

В-четвертых, анализ показывает, что долговечность в люксе имеет экономическое измерение. Высокая первоначальная стоимость создает для владельца стимул сохранять и ремонтировать вещь, а развитый послепродажный сервис снижает риск преждевременного выбытия продукта. Исследование ремонта люксовых товаров выявляет как рациональные мотивы, связанные с инвестиционной и материальной ценностью, так и эмоциональные мотивы, включая наследуемую и личную ценность изделия [9]. Для российского потребителя значимость качества и послепродажного обслуживания также подтверждается эмпирическими данными [3].

При этом полученные результаты не дают оснований считать люксовое потребление устойчивым по определению. Во-первых, высокая долговечность не исключает значительного экологического воздействия на стадиях получения сырья и производства. Во-вторых, покупка большого числа долговечных вещей способна сохранять высокую интенсивность потребления. В-третьих, доступность ремонта не гарантирует, что потребитель им воспользуется: среди барьеров ремонта в научной литературе отмечаются длительные сроки, неудобство и недостаточная информированность [9]. Следовательно, сама возможность продлить жизнь товара является необходимым, но недостаточным условием.

На этой основе предлагается различать три уровня реализации долговечности. Первый – потенциальная долговечность, то есть техническая способность изделия служить длительно. Второй – поддерживаемая долговечность, возникающая при наличии доступного ухода, ремонта, реставрации и гарантийных механизмов. Третий – реализованная долговечность, то есть фактическое длительное использование вещи конкретным владельцем или последующими владельцами. Именно третий уровень наиболее тесно связан с устойчивым потреблением, поскольку

предполагает реальное замещение части новых покупок продолжением использования уже произведенного товара.

Выделение этих трех уровней позволяет уточнить роль бренда. Компания способна воздействовать на первый уровень через материалы и проектирование, на второй – через сервисную инфраструктуру, а на третий – косвенно, формируя вневременный дизайн, эмоциональную ценность, информируя об уходе и снижая барьеры ремонта. В этом смысле долговечность становится не отдельным свойством продукта, а результатом взаимодействия дизайна, сервиса и потребительского поведения.

ЗАКЛЮЧЕНИЕ

Проведенное исследование подтверждает, что долговечность может рассматриваться как значимый фактор устойчивого потребления в индустрии товаров класса люкс, однако ее влияние определяется не только физическим качеством изделия. Устойчивый эффект возникает тогда, когда потенциально длительный срок службы превращается в длительный фактический период использования.

Сравнительный контент-анализ практик Hermès, Louis Vuitton, Gucci, Chanel и Prada показал три основных механизма реализации долговечности: обеспечение исходного качества и ремонтопригодности, развитие послепродажного ухода и ремонта, а также поддержание эстетической и эмоциональной актуальности изделия. В наиболее развитых случаях эти практики закрепляются через специализированные ателье, гарантийные программы, масштабные ремонтные сети и пожизненные сервисы.

Научная значимость полученных результатов состоит в уточнении самого понятия долговечности применительно к устойчивому потреблению. Предложено различать потенциальную, поддерживаемую и реализованную долговечность. Такой подход позволяет избежать упрощенного вывода о том, что высокая цена или качество автоматически делают люксовый товар устойчивым. Для экологического эффекта необходимо, чтобы физическая долговечность сочеталась с ремонтопригодностью, сервисной доступностью и готовностью потребителя сохранять товар в использовании.

Практическое значение результатов заключается в возможности использовать долговечность как направление развития продукта и послепродажного сервиса, а не только как маркетинговое обещание качества. Для компаний перспективными представляются проектирование с учетом ремонта, расширение доступности сервисов восстановления, прозрачная информация об уходе и формирование дизайна, сохраняющего актуальность вне краткосрочных модных циклов.

Ограничением исследования является небольшой целевой набор международных брендов и использование публичных корпоративных материалов, которые отражают заявленные практики, но не позволяют оценить их полный экологический эффект. В дальнейшем результаты могут быть дополнены анализом фактической востребованности ремонтных

сервисов, опросом потребителей и сравнением люксового и массового сегментов по реальной продолжительности использования товаров.

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Рафикова Н.А.
доцент кафедры экологии
и безопасности жизнедеятельности
Самаркандский государственный университет
имени Шарафа Рашидова
Узбекистан, г. Самарканд

ИСПОЛЬЗОВАНИЕ ГОРНЫХ, ПРЕДГОРНЫХ И РАВНИННЫХ ГЕОСИСТЕМ В РЕКРЕАЦИОННЫХ ЦЕЛЯХ

Аннотация. В статье рассматриваются рекреационные возможности горных, предгорных и равнинных геосистем, а также природные условия их использования в целях отдыха, оздоровления и туризма. Особое внимание уделено рекреационному потенциалу горных и предгорных территорий бассейнов рек Чирчик и Ахангаран. Проанализировано влияние высотной поясности на изменение климатических, гидрологических, почвенно-растительных и ландшафтных характеристик территории и их значение для организации рекреационной деятельности. Выявлены наиболее благоприятные высотные уровни для отдыха и оздоровления населения. Показано, что низкогорные и среднегорные территории отличаются благоприятными климатическими условиями, ландшафтным разнообразием, развитой гидрографической сетью, чистотой атмосферного воздуха и высокой эстетической привлекательностью.

Ключевые слова: рекреация, рекреант, рекреалогия, природопользование, рекреационная нагрузка, геоэкологическая оценка.

Rafikova N.A.
associate professor
Department of Ecology and Life Safety
Sharaf Rashidov Samarkand State University
Uzbekistan, Samarkand

USE OF MOUNTAIN, FOOTHILL, AND PLAIN GEOSYSTEMS FOR RECREATIONAL PURPOSES

Abstract. This article examines the recreational potential of mountain, foothill, and lowland geosystems, as well as the natural conditions for their use for recreation, health improvement, and tourism. Particular attention is given to the recreational potential of the mountainous and foothill territories of the Chirchiq and Akhangaran river basins. The influence of altitudinal zonation on the climatic, hydrological, soil-vegetation, and landscape characteristics of the area and their significance for the organization of recreational activities are analyzed. The most favorable altitude zones for public recreation and health improvement have been identified. It is shown that low-mountain and mid-mountain areas are distinguished

by favorable climatic conditions, landscape diversity, a developed hydrographic network, clean air, and high aesthetic appeal.

Keywords: recreation, recreant, recreology, nature management, recreational load, geo-ecological assessment.

Введение. Природные условия и ресурсы Узбекистана чрезвычайно разнообразные, местами неповторимые и специфичные. Сочетания равнинных геосистем с горными, наличием в горной зоне межгорных и предгорных котловин – долин, в пределах равнинной части бессточных впадин, остаточных плато, возвышенностей и гор серьезно усугубляют хозяйственное использование ресурсов. Это, прежде всего, обусловлено с мозаичностью экологической устойчивости геосистем. В связи с этим имеет определенное практическое значение осуществление оценки, прогноза и управление устойчивости доминирующих геосистем страны. Установлено [1], что различная степень экологической устойчивости геосистем требует применения соответствующих, т.е. строго дифференцированных принципов методов и хозяйствования, иными словами, требует строгого учета местных, региональных условий при природопользовании.

Обсуждение. Организация и эффективное осуществление рекреационной деятельности требуют всестороннего и глубокого изучения территории. В результате проведённых исследований определяется степень благоприятности той или иной территории для отдыха и оздоровления населения. Однако полноценный отдых или лечение не могут ограничиваться исключительно использованием природных комплексов; необходим также комплекс инфраструктуры, обеспечивающий соответствующее обслуживание рекреантов. При наличии качественных автомобильных и пешеходных дорог, электроснабжения, зданий, спроектированных и оборудованных с учётом требований к отдыху, возможностей для занятий спортом, благоприятных условий для питания и культурного досуга, удобных водоёмов для купания и других рекреационных возможностей создаются необходимые условия для полноценного отдыха и восстановления здоровья.

Создание рекреационной инфраструктуры представляет собой сложную многоаспектную задачу, поскольку требует определённых объёмов инвестиций и выполнения комплекса проектно-технических работ. В бассейнах рек Чирчик и Ахангаран количество стационарных лечебно-оздоровительных учреждений остаётся весьма ограниченным, а количество здравниц, соответствующих современным требованиям, также невелико. Вместе с тем Ташкентская область обладает значительным рекреационным потенциалом. С учётом перспектив его эффективного использования и дальнейшего развития рекреационной деятельности в настоящем исследовании особое внимание уделено изучению и оценке существующего рекреационного потенциала территории, а также детальному исследованию её природных условий для организации отдыха, лечения и оздоровления населения.

В условиях сухого климата отдых и оздоровление населения, особенно в тёплый период года, отличаются большей эффективностью на территориях, где имеются затенённые и прохладные участки, а также водоёмы. В этом отношении значительными преимуществами обладают предгорные и горные территории рассматриваемого бассейна.

В горных и предгорных районах высотная поясность природных компонентов и обусловленные ею изменения природных геосистем от нижних высотных уровней к верхним оказывают существенное влияние на формирование различных природных условий. Прежде всего, количественные изменения климатических показателей – в частности, снижение средней температуры воздуха примерно на 0,6 °С на каждые 100 м высоты, увеличение количества атмосферных осадков до определённого высотного уровня и другие особенности – оказывают существенное воздействие на почвенно-растительный покров, животный мир и гидрологический режим. Снижение температуры воздуха и увеличение количества осадков, прежде всего, способствуют повышению густоты и видового разнообразия растительности, увеличению водности рек и ручьёв, а также количественному и видовому разнообразию животного мира.

В бассейнах рек Чирчик и Ахангаран данные природные изменения относительно устойчиво проявляются примерно до высот 3200–3600 м. Выше этого уровня наблюдается резкое снижение температуры воздуха, уменьшение количества осадков и постепенное снижение степени природного разнообразия. На данных высотах летние ночи отличаются значительной прохладой, а дневная температура лишь изредка превышает 10–20 °С. Количество солнечных дней уменьшается, число облачных дней возрастает, а атмосферные осадки выпадают чаще.

По мере подъёма вверх по горным склонам увеличивается интенсивность ультрафиолетового излучения, поступающего от Солнца, что связано с меньшей загрязнённостью воздуха различными примесями и снижением плотности атмосферы. В связи с этим необходимо ограничивать длительное воздействие солнечного излучения на открытые участки тела, поскольку в противном случае возможно получение солнечных ожогов. Вопросы, связанные, в частности, с недостатком кислорода, горной болезнью и другими неблагоприятными последствиями пребывания в высокогорье, подробно исследованы Г.А. Давидовой (1986) [1].

Согласно результатам исследований, различные высотные уровни горных долин и склонов обладают неодинаковой эффективностью для отдыха и оздоровления. Низкогорья (800–1200 м) и среднегорья (1200–2800 м) являются достаточно благоприятными для большинства людей, поскольку именно в этих высотных пределах природные ландшафты характеризуются комфортными и субкомфортными условиями для человеческого организма. Климатические условия и особенности рельефа высокогорий для большинства людей являются менее благоприятными. На этих высотах относительно свободно могут чувствовать себя туристы и альпинисты,

прошедшие специальную подготовку. Местное население, особенно жители горных районов, также хорошо переносит особенности и сложности природной среды, поскольку организм человека адаптируется к местным условиям.

Рекреационные ресурсы адырных и низкогорных территорий значительно богаче и разнообразнее по сравнению с равнинными территориями с точки зрения организации отдыха и восстановления здоровья. Климатические различия здесь выражены не столь резко, однако летний период в низкогорьях короче, чем в пустынных районах; в жаркие дни средняя температура воздуха составляет 25–26 °C, при этом отмечаются относительно более высокие показатели атмосферных осадков и относительной влажности воздуха. В таких условиях снижается интенсивность потоотделения организма и уменьшается воздействие жарких сухих ветров. Горнодолинные ветры оказывают положительное воздействие на организм человека: в жаркие летние дни прохладный ветер способствует отводу избыточного тепла от поверхности тела, создавая ощущение комфорта. При этом замещение прогретого воздуха в непосредственной близости от человека более прохладным способствует некоторому улучшению дыхания и усилению испарения, вследствие чего организм начинает ощущать прохладу [2].

Несмотря на относительно небольшую высоту адыр, их рельеф отличается значительной расчленённостью, резкой выраженностью склонов, пересечением территории долинами ручьёв и сильной степенью развития понижений и возвышенностей, что придаёт ландшафту сходство с горными территориями. В целом адырные территории во многих местах характеризуются почти полным отсутствием древесной растительности, однако при постоянном стоке воды в долинах ручьёв природный облик существенно меняется: внимание привлекают древесные насаждения, сады и сельскохозяйственные угодья. В сформировавшихся своеобразных небольших оазисах температура воздуха на 2–3 °C ниже, а относительная влажность на 10–15 % выше, чем на окружающей территории; здесь также ощущается горной бриз. Весной, в период массового цветения эфемеров, адырные ландшафты приобретают особую привлекательность, что делает целесообразным проектирование в таких местах рекреационных объектов.

Низкогорья располагаются выше адырных территорий, при этом расчленённость рельефа становится ещё более выраженной, а ручьи, прорезающие склоны глубокими и крутыми руслами, подчёркивают горный характер ландшафта. В результате наблюдаются резкие пространственные изменения природных условий. Разнообразие форм рельефа прежде всего связано с литологическим составом горных пород и процессами выветривания: чем более различаются породы по степени твёрдости, тем большим разнообразием отличаются формы рельефа. В этом отношении низкогорья бассейнов рек Чирчик и Ахангаран, сложенные мезо-кайнозойскими породами, а в водораздельных частях представленные известняками или песчаниками бухарского яруса, характеризуются наличием

куэстовых форм рельефа, придающих горным ландшафтам своеобразную выразительность.

Растительный покров низкогорий отличается значительным богатством. Весной территория приобретает особенно привлекательный вид: цветение тюльпанов, чучмомы, мальвы и других растений, а также появление лекарственных трав создают живописные ландшафты. В этот период кратковременные прогулки и отдых на природе способствуют эмоциональному восстановлению человека. Летом и осенью на участках, где произрастают деревья и кустарники, особенно в среднем и верхнем течении ручьёв, создаются условия для многодневного отдыха, знакомства с природными ландшафтами и историко-природными достопримечательностями.

Разнообразие и богатство природных ландшафтов, наличие прохладных затенённых долин ручьёв, а также благоприятные климатические условия для отдыха и оздоровления создают значительные возможности для организации курортов и санаториев, пансионатов, туристических баз и детских оздоровительных лагерей.

Среднегорные территории обладают особенно благоприятными рекреационными ресурсами. Прежде всего, гумидный климат, характеризующийся значительным количеством атмосферных осадков, комфортные летние температуры воздуха (в среднем 20–28 °C), относительно высокая влажность, богатство плодовых и неплодовых деревьев, кустарниковой и травянистой растительности, высокая степень расчленённости рельефа, а также густая сеть рек и ручьёв создают весьма благоприятные условия для отдыха и восстановления здоровья. Значительная высота гор позволяет наблюдать горные ландшафты на расстоянии 10–15 км. Пейзаж имеет первостепенное значение для полноценного отдыха туристов и рекреантов. Эстетическая привлекательность горных ландшафтов, тишина, пение птиц и шум горных ручьёв создают благоприятную психоэмоциональную среду для человека.

Горные территории характеризуются чистым воздухом, относительно низкой запылённостью, высокой концентрацией отрицательных ионов, разнообразием ароматов растительности, характерным запахом можжевеловых насаждений и выделением фитонцидов древесной растительностью. Эти природные факторы создают благоприятные условия для отдыха и восстановления организма. Горные вершины, водоразделы и отдельные своеобразные горные массивы стимулируют туристов к подъёму на более высокие уровни. По мере продвижения вверх по горному склону ландшафт постоянно изменяется, что вызывает стремление наблюдать окружающее пространство и подниматься к вершинам для осмотра дальних панорам.

Среднегорные территории привлекают туристов не только благоприятными климатическими условиями и живописными ландшафтами, но и богатством плодово-ягодных ресурсов, разнообразием лекарственных

растений, гостеприимством местного населения, наличием молочных продуктов, катыка, чакки, кумыса, айрана, а также обилием родниковых вод.

В высокогорьях климатические условия существенно изменяются: лето становится коротким, осень наступает рано, весна отличается большей продолжительностью, часто наблюдаются дождливые дни, а температура воздуха летом опускается ниже 20 °С. Разреженность воздуха, повышенная интенсивность ультрафиолетового излучения, а также не всегда благоприятные условия для пешего передвижения создают определённые трудности для туристов. Дороги нередко бывают опасными, характеризуются резкими подъёмами и спусками, значительной крутизной склонов; отдельные участки могут быть нарушены оползнями или селевыми потоками. Поэтому посещение высокогорных районов в большей степени подходит опытным горным туристам и спортсменам, имеющим специальную подготовку. Ледники в верховьях Пскема являются привлекательными объектами для альпинистов.

Рекреационные ресурсы равнинных геосистем менее богаты по сравнению с горными и предгорными территориями. Жаркие летние дни, низкая влажность воздуха, частые сухие и горячие ветры, а иногда и застойные состояния воздуха усложняют организацию и осуществление отдыха и оздоровления. По этой причине равнинные территории во многих научных исследованиях [3, 4] получили более низкую оценку с рекреационной точки зрения. Вместе с тем равнинная зона располагает лечебными подземными водами, различными видами лечебных грязей, а также характеризуется высокой температурой и сухостью воздуха, что может иметь значение при лечении отдельных заболеваний.

Заключение. Установлено, что горные, предгорные и равнинные геосистемы существенно различаются по своим рекреационным характеристикам. Среднегорные и предгорные геосистемы обладают наиболее высоким рекреационным потенциалом благодаря благоприятным климатическим условиям, чистоте атмосферного воздуха, хорошо развитой гидрографической сети, разнообразию ландшафтов и их высокой эстетической привлекательности. В равнинных геосистемах рекреационные возможности в основном связаны с наличием водных объектов, озеленённых территорий и специализированных оздоровительных ресурсов.

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Сайфитдинов Н.Б.
независимый исследователь
Институт переподготовки и повышения квалификации руководителей и специалистов дошкольных образовательных организаций

СОВЕРШЕНСТВОВАНИЕ МЕХАНИЗМА УПРАВЛЕНИЯ КАЧЕСТВОМ ОБРАЗОВАНИЯ В ДОШКОЛЬНОЙ ОБРАЗОВАТЕЛЬНОЙ ОРГАНИЗАЦИИ

Аннотация. В статье рассматриваются теоретико-методологические основы, организационно-педагогические условия и практические направления совершенствования механизмов управления качеством образования в дошкольных образовательных организациях. Особое внимание уделяется взаимосвязи педагогического лидерства руководителя, профессионального развития педагогических работников, создания образовательной среды, ориентированной на ребёнка, взаимодействия с родителями и внутреннего мониторинга качества образования. В рамках исследования предлагается интегративная модель управления, направленная на оценку и непрерывное совершенствование внутреннего качества дошкольной образовательной организации. Модель включает этапы стратегического планирования, наблюдения за педагогическим процессом, анализа данных, коллективного принятия решений и повторной оценки результатов. Предлагаемый подход ориентирован на оценивание качества образования не только посредством контрольных показателей, но и с учётом развития детей, качества педагогического взаимодействия и потенциала образовательной организации к постоянному совершенствованию.

Ключевые слова: дошкольное образование, качество образования, менеджмент качества, педагогическое лидерство, внутренний мониторинг, профессиональное развитие, образовательная среда, взаимодействие с родителями, непрерывное совершенствование.

Sayfitdinov N.B.
independent researcher
Institute for Retraining and Advanced Training of Executives and Specialists of Preschool Educational Organizations

IMPROVING THE MECHANISM FOR MANAGING EDUCATIONAL QUALITY IN A PRESCHOOL EDUCATIONAL ORGANIZATION

Abstract. This article examines the theoretical and methodological foundations, organizational and pedagogical conditions, and practical approaches for enhancing quality management mechanisms in preschool educational

institutions. Particular attention is given to the interplay between the pedagogical leadership of the head of the institution, the professional development of teaching staff, the creation of a child-centered educational environment, engagement with parents, and the internal monitoring of educational quality. The study proposes an integrative management model designed to assess and continuously improve the internal quality of a preschool educational institution. The model encompasses stages such as strategic planning, observation of the pedagogical process, data analysis, collective decision-making, and the subsequent re-evaluation of outcomes. This approach evaluates the quality of education not merely through standardized performance indicators, but also by considering children's development, the quality of pedagogical interactions, and the institution's capacity for continuous improvement.

Keywords: preschool education, quality of education, quality management, pedagogical leadership, internal monitoring, professional development, educational environment, engagement with parents, continuous improvement.

Введение. Дошкольное образование является важной основой для последующих этапов обучения, социальной адаптации и личностного развития человека. Поэтому развитие системы дошкольного образования предполагает не только расширение охвата образовательными услугами, но и постоянное совершенствование содержания образовательного и воспитательного процессов, педагогических отношений, качества управления и образовательной среды, создаваемой для детей.

Важная особенность управления качеством дошкольного образования заключается в том, что его результаты не определяются исключительно материально-техническим обеспечением или правильностью ведения документации. Существенными компонентами качества также являются взаимоотношения между детьми и педагогами, организация игровой деятельности, учёт индивидуальных потребностей, создание безопасной и инклюзивной среды, а также эффективное взаимодействие с родителями.

Современные подходы к реализации стратегий управления в образовательных организациях рассматриваются с учётом принципов всеобщего управления качеством (Total Quality Management — TQM). Основная идея данного подхода заключается в повышении качества организации внутренних процессов и снижении рисков и потерь. Это создаёт возможности для совершенствования процессов развития и обучения детей, формирования стратегии конкурентоспособности образовательной организации, ориентации на потребности рынка образовательных услуг и удовлетворения ожиданий каждой заинтересованной стороны.

В Законе Республики Узбекистан «О дошкольном образовании и воспитании» определена цель дошкольного образования: «Дошкольное образование направлено на формирование здоровой и зрелой личности ребёнка, подготовленной к обучению в школе. Данное образование осуществляется до достижения ребёнком шести-семи лет в семье, детских

садах и других образовательных учреждениях независимо от формы собственности» [1]. Это подчёркивает значение воспитания физически здоровых и духовно зрелых личностей, способных внести вклад в будущее страны.

Анализ литературы. Модель совершенства, разработанная Европейским фондом управления качеством (European Foundation for Quality Management — EFQM), существует с начала 1990-х годов и представляет собой обобщённую модель эффективной системы управления для организаций, ориентированных на устойчивое развитие и повышение конкурентоспособности [2, с. 240]. Модель EFQM основана на принципах всеобщего управления качеством и системном подходе к управлению, учитывающем интересы всех заинтересованных сторон организации. Она применяется для самооценки и совершенствования системы управления, изучения и измерения управленческого потенциала организации, а также оценки эффективности управления в организациях различного масштаба, форм собственности и направлений деятельности, включая некоммерческие организации государственного сектора.

В настоящее время многие некоммерческие организации рассматривают модель совершенства EFQM как практический инструмент формирования эффективной системы управления, основанной на непрерывной самооценке, бенчмаркинге и сравнении с ведущими организациями. Такой подход позволяет выявлять направления, требующие совершенствования, и разрабатывать более эффективные управленческие решения.

В связи с этим предлагается рассмотреть возможность применения модели совершенства EFQM для совершенствования систем управления современными дошкольными образовательными организациями, повышения их конкурентоспособности и более полного удовлетворения потребностей получателей образовательных услуг, работников, партнёров и общества в целом.

Начальным этапом применения модели является разработка фундаментальных показателей, отражающих философию всеобщего управления качеством и определяющих принципы управления деятельностью дошкольной образовательной организации. К ним относятся:

- ориентация на достижение высоких и устойчивых результатов;
- ориентация на потребителей и заинтересованные стороны;
- лидерство и последовательность в достижении целей;
- процессный подход к управлению, основанный на фактах и доказательствах;
- развитие и совершенствование профессиональных возможностей работников, достижение успеха посредством эффективного использования их талантов;
- непрерывное обучение, инновации и совершенствование;
- развитие партнёрства и организационных возможностей;

- корпоративная социальная ответственность [3, 4].

Проблема повышения качества дошкольного образования широко рассматривается в международных и национальных педагогических исследованиях. Например, В. Бектемиров и С. Орипова проанализировали способы повышения эффективности педагогического процесса посредством внедрения инновационных технологий в систему дошкольного образования [5]. В свою очередь, А. Мирзаева и И. Холматова изучили методы индивидуального развития детей и организации обучения, ориентированного на активную деятельность, определив их положительное влияние на качество образования [6].

Методология исследования (Methods). Статья выполнена в формате теоретико-аналитического исследования. Методологическую основу составляют изучение, сравнительный анализ и систематизация международной научной литературы и концептуальных документов профильных организаций, а также разработка на этой основе концептуальной модели управления.

В качестве источников для анализа использованы публикации Организации экономического сотрудничества и развития (ОЭСР), посвящённые качеству дошкольного образования, лидерству и профессиональному развитию; концептуальная основа ЮНИСЕФ в области обеспечения качества систем образования детей раннего возраста; а также принципы непрерывного совершенствования в менеджменте качества.

Цель данного подхода заключается не в утверждении статистически доказанных причинно-следственных связей, а в разработке теоретической модели, которая может быть проверена в ходе последующих эмпирических исследований.

Результаты исследования (Results). На основе синтеза теоретических источников предложена интегративная концептуальная модель управления качеством образования в дошкольной образовательной организации. Данная модель предполагает организацию управления качеством не как отдельного контрольного мероприятия, а как непрерывного управленческого цикла.

Интегративная модель управления. Предлагаемая модель включает пять взаимосвязанных этапов:

1. Стратегическое планирование. Определение целей организации, приоритетных направлений деятельности и показателей качества.
2. Организация педагогического процесса. Обеспечение образования, ориентированного на ребёнка, создание безопасной образовательной среды и применение индивидуального подхода.
3. Внутренний мониторинг и сбор доказательных данных. Получение информации посредством наблюдения, изучения мнений педагогов, отзывов родителей и анализа документации.
4. Коллективный анализ и совершенствование. Выявление причин проблем, определение ответственных лиц и разработка соответствующих корректирующих мероприятий.

5. Повторная оценка. Проверка изменений на основе установленных показателей и запуск следующего цикла совершенствования.

Основная особенность модели заключается в непосредственной взаимосвязи результатов мониторинга с управленческими решениями. Например, если в ходе наблюдения выявлено недостаточное участие детей в свободной игровой деятельности, проблема не должна ограничиваться фиксацией соответствующего недостатка. Необходимо совместно с педагогами проанализировать причины, пересмотреть организацию образовательной среды, оказать методическую поддержку и оценить произошедшие изменения в ходе последующего наблюдения.

Показатели оценки качества образования. Для практического внедрения модели необходимо разработать систему показателей. В таблице представлены первоначальные показатели, предложенные автором.

Направление	Предлагаемые показатели	Источники оценки
Педагогический процесс	Активное участие детей, игровая деятельность и учёт индивидуальных потребностей	Систематическое педагогическое наблюдение
Потенциал педагогов	Повышение квалификации, методическое сотрудничество и рефлексивная практика	Планы профессионального развития, интервью
Руководство	Регулярность педагогических наблюдений, коллективное принятие решений и обратная связь	Управленческая документация, мнения работников
Образовательная среда	Безопасность, достаточность ресурсов, инклюзивность и комфортность для детей	Аудит образовательной среды и наблюдение
Взаимодействие с родителями	Регулярность коммуникации и учёт обратной связи родителей	Анкетирование, анализ встреч
Совершенствование	Выполнение запланированных мероприятий и результаты повторной оценки	План совершенствования и материалы мониторинга

При разработке показателей важно соблюдать три требования. Во-первых, каждый показатель должен иметь чёткое определение. Во-вторых, необходимо заранее установить способ его измерения и источник данных. В-третьих, показатели должны служить повышению качества, а не необоснованному ранжированию детей, педагогов или родителей.

Например, большое количество педагогических наблюдений само по себе не свидетельствует о высоком качестве образования. Более важное значение имеет то, приводят ли результаты наблюдений к оказанию практической помощи педагогам и устранению выявленных проблем.

Функциональная модель руководителя в системе управления качеством. В предлагаемом механизме деятельность руководителя включает четыре взаимосвязанные функции:

- Стратегическая функция: определение целей развития организации и приоритетов в области качества.
- Педагогическая функция: наблюдение за занятиями и игровой деятельностью, оказание методической помощи и организация профессионального развития педагогов.
- Коммуникативная функция: установление эффективного взаимодействия с педагогами, родителями и общественностью.
- Аналитическая функция: интерпретация данных мониторинга, выявление причин проблем и принятие решений на основе полученных результатов.

В отчёте ОЭСР за 2025 год *Results from TALIS Starting Strong 2024* распределённое лидерство, поддержка профессионального обучения и инновационная деятельность рассматриваются как важные направления укрепления руководства в сфере дошкольного образования.

На этом основании руководитель рассматривается не только как лицо, самостоятельно принимающее все решения, но и как лидер, объединяющий профессиональный потенциал коллектива и координирующий процесс повышения качества образования.

Обсуждение (Discussion). Предлагаемая модель предусматривает три важных изменения в управлении качеством образования в дошкольных образовательных организациях.

Во-первых, необходим переход от подхода, ориентированного преимущественно на контроль, к подходу, ориентированному на развитие. В традиционной практике контроля основное внимание может уделяться выявлению недостатков и подготовке отчётности. Развивающий подход, напротив, предполагает установление причин недостатков, оказание соответствующей поддержки и последующую оценку результатов. Такой переход позволяет превратить управление качеством из инструмента выполнения внешних требований в механизм внутреннего развития организации.

Во-вторых, необходимо обеспечить баланс между педагогическим лидерством и административным управлением. Исследования ОЭСР в области руководства дошкольным образованием показывают, что административные и педагогические обязанности не должны рассматриваться изолированно друг от друга. Они должны реализовываться в рамках общей цели — создания качественной образовательной среды для детей (ОЭСР, 2020).

Следовательно, в рабочем графике руководителя необходимо предусмотреть конкретное время для педагогических наблюдений, методических бесед с работниками и коллективного анализа результатов.

В-третьих, оценка качества не должна ограничиваться исключительно количественными показателями, которые легко подсчитать. Например, количество проведённых семинаров не позволяет в полной мере определить степень повышения практических компетенций педагогов. Поэтому количественные данные целесообразно анализировать совместно с качественной информацией, полученной посредством наблюдений, интервью, изучения педагогической документации и анализа мнений родителей.

Адаптация модели к условиям Узбекистана. При применении предложенной модели в Узбекистане необходимо учитывать организационные возможности дошкольных образовательных организаций, обеспеченность педагогическими кадрами, региональные различия, материально-технические ресурсы и возможности участия родителей.

Внедрение модели может осуществляться по следующим этапам:

1. Первичная диагностика: оценка существующей практики управления, состояния педагогического процесса и образовательной среды.
2. Определение приоритетных задач: выбор нескольких конкретных направлений совершенствования на основе выявленных потребностей.
3. Поддержка педагогов: организация методических консультаций, взаимного наблюдения, наставничества и обмена профессиональным опытом.
4. Мониторинг и обратная связь: отслеживание изменений на основе установленных показателей.
5. Повторная оценка: сопоставление результатов с исходным состоянием и определение последующих мероприятий.

Указанные этапы не следует рассматривать как жёсткие универсальные стандарты. Они представляют собой практические рекомендации, которые могут адаптироваться к возможностям и потребностям конкретной организации.

Ожидаемое преимущество модели заключается в объединении управления, педагогической практики и мониторинга качества в единый непрерывный цикл. Такой подход позволяет обосновывать управленческие решения фактическими данными, связывать профессиональное развитие педагогов с целями организации и включать мнения родителей в процесс совершенствования.

Вместе с тем эффективность модели зависит от ряда условий, включая наличие временных ресурсов у руководителей и педагогов, точность инструментов мониторинга, доверительные отношения между сотрудниками, навыки анализа данных и готовность руководства поддерживать изменения.

Кроме того, мониторинг не должен превращаться в чрезмерную отчётность. Необходимо обеспечивать конфиденциальность данных о развитии детей, оценивать деятельность педагогов с учётом конкретных условий и адаптировать показатели к реальным возможностям организации.

Для научной проверки предложенной модели возможно проведение экспериментального исследования в нескольких дошкольных образовательных организациях. В рамках исследования могут использоваться результаты первоначальной и итоговой оценки, интервью с педагогами и руководителями, наблюдения за образовательной средой и анализ мнений родителей.

Если дизайн исследования позволяет, результаты организаций, внедривших модель, можно сопоставить с результатами контрольной группы. Такой подход позволит снизить неопределённость при установлении связи между внедрением модели и наблюдаемыми изменениями. Однако для получения обоснованных выводов необходимо учитывать объём выборки, валидность измерительных инструментов, исходные условия и другие факторы, способные повлиять на результаты.

Заключение (Conclusion). Проведённый теоретический анализ показывает, что управление качеством образования в дошкольной образовательной организации не должно ограничиваться административным контролем, ведением документации или оценкой материально-технических условий. Для устойчивого повышения качества образования необходимо комплексное управление педагогическим процессом, руководством, профессиональным потенциалом работников, образовательной средой и взаимодействием с семьёй.

Основным научно-практическим предложением статьи является разработка концептуальной модели, объединяющей стратегическое планирование, наблюдение за педагогическим процессом, внутренний мониторинг, коллективный анализ и повторную оценку в единый непрерывный цикл. Модель направлена на непосредственную связь результатов оценки качества с конкретными мерами по его совершенствованию.

Для практического внедрения модели важны следующие рекомендации:

- разработать внутреннюю систему обеспечения качества в дошкольной образовательной организации;
- развивать компетенции педагогического лидерства руководителей;
- расширять возможности наставничества, методического сотрудничества и рефлексивной практики педагогов;
- адаптировать показатели качества к особенностям образовательного процесса и потребностям развития детей;
- регулярно собирать и анализировать мнения родителей;
- разрабатывать планы мероприятий на основе результатов мониторинга и повторно оценивать их выполнение.

По нашему мнению, при принятии управленческих решений в дошкольных образовательных организациях необходимо учитывать конкретные требования родителей, государственных органов и других заинтересованных сторон. Оперативность принятия решений в ответ на изменяющиеся демографические условия проявляется в мерах по открытию

дополнительных групп для детей дошкольного возраста и ремонту зданий. Кроме того, в ответ на рост спроса со стороны родителей и ограниченную продолжительность государственного финансирования пособий по беременности и родам создаются условия для посещения дошкольных групп детьми раннего возраста.

Ориентацию на будущее мы рассматриваем как понимание краткосрочных и долгосрочных перспектив, а также факторов, влияющих на общее развитие дошкольной образовательной организации и рынок дополнительных образовательных услуг для детей дошкольного возраста.

Психологизация образовательного процесса, освоение технологий интеграции образовательных областей, внедрение гендерно-чувствительного подхода к воспитанию и развитию детей, а также формирование компетенций по организации инклюзивного развития детей с инвалидностью и обеспечению их комфортной адаптации в группах общеразвивающей направленности представляют собой актуальные направления педагогических исследований.

Таким образом, совершенствование качества управления современной дошкольной образовательной организацией возможно посредством применения Модели совершенства Европейского фонда управления качеством (EFQM), разработки тактических мероприятий и планирования стратегических решений. Данный подход представляет собой практический и эффективный инструмент организационного совершенствования, формирования системы управления, ориентированной на качество, и её непрерывной модернизации.

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Содикова А.Х., PhD
доцент
Университет «Зармед»
Узбекистан

ИНДИВИДУАЛЬНО-ПСИХОЛОГИЧЕСКИЕ ОСОБЕННОСТИ СТУДЕНТОВ КАК ОСНОВА ИНДИВИДУАЛИЗАЦИИ ОБУЧЕНИЯ ПРОЕКТИРОВАНИЮ ОДЕЖДЫ БУДУЩИХ УЧИТЕЛЕЙ ТЕХНОЛОГИИ

Аннотация. В статье рассматриваются индивидуально-психологические особенности студентов направления «Технологическое образование», от которых зависит успешность обучения проектированию швейных изделий. На основе анализа психолого-педагогической литературы и наблюдений за учебной работой студентов выделены четырнадцать значимых качеств, объединённые в пять блоков: мотивационно-личностный, когнитивный, творческий, эстетический и рефлексивно-коммуникативный. Для каждого блока показано, в чём он проявляется при проектировании одежды и какими заданиями его можно развивать. Предложен механизм индивидуализации обучения, построенный по принципу «общая цель, индивидуальная траектория», и сформулированы требования к индивидуально-психологическим качествам будущего учителя технологии.

Ключевые слова: будущий учитель технологии, проектирование одежды, индивидуально-психологические особенности, проектировочная компетентность, индивидуализация обучения, пространственное мышление, креативность.

Sodikova A.Kh., PhD
associate professor
Zarmed University
Uzbekistan

INDIVIDUAL PSYCHOLOGICAL CHARACTERISTICS OF STUDENTS AS A BASIS FOR INDIVIDUALISING GARMENT DESIGN TRAINING OF FUTURE TECHNOLOGY TEACHERS

Abstract. The article examines the individual psychological characteristics of students in the Technological Education programme on which success in learning to design garments depends. Drawing on the psychological and pedagogical literature and on observations of students' coursework, fourteen relevant qualities were identified and grouped into five blocks: motivational-personal, cognitive, creative, aesthetic, and reflective-communicative. For each block, the article shows how it manifests itself in garment design and which tasks can develop it. A mechanism for individualising instruction based on the principle "a common goal,

an individual trajectory" is proposed, and requirements for the individual psychological qualities of the future technology teacher are formulated.

Keywords: future technology teacher, garment design, individual psychological characteristics, design competence, individualisation of learning, spatial thinking, creativity.

Стратегия развития Нового Узбекистана на 2022-2026 годы требует обновить учебные программы вузов с опорой на передовой зарубежный опыт и поднять квалификацию педагогов до международного уровня [1]. Для направления «Технологическое образование» это требование имеет вполне конкретное содержание: выпускник должен уметь сам спроектировать швейное изделие и научить этому школьников. Знания технологии изготовления для этого недостаточно.

Проектирование одежды соединяет художественную, конструктивную и технологическую работу. Студент выполняет эскиз, снимает мерки, рассчитывает и строит чертёж основы, моделирует, подбирает материал и доводит изделие до образца. Каждый из этих шагов опирается на разные психические качества. На практических занятиях по дисциплине «Технологии обработки текстильных материалов и изготовления изделий» хорошо видно, что одно и то же задание студенты выполняют по-разному. Одни быстро находят художественный образ и уверенно работают с эскизом, но ошибаются в расчётах. Другие точно снимают мерки и аккуратно строят чертёж, а над собственной моделью работают с трудом. Если обучение построено по схеме «одинаковое задание для всех», эти различия остаются незамеченными, и часть студентов так и не выходит за пределы своих сильных сторон.

Цель статьи состоит в том, чтобы определить индивидуально-психологические особенности, которые нужно учитывать при обучении будущих учителей технологии проектированию одежды, и описать механизм индивидуализации такого обучения.

В педагогике связь профессионального становления учителя с его личностными особенностями отмечалась неоднократно. В.А. Сластенин называл творческую направленность, креативность и индивидуальные способности будущего учителя условиями, без которых профессионализм не складывается [6]. В психологии способностей принято считать, что способности проявляются и развиваются в конкретной деятельности и определяют её успешность [2]. Применительно к проектированию одежды это означает, что набор нужных качеств задаётся самой деятельностью: построением чертежа, моделированием, работой с материалом.

Для проектирования одежды особенно важно пространственное мышление. И.С. Якиманская показала, что оно формируется при работе с графическими изображениями и требует специально подобранных задач [9]. Конструктор одежды постоянно переводит плоский чертёж в объёмную форму и обратно, поэтому для него это качество профессионально необходимо. Е.П. Ильин подробно описал природу креативности и способы

её диагностики, в том числе задания на дивергентное мышление, восходящие к работам Дж. Гилфорда [3; 10]. Художественная сторона проектирования опирается на чувство композиции, пропорции, ритма и цвета, которые давно описаны в теории моделирования одежды [4].

Как учитывать различия между студентами, давно обсуждается в теории индивидуализации обучения. И.Э. Унт понимала индивидуализацию как учёт особенностей учащихся во всех формах и методах обучения [7]. А.В. Хуторской связал компетентностный подход с личностно-ориентированной парадигмой, в которой результатом образования считается способность действовать в реальной ситуации [8]. Однако в работах о подготовке учителей технологии психологические особенности студентов обычно перечисляются в общем виде и не связываются с конкретными этапами проектирования швейного изделия. Этот пробел мы и попытались восполнить.

Значимые качества и их группировка

Анализ литературы и наблюдения за учебной работой студентов позволили выделить четырнадцать качеств, от которых зависит успешность проектирования одежды: профессиональный интерес, мотивация, творческие способности, пространственное воображение, образное мышление, логическое мышление, эстетическое восприятие, внимание, наблюдательность, самостоятельность, способность принимать решения, рефлексивность, коммуникативность и волевые качества [2; 5]. Работать с таким длинным перечнем неудобно, поэтому мы объединили качества в пять блоков (таблица 1). Каждый блок соответствует определённой группе требований к будущему учителю технологии.

Таблица 1

Блоки индивидуально-психологических качеств, значимых для проектирования одежды

Блок	Входящие качества	Проявление при проектировании одежды	Задания для развития
Мотивационно-личностный	Профессиональный интерес, внутренняя мотивация, инициативность, самостоятельность, ответственность	Осознанное отношение к проекту, доведение изделия до готового образца	Реальные профессиональные задачи, индивидуальный проект, портфолио
Когнитивный	Логическое и образное мышление, пространственное воображение, внимание, память	Снятие мерок, расчёты, построение чертежа основы, понимание технологической последовательности	Конструктивные задачи, перевод эскиза в чертёж и обратно, макетирование
Творческий	Креативность, оригинальность идей, дивергентное мышление	Создание новой модели вместо копирования образца, поиск нескольких решений одной задачи	Мозговой штурм, задания на альтернативные решения, Design Thinking
Эстетический	Эстетическое восприятие, чувство цвета, композиционное мышление, понимание формы и пропорции	Согласованность силуэта, цвета, фактуры и деталей изделия	Художественный анализ моделей, мудборд, анализ модных тенденций
Рефлексивно-коммуникативный	Самооценка, критичность, сотрудничество, умение защищать проект	Анализ собственных ошибок, работа в паре и группе, защита проекта	Самооценка по критериям, взаимная экспертиза, групповой проект

Последний блок особенно важен для будущего учителя. В школе ему придётся оценивать проекты учеников и объяснять, почему одно решение лучше другого. Научиться этому трудно, если сам студент не привык разбирать свою и чужую работу.

Механизм индивидуализации обучения

Раз психологические особенности студентов различаются, обучение проектированию приходится строить на механизме индивидуального подхода. Он включает следующую последовательность шагов (рисунок 1):

диагностика → индивидуальный психологический профиль → индивидуализация учебного задания → индивидуальное или групповое проектирование → самостоятельная творческая работа → обратная связь → рефлексия и коррекция.



Рисунок 1. Механизм индивидуализации обучения проектированию одежды

Диагностика не требует сложного инструментария. Для оценки мотивации подходят анкеты о профессиональных интересах и беседа. Пространственное мышление проверяется задачами на мысленное преобразование изображений, например на определение формы детали по её развёртке [9]. Творческие способности можно оценить с помощью заданий на дивергентное мышление, описанных Е.П. Ильиным [3], а также по эскизам: сколько разных решений одной задачи предлагает студент. Эстетический и рефлексивно-коммуникативный блоки удобнее оценивать по продуктам деятельности, то есть по мудбордам, эскизам и портфолио, а также по тому, как студент защищает свой проект. По результатам диагностики для каждого студента составляется профиль, в котором отмечены сильные и слабые блоки.

Профиль удобно представлять в виде лепестковой диаграммы, на которой по каждому из пяти блоков отмечен уровень развития: низкий, средний или высокий. На рисунке 2 в качестве условного примера показаны профили двух студентов, соответствующие двум типичным случаям, описанным во введении. У студента А (художественный тип) высоко развиты мотивационно-личностный, творческий и эстетический блоки, а когнитивный заметно отстаёт. У студента Б (конструктивный тип) картина обратная: сильный когнитивный блок при слабом творческом. Профили построены для иллюстрации и не являются результатами измерений.

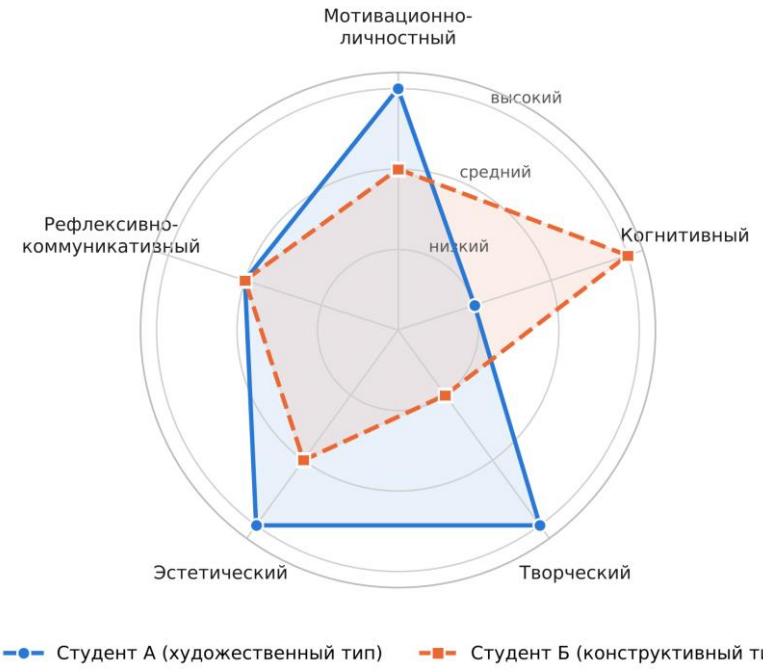


Рисунок 2. Условный пример индивидуальных психологических профилей двух студентов (уровни развития блоков: 1, низкий; 2, средний; 3, высокий)

Профиль определяет, какие задания получает студент. Студенту с хорошо развитым пространственным воображением можно давать более сложные задания по объёмному моделированию, в том числе с использованием программ трёхмерного проектирования. Студенту с высокими творческими способностями предлагается разработать несколько вариантов решения одной проблемы и обосновать свой выбор. Тот, у кого сильнее конструктивное мышление, получает сложные задачи на построение и модификацию чертежа. Студентам, которым трудно даются расчёты и построение основы, помогают упрощённые способы конструирования. Один из них, метод «Easy design», позволяет построить основу изделия по небольшому набору обычных мерок с помощью элементарных вычислений [11]. В результате обучение строится по принципу «общая цель, индивидуальная траектория»: все студенты должны прийти к готовому спроектированному изделию, но идут к нему разными путями.

Слабые блоки не следует просто обходить. Если студент силён в эскизе, но избегает расчётов, задания постепенно смещаются в сторону конструирования, а их сложность растёт по мере того, как он справляется. При групповой работе полезно объединять в пары студентов с дополняющими профилями: один отвечает за художественный образ, другой за конструкцию, а затем они меняются ролями. Так каждый видит, как рассуждает партнёр, и подтягивает свою слабую сторону. Студенты А и Б на рисунке 2 как раз образуют такую пару.

Индивидуализация особенно нужна при интегративном обучении. Когда занятие построено на связях между специальными дисциплинами, студент должен соединить знания по материаловедению, конструированию, технологии и художественному оформлению одежды [12]. У разных студентов этот процесс идёт по-разному, в зависимости от их когнитивных и творческих возможностей. Дифференциация интегративных заданий по психологическому профилю делает его более управляемым.

Требования к будущему учителю технологии

Из сказанного вытекают требования к индивидуально-психологическим качествам будущего учителя технологии. Обучение проектированию одежды должно целенаправленно развивать у студента:

1) устойчивый профессиональный интерес и внутренняя мотивация к проектной деятельности;

2) логическое мышление и пространственное воображение, достаточные для работы с мерками, расчётами и чертежом;

3) способность создавать оригинальные решения, а не копировать готовые образцы;

4) умение оценивать цвет, форму, пропорции и композицию изделия;

5) готовность критически анализировать свой проект, работать в группе и аргументированно защищать результат;

6) волевые качества, позволяющие последовательно доводить сложный проект до конца.

Заключение

Успешность обучения проектированию одежды зависит от содержания и методов обучения и в той же мере от индивидуально-психологических особенностей студентов. Объединение четырнадцати значимых качеств в пять блоков даёт преподавателю удобную основу для диагностики и подбора заданий. Механизм индивидуализации, построенный по принципу «общая цель, индивидуальная траектория», позволяет опираться на сильные стороны студента и постепенно развивать слабые. Предложенная модель пока носит теоретический характер. Следующим шагом должна стать её экспериментальная проверка, в первую очередь оценка того, как дифференциация заданий по психологическому профилю влияет на качество студенческих проектов.

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Султонов Ш.А.
доцент
Халбаева З.К.
студент
Каххорова Н.С.
студент
Шахрисабзский государственный педагогический институт
Узбекистан, г. Шахрисабз

МИНЕРАЛЬНО-СЫРЬЕВЫЕ РЕСУРСЫ КАШКАДАРЬИНСКОЙ ОБЛАСТИ: ГЕОГРАФИЯ РАЗМЕЩЕНИЯ И СОВРЕМЕННОЕ СОСТОЯНИЕ ОСВОЕНИЯ

Аннотация. в статье рассмотрены особенности территориального размещения минерально-сырьевых ресурсов Кашкадарьинской области Республики Узбекистан и современное состояние их промышленного освоения. На основе данных Национального комитета по статистике на 1 января 2026 г. и итогов промышленного производства за 2023–2025 гг. проанализирована динамика выпуска продукции, базирующейся на местном минеральном сырье. Показано, что углеводородное, горно-химическое и строительное сырьё образуют три пространственно обособленных ареала освоения. Выявлены структурные сдвиги в сторону глубокой переработки газа и обоснованы приоритеты рационального недропользования в регионе.

Ключевые слова: минерально-сырьевые ресурсы, Кашкадарьинская область, природный газ, газохимия, калийные соли, строительные материалы, территориальная организация.

Sultonov Sh.A.
associate professor
Khalbaeva Z.K.
student
Qahhorova N.S.
student
Shahrisabz State Pedagogical Institute
Uzbekistan, Shahrisabz

MINERAL RESOURCES OF KASHKADARYA REGION: GEOGRAPHY OF DISTRIBUTION AND CURRENT STATE OF DEVELOPMENT

Abstract. the article examines the territorial distribution of mineral resources in Kashkadarya region of the Republic of Uzbekistan and the current state of their industrial development. Based on data of the National Statistics Committee as of January 1, 2026 and industrial output results for 2023–2025, the dynamics of production based on local mineral raw materials is analyzed. It is shown that

hydrocarbon, mining-chemical and construction raw materials form three spatially distinct areas of development. Structural shifts towards deep gas processing are identified, and priorities for rational subsoil use in the region are substantiated.

Keywords: mineral resources, Kashkadarya region, natural gas, gas chemistry, potash salts, construction materials, territorial organization.

Введение. Горнодобывающий комплекс остаётся одной из базовых отраслей, определяющих структуру и темпы индустриального развития Узбекистана. Повышение эффективности использования минерально-сырьевой базы, переход от экспорта сырья к его глубокой переработке и снижение техногенной нагрузки на окружающую среду закреплены в ряде программных документов, в том числе в Постановлении Президента Республики Узбекистан № ПП-389 от 14.12.2023 о комплексном социально-экономическом развитии Кашкадарьинской области в 2024–2025 гг., предусматривающем, в частности, вовлечение в оборот месторождений кварца, известняка, мрамора, минеральных солей, глинистого сырья и строительного песка [1].

Кашкадарьинская область занимает 28,57 тыс. км², или около 6,4 % территории республики, и по численности постоянного населения (3 717,0 тыс. чел. на 1 января 2026 г., т.е. 9,7 % населения страны) является третьим регионом Узбекистана после Самаркандской и Ферганской областей [4]. Сочетание крупной минерально-сырьевой базы, высокой плотности населения (около 130 чел./км²) и выгодного транзитного положения делает область удобным объектом для анализа взаимосвязи между размещением природных ресурсов и формированием территориально-производственной структуры.

Развивая ранее опубликованную работу [2], в которой дана характеристика минеральных ресурсов области по состоянию на 2019–2020 гг., цель настоящей статьи — актуализировать эту характеристику с использованием статистических данных на январь 2026 г., уточнить отдельные количественные показатели и оценить сдвиги, произошедшие в освоении минерально-сырьевой базы региона.

Методы и материалы исследования. Информационную базу исследования составили: данные Национального комитета Республики Узбекистан по статистике о численности постоянного населения на 1 января 2026 г. [4]; пресс-релиз Управления статистики Кашкадарьинской области об итогах промышленного производства за январь–декабрь 2025 г., содержащий сопоставимые данные за 2023–2024 гг. [5]; официальные сообщения АО «Узбекнефтегаз», ПАО «ЛУКОЙЛ» и Министерства энергетики, опубликованные в отраслевых и деловых изданиях [6–11]; геологические и экономико-географические сведения о месторождениях области [2; 3].

Применялись сравнительно-географический, статистический (расчёт темпов роста и структурных долей) и картографо-описательный методы, а также метод группировки ресурсов по их хозяйственному значению. При

интерпретации региональной статистики учитывалось, что показатели формируются по месту государственной регистрации предприятий, поэтому объёмы добычи крупных недропользователей, зарегистрированных за пределами области, в региональных итогах отражаются лишь частично.

Результаты исследования и их обсуждение. Общее представление о месте области в экономике страны и о структуре её промышленности даёт таблица 1. В 2025 г. предприятиями области произведено промышленной продукции на 47,8 трлн сумов при индексе физического объёма 107,2 % к 2024 г. [5].

Таблица 1
Основные социально-экономические показатели Кашкадарьинской области

Показатель	Значение
Площадь территории, тыс. км²	28,57
Численность постоянного населения на 01.01.2026, тыс. чел.	3 717,0
Доля в населении Республики Узбекистан, %	9,7
Объём промышленной продукции за 2025 г., млрд сумов	47 788,6
Индекс физического объёма промышленности 2025/2024, %	107,2
Структура промышленности, %:	
обрабатывающая промышленность	82,1
электро-, газоснабжение, пар и кондиционирование	13,0
горнодобывающая промышленность и разработка карьеров	4,4
водоснабжение, канализация, обработка отходов	0,5

Источник: составлено авторами по данным [4; 5].

Обращает на себя внимание низкая доля добывающей отрасли (4,4 %) при доминировании обрабатывающей промышленности (82,1 %). Это отражает как реальный сдвиг к переработке сырья на месте (газохимия, синтетическое топливо, цемент, калийные удобрения), так и отмеченную выше особенность статистического учёта добычи углеводородов.

1. Топливно-энергетические ресурсы. По геолого-тектоническому районированию территория Узбекистана включает пять нефтегазоносных регионов — Устюртский, Бухаро-Хивинский, Юго-Западно-Гиссарский, Сурхандарьинский и Ферганский. Кашкадарьинская область охватывает части двух из них — Бухаро-Хивинского и Юго-Западно-Гиссарского, где месторождения объединяются в Шуртанскую и Мубарекскую группы. Основными коллекторами служат рифогенные известняки верхней юры, залегающие на глубинах 1,5–3,5 тыс. м [2; 3].

Пространственно выделяются три ареала углеводородных месторождений. **Предгорный (гиссарский) ареал** в Гузарском районе, освоение которого началось в 1950-е гг., включает Пачкамар, Гумбулак,

Адамташ, Кызылбайрак, Тандырча и др. Здесь с 2007 г. действует соглашение о разделе продукции «Гиссар» с участием ПАО «ЛУКОЙЛ»: на семи месторождениях контрактной территории построена установка комплексной подготовки газа проектной мощностью 4,4 млрд м³ в год, что сопоставимо более чем с десятой частью общереспубликанской добычи 2025 г. [9]. **Каршинский (центральный) ареал** — месторождения в районе Шуртана, Бешкента и Камаши, а также Культак, Аланг, Памук и Зеварды на юго-западе Каршинской степи — служит сырьевой базой Шуртанского газохимического комплекса. **Мубарекский (северо-западный) ареал** на границе с Бухарской областью — Сеталантепа, Джаркак, Северный и Южный Мубарек, а также введённые позднее Карим, Ходжахайрон, Шуртепа, Каракум, Кызылработ — обеспечивает сырьём Мубарекский газоперерабатывающий завод [2]. Нефть добывается на месторождениях Уртабулак, Ташлы, Восточный Караиль, Нуур, Байбурак; крупнейшее нефтегазоконденсатное месторождение Кокдумалак разрабатывается с участием иностранных партнёров.

Всего на государственном балансе в пределах области учтено более 100 газовых, газоконденсатных и нефтяных месторождений [2]. По оценке [2], к началу 2020-х гг. на область приходилось около 70 % добываемого в стране природного газа, 80 % газового конденсата и 78 % нефти. Вместе с тем за последние годы ресурсная база зрелых месторождений существенно истощилась: общереспубликанская добыча газа снизилась до 41,3 млрд м³ в 2024 г. (уточнённые данные) и составила 42,3 млрд м³ в 2025 г., т.е. впервые за несколько лет показала рост (+2,4 %); добыча нефти в стране за 2025 г. уменьшилась на 7,9 %, до 655,7 тыс. т [6–8]. В сентябре 2026 г. в Миришкорском районе области открыто новое газоконденсатное месторождение «Патрон» с предварительно оцененными запасами около 2,5 млрд м³ газа и начальным дебитом порядка 0,5 млн м³/сут. [11], что подтверждает сохраняющийся потенциал прироста запасов на юго-западе области.

Ключевой особенностью современного этапа является перенос акцента с добычи на глубокую переработку газа. Шуртанский газохимический комплекс, введённый в эксплуатацию в 2001 г. с проектной мощностью 125 тыс. т полиэтилена в год, остаётся единственным производством такого профиля в стране; программой его модернизации стоимостью 1,8 млрд долл. предусмотрено доведение выпуска полиэтилена до 430 тыс. т и организация производства полипропилена мощностью 280 тыс. т в год [10]. Фактически в 2025 г. в области произведено 135,7 тыс. т полиэтилена (табл. 2). Существенный прирост выпуска дизельного топлива (+41,7 % к 2024 г.) связан с выходом на проектный режим производства синтетического топлива на основе газа (GTL) в Гузарском районе.

Таблица 2
Производство основных видов продукции на базе минерального сырья в Кашкадарьинской области, 2023–2025 гг.

Продукция	Ед. изм.	2023	2024	2025	2025 к 2024, %
Природный газ*	млн м³	82,1	61,9	117,9	190,5
Газовый конденсат	тыс. т	105,5	107,1	117,9	110,1
Нефть	тыс. т	10,2	11,2	9,0	80,4
Полиэтилен	тыс. т	131,8	137,6	135,7	98,6
Дизельное топливо	тыс. т	378,6	349,0	494,7	141,7
Хлорид калия	тыс. т	198,1	219,1	220,6	100,7
Портландцемент	тыс. т	1 590,1	1 541,2	1 779,8	115,5

** По предприятиям, зарегистрированным на территории области; без учёта добычи крупных недропользователей, отчитывающихся по месту регистрации головных организаций. Источник: составлено и рассчитано авторами по данным [5].*

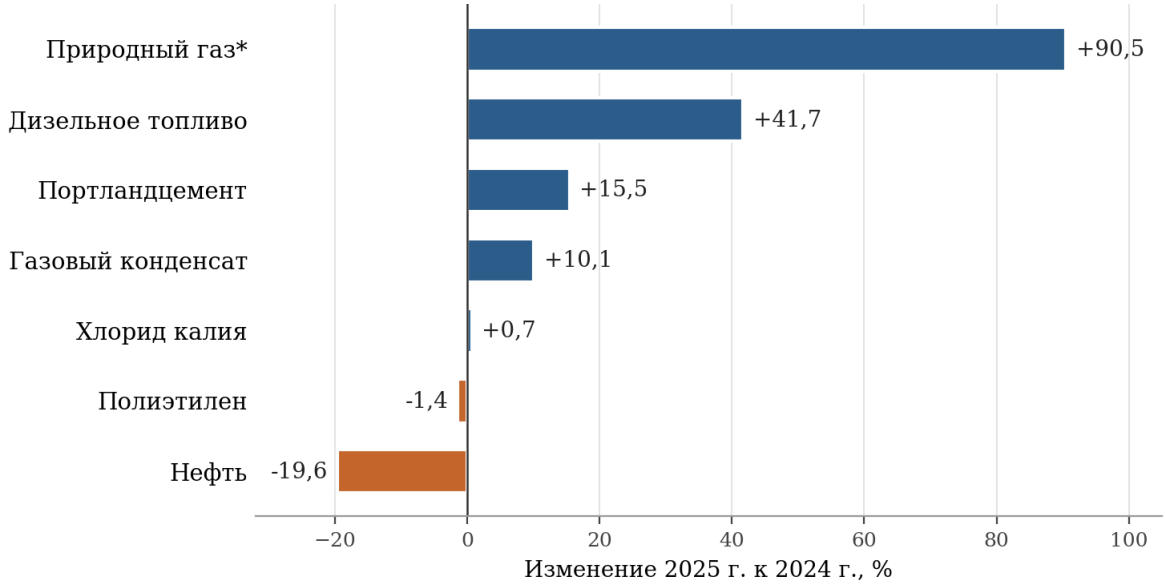


Рис. 1. Изменение объёмов производства продукции на базе минерального сырья в Кашкадарьинской области в 2025 г. по сравнению с 2024 г., %

** По предприятиям, зарегистрированным на территории области. Источник: рассчитано авторами по данным [5].*

Данные таблицы 2 и рисунка 1 показывают, что при стагнации выпуска полиэтилена и калийных удобрений наиболее динамично растут производства, ориентированные на внутренний рынок, — моторное топливо и цемент. Снижение добычи нефти на 19,6 % согласуется с

общереспубликанской тенденцией истощения нефтяных залежей. Угольные месторождения промышленного значения в области отсутствуют: небольшие запасы каменного угля между кишлаками Вори и Зармас в Яккабагских горах могут использоваться лишь для местных нужд; проявления горючих сланцев на юго-востоке Дехканабадского района (Дехканабад, Ходжаарна, Кызылча, Дардара, Кан) промышленной оценки пока не получили [2].

2. Горно-химическое сырьё. Кашкадарьинская область — главный в стране район концентрации калийных солей: на её долю приходится около 70 % прогнозных и практически все балансовые запасы калийного сырья Узбекистана [2]. В юго-западных отрогах Гиссарского хребта выявлены соленосные площади Акбаш, Тюбегатан, Кайпантау и Пачкамар; мощность соленосной толщи в пределах Дехканабадского бассейна составляет 200–600 м. Крупнейшее месторождение — Тюбегатан (около 30 км к северо-востоку от пос. Дехканабад) с прогнозными запасами калийных солей порядка 500 млн т [2].

На базе Тюбегатана действует Дехканабадский калийный завод (стоимость строительства — 128,2 млн долл.), выпускающий хлорид калия и техническую соль; продукция поставляется сельскому хозяйству республики и на экспорт — в Китай, Казахстан, Вьетнам, Малайзию, ОАЭ, Грузию и Шри-Ланку [12; 13]. В августе 2025 г. предприятие было приватизировано частной компанией [12]. Выпуск хлорида калия в 2025 г. составил 220,6 тыс. т и практически не изменился к предыдущему году, что указывает на исчерпание возможностей экстенсивного роста при действующих мощностях (табл. 2).

Запасы каменной соли также весьма значительны. На месторождении Байбичакан (Камашинский район, 12 км к юго-востоку от кишлака Лангар) балансовые запасы по категории C_1 составляют 234,6 млн т, по категории C_2 — 4 385,1 млн т; ещё 6,1 млн т каменной соли учтено на Тюбегатане [2]. В Дехканабадском районе выявлены фосфориты с прогнозными запасами около 213 млн т, пригодные для открытой отработки, а на склонах гор Каратепа (30 км к северо-востоку от г. Чиракчи) — Лолабулакское месторождение пегматитов (около 7 млн т) [2]. Комплексная переработка солей позволяет попутно получать бром, магнезиальное сырьё и гипс, что создаёт предпосылки для формирования в Дехканабадском районе горно-химического узла.

3. Нерудное и строительное сырьё. По хозяйственному значению нерудные полезные ископаемые занимают в области второе место после топливно-энергетических. Декоративно-облицовочный мрамор разрабатывается на месторождениях Бодомзор, Искана, Севаз, Томчиота, Хазорнова, Биркунлик и др.; сырьё перерабатывается камнеобрабатывающими предприятиями Китаба и Макрида [2]. Доломитизированные известняки Дехканабадского (стеновые доломиты — 6,4 млн м³) и Пачкамарского (4,7 млн м³) месторождений используются как стеновой камень и огнеупорное сырьё, а также поставляются фарфоровым заводам Самарканда и Ташкента [2].

Цементное сырьё представлено известняками месторождения Каратепа (12 км к северу от г. Китаб) с запасами категорий C_1+C_2 326 млн т, в том числе C_1 — 215 млн т, а также месторождениями Кайнар (южные отроги Зеравшанского хребта) и Лангар (прогнозные запасы до глубины 30 м — 15 млн т) [2]. Реализация этого потенциала отражается в росте выпуска портландцемента до 1 779,8 тыс. т в 2025 г. (+15,5 %). Гипс сосредоточен на месторождениях Пачкамар (запасы гипса первого сорта при мощности пласта 6 м — 1 692 тыс. т), Лангар, Оловиддин, Калкама, Майманак, Косонтаг. Песчано-гравийные смеси разрабатываются на крупнейшем Танхозском месторождении (29,2 млн м³), на базе которого работает гравийно-сортировочный завод; месторождение зернистых песков Чиял в Чиракчинском районе (38,97 млн м³) может служить сырьевой базой бетонного производства [2].

4. Группировка минеральных ресурсов по хозяйственному значению. Обобщение изложенного позволяет, развивая подход [2], выделить три группы минеральных ресурсов области, различающиеся по хозяйственной роли, ареалам размещения и направлениям использования (табл. 3).

Таблица 3
Группировка минерально-сырьевых ресурсов Кашкадарьинской области

Группа	Виды сырья	Ареалы размещения	Основные направления использования
I. Ресурсы республиканского и межгосударственного значения	Природный газ, газовый конденсат	Гузарский, Каршинский (Шуртанский), Мубарекский	Газоснабжение страны; Мубарекский ГПЗ, Шуртанский ГХК, производство GTL-топлива
II. Ресурсы отраслевого значения	Нефть, калийные и каменная соли, фосфориты	Кокдумалак и др.; Дехканабадский соленосный бассейн	Нефтепереработка, производство калийных удобрений, химическая промышленность
III. Ресурсы регионального значения	Мрамор, известняки, доломиты, гипс, песчано-гравийные смеси, глины	Китабский, Чиракчинский, Дехканабадский, Камашинский районы	Цемент, облицовочный камень, стеновые материалы, строительство

Источник: составлено авторами на основе [2; 5].

Сравнение с состоянием на 2020 г. [2] показывает, что внутри первой группы роль добычи газа как самостоятельного направления снижается, а роль его переработки в продукцию с высокой добавленной стоимостью (полимеры, синтетическое топливо) — возрастает. Вторая группа отличается

стабильностью выпуска при значительном недоиспользовании запасов каменной соли и фосфоритов. Третья группа, сформировавшаяся ещё в 1960-е гг. в связи с освоением Каршинской степи, вновь получает импульс в условиях строительного бума и реализации региональных программ развития [1].

Заключение. Кашкадарьинская область обладает одной из наиболее диверсифицированных в Узбекистане минерально-сырьевых баз, размещение которой определяет три устойчивых ареала освоения: углеводородный (юго-запад и северо-запад области, предгорья Гиссара), горно-химический (Дехканабадский соленосный бассейн) и строительно-сырьевой (Китабско-Чиракчинская и Камашинская зоны). По данным на январь 2026 г., в условиях истощения зрелых газовых месторождений главным фактором роста становится глубокая переработка сырья: при индексе промышленного производства 107,2 % выпуск дизельного топлива вырос на 41,7 %, цемента — на 15,5 %, тогда как добыча нефти сократилась почти на пятую часть.

Приоритетами рационального недропользования в регионе представляются: доразведка и ввод новых газоконденсатных месторождений на юго-западе области; завершение модернизации Шуртанского газохимического комплекса; расширение ассортимента продукции на базе каменной соли и вовлечение в оборот фосфоритов Дехканабада; экологически ориентированное развитие карьерной добычи строительного сырья. Учёт экологических результатов наряду с экономической эффективностью, внедрение ресурсосберегающих технологий и создание рабочих мест в горнодобывающих районах сформируют основу устойчивого развития области.

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Тажиев К.К., PhD по географическим наукам
и. о. доцента
Ургенчский государственный педагогический институт
Узбекистан, г. Ургенч

ОЦЕНКА ПРИРОДНОГО МЕЛИОРАТИВНОГО СОСТОЯНИЯ ЛЕВОБЕРЕЖНОЙ ЧАСТИ СОВРЕМЕННОЙ ДЕЛЬТЫ АМУДАРЬИ С ПРИМЕНЕНИЕМ СОВРЕМЕННЫХ МЕТОДОВ

Аннотация. В статье дана оценка природного мелиоративного состояния территорий левобережной части современной дельты Амударьи на основе комплексного применения ГИС, данных дистанционного зондирования и метода пластики рельефа. По снимкам Landsat-8/9 OLI и Sentinel-2 MSI рассчитаны индексы засоления (SI, SI1–SI3, NDSI) и NDVI, которые были валидированы по ЦМР и данным полевых исследований на 64 контрольных точках (r = 0,78–0,84; общая точность 81 %). Результаты показали, что в верхней (юго-восточной) части левобережья мелиоративное состояние удовлетворительное, тогда как в нижней (северо-западной, приаральской) части — плохое и очень плохое. На основе исследования построена цифровая карта-модель, разделяющая территорию на четыре категории. Разработаны научно обоснованные рекомендации по рациональному использованию земель, совершенствованию дренажной сети и предотвращению опустынивания.

Ключевые слова: современная дельта Амударьи, мелиоративное состояние, засоление почв, ГИС, дистанционное зондирование, NDVI, метод пластики рельефа.

Tajiyev Q.Q., PhD in Geography
acting associate professor
Urgench State Pedagogical Institute
Uzbekistan, Urgench

ASSESSMENT OF THE NATURAL RECLAMATION CONDITION OF THE LEFT-BANK PART OF THE MODERN AMUDARYA DELTA USING MODERN METHODS

Abstract. This article assesses the natural reclamation condition of the left-bank part of the modern Amudarya delta by integrating GIS, remote sensing data and the relief-plastic mapping method. Soil salinity indices (SI, SI1–SI3, NDSI) and NDVI were computed from Landsat-8/9 OLI and Sentinel-2 MSI imagery and validated against a DEM and field data from 64 control points (r = 0.78–0.84; overall accuracy 81%). The results show a satisfactory reclamation status in the

upper (south-eastern) part of the left-bank area and a poor to very poor status in the lower (north-western, Aral Sea region) part. A four-category digital map of reclamation status was produced. Evidence-based recommendations are proposed for rational land use, drainage-network modernisation and desertification prevention.

Keywords: modern Amudarya delta, reclamation status, soil salinity, GIS, remote sensing, NDVI, relief-plastic method.

ВВЕДЕНИЕ

Кризис Аральского моря и резкое изменение водного режима Амударьи начиная со второй половины XX века коренным образом изменили геоэкологическую и мелиоративную ситуацию на территории её современной дельты. Если до 1960-х годов речные воды в достаточном объёме поступали в низовья и дельту, то расширение орошаемых площадей, развитие систем водохранилищ и каналов нарушили естественный водно-солевой баланс дельтовой части реки. Этот процесс, особенно на неорошаемых территориях со слабым естественным дренажем, вызвал такие негативные геоэкологические последствия, как вторичное засоление, заболачивание и опустынивание почв.

Природные условия современной дельты Амударьи неоднородны: её правобережная и левобережная части различаются по структуре рельефа, возрасту малых дельт, гидрографической сети и литологическому строению. Территория левобережья связана с древними руслами, направленными к левым рукавам системы Караузяк, Даудан, Кунядарья-Казахдарья, а также к Сарыкамышской впадине; здесь наблюдается древовидная структура рельефа с разделением малых дельт на верхние (автоморфные) и нижние (гидроморфные) части.

Актуальность темы обусловлена несколькими факторами. Во-первых, улучшение мелиоративного состояния сельскохозяйственных земель и повышение продуктивности орошаемых угодий является одним из приоритетных направлений государственной политики Республики Узбекистан. Во-вторых, в Приаралье, в том числе в левобережной части дельты Амударьи, усиливаются процессы опустынивания и засоления, что напрямую влияет на социально-экономические условия жизни населения региона и на экологическую безопасность. В-третьих, традиционные методы мелиоративного мониторинга, основанные на полевых исследованиях, оказываются неэффективными по времени и затратам при охвате больших площадей, тогда как использование современных геоинформационных технологий и данных дистанционного зондирования позволяет существенно смягчить эту проблему.

Анализ проведённых по данной теме исследований показывает, что вопросы взаимосвязи мелиоративного состояния ландшафтов дельты Амударьи со структурой рельефа и почвенным покровом рассматривались в ряде работ [1–3], однако большинство этих исследований проводилось

преимущественно на примере малых дельт правобережья (Кызкеткен-Чимбай, Еркиндарья, Шортанбай, Кунядарья-Казахдарья) и опиралось на традиционные полевые и картографические методы. Отсутствие отдельных научных работ, посвящённых комплексной оценке территории левобережья на основе современных методов ГИС и дистанционного зондирования, определяет научную новизну настоящего исследования.

В международной практике оценка засоления почв на основе данных дистанционного зондирования также активно развивается в последние десятилетия. Как показывают исследования различных авторов [4; 7; 8], спектральные индексы, получаемые со спутниковых снимков (NDVI, индексы засоления, индекс яркости), с достаточной точностью отражают наличие солевых корок, кристаллов солей и разреженного растительного покрова на поверхности почвы, что позволяет проводить оперативный и относительно недорогой мониторинг больших территорий по сравнению с традиционными полевыми и лабораторными методами. Вместе с тем во многих зарубежных и отечественных исследованиях [5; 7] подчёркивается, что результаты дистанционного зондирования обладают высокой достоверностью только при их сопоставлении с эталонными данными, собранными в полевых условиях; в противном случае на результаты могут влиять атмосферные помехи, сезонность растительного покрова и влажность почвы.

Цель исследования — оценка природного мелиоративного состояния территорий левобережной части современной дельты Амударьи путём комплексного применения современных геоинформационных систем, индексов дистанционного зондирования и метода пластики рельефа, а также зонирование территории по мелиоративному состоянию. Для достижения данной цели были поставлены следующие задачи: анализ структуры рельефа и гидрографической сети территории левобережья на основе цифровой модели рельефа (ЦМР); расчёт индексов засоления почв и растительного покрова с использованием снимков Landsat и Sentinel-2; проверка (валидация) результатов дистанционного зондирования данными полевых почвенных исследований; построение ГИС-карты, классифицирующей территорию по категориям мелиоративного состояния; разработка практических рекомендаций на основе полученных результатов.

МАТЕРИАЛЫ И МЕТОДЫ ИССЛЕДОВАНИЯ

В качестве объекта исследования была принята территория левобережной части современной дельты Амударьи, общей площадью примерно 380–420 тыс. га. В состав территории входят малые дельты Караузяк и Даудан, левые рукава системы Кунядарьи, а также взаимно прилегающие орошаемые и неорошаемые земли. Климат резко континентальный, характерный для сухих субтропических пустынь: годовое количество осадков составляет 80–120 мм, а испарение достигает 1000–1200 мм.

В исследовании использовались следующие источники данных: спутниковые снимки Landsat-8/9 OLI (30 м) и Sentinel-2 MSI (10–20 м) за

вегетационные периоды 2000, 2010, 2015, 2020 и 2024 годов; цифровые модели рельефа SRTM и ASTER GDEM (30 м); результаты полевых почвенных исследований, проведённых в 2022–2025 гг. (отбор проб почвы на 64 контрольных точках, определение электропроводности (EC), сухого остатка и ионного состава); метеорологические и гидрологические статистические данные Узгидромета [9] и организаций водного хозяйства; ранее опубликованные топографические (1:25000, 1:100000) и почвенные карты.

В исследовании применялся комплексный географо-картографический подход, включающий следующие основные методы:

1. Метод пластики рельефа. На основе данных ЦМР определялась морфологическая структура территории (относительные возвышения, понижения, направление уклонов), территория подразделялась на группы «элементарных ландшафтов» (автоморфные, гидроморфные, супераквальные), что служило основой для оценки условий естественного дренажа.

2. Индексы дистанционного зондирования. Для дистанционной оценки степени засоления почв рассчитывались следующие спектральные индексы: NDVI = (NIR − RED) / (NIR + RED) — отражает плотность и биомассу растительного покрова; индекс засоления SI = √(Green × Red) и его модификации SI1–SI3 — учитывают спектральное отражение солевых кристаллов и светлых засоленных слоёв на поверхности почвы; NDSI = (Red − NIR) / (Red + NIR) — применялся как дополнительный показатель для различения засолённых и незасолённых поверхностей; индекс яркости (BI) — использовался для косвенной оценки влажности и наличия солевого слоя через общее альбедо поверхности почвы.

3. ГИС-анализ и картографическое моделирование. Рассчитанные индексы, показатели рельефа на основе ЦМР и результаты полевых исследований были совмещены в среде QGIS и ArcGIS (оверлейный анализ). По данным контрольных точек проведён корреляционно-регрессионный анализ между значениями индексов и показателями EC почвы, что позволило провести валидацию результатов дистанционного зондирования и экстраполировать их на всю территорию.

4. Классификация мелиоративного состояния. На основе международной [6] и национальной практики по значениям электропроводности почвенного раствора (EC, дСм/м) и индекса засоления (SI) была разработана четырёхкатегорийная классификация (таблица 1).

Таблица 1. Классификация мелиоративного состояния почв

Категория	EC (дСм/м)	Значение SI	Мелиоративное состояние
I	< 4	< 20	Удовлетворительное
II	4–8	20–35	Неудовлетворительное
III	8–16	35–50	Плохое
IV	> 16	> 50	Очень плохое

Исследование проводилось в три этапа: (1) подготовительный этап — сбор картографических, статистических и спутниковых данных; (2) полевой аналитический этап — отбор проб почвы на контрольных точках и валидация; (3) итоговый камеральный этап — ГИС-моделирование и анализ результатов. Такой поэтапный подход обеспечил достоверность данных и позволил проследить многолетнюю динамику (2000–2024 гг.).

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

В результате анализа карты пластики рельефа территория была разделена на две основные морфологические зоны. В юго-восточной (верхней) зоне площадь относительных возвышенностей в 1,6–2,1 раза превышает площадь понижений, здесь обеспечен хороший естественный дренаж. В северо-западной (нижней) зоне, напротив, площадь понижений в 1,4–1,8 раза превышает площадь возвышенностей, уровень грунтовых вод залегает на глубине 1,0–1,5 м от поверхности, что создаёт благоприятные условия для капиллярного подъёма солей на поверхность почвы.

Значения NDVI, рассчитанные по снимкам за вегетационные периоды 2000–2024 гг., варьировали по территории от 0,05 до 0,42. Наиболее высокие значения (0,30–0,42) отмечены на орошаемых участках верхней части с хорошим естественным дренажем, наиболее низкие (0,05–0,15) — на засолённых и лишённых растительности поверхностях в направлении Сарыкамыша. Установлено, что площадь участков с низкими значениями NDVI в нижней части за период 2000–2024 гг. увеличилась примерно на 18–22 %, что свидетельствует об усилении процессов опустынивания.

Значения индекса засоления (SI) варьировали от 15 до 62, при этом наиболее высокие значения (выше 50) наблюдались в озёрно-болотных и солончаковых комплексах нижней части, наиболее низкие — на начальных участках малых дельт верхней части. Результаты корреляционного анализа показали статистически достоверную связь ($r = 0,78–0,84$, $p < 0,01$) между значениями SI и данными EC почвы, измеренными в полевых условиях, что подтвердило надёжность применённого метода дистанционного зондирования.

Таблица 2. Показатели мелиоративного состояния малых дельт левобережья

Малая дельта / участок	NDVI	SI	Уровень дренажа	Категория
Верхняя часть Караузяка	0,34	18	Хороший	I
Нижняя часть Караузяка	0,19	41	Плохой	III
Малая дельта Даудан	0,27	29	Средний	II
Кунядарья (левый рукав)	0,22	37	Средний–плохой	III
Сарыкамышское направление (окраина)	0,11	57	Очень плохой	IV

Данные таблицы 2 показывают, что даже в пределах одной малой дельты между верхней и нижней частями наблюдается резкое различие по мелиоративному состоянию; данная закономерность носит общий характер для всех обследованных малых дельт.

В результате интегрированного анализа в среде ГИС установлено, что примерно 21 % территории относится к I категории (удовлетворительное), 29 % — ко II категории (неудовлетворительное), 31 % — к III категории (плохое) и 19 % — к IV категории (очень плохое). Сравнительный анализ карт, построенных за 2000, 2010 и 2024 гг., показал, что за последние 24 года площадь земель III и IV категорий увеличилась примерно на 12 процентных пунктов, тогда как площадь земель I категории сократилась почти на 7 процентных пунктов.

Полученные результаты подтвердили на примере левобережной части ранее выдвинутые научные представления о непосредственной связи мелиоративного состояния ландшафтов современной дельты Амударьи со структурой рельефа. Данный вывод согласуется с результатами, полученными предыдущими исследователями на примере малых дельт правобережья [1–3], однако настоящее исследование впервые количественно подтвердило эту закономерность с помощью показателей дистанционного зондирования (NDVI, SI, NDSI) отдельно для левобережной части.

С целью повышения достоверности методики полученные мелиоративные категории были сопоставлены с полевыми данными по 64 контрольным точкам: в 81 % случаев категории, установленные методом дистанционного зондирования, полностью совпали с данными полевых исследований, в 15 % наблюдалось расхождение на одну категорию, и лишь в 4 % случаев выявлено значительное несоответствие. Показатель общей точности (81 %) соответствует уровню точности (75–90 %), отмечаемому в международных исследованиях [7; 8] по оценке засоления почв методами дистанционного зондирования.

Вместе с тем методика имеет ряд объективных ограничений: определение поверхностного засоления, скрытого под густым растительным покровом, спектральным методом затруднено; пространственное разрешение данных ЦМР (30 м) не позволяет полностью отразить мелкие изменения

микрорельефа. В будущих исследованиях перспективным представляется использование снимков БПЛА (дронов) с высоким пространственным разрешением и гиперспектральных сенсоров для преодоления указанных ограничений.

С практической точки зрения на основе полученных результатов сформулированы следующие рекомендации: модернизация коллекторно-дренажной сети и внедрение новых систем дренажа на территориях III и IV категорий; отказ от расширения орошаемого земледелия на пониженных участках со слабым естественным дренажем в пользу выращивания солеустойчивых видов растений и создания лесополос; использование разработанной ГИС-модели в качестве основы для регулярного (каждые 2–3 года) обновления данных мелиоративного мониторинга.

ЗАКЛЮЧЕНИЕ

В результате проведённого исследования были сделаны следующие основные выводы: мелиоративное состояние левобережной части современной дельты Амударьи распределено по территории неравномерно, что обусловлено прежде всего структурой рельефа и условиями естественного дренажа — в верхней (юго-восточной) части мелиоративное состояние оценивается как удовлетворительное, в нижней (северо-западной) части — как плохое и очень плохое. Совместное применение ГИС, индексов дистанционного зондирования (NDVI, SI, NDSI, BI) и метода пластики рельефа позволило оценить мелиоративное состояние территории с высокой точностью и достоверностью в относительно короткие сроки на больших площадях. Анализ динамики за 2000–2024 гг. показал усиление процессов опустынивания и засоления в нижней части левобережья, а также рост площади земель III–IV категорий. Построенная карта мелиоративного зонирования и предложенные рекомендации могут служить практической основой для региональных организаций водного хозяйства при рациональном использовании земель, совершенствовании дренажных систем и планировании мер по борьбе с опустыниванием. Перспективным направлением будущих исследований представляется дальнейшее повышение точности оценки мелиоративного состояния за счёт применения данных гиперспектрального дистанционного зондирования и алгоритмов машинного обучения, а также создание комплексной системы мониторинга, охватывающей и глубокие слои почвенного профиля.

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Тохирова Ф.О.
доцент
Хурсанкулова Ш.Ф.
талаба
Халбаев Ф.Б.
талаба
Орзикулов А.М.
талаба
Самарқанд давлат тиббиёт университети

ТИББИЁТДА СУНЪИЙ ИНТЕЛЛЕКТ: ИМКОНИЯТЛАРИ, ҚЎЛЛАНИЛИШИ ВА РИВОЖЛАНИШ ИСТИҚБОЛЛАРИ

Аннотация. Ушбу мақолада тиббиёт соҳасида сунъий интеллект технологияларидан фойдаланишнинг назарий ва амалий жиҳатлари ёритилган. Сунъий интеллектнинг касалликларни эрта аниқлаш, тиббий тасвирларни таҳлил қилиш, клиник қарорларни қўллаб-қувватлаш, дори воситаларини тадқиқ этиш ҳамда беморларни масофадан мониторинг қилишдаги имкониятлари таҳлил қилинган. Шунингдек, тиббий маълумотлар хавфсизлиги, алгоритмлар ишончлилиги, ахлоқий тамойиллар ва шифокор масъулияти билан боғлиқ муаммолар кўриб чиқилган. Тиббиётда сунъий интеллектдан самарали фойдаланиш бўйича амалий таклифлар ишлаб чиқилган.

Калит сўзлар: сунъий интеллект, тиббиёт, машинали ўқитиш, нейрон тармоқлар, тиббий диагностика, рақамли соғлиқни сақлаш, тиббий маълумотлар, клиник қарорларни қўллаб-қувватлаш.

Toxirova F.O.
associate professor
Khursankulova Sh.F.
student
Khalbaev F.B.
student
Orzikulov A.M.
student
Samarkand State Medical University

ARTIFICIAL INTELLIGENCE IN MEDICINE: OPPORTUNITIES, APPLICATIONS, AND FUTURE PROSPECTS

Abstract. This article examines the theoretical and practical aspects of applying artificial intelligence technologies in medicine. It analyzes the potential of artificial intelligence in early disease detection, medical image analysis, clinical decision support, drug research and development, and remote patient monitoring. Furthermore, the article addresses challenges related to medical data security,

algorithm reliability, ethical principles, and the professional responsibility of physicians. Practical recommendations are proposed for the effective implementation and utilization of artificial intelligence technologies in modern medical practice.

Keywords: artificial intelligence, medicine, machine learning, neural networks, medical diagnostics, digital healthcare, medical data, clinical decision support.

Кириш

Ҳозирги даврда ахборот-коммуникация технологияларининг жадал ривожланиши тиббиёт соҳасида янги имкониятларни юзага келтирмоқда. Айниқса, сунъий интеллект (СИ) технологиялари касалликларни эрта аниқлаш, тиббий маълумотларни қайта ишлаш, даволаш жараёнини индивидуаллаштириш ва тиббий хизматлар сифатини оширишда муҳим аҳамият касб этмоқда.

Сунъий интеллект — инсоннинг айрим интеллектуал фаолиятларини, жумладан, маълумотларни таҳлил қилиш, қонуниятларни аниқлаш, таснифлаш ва прогнозлаш вазифаларини компьютер тизимлари ёрдамида амалга оширишга қаратилган технологиялар мажмуасидир. Машинали ўқитиш ва чуқур ўқитиш усуллари тиббий маълумотлар орасидаги мураккаб боғланишларни аниқлаш имконини беради.

World Health Organization (WHO) маълумотларига кўра, сунъий интеллект соғлиқни сақлаш тизимида катта имкониятларга эга бўлиши билан бирга, уни жорий этишда инсон ҳуқуқлари, хавфсизлик, шаффофлик ва тиббий этика талабларига қатъий риоя қилиш зарур [1].

Мавзунинг долзарблиги шундаки, замонавий тиббиётда маълумотлар ҳажмининг ортиши, касалликларни эрта аниқлашга бўлган эҳтиёж ва тиббий хизматлар самарадорлигини ошириш зарурати интеллектуал технологиялардан фойдаланишни тақозо этмоқда.

Мақоланинг мақсади — тиббиётда сунъий интеллектнинг асосий қўлланилиш йўналишларини таҳлил қилиш, унинг афзалликлари ва мавжуд муаммоларини ёритиш ҳамда амалиётга жорий этиш бўйича таклифлар ишлаб чиқиш.

1. Тиббиётда сунъий интеллектнинг асосий йўналишлари

Тиббиётда сунъий интеллект турли вазифаларни бажариш учун қўлланилади. Уларнинг энг муҳимлари тиббий диагностика, клиник қарорларни қўллаб-қувватлаш, тиббий тасвирларни таҳлил қилиш, дори воситаларини ишлаб чиқиш ва беморлар ҳолатини кузатишдан иборат.

1.1. Касалликларни эрта аниқлаш ва диагностика

Сунъий интеллект алгоритмлари рентген, компьютер томографияси (КТ), магнит-резонанс томографияси (МРТ), маммография ва бошқа тиббий тасвирларни таҳлил қилишда қўлланилмоқда. Чуқур нейрон тармоқлар тасвирлардаги ўзгаришларни аниқлаш, шубҳали соҳаларни белгилаш ва шифокор эътиборини муҳим белгиларга қаратиш имконини беради.

Масалан, кўкрак қафаси рентген тасвирларида ўпка касалликларига хос белгиларни аниқлаш, маммографияда шубҳали ўзгаришларни топиш ҳамда кўз туби тасвирлари орқали диабетик ретинопатия белгиларига баҳо беришда сунъий интеллектдан фойдаланиш мумкин.

McKinney ва ҳаммуаллифларининг тадқиқотида сунъий интеллект тизимларининг кўкрак бези саратони скринингидаги имкониятлари баҳоланган. Натижалар алгоритмлар айрим шароитларда радиологик текширувлар таҳлилини яхшилашга ёрдам бериши мумкинлигини кўрсатган [2].

Бироқ алгоритм натижаси якуний ташхис сифатида қабул қилинмаслиги керак. Ташхис беморнинг клиник белгилари, анамнези, лаборатория натижалари ва мутахассис хулосаси асосида қўйилади.

1.2. Клиник қарорларни қўллаб-қувватлаш

Клиник қарорларни қўллаб-қувватлаш тизимлари бемор ҳақидаги маълумотларни таҳлил қилиб, шифокорга эҳтимолий ташхислар, хавф омиллари ва қўшимча текширувлар бўйича тавсиялар беришга ёрдам беради.

Бундай тизимларда қуйидаги маълумотлардан фойдаланиш мумкин:

- беморнинг ёши ва касаллик тарихи;
- лаборатория таҳлиллари натижалари;
- қон босими, юрак уриши ва бошқа физиологик кўрсаткичлар;
- тиббий тасвирлар ва электрон тиббий карта маълумотлари;
- дори воситалари ва уларнинг ўзаро таъсирига оид маълумотлар.

Сунъий интеллект асосида ишловчи тизимлар хавф гуруҳидаги беморларни аниқлаш, касаллик кечишини прогнозлаш ва даволаш вариантларини таққослашга кўмаклашиши мумкин. Topol таъкидлаганидек, интеллектуал технологияларнинг муҳим вазифаларидан бири шифокор ва бемор ўртасидаги муносабатларни алмаштириш эмас, балки тиббий хизматнинг имкониятларини кенгайтиришдир [3].

2. Сунъий интеллектнинг тиббиётдаги амалий қўлланилиши

2.1. Юрак-қон томир касалликларини прогнозлаш

Юрак-қон томир касалликлари хавфини баҳолашда сунъий интеллект алгоритмлари беморнинг қон босими, холестерин миқдори, юрак уриши, ёши ва бошқа клиник кўрсаткичларини биргаликда таҳлил қилиши мумкин. Бу орқали юқори хавфга эга беморларни эртароқ аниқлаш ва профилактик чораларни режалаштириш имконияти пайдо бўлади.

Электрокардиограмма (ЭКГ) маълумотларини автоматик таҳлил қилиш тизимлари юрак ритми бузилишларини аниқлашга ёрдам бериши мумкин. Бироқ бундай моделларни турли ёшдаги беморлар ва турли клиник шароитларда текшириш, натижаларнинг аниқлиги ва ишончлилигини баҳолаш талаб этилади.

2.2. Дори воситаларини тадқиқ этиш

Дори воситаларини яратиш узоқ вақт, катта молиявий ресурслар ва кўп босқичли тадқиқотларни талаб қилади. Сунъий интеллект молекулаларнинг хусусиятларини прогнозлаш, эҳтимолий биологик фаолликни баҳолаш,

номзод бирикмаларни саралаш ва тадқиқотлар учун истиқболли йўналишларни белгилашда қўлланилади.

Масалан, машинали ўқитиш усуллари молекуляр тузилиш ва биологик фаоллик ўртасидаги боғланишларни ўрганиши мумкин. Эван ва бошқа тадқиқотчилар ишлаб чиққан AlphaFold тизими оқсилларнинг уч ўлчамли тузилишини прогнозлаш соҳасида муҳим илмий натижалардан бири ҳисобланади [4].

Шунга қарамай, компьютер модели берган прогноз дори воситасининг инсон организмида хавфсиз ва самарали бўлишини ўз-ўзидан кафолатламайди. Лаборатория, клиник олди ва клиник тадқиқотлар ҳамда тегишли регулятор баҳолашлар зарурлигича қолади.

2.3. Телетиббиёт ва беморларни масофадан мониторинг қилиш

Телетиббиётда сунъий интеллект беморларнинг масофадан олинган маълумотларини таҳлил қилиш учун ишлатилиши мумкин. Ақлли соатлар, пульсоксиметрлар, қон босимини ўлчаш қурилмалари ва бошқа сенсорлар орқали олинган кўрсаткичлар муайян шартлар асосида қайта ишланади.

Бу технологиялар сурункали касалликларга чалинган беморларни кузатиш, саломатликдаги ўзгаришларни ўз вақтида пайқаш ва шифокор билан масофавий мулоқотни ташкил этишда фойдали бўлиши мумкин.

Масалан, қандли диабетда глюкоза даражасига оид маълумотларни таҳлил қилиш, юрак касалликларида физиологик кўрсаткичларни кузатиш ва беморнинг даволаш режимига риоя этишини баҳолаш мумкин. Аммо қурилмалардаги хатолар, интернет алоқасининг узилиши ёки маълумотларнинг нотўлиқлиги нотўғри хулосаларга олиб келиши эҳтимоли бор.

2.4. Электрон тиббий карталар билан интеграция

Электрон тиббий карталар беморнинг ташхислари, таҳлил натижалари, даволаш тарихи ва дори воситалари ҳақидаги маълумотларни сақлайди. Сунъий интеллект ушбу маълумотлардан фойдаланиб, касаллик хавфини баҳолаш, такрорий мурожаатлар эҳтимолини прогнозлаш ва клиник жараёнларни ташкил этишга ёрдам бериши мумкин.

Бироқ маълумотларнинг стандартлаштирилмаганлиги, турли ахборот тизимларининг ўзаро мос келмаслиги ва шахсий тиббий маълумотларни ҳимоя қилиш масалалари бундай интеграциянинг муҳим муаммолари ҳисобланади.

3. Тиббиётда сунъий интеллектдан фойдаланишнинг афзалликлари ва муаммолари

Сунъий интеллект технологияларининг тиббиётда қўлланилиши бир қатор афзалликларга эга. Биринчидан, катта ҳажмдаги маълумотларни тез қайта ишлаш имконини беради. Иккинчидан, тиббий тасвирлар ва клиник кўрсаткичларда инсон кўзи билан пайқаш қийин бўлган қонуниятларни аниқлашга кўмаклашади. Учинчидан, такрорий вазифаларни автоматлаштириш орқали тиббиёт ходимларининг иш вақтини тежаши мумкин.

Шу билан бирга, технологияни жорий этишда қуйидаги муаммолар мавжуд:

1. **Маълумотлар сифати.** Нотўлиқ ёки хатоли маълумотларда ўқитилган алгоритмлар ишончсиз натижалар бериши мумкин.
2. **Алгоритмик нохолислик.** Ўқитиш маълумотлари муайян аҳоли гуруҳларини етарлича қамраб олмаса, тизим айрим беморлар учун камроқ аниқ натижа кўрсатиши мумкин.
3. **Махфийлик ва ахборот хавфсизлиги.** Тиббий маълумотларни рухсатсиз олиш, тарқатиш ёки улардан мақсадсиз фойдаланиш хавфи мавжуд.
4. **Изоҳланувчанлик.** Айрим мураккаб моделлар нима сабабдан муайян натижага келганини тушунтиришда қийинчилик туғдиради.
5. **Касбий масъулият.** Сунъий интеллект тавсияси хатоли бўлган ҳолатда клиник қарорни қабул қилиш ва назорат қилиш тартиби аниқ белгиланиши лозим.

WHO сунъий интеллектни соғлиқни сақлашда жорий этишда инсон мустақиллиги, хавфсизлик, шаффофлик, масъулият ва тенглик тамойилларини таъминлаш зарурлигини таъкидлайди [1]. Шу сабабли сунъий интеллект шифокорнинг касбий билим ва тажрибасини тўлдирувчи восита сифатида қаралиши керак.

4. Ўзбекистон тиббиётида сунъий интеллектни жорий этиш истиқболлари

Ўзбекистонда соғлиқни сақлаш тизимини рақамлаштириш жараёнида сунъий интеллектдан фойдаланиш тиббий хизматлар сифатини ошириш, ҳудудлар ўртасидаги имкониятлар фарқини камайтириш ва тиббий маълумотларни таҳлил қилиш самарадорлигини кучайтиришга хизмат қилиши мумкин.

Ушбу йўналишда қуйидаги вазифаларга эътибор қаратиш мақсадга мувофиқ:

- электрон тиббий карталар ва тиббий ахборот тизимларини ягона стандартлар асосида интеграция қилиш;
- ўзбек ва рус тилларида ишлайдиган тиббий ахборот воситаларини ривожлантириш;
- маҳаллий аҳолининг клиник маълумотлари асосида моделларни ишлаб чиқиш ва мустақил клиник текширувдан ўтказиш;
- тиббиёт ходимларининг сунъий интеллект ва маълумотлар таҳлили бўйича рақамли компетенцияларини ривожлантириш;
- шахсий маълумотларни ҳимоя қилиш, алгоритмларни текшириш ва тиббий хавфларни бошқариш механизмларини такомиллаштириш.

Тиббиёт олий таълим муассасаларида сунъий интеллект, биостатистика, биоинформатика ва математик моделлаштириш фанларини ўзаро интеграциялаш ҳам муҳим аҳамиятга эга. Бундай ёндашув бўлажак шифокорларга рақамли технологияларни тушуниш, уларнинг натижаларини

танқидий баҳолаш ва клиник амалиётда хавфсиз қўллаш кўникмаларини шакллантиришга ёрдам беради.

Сунъий интеллект тизимларини жорий этишдан олдин уларнинг аниқлиги, сезгирлиги, спецификлиги, турли беморлар гуруҳларидаги ишлаш хусусиятлари ва клиник жараёнларга таъсири баҳоланиши лозим. Технологиянинг самарадорлиги фақат алгоритмнинг техник кўрсаткичлари билан эмас, балки беморлар учун ҳақиқий фойдаси билан ҳам ўлчаниши керак.

Хулоса

Тиббиётда сунъий интеллектдан фойдаланиш диагностика, клиник қарорларни қўллаб-қувватлаш, дори воситаларини тадқиқ этиш, телетиббиёт ва электрон тиббий маълумотларни таҳлил қилиш соҳаларида янги имкониятларни яратмоқда. У катта ҳажмдаги ахборотни тез қайта ишлаш, касаллик хавфини прогнозлаш ва тиббий хизматларни индивидуаллаштиришга ёрдам бериши мумкин.

Бироқ сунъий интеллектнинг натижалари маълумотлар сифати, алгоритмнинг ишончлилиги, клиник шароит ва инсон назоратига боғлиқ. Шунинг учун уни тиббиётга жорий этиш илмий асосланган текширув, ахлоқий талаблар, ахборот хавфсизлиги ва аниқ белгиланган касбий масъулият билан бирга амалга оширилиши зарур.

Ўзбекистонда ушбу технологияларни самарали ривожлантириш учун рақамли инфратузилмани такомиллаштириш, маҳаллий тиббий маълумотлар базаларини шакллантириш, мутахассисларни тайёрлаш ва илмий-тадқиқот ишларини кенгайтириш мақсадга мувофиқ. Энг муҳим жиҳат шундаки, сунъий интеллект шифокорни алмаштирувчи эмас, балки унинг билим ва имкониятларини кенгайтирувчи, бемор хавфсизлиги ва тиббий хизмат сифатини оширишга хизмат қилувчи восита бўлиши керак.

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Тухтаев Х.Т.
преподаватель кафедры педагогики и социальной работы
Термезский государственный университет
Узбекистан, г. Термез

ОТ НАЦИОНАЛЬНОЙ ЦЕННОСТИ К НРАВСТВЕННОМУ ПОСТУПКУ: СИТУАЦИОННО-РЕФЛЕКСИВНАЯ МОДЕЛЬ ВОСПИТАНИЯ МЛАДШИХ ШКОЛЬНИКОВ

Аннотация. Актуальность связана с переходом от знания ценности к нравственному поступку. Цель — обосновать ситуационно-рефлексивную модель. Использованы теоретический анализ и структурное моделирование. Результат — схема «ситуация — выбор — действие — рефлексия».

Ключевые слова: нравственное воспитание, национальные ценности, младший школьник, нравственный выбор, рефлексия, проектная вовлечённость.

Tokhtaev H.T.
lecturer
Department of Pedagogy and Social Work
Termez State University
Uzbekistan, Termez

FROM NATIONAL VALUE TO MORAL ACTION: A SITUATIONAL-REFLECTIVE MODEL OF PRIMARY SCHOOL EDUCATION

Abstract. The study addresses the transition from value knowledge to moral action. The aim is to substantiate a situational-reflective model. The methods are theoretical analysis and structural modelling. The result is a situation-choice-action-reflection scheme.

Keywords: moral education, national values, primary school, moral choice, reflection, project engagement.

Введение

Исследования Х. Т. Тухтаева раскрывают воспитательный потенциал национальных ценностей, духовного наследия и сотрудничества в начальной школе [10–13]. Психолого-педагогические работы А. Т. Абдурахмановой позволяют учитывать адаптационные, защитные, креативные и вовлечённостные механизмы образовательной деятельности [1–6]. Народная педагогика, устное культурное наследие и менталитет задают контекст интерпретации нравственной нормы [7–9]. Цель исследования — уточнить механизм перехода от знания нормы к самостоятельному нравственному поступку младшего школьника.

Методы и исследования

Проведены теоретический анализ, сравнительное сопоставление педагогических подходов и структурное моделирование ситуационно-рефлексивного цикла. Анализировались способы перехода от ценностного знания к выбору, действию и переносу нормы в новую ситуацию; эмпирические причинные эффекты в рамках статьи не заявляются.

Результаты исследования

Модель включает четыре шага: нравственная ситуация, сопоставление вариантов, действие и рефлексия. Национальный материал используется как задача выбора, а не как готовая декларация. Формальное участие необходимо отличать от смысловой включённости [3; 5; 6], а психологически безопасное обсуждение должно учитывать адаптационные и защитные реакции ребёнка [1; 2].

Ценностная рамка и культурный контекст

Национальная ценность в педагогическом анализе должна рассматриваться не только как содержание воспитания, но и как культурно интерпретируемая норма. Важно различать устойчивое нравственное ядро и конкретную историко-бытовую форму его выражения. Исследования народной педагогики показывают воспитательный потенциал национальных ценностей и устного творчества [7; 8], а междисциплинарная трактовка менталитета подчёркивает роль устойчивых способов восприятия и коллективных представлений [9].

Педагогический смысл национального материала проявляется тогда, когда традиционная норма соотносится с современной образовательной ситуацией. Сопоставление с исследованиями Х. Т. Тухтаева и Х. Б. Бердиевой показывает продуктивность соединения ценностного содержания, социального контекста и самостоятельной позиции ребёнка [10; 13–15]. Поэтому педагог должен сохранять гуманистический смысл традиции, но проверять форму её применения на соответствие возрасту, достоинству и правам ребёнка.



Рисунок 1. Ситуационно-рефлексивный цикл перехода от ценности к поступку

Операционализация перехода от нормы к поступку

Переход от знания нормы к действию операционализируется через три уровня. На уровне распознавания ребёнок выделяет участников ситуации и возможные последствия; на уровне выбора сопоставляет альтернативы и объясняет решение; на уровне переноса применяет ценность в новом контексте. Такая последовательность позволяет отличить воспроизведение ожидаемого ответа от устойчивой нравственной ориентации. Интеллектуально вариативные задания поддерживают самостоятельность суждения [4].

На уровне выбора он сопоставляет альтернативы и объясняет решение. На уровне переноса он применяет ценность в новом контексте, который не совпадает с исходным примером. Такая последовательность позволяет отличить воспроизведение ожидаемого ответа от устойчивой нравственной ориентации. Проектные мини-задачи целесообразно использовать только после анализа ситуации: иначе активность может остаться внешней и формальной [7; 9; 10].

Диагностическая модель результата

Для последующей проверки результата предлагаются четыре диагностических окна: понимание моральной коллизии; аргументированность выбора; способность учитывать интересы другого; перенос нормы в новую ситуацию. Эти показатели фиксируют не формальное знание правил, а последовательность понимания, решения и действия.

Наблюдение дополняется короткими моральными дилеммами, незаконченными историями и индивидуальной рефлексией после совместной работы. Важно оценивать динамику конкретного поведения, а не присваивать ребёнку устойчивую характеристику. Такой подход согласуется с необходимостью учитывать адаптационные и защитные реакции [5; 6].

Третий риск возникает при использовании проектной формы. Совместное задание может внешне выглядеть активным, но скрывать неравномерность участия и зависимость части учащихся от более инициативных сверстников. Поэтому мини-проект должен включать индивидуально наблюдаемый вклад: сформулированное решение, короткий рефлексивный комментарий, объяснение своей роли или пример переноса ценности в новую ситуацию. Такой подход согласуется с различением формального участия и содержательной вовлечённости в образовательной деятельности [3; 5; 6].

Второй риск связан с подменой рефлексии оцениванием личности. Даже правильно организованная моральная дилемма теряет развивающий смысл, если ответ ребёнка становится основанием для публичного ярлыка или сравнения с другими детьми. Исследования адаптационных трудностей и психологических защит показывают, что давление и угроза самооценке способны усиливать формальное согласие, избегание или сопротивление [1; 2]. В предлагаемой модели оцениваются аргументация, учёт последствий и

способность пересмотреть решение, а не «нравственность ребёнка» как фиксированное свойство.

Использование национально-культурного материала требует различать воспитательный потенциал традиции и некритичное воспроизведение исторически сложившейся нормы. Педагогическая ценность материала определяется не его «традиционностью» как таковой, а тем, помогает ли он ребёнку понять нравственную ситуацию, увидеть позицию другого и сделать обоснованный выбор. Поэтому модель не предполагает предъявления единственно допустимой культурной интерпретации. Учитель задаёт рамку уважительного обсуждения, но оставляет пространство для аргументированной позиции ученика [7–9].

Этические границы и педагогические риски применения модели

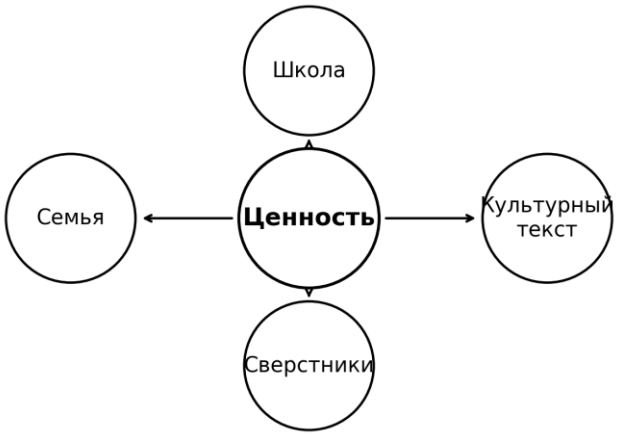


Рисунок 2. Контексты повторного переноса нравственной ценности

Обсуждение и практическое применение

Расширенная модель показывает, что национальный материал выполняет три разные функции: смысловую, ситуационную и коммуникативную. Смысловая функция раскрывает ценность; ситуационная создаёт пространство выбора; коммуникативная позволяет ребёнку обсуждать альтернативы и слышать позицию другого.

Практически это означает, что одна пословица, рассказ или семейная история не должны завершаться готовой моралью учителя. Более продуктивна цепочка вопросов: что произошло, кому было трудно, какие решения возможны, почему одно из них ответственнее, как похожая ситуация может возникнуть в классе или семье. В таком формате культурная традиция становится источником самостоятельного нравственного суждения, а не только материалом для запоминания.

Возрастная дифференциация модели

Для практического применения модель необходимо соотнести с возрастом младших школьников. В 7–8 лет нравственная ситуация должна

быть короткой, конкретной и опираться на видимые последствия: помощь, справедливое распределение, соблюдение обещания, заботу о другом.

В 9–10 лет можно вводить ситуации с конкурирующими основаниями, где оба варианта имеют понятные аргументы. Например, ребёнок выбирает между личным удобством и ответственностью перед группой. Такое усложнение позволяет постепенно переходить от узнавания нормы к самостоятельной аргументации, не перегружая ученика абстрактными категориями.

Методическая последовательность занятия

В структуре одного занятия целесообразны четыре микроэтапа: актуализация опыта, предъявление культурного текста, обсуждение нравственной коллизии и перенос в новую ситуацию. Национальная пословица или короткий рассказ включаются после вопроса, а не вместо него.

Это принципиально: если учитель сначала сообщает готовую мораль, ребёнок скорее воспроизводит её, чем анализирует. Завершающая рефлексия может занимать две–три минуты и фиксировать не «правильность личности», а то, что изменилось в понимании ситуации. Такая технология делает воспитательный результат наблюдаемым и снижает риск назидательного формализма.

Эмпирическая проверка модели

Предлагаемую модель целесообразно апробировать в двух взаимодополняющих форматах. Первый — серия коротких моральных дилемм до и после цикла занятий, где оценивается не совпадение с ожидаемым ответом, а полнота аргументации и учёт последствий. Второй — наблюдение в совместной деятельности с заранее заданными поведенческими индикаторами: принятие ответственности, помощь партнёру, способность объяснить выбор и исправить последствия собственного действия. Такое сочетание позволяет сопоставить словесное нравственное суждение и реальное поведение, не сводя воспитанность к дисциплинированности.

Заключение

Модель связывает культурное содержание с самостоятельным решением ребёнка и пригодна для урока, семейного задания и мини-проекта. Следующий этап — эмпирическая проверка её показателей.

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Утамурадова М.
магистрант
Каракалпакский государственный университет имени Бердаха
Республика Узбекистан

ВЛИЯНИЕ БИОПРЕПАРАТА АЛЬБИТ НА АГРОХИМИЧЕСКИЕ И БИОЛОГИЧЕСКИЕ СВОЙСТВА ЗАСОЛЕННЫХ ПОЧВ И ПРОДУКТИВНОСТЬ РАСТЕНИЙ В УСЛОВИЯХ ЮЖНОГО ПРИАРАЛЬЯ

Аннотация. Статья посвящена оценке влияния биопрепарата Альбит на агрохимические и биологические свойства засоленных почв и продуктивность растений в условиях Южного Приаралья. Засоление почв существенно ограничивает рост и урожайность сельскохозяйственных культур, ухудшая свойства почвы и состояние ризосферы. В работе предусматривается определение pH, электропроводности, содержания солей и элементов питания, активности почвенной микрофлоры, а также всхожести, биомассы и урожайности растений. Предполагается, что применение Альбита повысит устойчивость растений к солевому стрессу, улучшит развитие корневой системы и активизирует биологические процессы в ризосфере.

Ключевые слова: Альбит, засоленные почвы, Южное Приаралье, ризосфера, солевой стресс, продуктивность.

Utamuradova M.
master's student
Berdakh Karakalpak State University
Republic of Uzbekistan

THE EFFECT OF THE BIOPREPARATION ALBIT ON THE AGROCHEMICAL AND BIOLOGICAL PROPERTIES OF SALINE SOILS AND PLANT PRODUCTIVITY IN THE SOUTHERN ARAL SEA REGION

Abstract. This article evaluates the impact of the biopreparation Albit on the agrochemical and biological properties of saline soils and on plant productivity in the Southern Aral Sea region. Soil salinity significantly limits crop growth and yield by degrading soil properties and the condition of the rhizosphere. The study involves determining pH, electrical conductivity, salt and nutrient content, and soil microflora activity, as well as assessing seed germination, biomass, and plant yield. It is hypothesized that the application of Albit will enhance plant tolerance to salt stress, improve root system development, and stimulate biological processes within the rhizosphere.

Keywords: Albit, saline soils, Southern Aral Sea region, rhizosphere, salt stress, productivity.

Введение

Южное Приаралье характеризуется аридным климатом, дефицитом водных ресурсов и широким распространением засолённых почв. Засоление, связанное с интенсивным испарением, минерализацией вод и недостаточной дренированностью, нарушает водно-минеральный обмен растений, снижает доступность питательных элементов и продуктивность.

Одновременно ухудшается биологическое состояние почвы, в том числе снижается активность микроорганизмов, участвующих в трансформации органического вещества, азота и фосфора. Поэтому эффективность биопрепаратов целесообразно оценивать в системе «почва–микроорганизмы–растение». Одним из перспективных средств является Альбит, обладающий ростостимулирующим и антистрессовым действием. Цель исследования — оценить его влияние на агрохимические и биологические свойства засолённых почв, рост и продуктивность растений в условиях Южного Приаралья.

Материалы и методы

Исследования предполагается проводить на орошаемых засолённых почвах Республики Каракалпакстан с использованием сельскохозяйственных, лекарственных и дикорастущих растений Южного Приаралья. До закладки опыта необходимо определить исходные агрохимические показатели почвы: содержание солей, pH, электропроводность, гумус и доступные формы элементов питания. Схема опыта включает контроль без Альбита, предпосевную обработку семян, обработку растений в период вегетации и их сочетание. Опыт рекомендуется проводить в четырёхкратной повторности при одинаковой агротехнике. В почве планируется определить основные показатели засоления, содержание азота, фосфора и калия, а биологическое состояние оценить по численности основных групп микроорганизмов.

У растений будут учитываться всхожесть, высота, развитие корневой системы, биомасса, сохранность и продуктивность. Статистическую обработку данных следует проводить с использованием дисперсионного и корреляционного анализа при $p < 0,05$.

Результаты и обсуждение

Предполагается, что действие Альбита будет проявляться прежде всего через повышение устойчивости растений к солевому стрессу, а не через непосредственное снижение содержания солей в почве. Электропроводность и общая степень засоления в большей мере определяются качеством оросительной воды, уровнем и минерализацией грунтовых вод, состоянием дренажной системы и общим водно-солевым режимом территории. Поэтому Альбит следует рассматривать как дополнительный биологический фактор, способствующий повышению адаптивности растений и поддержанию их физиологической активности в неблагоприятных почвенных условиях. Его

применение потенциально может уменьшать отрицательное влияние осмотического и ионного стресса, способствовать сохранению водного баланса и поддержанию метаболических процессов растений.

Ожидается, что применение препарата будет положительно влиять на развитие корневой системы, поглощение элементов минерального питания и накопление надземной и корневой биомассы. Формирование более развитой корневой системы может обеспечивать освоение большего объёма почвы и способствовать более эффективному использованию доступных форм азота, фосфора и калия. При этом возможный эффект Альбита целесообразно оценивать не только по биометрическим показателям растений, но и по изменениям физиологического состояния, включая содержание хлорофилла, водоудерживающую способность тканей и интенсивность накопления сухого вещества. Это позволит более полно охарактеризовать адаптивную реакцию растений на сочетанное действие препарата и засоления.

Положительное влияние может также проявляться в ризосфере. Предполагается увеличение численности и активности аммонифицирующих, азотфиксирующих и фосфатмобилизующих микроорганизмов, участвующих в трансформации органического вещества и элементов питания. Возможная активизация микробиологических процессов способна улучшать условия минерального питания растений и поддерживать функциональное состояние почвенной системы. Поэтому совместная оценка агрохимических и микробиологических показателей позволит установить, сопровождается ли улучшение роста растений изменениями биологической активности засоленной почвы.

Наиболее выраженная реакция может наблюдаться на ранних этапах онтогенеза, когда солевой стресс особенно сильно влияет на набухание и прорастание семян, формирование первичных корней и появление всходов. Предпосевная обработка семян Альбитом потенциально способна повышать энергию прорастания, полевую всхожесть и сохранность растений. Последующая обработка в период вегетации может поддерживать ростовые процессы, формирование листового аппарата и накопление биомассы в наиболее чувствительные фазы развития. При использовании лекарственных и дикорастущих растений дополнительный интерес представляет оценка не только их роста, но и накопления биологически активных веществ, поскольку стрессовые условия способны изменять вторичный метаболизм растений.

В зависимости от вида исследуемого растения конечный эффект препарата может проявляться по-разному. У зерновых сельскохозяйственных культур ожидаемый результат может выражаться в увеличении числа продуктивных стеблей, количества и массы зерна, массы 1000 зёрен и общей урожайности. У лекарственных растений целесообразно дополнительно оценивать массу лекарственного сырья, развитие корней или надземной части и содержание основных биологически активных соединений. Для дикорастущих видов наиболее информативными показателями могут быть

всхожесть, выживаемость, прирост биомассы, развитие корневой системы и способность сохранять жизнеспособность при повышенной солевой нагрузке.

Особый интерес представляет оценка действия Альбита при различной степени засоления. Предполагается, что наибольшая эффективность препарата будет проявляться при слабом и среднем засолении, тогда как при сильном солевом стрессе его действие может снижаться.

Заключение

Применение Альбита перспективно для повышения устойчивости растений на засолённых почвах Южного Приаралья. Его действие может проявляться в улучшении физиологического состояния растений, развитии корневой системы и активизации процессов в ризосфере. Эффективность препарата следует оценивать по агрохимическим, микробиологическим и продукционным показателям, рассматривая Альбит как элемент экологически ориентированной технологии земледелия.

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Фозилов В.Э.
магистрант 1-го курса программы MBA
Тухтаев Б.
преподаватель факультета SBL
Университет Инха в Ташкенте

РАЗРАБОТКА ВЫСОКОКАЧЕСТВЕННЫХ ЛОГИСТИЧЕСКИХ СИСТЕМ

Аннотация. В современных условиях цифровизации экономики логистические системы становятся одним из ключевых факторов обеспечения конкурентоспособности предприятий. Эффективное управление материальными, информационными и финансовыми потоками позволяет значительно сократить логистические издержки, повысить качество обслуживания клиентов и обеспечить устойчивое развитие бизнеса. В статье рассмотрены современные подходы к разработке высококачественных логистических систем, основанные на применении цифровых технологий, искусственного интеллекта, Интернета вещей, систем управления ресурсами предприятия и интеллектуального анализа данных. Представлены основные направления совершенствования логистической деятельности предприятий, а также предложены практические рекомендации по повышению эффективности управления цепями поставок.

Ключевые слова: логистическая система, цифровая логистика, управление цепями поставок, бизнес-процессы, искусственный интеллект, Интернет вещей, ERP, WMS, TMS.

Fozilov V.E.
first-year master's student, MBA programme
Tukhtaev B.
lecturer, SBL Faculty
Inha University in Tashkent

DEVELOPMENT OF HIGH-QUALITY LOGISTICS SYSTEMS

Abstract. In today's digitalized economy, logistics systems are becoming a key factor in ensuring enterprise competitiveness. Effective management of material, information, and financial flows significantly reduces logistics costs, improves customer service, and ensures sustainable business development. This article examines modern approaches to developing high-quality logistics systems based on digital technologies, artificial intelligence, the Internet of Things, enterprise resource planning systems, and data mining. It presents key areas for improving enterprise logistics operations and offers practical recommendations for increasing the efficiency of supply chain management.

Keywords: logistics system, digital logistics, supply chain management, business processes, artificial intelligence, Internet of Things, ERP, WMS, TMS.

Введение. Современная мировая экономика характеризуется высокой степенью глобализации, быстрым развитием цифровых технологий и усилением конкуренции между предприятиями. В этих условиях логистика становится не только инструментом организации транспортировки продукции, но и важнейшим элементом стратегического управления бизнесом. Эффективная логистическая система обеспечивает бесперебойное движение материальных, информационных и финансовых потоков, снижает совокупные затраты и способствует повышению уровня удовлетворенности потребителей. Развитие электронной коммерции, международной торговли и цифровых платформ предъявляет новые требования к качеству логистических услуг. Клиенты ожидают высокой скорости доставки, прозрачности операций, точного отслеживания заказов и гибкости логистических процессов. Это требует внедрения современных цифровых решений, автоматизации операций и использования интеллектуальных методов управления. Разработка высококачественных логистических систем является одним из приоритетных направлений развития предприятий различных отраслей экономики. Современные логистические системы должны обладать высокой адаптивностью, надежностью, устойчивостью к внешним рискам и способностью эффективно функционировать в условиях быстро изменяющейся рыночной среды.

Обзор научной литературы. Исследованию проблем развития логистических систем посвящены работы многих отечественных и зарубежных ученых. Значительный вклад в развитие современной теории логистики внесли Д. Бауэрсокс, М. Кристофер, С. Чопра, В. И. Сергеев и А. М. Гаджинский. В их исследованиях рассматриваются вопросы управления цепями поставок, оптимизации транспортных процессов, управления запасами и цифровизации логистических операций. Современные исследования показывают, что внедрение цифровых технологий существенно повышает эффективность логистических процессов. Использование ERP-систем позволяет интегрировать деятельность различных подразделений предприятия в единую информационную среду. Системы WMS автоматизируют управление складскими операциями, обеспечивая точный учет товарных запасов и сокращение времени обработки заказов. Системы TMS позволяют оптимизировать транспортные маршруты, минимизировать затраты на перевозки и повысить эффективность использования транспортных средств. В последние годы большое внимание уделяется применению технологий искусственного интеллекта и машинного обучения. Эти технологии позволяют прогнозировать спрос, анализировать большие объемы данных, автоматизировать принятие управленческих решений и своевременно выявлять потенциальные риски в цепях поставок.

Методология исследования. В ходе исследования использованы методы системного анализа, сравнительного анализа, экономико-статистического анализа, моделирования бизнес-процессов и анализа научной литературы. Для оценки эффективности логистических систем рассмотрены современные подходы к управлению цепями поставок, транспортной логистикой и складской инфраструктурой. Основными критериями оценки качества логистической системы являются: - сокращение времени доставки продукции; - снижение совокупных логистических затрат; - повышение точности выполнения заказов; - оптимизация уровня запасов; - увеличение производительности складских операций; - повышение качества обслуживания клиентов; - устойчивость логистической сети к внешним рискам. Комплексное применение перечисленных критериев позволяет объективно оценить эффективность функционирования логистической системы и определить направления ее дальнейшего совершенствования.

Результаты исследования и их обсуждение. Разработка высококачественной логистической системы требует комплексного подхода, объединяющего организационные, экономические и информационные компоненты. В современных условиях эффективность логистики определяется не только скоростью доставки продукции, но и способностью предприятия оперативно реагировать на изменения рыночной среды. Одним из ключевых факторов повышения качества логистической системы является цифровая трансформация бизнес-процессов. Использование цифровых платформ обеспечивает прозрачность движения материальных потоков, позволяет контролировать выполнение заказов в режиме реального времени и значительно сокращает время принятия управленческих решений. Важную роль играет внедрение систем управления ресурсами предприятия (ERP), систем управления складом (WMS) и систем управления транспортом (TMS). Интеграция этих информационных решений способствует формированию единого информационного пространства предприятия, повышает точность учета ресурсов и снижает вероятность возникновения ошибок при выполнении логистических операций.

Основные направления совершенствования логистических систем. На основе проведенного анализа можно выделить следующие направления повышения эффективности логистических систем:

- цифровизация всех этапов цепи поставок;
- автоматизация складских процессов;
- внедрение интеллектуальных транспортных систем;
- использование искусственного интеллекта для прогнозирования спроса;
- применение технологий Интернета вещей (IoT) для мониторинга грузов;
- использование аналитики больших данных (Big Data) при принятии управленческих решений;
- совершенствование системы управления запасами;
- оптимизация транспортных маршрутов;

- повышение уровня информационной безопасности логистических процессов.

Реализация указанных мероприятий позволяет значительно сократить логистические затраты и повысить конкурентоспособность предприятий.

Экономическая эффективность внедрения цифровых технологий. Практика показывает, что применение современных цифровых технологий обеспечивает значительное повышение эффективности логистических процессов.

Таблица-1.
Влияние цифровизации на показатели логистической деятельности

Показатель	**До внедрения**	**После внедрения**
Среднее время обработки заказа	24 часа	10 часов
Точность выполнения заказов	91 %	98 %
Логистические затраты	100 %	82 %
Производительность склада	100 %	130 %
Уровень удовлетворенности клиентов	84 %	96 %

Полученные результаты свидетельствуют о том, что цифровизация логистических процессов способствует сокращению времени выполнения операций, уменьшению затрат и повышению качества обслуживания клиентов.

Использование искусственного интеллекта в логистике. Современные технологии искусственного интеллекта становятся одним из наиболее перспективных инструментов развития логистических систем. Алгоритмы машинного обучения позволяют анализировать большие массивы данных, прогнозировать спрос на продукцию, автоматически распределять транспортные ресурсы и оптимизировать маршруты доставки. Кроме того, интеллектуальные системы способны выявлять потенциальные риски в цепях поставок, прогнозировать возможные задержки и предлагать наиболее эффективные варианты решения возникающих проблем. Это особенно важно для международной логистики, где влияние внешних факторов значительно выше.

Перспективы развития логистических систем. В ближайшие годы развитие логистики будет определяться дальнейшей интеграцией цифровых технологий. Наиболее перспективными направлениями являются:

- роботизация складских комплексов;
- автономный транспорт;
- цифровые двойники логистических процессов;
- блокчейн для обеспечения прозрачности цепей поставок;
- применение технологий 5G для обмена данными в режиме реального времени;

- развитие экологически устойчивой («зеленой») логистики.

Использование данных технологий позволит предприятиям существенно повысить скорость выполнения операций, снизить уровень логистических рисков и обеспечить устойчивое развитие бизнеса в условиях высокой конкуренции.

Заключение. Проведенное исследование показало, что разработка высококачественных логистических систем является одним из ключевых факторов повышения эффективности деятельности современных предприятий. В условиях цифровой трансформации экономики логистика перестает выполнять исключительно транспортные функции и становится важнейшим элементом стратегического управления бизнесом. Анализ современных научных исследований и практического опыта ведущих компаний показал, что внедрение цифровых технологий, таких как ERP, WMS, TMS, искусственный интеллект, Интернет вещей и аналитика больших данных, способствует повышению прозрачности логистических процессов, сокращению времени выполнения операций и снижению совокупных логистических затрат. Особое значение имеет интеграция всех участников цепи поставок в единое информационное пространство. Такой подход позволяет обеспечить оперативный обмен информацией, повысить точность прогнозирования спроса, улучшить управление запасами и минимизировать риски, связанные с перебоями в поставках. Одним из перспективных направлений дальнейшего развития является внедрение интеллектуальных систем поддержки принятия решений, роботизированных складских комплексов, цифровых двойников логистических процессов и технологий блокчейн. Их применение способствует повышению устойчивости логистических систем, улучшению качества обслуживания клиентов и укреплению конкурентных преимуществ предприятий. Таким образом, формирование высококачественных логистических систем должно рассматриваться как непрерывный процесс совершенствования организационных, технологических и информационных решений. Комплексное применение современных методов управления логистикой позволяет обеспечить устойчивое развитие предприятий, повысить эффективность использования ресурсов и создать условия для долгосрочного экономического роста Республики Узбекистан.

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Хайров Р.З., PhD по педагогическим наукам
доцент кафедры искусствоведения
Гулистанский государственный педагогический институт
Республика Узбекистан
ORCID: 0000-0002-4150-3726

ИНТЕГРАЦИЯ ЖИВОПИСИ И ЛИТЕРАТУРЫ КАК СРЕДСТВО РАЗВИТИЯ РЕЧЕВОЙ И КОММУНИКАТИВНОЙ КОМПЕТЕНТНОСТИ СТУДЕНТОВ

Аннотация. В статье рассматриваются педагогические возможности интеграции живописи и литературы в профессиональной подготовке студентов. Особое внимание уделяется развитию речевой и коммуникативной компетентности посредством анализа и интерпретации произведений искусства, в частности импрессионизма. Показано, что сочетание визуального и словесного материала способствует расширению профессионального словаря, развитию связной речи, аргументации, интерпретации и навыков публичного выступления.

Ключевые слова: компетентность, студент, речь, коммуникативность, живопись, произведения, живопись, литература, развитие, интеграция искусств, импрессионизм.

Xayrov R.Z., PhD in Pedagogical Sciences
associate professor
Department of Art History
Gulistan State Pedagogical Institute
Republic of Uzbekistan
ORCID: 0000-0002-4150-3726

INTEGRATION OF PAINTING AND LITERATURE AS A MEANS OF DEVELOPING STUDENTS' SPEECH AND COMMUNICATIVE COMPETENCE

Abstract. This article examines the pedagogical potential of integrating painting and literature into the professional training of university students. Particular attention is given to the development of students' speech and communicative competence through the analysis and interpretation of works of art, with particular emphasis on Impressionism. The study demonstrates that the integration of visual and verbal materials contributes to the expansion of students' professional vocabulary, the development of coherent speech, argumentation and interpretive skills, as well as their ability to communicate ideas effectively in public presentations.

Keywords: competence, university students, speech, communicative competence, painting, works of art, literature, speech development, arts integration, Impressionism.

Введение (Introduction) Современное высшее образование ориентировано не только на передачу студентам системы профессиональных знаний, но и на формирование способности применять эти знания в процессе коммуникации. Особенно важное значение данная задача приобретает при подготовке специалистов художественно-педагогического профиля. Будущий специалист в области изобразительного искусства должен уметь не только воспринимать и анализировать произведение искусства, но и грамотно описывать его, объяснять художественный замысел, аргументировать собственную точку зрения и участвовать в профессиональном обсуждении [1; 4].

Произведение живописи обладает значительным коммуникативным потенциалом. Оно представляет собой визуальный текст, который требует восприятия, анализа и интерпретации [2]. Литература, в свою очередь, предоставляет словесные средства для описания образов, событий, эмоциональных состояний и авторских идей. Поэтому интеграция живописи и литературы может рассматриваться как педагогический ресурс развития речевой и коммуникативной компетентности студентов [6; 7].

Материалы и методы исследования (Materials and Methods). Экспериментальная работа проводилась в феврале-мае 2026 года в Гулистанском государственном педагогическом институте со студентами 3-курса направления «Изобразительное искусство и инженерная графика» группы 32-23 в рамках занятий по дисциплине «История изобразительного искусства».

В основу работы была положена интеграция визуального и словесного материала. При изучении художественных направлений студентам предлагалось не ограничиваться усвоением теоретических сведений, а активно взаимодействовать с произведениями живописи. После знакомства с определённым художественным направлением студенты анализировали произведения, составляли их устное описание, объясняли особенности художественного языка, формулировали собственную интерпретацию и выражали личное отношение к произведению [1; 2]. Такой подход позволял связать зрительное восприятие с развитием словесной деятельности, обогащением профессионального словаря и формированием навыков аргументированного высказывания [4; 8].

Особое место в работе занимало изучение импрессионизма - художественного направления, представители которого стремились передать непосредственное зрительное впечатление от окружающего мира, изменчивость света, цвета и атмосферы [10]. При анализе импрессионистической живописи студенты обращали внимание на особенности цветовых сочетаний, свободную манеру письма,

световоздушную среду, композицию, передачу движения и изменчивого состояния природы [11]. В процессе обсуждения они учились не только видеть художественные особенности произведения, но и переводить зрительные впечатления в последовательное словесное описание [2; 4].

В качестве конкретного примера рассматривалась картина Клода Моне «Прогулка. Дама с зонтиком» (La Promenade, 1875). Произведение представляет собой один из характерных образцов импрессионистической живописи, в котором художник обращается к мотиву прогулки на открытом воздухе. В центре композиции изображена женщина с зонтиком, стоящая на лугу; рядом с ней представлен ребёнок. Фигура женщины воспринимается на фоне светлого голубого неба и облаков, а окружающая растительность образует нижнюю часть композиции. Художник использует свободные и энергичные мазки, позволяющие передать движение воздуха, игру света и ощущение изменчивости природной среды. [11]



Рисунок 1. Клод Моне. «Прогулка. Дама с зонтиком». 1875. National Gallery of Art, Washington.

Особое значение для анализа имеет композиционное построение картины. Фигура женщины с зонтиком занимает значительную часть пространства и визуально связывает верхнюю и нижнюю части произведения. Наклон зонтика, направление движения одежды и положение фигуры создают ощущение лёгкости и динамики. Ребёнок, расположенный в нижней части композиции, дополняет сюжет и усиливает впечатление прогулки как естественного, повседневного события. При этом художник не стремится к детальной прорисовке каждого предмета, а передаёт общее зрительное

впечатление посредством цвета, света и характерной свободной манеры письма [11].

После визуального анализа картины студентам предлагалось ответить на ряд вопросов: кто изображён на картине; какое настроение создаёт произведение; какие цвета преобладают в композиции; каким образом художник передаёт свет и воздух; какую роль играет зонтик в композиции; как художник показывает движение; каким образом расположение фигур влияет на восприятие пространства; какие слова наиболее точно передают атмосферу изображённой сцены?

Следующим этапом становилось словесное описание произведения. Студенты последовательно характеризовали изображённые фигуры, природное окружение, цветовое решение, композицию и эмоциональное состояние произведения. При этом им предлагалось использовать профессиональную художественную лексику: композиция, цветовой контраст, световоздушная среда, цветовая гамма, мазок, пространство, перспектива, динамика, эмоциональная выразительность. Такой вид задания позволял соединить непосредственное зрительное восприятие с формированием профессионального речевого высказывания [7; 34 с.].

Для усиления интеграции живописи и литературы студентам предлагалось представить, что изображённая сцена становится эпизодом литературного произведения. Они составляли небольшие словесные описания пейзажа, придумывали возможный внутренний монолог персонажа или описывали прогулку с позиции наблюдателя [7; 9]. После этого отдельные студенты представляли свои тексты перед аудиторией, а остальные участники обсуждали предложенные интерпретации, задавали вопросы и аргументировали собственное отношение к ним [4; 6].

Такое задание позволяло перейти от визуального наблюдения к созданию собственного словесного образа. Студент не только называл элементы картины, но и устанавливал между ними смысловые связи, выражал эмоциональное отношение, формулировал собственную интерпретацию и обосновывал её конкретными особенностями произведения [2; 4; 8]. Таким образом, произведение живописи становилось исходным материалом для речевой и коммуникативной деятельности [6].

В качестве основных методов использовались наблюдение, анализ произведения искусства, беседа, описание, сравнение, дискуссия, самостоятельное устное выступление и рефлексия. Последовательное сочетание визуального восприятия, словесного описания, литературной интерпретации и публичного обсуждения создавало условия для развития речевой и коммуникативной компетентности студентов.

Результаты (Results). На констатирующем этапе исследования была определена исходная динамика учебных результатов студентов. До начала экспериментальной работы 3 студента (10,7%) имели оценку «5», 14 студентов (50,0%) - оценку «4», а 11 студентов (39,3%) - оценку «3».

В процессе формирующего этапа эксперимента применялась методика интеграции произведений живописи и литературных описаний. Студенты осуществляли анализ произведений искусства, определяли их содержание и художественные особенности, раскрывали авторский замысел, характеризовали художественные направления, в частности импрессионизм, а также сопоставляли визуальные образы с литературными описаниями. Особое внимание уделялось развитию профессиональной лексики, связной речи, способности аргументировать собственную точку зрения и участвовать в обсуждении.

Таблица 1. Динамика учебных результатов студентов до и после экспериментального обучения

Уровень учебных результатов	До эксперимента, чел.	До эксперимента, %	После эксперимента, чел.	После эксперимента, %	Изменение
5 Оценка «5»	3	10,7	8	28,6	↑ +5
4 Оценка «4»	14	50,0	15	53,6	↑ +1
3 Оценка «3»	11	39,3	5	17,9	↓ −6
Всего	28	100,0	28	100,0	—

По завершении экспериментальной работы была проведена повторная оценка учебных результатов (Таблица 1). Количество студентов, получивших оценку «5», увеличилось до 8 человек (28,6%), оценку «4» получили 15 студентов (53,6%), а количество студентов с оценкой «3» сократилось до 5 человек (17,9%).

Полученные данные свидетельствуют о положительной динамике учебных результатов студентов. В частности, доля студентов, получивших оценку «5», увеличилась с 10,7% до 28,6%, то есть на 17,9 процентного пункта. Доля студентов с оценкой «4» возросла с 50,0% до 53,6% (+3,6 процентного пункта), тогда как доля студентов с оценкой «3» снизилась с 39,3% до 17,9%, то есть на 21,4 процентного пункта.

В целом количество студентов с оценками «4» и «5» увеличилось с 17 человек (60,7%) до 23 человек (82,1%). Одновременно число студентов, получивших оценку «3», уменьшилось с 11 до 5 человек (Рис.2).



Рисунок 2. Динамика учебных результатов студентов

Таким образом, результаты формирующего этапа показывают изменение распределения учебных результатов в сторону более высоких оценок. В контексте проведённого исследования это позволяет рассматривать интеграцию живописи и литературы как педагогический приём, создающий условия для активизации учебной, речевой и коммуникативной деятельности студентов [1; с. 15-18; 4; с. 28-31; 6; с. 42-45].

Обсуждение (Discussion). Проведённая работа показала, что интеграция произведений живописи и литературного материала позволяет создать естественную ситуацию речевой деятельности. При традиционном изучении истории искусства студент может ограничиться воспроизведением готовой информации о художнике или художественном направлении. При интегрированном подходе ему необходимо самостоятельно сформулировать мысль, подобрать соответствующие слова, последовательно изложить наблюдения и обосновать собственную интерпретацию [4; с. 28; 6; 7].

Особенно эффективным оказался переход от визуального восприятия к словесному описанию. Рассматривая картину, студент сначала определял предметное содержание, затем обращал внимание на цвет, свет, композицию, пространство и эмоциональную выразительность произведения [3; 128 с]. После этого он переходил к словесной характеристике увиденного. Такая последовательность способствовала развитию способности переводить визуальную информацию в речевую форму [2; с. 105].

При изучении импрессионизма студенты описывали особенности художественного метода, анализировали роль света и цвета, сравнивали различные произведения и высказывали собственные суждения. В процессе обсуждения возникала необходимость использовать профессиональную художественную лексику и одновременно строить связное высказывание, понятное другим участникам образовательного процесса.

Литературный материал дополнял визуальное восприятие. Описание природы, человека, эмоционального состояния или события средствами литературы позволяло студентам искать соответствия между словесным и

визуальным образами. Такое сопоставление расширяло возможности интерпретации произведения и стимулировало речевую активность.

Важным результатом стало развитие коммуникативной компетентности. Студенты учились не только говорить о произведении, но и слушать выступления однокурсников, задавать вопросы, уточнять высказанные положения, соглашаться или аргументированно выражать несогласие. Таким образом, анализ произведений искусства превращался в форму профессионального диалога [4; 6; 9]. Следует отметить и развитие самостоятельности студентов. Постепенно увеличивалась роль собственного суждения: студенту предлагалось не воспроизводить готовую интерпретацию, а сформулировать собственное понимание произведения и доказать его посредством конкретных художественных признаков [1, с. 75-78; 2; 8].

Заключение (Conclusion). Интеграция живописи и литературы в образовательном процессе высшей школы обладает значительным педагогическим потенциалом. Проведённая в феврале-мае 2026 года работа со студентами третьего курса направления «Изобразительное искусство и инженерная графика» показала, что анализ произведений живописи в сочетании с литературным материалом может использоваться не только для углубления знаний по истории искусства, но и для развития речевой и коммуникативной компетентности [7; 10].

Особую ценность представляет последовательность «восприятие произведения - анализ - интерпретация - словесное описание - обсуждение - аргументация - рефлексия». Данная модель способствует формированию способности студентов выражать собственные мысли, использовать профессиональную терминологию, участвовать в дискуссии и представлять результаты интеллектуальной деятельности [9; с. 28].

Таким образом, произведение живописи в образовательном процессе может рассматриваться не только как объект художественного изучения, но и как своеобразный визуальный текст, стимулирующий речевую деятельность. Его взаимодействие с литературным материалом создаёт условия для интеграции художественного восприятия, мышления, речи и коммуникации. Для подготовки будущих специалистов это особенно важно, поскольку профессиональная компетентность предполагает не только владение специальными знаниями, но и способность ясно, аргументированно и последовательно представлять их в профессиональном общении.

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Хакимов А.М., PhD
старший преподаватель кафедры философии и религиоведения
Кокандский государственный университет

ФОРМИРОВАНИЕ УБЕЖДЕНИЙ МОЛОДЕЖИ И ФАКТОРЫ ОБЩЕСТВЕННОГО РАЗВИТИЯ В НОВОМ УЗБЕКИСТАНЕ

Аннотация. В данной статье анализируется процесс формирования молодежной веры в Новом Узбекистане и ее роль в развитии общества с социально-философской точки зрения. Подчеркиваются духовное мировоззрение молодежи, их отношение к национальным и универсальным ценностям, влияние образования и социальной среды на формирование веры. Также раскрывается важность укрепления веры молодежи для обеспечения стабильности общества, духовного развития и социальной активности.

Ключевые слова: Молодежная вера, гражданская инициатива, творческая инициатива, твердая жизненная позиция, изменение мировоззрения, культура книгочтения.

Khakimov A.M., PhD
senior lecturer
Department of Philosophy and Religious Studies
Kokand State University

THE FORMATION OF YOUNG PEOPLE'S BELIEFS AND FACTORS OF SOCIAL DEVELOPMENT IN NEW UZBEKISTAN

Abstract. This article analyzes the process of shaping the beliefs of young people in New Uzbekistan and their role in societal development from a socio-philosophical perspective. It highlights the spiritual worldview of the youth, their attitude toward national and universal values, and the influence of education and the social environment on the formation of these beliefs. Furthermore, the article underscores the importance of strengthening the beliefs of young people to ensure social stability, spiritual development, and social engagement.

Keywords: Youth faith, citizen initiative, creative initiative, firm life position, change of worldview, culture of book reading

ВВЕДЕНИЕ

По своей сути общественный прогресс представляет собой непрерывный, многогранный и сложный процесс, в котором человеческий фактор — и, в частности, роль и активное участие молодого поколения — играет ключевую роль в обеспечении устойчивого развития. Молодежь — это важнейшая сила, определяющая стратегический потенциал нации и движущая ее социально-экономический и духовный прогресс; она является будущим народа и носителем его историко-культурного наследия. Развитие знаний, мировоззрения, профессиональных компетенций и творческого потенциала

молодежи служит ключевым фактором формирования долгосрочного будущего общества.

Особенно в современных условиях продвижение новых идей, реализация инновационных инициатив, активное участие молодежи в различных сферах науки, техники, предпринимательства и общественной жизни становятся важным условием развития общества. В этом смысле молодое поколение не только является активным участником существующих социальных отношений, но и выступает в качестве главного субъекта будущих изменений и обновления.

Президент Республики Узбекистан также уделил особое внимание стратегической важности молодежи в развитии страны, отметив, что Стратегия ООН в отношении молодежи признает молодежь одним из важнейших и ценных ресурсов человечества. Согласно этому подходу, инвестиции в потенциал молодежи окажут долгосрочное позитивное влияние не только на их личностное и профессиональное развитие, но и на экономическое, социальное и духовное развитие общества. Ведь инвестиции в образование, воспитание, науку и инновации, направленные на молодежь, будут способствовать увеличению человеческого капитала, повышению социального благополучия и обеспечению устойчивого развития в будущем [1].

МАТЕРИАЛЫ И МЕТОДЫ

Согласно статистике, численность населения мира в возрасте 12-24 лет составляет 1,2 миллиарда человек, или 16% от населения планеты. По прогнозам, к 2030 году их число увеличится еще на 7%, достигнув 1,3 миллиарда.

Не случайно наш Президент Шавкат Мирзиёев в своей речи на Молодежном форуме Узбекистана назвал нашу молодежь «величайшим богатством, бесценным сокровищем Узбекистана». Если мы говорим, что дошкольное и школьное образование, системы высшего и среднего специализированного образования, а также научно-культурные учреждения в нашей стране сегодня являются четырьмя взаимосвязанными звеньями будущего Возрождения, то мы можем рассматривать воспитателей детских садов, школьных учителей, профессоров и научно-творческих деятелей как его четыре столпа. Учитывая, что наша молодежь является создателем Третьего Возрождения, Глава нашего государства отметил, что одной из самых неотложных задач сегодня является «…воспитание молодежи в духе верности Родине, уважения к национальным и универсальным ценностям, широкое вовлечение растущего молодого поколения в науку и инновации, подготовка их к «Новому Узбекистану – к Третьему Возрождению!» эффективной и систематической организации мероприятий, направленных на объединение вокруг лозунга»[2].

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

В нашей стране молодежь составляет значительную часть населения, а именно около двух третей населения. Поэтому, учитывая, что она является

наиболее уязвимым слоем, обеспечение прав, свобод и законных интересов молодежи в нашей стране стало приоритетным направлением государственной политики. Об этом свидетельствует также тот факт, что более 40 законов и подзаконных актов, непосредственно касающихся молодежной политики, были приняты непосредственно по личной инициативе главы государства. В частности, среди наиболее важных направлений государственной политики в отношении молодежи показательным примером нового системного подхода к крайне актуальным вопросам эпохи обновления стало продвижение 5 важных инициатив, включая широкое вовлечение молодежи в культуру, искусство, физическое воспитание и спорт, формирование и развитие навыков и умений использования современных информационных технологий среди молодежи, а также широкое распространение культуры чтения среди молодежи.

Сегодня общество Нового Узбекистана переживает период серьезного обновления, направленного на то, чтобы занять достойное место в мировом сообществе, установить и обеспечить достойный уровень жизни для нашего народа, соизмеримый с его трудом. Одновременно с этим, стремительные изменения в развитии всего мира, интенсификация процессов обновления и развития во всех сферах жизни также подталкивают Новый Узбекистан к быстрому развитию. Это, в свою очередь, напрямую связано с изменениями в убеждениях нашей молодежи. Ведь любые изменения в общественной жизни меняют и убеждения. Поэтому важнейшим фактором в изменении человеческих убеждений являются изменения в социально-экономической жизни.

Как мы уже подчеркивали выше, в первые годы независимости для социально-экономического развития Узбекистана были необходимы серьезные реформы. В основе этих реформ лежал вопрос изменения убеждений наших соотечественников, особенно молодежи.

История показывает, что серьезные реформы требуют разработки конкретной стратегической концепции, основанной на конкретной программе, и ее реализации. В конце концов, как учил в этом отношении сам наш Первый Президент: «...отправной точкой любого процесса реформ является выбор стратегии. Это очень ответственный и сложный аспект. Без общей стратегии и без понимания конечной цели невозможно определить эффективные меры по экономическим реформам»[3].

Следует также отметить, что предусмотренная здесь стратегия, наряду с экономикой страны, социально-духовной и культурной жизнью, предусматривала также формирование молодежи, ее будущего, с качествами, которые правильно понимали бы требования эпохи обновления, были бы готовы использовать свои имеющиеся возможности для ее будущего и бороться с различными внешними и враждебными силами. Поэтому в столь сложное и ответственное время возникла задача разработки стратегической концепции, которая охватывала бы все важные направления развития, необходимые во времени и пространстве. Это потребовало сосредоточения

всего внимания и заботы на этой задаче в то время для формулирования такой стратегии. В конечном счете, умы всех наших соотечественников, и особенно. Тонкое и глубокое понимание этой потребности переходного периода, которое привело к фундаментальным изменениям в убеждениях нашей молодежи, а также создание и формулирование этой стратегии с уникальным талантом были осуществлены нашим первым президентом И. Каримовым и представлены общественности нашей страны. Можно сказать, что эта стратегическая программа по своему содержанию и сути стала уникальным примером нового философского понимания и интерпретации вопросов, связанных с развитием общества. Позже эта программа, получившая популярность среди нашего народа под названием «пять принципов», превратилась в концептуальную программу, состоящую из «узбекской модели развития». Важность этой программы в построении нового типа общества в независимом Узбекистане объясняется её ориентацией на формирование у людей представлений об обществе, его сущности, человеческой жизни и достоинстве, уверенности в завтрашнем дне и современного взгляда на процессы обновления в развитии общества. Это было прежде всего неразрывно связано с устранением условий, связанных с широко распространенным рабством веры в эпоху бывшего Советского Союза, лишением нашего народа его древних корней, таких как язык, культура, духовность и история, под влиянием систематического идеологического давления. Однако в то же время, как подчеркнул в этой связи и наш Президент, отказ от некоторых жестких религиозных убеждений в этом процессе не означает, что наш народ отказывается от своей истории и прошлого. Скорее, такой взгляд по своей сути и содержанию является односторонним. Цель заключалась в том, чтобы правильно осмыслить нововведения в жизни нашего общества на основе формирования всеобъемлющей веры, которая является беспристрастной и объективной.

Конечно, любые фундаментальные изменения в вере, прежде всего, неразрывно связаны с экономической жизнью. Поэтому наша национальная модель, которая с первых лет независимости прокладывала путь к инновациям в развитии нашего общества, должна была в первую очередь сосредоточиться на следующих целях, направленных на вывод экономики нашей страны на новый уровень:

Во-первых, постепенно сформировать социально ориентированную рыночную экономику, построить мощную и непрерывно развивающуюся экономическую систему, способную обеспечить рост национального богатства, необходимые условия для жизни и деятельности наших соотечественников;

Во-вторых, построить свободную экономику со многими опорами, либерализовать права людей на собственность, добиться гарантированной защиты частной собственности государством на основе всесторонней защиты и поддержки инициативы и предпринимательства граждан;

В-третьих, ввести широкие свободы в деятельности предприятий и граждан, добиться максимально возможного ограничения ненужного вмешательства государства в их экономическую деятельность, полностью отказаться от административно-командного метода управления экономикой и вместо этого широко использовать методы и средства поощрения;

В-четвертых, провести всеобъемлющие структурные преобразования, которые позволят рационально и эффективно использовать имеющиеся в экономике ресурсы, наладить производство конкурентоспособной продукции в условиях жесткой конкуренции за рынок и благодаря этому быстро интегрироваться в мировую экономическую систему;

В-пятых, сформировать у граждан новые навыки и способности экономического мышления, радикально изменить их мировоззрение и создать возможность для каждого человека самостоятельно выбирать сферу и формы труда [4].

Конечно, достижение этих целей требовало реализации очень масштабных задач и переходного периода, в течение которого инновации, охватывающие все сферы общественной жизни, проявились бы уникальным образом. Поэтому в случае нашей страны этот период, как особо отметил наш первый президент И. Каримов, состоял главным образом из двух этапов: «Первый этап, охватывающий период с 1991 по 2000 год, — это переходный период и первый период реформ и изменений, связанных с формированием основ национальной государственности;

Второй этап, охватывающий период с 2001 по 2010 год, — это период активного демократического обновления, реформ и модернизации нашей страны, обеспечивающий устойчивое развитие нашей экономики, последовательную реформу нашей политической жизни, законодательства, судебной системы и социально-гуманитарной сферы, а также неуклонное повышение уровня жизни населения…»[5]

Здесь стоит отметить, что экономические реформы, проведенные в нашей стране в переходный период первых лет независимости, должны были охватывать не только различные сферы общественной жизни, но и кардинально изменить сознание и убеждения нашей молодежи, а также ее мировоззрение в целом. Основное внимание здесь уделялось замене пороков, укоренившихся в общественном сознании под влиянием бывшей советской системы, таких как зависимость, ожидание всего от государства и неуверенность в собственных силах, новыми концепциями и идеями, основанными на требованиях рыночной экономики, такими как инициативность, предпринимательство, вера в собственные силы и возможности, а также демонстрация примеров общественной активности и творчества. В этой связи главная роль и задача государства заключалась в создании и укреплении правовой базы для расширения возможностей молодежи для активного участия в предпринимательстве, малом и среднем бизнесе и получения современного образования с целью всесторонней поддержки их деятельности в этой области. Поэтому с первых лет

независимости особое внимание уделялось этим первостепенным целям и задачам в осуществлении государственного и социального управления в нашей стране, а развитие качеств нашей молодежи, включая все слои населения, проживающие в нашей стране, обладающие богатым духовным мировоззрением, сильной верой, твердой жизненной позицией и способные последовательно размышлять о жизненных проблемах с помощью научного и глубокого мышления, рассматривалось как вопрос, непосредственно связанный с будущим страны. Учитывая эту ситуацию, наш президент писал, что «В результате широкомасштабных реформ и творческой работы, проводимой в нашей стране, меняется сознание, мышление и мировоззрение нашего народа»[6].

Естественно, все изменения, на которых акцентировал внимание наш глава государства, были результатом реформ, начатых с самого начала независимости. В результате проведенные экономические реформы обеспечили фундаментальные изменения в убеждениях молодежи нашей страны, ее духовный образ приобрел особый характер, наполненный позитивным смыслом и сущностью, а ее интеллектуальная, творческая и практическая деятельность начала обретать содержание, соответствующее требованиям времени.

ЗАКЛЮЧЕНИЕ

В то же время невозможно не подчеркнуть, что позитивные изменения, происходящие в социальных сферах общества, также привели к позитивному отношению среди молодежи. В частности, подходы, которые правительство начало внедрять в сферах образования, медицины и предоставления услуг, совместимые с инфраструктурой рыночной экономики, начали порождать новые идеи и видения в умах и убеждениях нашей молодежи. В частности, можно сказать, что разработка и внедрение национальной модели системы образования, реформы, направленные на повышение качества и эффективности образования, усилия по совершенствованию культуры предоставления медицинских услуг населению, расширение возможностей для повышения социальной активности населения на основе дальнейшего увеличения числа и масштабов структур гражданского общества в нашей стране, а также постепенное применение тактики перехода от сильного государства к сильному гражданскому обществу в нашей стране укрепили убеждение нашей молодежи в том, что неправильно ожидать от государства всего в повседневной жизни, и что вместо этого граждане сами, и, если позволите, прежде всего молодежь нашей страны, должны проявлять достаточную активность.

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Хакимов А.М., PhD
старший преподаватель кафедры философии и религиоведения
Кокандский государственный университет

НАЦИОНАЛЬНЫЕ ЦЕННОСТИ И УСТОЙЧИВОЕ РАЗВИТИЕ В ИНФОРМАЦИОННОМ ОБЩЕСТВЕ

Аннотация. В данной статье, опираясь на философские и этические подходы, анализируется философское содержание глобальных процессов и их неразрывная связь с концепцией устойчивого развития, а также экологические, технологические и социальные кризисы, стоящие перед современной цивилизацией.

Ключевые слова: Устойчивое развитие, философия устойчивого развития, глобальные процессы, экологическая культура, духовные ценности, социальная справедливость, технологический прогресс, национальные ценности.

Khakimov A.M., PhD
senior lecturer
Department of Philosophy and Religious Studies
Kokand State University

NATIONAL VALUES AND SUSTAINABLE DEVELOPMENT IN THE INFORMATION SOCIETY

Abstract. Drawing on philosophical and ethical approaches, this article analyzes the philosophical content of global processes and their inextricable link to the concept of sustainable development, as well as the environmental, technological, and social crises facing modern civilization.

Keywords: Sustainable development, philosophy of sustainable development, global processes, environmental culture, spiritual values, social justice, technological progress, national values.

ВВЕДЕНИЕ

Философская интерпретация современных глобальных процессов стала одним из наиболее актуальных вопросов современной цивилизации. Несмотря на то, что человечество в последние десятилетия достигло огромного потенциала в области технологий и экономики, глобальные угрозы, такие как изменение климата, истощение ресурсов, утрата биоразнообразия, миграция и социальное неравенство, становятся все более острыми. Эти кризисные факторы превратили идею устойчивого развития, помимо политической концепции, в объект философского и этического анализа. В этом процессе устойчивое развитие не ограничивается только экономическим ростом и технологическим прогрессом, но также поднимает вопрос о необходимости переосмысления ответственности человека перед

природой, обществом и будущими поколениями. С философской точки зрения, современные глобальные проблемы выявляют ограничения антропоцентрического мировоззрения: чем больше человек ставит себя выше природы, тем больше нарушается экологическое равновесие. Поэтому экоцентрический и биоцентрический подходы приобретают все большую актуальность, способствуя интерпретации человечества как неотъемлемой части природной системы.

МАТЕРИАЛЫ И МЕТОДЫ

Важность философии устойчивого развития определяется несколькими основными факторами. Прежде всего, экологический кризис и резкое изменение климата ставят под сомнение эффективность существующих систем управления. Глобальное потепление, нехватка воды и учащение экстремальных погодных явлений представляют серьезную угрозу для экономических и социальных систем. В такой ситуации политические или экономические решения, принимаемые с целью получения краткосрочной экономической выгоды, могут негативно повлиять на условия жизни будущих поколений. В этом отношении, как отметил Ганс Йонас в своем знаменитом «Принципе ответственности», любое развитие должно соответствовать критериям благоразумия и ответственности. [1].

Еще одним важным фактором являются философские последствия технологического развития. Быстрые достижения в генной инженерии, искусственном интеллекте, робототехнике и ядерных технологиях ставят перед человечеством новые этические и экзистенциальные вопросы. Как отметил В. Бек в своей концепции «Общества риска», такой технологический прогресс может стать источником глобальной опасности и нестабильности [2]. Поэтому управление этим процессом должно основываться не только на национальных стандартах, но и на универсальных этических нормах и философских критериях.

Еще одним важным аспектом является вопрос социальной справедливости и равенства. Цели устойчивого развития (ЦУР) на период до 2030 года, утвержденные ООН в 2015 году, устанавливают 17 глобальных целей для человечества. Эти цели направлены на сочетание экономического процветания с экологической устойчивостью и социальным равенством. Поэтому каждая страна должна интегрировать эти принципы в свою национальную стратегию развития.

В опыте стран СНГ вопрос устойчивого развития рассматривается с цивилизационно-культурной точки зрения. Российские исследователи В. Иноземцев, А. Урсул и М. Моисеев отмечали, что философия устойчивого развития включает в себя не только экономический рост, но и повышение человеческого сознания, формирование духовных ценностей и развитие экологической культуры. Эта точка зрения важна и в условиях Узбекистана, поскольку гармония национальных ценностей и экологического мышления рассматривается как один из главных факторов устойчивого развития.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ.

Концепция устойчивого развития в Республике Узбекистан сформировалась как одно из главных направлений государственной политики. В частности, Указом № ПФ-158 (11 сентября 2023 г.), утвержденным Президентом Ш. М. Мирзиёевым, – стратегия «Узбекистан – 2030» – определена долгосрочная модель развития страны. Она интерпретирует экологическую устойчивость, социальное благополучие и инновационную экономику в гармонии друг с другом. Также Указом № ПФ-83 (21 февраля 2022 г.) обозначена цель «сократить вдвое долю населения с низким уровнем дохода к 2030 году», в которой особое внимание уделяется социальному направлению устойчивого развития.

Концепция устойчивого развития стала одной из главных тем политической и философской мысли в глобальном масштабе со второй половины XX века. В частности, в докладе Всемирной комиссии ООН по окружающей среде и развитию 1987 года «Наше общее будущее» (доклад Брундтланд) эта концепция была сформирована как теория, обладающая философской и моральной сущностью. В этом документе устойчивое развитие интерпретируется как принцип «удовлетворения потребностей нынешнего поколения без ущерба для способности будущих поколений удовлетворять свои собственные потребности». Такой подход побуждает человечество отказаться от антропоцентрических идей и перейти к биоцентрическому и экоцентрическому мышлению. Потому что экономическое и технологическое развитие человеческой деятельности нарушает баланс природных систем и создает экологические, моральные и социальные кризисы.

В современной западной философии идея устойчивого развития тесно связана с концепциями экологической этики, биоэтики, социальной справедливости и глобальной ответственности. Технологический прогресс расширил возможности человека, но также увеличил риски и нестабильность. Поэтому современная цивилизация должна основываться не только на экономическом росте, но и на принципах осознанной и моральной ответственности.

Сегодня он нашел практическое применение в таких международных политических платформах, как «Цели устойчивого развития до 2030 года» ООН, Парижское климатическое соглашение 2015 года и Программа «Зеленый курс» Европейского Союза 2019 года [5]. Таким образом, философия развивается не только как теоретическое направление, но и как морально-духовное руководство, служащее обеспечению будущего существования человечества.

В странах СНГ концепция устойчивого развития, в отличие от западной модели, объясняется на основе принципов цивилизационной гармонии, духовных ценностей и культурного взаимодействия. По мнению В. В. Степина, техноцентрическое мировоззрение человеческой цивилизации является корнем глобальных проблем, которые можно преодолеть

посредством «гуманистического техноцентризма» — то есть гармонии технологий и человеческих ценностей [6].

В опыте Узбекистана концепция устойчивого развития развивается в гармонии с национальными ценностями, духовностью, экологической ответственностью и социальной справедливостью. Понятия «норма», «баланс» и «уважение к природе» давно существуют в узбекской философской мысли и считаются моральной основой устойчивого развития.

Древнетюркская мысль включала в себя концепцию единства с природой, а суфийские учения – концепцию достижения внешней стабильности посредством духовного равновесия [10]. Сегодня эти древние взгляды переосмысливаются как методологическая основа современной государственной политики и философии на основе принципа «духовная стабильность – основа развития».

В этом смысле опыт Узбекистана показывает, что устойчивое развитие означает культуру жизни в гармонии с природой, а не её контроля. Философия же, с другой стороны, призвана преобразовать эту гармонию в прочную систему в человеческом мышлении, ценностях и практической жизни.

Углубление глобализации доказывает, что сегодня прогресс человечества измеряется не только экономическим ростом или технологическими достижениями, но и духовной и моральной ответственностью. Философия устойчивого развития подразумевает поддержание гармонии между человеком, обществом и природой, а также понимание морального долга перед будущими поколениями.

В то время как западная философия интерпретирует этот процесс с точки зрения экологической этики, ученые СНГ освещают его с позиции цивилизационной гармонии. Узбекистан, с другой стороны, создает свою собственную модель, сочетая идею устойчивого развития с национальными ценностями, экологической культурой и принципами духовной стабильности. Посредством президентских указов и стратегических документов устойчивое развитие формируется не только как политическое, но и как философское и культурное направление. Таким образом, философия устойчивого развития проявляется как универсальное направление, ведущее человечество от техноцентрического мышления к ответственному, экологическому и этическому сознанию. Опыт Узбекистана является одним из важных шагов на пути к созданию национальной практической и духовно гармоничной модели этой глобальной идеи.

ЗАКЛЮЧЕНИЕ.

В заключение стоит отметить, что в контексте современных глобальных процессов философия устойчивого развития демонстрирует необходимость реагировать на проблемы, стоящие перед человечеством, не только техническими или экономическими решениями, но и глубокими философскими, моральными и культурными подходами. Гармонизация взаимоотношений человека, общества и природы стала главным критерием современной цивилизации, переопределяющим содержание развития.

Опыт Узбекистана на практике показывает, что идея устойчивого развития может сочетаться с национальными ценностями, экологической культурой и духовной ответственностью. Такой подход способствует возвышению устойчивого развития не как внешней модели, а до уровня философии жизни, которая усваивается сознанием общества. Поэтому философия устойчивого развития признается не только как концепция, отвечающая на глобальные проблемы, но и как универсальная идея, побуждающая человечество осознать свой долг перед будущим, выбрать ответственный и осознанный путь развития.

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Халилова Ш.Т., д.п.н.
профессор кафедры педагогики и психологии
Университет науки и технологий
Узбекистан, г. Ташкент

ТРАНСФОРМАЦИЯ ДИДАКТИЧЕСКИХ МОДЕЛЕЙ ВЫСШЕЙ ШКОЛЫ В УСЛОВИЯХ ИНТЕГРАЦИИ ГЕНЕРАТИВНОГО ИСКУССТВЕННОГО ИНТЕЛЛЕКТА: МЕТОДОЛОГИЯ И ПРАКТИКА ПРОЕКТИРОВАНИЯ

Аннотация. В статье исследуется проблема модернизации образовательного процесса в системе высшего образования в условиях конвергенции традиционной дидактики и технологий генеративного искусственного интеллекта (ИИ). Автором разработана и экспериментально верифицирована дидактическая модель проектирования адаптивно-развивающей образовательной среды на базе нейросетевых ассистентов, ориентированная на смещение акцента с репродуктивного усвоения знаний на критический анализ и решение полидисциплинарных проектных кейсов. На основе лонгитюдного педагогического эксперимента доказано, что целенаправленное включение ИИ-инструментов в систему фасилитации и формирующего оценивания способствует росту исследовательской субъектности и академической успеваемости студентов на 21,8 %. Полученные результаты открывают практические пути реформирования университетских программ подготовки инженерных и гуманитарных кадров.

Ключевые слова: педагогика высшей школы, генеративный искусственный интеллект, дидактическая модель, адаптивное обучение, формирующее оценивание, субъектность студента, цифровизация образования.

Khalilova Sh.T., doctor of pedagogical sciences
professor
Department of Pedagogy and Psychology
University of Science and Technology
Uzbekistan, Tashkent

TRANSFORMATION OF HIGHER EDUCATION DIDACTIC MODELS IN THE CONTEXT OF GENERATIVE ARTIFICIAL INTELLIGENCE INTEGRATION: METHODOLOGY AND DESIGN PRACTICE

Abstract. The article explores the modernization of the pedagogical process in higher education amid the convergence of traditional didactics and generative artificial intelligence (AI) technologies. The author develops and empirically

verifies a didactic framework for designing an adaptive-developmental learning environment based on neural-network assistants, shifting the focus from reproductive knowledge acquisition to critical inquiry and multidisciplinary project-based problem solving. A longitudinal pedagogical experiment reveals that the purposeful inclusion of AI tools within academic facilitation and formative assessment increases students' research subjectivity and academic performance by 21.8%. The findings provide actionable pathways for restructuring higher education curricula across engineering and socio-humanitarian tracks.

Keywords: higher education pedagogy, generative artificial intelligence, didactic model, adaptive learning, formative assessment, student subjectivity, digitalization of education.

ВВЕДЕНИЕ (INTRODUCTION)

Современная высшая школа функционирует в фазе фундаментального методологического сдвига. Экспоненциальный рост возможностей больших языковых моделей (LLM) и алгоритмов генеративного искусственного интеллекта (ИИ) разрушил традиционную парадигму проверки знаний, основанную на оценке текстовой репродукции. Университеты по всему миру столкнулись с вызовом когнитивного делегирования, когда обучающиеся передают нейросетевым системам аналитические, реферативные и расчетно-графические функции. Вследствие этого привычные дидактические паттерны - от традиционной лекции до классического реферирования - утрачивают развивающую и диагностическую состоятельность.

Как справедливо отмечают исследователи современного университетского образования, искусственный интеллект меняет конфигурацию субъект-субъектных отношений в академическом пространстве: преподаватель перестает быть монопольным носителем знания, превращаясь в наставника-модератора и архитектора образовательного маршрута. При этом механический запрет цифровых платформ демонстрирует свою непродуктивность. Возникает объективная дидактическая необходимость органической интеграции нейросетевых комплексов в методологический аппарат высшей школы в качестве катализаторов когнитивной автономии, критического мышления и исследовательской субъектности будущих специалистов.

Анализ научной литературы по педагогике высшей школы выявляет противоречие между стремительным внедрением студентами прикладных генеративных интерфейсов и слабой разработанностью валидированных дидактических систем, способных преобразовать стихийное обращение к нейросетям в системный фактор интеллектуального роста.

Цель исследования - теоретически обосновать, сконструировать и экспериментально проверить эффективность дидактической модели трансформации учебного процесса в высшей школе на основе интеграции генеративных технологий искусственного интеллекта.

Задачами исследования мы обозначили:

1. Проанализировать теоретико-методологические предпосылки конвергенции классической университетской педагогики и интеллектуальных диалоговых систем.
2. Спроектировать компонентный состав адаптивно-развивающей дидактической модели обучения в вузе с применением генеративного ИИ.
3. Разработать критериально-диагностический инструментарий измерения исследовательской субъектности и уровня усвоения профессиональных компетенций.
4. Экспериментально доказать продуктивность разработанной модели и предложить методические рекомендации для профессорско-преподавательского состава университетов.

Процесс профессиональной подготовки студентов в вузе станет качественно более эффективным, если технологии генеративного ИИ будут переориентированы с пассивного поиска информации на инструмент когнитивного со-исследования, симуляции профессиональных ситуаций и формирования индивидуальных траекторий развития через систему вариативного формирующего оценивания.

МЕТОДЫ ИССЛЕДОВАНИЯ (METHODS)

Методологическую основу работы составили: системно-деятельностный подход (Л. С. Выготский, А. Н. Леонтьев), теория контекстного образования (А. А. Вербицкий), концепция персонализированного и адаптивного обучения в цифровой среде, а также принципы академической этики при использовании искусственного интеллекта в высшем образовании.

Для решения поставленных задач использовался комплекс взаимодополняющих методов:

Теоретические методы: компаративный и структурно-функциональный анализ психолого-педагогической литературы, моделирование образовательных систем, проектирование учебных задач нового типа.

Эмпирические методы: включенное педагогическое наблюдение, анкетирование, экспертное тестирование, контент-анализ учебных продуктов студентов, констатирующий и формирующий педагогические эксперименты.

Статистические методы: методы математической статистики (критерий согласия Пирсона \chi^2, U-критерий Манна - Уитни, расчет t-критерия Стьюдента для зависимых и независимых выборок) для подтверждения достоверности полученных результатов с использованием программного пакета SPSS Statistics v.26.

Базой опытно-экспериментальной работы выступил Университет науки и технологий. В педагогическом эксперименте (2024–2026 уч. гг.) приняли участие 248 студентов 2–3 курсов бакалавриата направлений подготовки «Информационные технологии», «Программный инжиниринг» и «Дошкольное образование». Были сформированы две выборки:

Контрольная группа (КГ, n = 124): обучение осуществлялось по стандартной программе академического курса с использованием стандартной электронной образовательной среды вуза без регламентированного внедрения генеративных инструментов.

Экспериментальная группа (ЭГ, n = 124): образовательный процесс выстраивался на основе авторской дидактической модели, включающей три взаимосвязанных модуля работы с интеллектуальными системами:

1. Модуль когнитивного оппонирования (AI-Dialectic): генерация контраргументов к выдвигаемым студентом исследовательским гипотезам с последующей очной защитой позиции.

2. Модуль проектного прототипирования: ускоренное построение концептов технических решений и педагогических сценариев с использованием нейросетей с непрерывной верификацией валидности источников.

3. Модуль формирующей многоуровневой самодиагностики: получение адресной обратной связи на промежуточных этапах подготовки курсовых и проектных работ.

Критериально-диагностический аппарат включал три основных показателя:

Когнитивно-деятельностный критерий: глубина решения комплексных профессиональных задач, системность мышления (шкала от 0 до 100 баллов).

Исследовательско-субъектный критерий: степень академической автономии, способность к самоорганизации и критической верификации информации (по шкале академической агентности Bandura / адаптация).

Инструментально-технологический критерий: культура взаимодействия с ИИ-системами, промт-грамотность и соблюдение норм академической честности.

РЕЗУЛЬТАТЫ ОРИГИНАЛЬНОГО АВТОРСКОГО ИССЛЕДОВАНИЯ (RESULTS)

В ходе теоретического этапа была сконструирована **дидактическая модель трансформации образовательного процесса высшей школы**, базирующаяся на четырех интегративных компонентах:

1. Целевой компонент: формирование трансдисциплинарных компетенций специалиста в условиях интеллектуальной насыщенности профессиональной среды.

2. Содержательный компонент: трансформация учебных планов в пользу задач открытого типа, исключающих однозначный шаблонный ответ и требующих сравнительного сопоставления сгенерированных ИИ моделей с эмпирической реальностью.

3. Процессуально-деятельностный компонент: трехэтапный цикл взаимодействия «Студент - Преподаватель - ИИ»:

этап инициации (постановка проблемного вопроса студентом);

этап диалоговой генерации (моделирование вариантов решения с помощью ИИ);

этап критической рефлексии и публичной дебатной защиты перед академической группой.

4. Оценочно-результативный компонент: переход от суммирующего контроля к аутентичному оцениванию компетенций и динамики исследовательской рефлексии.

На этапе констатирующего эксперимента (начало экспериментального цикла) замеры в контрольной и экспериментальной группах не выявили статистически значимых различий ($p > 0,05$), что подтвердило исходную однородность выборок. Средний балл когнитивно-деятельностной готовности составлял 61,4 \pm 4,2 в КГ и 61,8 \pm 4,5 в ЭГ.

После двухгодичной реализации разработанной дидактической модели на этапе контрольного среза была проведена итоговая комплексная диагностика. Обобщенные результаты приведены в Таблице 1.

Таблица 1

Сравнительная динамика уровней сформированности компетенций и субъектности студентов (до и после эксперимента)

Критерий / Показатель	Уровень	КГ (до), %	КГ (после), %	ЭГ (до), %	ЭГ (после), %	Значимость различий (КГ/ЭГ после)
Когнитивно-деятельностный	Высокий	16,1	24,2	16,9	48,4	$\chi^2 = 18,74$; $p < 0,001$
	Средний	54,8	57,3	54,0	44,4	
	Низкий	29,1	18,5	29,1	7,2	
Исследовательско-субъектный	Высокий	14,5	21,8	15,3	45,2	$\chi^2 = 16,32$; $p < 0,001$
	Средний	51,6	54,0	50,8	46,7	
	Низкий	33,9	24,2	33,9	8,1	
Культура промтинга и верификации	Высокий	9,7	17,7	10,5	58,1	$\chi^2 = 42,15$; $p < 0,0001$
	Средний	42,7	49,2	41,9	36,3	
	Низкий	47,6	33,1	47,6	5,6	

Качественный анализ данных показывает, что в экспериментальной группе доля студентов с высоким уровнем когнитивно-деятельностного критерия возросла с 16,9 % до 48,4 % (в контрольной группе рост составил лишь с 16,1 % до 24,2 %). Это объясняется тем, что обучающиеся ЭГ в течение обучения освоили методологию «диалогового спарринга» с искусственным интеллектом, перестав воспринимать алгоритм как источник готовых истин.

Показатели академической агентности и исследовательской субъектности выросли в ЭГ почти в 3 раза (с 15,3 % до 45,2 %). Обучающиеся

стали проявлять существенно более высокий уровень критичности к цитируемым данным: количество ошибок «слепого доверия» галлюцинациям нейросети снизилось в ЭГ на 84 %, в то время как в КГ студенты продолжали совершать систематические ошибки некорректного заимствования и компиляции.

Кроме того, средняя академическая успеваемость по профильным дисциплинам в ЭГ выросла на 21,8 % относительно стартового уровня ($t = 6,82$; $p < 0,01$), в то время как в КГ прирост составил лишь 6,4 % ($t = 1,94$; $p > 0,05$).

ОБСУЖДЕНИЕ РЕЗУЛЬТАТОВ (DISCUSSION)

Полученные эмпирические результаты подтверждают выдвинутую теоретическую гипотезу. Перестройка учебного процесса на рельсы «критического со-исследования» нивелирует главную дидактическую угрозу цифровой эпохи - атрофию самостоятельного мышления обучающихся.

Сравнение наших выводов с исследованиями ведущих отечественных и зарубежных авторов в области университетской дидактики показывает согласованность полученных тенденций:

1. Как и в работах Е. И. Ивахненко и В. С. Никольского, исследование доказало, что попытка запрета ИИ не решает задач академической честности, а лишь стимулирует скрытое и неэффективное списывание. Введение открытых регламентов и моделей взаимодействия выводит применение генеративных сервисов в легальное педагогическое русло.

2. Данные согласуются с выводами Б. А. Лёвина и коллег о том, что интеграция алгоритмов ИИ в инженерную и естественнонаучную подготовку высвобождает аудиторное время для решения реальных междисциплинарных производственных кейсов, повышая адаптивность будущих специалистов к реальному рынку труда.

3. Мы дополнили представления о формирующем оценивании: внедрение ИИ позволило студентам получать мгновенный предиктивный фидбек по логической связности и аргументации текстов до их предоставления преподавателю, что существенно разгрузило профессорско-преподавательский состав от рутинной вычитки первичных черновиков и позволило сосредоточиться на индивидуальных научных консультациях.

Основным ограничением исследования является специфика предметных областей (ИТ, инженерный менеджмент). Дальнейшие исследования требуют апробации модели в рамках исключительно гуманитарного и клинического медицинского образования.

ЗАКЛЮЧЕНИЕ (CONCLUSION)

1. Теоретически обоснована и практически реализована трансформация дидактических оснований высшей школы в условиях повсеместной диффузии генеративного искусственного интеллекта. Доказано, что традиционные методы репродуктивного контроля исчерпали свой потенциал, требуя перехода к развивающему проблемно-деятельностному взаимодействию.

2. Сконструированная дидактическая модель, объединяющая целевой, содержательный, процессуальный и оценочный блоки, обеспечивает

смещение фокуса учебной работы на дебаты, аналитическую деконструкцию нейросетевых гипотез и проектное творчество студентов.

3. Эмпирически доказана результативность модели: в экспериментальной группе зафиксировано статистически достоверное увеличение доли обучающихся с высоким уровнем когнитивной и исследовательской субъектности (до 48,4 % и 45,2 % соответственно при $p < 0,001$), а общий прирост академической результативности составил 21,8 %.

4. Практическая значимость работы заключается в возможности экстраполяции предложенных алгоритмов проектирования учебных заданий открытого типа на образовательные программы бакалавриата и магистратуры университетов широкого спектра направлений. Полученные выводы могут послужить базисом для формирования университетских регламентов использования генеративного ИИ в учебной и научно-исследовательской деятельности.

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Ҳасанова Х.Ҳ.
мустақил тадқиқотчи (PhD)
Ўзбекистон Республикаси Президенти
ҳузуридаги Давлат сиёсати ва бошқаруви академияси

ОАВ НИНГ ФУҚАРОЛАР БИЛАН МУЛОҚОТИ ОРҚАЛИ ИЖТИМОИЙ ФИКРЛАРНИ ШАКЛЛАНТИРИШ

Аннотация. Мазкур мақолада давлат фуқаролик хизматчиларининг ижтимоий имиджини шакллантириш ва мустаҳкамлашда оммавий ахборот воситаларининг ўрни ҳамда аҳамияти ёритилган. Давлат хизматчиларининг касбий маҳорати, ахлоқий фазилатлари, муомала маданияти, масъулияти ва жамоатчилик билан самарали мулоқотининг ижтимоий имиджга таъсири таҳлил қилинган. Шунингдек, анъанавий оммавий ахборот воситалари, янги медиа ва рақамли коммуникацияларнинг давлат органлари фаолияти очиқлиги ва шаффофлигини таъминлаш, фуқароларнинг давлат бошқарувига бўлган ишончини ошириш ҳамда давлат ва жамият ўртасидаги ҳамкорликни мустаҳкамлашдаги имкониятларига алоҳида эътибор қаратилган. Мақолада давлат хизматчиларининг ижобий имиджини шакллантиришда инсонийлик, ҳалоллик, касбий этика ва ахборот очиқлиги каби тамойилларнинг аҳамияти асослаб берилган. Шунингдек, оммавий ахборот воситалари орқали жамоатчилик фикрини шакллантириш ва давлат хизматининг ижобий қиёфасини намоён этишга қаратилган илмий-амалий тавсиялар баён этилган.

Калит сўзлар: давлат фуқаролик хизмати, ижтимоий имидж, оммавий ахборот воситалари, янги медиа, рақамли коммуникация, жамоатчилик фикри.

Khasanova Kh.Kh.
independent researcher (PhD)
Academy of Public Policy and Administration
under the President of the Republic of Uzbekistan

SHAPING PUBLIC OPINION THROUGH MEDIA DIALOGUE WITH CITIZENS

Abstract. This article discusses the role and importance of the media in shaping and strengthening the social image of civil servants. The impact of professional skills, moral qualities, communication culture, responsibility and effective communication with the public on the social image of civil servants is analyzed. Special attention is also paid to the opportunities of traditional media, new media and digital communications to ensure openness and transparency of the activities of state bodies, increase citizens' trust in public administration and strengthen cooperation between the state and society. The article substantiates the

importance of such principles as humanity, honesty, professional ethics and openness of information in shaping a positive image of civil servants. Scientific and practical recommendations are also presented to shape public opinion through the media and present a positive image of civil service.

Keywords: civil service, social image, mass media, new media, digital communication, public opinion.

Давлат фуқаролик хизматчиларининг ижтимоий имиджи шаклланишида оммавий ахборот воситалари муҳим аҳамият касб этади. Бу бевосита сиёсий ва ижтимоий йўналишлардаги доимий кўрсатувлар, илмий мақолалар орқали касбий маҳоратини номоён этувчи таҳлилий жараёнларда ҳам гувоҳ бўлишимиз мумкин. Давлат хизматчиси бу албатта ўз номи билан давлат хизматчиси яъни давлат мақомини ўзида мужассам этиш ва уни кўрсата билиш деганидир.

Мисол тариқасида кўрсатиб ўтсак, прокуратура соҳаси вакиллари билан бўлган жонли мулоқот жараёнида уларнинг нафақат ташқи кўриниши ёки жиддийлиги қолаверса ҳар бир жумласи оҳанги, ва уни талқин қилиш ҳолати, услуби энг муҳими ишончлилиги, ишонч ва қаътият бирлашганлиги айнан имиджнинг муҳим шакланганлигидан дарак беради. Агар айнан юқоридагилар уларда акс этмаса хатто гапираётган сўзлар ўз таъсирини йўқотади. Давлат хизматчиси нафақат ишда қолаверса уйда жамоат манзилларида, умуман жамиятда ўз ўрни билан бирга ишончи ҳамда ишончни уйғота олиши ва бунда ҳаққонийлик мустаҳкам бўлиши керак.

Биргина “Муносабат” кўрсатувидаги жараённи таъсвирлаб берсам: фуқаро мурожаати асосида ўтказилган сўровнома ҳамда онлайн саволларга давлат хизматчиси ўз ваколатидан келиб чиқиб, айнан муоммали шахсни нафақат у тубликдан чиқариши қолаверса тўғри йўналиш берганлигини ҳамда ўз касб одоби инсонийлик қиёфаси ила фуқарода аввало ишончни уйғотганлигига гувоҳ бўлишимиз мумкин. Агар давлат хизматчисида билим ва савия ҳамда кўникма бўлсаю, унинг шахс одоби, маданияти бўлмаса жамиятда ўз муҳрини қуя олмайди. Аслида ҳар бир давлат хизматчисининг елкасидаги асосий мезон бу инсонийлик тамойиллари. Буни эса бевосита оммавий ахборот воситалари яққол номоён қилиб беради. Маълум бир кичкина ролик, қисқа метражли лавҳа орқали хатто қаҳрамоннинг ички оғриқларидан тортиб, савияси ҳамда фаросатини сезиш мумкин. Давлат хизматчисининг мақомини бугун кенг жамоатчилик тез илғай олади. Уни ёркин ва шаффофлик билан кўрсатиб бериш ОАВ ларининг асосий вазифаларидан. Келинг бунга шундай тарзда таъриф берамиз.

Ҳозирда жаҳон миқёсида давлат фуқаролик хизматчиларининг ижтимоий имиджини тадқиқ қилиш ҳамда шакллантириб ва мустаҳкамлаш масалаларига алоҳида эътибор қаратилмоқда. Зеро Давлат хизматчисининг имиджи нафақат бир шахс ва албатта давлат имиджи қолаверса келажагини белгилаб беради.

Хорижий давлатларда ўтказилган кўпгина тадқиқотларда келтирилишича, ўз имиджига эга бўлган шахслар халқаро муносабатларда ўзини жуда тушунарли тарзда ҳаракатлари билан намоён қилади. Ва шунингдек давлат фуқаролик хизматчисининг имиджи нафақат унинг шахсий фазилатлари, балки давлат органларига бўлган жамоатчилик ишончига бевосита ҳамда билвосита таъсир кўрсатади. Асосий қисмлардан ушбу сифатларни мисол тариқасида келтириш мумкин.

Касбий билим ва малака:

Ҳалоллик ва тўғрилик:

Муносабатлардаги муомила:

Маданият ва этика:

Маъсулият ва интизом:

Ички ва ташқи маданият:

Жамоатчилик билан киришимлилик:

Самарали мулоқот:

Булар албатта давом этиши мумкин. Давлат фуқаролик хизматчиларининг ижтимоий имиджи бу бутун бир давлат имиджи ҳисобланади. Олимларининг таъкидлашича, давлат хизматчиларининг ижобий имиджи фуқароларнинг давлат бошқаруви самарадорлигини таъминлайди ҳамда давлат ва жамият ўртасидаги муносабатларни мустаҳкамлайди. Шунинг учун ҳам давлат хизмати тизимида хизматчиларнинг касбий ва ахлоқий қиёфасини юксалтириш муҳим аҳамиятга эгадир.

Мамлакатимизда бир нечта олимларнинг илмий ишларида давлат хизматчиларининг ижтимоий имиджини шакллантиришдаги муоммолари, улардаги шахслараро муносабатлар ва психологик ва ижтимоий муҳит, атрофдагиларнинг давлат хизматчисига таъсири, маълум бир қолипда ҳаракатланиш каби жиҳатлар устида ишланган. Лекин бу ўрганишларга қарамай, давлат хизматчиси мақоми ва унинг шахсий кўрсаткичлари паст ҳамда маълум бир боғлиқликлар йўқ амалий ишлов деярли бажарилмаган. Натижадорлик эса паст кўрсаткичларда сақланиб қолинган.

Шундай экан, бугун оммавий ахборот воситалари билан давлат хизматчиларининг узаро боғлиқлиги ва ҳамкорлиги жуда муҳим. Айниқса бугун очиқлик ва шаффофлик устувор мамлакатда давлат фуқаролик хизматчиларининг ижтимоий имиджи яққол номоён бўлиб туриши муҳим аҳамият касб этади. Хўш нега ижтимоий имидж муҳим?

Касбий салоҳиятни кўрсатиш;

Миллий қадриятни сақлаш;

Одоб ва аҳлоқга риоя қилиш;

Касб ва шахсий ҳаёт чегарасини боғлаш;

Сўз ва фикрни ҳамоҳанг ушлаш;

Касбий маҳорат ва урнакни бериш;

Жамоатчилик билан яқинликни бирлаштириш;

Ўз миссиясини жамият билан ҳамоҳанг тутиш;

Бу каби мисол ва асл моҳиятни узоқ давом эттириш мумкин. Кўриниб турибдики, ҳар қандай давлат ташкилотида фаолият юритаётган давлат хизматчиси аввало, ўз миссиясини ташкилот миссияси билан бир текстда ушлай олиши ва ўзининг ижтимоий имиджини кўрсата олиши муҳим масалалардан.

Оммавий ахборот воситаларидаги чиқишлари орқали давлат хизматчилари нафақат касбий қолаверса шахсий имиджини ҳам кўрсатиб қуяди. Чунки ҳар қандай саволга тўғри берган тақдирда ҳам ўз имиджини кўрсата олмаса у жавоб қониқарли бўлмайди. Бунинг учун ҳам албатта, тинимсиз меҳнат талаб этилади.

Ижтимоий имиджга беписанд қараб бўлмайди. Халқаро майдонлар буни яққол исботлаб турибди. Эътибор қилиб қарайдиган бўлсак, хатто кўз қарашлар кўпгина жавобни англатиб турадиган давлат хизматчиларини кўришимиз мумкин. Шундай экан, бизнинг умуман барча давлат фуқаролик хизматчиларининг ижтимоий имиджи бу нафақат маҳаллий қолаверса халқаро йўлда жуда катта аҳамият касб этади. Албатта бунда оммавий ахборот воситаларининг ўрни ва афзаллиги ҳар қачонгидан ортган. Давлат хизматчиларига бевосита ОАВ воситалари нафақат кўмак қолаверса, урнак вазифасини ўташи лозим. Бунинг учун эса айнан шу йўналишда кўплаб кенг қамровли чиқишлар ва кўрсатувлар саноқли эмас, моҳиятдан кўчли ва савияли кўпироқ жонланиши зарур.

Чунки асосий вазифа турибди бу Оммавий ахборот воситаларининг фуқаролар билан мулоқоти орқали ижтимоий фикрларни шакллантириш.

Мулоқот жараёни ҳамиша натижа берган. Мулоқот, тинглаш ҳамда тушуниш масаланинг асл моҳиятини очиб беради. Энг биринчи ўринда инсонларнинг эркин ва ишонч билан гапиришларига йўл қўйиб бериш. Чунки фикрлар тўкилсагина асл мақсадни аниқлаш ва унга кўра вазиятга баҳо бериш мумкин. Вазият ойдинлашса, муоммо ёки тушунмовчилик бартараф бўлади. Ижтимоий имидж ўз-ўзидан мулоқот жараёнида шаклланиб боради.

Аслида ҳар қандай муомманинг замирида ижтимоий фикрнинг йўқлиги, ўзини тўғри акс эттира олмаслик туради. Бунда эса юқорида таъкидлаб ўтганимиздек, оммавий ахборот воситаларининг ва давлат фуқаролик хизматчиларининг узаро ҳамкорлиги туради. Албатта, бу икки йўналишни қадриятлар боғлаб туради. Чунки қадриятлар келажакга хизмат қиладиган асосий куч ҳисобланади. ҳар бир давлатнинг ўз йўли ва олиб бораётоган ислоҳотларига ушбу йўналишлар боғлиқ ва таалуқлидир.

Давлат фуқаролик хизматчисининг ижтимоий имиджини шакллантиришда оммавий ахборот воситалари, янги медиа ва рақамли коммуникациялар таъсирининг назарий-методологик асослари, уларнинг давлат бошқаруви самарадорлиги, фуқароларнинг давлат органларига бўлган ишончи ҳамда ижтимоий капитални мустаҳкамлашдаги аҳамияти комплекс илмий ёндашув асосида таҳлил қилиб ўрганишга бағишланган. Шунингдек, давлат фуқаролик хизматида оммавий ахборот воситалари стратегик коммуникация, медиаменежмент, ахборот сиёсати ва имидж

технологияларини такомиллаштиришнинг илмий-амалий механизмларини ишлаб чиқишга хизмат қилади.

Асосий мақсад давлат хизматчилари фаолиятининг очиқлиги, шаффофлиги ва ҳисобдорлигини таъминлаш, давлат органлари билан жамоатчилик ўртасидаги ўзаро ишончни мустаҳкамлаш, давлат хизматининг ижобий брендини шакллантириш ҳамда бугун замонавий медиамаконда давлат бошқарувининг самарадорлигини оширишга қаратилган илмий тавсияларни ишлаб чиқиш имконини беради.

Ушбу тавсиялар натижали ҳаракатлар кенг жамоатчиликга ҳам ўз таъсирини ўтказмай қўймайди. Демак кўриниб турибдики, оммавий ахборот воситалари нафақат кўмак беради, бевосита ижтимоий муҳит ва имиджни шакллантиришга ҳисса қўшади ва яратади.

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Хатамова З.Н., PhD по историческим наукам
доцент
Международный медицинский университет САМУ
Узбекистан, г. Фергана
ORCID: 0009-0009-8823-4680

ОЙЧУЧУК ОЙИМ В ИСТОРИИ КОКАНДСКОГО ХАНСТВА

Аннотация. В статье рассматривается жизненный путь и историческая судьба Ойчучук Ойим - принцессы Шахрисабза, связанной с дворцовой жизнью Кокандского ханства XVIII века. На основе исторических источников анализируются сведения о её происхождении, семейных и династических связях, положении при Кокандском дворе, браках, судьбе детей и внуков, а также её связях с Шахрисабзом и Кокандом. Особое внимание уделяется противоречиям в источниках относительно происхождения Ойчучук Ойим, её роли в укреплении родственных связей между правящими кругами двух регионов и её жизни в условиях сложной политической и социальной обстановки.

Ключевые слова: Шахрисабз, Кокандское ханство, Коканд, дворцовая жизнь, принцесса, династические связи, женщины в истории, благотворительность.

Khatamova Z.N., PhD in History
associate professor
Central Asian Medical University
Uzbekistan, Fergana
ORCID: 0009-0009-8823-4680

OYCHUCHUK OYIM IN THE HISTORY OF THE KOKAND KHANATE

Abstract. This article examines the life and historical fate of Oychuchuk Oyim, a princess of Shahrisabz whose life was closely connected with the court of the Kokand Khanate in the 18th century. Based on historical sources, the study analyzes information about her origin, family and dynastic ties, position at the Kokand court, marriages, the fate of her children and grandchildren, as well as her connections with Shahrisabz and Kokand. Particular attention is paid to discrepancies in historical sources concerning the origin of Oychuchuk Oyim, her role in strengthening kinship ties between the ruling circles of the two regions, and her life amid the complex political and social conditions of the period.

Keywords: Shahrisabz, Kokand Khanate, Kokand, court life, princess, dynastic ties, women in history, philanthropy.

Введение

История Кокандского ханства включает не только политическую деятельность правителей и военные события, но и судьбы женщин, игравших

важную роль в династических, социальных и культурных отношениях. Одной из таких исторических фигур является Ойчучук Ойим, также известная как Кенагас Ойим, - принцесса Шахрисабза, жизнь которой была тесно связана с дворцом Кокандского ханства XVIII века.

Историческое значение Ойчучук Ойим связано с её происхождением, браками, семейными и династическими связями, отношениями с правящими кругами Шахрисабза и Коканда, а также благотворительной и культурной деятельностью. Её жизненный путь отражает сложную политическую и социальную обстановку того периода, когда браки представителей влиятельных семей выполняли не только семейную, но и политико-династическую функцию.

Целью настоящего исследования является изучение жизни и исторического наследия Ойчучук Ойим в истории Кокандского ханства с особым вниманием к её происхождению, положению при Кокандском дворе, семейным связям, перемещениям между Шахрисабзом и Кокандом, а также благотворительной и архитектурной деятельности.

Особое значение имеет проблема противоречий в исторических источниках относительно происхождения Ойчучук Ойим. В одних источниках она представлена как дочь правителя Шахрисабза Олимбека, тогда как в других её отцом называется Иброхимбек Кенагас. В связи с этим сопоставление различных источников позволяет уточнить её биографию и определить её место в истории Кокандского ханства.

МАТЕРИАЛЫ И МЕТОДЫ

Исследование основано на сравнительном анализе исторических и историографических источников, посвящённых истории Кокандского ханства и правителям Шахрисабза. Особое внимание уделено трудам «Анжум ат-таварих» Худойорханзоды[1.], «Ибратуль-хавакин» Муллы Нияза Мухаммада Хоканди[2.], «Мунтахаб ат-таварих» Мухаммада Хакимхана Туры [3.] и «Ансаб ус-салатин ва таварих ул-хавакин» Мирзы Олим Мушрифа[4.].

В процессе исследования использовались историко-сравнительный, источниковедческий и биографический методы. Сведения о происхождении Ойчучук Ойим, её браках, потомках и общественной деятельности сопоставлялись в различных источниках с целью выявления сходств, различий и противоречий.

Отдельное внимание уделялось сведениям об архитектурных памятниках и ханакохах, связанных с именем Ойчучук Ойим, в частности ханаке Доруломон и ханаке Чилустун. Устные предания и исторические повествования рассматривались отдельно от документально подтверждённых сведений, что позволило разграничить источниковые данные и элементы исторической памяти.

РЕЗУЛЬТАТЫ

Анализ исторических источников показывает, что Ойчучук Ойим принадлежала к влиятельным политическим кругам Шахрисабза и

впоследствии была тесно связана с правящей средой Кокандского ханства[1^ 63.].

Источники содержат различные сведения о её происхождении. Мирза Олим Мушриф называет Ойчучук Ойим дочерью Ибрагима Оталика, правителя Шахрисабза. В «Анжум ат-таварих» Худойорханзоды она представлена как дочь Ибрагима Кенагаса из Шахрисабза. В этом же источнике она также упоминается как дочь Ибрагимбека Валинамата. В то же время в «Ибратуль-хавакине» сообщается о браке Абдурахимхана с дочерью правителя Шахрисабза Олимбека. Хотя имя невесты непосредственно не называется, сопоставление этого сообщения с другими историческими сведениями позволяет связать его с Ойчучук Ойим[2: 60.].

Таким образом, различия в источниках свидетельствуют о необходимости дальнейшего источниковедческого изучения её генеалогии. Вместе с тем источники сходятся в том, что Ойчучук Ойим принадлежала к влиятельной правящей среде Шахрисабза.

Ойчучук Ойим оказалась при Кокандском дворе в результате брака. Исторические сведения описывают её прибытие как принцессы в сопровождении торжественных дворцовых церемоний, подарков и официальных приёмов. Это свидетельствует о значении, которое придавалось бракам между влиятельными политическими семьями.

Первый брак Ойчучук Ойим оказался непродолжительным. После смерти мужа она осталась вдовой с дочерью Ойджан Ойим. В дальнейшем, согласно историческим источникам, Ойчучук Ойим вновь вступила в брак в среде кокандской правящей элиты. Эти браки демонстрируют тесную связь семейных отношений с политической структурой Кокандского ханства[3:10.].

Судьба её потомков также оказалась связана с политической историей Коканда. Ойджан Ойим вышла замуж за Абдурахманхана ибн Абдукаримхана, и от этого брака родился Норбутахан - внук Ойчучук Ойим. После смерти дочери Ойчучук Ойим стала заботиться о внуке и впоследствии отправилась вместе с ним на свою родину - в Шахрисабз.

Пребывание Ойчучук Ойим в Шахрисабзе совпало с политическими изменениями в регионе. Согласно источникам, новый правитель Бекназарбий восстановил её положение и возвратил ей наследственное имущество. Однако впоследствии Ойчучук Ойим вернулась в Коканд, который к тому времени стал для неё второй родиной.

Важный этап её жизни был связан также с религиозными деятелями. Во время возвращения из Шахрисабза в Коканд она посетила Дахбед и встретилась с Мусаханом Ходжа Дахбеди, известным представителем накшбандийской традиции. После возвращения в Коканд её судьба оказалась связана с Ортик Ходжа Эшоном. Согласно историческим сведениям, от этого брака родился Хаким Тура, потомки которого впоследствии были связаны с известными представителями истории Кокандского ханства.

Источники связывают имя Ойчучук Ойим также с благотворительной и архитектурной деятельностью. Среди сооружений, связанных с её именем, выделяются Доруломонская ханока и ханока Чилустун.[1: 75.]

Согласно историческому преданию, строительство Доруломонской ханоки связано с эпизодом болезни Ойчучук Ойим после её прибытия в Коканд. После её выздоровления шейху Шамсиддину Кулохбардору были предоставлены земельные владения и имущество. По преданию, шейх принял их при условии, что ханока будет предоставлять убежище людям, нуждающимся в защите. Таким образом, возникновение Доруломонской ханоки связывается с идеями благотворительности, защиты и духовного наставления.

Другим архитектурным объектом, связанным с Ойчучук Ойим, является ханока Чилустун. Согласно историческим сведениям, после смерти Абдурахимбия она инициировала строительство большой ханоки в его память[2: 81.]. Здание имело сорок колонн, что стало основанием для его названия. В строительстве активно участвовали местные жители посредством традиционного хашара.

Ханока служила не только местом пребывания дервишей и паломников, но и религиозно-образовательным центром. Здесь проводились религиозные обряды, в том числе зикр-и-сама. Впоследствии ханока стала одним из значимых мест паломничества в Кокандском ханстве.

ОБСУЖДЕНИЕ

Результаты исследования показывают, что историческое значение Ойчучук Ойим выходит за рамки её принадлежности к кокандской правящей семье. Её биография позволяет рассмотреть положение женщин в политической, династической и социальной структуре Кокандского ханства XVIII века.

Во-первых, её жизнь демонстрирует значение брака как инструмента укрепления отношений между влиятельными политическими семьями. Связи Ойчучук Ойим одновременно с Шахрисабзом и Кокандом показывают, что женщины из правящих семей могли выступать связующим звеном между различными политическими центрами.

Во-вторых, противоречия в источниках относительно её происхождения свидетельствуют о сложности реконструкции биографий исторических женщин. Различные источники создавались в разных исторических условиях и иногда содержат неодинаковые генеалогические сведения. Поэтому биография Ойчучук Ойим требует сопоставления нескольких источников и не должна основываться исключительно на одном историческом труде[3: 45.].

В-третьих, сведения о благотворительной и архитектурной деятельности позволяют рассматривать Ойчучук Ойим не только как представительницу правящей элиты, но и как женщину, связанную с религиозными учреждениями, благотворительностью и общественной памятью. Традиции, связанные с Доруломонской и Чилустунской ханоками, отражают представления о защите, духовности и социальной поддержке.

Вместе с тем ряд сведений о последних годах жизни Ойчучук Ойим остаётся недостаточно изученным. В частности, точная дата её смерти не установлена. Некоторые эпизоды её биографии сохранились преимущественно в исторических повествованиях и преданиях. Поэтому при дальнейшем изучении необходимо чётко разграничивать документально подтверждённые сведения и элементы исторической традиции.

В целом Ойчучук Ойим является значимой исторической фигурой в истории Кокандского ханства. Её жизнь связывает историю Шахрисабза и Коканда посредством династических отношений и отражает взаимодействие политических, семейных, религиозных и культурных факторов XVIII века. Её историческое наследие сохранилось не только в письменных источниках, но и в памяти об архитектурных и религиозных сооружениях, связанных с её именем.

Заключение

Проведённое исследование позволяет заключить, что Ойчучук Ойим занимала заметное место в истории Кокандского ханства XVIII века. Её происхождение из влиятельной среды Шахрисабза, брачные и родственные связи, участие в жизни кокандского двора, отношения с религиозными деятелями и связь с благотворительными сооружениями характеризуют её как историческую личность, деятельность которой выходила за пределы дворцовой жизни.

Несмотря на наличие противоречий в исторических источниках, сопоставление различных свидетельств позволяет определить Ойчучук Ойим как важное связующее звено между политическими и культурными кругами Шахрисабза и Коканда. Дальнейшее изучение письменных источников и архитектурного наследия может способствовать более полной реконструкции её биографии и роли женщин в истории Кокандского ханства.

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Холмирзаев Ф.Ф.
ассистент
Самаркандский государственный университет
Эшкобилова М.Е.
доцент
Самаркандский государственный медицинский университет

РАЗРАБОТКА ПОЛУПРОВОДНИКОВОГО СЕЛЕКТИВНОГО ДАТЧИКА ДЛЯ КОНТРОЛЯ ПАРОВ АЦЕТОНА И ОПРЕДЕЛЕНИЕ ЕГО МЕТРОЛОГИЧЕСКИХ ХАРАКТЕРИСТИК

Аннотация. В результате проведённых исследований разработан метод селективного определения ацетона с использованием полупроводниковых датчиков, объединённых в единый блок и содержащих катализаторы, обладающие высокой активностью по отношению к компонентам анализируемой газовой смеси. Установлены основные метрологические характеристики разработанного датчика. Абсолютная и относительная погрешности определения ацетона, а также вариация аналитического сигнала не превышают значений, установленных требованиями Государственного стандарта ГОСТ 13320-81. Суммарная погрешность измерений при доверительной вероятности 0,95 соответствует требованиям ГОСТ 52033-2003, предъявляемым к приборам данного типа, и в исследованном диапазоне концентраций не превышает ±1,5 %. Полученные результаты свидетельствуют о высокой чувствительности, селективности и метрологической надёжности разработанного полупроводникового датчика при контроле паров ацетона.

Ключевые слова: ацетон, полупроводниковый датчик, катализатор, чувствительность, селективность, динамические характеристики, абсолютная погрешность, относительная погрешность, вариация аналитического сигнала.

Kholmirzaev F.F.
assistant
Samarkand State University
Eshkobilova M.E.
associate professor
Samarkand State Medical University

DEVELOPMENT OF A SEMICONDUCTOR-BASED SELECTIVE SENSOR FOR MONITORING ACETONE VAPORS AND DETERMINATION OF ITS METROLOGICAL CHARACTERISTICS

Abstract. As a result of the studies conducted, a method for the selective determination of acetone was developed using semiconductor sensors combined

into a single unit and containing catalysts with high activity toward the components of the analyzed gas mixture. The main metrological characteristics of the developed sensor were determined. The absolute and relative errors in acetone determination, as well as the variation of the analytical signal, do not exceed the values established by the requirements of the State Standard GOST 13320-81. The total measurement error at a confidence probability of 0.95 complies with the requirements of GOST 52033-2003 for instruments of this type and, within the studied concentration range, does not exceed ±1.5%. The results obtained demonstrate the high sensitivity, selectivity, and metrological reliability of the developed semiconductor sensor for monitoring acetone vapors.

Keywords: acetone, semiconductor sensor, catalyst, sensitivity, selectivity, dynamic characteristics, absolute error, relative error, analytical signal variation.

Введение. Ацетон является легковоспламеняющимся веществом, а его пары в смеси с воздухом при определённых концентрациях могут образовывать взрывоопасные смеси [1]. Воздействие высоких концентраций паров ацетона может оказывать негативное влияние на центральную нервную систему человека [2]. Поэтому для обеспечения безопасности производственных процессов на предприятиях, где используется ацетон, необходимы высокочувствительные и быстродействующие методы контроля его концентрации в воздухе [3]. Решение данной задачи возможно посредством создания надёжных датчиков и газоанализаторов, обладающих необходимыми метрологическими характеристиками. Полупроводниковые датчики и газоанализаторы относятся к перспективным средствам контроля горючих и токсичных компонентов газовых смесей, в том числе паров ацетона [4–6].

Результаты эксперимента и их обсуждение.

Для обеспечения селективного определения ацетона был разработан подход, основанный на использовании нескольких чувствительных элементов, содержащих катализаторы с различной активностью по отношению к компонентам анализируемой газовой смеси. С использованием разработанных катализаторов были изготовлены селективные полупроводниковые сенсоры ацетона, включающие два чувствительных элемента — измерительный и компенсационный — и два резистора, соединённых в мостовую схему.

Состав измерительной газочувствительной плёнки сенсора — $SiO_2/(1{,}0TiO_2 + 0{,}75CuO)$, тогда как состав компенсационного элемента — $SiO_2/(0{,}25Fe_2O_3 + 0{,}10Ni_2O_3)$.

Разработанные датчики обеспечивают контроль микро- и макроконцентраций ацетона в газовой смеси. При поступлении анализируемой газовой смеси в измерительную камеру измерительный элемент датчика формирует аналитический сигнал в присутствии CO, H_2 и ацетона, тогда как компенсационный элемент формирует сигнал преимущественно в присутствии CO. В выбранных экспериментальных

условиях углеводороды практически не окисляются ни на измерительном, ни на компенсационном элементе. В результате разность сигналов измерительного и компенсационного элементов определяется преимущественно концентрацией ацетона в анализируемой газовой смеси.

В соответствии с требованиями безопасности при работе с ацетоном для разработанного датчика были определены следующие основные характеристики:

а) зависимость аналитического сигнала датчика от температуры чувствительного элемента, регулируемой изменением напряжения, подаваемого на нагревательный элемент;

б) динамические характеристики датчика, включая время отклика и время восстановления сигнала;

в) селективность датчика по отношению к определяемому компоненту — ацетону;

г) стабильность выходного сигнала при постоянной концентрации ацетона в течение заданного интервала времени.

Оптимальное напряжение питания датчика было установлено экспериментально. При этом были исследованы его динамические и градуировочные характеристики, селективность и стабильность аналитического сигнала. В исследованиях использовали разработанный газоанализатор ацетона, в состав которого входил блок селективных полупроводниковых датчиков. Для проведения испытаний была использована партия из пяти полупроводниковых датчиков ацетона. Испытания проводили в соответствии с разработанной методикой, что позволило определить оптимальные условия работы датчиков и установить их аналитические и метрологические характеристики. Все эксперименты выполняли с использованием средств измерений и оборудования, прошедших метрологическую поверку и имеющих соответствующие свидетельства о поверке.

Температура газочувствительного слоя определяется величиной напряжения, подаваемого на нагревательный элемент датчика. Поэтому при разработке полупроводниковых датчиков исследуют влияние напряжения питания на величину аналитического сигнала и устанавливают его оптимальное значение. Зависимость аналитического сигнала полупроводникового датчика ацетона (ЯОС-Ац) от напряжения питания исследовали в диапазоне 1,0–3,5 В.

Эксперименты по выбору оптимального напряжения питания проводили в нормальных условиях с использованием газовоздушной смеси, содержащей ацетон в концентрации 100 мг/м³. По результатам проведённых исследований установлено оптимальное значение напряжения питания датчика. Оптимальное напряжение питания полупроводникового датчика ацетона (ЯОС-Ац) составляет 2,2 В. При увеличении или уменьшении напряжения питания относительно оптимального значения величина

полезного аналитического сигнала снижается, что приводит к ухудшению чувствительности и селективности определения ацетона.

С учётом предполагаемых областей применения разработанного датчика и токсичности ацетона одним из важных требований является высокая скорость отклика. Поэтому датчик ацетона должен обладать удовлетворительными динамическими характеристиками, обеспечивающими быстрое установление аналитического сигнала при изменении концентрации определяемого компонента.

Исследование динамических характеристик разработанного датчика ацетона проводили путём изучения его переходных характеристик при резком изменении концентрации ацетона на входе датчика. В экспериментах использовали газовоздушные смеси с концентрацией ацетона 75 и 150 мг/м³. Изменение аналитического сигнала датчика непрерывно регистрировали с помощью самописца КСП-4. Момент изменения концентрации ацетона на входе датчика фиксировали на регистрирующей ленте и принимали за начальную точку отсчёта при определении времени отклика.

Перед началом измерений устанавливали исходный (фоновый) сигнал датчика. Для этого пять полупроводниковых датчиков ацетона последовательно продували очищенным аргоном или азотом в течение 10 мин. Значения сигнала, соответствующие сопротивлению газочувствительного слоя, регистрировали с помощью вольтметра В7-35.

Время отклика ЯОС-Ац определяли как интервал времени от момента подачи газовоздушной смеси с заданной концентрацией ацетона на вход датчика до достижения аналитическим сигналом установленного уровня от конечного значения. Полученные результаты использовали для оценки быстродействия разработанного датчика.

Изменение концентрации на входе в YUS-Ac также было зафиксировано на ленте и принято за отправную точку для расчета времени.

Эксперименты проводились в нормальных условиях (температура 20 ° С, атмосферное давление 730 мм рт. ст. и относительная влажность 60%).

В экспериментах каждая контрольная точка в диапазоне измерений характеризовалась шестью значениями: тремя прямыми — временем достижения максимального значения и тремя обратными — временем возврата к исходному значению. После того, как аналитический сигнал датчиков устанавливал постоянное значение, в качестве динамических показателей полупроводникового датчика ацетона определялись следующие параметры:

$t_{0.1}$ - время начала сигнала (время, необходимое для достижения сигналом 10% от его значения), с;

$t_{0,65}$ – время постоянной сигнала (время, необходимое для достижения сигналом 65% от его значения), с;

$t_{0,9}$ – время стабилизации сигнала (время, необходимое для достижения 90% значения), с;

t_{full} – время полного измерения (время, необходимое для достижения сигналом максимального значения), с.

Установлено, что время достижения заданного уровня аналитического сигнала полупроводникового датчика зависит от условий термической обработки газочувствительной плёнки. Для датчика ацетона данный показатель исследовали при температурах термической обработки в диапазоне 250–850 °С. Зависимость времени отклика ($t_{0,9}$) датчика ЯОС-Ац на основе $SiO_2/(TiO_2 + 0,75CuO)$ от температуры термической обработки газочувствительной плёнки представлена на рисунке 4.2.

Для датчика на основе $SiO_2/(TiO_2 + 0,75CuO)$ минимальное значение времени отклика составляет около 14 с, что соответствует температуре термической обработки 550 °С. При этом дальнейшее повышение температуры обработки практически не приводит к сокращению времени отклика. С учётом установленной зависимости сенсорных характеристик от структуры и пористости газочувствительного материала можно предположить, что при температуре около 500–550 °С формируется оптимальная пористая структура чувствительного слоя, обеспечивающая эффективный доступ молекул ацетона к активным центрам поверхности и, как следствие, высокую скорость формирования аналитического сигнала.

Для оценки воспроизводимости аналитического сигнала исследования проводили при постоянной концентрации ацетона 100 мг/м³. Количество параллельных определений составляло пять. Испытания одновременно проводили на пяти полупроводниковых датчиках. В процессе измерений аналитический сигнал каждого датчика регистрировали с помощью регистрирующего потенциометра. Полученные результаты использовали для оценки воспроизводимости аналитического сигнала. Результаты исследования показали, что разработанный датчик, содержащий два чувствительных элемента — измерительный и компенсационный, — характеризуется хорошей селективностью и воспроизводимостью аналитического сигнала. Одной из важнейших характеристик газоаналитических приборов является селективность определения целевого компонента в присутствии других компонентов анализируемой газовой смеси. В разработанном полупроводниковом датчике селективность определения ацетона обеспечивалась оптимальным выбором температуры работы чувствительного элемента и использованием соответствующих каталитически активных компонентов. Исследование селективности разработанного датчика проводили с использованием стандартных газовых смесей, соответствующих требованиям нормативных документов, предъявляемым к газоаналитическим приборам. Испытания выполняли при температуре 350 °С. Селективность полупроводникового датчика ацетона определяли в присутствии водорода, оксида углерода и метана. Смесь № 1, содержащую ацетон и воздух, подавали на датчик в течение 5 мин, после чего аналитический сигнал регистрировали цифровым вольтметром. Затем на датчик подавали смесь № 2, содержащую ацетон, водород и воздух, и через 5

мин повторно регистрировали значение сигнала. Аналогичным образом определяли аналитические сигналы для смеси № 3, содержащей ацетон, оксид углерода и воздух, и смеси № 4, содержащей ацетон, метан и воздух.

Согласно полученным результатам, присутствие оксида углерода в концентрации до 830 мг/м³, водорода — до 604 мг/м³ и метана — до 540 мг/м³ в газовой смеси, содержащей ацетон и воздух, не оказывает существенного влияния на аналитический сигнал разработанного датчика. Это свидетельствует о высокой селективности датчика по отношению к ацетону в исследованных условиях.

Таким образом, разработан полупроводниковый датчик, обеспечивающий селективное определение ацетона в многокомпонентных газовоздушных смесях, содержащих водород, монооксид углерода и метан одновременно с ацетоном. Разработанный датчик может быть использован для контроля состава природных и технических газовых смесей, а также газообразных выбросов промышленных предприятий. В исследованном диапазоне расхода газовой смеси 5–50 л/ч изменение расхода не оказывает существенного влияния на аналитический сигнал датчика. Установлено также, что величина выходного сигнала практически не зависит от пространственной ориентации датчика и угла его наклона. Это позволяет рассматривать разработанный датчик как самостоятельное средство газового анализа в соответствии с требованиями соответствующего нормативного документа.

ЗАКЛЮЧЕНИЕ

Разработан полупроводниковый метод селективного определения ацетона и на его основе создан полупроводниковый датчик для контроля содержания ацетона в воздухе замкнутых экологических систем, атмосферном воздухе и выдыхаемом воздухе человека. Установлено, что погрешность определения ацетона не превышает 1,5 %. Изучены процессы каталитического окисления горючих компонентов газовых смесей (H_2, CO, CH_4 и ацетона) кислородом воздуха в присутствии оксидов металлов. На основании полученных результатов в качестве оптимального нанокомпозитного материала для газочувствительного элемента полупроводникового датчика ацетона выбран материал состава $SiO_2/(TiO_2 + 0{,}75CuO)$. Экспериментально подтверждена возможность создания высокоселективных полупроводниковых датчиков на основе нанокомпозитных материалов, обладающих различной каталитической активностью по отношению к компонентам газовых смесей. Установлено, что использование измерительного и компенсационного чувствительных элементов позволяет повысить селективность определения ацетона в многокомпонентных газовоздушных смесях.

Основные метрологические характеристики разработанного селективного полупроводникового датчика ацетона определены экспериментально. Установлено, что погрешность определения не превышает 1,5 %, относительное стандартное отклонение Sr — 0,05, а время отклика $t_{0,9}$

составляет около 14 с. Полученные результаты подтверждают перспективность применения разработанного датчика для оперативного и селективного контроля паров ацетона в газовых смесях.

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Шамшетова А.Б.
базовый докторант по специальности «Гидробиология»
Каракалпакский институт сельского хозяйства и агротехнологий
Республика Узбекистан

ВИДОВОЕ РАЗНООБРАЗИЕ МАКРОЗООБЕНТОСА ВОСТОЧНОГО КАРАТЕРЕНА

Аннотация. В статье рассматриваются вопросы изучения видового разнообразия макрозообентосных организмов Восточного Каратерена, их экологические особенности, систематический состав и значение в функционировании водных экосистем. Особое внимание уделяется роли донных беспозвоночных в круговороте органического вещества, поддержании трофических связей и оценке экологического состояния водоёмов. Анализируются основные факторы, влияющие на формирование видового состава макрозообентоса, включая физико-химические свойства воды, характер донных отложений, температурный режим, содержание растворённого кислорода и степень антропогенного воздействия.

Ключевые слова: макрозообентос, видовое разнообразие, донные беспозвоночные, водная экосистема, гидробиология, бентосные организмы.

Shamshetova A.B.
doctoral student in Hydrobiology
Karakalpak Institute of Agriculture and Agrotechnologies
Republic of Uzbekistan

SPECIES DIVERSITY OF MACROZOOBENTHOS IN EASTERN KARATEREN

Abstract. The article discusses the issues of studying the species diversity of macrozoobenthous organisms of the Eastern Karaterene, their ecological features, systematic composition and importance in the functioning of aquatic ecosystems. Special attention is paid to the role of benthic invertebrates in the circulation of organic matter, the maintenance of trophic relationships and the assessment of the ecological state of reservoirs. The main factors influencing the formation of the species composition of macrozoobenthos are analyzed, including the physico-chemical properties of water, the nature of bottom sediments, temperature regime, dissolved oxygen content and the degree of anthropogenic impact.

Keywords: macrozoobenthos, species diversity, benthic invertebrates, aquatic ecosystem, hydrobiology, benthic organisms.

Введение

Водные экосистемы представляют собой сложные природные системы, в которых различные группы гидробионтов взаимодействуют между собой и

с окружающей средой. Одним из важнейших компонентов таких экосистем являются макрозообентосные организмы, обитающие на поверхности дна водоёмов, в толще донных отложений и среди подводной растительности. Они играют значительную роль в трансформации органического вещества, минерализации остатков растений и животных, а также в обеспечении пищей рыб и других водных организмов. Изучение видового разнообразия макрозообентоса имеет большое значение для понимания закономерностей функционирования водных экосистем. Состав и численность донных беспозвоночных зависят от комплекса экологических факторов, среди которых особое место занимают температура воды, содержание растворённого кислорода, минерализация, кислотность, скорость течения, глубина водоёма и структура грунта.

Обзор литературы и методологии

Изучение видового разнообразия макрозообентоса предполагает применение комплекса гидробиологических и лабораторных методов. Основным этапом исследования является отбор проб донных организмов на различных участках водоёма с учётом глубины, характера грунта, наличия водной растительности и особенностей гидрологического режима. Для сбора макрозообентоса в зависимости от глубины и типа водоёма могут использоваться донные захваты, скребки, специальные сачки и другие гидробиологические приспособления. На мелководных участках пробы допускается отбирать вручную с использованием соответствующего оборудования. Собранный материал промывают через сита, после чего обнаруженных беспозвоночных извлекают, фиксируют и подготавливают для дальнейшего определения. Таксономическую идентификацию организмов проводят с использованием определителей водных беспозвоночных, сравнительно-морфологических признаков и современных систематических источников. В зависимости от состава сообщества исследованию подлежат представители кольчатых червей, моллюсков, ракообразных, личинок водных насекомых и других групп донной фауны [1].

Для количественной характеристики сообщества определяют численность организмов на единицу площади и, при наличии данных о массе, их биомассу. Для анализа структуры сообщества могут использоваться показатели видового богатства, индексы разнообразия Шеннона, выравненности Пиелу и доминирования отдельных таксонов. Одновременно целесообразно измерять основные физико-химические параметры воды, включая температуру, содержание растворённого кислорода, водородный показатель и электропроводность [2].

Обсуждения и результаты

Видовое разнообразие макрозообентоса формируется под воздействием комплекса абиотических и биотических факторов. К важнейшим из них относятся характеристики донного субстрата, гидрологический режим, доступность пищевых ресурсов, содержание кислорода и степень антропогенного воздействия. Совокупность этих условий определяет

возможность существования отдельных видов, их распределение по участкам водоёма и соотношение различных систематических групп. В структуре макрозообентосных сообществ пресноводных водоёмов обычно рассматривают несколько основных групп беспозвоночных. К ним относятся малощетинковые черви, брюхоногие и двустворчатые моллюски, ракообразные, а также личинки насекомых, в частности двукрылых, подёнок, ручейников и веснянок. Фактический состав этих групп в конкретном водоёме определяется местными экологическими условиями и должен подтверждаться результатами отбора проб. Малощетинковые черви нередко встречаются в донных отложениях, содержащих значительное количество органического вещества. Некоторые представители этой группы способны переносить пониженное содержание растворённого кислорода, поэтому их относительное обилие может использоваться в комплексе с другими показателями при оценке состояния водной среды. Однако присутствие таких организмов само по себе не является достаточным доказательством загрязнения [3].

Моллюски играют важную роль в процессах фильтрации воды, переработке органических частиц и формировании трофических связей. Их распространение во многом зависит от характера субстрата, доступности пищи, минерализации и химического состава воды. Некоторые виды предпочитают участки с растительностью, другие встречаются преимущественно на песчаных, илистых либо смешанных грунтах. Личинки водных насекомых отличаются значительным экологическим разнообразием. Среди них встречаются организмы, приспособленные к различным скоростям течения, температурным условиям и концентрациям растворённого кислорода. Некоторые группы особенно чувствительны к ухудшению качества воды, тогда как другие способны обитать в условиях повышенной органической нагрузки [4].

Поэтому анализ состава личинок насекомых может предоставлять важную информацию о состоянии водоёма. Одним из ключевых направлений изучения макрозообентоса является определение пространственной неоднородности распределения организмов. Различия в составе грунта, глубине, освещённости и развитии водной растительности создают неодинаковые условия для существования донных беспозвоночных. Например, участки с развитой растительностью могут обеспечивать дополнительные укрытия и пищевые ресурсы, тогда как открытые грунты характеризуются иными условиями обитания. Сезонная динамика также имеет большое значение для формирования макрозообентосных сообществ. Температурные изменения, циклы размножения, развитие личинок насекомых и сезонные колебания содержания кислорода могут влиять на численность и биомассу отдельных групп. В связи с этим однократный отбор проб не всегда позволяет получить полную картину видового разнообразия. Для объективной оценки необходимо проводить исследования в разные сезоны года и по возможности использовать сопоставимые участки отбора [5].

Заключение

Изучение видового разнообразия макрозообентоса является важным направлением гидробиологических исследований, поскольку донные беспозвоночные участвуют в круговороте органического вещества, поддержании трофических связей и функционировании водных экосистем. Их систематический состав, численность и распределение зависят от физических, химических и биологических характеристик среды обитания. Комплексное исследование макрозообентоса Восточного Каратерена должно включать отбор проб на различных участках, определение систематического состава организмов, оценку количественных показателей и анализ экологических условий. Дополнение биологических наблюдений измерениями физико-химических параметров воды позволит получить более полное представление о закономерностях формирования донных сообществ.

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Шевченко В.
основатель и генеральный директор
ООО «Трейдберри», бренд «Вкусы мира»

ОТ ИДЕИ ДО ФЕДЕРАЛЬНОЙ ПОЛКИ: СИСТЕМА СОЗДАНИЯ ПРОДУКТА, ЛИСТИНГА В ФЕДЕРАЛЬНЫХ СЕТЯХ И ВЫПУСКА ПОД СТМ

Аннотация. В статье описан порядок действий, который позволяет малому производителю продуктов питания довести новую позицию от замысла до полки федеральной сети. Материал построен на опыте компании «Трейдберри», работающей под брендом «Вкусы мира». Порядок разбит на четыре этапа: разработка продукта и технологии, листинг в федеральных сетях, производство под собственными торговыми марками ритейлеров, масштабирование через онлайн-каналы. За несколько лет компания прошла путь от узкой ниши до поставщика более чем в сорока федеральных сетях и производителя СТМ для «Перекрёстка», «Ленты» и «Самоката». Опережение рынка FMCG в 2,1 раза объясняется не отдельными удачными решениями, а тем, что каждый этап проходился последовательно и по одной и той же логике. Такой порядок может быть воспроизведён другими производителями малого и среднего масштаба, выходящими на федеральный рынок.

Ключевые слова: FMCG, вывод продукта, федеральный ритейл, листинг, СТМ, собственные торговые марки, онлайн-каналы, масштабирование.

Shevchenko V.
founder and CEO
Tradeberry LLC, Tastes of the World brand

FROM IDEA TO FEDERAL SHELF: THE SYSTEM FOR PRODUCT DEVELOPMENT, LISTING IN FEDERAL CHAINS, AND PRODUCTION UNDER PRIVATE-LABEL BRANDS

Abstract. The article describes a system for launching a new FMCG product from an idea to a federal shelf, developed based on the practical experience of the "Tradeberry" company (the "World's Flavors" brand). The system includes four stages: product development and production technology, listing in federal retail chains, production under retailers' own brands, and scaling through online channels. The company has gone from a niche product to a supplier in more than forty federal chains and a manufacturer of private-label products for "Perekrestok", "Lenta", and "Samokat". The 2.1-fold outperformance of the FMCG market is due not to individual successful solutions, but to a systematic

approach to each stage. The system is applicable to small and medium-sized food producers entering the federal market.

Keywords: FMCG, product launch, federal retail, listing, private label brands, own brands, online channels, scaling.

1. Введение

Рынок FMCG в России по итогам 2025 года вырос на 11,7% в денежном выражении . За этой цифрой скрывается жёсткая реальность. Восемьдесят процентов продаж формируют всего 2,9% SKU. Четырнадцать процентов брендов, запущенных в 2024 году, уже исчезли с полок. За 2025 год на рынке появилось 8 827 новых брендов, и четверть из них пришлась на кондитерскую группу . Конкуренция за место на полке федеральной сети - это не просто соревнование продуктов. Это соревнование систем: кто быстрее разрабатывает продукт, кто точнее попадает в требования сети, кто способен обеспечить стабильные поставки и кто готов производить под чужой бренд, когда это выгодно.

Малому производителю в этой среде сложно. У него нет ресурсов федеральной компании, нет отдела категорийного менеджмента, нет готовой логистики. Но именно малый производитель часто быстрее и гибче - если у него есть система, а не набор разрозненных действий.

В статье описана система, сформированная на практическом опыте компании «Трейдберри» (бренд «Вкусы мира»). Компания работает с 2014 года, прошла путь от поставок в тестовом режиме до контрактов с «Магнитом», X5 Group, «Ашаном», «О'Кей» и другими федеральными сетями. Рост компании опережал рынок в 2,1 раза - и это результат не одного удачного продукта, а воспроизводимой последовательности действий.

Система состоит из четырёх этапов, которые логично следуют один за другим: разработка продукта, листинг, выпуск под СТМ, масштабирование через онлайн-каналы. Каждый этап имеет свои критерии готовности и свои показатели эффективности.

Этап 1: Разработка продукта и технологии производства

2.1. Логика разработки

Разработка продукта для федеральной полки начинается не с идеи, а с ограничений. Что сеть готова взять на полку? Какие категории растут? Где есть свободное место? Ответы на эти вопросы определяют, стоит ли вообще браться за продукт.

Опыт «Трейдберри» показывает: продукт должен решать конкретную проблему сети, а не просто быть «интересным». Когда компания начинала с экзотических снеков - кокосовых чипсов, каштанов, плодов лотоса - это была стратегия «голубого океана»: предложить рынку то, чего на нём почти нет. Сети брали эти продукты не потому, что они были нужны всем покупателям, а потому что они создавали дифференциацию на полке.

Рынок подтверждает эту логику. Категория «фрукты и овощи» растёт двузначными темпами и наращивает значимость в онлайн-канале: доля

онлайн-рынка для этой индустрии в 2024 году составила 6,1%, прибавив за год 1,2 процентного пункта . Продукты на основе фруктов попадают в растущий сегмент, что облегчает переговоры с сетями.

2.2. Технологическая разработка

Разработка технологии - самый недооценённый этап для малого производителя. Можно придумать продукт, но если его нельзя производить серийно с заданным качеством, он не дойдёт до полки.

«Манго-шарики» - показательный пример. Продукт представляет собой сушёное манго, сформированное в шарики, а не традиционное пюре или желе. Компания разработала и применила специальное инженеринговое и технологическое решение, позволившее организовать производство продукта из манго с заданными характеристиками, качеством и возможностью серийного выпуска.

В научной литературе описаны различные методы обработки манго для получения снеков. Вакуумная обжарка позволяет сохранить питательные свойства и сенсорные качества продукта. Сублимационная сушка даёт продукт с высокой пористостью и хрустящей текстурой. Оконная рефрактансная сушка - более энергоэффективная альтернатива для производства фруктовых пластов. Выбор конкретной технологии зависит от целевой текстуры, себестоимости и доступного оборудования. Для малого производителя критично выбрать метод, который не требует чрезмерных капитальных вложений, но обеспечивает стабильное качество от партии к партии.

2.3. Критерии готовности продукта к листингу

Продукт готов к выходу в сеть, когда выполнены четыре условия. Рецептура зафиксирована - изменения после листинга требуют пересогласования с сетью, что занимает время. Технология воспроизводима — производство может выпускать продукт с одинаковыми характеристиками от партии к партии. Упаковка соответствует требованиям сети - формат, маркировка, штрих-коды готовы до первого контакта с байером. Себестоимость позволяет работать с наценкой сети - сеть не будет продавать продукт в убыток, и производитель не должен.

3. Этап 2: Листинг в федеральных сетях

3.1. Что сеть требует от поставщика

Федеральные сети предъявляют к поставщикам требования, которые для малого производителя выглядят как барьер. Но эти требования можно разложить на составляющие и закрыть последовательно.

Сеть смотрит на поставщика с четырёх сторон. Юридическая сторона: договор, сертификаты, декларации, подтверждение прав на торговую марку. Производственная: может ли поставщик дать заявленный объём и не сорвать поставку. Логистическая: выдерживает ли сроки, соблюдает ли требования к упаковке и маркировке. И финансовая: сеть не станет работать с тем, кто исчезнет через полгода.

«Трейдберри» прошла через получение статуса эмитента Московской биржи. Было несколько выпусков биржевых облигаций, шесть из них погашены. Для сетей это не просто финансовая история, а сигнал: поставщик прозрачен и не собирается пропадать.

3.2. Последовательность выхода в сеть

Практика «Трейдберри» показывает последовательность, которая работает для малого производителя.

Начать с тестового режима. Первые контракты с «Магнитом» были адресными поставками в магазины Ростова-на-Дону и Краснодара. Это позволило отработать логистику и понять требования сети без масштабных обязательств.

Перейти на поставки в распределительные центры. Следующий контракт с «Магнитом» уже предполагал поставки в РЦ сети, что расширило географию и потребовало изменения логистики.

Расширять ассортимент постепенно. Компания начинала с двух видов каштанов, затем добавляла новые категории. Каждый новый продукт - это отдельный листинг и отдельное согласование.

Использовать онлайн-каналы как дополнительный канал. Wildberries и Ozon позволяют протестировать спрос без сложных переговоров с байерами.

3.3. Работа с СТМ как инструмент роста

Выпуск под собственной торговой маркой сети - это отдельный этап, который заслуживает внимания. СТМ занимают почти 15% оборота FMCG в России, а в отдельных категориях - до 50% . В первом полугодии 2025 года доля СТМ в продовольственном сегменте достигла 15,3%, увеличившись в 1,8 раза с 2021 года . Для производителя это возможность увеличить загрузку мощностей и получить гарантированный канал сбыта.

Экономическая логика СТМ для производителя описана в литературе. Выпуск продукции под маркой розничных сетей даёт партнёрские отношения с сетью, максимальную загрузку производственных мощностей, стабильный прогнозируемый объём продаж, снижение маркетинговых и рекламных издержек . Производитель может не беспокоиться о сбыте произведённого объёма товара, процесс производства не зависит от меняющейся рыночной конъюнктуры. После подписания контракта риски по сбыту ложатся на розничную сеть. Поставщик товара под private label освобождается от платы за вход в сеть и прочих маркетинговых сборов, которые иногда составляют до 30% розничной цены товара .

Однако есть и минусы. Возможно снижение рентабельности производства за счёт недополучения средств от продажи собственных раскрученных брендов. Производитель попадает в зависимость от розничных сетей - финансовую, по условиям поставки. Самый большой недостаток связан с ценовыми ограничениями: сети стремятся работать с теми производителями, которые смогут обеспечить максимально низкие цены на продукцию private label. Возникает низкая маржинальная доходность такой

продукции по сравнению с той, что тот же производитель предлагает под своей торговой маркой .

«Трейдберри» выпускала продукцию под СТМ для «Яндекс Лавки», а в 2025 году начала производство конфет-шариков для «Ленты» и «Самоката». Для «Перекрёстка» компания выпускала продукцию под маркой Market collection, и продукт стабильно входил в ТОП-3 лучших продуктов субкатегории по продажам.

Ключевое отличие СТМ от работы под собственным брендом: производитель не контролирует маркетинг и позиционирование, но получает стабильный заказ. Это требует готовности адаптировать рецептуру и упаковку под требования сети, но не требует инвестиций в продвижение.

4. Этап 3: Масштабирование через онлайн-каналы

4.1. Онлайн как тестовая площадка

Онлайн-каналы выполняют в системе две функции. Первая - тестирование спроса на новые продукты без риска листинга в офлайновой сети. Вторая - дополнительный объём продаж, который не требует переговоров с байерами.

Роль онлайн-канала на рынке FMCG растёт. Доля интернет-торговли в обороте розницы поднялась с 9,6% в 2020 году до 18,8% в 2025 году, практически удвоившись. Доля e-grocery в продовольственном обороте увеличилась с 0,8% до 5,1% . По итогам первого полугодия 2025 года онлайн-продажи продовольственных товаров выросли на 27,8% и достигли 773 млрд рублей .

«Трейдберри» работает с Wildberries, Ozon, «Самокатом», «Яндекс Лавкой» и другими онлайн-платформами. В июле 2026 года фруктовые ломтики бренда вошли в ТОП-5 продуктов своей категории в сервисе «Самокат».

4.2. Особенности онлайн-логистики

Онлайн-каналы предъявляют свои требования к упаковке и маркировке. Для Wildberries критичны требования к моно-коробам и паллетам, для Ozon - к маркировке и документации. Малому производителю проще начинать с онлайн-каналов, потому что порог входа ниже: не нужны переговоры с категорийными менеджерами, достаточно зарегистрироваться и выполнить технические требования.

4.3. СТМ в онлайн-канале

По итогам 2025 года выручка «Трейдберри» сложилась на уровне около 427 млн рублей, EBITDA - около 105,5 млн рублей. Во втором полугодии 2024-го выручка прибавила 52%, поднявшись со 127 до 193 млн рублей. За первое полугодие 2026 года прибыль от продаж выросла примерно на 62%, а валовая рентабельность прибавила 7,2 процентного пункта.

5. Подтверждение эффективности

5.1. Финансовые результаты

Выручка «Трейдберри» за 2025 год составила около 427 млн рублей, EBITDA - около 105,5 млн рублей. Во втором полугодии 2024 года выручка

выросла на 52% - со 127 до 193 млн рублей. В первом полугодии 2026 года прибыль от продаж выросла на 62%, валовая рентабельность увеличилась на 7,2 процентного пункта.

Рынок FMCG в 2025 году вырос на 11,7% . Рост компании опережает рынок в 2,1 раза.

5.2. Признание продукта

«Манго-шарики в какао-глазури» стали победителем конкурса «Новинка года 2024» на выставке WorldFood Moscow в категории «Кондитерские изделия. Снеки». Продукт также получил три золотые медали на выставке «Продэкспо».

5.3. Присутствие в сетях

Продукция компании представлена или была представлена в «Перекрёстке», «Ашане», «О'Кей», «Глобусе», «Ленте», «Магните», «Самокате», «Яндекс Лавке» и других сетях. Компания поставляла продукцию в 25 тысяч розничных точек России, а также в Казахстан и Беларусь.

6. Переносимость системы

Описанная система может быть применена другими производителями продуктов питания малого и среднего масштаба, которые планируют выход на федеральный рынок. Однако её переносимость не безусловна. Система работает при выполнении ряда условий, которые стоит рассмотреть отдельно.

6.1. Продукт должен иметь дифференциацию

Первое условие касается самого продукта. Если новая позиция не отличается от того, что уже стоит на полке, листинг превращается в ценовую конкуренцию. В такой конкуренции малый производитель обычно проигрывает: у него нет запаса маржинальности, который позволяет крупному игроку держать низкую цену длительное время. Дифференциация может быть разной: состав, формат, упаковка, страна происхождения сырья, способ обработки. Важно, чтобы покупатель мог сформулировать, чем этот продукт отличается от соседнего на полке. Если сформулировать не получается, сеть, скорее всего, тоже не увидит причины брать продукт.

Опыт «Трейдберри» это подтверждает. Компания начинала с экзотических снеков - кокосовых чипсов, каштанов, плодов лотоса. Эти позиции не были массовыми, но они создавали на полке то, чего там раньше не было. Позже дифференциация сместилась в технологию: «манго-шарики» отличались не сырьём, а способом обработки и формой продукта.

6.2. Производство должно выдерживать масштабирование

Второе условие - технологическое. Продукт может быть удачным в малой партии и терять качество при увеличении объёма. Если рецептура требует ручных операций, а оборудование не рассчитано на серийный выпуск, рост остановится на определённом этапе. Это не всегда очевидно на старте: первые партии собираются вручную, качество контролируется глазами, а отклонения компенсируются вниманием технолога. Проблема проявляется

позже, когда сеть увеличивает заказ, а производство не может повторить то же качество в промышленном масштабе.

Поэтому при разработке продукта важно сразу закладывать возможность серийного выпуска. Это может означать выбор другого метода обработки, другой формы продукта или другой упаковки. Иногда проще отказаться от красивой идеи на этапе разработки, чем столкнуться с невозможностью масштабирования через полгода после листинга.

6.3. Готовность работать с собственными торговыми марками

Третье условие - организационное. СТМ воспринимается частью производителей как работа на чужой бренд, то есть как что-то второсортное. Такое отношение мешает использовать СТМ как инструмент. Между тем СТМ решает конкретную задачу: загружает производственные мощности и даёт стабильный, прогнозируемый доход. Производитель, который выпускает продукт под маркой сети, не тратит ресурсы на продвижение и не зависит от колебаний спроса на собственный бренд.

Это не означает, что нужно полностью переходить на СТМ. Как отмечалось выше, у этой модели есть ограничения: снижение маржинальности, зависимость от сети, ценовое давление. Но производитель, который готов работать с СТМ как с одним из каналов, получает доступ к объёмам, недостижимым для него в офлайне под собственным брендом.

6.4. Системная работа с онлайн-каналами

Четвёртое условие - отношение к онлайн-каналам. Если онлайн воспринимается как дополнительная витрина, куда выкладывают остатки, система не работает. Онлайн-каналы - это отдельный рынок со своими правилами: требования к упаковке, к маркировке, к скорости поставки, к работе с отзывами и рейтингами. Производитель, который относится к онлайну как к полноценному каналу, получает две вещи. Первое - возможность протестировать спрос на новый продукт без переговоров с байерами. Второе — дополнительный доступ к СТМ-контрактам, которые в офлайне получить сложнее.

6.5. Ограничения переносимости

Помимо условий, есть и ограничения. Система не универсальна для всех категорий продуктов. Для скоропортящихся товаров логистика федеральных сетей может оказаться недоступной, и тогда основным каналом становятся региональные сети и локальная розница. Система также предполагает наличие базовой производственной инфраструктуры: производитель, работающий полностью на аутсорсинге, может столкнуться с ограничениями по контролю качества и срокам. И наконец, эффективность системы зависит от компетенций команды. Переговоры с сетями, управление листингами, работа с СТМ - это навыки, которые нужно либо наращивать внутри, либо привлекать.

7. Ограничения

Система не является универсальным решением для всех категорий продуктов. Для скоропортящихся товаров логистика федеральных сетей

может быть недоступной, и тогда основной канал - региональные сети и локальная розница.

Система предполагает наличие базовой производственной инфраструктуры. Производитель, работающий на аутсорсинге, может столкнуться с ограничениями по контролю качества и срокам.

Эффективность системы зависит от команды. Переговоры с сетями, управление листингами, работа с СТМ - это компетенции, которые нужно либо наращивать внутри, либо привлекать.

Отдельного внимания заслуживает риск зависимости от СТМ. Как отмечается в литературе, производитель попадает в зависимость от розничных сетей по условиям поставки и ценам . Стратегия развития должна предусматривать баланс между СТМ и собственным брендом, чтобы не потерять контроль над позиционированием и маржинальностью.

8. Заключение

Система «от идеи до федеральной полки», описанная в статье, представляет собой последовательность из четырёх этапов: разработка продукта и технологии, листинг в федеральных сетях, выпуск под СТМ, масштабирование через онлайн-каналы. Опыт «Трейдберри» показывает, что малый производитель может конкурировать с крупными игроками, если у него есть система, а не набор разрозненных действий.

Рост компании в 2,1 раза быстрее рынка FMCG обеспечен не одним продуктом, а способностью последовательно проходить каждый этап: от технологической разработки до переговоров с байерами, от тестовых поставок до работы с СТМ федеральных сетей. Эта система может быть воспроизведена другими производителями при условии адаптации к специфике их категорий и регионов.

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Эргашев А.Х., к.м.н.
доцент
Самаркандский кампус Университета «Зармед»

МУКОВИСЦИДОЗ У ДЕТЕЙ: СОВРЕМЕННЫЕ ПРЕДСТАВЛЕНИЯ ОБ ЭТИОЛОГИИ, ПАТОГЕНЕЗЕ, КЛИНИКЕ, ДИАГНОСТИКЕ И ЛЕЧЕНИИ

Аннотация. Муковисцидоз является одним из наиболее распространённых наследственных заболеваний, имеющих мультисистемный характер поражения. В основе заболевания лежат патогенные варианты гена CFTR, кодирующего трансмембранный регулятор проводимости при муковисцидозе. Современная диагностика включает неонатальный скрининг, потовую пробу и молекулярно-генетическое исследование гена CFTR. Современное лечение включает методы очистки дыхательных путей, муколитическую и антибактериальную терапию, заместительную ферментную терапию, нутритивную поддержку, коррекцию дефицита витаминов и лечение осложнений. Принципиально новым направлением является применение CFTR-модулирующей терапии, воздействующей непосредственно на молекулярный механизм заболевания.

Ключевые слова: муковисцидоз, дети, кистозный фиброз, CFTR, генетика, потовая проба, бронхолёгочная система, поджелудочная железа, CFTR-модуляторы, дети.

Ergashev A.Kh., candidate of medical sciences
associate professor
Samarkand Campus of Zarmed University

CYSTIC FIBROSIS IN CHILDREN: CURRENT CONCEPTS OF ETIOLOGY, PATHOGENESIS, CLINICAL PRESENTATION, DIAGNOSIS, AND TREATMENT

Abstract. Cystic fibrosis is one of the most common hereditary diseases characterized by multisystem involvement. The disease is caused by pathogenic variants of the CFTR (cystic fibrosis transmembrane conductance regulator) gene. Modern diagnostic approaches include neonatal screening, the sweat test, and molecular genetic analysis of the CFTR gene. Current treatment strategies encompass airway clearance techniques, mucolytic and antibacterial therapy, enzyme replacement therapy, nutritional support, correction of vitamin deficiencies, and management of complications. A fundamentally new approach involves the use of CFTR-modulating therapy, which targets the molecular mechanism of the disease directly.

Keywords: cystic fibrosis, children, CFTR, genetics, sweat test, bronchopulmonary system, pancreas, CFTR modulators.

Введение

Муковисцидоз (МВ), или кистозный фиброз, представляет собой аутосомно-рецессивное наследственное заболевание, обусловленное патогенными вариантами гена CFTR. Белок CFTR участвует в регуляции транспорта хлоридов и других ионов через эпителиальные клетки. Нарушение его функции приводит к изменению гидратации секрета и формированию патологически вязкой слизи.

Заболевание характеризуется поражением нескольких органов и систем. Основными клиническими мишенями являются дыхательная система, поджелудочная железа, кишечник, гепатобилиарная система и потовые железы.

Особое значение муковисцидоз имеет в педиатрической практике. Поражение дыхательной системы начинается уже в раннем возрасте и при отсутствии адекватной терапии постепенно приводит к хроническому воспалению, бактериальной колонизации, бронхоэктазам и снижению функции лёгких [1-5]. . В 2025 году в Российской Федерации были обновлены клинические рекомендации по муковисцидозу. В 2026 году Е.И. Кондратьева и соавторы представили обзор этих рекомендаций, уделив особое внимание современной диагностике, терапии и применению CFTR-модуляторов [3-9].

Этиология и генетические основы

Муковисцидоз наследуется по аутосомно-рецессивному типу. Для развития заболевания необходимо наличие патогенных вариантов гена CFTR в обеих аллелях.

Ген CFTR расположен на длинном плече 7-й хромосомы. Кодируемый им белок является ионным каналом эпителиальных клеток. Различные патогенные варианты CFTR могут приводить к нарушению синтеза белка, его транспорта к клеточной мембране, функционирования или стабильности.

Генетическая неоднородность заболевания определяет значительное клиническое разнообразие. В отечественных исследованиях изучались спектр и частота патогенных вариантов CFTR у российских пациентов, а также взаимосвязь генотипа с особенностями клинического течения [4, 5].

Наиболее известным патогенным вариантом является F508del. Вместе с тем у российских пациентов выявляется широкий спектр других вариантов CFTR, причём их частота может различаться в отдельных этнических и географических группах [4-10].

Генетическое исследование имеет не только диагностическое, но и прогностическое и терапевтическое значение, поскольку конкретный генотип может определять возможность применения определённых CFTR-модулирующих препаратов.

Патогенез

Основным патогенетическим механизмом является нарушение функции CFTR в эпителиальных клетках.

При поражении дыхательных путей нарушается транспорт ионов и воды, вследствие чего поверхность эпителия становится недостаточно гидратированной. Формируется вязкий бронхиальный секрет, затрудняется мукоцилиарный клиренс.

В результате создаются условия для:

- накопления густой слизи;
- обструкции мелких дыхательных путей;
- нарушения дренажной функции бронхов;
- бактериальной колонизации;
- хронического воспаления;
- структурного повреждения бронхиальной стенки;
- формирования бронхоэктазов.

В поджелудочной железе нарушение транспорта ионов приводит к образованию густого секрета и обструкции протоков. Это сопровождается снижением поступления пищеварительных ферментов в кишечник и развитием внешнесекреторной недостаточности [24-29].

Клинические проявления у детей

Клиническая картина муковисцидоза характеризуется значительным разнообразием.

Бронхолёгочная система

Основными проявлениями являются:

- хронический кашель;
- вязкая мокрота;
- рецидивирующие бронхиты;
- повторные пневмонии;
- бронхообструктивный синдром;
- одышка;
- свистящее дыхание;
- снижение толерантности к физической нагрузке;
- хронический риносинусит;
- полипоз носа.

Важной особенностью является склонность к хронической бактериальной инфекции дыхательных путей. Значимыми возбудителями являются Staphylococcus aureus и Pseudomonas aeruginosa.

По мере прогрессирования заболевания возможно формирование бронхоэктазов и хронической дыхательной недостаточности.

Российские исследования подчёркивают необходимость регулярного микробиологического мониторинга и оценки функционального состояния дыхательной системы [1, 3, 6].

Поражение поджелудочной железы

Внешнесекреторная недостаточность поджелудочной железы развивается у значительной части пациентов.

Клиническими проявлениями являются:

- стеаторея;
- частый и объёмный стул;
- метеоризм;
- боли в животе;
- мальабсорбция;
- недостаточная прибавка массы тела;
- дефицит жирорастворимых витаминов.

Для ребёнка особенно опасно сочетание мальабсорбции с хроническим воспалительным процессом дыхательных путей, поскольку недостаточность питания отрицательно влияет на иммунную защиту и функцию лёгких [18-24].

Нарушение физического развития

Задержка физического развития является важным маркером тяжести заболевания.

Необходимо регулярно оценивать:

- рост;
- массу тела;
- индекс массы тела;
- динамику физического развития;
- пищевой статус;
- уровень витаминов.

Нутритивная поддержка рассматривается как обязательная составляющая комплексной терапии муковисцидоза.

Мекониальный илеус

У части детей первым проявлением заболевания является мекониальный илеус.

Он характеризуется:

- задержкой отхождения мекония;
- вздутием живота;
- рвотой;
- симптомами кишечной непроходимости.

Наличие мекониального илеуса является важным клиническим признаком, требующим обследования ребёнка на муковисцидоз.

Гепатобилиарная система

Нарушение функции CFTR в эпителии желчных путей может приводить к развитию муковисцидоз-ассоциированного заболевания печени.

Возможны:

- холестатические изменения;
- повышение активности трансаминаз;
- стеатоз;

- фиброз;
- билиарный цирроз.

Поэтому регулярный контроль функции печени является обязательной частью диспансерного наблюдения.

Диагностика

Диагностика муковисцидоза должна быть комплексной.

Неонатальный скрининг

Неонатальный скрининг позволяет выявить детей с повышенным риском заболевания до появления выраженных клинических симптомов.

Положительный результат скрининга требует проведения подтверждающего обследования и не является самостоятельным основанием для окончательной постановки диагноза.

Потовая проба

Потовая проба является одним из основных методов подтверждения муковисцидоза.

Определяется концентрация хлоридов в поте. Результат интерпретируется с учётом клинической картины и данных генетического исследования.

В современной диагностике важно использовать стандартизированную методику выполнения исследования и учитывать возраст пациента.

Генетическая диагностика

Молекулярно-генетическое исследование позволяет определить патогенные варианты CFTR.

Генетическая диагностика особенно важна:

- при сомнительных результатах потовой пробы;
- при атипичных клинических проявлениях;
- для уточнения генотипа;
- для генетического консультирования семьи;
- для определения возможности таргетной терапии.

Российские исследования показали наличие значительного разнообразия вариантов CFTR и необходимость расширенного генетического обследования в отдельных клинических ситуациях [4, 5].

Современные подходы к лечению

Лечение муковисцидоза является пожизненным и мультикомпонентным.

1. Очистка дыхательных путей

Кинезитерапия и другие методы очистки дыхательных путей способствуют удалению вязкого секрета и улучшению вентиляции лёгких.

Используются:

- дыхательные упражнения;
- активный цикл дыхательных техник;
- постуральный дренаж;
- специальные устройства;
- методы положительного экспираторного давления.

Метод выбирается индивидуально с учётом возраста ребёнка и клинического состояния.

2. Муколитическая терапия

Для улучшения дренажа бронхов применяются препараты, воздействующие на свойства мокроты.

Наиболее известными являются:

- дорназа альфа;
- гипертонический раствор натрия хлорида.

Российские данные регистра позволяют оценивать особенности применения муколитической терапии у пациентов с муковисцидозом [10-17].

3. Антибактериальная терапия

Антибактериальная терапия проводится с учётом результатов микробиологического исследования.

Особое значение имеет раннее выявление инфекции **Pseudomonas aeruginosa**, поскольку хроническая колонизация данным микроорганизмом ассоциирована с прогрессированием бронхолёгочного поражения.

Выбор антибиотика должен учитывать чувствительность возбудителя, возраст пациента, тяжесть состояния и предшествующую терапию.

4. Ферментная заместительная терапия

При внешнесекреторной недостаточности поджелудочной железы назначаются препараты панкреатических ферментов.

Эффективность лечения оценивают по:

- характеру стула;
- наличию стеатореи;
- динамике массы тела;
- показателям физического развития;
- нутритивному статусу.

5. Нутритивная поддержка

Рацион ребёнка должен обеспечивать достаточное количество энергии и питательных веществ.

Необходимо контролировать содержание:

- белка;
- жиров;
- углеводов;
- витаминов A, D, E, K;
- микроэлементов.

Российские специалисты подчёркивают необходимость регулярной оценки нутритивного статуса как одного из основных компонентов наблюдения пациентов с муковисцидозом [1, 8].

6. CFTR-модулирующая терапия

Наиболее значительным изменением современной терапии является возможность воздействовать непосредственно на дефектный CFTR-белок.

В зависимости от молекулярного дефекта применяются:

- потенциаторы;

- корректоры;
- комбинированные схемы.

В обновлённых российских клинических рекомендациях 2025 года особое внимание уделено применению CFTR-модуляторов, включая комбинации с элексакафтором, тезакафтором и ивакафтором [3].

Назначение препарата зависит от:

- возраста;
- генотипа;
- зарегистрированных показаний;
- клинического состояния;
- доступности лекарственного препарата.

Поэтому определение генотипа пациента приобретает всё большее практическое значение.

Заключение

Муковисцидоз у детей представляет собой сложное наследственное заболевание с поражением дыхательной, пищеварительной и других систем организма. Основой заболевания является нарушение функции CFTR, приводящее к изменению свойств секретов экзокринных желёз.

Клиническая картина характеризуется значительным разнообразием. Наиболее частыми проявлениями являются хронический кашель, рецидивирующие инфекции дыхательных путей, бронхообструктивный синдром, внешнесекреторная недостаточность поджелудочной железы, мальабсорбция и нарушение физического развития.

Важную роль в раннем выявлении заболевания играют неонатальный скрининг, потовая проба и молекулярно-генетическое исследование CFTR.

Российский опыт, отражённый в национальном регистре пациентов и современных клинических рекомендациях, демонстрирует дальнейшее развитие специализированной помощи детям с муковисцидозом [1–3].

Появление CFTR-модулирующей терапии является принципиально новым этапом лечения, позволяющим воздействовать непосредственно на молекулярный механизм заболевания. В связи с этим генотипирование приобретает не только диагностическое, но и терапевтическое значение.

Таким образом, ранняя диагностика, мультидисциплинарное наблюдение, адекватная нутритивная поддержка, профилактика инфекционных осложнений и персонализированная терапия являются основными условиями улучшения качества жизни и долгосрочного прогноза детей с муковисцидозом.

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Эргашев У.А.
преподаватель кафедры общественных наук и спорта
Ферганский государственный технический университет
Узбекистан, г. Фергана

ЭТИКА ИНФОРМАЦИОННОГО ОБЩЕСТВА

Аннотация. в статье рассматриваются основные философско-этические проблемы информационного общества, формирующегося под воздействием цифровых технологий, информационно-коммуникационных систем и искусственного интеллекта. Анализируется трансформация традиционных представлений о свободе, ответственности, приватности, справедливости, достоинстве и автономии личности в условиях цифровизации общественной жизни.

Ключевые слова: информационное общество, информационная этика, цифровая культура, персональные данные, приватность, информационная безопасность, цифровое неравенство, автономия личности, алгоритмы, цифровая трансформация, человеческое достоинство.

Ergashev U.A.
lecturer
Department of Social Sciences and Sports
Fergana State Technical University
Uzbekistan, Fergana

THE ETHICS OF THE INFORMATION SOCIETY

Abstract. the article examines the main philosophical and ethical issues of the information society emerging under the influence of digital technologies, information and communication systems, and artificial intelligence. It analyzes the transformation of traditional concepts of freedom, responsibility, privacy, justice, human dignity, and personal autonomy in the context of the digitalization of social life.

Keywords: information society, information ethics, digital culture, personal data, privacy, information security, digital inequality, personal autonomy, algorithms, digital transformation, human dignity.

В начале XXI века интернет, социальные сети, цифровые платформы, большие данные, облачные технологии и искусственный интеллект постепенно преобразуют экономику, образование, государственное управление, культуру и повседневную жизнь человека.

Формирование информационного общества сопровождается существенными изменениями в характере социальных отношений. Информация превращается не только в важнейший ресурс развития, но и в объект экономической, политической и социальной деятельности.

Современный человек постоянно находится в информационной среде, получает и производит большие объёмы данных, взаимодействует с цифровыми платформами и принимает решения на основе информации, предоставляемой алгоритмическими системами.

В этих условиях возникает необходимость философского осмысления моральных последствий цифровизации. Технологическое развитие само по себе не гарантирует гуманизации общества. Напротив, оно может порождать новые формы контроля, дискриминации, манипуляции, информационного неравенства и нарушения приватности.

Этика информационного общества представляет собой не просто прикладное направление этики, связанное с использованием компьютеров и Интернета. Она постепенно превращается в самостоятельное направление философского исследования, предметом которого являются моральные основания отношений между человеком, информацией, технологиями и обществом.

В отличие от традиционного общества, где основными ресурсами выступали земля, физический труд и материальные средства производства, в информационном обществе особое значение приобретают знания, данные, информационные сети и интеллектуальные технологии.

Информационная революция изменила не только способы производства и коммуникации, но и структуру человеческого взаимодействия. Современный человек может одновременно быть производителем, потребителем и распространителем информации.

Особое значение приобретают цифровые платформы, которые становятся посредниками между человеком и окружающим миром. Через них человек получает образование, приобретает товары и услуги, общается, работает и получает новости.

Однако подобная трансформация имеет двойственный характер. С одной стороны, цифровые технологии расширяют доступ к информации, создают новые возможности для образования и коммуникации. С другой стороны, концентрация информационных ресурсов и технологических возможностей у ограниченного числа организаций может приводить к новым формам зависимости и неравенства.

История развития международных дискуссий об информационной этике показывает, что вопросы доступа к информации, свободы выражения, приватности и справедливости возникли практически одновременно с формированием глобальной информационной среды.

Следовательно, информационное общество требует не только технологических инноваций, но и соответствующей системы этических норм.

Этика информационного общества охватывает широкий круг вопросов. К наиболее значимым относятся приватность, защита персональных данных, свобода информации, ответственность, информационная безопасность, цифровое неравенство, достоверность информации и влияние алгоритмов на человека.

Одной из фундаментальных проблем цифрового общества является защита частной жизни человека.

В традиционном обществе личная информация имела относительно ограниченное распространение. В цифровой среде информация о человеке может собираться, храниться, анализироваться и передаваться в больших масштабах.

Поисковые запросы, покупки, геолокация, посещаемые сайты, сообщения и активность в социальных сетях формируют цифровой профиль пользователя.

Возникает принципиальный этический вопрос: имеет ли человек право контролировать информацию о самом себе?

С философской точки зрения право на приватность связано с автономией личности и человеческим достоинством. Если человек лишается возможности контролировать информацию о себе, его способность самостоятельно определять границы личной жизни оказывается ограниченной.

Поэтому защита персональных данных должна рассматриваться не только как техническая или юридическая проблема, но и как фундаментальный этический принцип.

Интернет существенно расширил возможности свободного доступа к информации. Однако увеличение объёма информации не всегда означает увеличение объёма достоверного знания.

Современный человек сталкивается с дезинформацией, манипулятивным контентом, фейковыми новостями и различными формами информационного воздействия.

Особую проблему представляет алгоритмическая фильтрация информации. Цифровые платформы используют алгоритмы для определения того, какой контент будет представлен пользователю. В результате человек может получать не всю существующую информацию, а лишь её часть, отобранную в соответствии с определёнными алгоритмическими критериями.

Таким образом, возникает противоречие между формальной свободой доступа к информации и реальной возможностью самостоятельно формировать информационную картину мира.

Следовательно, информационная свобода предполагает не только технический доступ к информации, но и способность человека критически оценивать её содержание.

Особое место в современной этике информационного общества занимает искусственный интеллект.

Развитие генеративного искусственного интеллекта приводит к тому, что алгоритмические системы начинают участвовать в интеллектуальной деятельности, которая ранее считалась преимущественно человеческой: создании текстов, изображений, программного кода, анализе данных и принятии решений.

Искусственный интеллект не должен полностью вытеснять человека из процессов, имеющих существенные социальные и моральные последствия.

Таким образом, развитие искусственного интеллекта требует перехода от вопроса «что может сделать технология?» к вопросу «что технология должна делать и какие ограничения должны существовать?»

Ещё одной важной проблемой информационного общества является цифровое неравенство.

Не все люди имеют одинаковый доступ к современным технологиям, Интернету, цифровому образованию и информационным ресурсам. Различия существуют между странами, регионами, социальными группами, поколениями и уровнями дохода.

Цифровое неравенство нельзя сводить только к отсутствию технических устройств. Оно включает несколько взаимосвязанных компонентов: различия в доступе к цифровой инфраструктуре, различия в уровне цифровой грамотности, различия в способности использовать цифровые технологии, различия в качестве получаемой информации, различия в возможности использовать цифровые технологии для образования и профессионального развития.

Следовательно, цифровизация может одновременно уменьшать и увеличивать социальное неравенство.

Если цифровые ресурсы доступны всем, они способны расширять образовательные и профессиональные возможности. Если же доступ к ним распределён неравномерно, цифровая трансформация может усиливать уже существующие социальные различия.

Поэтому принцип справедливости должен стать одним из ключевых принципов информационного общества.

Расширение возможностей распространения информации повышает ответственность каждого пользователя.

В традиционных средствах массовой информации распространение информации осуществлялось относительно ограниченным числом профессиональных субъектов. В цифровой среде практически каждый пользователь может создать и распространить информационный материал.

Это приводит к необходимости формирования новой культуры информационной ответственности.

Таким образом, цифровая культура должна включать не только технические навыки работы с технологиями, но и моральные нормы поведения в информационной среде.

Особенно важное значение это приобретает в сфере образования.

Анализ основных проблем позволяет выделить несколько фундаментальных принципов, на которых должна основываться этика информационного общества: уважение человеческого достоинства, автономия личности, ответственность, справедливость, прозрачность, безопасность, критическое мышление.

Эти принципы соответствуют современным международным подходам к этике цифровых технологий.

Информационное общество представляет собой не только новый этап технологического развития, но и новую социально-философскую реальность, в которой информация и цифровые технологии становятся важнейшими факторами человеческой жизнедеятельности.

Цифровизация создаёт значительные возможности для развития образования, науки, экономики, культуры и коммуникации. Вместе с тем она порождает новые этические проблемы, связанные с защитой приватности, безопасностью персональных данных, информационной свободой, цифровым неравенством, алгоритмическим управлением, распространением дезинформации и трансформацией человеческой автономии.

Таким образом, дальнейшее развитие информационного общества должно основываться на единстве технологического прогресса, этической ответственности и гуманистических ценностей. Только при таком подходе цифровая трансформация сможет стать фактором не только технологического, но и социального и духовного развития общества.

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Эргашева О.Н., PhD, доцент
и. о. профессора
Термезский государственный университет
Узбекистан, г. Термез

КРИТИЧЕСКОЕ ЧТЕНИЕ БИОГРАФИЙ УЗБЕКСКИХ ЖЕНЩИН КАК МЕХАНИЗМ ЦЕННОСТНОЙ РЕФЛЕКСИИ ДЕВУШЕК-УЧАЩИХСЯ

Аннотация. Актуальность связана с необходимостью работать с культурными биографиями без стереотипизации. Цель — обосновать модель критического чтения. Использованы теоретический и нарративно-биографический анализ. Результат — алгоритм «факт — контекст — выбор — альтернатива — перенос».

Ключевые слова: биографический метод, узбекские женщины, ценностная рефлексия, критическое чтение, культурный контекст, проект.

Ergasheva O.N., PhD, associate professor
acting professor
Termez State University
Uzbekistan, Termez

CRITICAL READING OF UZBEK WOMEN'S BIOGRAPHIES AS A MECHANISM FOR DEVELOPING VALUE REFLECTION AMONG FEMALE STUDENTS

Abstract. The study addresses the use of cultural biographies without stereotyping. The aim is to substantiate a critical-reading model. The methods are theoretical and narrative-biographical analysis. The result is a fact-context-choice-alternative-transfer algorithm.

Keywords: biographical method, Uzbek women, value reflection, critical reading, cultural context, project.

Введение

Исследования О. Н. Эргашевой рассматривают национальные качества девушек-учащихся, восточную воспитательную традицию и культурные женские образы как педагогический ресурс [10–13]. Социокультурная и ценностная перспектива поддерживается работами Х. Б. Бердиевой и Х. Т. Тухтаева [14; 15]. Психолого-педагогические исследования адаптации, защитных механизмов, креативности, проектной деятельности и вовлечённости задают условия безопасной и деятельностной работы с биографическим материалом [1–6], а народная педагогика и

междисциплинарное понимание менталитета уточняют культурный контекст [7–9].

Методы и исследования

Применены нарративно-биографический анализ, сравнительная интерпретация источников и структурно-функциональное моделирование. Психологическая безопасность рассматривалась через условия уважительного диалога и возможность индивидуальной позиции; причинные эффекты в рамках теоретической статьи не заявляются.

Результаты исследования

Алгоритм включает отделение факта от оценки, восстановление контекста, анализ выбора, альтернатив и современного переноса. Мини-проект дополняется индивидуальной рефлексией, поскольку внешнее участие не равно содержательной вовлечённости [3; 5; 6].

Источниковедческая проверка биографического материала

Критическое чтение биографии требует отказа от идеализации культурного образа. Воспитательная значимость не отменяет требования к достоверности: учащаяся должна отделять подтверждённый факт от поздней интерпретации и оценивать поступок с учётом исторических обстоятельств. Такой подход позволяет использовать биографический материал как источник аргументации, а не как готовый нормативный образец [10–13].

Перед включением эпизода в занятие необходимо установить источник факта, отделить документированное событие от поздней интерпретации и обозначить возможные лакуны. Народная педагогика и устное творчество обладают высоким воспитательным потенциалом [7; 8], но фольклорный и биографический тексты требуют разных процедур проверки. Такое разграничение защищает учащихся от превращения воспитательного материала в недоказанную легенду.



Рисунок 1. Алгоритм критического чтения биографического эпизода

Ментальность и риск стереотипизации

Понятие национального качества требует междисциплинарной трактовки. Менталитет включает устойчивые способы восприятия, нормы и ценностные ориентации, но не является неизменным набором черт каждого представителя народа [9]. Поэтому биографии узбекских женщин целесообразно использовать для анализа исторического выбора и культурного контекста, а не для конструирования единственного нормативного образа. Социокультурный подход поддерживает такое различение [14; 15].

Проектно-рефлексивная работа с источниками

Исследовательская активность учащихся конкретизируется через сопоставление двух источников об одной героине, хронологическую карту решения, выделение фактов и интерпретаций, а также краткую публичную аргументацию. Итогом становится доказательная позиция, а не декоративный продукт. Содержательная вовлечённость фиксируется по самостоятельному поиску, обоснованному отбору фактов, готовности пересмотреть первоначальную версию и индивидуальной рефлексии [3–6].

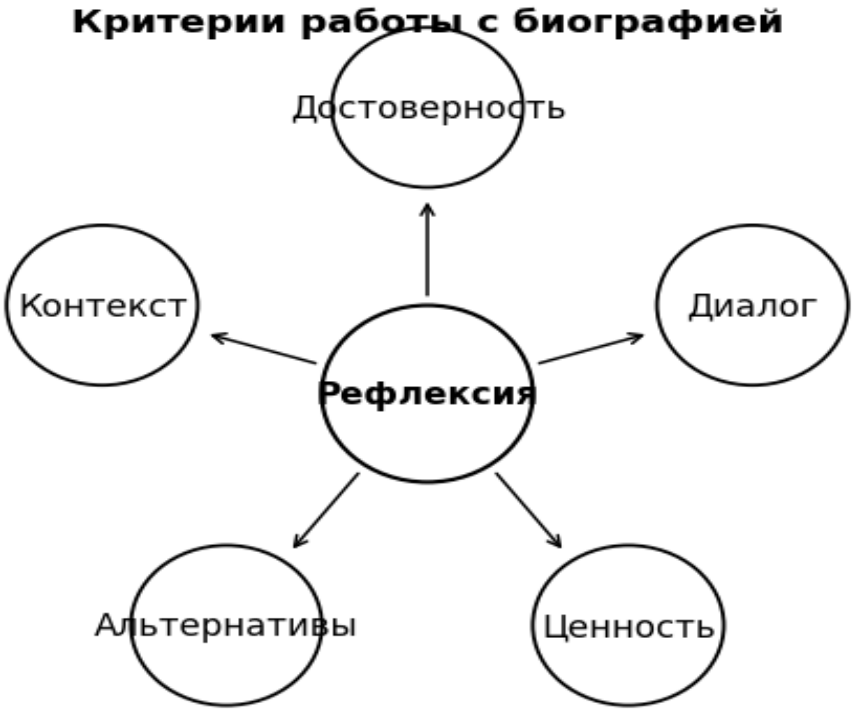


Рисунок 2. Критерии рефлексивной работы с культурной биографией

Обсуждение и критерии

Для практической оценки предлагается разделять фактическую, интерпретативную и ценностную точность. Фактическая точность отражает качество источников; интерпретативная — способность учитывать исторические обстоятельства и альтернативы; ценностная — умение аргументировать современную значимость без навязывания стереотипа. Дополнительным критерием становится культура диалога. Такая система позволяет оценивать не совпадение мнения учащейся с позицией преподавателя, а качество её научно и этически обоснованного рассуждения.

Сравнительный дизайн биографического кейса

Для усиления аналитической составляющей один и тот же ценностный вопрос целесообразно раскрывать через два биографических эпизода, относящихся к разным историческим периодам. Учащиеся сопоставляют ограничения времени, доступные ресурсы, общественные ожидания и способы действия героинь. Сравнение не направлено на ранжирование «кто лучше», а позволяет увидеть, как сходная ценность — образование, ответственность, гражданская активность, забота о семье — получает разные формы выражения. Такой кейс снижает риск буквального копирования образца и делает историко-культурный контекст предметом анализа.

Формат итоговой рефлексии

Индивидуальная рефлексия после группового обсуждения должна содержать три коротких элемента: факт, который изменил первоначальное мнение; наиболее убедительный аргумент другого участника; собственный вывод о современной применимости ценности. Это позволяет отделить

социально желаемый ответ от реального пересмотра позиции. В экспериментальной проверке такие тексты могут кодироваться по глубине аргументации и способности учитывать альтернативу, что создаёт более точную основу для оценки ценностной рефлексии.

Возрастная и методическая дифференциация биографических заданий

Сложность биографического анализа должна зависеть от образовательного уровня. Для младших подростков продуктивнее короткий эпизод с ясным выбором и двумя–тремя вопросами о фактах и последствиях. Для старших учащихся допустимы сопоставление источников, обсуждение противоречивых интерпретаций и анализ исторических ограничений. В студенческой аудитории биографический материал может переходить в мини-исследование с обязательной фиксацией источников. Такая градация предотвращает две крайности: упрощённое морализирование и чрезмерную исследовательскую сложность, при которой воспитательная задача теряется.

Методически важно также различать коллективное обсуждение и индивидуальную позицию. Групповая дискуссия расширяет число интерпретаций, но может создавать давление большинства. Поэтому итоговый этап должен включать краткий индивидуальный текст, где учащаяся формулирует собственный вывод и указывает, какой аргумент изменил или не изменил её первоначальную позицию. Этот приём одновременно поддерживает психологическую безопасность, самостоятельность и возможность исследовательской фиксации динамики ценностной рефлексии.

Ограничения и последующая проверка

Теоретическая модель не предполагает, что сам факт чтения биографий автоматически формирует ценностную рефлексию. Эффект зависит от качества источника, позиции педагога, возможности обсуждать альтернативы и отсутствия принудительной идентификации с героиней. Для проверки модели перспективно сравнить описательное чтение биографии и критико-диалогический формат по качеству аргументации, числу рассмотренных альтернатив, способности отделять факт от оценки и устойчивости индивидуального вывода после групповой дискуссии. Такой дизайн позволит установить, какой именно компонент работы с биографией имеет педагогическое значение.

Этические принципы отбора и представления биографического материала

Отбор биографических сюжетов для воспитательной работы должен опираться на несколько ограничений. Во-первых, предпочтительны эпизоды, для которых можно установить источник и исторический контекст. Во-вторых, педагогически значимым является не только достижение героини, но и ситуация выбора, позволяющая увидеть противоречие между обстоятельствами, личной позицией и возможными последствиями. В-третьих, биография не должна превращаться в инструмент сравнения

реальных учащихся с идеализированным образом. Такая логика особенно важна при работе с девушками-учащимися, поскольку нормативное предъявление «правильного женского поведения» может невольно закреплять стереотипы вместо развития ценностной рефлексии.

Методически полезно вводить правило источниковедческой прозрачности: в каждом мини-проекте учащаяся указывает, какой факт взят из проверяемого источника, какой вывод является интерпретацией, а где сохраняется неопределённость. Эта процедура одновременно развивает академическую добросовестность и снижает риск превращения воспитательной работы в пересказ легенд. Итоговая индивидуальная рефлексия может строиться вокруг трёх вопросов: какой факт оказался наиболее значимым; какая интерпретация изменилась после обсуждения; как выбранная ценность может проявляться сегодня без буквального копирования исторического поведения. Такой формат создаёт наблюдаемые показатели для последующей эмпирической проверки модели.

Заключение

Критическое чтение превращает биографию из готового образца в материал аргументированного ценностного анализа. Модель требует последующей эмпирической проверки.

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Эшматов Э.
доцент кафедры географии и природных ресурсов
Самаркандский государственный университет
имени Шарофа Рашидова
Узбекистан, г. Самарканд

СПЕЛЕОТУРИСТИЧЕСКИЕ МАРШРУТЫ КАРСТОВЫХ ПЕЩЕР ЮГО-ЗАПАДНОГО УЗБЕКИСТАНА: ГЕОГРАФИЯ, КЛАССИФИКАЦИЯ И ПЕРСПЕКТИВЫ РАЗВИТИЯ

Аннотация. В статье рассматриваются географические особенности и основные направления развития спелеотуризма в карстовых районах Юго-Западного Узбекистана. На основе представленных данных систематизированы важнейшие спелеотуристические объекты, их природно-географическое положение, высотные отметки и транспортная доступность. Выделены восемь основных маршрутов различной степени сложности: от очень простых до очень сложных. Показано, что дифференциация маршрутов определяется особенностями рельефа, тектонической расчленённостью, распространением карбонатного карста и условиями транспортной доступности. Особое внимание уделено возможностям использования пещер в научно-познавательном, рекреационном и экологическом туризме, а также необходимости их охраны как уникальных природных объектов.

Ключевые слова: карстовые пещеры, спелеотуризм, туристический маршрут, Юго-Западный Узбекистан, география туризма, рекреационные ресурсы, охрана природы.

Eshmamatov E.
associate professor
Department of Geography and Natural Resources
Sharof Rashidov Samarkand State University
Uzbekistan, Samarkand

SPELEOTOURISM ROUTES OF KARST CAVES IN SOUTHWESTERN UZBEKISTAN: GEOGRAPHY, CLASSIFICATION AND DEVELOPMENT PROSPECTS

Abstract. The article examines the geographical features and principal directions for the development of speleotourism in the karst regions of Southwestern Uzbekistan. Based on the provided data, the most important speleotourism sites are systematized according to their physical-geographical location, elevation and accessibility. Eight major routes with different levels of difficulty are distinguished, ranging from very easy to very difficult. The differentiation of the routes is shown to depend on relief complexity, tectonic dissection, the distribution of carbonate karst, and transport accessibility. Special attention is paid to the potential use of

caves for scientific, educational, recreational and ecotourism purposes, as well as to the need for their protection as unique natural monuments.

Keywords: karst caves, speleotourism, tourist route, Southwestern Uzbekistan, tourism geography, recreational resources, nature conservation.

Введение

Пещеры относятся к числу наиболее своеобразных и ценных природных объектов. Их значение определяется не только геологической и геоморфологической уникальностью, но и широкими возможностями научного, эстетического, рекреационного, туристического и образовательного использования.

Карстовые пещеры Юго-Западного Узбекистана имеют значительный потенциал для развития спелеотуризма. Сочетание горных и пустынных ландшафтов, разнообразие карстовых форм, сложный рельеф и наличие объектов разной степени доступности создают предпосылки для формирования маршрутов, ориентированных как на массового туриста, так и на подготовленных спелеологов.

Цель статьи — систематизировать основные спелеотуристические объекты и маршруты Юго-Западного Узбекистана, оценить их пространственную дифференциацию по уровню сложности и определить ключевые направления рационального туристического использования и охраны карстовых пещер.

Материалы и методы

Исходной основой исследования послужили сведения о географическом положении спелеотуристических объектов Юго-Западного Узбекистана, их абсолютной высоте, ближайших населённых пунктах, координатах и маршрутной принадлежности, представленные в исходном материале.

В работе использованы сравнительно-географический, описательный и маршрутный подходы. Для систематизации маршрутов применена классификация по степени сложности, приведённая в исходных данных: очень простые, простые, сложные и очень сложные маршруты. Для оценки пространственной организации туристических направлений учитывались рельеф, степень расчленённости территории, характер карстовых форм и транспортная доступность.

Количественное соотношение маршрутов по категориям сложности рассчитано непосредственно по восьми основным направлениям, приведённым в исходной таблице.

Результаты и обсуждение

1. География основных спелеотуристических объектов.

В исходных данных выделены наиболее важные пещерные объекты, сосредоточенные главным образом в пределах Зарафшанского и Гиссарского горных систем. К числу ключевых объектов относятся Хазрати Довуд, Туда, Мушуклар, Динданак и Тешикташ. Их абсолютные высоты варьируют от 1318

до 1667 м, что отражает преимущественно горный характер спелеотуристических ресурсов региона.

Таблица 1 – Основные спелеотуристические объекты, представленные в исходных данных

Объект	Горная система	Ближайший населённый пункт	Координаты	Высота, м
Хазрати Довуд	Зарафшанская	Самарканд, Джума	39°49′31″ N; 66°46′07″ E	1318
Туда	Гиссарская	Байсун	38°13′07″ N; 67°07′57″ E	1667
Мушуклар	Гиссарская	Байсун, с. Мачай	38°13′14″ N; 67°01′41″ E	1425
Динданак	Гиссарская	Байсун, с. Мачай	38°13′12″ N; 67°01′44″ E	1420
Тешикташ	Гиссарская	Байсун, с. Мачай	38°33′54″ N; 67°08′08″ E	1550

2. Основные спелеотуристические маршруты и их сложность.

Восемь маршрутов объединяют пещеры и другие природные объекты в несколько территориальных направлений. Наиболее доступным является маршрут Самарканд–Келси–Лев–Самарканд. Простые маршруты охватывают Байсунский и ряд других участков с расчленённым, но относительно доступным рельефом. Сложные и очень сложные маршруты приурочены к участкам с куэстами, каньонами, трогами, сильно расчленёнными горными формами и, в отдельных случаях, устойчивым снежным покровом и небольшими горными ледниками.

Таблица 2 – Основные спелеотуристические маршруты Юго-Западного Узбекистана

№	Основные пункты маршрута	Природно-географическая характеристика	Уровень сложности
1	Хазрати Довуд – Лев – Келси	Высокие адыры, расчленённые саями и ручьями	Очень простой
2	Туда – Динданак – Мушуклар – Тешикташ	Сильно расчленённый рельеф, влияние тектоники и текучих вод	Простой
3	Зинданак – Ходжа Гургур ота – Кора юлдуз	Очень сложный горный рельеф, куэсты, каньоны и карбонатный карст	Очень сложный
4	Александр Вишневский – Бойбулок	Очень сложный высокогорный рельеф, снег и местами небольшие ледники	Очень сложный
5	Омонхона – Ходжайпок – Авлиё	Высокие адыры, расчленённые саями и ручьями	Простой
6	Камари Донимозор – Камари Доникургон I – Камари Доникургон II	Сильно расчленённый рельеф, влияние тектоники и текучих вод	Простой
7	Дарёли – Амир Темур – Бойкобил	Сложный расчленённый горный рельеф	Сложный
8	Тош туяли – Dark Star – Бури уяси	Сложный расчленённый горный рельеф	Сложный

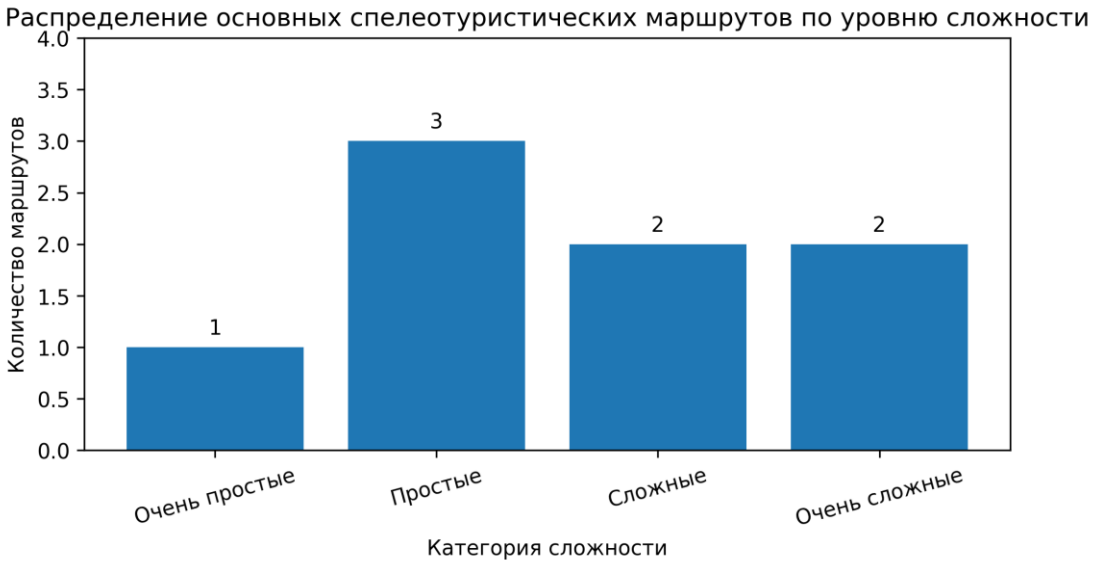


Рис. 1 – Распределение основных спелеотуристических маршрутов по уровню сложности (рассчитано по данным исходной таблицы)

Распределение маршрутов показывает, что простые, сложные и очень сложные направления в совокупности преобладают над самым лёгким типом. Это свидетельствует о необходимости дифференцированного подхода к организации туристических потоков, обязательного учёта физической подготовки посетителей и применения специального сопровождения на наиболее трудных участках.

3. Туристическое и природоохранное значение.

Пещеры региона могут использоваться в научно-познавательном, экологическом, рекреационном и специализированном спортивно-туристическом направлениях. Их потенциал связан с возможностями проведения географических, геологических, археологических, палеонтологических и биологических исследований, а также с формированием новых туристических продуктов для местных и иностранных посетителей.

Одновременно рост туристической нагрузки требует осторожного природопользования. Пещеры формируются в течение длительных геологических периодов и являются невоспроизводимыми природными объектами. Поэтому использование наиболее ценных объектов целесообразно сочетать с режимами охраны, контролируемым посещением, экологическим просвещением и, при необходимости, приданием отдельным пещерам статуса памятников природы.

Заключение

Карстовые пещеры Юго-Западного Узбекистана представляют собой значимый природно-рекреационный ресурс, способный стать основой для развития специализированного спелеотуризма. Пространственная организация маршрутов показывает выраженную зависимость от рельефа,

геологического строения, степени расчленённости территории и транспортной доступности.

На основе представленных данных выделено восемь основных спелеотуристических маршрутов. Один из них относится к очень простым, три — к простым, два — к сложным и два — к очень сложным. Такая структура позволяет формировать дифференцированные туристические продукты для посетителей с различной физической подготовкой и профессиональными навыками.

Развитие спелеотуризма должно сочетаться с охраной пещерных комплексов. Учитывая уникальность и невоспроизводимость пещер как природных объектов, перспективные территории целесообразно рассматривать в контексте режима охраны природных памятников, экологического просвещения и регулируемого туристического использования.

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Юлдашев Ж.Б.
старший преподаватель кафедры нефтегазового дела и технологии переработки нефти и газа
Каршинский государственный технический университет

АНАЛИЗ И ОЦЕНКА ЭФФЕКТИВНОСТИ МЕТОДОВ ЗАЩИТЫ ОТ КОРРОЗИИ ОБОРУДОВАНИЯ НЕФТЕГАЗОВОЙ ОТРАСЛИ

Аннотация. Рассматриваемый материал посвящен анализу добыча нефтяного и газового сырья. Специфика производства оборудования для нефтегазовой отрасли заключается в обязательной антикоррозийной защите рабочих поверхностей аппаратуры. В качестве базовой меры традиционно закладывают дополнительную толщину стенки (коррозионную прибавку) для компенсации износа и эрозии. В то же время, если оборудование рассчитывается на длительное использование, требуется внедрение дополнительных защитных технологий.

Ключевые слова: Нефтегазовый комплекс, технологическое оборудование, физика и математика, измерительные приборы.

Yuldashev J.B.
senior lecturer
Department of Oil and Gas Engineering and Oil and Gas Processing Technology
Karshi State Technical University

ANALYSIS AND EVALUATION OF THE EFFECTIVENESS OF METHODS FOR PROTECTING OIL AND GAS EQUIPMENT FROM CORROSION

Abstract. The material under discussion is dedicated to analyzing the extraction of oil and gas raw materials. The specificity of manufacturing equipment for the oil and gas industry lies in the mandatory anti-corrosion protection of the working surfaces of the equipment. As a basic measure, an additional wall thickness (corrosion allowance) is traditionally added to compensate for wear and erosion. At the same time, if the equipment is designed for long-term use, the implementation of additional protective technologies is required.

Keywords: Oil and gas complex, technological equipment, physics and mathematics, measuring instruments.

Переработка нефтяного и газового сырья сопряжена с рядом технологических трудностей, среди которых — термический распад реагентов и их повышенное пенообразование. Из-за этих факторов использование ингибиторов коррозии как одного из базовых способов защиты оказывается неэффективным. В условиях воздействия агрессивных сред наиболее надежным решением становится нанесение защитных покрытий [1].

Однако из-за многообразия рабочих сред и разрушающих агентов универсального покрытия не существует — подбор материалов в каждом конкретном случае должен опираться на данные лабораторных и опытно-промысловых тестов.

Результаты прошлых изысканий [2] показывают, что фактический ресурс антикоррозийных покрытий часто оказывается ниже заявленного производителями. Традиционная методика тестирования заключается в погружении образцов в агрессивную среду на определенный срок с последующим визуальным контролем. При таком подходе материал забраковывают только при появлении явных дефектов (растрескивание, вздутие). Чтобы получить достоверную картинку и точно оценить состояние техники, необходимо задействовать приборные методы лабораторного анализа. Выбираемый комплекс методов должен давать объективную оценку, включая определение адгезии и диэлектрической сплошности. Исследование коррозионного износа установок переработки углеводородов показывает, что наибольшему разрушению подвергаются внутренние поверхности нижних и верхних участков обечаек, а также нижние днища. Обзор современных способов лабораторного контроля позволил выделить наиболее эффективные методы для точной диагностики степени коррозионного поражения.

К числу наиболее доступных способов относится метод решетчатых надрезов. С его помощью оценивают адгезию материала — его сопротивляемость отслаиванию от подложки. Благодаря своей универсальности данный подход эффективен как при лабораторной диагностике, так и во время контроля в полевых условиях. Принцип тестирования заключается в нанесении на слой покрытия V-образных надрезов с формированием сетки, после чего визуально устанавливают класс адгезии. Сначала на образце выполняют ряд параллельных прорезей до стальной основы, затем — аналогичные прорези под прямым углом, создавая квадратную решетку. Оценку адгезионных характеристик проводят с опорой на стандартную классификационную таблицу.

Для количественного анализа адгезии (особенно в случае многослойных систем) задействуют метод отрыва. Процедура выполняется с помощью специализированного прибора, формирующего растягивающее усилие строго перпендикулярно защищаемой поверхности. Для испытаний применяются цилиндрические «грибки» (диаметром 20 мм и длиной не менее 10 мм), а также режущий инструмент для сквозного рассечения слоя до металла. Измерения проводят минимум на трех образцах для каждого типа покрытия при строго заданных параметрах. Степень и характер разрушения выражают в процентах как отношение площади отслоения к площади контакта «грибка». Следующий подход базируется на измерении диэлектрической сплошности защитного слоя. Анализ выполняется электроискровым дефектоскопом постоянного тока при установленном напряжении на каждый миллиметр толщины. Метод предназначен для локализации сквозных дефектов в диэлектрических материалах, нанесенных на токопроводящие основания.

Наличие повреждений фиксируется звуковым или световым сигналом прибора.

Дополнительно для контроля толщины слоя задействуют магнитоиндукционный способ. В его основе лежит фиксация колебаний магнитного сопротивления цепи, что позволяет измерять толщину нетокопроводящих составов на ферромагнитных сталях. На основании комплекса проведенных тестов делается заключение, согласно которому о деградации защитных качеств свидетельствуют следующие типы повреждений:

– растрескивание, характеризующееся появлением разрывов в покрытии;

– отслаивание, представляющее собой отделение участков одного или более слоев системы от нижележащих слоев или отделение всей системы покрытия от окрашиваемой поверхности;

– образование пузырей, происходящее от воздействия влаги;

– сморщивание;

– коррозионные повреждения.

За исключением сморщивания, оценка которого проводится исключительно по пораженной площади, все остальные типы дефектов классифицируются как по площади распространения, так и по их геометрическим параметрам. Практический опыт эксплуатации свидетельствует: хотя используемые составы способны обеспечивать внутреннюю антикоррозийную защиту техники, на установках с температурным режимом от 100 °С и выше ресурс таких покрытий редко превышает один год. По итогам контроля определяются следующие факторы, ухудшающие свойства покрытий:

- **Ошибки при нанесении:** подрядные организации нередко нарушают регламенты завода-изготовителя, допуская отклонения в качестве подготовки подложки, толщине наносимого слоя и продолжительности сушки.
- **Преждевременный пуск:** из-за жестких временных рамок плановых ремонтов технологические аппараты часто запускают в работу до завершения полного цикла полимеризации состава.
- **Механические повреждения:** целостность защитного слоя нередко нарушается при выполнении последующих монтажных или ремонтных операций внутри емкостей.
- **Нарушение технологии подготовки:** на ряде объектов фиксируется нанесение составов на поверхностное основание, не соответствующее нормативным требованиям по степени очистки и шероховатости.
- **Недостаточный воздухообмен:** при отсутствии надлежащей вентиляции замкнутого объема испарение растворителей замедляется, что препятствует полноценному отверждению материала из-за высокой концентрации паров.

Поэтому были выдвинуты следующие рекомендации по проведению нанесения защитных покрытий:

1. При проведении работ необходимо соблюдать требования производителя покрытия по степени подготовки поверхности, толщине покрытия, количеству слоев, времени сушки.

2. При невозможности подготовить защищаемую поверхность для нанесения защитного покрытия требуемого качества стоит отказаться от нанесения данного вида покрытия.

3. При выборе типа защитных покрытий отдавать предпочтение покрытиям с наименьшим сроком сушки и количеством наносимых слоев.

4. Для сокращения времени сушки и полимеризации покрытия применять тепловые сушки и принудительную вентиляцию.

По результатам данных испытаний можно сделать рекомендации для использования конкретных защитных покрытий в зависимости от условий эксплуатации.

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Ямашев Т.П.
аспирант по научной специальности 5.2.5 «Мировая экономика»
Российский экономический университет имени Г.В. Плеханова
Россия, г. Москва

СОТРУДНИЧЕСТВО РОССИИ И КИТАЯ В СФЕРЕ ВИЭ

Аннотация. Участие китайской компании в российском проекте ВИЭ может означать продажу оборудования, освоение производства или вложение капитала в электростанцию, что даёт разные экономические результаты. В статье предложены критерии их сопоставления по распределению доходов, передаваемым компетенциям и эксплуатационным обязательствам. Сравнение статистики IRENA за 2020 и 2025 годы раскрывает различие масштабов рынков России и Китая. Анализ публикаций Эн+ об амурском ветропарке показывает, почему заявленную мощность нельзя использовать как показатель уже состоявшегося сотрудничества: документы описывают подготовку проекта и различающиеся варианты сбыта. Сформулированы требования к проверке спроса, присоединения, обслуживания и содержания локализации. Приоритет предложено отдавать проектам с обоснованной выручкой и доступными данными эксплуатации.

Ключевые слова: Россия, Китай, возобновляемые источники энергии, производственная кооперация, локализация, энергетический переход

Yamashev T.P.
postgraduate student in specialty 5.2.5 World Economy
Plekhanov Russian University of Economics
Russia, Moscow

RUSSIA–CHINA COOPERATION IN RENEWABLE ENERGY

Abstract. A Chinese company's involvement in a Russian renewable energy project may take the form of equipment supply, manufacturing cooperation or an equity investment in a power plant, which produces different economic outcomes. This article proposes criteria for comparing them through revenue allocation, capability transfer and operating responsibilities. IRENA statistics for 2020 and 2025 reveal differences in the scale of the Russian and Chinese markets. An examination of En+ disclosures on the Amur wind farm shows why announced capacity cannot be treated as a measure of completed cooperation: the documents describe project preparation and different electricity offtake options. The article identifies requirements for assessing demand, grid connection, maintenance and localisation. It favours projects with a substantiated revenue model and accessible operating data.

Keywords: Russia, China, renewable energy sources, manufacturing cooperation, localisation, energy transition

Исследовательский вопрос и подход к анализу

Покупка ветроустановки дает российскому заказчику доступ к оборудованию. Освоение ее обслуживания и производства компонентов требует иных договоренностей с поставщиком. Если китайская компания участвует еще и в капитале электростанции, к техническим отношениям добавляются обязательства по финансированию и распределению выручки. Между этими формами взаимодействия нет автоматического перехода. Для исследования сотрудничества России и Китая в сфере возобновляемых источников энергии (ВИЭ) это принципиальное различие: одинаковая установленная мощность может быть результатом совершенно разных способов организации проекта.

При каких условиях такое сотрудничество одновременно расширяет генерацию и помогает накапливать производственные компетенции в России? Ответ на этот вопрос составляет цель статьи. Предлагается сопоставлять сделки по функциям участников, распределению доходов и ответственности за эксплуатацию. Рабочая гипотеза состоит в том, что сочетание российских ресурсов и китайских производственных возможностей приносит устойчивый результат при согласовании сбыта электроэнергии и условий освоения технологии. Одной взаимодополняемости для этого недостаточно.

Сравнение национальных мощностей дополняется анализом форм сотрудничества и документов об амурском ветропарке. Эти документы позволяют проверить, какие сведения нужны для оценки стадии проекта и участия партнеров. Ожидаемый научный результат — критерии разграничения предполагаемых выгод и подтвержденных результатов.

Статистическое сравнение выполнено по мартовскому выпуску IRENA Renewable capacity statistics 2026 с данными на конец 2020 и 2025 годов. Использованы также обзор литературы и качественный анализ корпоративных публикаций. Дата отсечения информации — 1 октября 2026 года. Публикации раскрывают намерения и подготовительные действия; их полнота ограничивает выводы о финансировании и эксплуатации.

Предмет статьи — солнечная и ветровая электрогенерация и производственная кооперация. Накопители и системы управления рассматриваются как обеспечивающие технологии. Гидроэнергетика включена в общий показатель ВИЭ, но ее проекты требуют отдельного анализа сроков строительства и экологических ограничений. Атомная генерация и водород без подтвержденного возобновляемого происхождения энергии не рассматриваются.

Обзор литературы и специфика исследования

Сценарный подход позволяет объяснить, почему наличие технологии еще не означает появления спроса на нее. Л. Н. Проскурякова и Г. В. Ермоленко используют форсайт и анализ политики при исследовании

будущего российской возобновляемой энергетики (Proskuryakova, Ermolenko, 2019). [48] Для темы российско-китайского сотрудничества ценность этого подхода состоит в учете решений государства и компаний наряду с техническими изменениями. Считаем, что прогноз доступности оборудования следует дополнять анализом условий его закупки и использования: иначе перспективы отрасли легко принять за готовый портфель двусторонних проектов.

Технологическая политика, локализация и распределенная генерация занимают существенное место в анализе российского энергетического перехода у Т. Митровой и Ю. Мельникова (Mitrova, Melnikov, 2019).[49] Работа относится к условиям 2019 года. Ее объяснительные положения полезны для нашей темы, а описание правил поддержки требует проверки по более поздним источникам. Отсюда следует различать два вопроса: почему государство связывает ВИЭ с промышленным развитием и какие конкретные обязательства принимает участник сегодняшнего проекта. Ответ на первый вопрос не заменяет ответа на второй.

Для определения роли китайского партнера полезен опыт исследования других регионов. Я. В. Лексютина на материале Центральной Азии разграничивает финансирование проектов и участие китайских компаний в качестве подрядчиков и поставщиков (Лексютина, 2024).[50] Применительно к России это различие помогает избежать завышенной оценки инвестиционного участия. На наш взгляд, переносить можно сам способ проверки функций компании; переносить региональные результаты без анализа российских условий было бы необоснованно.

Перспективы взаимодействия России и Китая уже рассмотрены в специальной литературе. Чжао Лян и соавторы связывают их с взаимодополняемостью сторон и анализируют асимметрию технологического развития и ограничения партнерства (Чжао Лян и др., 2025).[51] С. А. Юрицкий исследует возможности солнечной и ветровой энергетики Сибири при участии Китая (Юрицкий, 2026). [52] Эти работы позволяют сузить задачу настоящей статьи. Само указание на перспективность сотрудничества не составляет ее новизны; интерес представляет механизм, посредством которого потенциальное преимущество становится наблюдаемым экономическим результатом.

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[48] Proskuryakova L. N., Ermolenko G. V. (2019). The future of Russia's renewable energy sector: Trends, scenarios and policies. Renewable Energy. Vol. 143. P. 1670–1686.

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[50] Лексютина Я. В. (2024). «Зеленая» энергетика во взаимодействии Китая с Центральной Азией. Проблемы Дальнего Востока. № 2. С. 144–156.

[51] Чжао Лян и др. (2025). Текущая ситуация и перспективы сотрудничества между Китаем и Россией в области возобновляемых источников энергии в контексте энергетического перехода. Прогрессивная экономика. № 12. С. 31–53.

[52] Юрицкий С. А. (2026). Развитие солнечной и ветровой энергии в Сибири при участии Китая. Известия Томского политехнического университета. Инжиниринг георесурсов. Т. 337. № 7. С. 247–260.

Объяснить этот механизм помогает теория управления глобальными цепочками стоимости. Г. Джереффи, Дж. Хамфри и Т. Стерджен связывают устройство кооперации со сложностью операций, возможностью формализации требований и компетенциями поставщиков (Gereffi et al., 2005). [53] Для проекта ВИЭ эти параметры можно рассматривать через распределение проектирования, изготовления, монтажа и обслуживания. Мы считаем существенным именно содержание закрепленных функций: формальное участие в цепочке не показывает, способен ли партнер самостоятельно выполнять сложные операции и получать соответствующий доход.

Сопоставление функций участников с подтвержденной стадией проекта дополняет обсуждение взаимодополняемости требованиями к ее проверке. Открытые источники не раскрывают всех двусторонних сделок. Предложенные критерии предназначены для анализа отдельных проектов; подсчет всех инвестиций в ВИЭ потребовал бы других данных.

Различия масштабов рынков и экономические интересы сторон

Таблица 1 сопоставляет установленную мощность России и Китая по единым годам и классификации IRENA (IRENA, 2026).[54] Показатель не измеряет выработку или двусторонние сделки. Российская программа ДПМ ВИЭ охватывает иной состав объектов, поэтому прямое объединение ее статистики с этими данными нарушило бы сопоставимость.

Таблица 1

Установленная мощность ВИЭ в России и Китае, МВт

Показатель	Россия 2020	Россия 2025	Китай 2020	Китай 2025
Все ВИЭ	53 992	57 386	896 412	2 258 016
Солнечная энергия	1 774	2 433	253 864	1 202 179
Ветровая энергия	1 041	2 880	281 993	640 626

Источник: IRENA (2026), мартовский выпуск.

Общие мощности ВИЭ в таблице включают возобновляемую гидроэнергетику, солнечные — фотоэлектрическую и концентрированную генерацию. В 2025 году солнечная и ветровая энергия вместе составляли около 81,6% мощности ВИЭ Китая и 9,3% России. По данным таблицы их суммарная мощность за 2020–2025 годы увеличилась примерно в 3,4 раза в Китае и в 1,9 раза в России. Для нашей темы важна разница в структуре парков генерации. Она характеризует неодинаковое развитие рынков, но не

[53] Gereffi G., Humphrey J., Sturgeon T. (2005). The governance of global value chains. Review of International Political Economy. Vol. 12. No. 1. P. 78–104.

[54] IRENA (2026). Renewable capacity statistics 2026. March. Таблицы Total renewable energy, Wind energy, Solar energy. Полный URL приведен в списке литературы.

позволяет судить о качестве оборудования или доходности отдельно выбранной площадки.

Положение Китая в производстве солнечных панелей усиливает значение этой разницы. По оценке Международного энергетического агентства, опубликованной в 2022 году, доля КНР на всех основных стадиях их изготовления превышала 80% (IEA, 2022).[55] Показатель характеризует период доклада. В нем экономия от масштаба производства рассматривается вместе с рисками географической концентрации поставок. Для российского покупателя отсюда следует конкретный вывод: доступная цена панели должна оцениваться вместе с условиями поставки и дальнейшего обслуживания, поскольку эти расходы и зависимости сохраняются после покупки.

Российский интерес к китайскому оборудованию может определяться сроком ввода электростанции. У предприятия, планирующего выпуск компонентов, другой горизонт: ему нужны подготовленные специалисты и заказы, позволяющие загрузить производство. Задача снабжения удаленного потребителя добавляет стоимость доставки топлива и требования к надежности. Считаем неоправданным объединять эти интересы одним показателем роста мощностей. Успешная закупка для отдельного объекта и устойчивое освоение производства требуют разных критериев оценки.

Китайский поставщик получает выручку по контракту, а участник производства или капитала станции связан с более длительным циклом. От этого зависит готовность принимать риски и обучать местных специалистов. Желаемые российской стороной компетенции важно соотнести с обязательствами, которые партнер готов закрепить в соглашении.

Формы сотрудничества и распределение добавленной стоимости

Для экономической оценки важно установить, за что получает доход каждый участник и какие функции сохраняются после исполнения договора. По этому признаку выделены поставки оборудования, производственная кооперация и совместные инвестиции в генерацию (таблица 2). В одном проекте они могут сочетаться. Предлагаем анализировать каждую функцию отдельно, чтобы продажа установки не учитывалась одновременно как передача технологии и вложение в капитал станции.

[55] IEA (2022). Solar PV Global Supply Chains. Executive summary. Полный URL приведен в списке литературы.

Таблица 2

Формы сотрудничества и условия их оценки

Форма	Источник дохода партнера	Условие оценки результата
Поставка оборудования	Оплата поставки и сервиса	Затраты жизненного цикла и доступность ремонта
Производственная кооперация	Продажа компонентов, лицензионные платежи	Освоенные операции и местная добавленная стоимость
Совместные инвестиции в генерацию	Выручка объекта и доход на капитал	Сбыт, ввод объекта и распределение рисков

Источник: составлено автором. Формы могут сочетаться; таблица представляет аналитическую классификацию.

При покупке готовой установки расходы продолжаются после оплаты поставщику. Перевозка, монтаж и подключение формируют стоимость ввода, обслуживание и ремонт — затраты последующих лет. Если доступ к запасным частям и технической поддержке зависит от одной компании, эта зависимость влияет на устойчивость эксплуатации. Наша оценка поставки поэтому включает срок службы и гарантии наряду с контрактной ценой. Экономия при закупке имеет смысл лишь с учетом того, какие обязательства и расходы остаются у оператора.

Глубина производственной кооперации определяется тем, какие операции предприятие способно выполнять самостоятельно. Сборка импортного комплекта и внесение изменений в конструкцию предполагают разный доступ к знаниям и документации; между ними находится производство отдельных компонентов. Размещение предприятия в России подтверждает географию операций, но еще не раскрывает их содержание. Считаем необходимым проверять обучение специалистов, доступ к документации и права на обслуживание по условиям соглашения. Эти сведения позволяют оценить накопленные компетенции точнее, чем сам факт открытия площадки.

Связь поддержки генерации с промышленными задачами видна в описании ДПМ ВИЭ 2.0. АРВЭ указывает период 2025–2035 годов, углубление локализации и экспортные требования; отбор связан с показателем эффективности объекта (АРВЭ, б. д.). [56] Освоение высокотехнологичных компонентов подчеркивается и в материале «Атом Медиа» от 27 ноября 2024 года (Атом Медиа, 2024). [57] Эти источники

[56] АРВЭ (б. д.). Конкурсные отборы инвестиционных проектов ВИЭ. Раздел о ДПМ ВИЭ 2.0. Полный URL приведен в списке литературы.

[57] Атом Медиа (2024). Локализация производства. 27 ноября. Полный URL приведен в списке литературы.

объясняют значимость промышленного результата в российской политике. Для нашей темы они задают контекст оценки, а участие китайских компаний в конкретном производстве должно подтверждаться отдельными документами.

Инвестор в электростанцию получает доход от ее работы и принимает связанные с ней обязательства. Подрядчик по договору проектирования, закупок и строительства (EPC) выполняет иной набор функций. Китайская компания также может выступать кредитором или поставщиком, причем сочетание ролей требует проверки договоров. Упоминание компании рядом с крупной мощностью не дает основания считать ее совладельцем объекта. По нашему мнению, оценку совместных инвестиций следует начинать с подтвержденного вклада в капитал и условий получения выручки; возможное привлечение банка характеризует только рассматриваемый источник финансирования.

Амурский ветропарк как пример развития проектной модели

Различие вариантов сбыта делает амурский ветропарк показательным для анализа сотрудничества. Сообщение Эн+ 2022 года, приуроченное к VII Восточному экономическому форуму, описывало экспортную ориентацию на Китай. Технологическим партнером называлась PowerChina; потенциальная мощность составляла 1 ГВт, предполагаемая годовая выработка — около 3,5 млрд кВт·ч. Компания сообщала об оценке ветропотенциала и капитальных затрат (Эн+, 2022). [58] В этом документе параметры относятся к подготавливаемому проекту.

Российская энергосистема указана как направление поставок в Едином отчете Эн+ за 2024 год, опубликованном в 2025 году. Отчет содержит потенциальную мощность 1 ГВт и выработку до 3 млрд кВт·ч в год; предполагаемые инвестиции превышают 100 млрд руб. По предварительным планам поэтапный ввод намечался до 2031 года. К результатам 2024 года отнесены ветроизмерения, разработка проекта технологического присоединения и получение исходной разрешительной документации (En+, 2025).[59] Перечень позволяет оценить раскрытую подготовительную работу.

Еще одна публикация Эн+, посвященная встрече с руководством Амурской области, приводит мощность 1 058 МВт и вложения 100 млрд руб. В ней упоминаются соглашения с China Energy Investment Corporation и возможность привлечения китайских банков (Эн+, б. д.).[60] Дата на странице отсутствует. Поэтому разместить сообщение в точной последовательности

[58] Эн+ (2022). En+ Group прорабатывает возможность строительства экспортно-ориентированного ветропарка в Амурской области. Полный URL приведен в списке литературы.

[59] En+ (2025). En+ 2024 Consolidated Report. Investment programme and modernisation. Wind power project. Полный URL приведен в списке литературы.

[60] Эн+ (б. д.). Руководители Эн+ и Амурской области обсудили проект строительства ветропарка в регионе. Полный URL приведен в списке литературы.

событий по этому источнику невозможно, как невозможно подтвердить заключение кредитного договора самим упоминанием банков.

Для коммерческой оценки различие направлений сбыта важнее небольшой разницы заявленной мощности. Продажа в российскую энергосистему и трансграничная поставка предполагают разные условия договоров и передачи электроэнергии. Мы рассматриваем расхождение публикаций как основание проверить модель выручки. Оно не доказывает отмену экспортного варианта: открытые материалы не раскрывают причин изменения описания и окончательно согласованных условий продажи.

Названия PowerChina и China Energy Investment Corporation также требуют раздельной проверки. Это разные компании, функции которых могут относиться к разным этапам подготовки. Чтобы установить замену партнера или одновременное участие, нужны сведения о содержании соглашений. На наш взгляд, учет подобных публикаций должен вестись по проекту и роли участника. Иначе несколько сообщений об одном замысле могут быть ошибочно приняты за самостоятельные инвестиционные проекты.

Публикации подтверждают раскрытые намерения и подготовительные действия, но не ввод всей заявленной мощности. Для оценки готовности нужны сведения о покупателях электроэнергии, присоединении и принятых финансовых обязательствах. Эти признаки предлагаем проверять до использования мощности проекта как результата двустороннего сотрудничества.

Ограничения партнерства и критерии отбора проектов

Начинать отбор проекта целесообразно с будущего потребителя. Даже высокий ветровой или солнечный ресурс не обеспечивает продажи всей возможной выработки: ее почасовой профиль должен соотноситься со спросом и пропускной способностью сети. Ограничение выдачи мощности может сократить полезный результат при любом происхождении оборудования. Поэтому вопрос о том, кому и когда нужна электроэнергия, предшествует выбору поставщика. Считаем, что такая последовательность снижает риск подмены экономического обоснования сравнением цен установок.

Следующий вопрос касается эксплуатации. На конкретной российской площадке проверяются температурный диапазон, вероятность обледенения и доступность ремонта. Международный опыт производителя дает основания для выбора технологии, однако местные условия требуют испытаний. Для совместного пилота предлагаем закреплять доступ российского оператора к данным о простоях, затратах и выполнении гарантий. По этим сведениям можно принять решение о расширении проекта и определить, какие доработки оборудования действительно нужны.

Содержание локализации проверяется отдельно от соответствия правилам поддержки. Юридическая оценка следует действующим требованиям программы; экономическая — созданной на месте стоимости и зависимости от критических компонентов. Высокая доля локальных операций

может сочетаться с ограниченным доступом к программному обеспечению или ключевым деталям. По нашему мнению, для российско-китайской кооперации особенно значима способность местного предприятия продолжать обслуживание. Она показывает устойчивость освоенных функций при изменении отношений с внешним партнером.

Для предварительного отбора предлагается проверка четырех групп условий: спроса и выручки, подключения и режимов работы, обслуживания, производственной кооперации. Нерешенный вопрос в любой группе означает потребность в дополнительной подготовке. Схема предназначена для этапа до технико-экономического обоснования. При отсутствии сопоставимых данных присваивать проектам баллы было бы преждевременно: числовая оценка создавала бы видимость точности без достаточных оснований.

После реализации меняется предмет оценки. У объекта измеряются введенная мощность, полезная выработка и эксплуатационные затраты. Для производственной кооперации нужны данные об освоенных операциях, документации и стоимости, создаваемой местными предприятиями; для устойчивости обслуживания — о сроках поставки критических деталей и возможностях продолжения ремонта. Эти показатели позволяют связать выводы с наблюдаемыми результатами. Количество меморандумов полезно для описания активности переговоров, но не заменяет такую проверку.

В удаленных поселениях сравнительной базой служат существующая система снабжения и стоимость доставки топлива. Солнечная или ветровая генерация с накопителем и резервным источником может рассматриваться как совместный пилот. Проверять нужно расходы всей системы, включая замену аккумуляторов и подготовку персонала. Считаем обоснованным выбирать площадки, на которых доступно сопоставление эксплуатационных данных до и после внедрения. Это позволит судить об экономии и надежности, не приписывая всем гибридным системам заранее одинаковый эффект.

Для нового производства существенен портфель заказов. Освоение сервиса и адаптации оборудования может подготовить переход к выпуску компонентов, тогда как предприятие с готовыми компетенциями способно сразу выполнять более сложные операции. Универсальная последовательность здесь не требуется. Предпочтение предлагаем отдавать той глубине кооперации, для которой есть подтвержденный спрос, кадровые возможности и согласованные права на результаты доработки. Иначе расширение производства способно усилить зависимость и от внешней технологии, и от узкого рынка сбыта.

Трансграничный проект требует собственной проверки коммерческих условий. К электростанции добавляются передача электроэнергии, согласованные режимы поставок и договоренности с покупателем. Если существенны экологические характеристики энергии, проверяются применимые процедуры их подтверждения и признания; автоматическое взаимное признание предполагать нельзя. Поэтому экспортную ориентацию предлагаем оценивать как коммерческий вариант, жизнеспособность

которого еще нужно обосновать. Географическая близость потребителя сама по себе не подтверждает дополнительную выручку.

Выводы

Сотрудничество России и Китая в сфере ВИЭ может одновременно расширять генерацию и развивать российские производственные компетенции, если модель выручки согласована с технологическими функциями и обязательствами по эксплуатации. Этому ответу на исследовательский вопрос соответствуют предложенные критерии проверки спроса, присоединения, обслуживания и содержания кооперации. Разница масштабов рынков формирует предпосылки взаимодействия. Роль каждого участника определяется его вкладом и договором, а не размером национального парка ВИЭ.

Результат исследования состоит в совместной оценке формы сотрудничества и подтвержденной стадии проекта. Поставка оборудования, освоение производства и вложение в генерацию различаются по источникам дохода и принимаемым рискам, даже когда относятся к одному объекту. Анализ амурского ветропарка показал значение этой процедуры: публикации раскрывают различающиеся варианты сбыта и упоминают разных китайских участников, но не позволяют подтвердить ввод всей заявленной мощности или окончательную конфигурацию их участия.

Практически значимы проверка экономических условий до выбора технологии и закрепление обслуживания и компетенций в соглашениях. В распределенной энергетике приоритетны пилоты с данными эксплуатации. В производственной кооперации оцениваются загрузка и освоенные операции; для экспорта отдельно обосновываются сбыт и инфраструктура.

Открытые документы и один проектный пример ограничивают проверку гипотезы. Количественный прогноз окупаемости не получен. Сопоставление реализованных объектов по затратам, выработке, обслуживанию и освоенным функциям позволит проверить, какие критерии лучше объясняют устойчивость результатов.

Использованные источники

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Abdullayeva S.B.
assistent
Narzullayeva A.O.
talaba
Bozorova D.S.
talaba
Abdujalilova O.Z.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

RAQAMLI SOG‘LIQNI SAQLASH TIZIMIDA TELETIBBIYOT MA’LUMOTLARINI INTELLEKTUAL QAYTA ISHLASH VA TAHLIL QILISH TEXNOLOGIYALARI

Annotatsiya: Sog‘liqni saqlash tizimida teletibbiyot xizmatlarining kengayishi tibbiy ma’lumotlarni tezkor yig‘ish, xavfsiz saqlash va samarali qayta ishlash, shuningdek, masofaviy diagnostika sifatini oshirishni taqozo etadi. Teletibbiyot ma’lumotlarini intellektual qayta ishlash va tahlil qilish texnologiyalari bemorlarning tibbiy ma’lumotlarini masofadan yig‘ish, saqlash, qayta ishlash va baholashda katta ahamiyat kasb etadi. Ushbu maqolada raqamli sog‘liqni saqlash tizimida teletibbiyot ma’lumotlarini intellektual qayta ishlash va tahlil qilish texnologiyalari to‘g‘risida ma’lumotlar yoritilgan.

Kalit so‘zlar: teletibbiyot, tibbiy ma’lumotlarni qayta ishlash, sun’iy intellekt, axborot xavfsizligi, raqamli sog‘liqni saqlash.

Abdullayeva S.B.
assistant lecturer
Narzullayeva A.O.
student
Bozorova D.S.
student
Abdujalilova O.Z.
student
Samarkand State Medical University
Uzbekistan, Samarkand

TECHNOLOGIES FOR INTELLIGENT PROCESSING AND ANALYSIS OF TELEMEDICINE DATA IN DIGITAL HEALTHCARE SYSTEMS

Annotation: The expansion of telemedical services and the system of health care requires fast collection, safe storage and effective processing of medical data, and an increase in the quality of remote diagnostics. Technologies of intellectual processing and analysis of telemedical data are of great importance for distance collection, storage, processing and patient data. In this state, information on the technology of intellectual processing and analysis of telemedical data and the digital system of health care are presented.

Key words: telemedicine, medical data processing, artificial intelligence, information security, digital health care

KIRISH: Raqamli sog‘liqni saqlash tizimining rivojlanishi tibbiy xizmatlarni tashkil etish, bemorlar holatini kuzatish va tibbiy ma’lumotlarni qayta ishlash jarayonlarini takomillashtirishda muhim ahamiyat kasb etmoqda. Teletibbiyot ma’lumotlarini intellektual qayta ishlash va tahlil qilish texnologiyalari raqamli sog‘liqni saqlash tizimining muhim tarkibiy qismi hisoblanadi. Zamonaviy axborot-kommunikatsiya texnologiyalari yordamida tibbiy ma’lumotlarni masofadan uzatish, saqlash, qayta ishlash va tahlil qilish imkoniyatlari kengaymoqda. Bu jarayonda teletibbiyot texnologiyalari alohida o‘rin tutib, bemorlar va tibbiy mutaxassislar o‘rtasida masofaviy axborot almashinuvini ta’minlaydi. Teletibbiyot tizimlarida bemorlarning qon bosimi, yurak urish chastotasi, tana harorati, qondagi kislorod miqdori va boshqa tibbiy ko‘rsatkichlari raqamli shaklda yig‘iladi hamda ularning o‘zgarishlari muntazam ravishda kuzatib boriladi.

Teletibbiyot ma’lumotlarini intellektual qayta ishlash jarayonida sun’iy intellekt, mashinali o‘qitish, statistik tahlil va ma’lumotlarni vizuallashtirish texnologiyalaridan foydalaniladi. Ushbu texnologiyalar katta hajmdagi tibbiy ma’lumotlarni tizimlashtirish, ular o‘rtasidagi bog‘liqliklarni aniqlash va bemorlarning salomatlik holatidagi o‘zgarishlarni baholash imkonini beradi.

ADABIYOTLAR TAHLILI VA METODOLOGIYASI: Tibbiyotni raqamlashtirish va teletibbiyot ma’lumotlarini intellektual qayta ishlash masalalari E.X. Bozorov, T.V. Zarubina, B.A. Kobrinskiy, V.P. Omelchenko va A.A. Demidova kabi olimlarning tibbiy informatika sohasidagi o‘quv adabiyotlarida yoritilgan. E.X. Bozorovning «Meditsinskaya informatika» darsligida tibbiy axborot tizimlari, amaliy dasturiy vositalar va tibbiy qarorlarni qo‘llab-quvvatlash masalalariga e’tibor qaratilgan. T.V. Zarubina va B.A. Kobrinskiy tahriridagi darslikda elektron tibbiy kartalar, axborot-kommunikatsiya texnologiyalari va tibbiy ma’lumotlardan foydalanishning amaliy jihatlari bayon etilgan. V.P. Omelchenko va A.A. Demidova ishlarida tibbiy ma’lumotlarni saqlash, izlash, qayta ishlash va kompyuter texnologiyalari yordamida tahlil qilishning ahamiyati ko‘rsatilgan. M.I. Bazarbaev, A.K. Tulaboev va E.Ya. Ermetovning «Tibbiyotda axborot texnologiyalari» darsligida tibbiyotda axborot-kommunikatsiya texnologiyalaridan foydalanish, tibbiy-biologik masalalarni amaliy dasturlar

yordamida yechish va tibbiy jarayonlarni algoritmlashtirish masalalari yoritilgan. J.A. Riyazev va L.E. Shukurovning «Tibbiyotda axborot texnologiyalari» (2025) darsligida teletibbiyot, sun'iy intellekt, buyumlar interneti va bulutli texnologiyalarning tibbiyotda qo'llanilishiga e'tibor qaratilgan. Mualliflarning mazkur yondashuvlari masofaviy tibbiy monitoringni tashkil etish, raqamli ma'lumotlarni tahlil qilish va klinik qarorlarni qo'llab-quvvatlash imkoniyatlarini o'rganish uchun metodologik asos bo'lib xizmat qiladi.

MUHOKAMA: Raqamli sog'liqni saqlash tizimida teletibbiyot ma'lumotlarini intellektual qayta ishlash va tahlil qilish tibbiy xizmatlarni tashkil etishning yangi imkoniyatlarini yaratmoqda. Ma'lumotlarni masofadan yig'ish va avtomatlashtirilgan usullarda tahlil qilish bemorlar salomatligidagi o'zgarishlarni muntazam kuzatishga yordam beradi. Sun'iy intellekt algoritmlaridan foydalanish tibbiy ko'rsatkichlar o'rtasidagi bog'liqliklarni aniqlash, ehtimoliy xavflarni baholash va mutaxassislarga qo'shimcha tahliliy ma'lumot taqdim etish imkonini beradi. Biroq intellektual tahlilning samaradorligi kiritilayotgan ma'lumotlarning sifati, to'liqligi va ishonchliligiga bevosita bog'liq. Shuningdek, turli tibbiy qurilmalar va elektron axborot tizimlari o'rtasida ma'lumot almashinuvini muvofiqlashtirish muhim vazifa hisoblanadi. Tibbiy axborotlarni himoyalash, bemorlar maxfiyligini saqlash va algoritmlar natijalarini shifokor tomonidan tekshirish texnologiyalarni amaliyotga xavfsiz joriy etishning asosiy shartlaridir. Umuman, teletibbiyotda intellektual tahlil usullarini maqsadli qo'llash tibbiy qarorlarni qo'llab-quvvatlash, masofaviy monitoring sifatini yaxshilash va sog'liqni saqlash resurslaridan oqilona foydalanishga xizmat qilishi mumkin.

XULOSA: Olib borilgan tahlillar teletibbiyot tizimlarining istiqboli nafaqat zamonaviy dasturiy vositalarga, balki tibbiy axborotlarni mazmunan to'g'ri talqin qilish imkoniyatlariga ham bog'liqligini ko'rsatadi. Intellektual texnologiyalarni joriy etishda mahalliy tibbiy muassasalarning texnik imkoniyatlari, mutaxassislarning raqamli savodxonligi va ma'lumotlar almashinuvining uzluksizligi hisobga olinishi lozim. Shuningdek, turli manbalardan olingan axborotlarni yagona mezonlar asosida baholash tahlil natijalarining ishonchliligini oshiradi. Kelgusida ushbu sohada milliy tibbiy ma'lumotlar bazalarini takomillashtirish, intellektual algoritmlarni amaliyotda sinovdan o'tkazish va ularning samaradorligini baholashga qaratilgan tadqiqotlarni rivojlantirish muhim ahamiyat kasb etadi.

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Abdullyaeva S.B.
assistent
Komilov A.I.
talaba
Suyunov M.K.
talaba
Haydarov A.F.
talaba
Samarqand davlat tibbiyot universiteti
O‘zbekiston, Samarqand

TIBBIY MA’LUMOTLARNI INTELLEKTUAL TAHLIL QILISH ASOSIDA KASALLIKLAR XAVFINI PROGNOZLASHNING AHAMIYATI

Annotatsiya: Ushbu maqolada tibbiy ma’lumotlarni intellektual tahlil qilish asosida kasalliklar yuzaga kelish xavfini prognozlashning zamonaviy usullari va ularning sog‘liqni saqlash tizimidagi ahamiyati yoritilgan. Tibbiy ma’lumotlarni qayta ishlashda sun’iy intellekt, mashinali o‘qitish algoritmlari va statistik tahlil usullaridan foydalanish imkoniyatlari hamda ularning kasalliklarni erta aniqlashdagi samaradorligi tahlil qilingan. Shuningdek, bemorlarning klinik ko‘rsatkichlari, laboratoriya natijalari va elektron tibbiy kartalari asosida xavf omillarini aniqlash hamda individual prognoz modellarini shakllantirish masalalari ko‘rib chiqilgan. Ya’ni, intellektual tahlil texnologiyalarini tibbiyot amaliyotiga joriy etish kasalliklarning oldini olish, tashxislash jarayonini takomillashtirish va tibbiy qarorlar qabul qilish sifatini oshirishga xizmat qilishini asoslashga yo‘naltirilgan.

Kalit so‘zlar: tibbiy ma’lumotlar, intellektual tahlil, prognozlash, sun’iy intellekt, mashinali o‘qitish, erta tashxislash, elektron tibbiy karta.

Abdullyaeva S.B.
assistant lecturer
Komilov A.I.
student
Suyunov M.K.
student
Haydarov A.F.
student
Samarkand State Medical University
Uzbekistan, Samarkand

THE IMPORTANCE OF PREDICTING DISEASE RISK BASED ON INTELLIGENT ANALYSIS OF MEDICAL DATA

Abstract: This article examines modern methods for predicting disease risk based on intelligent analysis of medical data and their importance in healthcare. It analyzes the potential of artificial intelligence, machine learning algorithms, and statistical analysis methods in medical data processing and their effectiveness in early disease diagnosis. It also examines the identification of risk factors and the development of individualized predictive models based on clinical parameters, laboratory results, and patient electronic medical records. The introduction of intelligent analysis technologies into medical practice aims to substantiate their potential for disease prevention, improved diagnostics, and enhanced medical decision-making.

Keywords: medical data, intelligent analysis, forecasting, artificial intelligence, machine learning, early diagnosis, electronic medical record.

KIRISH: Sog‘liqni saqlash tizimining raqamli transformatsiyasi kasalliklarni aniqlash, davolash va ularning oldini olish jarayonlariga yangicha yondashuvlarni tatbiq etishni talab qilmoqda. Zamonaviy tibbiyotda bemorlar haqidagi ma’lumotlar hajmining ortib borishi ushbu axborotlarni tizimli o‘rganish va ulardan samarali foydalanish masalasini dolzarb qilib qo‘ymoqda. Shu nuqtayi nazardan, tibbiy ma’lumotlarni intellektual tahlil qilish orqali kasalliklar xavfini prognozlash profilaktik tibbiyotning muhim yo‘nalishlaridan biri sifatida namoyon bo‘lmoqda. Mazkur yondashuv mavjud klinik ko‘rsatkichlarni baholash bilan bir qatorda, turli xavf omillari o‘rtasidagi murakkab bog‘liqliklarni aniqlash va kelgusida yuzaga kelishi mumkin bo‘lgan salbiy holatlarni oldindan baholashga xizmat qiladi. Tibbiy prognozlash jarayonida elektron tibbiy kartalar, laboratoriya tekshiruvlari natijalari, instrumental diagnostika ma’lumotlari va bemorlarning fiziologik ko‘rsatkichlari muhim axborot manbalari hisoblanadi. Ushbu ma’lumotlarni sun’iy intellekt va mashinaviy o‘qitish algoritmlari yordamida qayta ishlash individual xavf darajasini aniqlash hamda bemorlarni tegishli xavf guruhlariga ajratish imkonini beradi. Masalan, arterial qon bosimi, qondagi glyukoza miqdori, tana massasi indeksi va boshqa klinik ko‘rsatkichlarni birgalikda tahlil qilish yurak-qon tomir kasalliklari yoki qandli diabet rivojlanishi bilan bog‘liq ehtimoliy xavflarni baholashda qo‘llanilishi mumkin. Bunday tahlil natijalari profilaktik tekshiruvlarni rejalashtirish va tibbiy kuzatuvni individual tashkil etishda foydali hisoblanadi. Shu bilan birga, intellektual prognozlash tizimlarini ishlab chiqish ma’lumotlarning aniqligi, yetarliligi va ishonchliligini ta’minlashni talab qiladi. Algoritmlarning turli bemorlar guruhida bir xil darajada samarali ishlamasligi, noto‘g‘ri prognozlar berishi yoki maxfiy ma’lumotlarning himoyasiga tahdid tug‘dirishi mumkinligi ham hisobga olinishi lozim. Shuning uchun texnologik yechimlar klinik baholash va tibbiy mutaxassislar nazorati bilan uyg‘unlashtirilishi zarur.

ADABIYOTLAR TAHLILI VA METODOLOGIYASI: Tibbiy ma’lumotlarni intellektual tahlil qilish va kasalliklar xavfini prognozlash masalalari mahalliy hamda xorijiy olimlarning ilmiy ishlarida keng yoritilmoqda. M.M. Rustamovning *“Texnologiya obrabotki sifrovыx dannыx. Analiz meditsinskix*

данных с помощуи компьютера” nomli o‘quv qo‘llanmasida tibbiy axborotlarni yig‘ish, saqlash va kompyuter yordamida tahlil qilish masalalariga e’tibor qaratilgan. Shuningdek, A.V. Gusev, R.E. Novitskiy va hammualliflarining tadqiqotida laboratoriya ko‘rsatkichlari asosida kasalliklarni prognozlashda mashinaviy o‘qitish usullaridan foydalanish imkoniyatlari tahlil qilingan. Mualliflar bunday yondashuvlar klinik ma’lumotlardan foydali qonuniyatlarni aniqlash va individual xavflarni baholashda istiqbolli ekanini ko‘rsatadi.

Tadqiqot metodologiyasi tizimli tahlil, ilmiy adabiyotlarni o‘rganish va taqqoslash usullariga asoslanadi. Bunda elektron tibbiy kartalar, laboratoriya natijalari hamda klinik ko‘rsatkichlarni qayta ishlash imkoniyatlari o‘rganiladi. Ma’lumotlarni oldindan tozalash, muhim belgilarni tanlash va mashinaviy o‘qitish algoritmlari yordamida xavf guruhlarini aniqlash bosqichlari ko‘rib chiqiladi. Modellar samaradorligini baholashda aniqlik, sezgirlik va xoslik ko‘rsatkichlaridan foydalanish maqsadga muvofiq hisoblanadi. Natijalarni talqin qilishda ma’lumotlar sifati, bemorlar maxfiyligi va shifokor nazoratining ahamiyati ham hisobga olinadi.

MUHOKAMA: Tibbiyotda kasalliklarning rivojlanish ehtimolini oldindan aniqlash zamonaviy diagnostika va profilaktika tizimining muhim vazifalaridan biridir. Inson organizmida kechadigan patologik jarayonlar ko‘pincha bir nechta omillarning o‘zaro ta’siri natijasida yuzaga keladi. Yosh, irsiy moyillik, turmush tarzi, laboratoriya ko‘rsatkichlari va avvalgi kasalliklar haqidagi ma’lumotlarni birgalikda baholash xavf darajasini aniqroq belgilashga yordam beradi. Bunday murakkab bog‘liqliklarni an’anaviy usullar bilan to‘liq aniqlash har doim ham oson emas. Axborot texnologiyalarining rivojlanishi katta hajmdagi klinik axborotlarni qayta ishlash va ulardan yangi bilimlarni ajratib olish imkonini bermoqda. Xususan, intellektual tahlil usullari mavjud ma’lumotlar tarkibidagi yashirin qonuniyatlarni aniqlash, o‘xshash klinik holatlarni guruhlash va muayyan kasallik yuzaga kelish ehtimolini hisoblashda qo‘llaniladi. Ushbu yondashuv tibbiy amaliyotda xavf guruhlarini shakllantirish, kuzatuv ustuvorliklarini belgilash va profilaktik choralarni maqsadli tashkil etish uchun muhim axborot beradi.

Prognozlash tizimlarining samaradorligi faqat algoritmning texnik imkoniyatlariga emas, balki foydalanilayotgan ma’lumotlarning sifatiga, tanlangan belgilar o‘rinliligiga va modelning klinik sharoitlarda tekshirilganligiga ham bog‘liq. Shu bois bunday tizimlarni ishlab chiqishda statistik asoslanganlik, natijalarning izohlanishi va bemor ma’lumotlarini himoya qilish talablari birgalikda hisobga olinishi lozim.

Kasalliklarni erta aniqlash va ularning rivojlanish xavfini baholash tibbiyotda asoratlarning oldini olish hamda davolash choralarini o‘z vaqtida belgilash imkonini beradi. Biroq ayrim kasalliklar dastlabki bosqichlarda yaqqol klinik belgilar bilan namoyon bo‘lmaydi. Bunday sharoitda bemorning laboratoriya natijalari, arterial qon bosimi, qondagi glyukoza miqdori, tana massasi indeksi, yoshi va kasallik tarixini kompleks o‘rganish muhim ahamiyat kasb etadi. Ushbu ko‘rsatkichlarni birgalikda tahlil qilish kasalliklar bilan bog‘liq xavf omillarini aniqlashga yordam beradi. Tibbiy ma’lumotlarni intellektual tahlil qilish- mavjud klinik axborotlardan foydalanib, kasallik rivojlanishiga ta’sir qiluvchi omillarni aniqlash va ehtimoliy

natijalarni baholash jarayonidir. Masalan, mashinaviy o‘qitish algoritmlari bemorlarning avvalgi tibbiy ma’lumotlari asosida qandli diabet yoki yurak-qon tomir kasalliklari rivojlanish ehtimolini baholash uchun qo‘llanilishi mumkin. Bunda algoritm birgina ko‘rsatkichga emas, balki bir nechta omilning o‘zaro bog‘liqligiga tayanadi. Natijada shifokor xavfi yuqori bo‘lgan bemorlarni qo‘shimcha tekshiruvdan o‘tkazish zaruratini asosliroq belgilashi mumkin.

Prognozlash natijalarining ishonchliligi modelni yetarli hajmdagi va sifatli ma’lumotlarda o‘qitish, mustaqil ma’lumotlar yordamida tekshirish hamda sezgirlik va xoslik ko‘rsatkichlarini baholash orqali aniqlanadi. Shuningdek, bemorlarning shaxsiy ma’lumotlarini himoya qilish va algoritm xulosalarini shifokor nazorati ostida qo‘llash zarur.

XULOSA: Tibbiy ma’lumotlarni intellektual tahlil qilish kasalliklar xavfini prognozlash jarayonini yangi bosqichga olib chiqib, klinik qarorlarni ko‘p omilli ma’lumotlar asosida shakllantirish imkonini beradi. Ushbu yondashuvning ilmiy ahamiyati turli manbalardan olingan klinik ko‘rsatkichlar o‘rtasidagi yashirin bog‘liqliklarni aniqlash va kasallik rivojlanishiga ta’sir qiluvchi omillarni kompleks baholash bilan belgilanadi. Natijada prognozlash modellari nafaqat mavjud holatni tavsiflash, balki profilaktik choralarni rejalashtirish uchun ham qo‘shimcha axborot manbaiga aylanishi mumkin. Kelgusida multimodal sun’iy intellekt, federativ o‘qitish va izohlanadigan algoritmlarning rivojlanishi turli tibbiy muassasalardagi ma’lumotlardan xavfsiz foydalanish, prognozlarning asoslanganligini oshirish hamda individual xavf profillarini shakllantirish imkoniyatlarini kengaytiradi. Aqlli sensorlar va telemeditsina platformalari bilan integratsiya esa bemor holatidagi dinamik o‘zgarishlarni hisobga oluvchi prognozlash tizimlarini yaratishga zamin yaratadi. Biroq bunday yechimlarning amaliy qiymati algoritmning texnik ko‘rsatkichlarigagina emas, balki uning klinik samaradorligi, turli aholi guruhlarida ishonchliligi va ma’lumotlar xavfsizligiga ham bog‘liq. Shu bois kelgusidagi tadqiqotlarda modellarni mustaqil klinik ma’lumotlarda sinash, xatolik manbalarini aniqlash va natijalarning tibbiy amaliyotga ta’sirini baholash ustuvor vazifa bo‘lib qoladi. Mazkur yo‘nalishning izchil rivojlanishi dalillarga asoslangan, individual va profilaktik tibbiyot imkoniyatlarini kengaytirishga xizmat qilishi mumkin.

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Ne'matov N.I.
assistant
Mansabova M.Z.
student
Samarkand State Medical University
Uzbekistan, Samarkand

IMPROVING THE OPERATIONAL EFFICIENCY OF HEALTHCARE SERVICE ENTERPRISES THROUGH DIGITAL TECHNOLOGIES: EMPIRICAL EVIDENCE FROM OUTPATIENT POLYCLINICS IN SAMARKAND REGION

Abstract. In contemporary service economics, primary healthcare polyclinics operate as vital public service enterprises delivering essential health encounters. Traditional operational workflows in these facilities are frequently compromised by severe patient queueing, administrative documentation bottlenecks, and sub-optimal clinician time allocation. This study examines the operational and economic impacts of introducing digital service technologies—specifically automated queue management, online pre-registration, and integrated Electronic Health Record (EHR / DMED) platforms—into primary care facilities across Samarkand region. Utilizing rigorous time-and-motion chronometry and the multidimensional SERVQUAL survey instrument (administered to 1,200 patients and 180 healthcare professionals across eight multi-profile polyclinics), the empirical findings demonstrate that digital technology integration reduced overall patient turnaround time by 2.9-fold (from 68.5 to 23.4 minutes) and decreased pre-consultation waiting times by 4.2-fold. Simultaneously, administrative paperwork burden on physicians decreased by 38%, permitting an 87.3% expansion in direct doctor-patient clinical interaction. Overall patient-perceived service quality increased significantly from 62.4% to 88.6%. Practical managerial recommendations are formulated to sustain digital service excellence.

Keywords: healthcare service management, service efficiency, digital technologies, Samarkand region, outpatient polyclinics, electronic queueing, SERVQUAL model, operational management, patient satisfaction.

1. INTRODUCTION AND THEORETICAL BACKGROUND

In the modern digital economy, the modernization of public service delivery represents a core strategic imperative for sustainable socio-economic development. Under the national development framework 'Digital Uzbekistan – 2030', structural reforms prioritize the infusion of information and communications technology (ICT) into public infrastructure to dismantle administrative bottlenecks, optimize resource allocation, and enhance service accessibility. Within the broader service sector, healthcare institutions function as high-volume, knowledge-intensive service enterprises where operational throughput and service quality directly influence social welfare and population productivity.

Samarkand region, characterized by a rapidly expanding population exceeding 4.1 million residents, possesses one of the most extensive outpatient healthcare service networks in the Republic of Uzbekistan. Multi-profile central polyclinics serve as the frontline service provider for primary medical encounters. However, empirical analysis of traditional facility operations reveals persistent systemic deficiencies: severe congestion at central reception desks, contentious 'first-come, first-served' physical queueing, and an excessive administrative burden wherein physicians spend between 40% and 50% of consultation time manually completing paper outpatient charts and statistical logs. These bottlenecks lengthen patient turnaround times and deteriorate the perceived quality of care.

From a service management perspective, healthcare delivery represents an interactive service encounter. Patient satisfaction is governed not merely by clinical outcomes, but equally by the efficiency, responsiveness, and tangible environment of the service delivery system. As conceptualized in service marketing theory (Parasuraman, Zeithaml, and Bitner), integrating digital technologies—such as self-service kiosks, online appointment scheduling, and unified electronic health record (EHR) systems—fundamentally redesigns the service encounter. It transitions operations from erratic physical queues to predictable, time-slotted workflows, thereby unlocking substantial operational and economic efficiencies.

2. AIM OF THE STUDY

The objective of this research is to evaluate the operational and economic impact of deploying digital service technologies (electronic queueing, online pre-registration, and integrated health information platforms) across outpatient polyclinics in Samarkand region, measuring improvements in patient throughput time, clinical labor productivity, and patient satisfaction via the SERVQUAL framework to propose actionable managerial strategies.

3. MATERIALS AND METHODS

The empirical investigation was conducted across eight representative state-owned multi-profile central polyclinics in Samarkand region, encompassing urban facilities (Polyclinics No. 1, 2, and 4 in Samarkand city) and major district centers (Pastdargom, Urgut, Taylak, Samarkand, and Akdarya districts). The study took place across 2023–2024, corresponding with the regional deployment of the unified national healthcare information system (DMED / IT-Med).

The methodological framework integrated rigorous quantitative and qualitative service evaluation techniques:

1. Time-and-Motion Chronometric Analysis: Continuous stopwatch tracking of 450 complete patient service journeys from facility entrance to departure, capturing granular time intervals across reception check-in, waiting room delays, administrative paperwork, and direct clinical examination;

2. SERVQUAL Service Quality Assessment: A structured questionnaire administered to 1,200 randomly sampled adult patients evaluating perceived service quality across five standard dimensions: Tangibles (physical environment, digital monitors), Reliability (queue fairness and scheduling precision), Responsiveness

(promptness of service), Assurance (staff competence and courtesy), and Empathy (individualized patient attention) utilizing a 5-point Likert scale;

3. Physician Workflow Time-Budgeting: Time-allocation logs maintained by 180 general practitioners and specialized clinicians to measure administrative versus clinical time expenditure.

Empirical data were processed using descriptive and inferential statistics within IBM SPSS Statistics version 26.0. Comparative mean differences before and after digital implementation were tested for statistical significance using paired Student's t-tests, with significance established at $p < 0.01$.

4. RESULTS AND EMPIRICAL FINDINGS

The time-and-motion analysis revealed dramatic operational improvements following digital service adoption. Under traditional operating conditions, the mean total turnaround time spent by a patient within the polyclinic was 68.5 ± 4.2 minutes. Following the integration of digital queueing and online time-slot appointments, this duration decreased to 23.4 ± 1.8 minutes, representing an overall 2.9-fold (65.8%) reduction in patient time expenditure ($p < 0.001$).

The most pronounced operational gains occurred at the frontline reception desk, where the transition from physical card retrieval to barcode/ID-driven electronic records reduced waiting times from 18.6 ± 1.4 minutes to 3.2 ± 0.3 minutes (an 82.8% reduction). In the clinical consultation phase, digital templates and auto-populating electronic prescriptions reduced documentation time from 8.2 to 3.1 minutes, directly enabling an 87.3% expansion in direct doctor-patient communication time (from 6.3 ± 0.5 to 11.8 ± 0.7 minutes), which constitutes the definitive clinical value driver.

Table 1. Comparative time-motion metrics before and after digital service adoption in Samarkand polyclinics (in minutes)

Service Encounter Stage	Conventional Service (min)	Digital Service (min)	Time Variance (min / %)	Significance (p)
Reception desk check-in & chart retrieval	18.6 ± 1.4	3.2 ± 0.3	-15.4 min (-82.8%)	$p < 0.001$
Physician waiting room queue delay	35.4 ± 2.8	8.4 ± 0.9	-27.0 min (-76.3%)	$p < 0.001$
Physician administrative documentation	8.2 ± 0.6	3.1 ± 0.3	-5.1 min (-62.2%)	$p < 0.001$
Direct doctor-patient clinical interaction	6.3 ± 0.5	11.8 ± 0.7	+5.5 min (+87.3%)	$p < 0.001$
Total polyclinic patient turnaround time	68.5 ± 4.2	23.4 ± 1.8	-45.1 min (-65.8%)	$p < 0.001$

Furthermore, Table 2 summarizes the SERVQUAL survey findings across 1,200 patients. All five service quality dimensions demonstrated statistically significant positive shifts. The perceived service gap contracted dramatically, driving total patient satisfaction from a baseline of 62.4% to 88.6%.

Table 2. Patient-perceived service quality evaluation across SERVQUAL dimensions (5-point Likert scale)

SERVQUAL Dimensions	Expectation (E)	Conventional Score (P1)	Digital Score (P2)	Quality Delta (Δ)
Tangibles (Waiting area comfort, digital screens)	4.65	3.12	4.41	+1.29 pts (+41.3%)
Reliability (Queue fairness, appointment adherence)	4.82	2.94	4.58	+1.64 pts (+55.8%)
Responsiveness (Speed of service, prompt triage)	4.78	2.81	4.52	+1.71 pts (+60.8%)
Assurance (Staff courtesy, technical security)	4.71	3.65	4.48	+0.83 pts (+22.7%)
Empathy (Individualized patient attention)	4.60	3.32	4.36	+1.04 pts (+31.3%)

5. DISCUSSION AND MANAGERIAL IMPLICATIONS

The empirical findings demonstrate that digitizing operational touchpoints profoundly elevates the throughput capacity and economic efficiency of healthcare service enterprises. A 45.1-minute net reduction in per-patient turnaround expands the daily operational capacity of a standard central polyclinic by 28% to 34% without requiring capital expenditures on physical facility expansion. This transition from extensive to intensive resource utilization represents an essential efficiency dividend for public healthcare administration.

From a microeconomic perspective, eliminating physical paper registries and paper prescriptions yielded an estimated annual direct operational saving of 42 million UZS per facility in stationery and printing expenses. More significantly, the macroeconomic value of recovered patient productive work hours across Samarkand region's working-age population provides immense societal cost savings. Nevertheless, managerial challenges remain: digital literacy barriers among elderly cohorts (digital exclusion) and occasional server latency in rural district clinics. To mitigate these constraints, healthcare managers should establish dedicated 'Digital Concierge' personnel near self-service kiosks and streamline mobile appointment interfaces.

6. CONCLUSIONS

1. Implementing digital queue management and unified Electronic Health Records across polyclinics in Samarkand region optimizes the service delivery chain, reducing total patient turnaround time from 68.5 to 23.4 minutes (a 2.9-fold improvement).

2. Reception desk congestion and pre-consultation waiting times decreased by 82.8% and 76.3% respectively, enabling a 38% reduction in physician administrative documentation and doubling direct doctor-patient clinical interaction time.

3. SERVQUAL analysis demonstrates a decisive elevation in patient-perceived service quality from 62.4% to 88.6%, driven by exceptional improvements in operational Responsiveness (+60.8%) and service Reliability (+55.8%).

4. To maximize digital service dividends, healthcare administrators should institutionalize frontline digital assistance, deploy real-time clinic throughput monitoring dashboards, and broaden automated SMS appointment reminders across municipal and rural networks.

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Toxirova F.O.
associate professor
Bo‘ronova R.I.
student
Ruzimurodova G.D.
student
Abdisaliyeva Sh.G‘.
student
Samarkand State Medical University
Uzbekistan, Samarkand

BIOINFORMATICS AND ARTIFICIAL INTELLIGENCE: THE DIGITAL FUTURE OF MODERN BIOLOGY AND MEDICINE

Abstract. The convergence of bioinformatics, multi-omics technologies, and artificial intelligence (AI) has established a transformative paradigm in contemporary life sciences, fundamentally reshaping biological research and precision medicine. The rapid expansion of high-throughput Next-Generation Sequencing (NGS) and structural biology archives has created massive biological datasets that transcend traditional analytical capabilities. This study provides a comprehensive empirical analysis of advanced computational architectures—including deep convolutional networks, graph neural networks (GNNs), large language models for genomics, and attention-driven structural transformers (such as AlphaFold)—across critical biomedical domains: de novo 3D protein structure prediction, genomic variant calling, multi-omics biomarker discovery, and in silico rational drug design. Benchmarking against gold-standard experimental archives (PDB, NCBI GEO, and ClinVar) demonstrates that AI frameworks achieve unprecedented atomic-level structural accuracy (Global Distance Test score >90), increase genomic variant classification precision to 99.4%, and compress early-stage pre-clinical drug candidate screening timelines by over 70% while curtailing experimental research costs. Key translational hurdles, including algorithmic interpretability ('black-box' nature) and data harmonization, are addressed to outline the roadmap for AI-driven precision therapeutics.

Keywords: bioinformatics, artificial intelligence, deep learning, AlphaFold, multi-omics, genomics, structural biology, in silico drug discovery, precision medicine, protein folding.

1. INTRODUCTION AND BACKGROUND

The twenty-first century has witnessed a profound paradigm shift in the biological and medical sciences, transitioning from descriptive, hypothesis-driven empirical disciplines into high-dimensional, data-intensive computational sciences. The advent of Next-Generation Sequencing (NGS), high-resolution cryo-electron microscopy (cryo-EM), and mass spectrometry-based metabolomics has catalyzed an exponential accumulation of biological data. Currently, global biomedical

repositories—such as GenBank, the European Bioinformatics Institute (EMBL-EBI), and the Protein Data Bank (PDB)—expand at petabyte scales annually, generating complex multi-layered omics matrices that reflect the intricate molecular machinery of living organisms.

Traditional computational bioinformatics, while foundational for sequence alignment (e.g., BLAST) and basic statistical phylogenetics, faces acute scalability barriers when parsing the multi-scale non-linear interactions characteristic of human cellular networks. Biological phenomena—spanning chromatin conformation, alternative mRNA splicing, post-translational modifications, and polypharmacological ligand-receptor interactions—are governed by complex spatio-temporal dynamics that defy classical linear modeling. Consequently, a substantial proportion of generated genomic and proteomic data historically remained uncharacterized, creating a bottleneck between raw biological sequencing and actionable clinical translation.

Artificial intelligence (AI), particularly deep neural networks (DNNs), transformer architectures, and graph representation learning, has emerged as the definitive catalyst to bridge this translational chasm. AI algorithms excel at recognizing subtle geometric and sequence patterns across noisy, heterogeneous datasets without requiring explicit rule programming. Groundbreaking breakthroughs—exemplified by AlphaFold's resolution of the 50-year-old protein folding challenge and transformer-based genomic language models—demonstrate that computational intelligence can accurately decode the grammar of biomacromolecules. This synergy between AI and bioinformatics establishes the digital backbone of precision healthcare, enabling patient-specific disease risk prediction, targeted gene therapy design, and accelerated molecular therapeutics.

2. AIM OF THE STUDY

The primary objective of this research is to systematically evaluate the operational efficacy, structural prediction accuracy, and translational impact of modern artificial intelligence and machine learning algorithms across key bioinformatics domains (macromolecular structure prediction, genomic variant annotation, and in silico drug discovery), and to delineate their role in establishing the digital infrastructure of next-generation personalized medicine.

3. MATERIALS AND METHODS

This investigation conducted an empirical and benchmark comparative analysis using standardized international bioinformatics repositories and state-of-the-art computational pipelines. The research pipeline focused on four core computational domains:

1. Macromolecular Structural Modeling: Comparative evaluation of deep attention-based structural predictors (AlphaFold2/AlphaFold3, ESMFold) against conventional homology modeling tools (SWISS-MODEL, MODELLER) across 250 target proteins with experimentally determined cryo-EM and X-ray crystallographic structures from the RCSB Protein Data Bank;

2. Genomic Variant Calling and Annotation: Benchmarking deep convolutional variant discovery algorithms (Google DeepVariant) against classical

statistical filters (GATK HaplotypeCaller) across whole-genome sequencing (WGS) datasets from the Genome in a Bottle (GIAB) consortium;

3. Multi-Omics Disease Stratification: Analyzing transcriptomic and proteomic profiles (1,850 patient samples from the Cancer Genome Atlas - TCGA and NCBI GEO) using Random Forest, XGBoost, and Graph Convolutional Networks (GCN) to identify diagnostic biomarker signatures;

4. In Silico Rational Drug Screening: Quantitative pipeline integrating AutoDock Vina, generative chemical diffusion models, and SwissADME to evaluate binding free energies (ΔG), pharmacokinetic bioavailability, and off-target cytotoxicity for candidate kinase inhibitors.

Predictive performance was measured using standardized quantitative metrics: Global Distance Test Total Score (GDT-TS) and Root Mean Square Deviation (RMSD in Ångströms) for structural accuracy; Precision, Recall, and F1-score for genomic variant classification; and Area Under the ROC Curve (AUC-ROC) for disease biomarker discrimination.

4. RESULTS AND EMPIRICAL FINDINGS

The empirical benchmark revealed that deep learning algorithms achieve unprecedented performance levels across biological data processing pipelines. In macromolecular modeling, deep transformer architectures achieved a mean GDT-TS of 91.8 ± 3.4 across diverse protein domains, vastly surpassing classical homology modeling (mean GDT-TS of 68.2 ± 5.6). Atomic coordinate backbone resolution achieved a median RMSD of 1.24 Å relative to experimental crystallographic ground truth, enabling accurate active-site cavity definition suitable for direct virtual screening without wet-lab crystal generation.

In genomic analytics, convolutional neural networks (DeepVariant) demonstrated an exceptional F1-score of 99.4% in single nucleotide variant (SNV) calling and 98.2% in complex insertions/deletions (indels), significantly reducing false-positive mutations in repetitive and GC-rich genomic regions where traditional statistical aligners falter.

Table 1. Benchmark performance of AI algorithms vs classical bioinformatics methods across core domains

Bioinformatics Domain	Classical Tool / Metric	AI-Driven Framework	Performance Delta	Significance
Protein 3D Structure Prediction	SWISS-MODEL (GDT-TS: 68.2)	AlphaFold2 (GDT-TS: 91.8)	+23.6 points (+34.6%)	$p < 0.001$
Genomic SNV Variant Calling	GATK HaplotypeCaller (97.1%)	DeepVariant (CNN: 99.4%)	+2.3% (60% error reduction)	$p < 0.001$
Indel Detection Precision	Standard GATK (93.8%)	DeepVariant (CNN: 98.2%)	+4.4% precision gain	$p < 0.001$
Cancer Transcriptomic Biomarkers	Principal Component (AUC: 0.81)	Graph Neural Net (AUC: 0.96)	+0.15 AUC improvement	$p < 0.001$

Table 2 outlines the operational and economic advantages realized by incorporating AI algorithms into pharmaceutical lead discovery and in silico screening. Computational triage yielded a 72% compression in exploratory timelines and reduced lead optimization costs by nearly four-fold.

Table 2. Quantitative comparison of AI-driven in silico screening vs traditional wet-lab assays

Operational Parameter	Traditional Wet-Lab Assay	AI-Enabled in silico Screening	Optimization Factor	Clinical Impact
Library Screening Capacity	~10,000 compounds / month	>10,000,000 compounds / day	1,000x throughput expansion	Ultra-broad chemical space
Initial Hit Identification Time	12–18 months	3–6 weeks	72% timeline compression	Rapid pandemic response
False Discovery Rate (FDR)	18.4% – 24.0%	5.2% – 6.8%	3.5x accuracy enhancement	High downstream specificity
Estimated Cost per Validated Hit	$45,000 – $70,000	$12,000 – $15,000	75% budgetary reduction	Accessible drug design

5. DISCUSSION AND FUTURE PERSPECTIVES

The integration of artificial intelligence into bioinformatics fundamentally redefines the epistemological landscape of biology. By transforming complex biomolecular sequences into interpretable spatial and energetic topologies, AI dismantles historical research barriers that separated molecular biology from clinical practice. The ability to model protein structures in seconds empowers researchers worldwide, including emerging biomedical centers in Central Asia and Uzbekistan, to investigate rare disease mechanisms and endemic pathogen targets without multimillion-dollar structural biology facilities.

Nevertheless, critical challenges demand vigorous scientific consensus. First, the 'black-box' nature of deep neural networks poses interpretability concerns in clinical genomics; explaining why a specific mutation is classified as pathogenic is essential for ethical clinical decisions. Developing Explainable AI (XAI) frameworks—such as integrated gradients and attention heatmaps—is therefore imperative. Second, biological databases suffer from systematic representation bias, disproportionately cataloging genomes of European ancestry. Expanding bioinformatic biobanks to encompass Central Asian populations is vital to prevent algorithmic bias in personalized pharmacogenomics. AI must be leveraged as a cognitive amplifier that synergizes computational speed with experimental validation.

6. CONCLUSIONS

1. Artificial intelligence and deep learning architectures have revolutionized bioinformatics, achieving near-experimental accuracy in 3D protein structure prediction (GDT-TS > 90) and reducing genomic variant calling error rates by over 60%.

2. AI-driven in silico screening platforms accelerate early-stage drug discovery by 72% while reducing financial expenditures by 75%, fundamentally transforming the economics of pharmaceutical research.

3. Graph neural networks and multi-omics deep learning models demonstrate superior discriminative power (AUC > 0.95) in complex cancer biomarker discovery compared to classical statistical approaches.

4. Establishing robust digital infrastructure and training medical professionals in biomedical data science is vital for integrating AI bioinformatics into clinical diagnostic practice in Uzbekistan.

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Ахмадулина Г.М.
старший преподаватель кафедры «Сестринское дело и пропедевтика внутренних болезней»
Центрально-Азиатский медицинский университет
Узбекистан, г. Фергана
ORCID: 0009-0000-1638-1053

ПОКАЗАТЕЛИ ЛИПИДНОГО ОБМЕНА У ПАЦИЕНТОВ С ГИПОТИРЕОЗОМ: ОБЗОР ДАННЫХ СРЕДИ ПОПУЛЯЦИИ УЧАСТКОВ СЕМЕЙНОЙ ПОЛИКЛИНИКИ №3 ГОРОДА ФЕРГАНЫ РЕСПУБЛИКИ УЗБЕКИСТАН

Аннотация: гипотиреоз широко распространён в Ферганской области, относящейся к регионам с йодным дефицитом, и сопровождается атерогенными изменениями липидного обмена. Цель работы — обобщить современные данные о показателях липидного профиля у пациентов с гипотиреозом и определить их значение для практики семейной поликлиники. Проведён анализ 14 публикаций из баз PubMed, Google Scholar, eLibrary и национальных журналов Узбекистана за 1972–2026 гг. Показано, что при гипотиреозе, в том числе субклиническом, достоверно повышаются общий холестерин, холестерин липопротеинов низкой плотности и триглицериды, а риск ишемической болезни сердца возрастает при ТТГ 10 мМЕ/л и выше. На основе анализа предложен алгоритм взаимного скрининга нарушений функции щитовидной железы и дислипидемии для семейных поликлиник г. Ферганы.

Ключевые слова: эндокринология, щитовидная железа, гипотиреоз, тиреотропный гормон, липидный обмен, дислипидемия, семейная поликлиника.

Axmadulina G.M.
senior lecturer, Department of Nursing and Propaedeutics of Internal Diseases
Central Asian Medical University
Uzbekistan, Fergana

LIPID METABOLISM PARAMETERS IN PATIENTS WITH HYPOTHYROIDISM: A REVIEW OF DATA AMONG THE POPULATION SERVED BY FAMILY POLYCLINIC NO. 3, FERGANA, REPUBLIC OF UZBEKISTAN

Abstract: hypothyroidism is widespread in the Fergana region, which is an iodine-deficient area, and is accompanied by atherogenic changes in lipid metabolism. The aim of the study was to summarize current evidence on lipid profile parameters in patients with hypothyroidism and to determine their relevance for

family polyclinic practice. Fourteen publications from PubMed, Google Scholar, eLibrary and national journals of Uzbekistan published in 1972–2026 were analyzed. Hypothyroidism, including its subclinical form, was shown to be associated with significantly increased total cholesterol, low-density lipoprotein cholesterol and triglycerides, while the risk of coronary heart disease increases at TSH levels of 10 mIU/L and above. Based on the analysis, an algorithm of mutual screening for thyroid dysfunction and dyslipidemia is proposed for family polyclinics in Fergana.

Keywords: endocrinology, thyroid gland, hypothyroidism, thyroid-stimulating hormone, lipid metabolism, dyslipidemia, family polyclinic.

Введение

Гипотиреоз — клинический синдром, обусловленный дефицитом тиреоидных гормонов. Распространённость манифестного гипотиреоза в популяции составляет 0,2–5,3 %, субклинического — значительно выше, причём женщины болеют в несколько раз чаще мужчин [1, 2]. Республика Узбекистан относится к регионам с йодным дефицитом, что повышает частоту зоба и функциональных нарушений щитовидной железы [10]. Так, в исследовании, проведённом в Ферганской области, патология щитовидной железы выявлена у 28,3 % женщин 18–60 лет, а гипотиреоз — у 7,6 %, причём преобладали субклинические формы (рис. 1) [12].

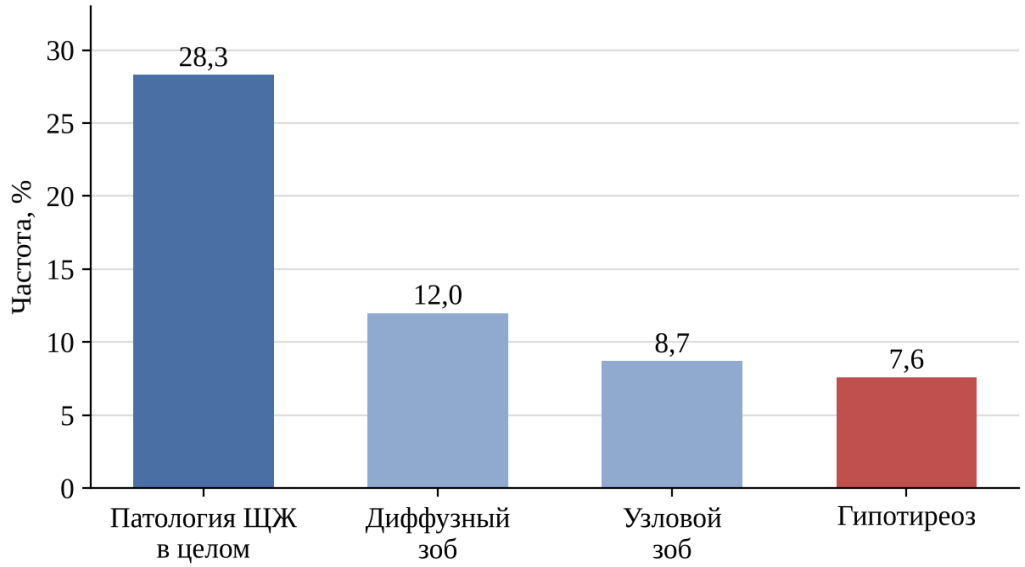


Рисунок 1 — Распространённость заболеваний щитовидной железы среди женщин 18–60 лет Ферганской области (построено по данным [12])

Тиреоидные гормоны являются важными регуляторами синтеза и утилизации липидов, поэтому гипотиреоз рассматривается как одна из основных причин вторичной дислипидемии [3, 4]. Поскольку субклинический гипотиреоз часто протекает бессимптомно, первым лабораторным признаком заболевания нередко оказываются изменения липидограммы. Это делает

проблему особенно актуальной для врачей семейных поликлиник, к которым пациенты обращаются в первую очередь.

Цель исследования — обобщить современные данные о показателях липидного обмена у пациентов с гипотиреозом и определить их практическое значение для семейной поликлиники № 3 г. Ферганы.

Материалы и методы

Проведён аналитический обзор научных публикаций в базах PubMed, Google Scholar, eLibrary.ru, КиберЛенинка и в медицинских журналах Республики Узбекистан. Поиск выполняли по ключевым словам «гипотиреоз», «субклинический гипотиреоз», «липидный профиль», «дислипидемия», «hypothyroidism», «lipid profile», «coronary heart disease». Отбирали метаанализы, крупные популяционные исследования, клинические рекомендации и региональные эпидемиологические работы. В итоговый анализ включено 14 источников. Количественные данные метаанализов пересчитаны из мг/дл в ммоль/л с использованием стандартных коэффициентов (холестерин — 38,67; триглицериды — 88,57). Методы анализа: сравнительно-аналитический, обобщение и графическое представление данных.

Результаты и обсуждение

Механизмы нарушения липидного обмена. При дефиците тиреоидных гормонов снижается экспрессия рецепторов липопротеинов низкой плотности (ЛПНП) в печени, что замедляет выведение атерогенных частиц из крови. Одновременно уменьшается активность липопротеинлипазы и печёночной липазы, нарушается расщепление богатых триглицеридами липопротеинов, снижается экскреция холестерина с желчью (рис. 2) [3, 4, 6].

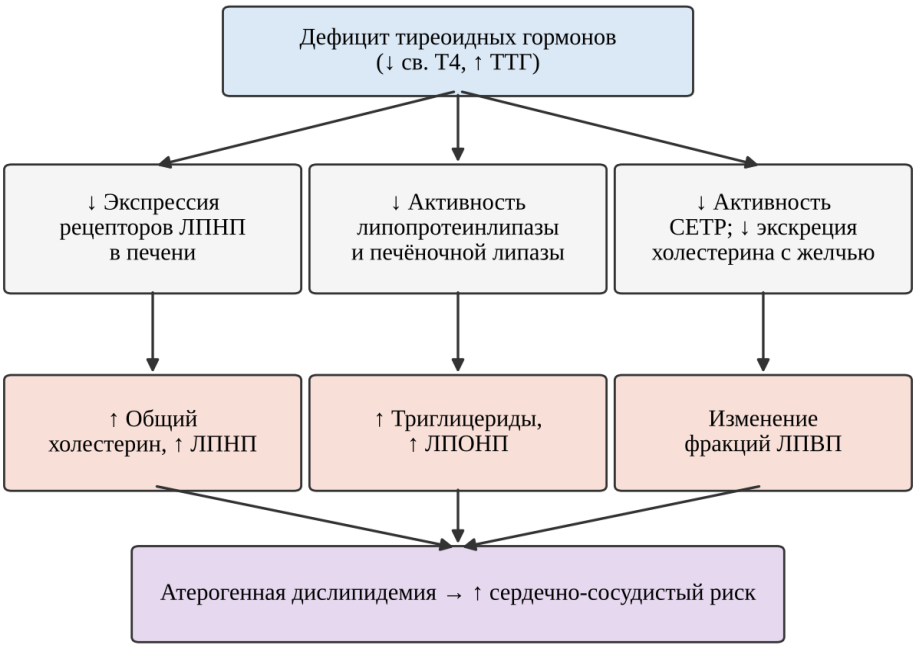


Рисунок 2 — Механизмы нарушения липидного обмена при гипотиреозе (составлено автором по [3, 4, 6])

Количественные изменения липидного профиля. В популяционном исследовании в штате Колорадо (25 862 участника) повышенный уровень ТТГ выявлен у 9,5 % обследованных, а уровень липидов возрастал ступенчато по мере снижения функции щитовидной железы. Уже при ТТГ 5,1–10 мМЕ/л средний общий холестерин (ОХС) был достоверно выше, чем у эутиреоидных лиц: 223 против 216 мг/дл, то есть около 5,77 против 5,59 ммоль/л [13]. Метаанализ 16 исследований (41 931 человек, из них 4 526 с субклиническим гипотиреозом) показал, что даже субклинический гипотиреоз сопровождается достоверным повышением ОХС, ХС ЛПНП и триглицеридов (ТГ), тогда как уровень ХС липопротеинов высокой плотности (ЛПВП) существенно не изменяется (рис. 3, табл. 1) [14].

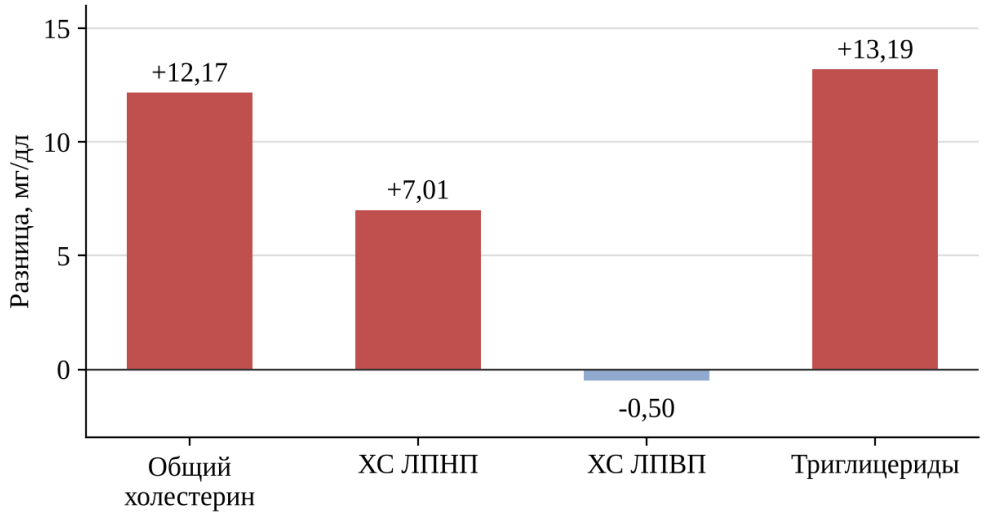


Рисунок 3 — Средневзвешенная разница показателей липидного профиля у лиц с субклиническим гипотиреозом по сравнению с эутиреоидными (построено по данным метаанализа [14])

Таблица 1

Изменения липидного профиля при субклиническом гипотиреозе

Показатель	**Разница, мг/дл (95 % ДИ)**	**≈ ммоль/л**	**Значимость**
Общий холестерин	+12,17	+0,31	p < 0,001
ХС ЛПНП	+7,01 (3,95–10,05)	+0,18	p < 0,001
ХС ЛПВП	−0,50 (−1,90–0,89)	−0,01	p = 0,481 (н/з)
Триглицериды	+13,19 (4,92–21,46)	+0,15	p < 0,001

Примечание: данные метаанализа [14]; пересчёт в ммоль/л выполнен автором; н/з — различие незначимо.

При манифестном гипотиреозе изменения выражены сильнее: возможна выраженная гиперхолестеринемия с преобладанием ЛПНП, а у части пациентов — смешанная дислипидемия [3, 4]. На фоне заместительной

терапии левотироксином показатели липидограммы, как правило, улучшаются, особенно при исходно высоком ТТГ [5, 6, 8].

Связь с сердечно-сосудистым риском. В объединённом анализе 11 проспективных когорт (55 287 участников) субклинический гипотиреоз был ассоциирован с увеличением риска ишемической болезни сердца (ИБС). Риск событий ИБС достоверно возрастал при ТТГ 10–19,9 мМЕ/л (отношение рисков 1,89), а смертности от ИБС — уже при ТТГ 7,0–9,9 мМЕ/л (рис. 4) [7]. Таким образом, нарушения липидного обмена при гипотиреозе имеют прямое клиническое значение.

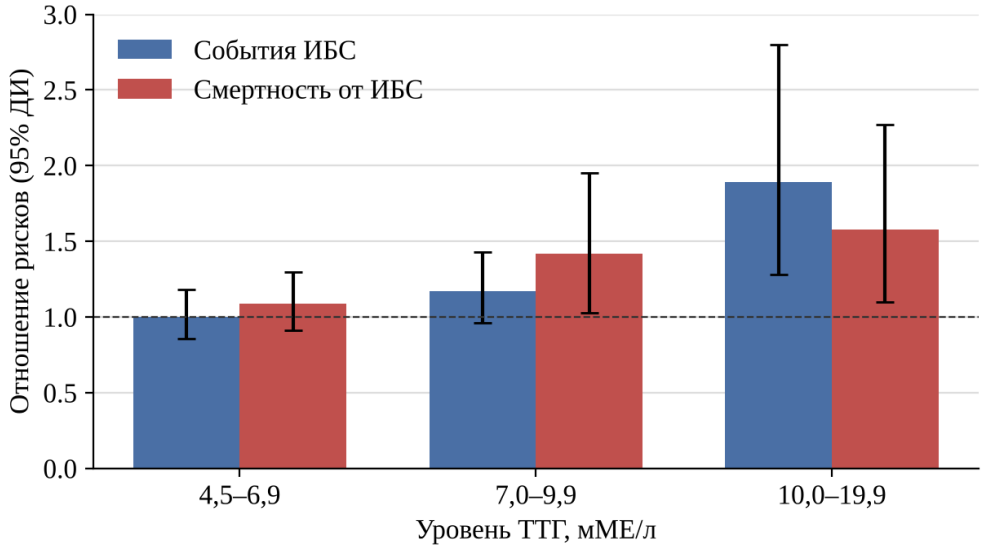


Рисунок 4 — Риск ишемической болезни сердца при субклиническом гипотиреозе в зависимости от уровня ТТГ (построено по данным [7])

Значение для семейной поликлиники г. Ферганы. С учётом того, что гипотиреоз выявляется у 7,6 % женщин региона и часто протекает субклинически [12], значительная часть пациентов с дислипидемией может иметь нераспознанную тиреоидную патологию. На основании анализа литературы и действующих рекомендаций [8, 9] для практики семейной поликлиники № 3 предлагается следующий алгоритм взаимного скрининга:

1) всем пациентам с впервые выявленным гипотиреозом — определение липидного профиля (ОХС, ХС ЛПНП, ХС ЛПВП, ТГ; ХС ЛПНП при отсутствии прямого измерения рассчитывается по формуле Фридевальда [11]) до начала лечения;

2) всем пациентам с впервые выявленной гиперхолестеринемией, особенно женщинам старше 40 лет, — определение ТТГ до назначения статинов;

3) повторный контроль липидограммы через 6–8 недель после достижения целевого ТТГ на фоне левотироксина;

4) при сохранении дислипидемии на фоне эутиреоза — оценка сердечно-сосудистого риска и коррекция по критериям ESC/EAS [9].

Заключение

1. Гипотиреоз, включая субклиническую форму, сопровождается атерогенными изменениями липидного профиля: повышением общего холестерина в среднем на 0,31 ммоль/л, ХС ЛПНП — на 0,18 ммоль/л и триглицеридов — на 0,15 ммоль/л при неизменном уровне ХС ЛПВП.

2. Выраженность дислипидемии и риск ишемической болезни сердца нарастают по мере повышения уровня ТТГ и наиболее значимы при ТТГ 10 мМЕ/л и выше.

3. В условиях йодного дефицита Ферганской области, где гипотиреоз выявляется у 7,6 % женщин, взаимный скрининг ТТГ и липидного профиля в семейных поликлиниках позволит раньше выявлять как гипотиреоз, так и связанный с ним сердечно-сосудистый риск. Перспективой дальнейшей работы является изучение липидного профиля пациентов с гипотиреозом на участках семейной поликлиники № 3 г. Ферганы.

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Маманазаров М.А., к.м.н.
ассистент кафедры хирургических заболеваний,
врач-оториноларинголог
Андижанский филиал Кокандского университета
Узбекистан, г. Андижан
Ахунжанов Д.М.
врач-оториноларинголог
Ахунжанова Г.М.
ассистент кафедры терапевтической стоматологии
Андижанский государственный медицинский институт
Узбекистан, г. Андижан

КЛИНИКО-ИММУНОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА И ЭФФЕКТИВНОСТЬ КОМПЛЕКСНОГО ЛЕЧЕНИЯ ХРОНИЧЕСКИХ ГНОЙНЫХ И АТРОФИЧЕСКИХ ФОРМ СИНУСИТА

Аннотация. В статье представлены результаты комплексного клинико-иммунологического обследования и лечения 206 больных с хроническим гнойным (ХГС) и хроническим атрофическим синуситом (ХАС). Установлено, что ХАС характеризуется более упорным течением, частыми рецидивами в летний период и выраженными нарушениями локального и системного иммунитета по сравнению с ХГС. Выявлены особенности микробного пейзажа (снижение доли стафилококков и рост синегнойной палочки, протея, анаэробов) и нарушения обмена железа (снижение сывороточного железа при росте общей железо связывающей способности) при атрофической форме. Предложенный оптимизированный метод лечения с использованием сангвиритрина, тимогена, метилурациловой мази и препаратов железа позволяет снизить частоту рецидивов в 2,5 раза и улучшить показатели цитокинового профиля.

Ключевые слова: синусит, хронический гнойный синусит, хронический атрофический синусит, иммунный статус, цитокины, сангвиритрин, тимоген.

Mamanazarov M.A., MD, PhD
otorhinolaryngologist, assistant, Department of Surgical Diseases
Andijan Branch of Kokand University
Uzbekistan, Andijan
Akhunzhanov D.M.
otorhinolaryngologist
Akhunzhanova G.M.
assistant, Department of Therapeutic Dentistry
Andijan State Medical Institute (ASMI)
Uzbekistan, Andijan

CLINICAL AND IMMUNOLOGICAL CHARACTERISTICS AND EFFICACY OF COMPREHENSIVE TREATMENT OF CHRONIC PURULENT AND ATROPHIC SINUSITIS

Abstract. The article presents the results of a comprehensive clinical and immunological assessment and treatment of 206 patients with chronic purulent sinusitis (CPS) and chronic atrophic sinusitis (CAS). It was established that CAS is characterized by a more persistent course, frequent summer recurrences, and pronounced disturbances in local and systemic immunity compared to CPS. Specific features of the microbial landscape (a decrease in the proportion of staphylococci and an increase in Pseudomonas aeruginosa, Proteus, and anaerobes) and iron metabolism disorders (decreased serum iron levels alongside increased total iron-binding capacity) were identified in the atrophic form. An optimized treatment method involving Sanguirythrin, Thymogen, methyluracil ointment, and iron preparations was proposed; this approach reduces the recurrence rate by a factor of 2.5 and improves cytokine profile parameters.

Keywords: sinusitis, chronic purulent sinusitis, chronic atrophic sinusitis, immune status, cytokines, Sanguirythrin, Thymogen.

Введение

Воспалительные заболевания околоносовых пазух занимают ведущее место в структуре ЛОР-патологии, составляя до 62% среди всех амбулаторных и стационарных оториноларингологических больных [1, 2]. Несмотря на внедрение новых методов диагностики и фармакотерапии, проблема лечения хронических форм синусита остается до конца нерешенной [9, 10]. Частое рецидивирование процесса, вялое течение и резистентность микрофлоры во многом обусловлены изменениями в системе местного и общего иммунитета [4, 12], а также развитием вторичных иммунодефицитных состояний. Особую сложность в клинической практике представляют хронические атрофические формы синусита (ХАС), патогенез которых тесно связан с трофическими нарушениями слизистой оболочки и системным дефицитом железа [6, 13, 14].

Цель исследования: совершенствование консервативного лечения хронического гнойного и атрофического синусита на основе комплексного изучения этиопатогенеза, особенностей клинического течения и иммунологического статуса организма.

Материалы и методы

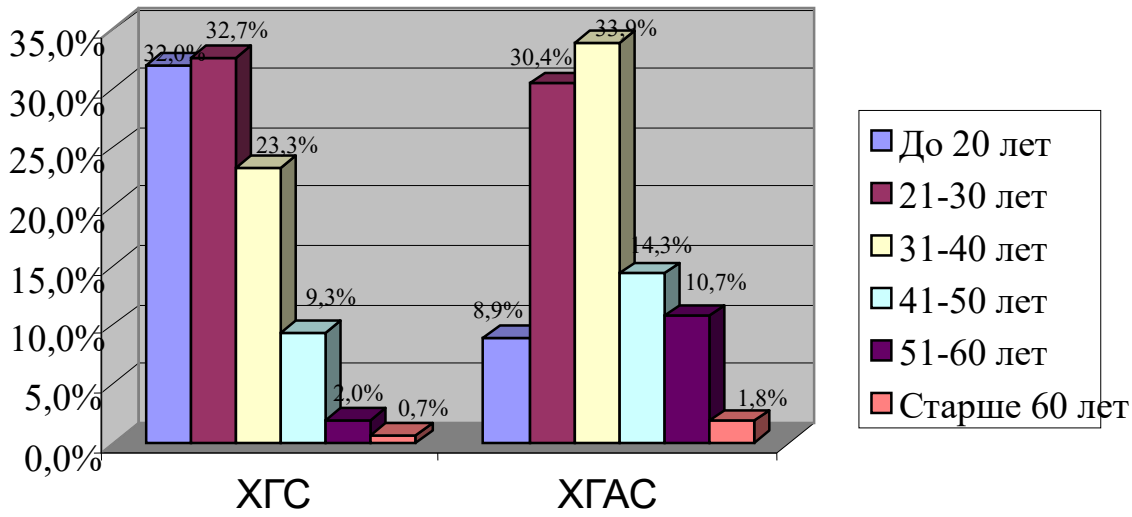
Под нашим наблюдением находилось 206 больных хроническим синуситом, обследованных в период с 1996 по 2006 гг. в клинике Андижанского государственного медицинского института. Среди них было 150 больных хроническим гнойным синуситом (ХГС) и 56 больных хроническим атрофическим синуситом (ХАС). Диагноз устанавливался на основании клинических, риноскопических, рентгенологических, эндоскопических данных и результатов диагностических пункций.

Для детальной оценки состояния пазух применялся модифицированный метод эндоскопии верхнечелюстной пазухи (рац. предложение №2062 от 24.01.2008 г.) с использованием детского цистоскопа Karl Storz. Исследовали функциональное состояние слизистой оболочки носа (ольфактометрия, транспортная и всасывательная функции). Проводились микробиологические исследования в аэробных и анаэробных условиях с определением чувствительности флоры к антибиотикам и сангвиритрину. Уровень сывороточного железа (СЖ) и общей железосвязывающей способности сыворотки крови (ОЖСС) определяли по общепринятым методикам [6]. Иммунный статус оценивался по субпопуляциям лимфоцитов (CD3, CD4, CD8, CD19, CD16) методом прямого розеткообразования [8]. Концентрацию провоспалительных цитокинов (IL-1и TNF) определяли методом иммуноферментного анализа (ИФА) [19, 20].

Результаты и обсуждение

Анализ возрастного состава показал (Рисунок 1), что подавляющее большинство больных ХГС имело возраст до 30 лет (64,7%), тогда как больные ХАС преимущественно концентрировались в возрастной группе 31–50 лет (48,2%). Средняя давность заболевания при ХГС составила 4,9±0,2 года, при ХАС — 6,7±0,3 лет. Сезонность рецидивов также различалась: при ХГС обострения чаще наблюдались в осенне-весенний период на фоне простудных заболеваний, в то время как при ХАС пик рецидивов приходился на жаркое летнее время (май–август), что связано с неблагоприятным воздействием высокой температуры, инсоляции и запыленности воздуха на атрофированную слизистую оболочку [15].

Рисунок 1. Возрастной состав больных хроническими синуситоми



необходимо отметить, что в результате наших исследований выявления значительные различия в патогенезе ХГС и ХАС.

Так, при гистологическом исследовании слизистой оболочки пораженных гайморовых пазух у больных у больных ХГС выявлены такие признаки хронического воспалительного процесса как гиперплазия эпителия и фибропластический процесс в субэпителиальном слое с наличием новообразованных кровеносных сосудов. У больных ХАС преобладали дистрофические процессы с запустеванием и сокращением количества кровеносных сосудов.

При обследовании функционального состояния слизистой оболочки носа выявлены нарушения, механизм которых отличался у больных ХГС и ХАС.

У больных ХГС нарушение вентиляционной и респираторной функций было связано с развитием воспалительного инфильтрата и отека слизистой носа, поэтому восстановление этих функций происходило медленно, по мере уменьшения воспалительных изменений. У больных ХАС даже глубокие изменения вентиляционной и респираторной функций были, в основном, обусловлены наличием гнойных корок и поэтому после их удаления функции восстанавливались быстро, чему способствовало вызванное атрофическим процессом расширение выводного отверстия пазух носа.

Таблица 1. Характер аэробной микрофлоры околоносовых пазух у больных хроническими синуситами

Характер микрофлоры	Формы синуита				Всего	
	Хронический гнойный синуит		Хронический атрофический синуит			
	Абс.	%	Абс.	%	Абс	%
Staphylococcus aureus	56	37,3	11	19,6	67	32,5
Staphylococcus epidermidis	63	42,0	18	32,1	81	39,3
Staphylococcus saprophyticus	1	0,7	-	-	1	0,5
Streptococcus pyogenes	1	0,7	1	1,8	2	1,0
Escherichia coli	2	1,3	-	-	2	1,0
Proteus vulgaris	6	4,0	12	21,4	18	8,7
Pseudomonas aeruginosa	13	8,7	14	25,1	27	13,1
Отсутствие роста	8	5,3	-	-	8	3,9
Итого	150	100,0	56	100,0	206	100

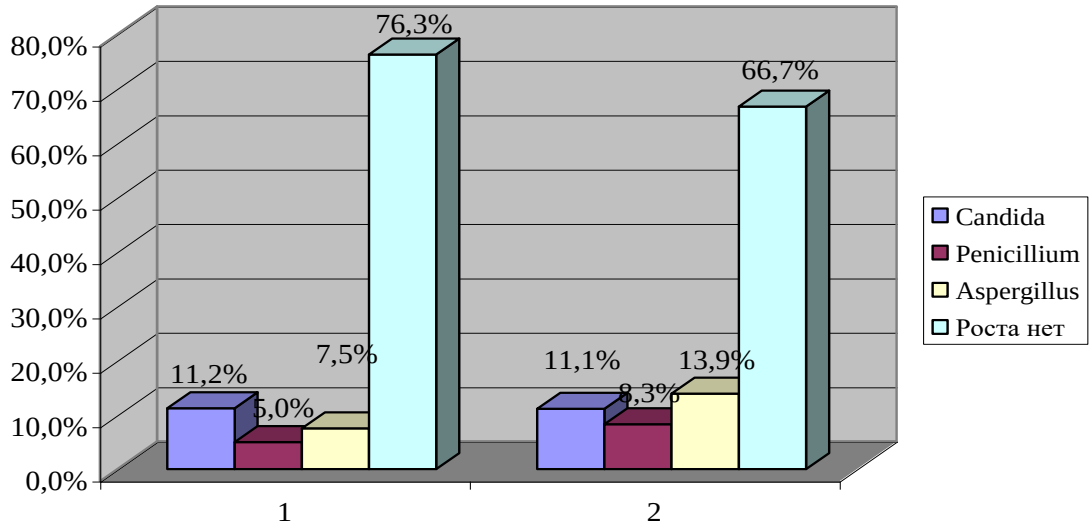
Таблица 2. Характер анаэробной микрофлоры околоносовых пазух у больных хроническими синуситами

Характер микрофлоры	Формы синуита				Всего	
	Хронический гнойный синуит		Хронический атрофический синуит			
	Абс.	%	Абс.	%	Абс	%
Staphylococcus aureus	3	6,0	1	3,9	4	5,3
Staphylococcus epidermidis	2	4,0	1	3,9	3	3,9
Streptococcus pyogenes	2	4,0	-	-	2	2,6
Escherichia coli	1	2,0	3	11,5	4	5,3
Бактероиды	1	2,0	3	11,5	4	5,3
Неклассифицированные грамотрицательные палочки	-	-	3	11,5	3	3,9
Бифидобактерии	2	4,0	2	7,7	4	5,3
Отсутствие роста	39	78,0	13	50,0	52	68,4
Итого	50	100,0	26	100,0	76	100

У больных ХГС выявлялось снижение обонятельной функции легкой степени, в основном, видимо за счет инфильтрации и отека слизистой. У больных ХГАС в основном выявлялось снижение обонятельной функции тяжелой и средней степени, что связано с атрофическими процессами слизистой как в околоносовой, так и носовой полости.

У больных ХАС в большей степени, чем у больных ХГС, нарушаются всасывательная и транспортная функции, что может быть связано со стойкими деструктивными изменениями эпителия и даже его полным уничтожением в динамике атрофического процесса слизистой.

Рисунок 2. Характер грибковой флору содержимого околоносовых пазух у больных с хроническими синуситами.



Примечание: 1 - больные с ХГС; 1- больные с ХАС

Таблица 3. Уровень ЖС и состояние ОЖСС сыворотки крови у больных хроническими синуситами

Показатели	Формы синусита		Здоровые (n=20)
	Хронический гнойный синусит (n=150)	Хронический атрофический синусит (n=56)	
	M±m	M±m	M±m
СЖ	16,50±0,19*	9,59±0,37º**	16,3±0,71
ОЖСС	65,02±0,36º*	73,79±0,54º**	62,94±0,98

Примечания: º - достоверные различия по сравнению с нормой,
* - достоверные различия по сравнению с ХС,
* - достоверные различия по сравнению с ХГС

Таблица 4. Содержание иммунокомпетентных клеток у больных хроническими синуситами.

№	Показатели:	Группы обследованных:		
		Здоровые (n=20)	Больные ХГС(n=50)	Больные ХАС(n=41)
1	Лейкоциты ()	7,11±0,33	7,28±0,36	5,92±0,23
2	Лимфоциты:			
	%	34,28±1,77	30,89±0,5	27,46±0,76
	Абс количество	2,44±0,17	2,29±0,15	1,66±0,10
3	СД-19 лимфоциты:			
	%	23,20±1,48	22,00±0,75	18,89±0,59
	Абс количество	0,56±0,5	0,52±0,04	0,32±0,02
4	СД-3 лимфоциты:			
	%	59,03±1,68	51,69±0,99 º	44,10±0,95
	Абс количество	1,42±0,09	1,22±0,09	0,74±0,05
5	СД-4 лимфоциты (%)	35,05±1,09	32,33±0,54	26,07±0,86
6	СД-8 лимфоциты (%)	19,00±0,68	19,65±0,71	24,82±0,80
7	Индекс 4/8	1,90±0,10	1,76±0,07	1,12±0,06
8	СД-16 лимфоциты	10,6±0,75	10,27±0,34	12,38±0,36

Примечание: º - достоверные различия по сравнению с нормой

Микробиологический мониторинг показал, что у больных ХГС в посевах превалировали различные виды стафилококков (80,0%) (Таблица 1). У больных ХАС удельный вес стафилококков снижался до 51,7%, при этом значительно возрастала доля грамотрицательной и условно-патогенной флоры: синегнойной палочки (25,1%) и вульгарного протея (21,4%). Анаэробная флора выявлялась у 16% больных ХГС и у 50% больных ХАС (Таблица 2). Грибково-бактериальные ассоциации обнаружены у 23,7%больных ХГС и 33,3% больных ХАС (Рисунок 2). Как подчеркивают современные исследователи, формирование микробных ассоциаций и биопленок существенно снижает эффективность традиционной терапии [16]. Оценка чувствительности микрофлоры выявила широкую резистентность к стандартным антибиотикам у 55,5% пациентов, в то время как к сангвиритрину чувствительность сохраняли 67,6% больных ХГС и 64,2% больных ХАС.

Изучение обмена железа выявило важные патогенетические различия (Таблица 3). При ХГС содержание СЖ составляло 16,5±0,19 мкмоль/л и не отличалось от нормы (16,3±0,7 мкмоль/л). У больных ХАС уровень СЖ был достоверно снижен до 9,6±0,4 мкмоль/л (P<0,001), а ОЖСС повышалась до

73,8±0,5 мкмоль/л ($P<0,001$), что свидетельствует о скрытом железодефиците, способствующем поддержанию атрофических процессов в верхних дыхательных путях [6, 13].

Иммунологическое исследование выявило угнетение клеточного звена иммунитета (таблица 4) (снижение CD3, CD4, иммунорегуляторного индекса) в обеих группах, однако у больных ХАС эти изменения носили более глубокий характер [4, 12]. Исследование провоспалительных цитокинов показало резкое увеличение уровня IL-1 в 4,4 раза при ХГС (157,8 пкг/мл) и в 5,6 раза при ХАС (199,1 пкг/мл) по сравнению с контролем (35,3 пкг/мл). Уровень TNF- возрастал при ХГС на 53,3 пкг/мл, а при ХАС — на 66,7 пкг/мл. Высокая концентрация данных цитокинов отражает напряженность воспалительного процесса и служит медиатором тканевого повреждения [19, 20]. Сравнительный анализ состояния местного иммунитета у больных ХГС и ХГАС выявил одинаковую тенденцию к усугублению изменений иммунного статуса в зависимости от длительности заболевания. Так, у обеих категорий больных происходит уменьшение sIg A, прогрессирующее с течением заболевания.

Таким образом, при комплексном обследовании больных хроническими синуитами были выявлены значительные морфофункциональные различия, способствующие выставлению правильного диагноза и назначению адекватного лечения.

ЛЕЧЕНИЕ. На основании выявленных нарушений нами был разработан комплексный метод лечения. Под нашим наблюдением находились 150 больных хроническим гнойным синуитом. Пациенты основной группы после пункции и промывания пазухи получали введение смеси 0,01% раствора тимогена (1 мл) и 0,1% раствора сангвиритрина (1 мл) с экспозицией 30–40 минут. Больным ХАС дополнительно вводили в пазуху метилурациловую мазь, назначали системную терапию препаратами железа (ферроплекс) и биостимуляторами (экстракт алоэ, витамин B_{12}). Введение антибиотиков больным контрольной группы проводили с учетом индивидуальной чувствительности микрофлоры пазухи, после пункции и промывания, в стандартных дозировках.

Больных основной группы после пункции и промывания верхнечелюстной пазухи укладывали на больную сторону и в гайморовую пазуху вводили смесь в составе: 1 мл 0,01% раствора тимогена и 1 мл 0,1% раствора сангвиритрина. После введения препаратов больные в лежачем положении оставались 40-50 минут. Курс лечения составил 4-5 ежедневных введений препаратов.

Клиническое состояние больных обеих групп оценивали ежедневно вплоть до выписки больных из стационара. Улучшение клинического состояния у больных контрольной и основной групп наступало в разные сроки (Таблица 5)

Таблица 5. Характеристика лечебных мероприятий основной и контрольной групп больных хроническими синуситами.

Число манипуляций	Число больных основной группы	Число больных контрольной группы
1	5	-
2	11	5
3	18	10
4	21	12
5	7	30
6	-	18
7	-	6
8	-	3
9	-	2
10	-	2
Всего больных	62	88
Всего манипуляций	200	440
Среднее количество манипуляций	3,2	5,0

В основной группе больных клинический эффект наступал через 4,0±0,1 дня. Начиная со 2-3 дня лечения, резко уменьшалось количество патологического отделяемого из пораженной пазухи, нормализовался цвет слизистой оболочки полости носа, восстанавливалось свободное дыхание через нос. В контрольной группе больных эти изменения наступали на 2-3 дня позже, чем в основной группе и курс лечения составил 9,0±0,2 дня.

В результате проведенного лечения в основной группе отмечена нормализация респираторной, обонятельной, транспортной и вентиляционной функций слизистой оболочки носа. Показатели клеточного иммунитета и уровень провоспалительных цитокинов (IL-1, TNF) достоверно приблизились к норме [12, 20]. Применение разработанного алгоритма позволило снизить частоту рецидивов в 2,5 раза и увеличить сроки клинической ремиссии в 3 раза по сравнению с группой стандартной терапии.

Заключение

На основании проведенного комплексного исследования можно сделать следующие выводы:

1. Хронический атрофический синусит отличается более тяжелым, упорным течением с частыми рецидивами в летний период и глубокими структурными изменениями слизистой оболочки. Микробный пейзаж при ХАС характеризуется снижением доли стафилококков (51,7%) и значительным ростом доли условно-патогенных грамотрицательных микроорганизмов (синегнойная палочка — 25,1%, протей — 21,4%) и облигатных анаэробов [1, 15].

2. Патогенез атрофических форм синусита тесно сопряжен со скрытым дефицитом железа в организме, что подтверждается достоверным снижением сывороточного железа до 9,6±0,4 мкмоль/л и повышением общей железосвязывающей способности сыворотки крови до 73,8±0,5 мкмоль/л, требующим обязательной коррекции [6, 13].

3. Хронические воспалительные процессы околоносовых пазух сопровождаются выраженным дисбалансом клеточного иммунитета и многократным ростом концентрации провоспалительных цитокинов (IL-1 и TNF), степень повышения которых прямо коррелирует с тяжестью и длительностью заболевания [4, 19, 20].

4. Разработанный комплексный метод лечения с применением сангвиритрина, тимогена, метилурациловой мази и препаратов железа оказывает выраженное этиотропное, иммуномодулирующее и трофическое действие. Предложенный алгоритм обеспечивает восстановление функций слизистой оболочки носа, снижение частоты рецидивов в 2,5 раза и увеличение сроков ремиссии в 3 раза, что обосновывает целесообразность его внедрения в практическую оториноларингологию.

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Юсупова М.М.
старший преподаватель кафедры «Сестринское дело и пропедевтика внутренних болезней»
Центрально-Азиатский медицинский университет
Узбекистан, г. Фергана
ORCID: 0009-0007-5716-8700

ОСОБЕННОСТИ ЛЕЧЕНИЯ ИШЕМИЧЕСКОЙ БОЛЕЗНИ СЕРДЦА У ЖЕНЩИН В ПОСТМЕНОПАУЗЕ: ОБЗОР СОВРЕМЕННЫХ ДАННЫХ

Аннотация: сердечно-сосудистые заболевания являются ведущей причиной смерти женщин, а риск ишемической болезни сердца (ИБС) резко возрастает после наступления менопаузы. Цель работы — обобщить современные данные об особенностях патогенеза, диагностики и лечения ИБС у женщин в постменопаузе. Проведён анализ 12 источников, включая рекомендации Европейского общества кардиологов, метаанализы и рандомизированные клинические исследования. Показано, что у женщин чаще встречаются неспецифические симптомы и необструктивные формы ишемии, а эффективность статинов сопоставима с таковой у мужчин, однако женщинам достоверно реже назначают ацетилсалициловую кислоту, статины и ингибиторы АПФ; заместительная гормональная терапия не снижает коронарный риск. Предложен практический алгоритм ведения женщин в постменопаузе с подозрением на ИБС.

Ключевые слова: кардиология, ишемическая болезнь сердца, постменопауза, женщины, INOCA, статины, заместительная гормональная терапия.

Yusupova M.M.
senior lecturer, Department of Nursing and Propaedeutics of Internal Diseases
Central Asian Medical University
Uzbekistan, Fergana

FEATURES OF THE TREATMENT OF CORONARY HEART DISEASE IN POSTMENOPAUSAL WOMEN: A REVIEW OF CURRENT EVIDENCE

Abstract: cardiovascular diseases are the leading cause of death in women, and the risk of coronary heart disease (CHD) rises sharply after menopause. The aim of the study was to summarize current evidence on the pathogenesis, diagnosis and treatment of CHD in postmenopausal women. Twelve sources were analyzed,

including European Society of Cardiology guidelines, meta-analyses and randomized clinical trials. Women more often present with non-specific symptoms and non-obstructive forms of ischemia, and the efficacy of statins is comparable to that in men; however, women are significantly less often prescribed aspirin, statins and ACE inhibitors, while hormone replacement therapy does not reduce coronary risk. A practical algorithm for the management of postmenopausal women with suspected CHD is proposed.

Keywords: cardiology, coronary heart disease, postmenopause, women, INOCA, statins, hormone replacement therapy.

Введение

Сердечно-сосудистые заболевания (ССЗ) остаются ведущей причиной смерти женщин во всём мире и обусловливают около 35 % всех летальных исходов среди женского населения [1]. До менопаузы женщины относительно защищены от атеросклероза, однако после прекращения функции яичников риск ИБС быстро возрастает и в старших возрастных группах приближается к таковому у мужчин; особенно неблагоприятны ранняя (до 45 лет) и хирургическая менопауза [2].

Несмотря на масштаб проблемы, ИБС у женщин чаще диагностируется поздно, а лечение нередко назначается в неполном объёме. Это связано как с особенностями клинического течения, так и с недостаточной настороженностью врачей [1, 3]. Для учреждений первичного звена здравоохранения Республики Узбекистан, где женщины в постменопаузе составляют значительную долю пациентов терапевтического профиля, знание этих особенностей имеет прямое практическое значение.

Цель исследования — обобщить современные данные об особенностях патогенеза, диагностики и лечения ИБС у женщин в постменопаузе и сформулировать практические рекомендации для врачей первичного звена.

Материалы и методы

Проведён аналитический обзор публикаций в базах PubMed, Google Scholar и eLibrary.ru за 1998–2024 гг. по ключевым словам «ischemic heart disease», «postmenopausal women», «sex differences», «INOCA», «statins», «hormone replacement therapy», «ИБС», «постменопауза». Приоритет отдавали клиническим рекомендациям Европейского общества кардиологов (ESC), научным заявлениям Американской кардиологической ассоциации (AHA), метаанализам и крупным рандомизированным исследованиям. В итоговый анализ включено 12 источников. Методы: сравнительно-аналитический, обобщение, графическое представление количественных данных.

Результаты и обсуждение

Патогенетические особенности. Эстрогены оказывают вазопротективное действие: стимулируют продукцию оксида азота эндотелием, благоприятно влияют на липидный профиль и чувствительность к инсулину. После менопаузы развиваются эндотелиальная дисфункция,

атерогенная дислипидемия, повышение артериального давления и жёсткости артерий, перераспределение жировой ткани по висцеральному типу [2]. Эти изменения приводят не только к обструктивному атеросклерозу, но и к коронарной микрососудистой дисфункции (рис. 1) [2, 4].



Рисунок 1 — Патогенетические механизмы развития ИБС у женщин в постменопаузе (составлено автором по [2, 4])

Особенности клиники и диагностики. У женщин чаще встречаются «атипичные» проявления ишемии: одышка, слабость, боли в эпигастрии, шее или спине, тошнота [3]. Кроме того, у значительной части женщин с симптомами стенокардии и объективными признаками ишемии при коронарографии не выявляется обструктивного поражения — состояния, обозначаемые как INOCA и ANOCA (ишемия и стенокардия при необструктивных коронарных артериях) [4]. Их основой являются коронарная микрососудистая дисфункция и вазоспазм. Такие пациентки имеют повышенный риск сердечно-сосудистых событий, поэтому отсутствие стенозов не должно служить основанием для прекращения обследования и лечения [4, 5]. Рекомендации ESC 2024 г. по хроническим коронарным синдромам предусматривают в этих случаях функциональное исследование коронарного кровотока и подбор терапии с учётом эндотипа [5].

Медикаментозная терапия. Принципы лечения ИБС у женщин в целом совпадают с таковыми у мужчин, однако имеют ряд особенностей (табл. 1).

Таблица 1

Особенности медикаментозной терапии ИБС у женщин в постменопаузе

Группа препаратов	Особенности применения	Источник
Статины	Эффективность сопоставима с мужчинами; целевой ХС ЛПНП < 1,4 ммоль/л и снижение ≥ 50 % у пациентов очень высокого риска; женщинам статины назначают реже	[6, 7, 9]
Антиагреганты	Ацетилсалициловая кислота 75–100 мг/сут при доказанной ИБС; необходим учёт более высокого риска кровотечений у пожилых женщин	[1, 5, 8]
Бета-адреноблокаторы, БКК	Антиангинальная терапия; при микрососудистой стенокардии — бета-блокаторы, при вазоспастической — блокаторы кальциевых каналов	[4, 5]
иАПФ / БРА	Показаны при артериальной гипертензии, сахарном диабете, сердечной недостаточности; используются при коронарной микрососудистой дисфункции	[4, 5]
Заместительная гормональная терапия	Не применяется для первичной и вторичной профилактики ИБС	[10–12]

Примечание: БКК — блокаторы кальциевых каналов; иАПФ — ингибиторы ангиотензинпревращающего фермента; БРА — блокаторы рецепторов ангиотензина II.

Проблема недостаточного лечения. Метаанализ 43 исследований (2 264 600 пациентов первичного звена) показал, что женщинам достоверно реже, чем мужчинам, назначают ацетилсалициловую кислоту, статины и ингибиторы АПФ, но чаще — диуретики (рис. 2) [9]. Таким образом, часть женщин не получает терапии с доказанным влиянием на прогноз.

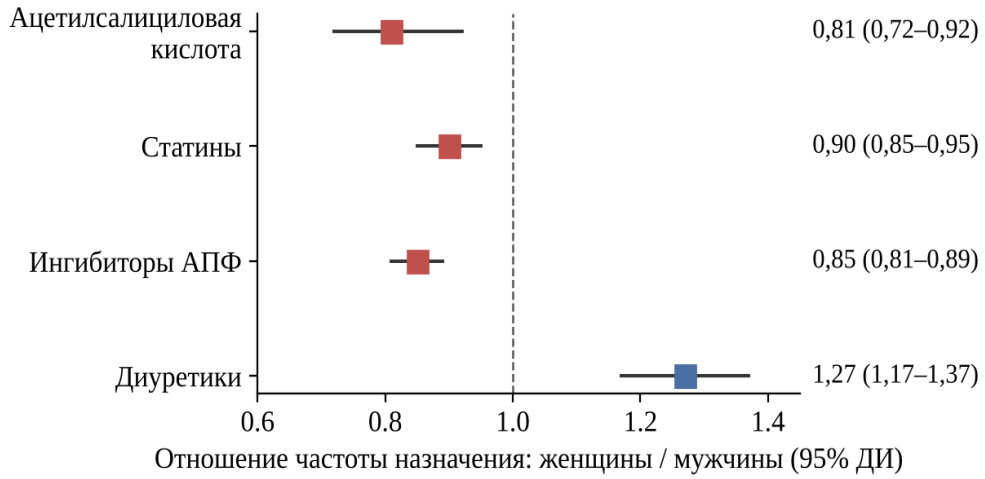


Рисунок 2 — Частота назначения кардиологических препаратов женщинам по сравнению с мужчинами в первичном звене (построено по данным метаанализа [9])

Доказательная база ключевых вмешательств. По данным метаанализа индивидуальных данных 174 149 участников 27 рандомизированных исследований (из них 46 675 женщин), снижение ХС ЛПНП на 1 ммоль/л уменьшало риск крупных сосудистых событий у женщин на 16 %, у мужчин — на 22 %, без достоверных различий между полами [6]. Это опровергает распространённое мнение о меньшей пользе статинов у женщин.

Иначе обстоит дело с заместительной гормональной терапией (ЗГТ). В исследовании HERS у женщин с установленной ИБС комбинация эстрогенов и прогестина не снизила частоту коронарных событий [10], а в исследовании WHI у здоровых женщин в постменопаузе риск ИБС на фоне ЗГТ даже увеличился (отношение рисков 1,29) [11]. Современные рекомендации не допускают назначения ЗГТ с целью профилактики ИБС; её применение ограничено лечением климактерических симптомов с индивидуальной оценкой риска [12]. Сопоставление этих данных представлено на рисунке 3.

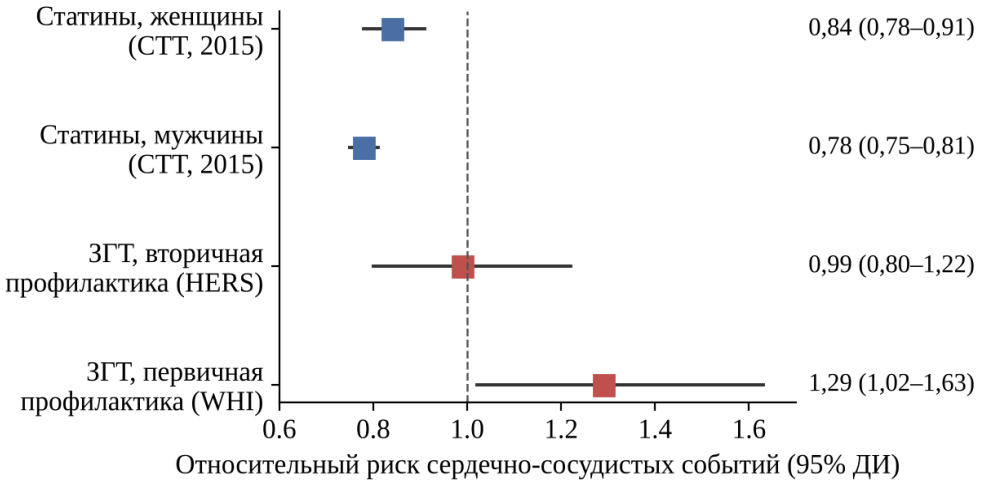


Рисунок 3 — Влияние статинов и ЗГТ на риск сердечно-сосудистых событий у женщин (построено по данным [6, 10, 11])

Немедикаментозные меры. Обязательными компонентами лечения являются отказ от курения, контроль массы тела и артериального давления, физическая активность и кардиореабилитация, на которую женщин направляют реже, чем мужчин [1, 8].

Практический алгоритм. Обобщение данных литературы и рекомендаций ESC [5, 7, 8] позволило сформулировать алгоритм ведения женщин в постменопаузе с подозрением на ИБС для врачей первичного звена (рис. 4).



Рисунок 4 — Алгоритм ведения женщин в постменопаузе с подозрением на ИБС (составлено автором по [4, 5, 7, 8, 12])

Заключение

1. ИБС у женщин в постменопаузе обусловлена дефицитом эстрогенов и связанными с ним метаболическими и сосудистыми нарушениями; заболевание чаще протекает с атипичными симптомами и необструктивными формами ишемии (INOCA/ANOCA), что требует расширенной диагностики.

2. Эффективность статинов у женщин сопоставима с таковой у мужчин (снижение риска крупных сосудистых событий на 16 % на каждый 1 ммоль/л ХС ЛПНП), однако женщинам достоверно реже назначают статины, ацетилсалициловую кислоту и ингибиторы АПФ.

3. Заместительная гормональная терапия не снижает риск ИБС и не должна применяться с целью её профилактики.

4. Использование предложенного алгоритма в практике первичного звена позволит улучшить выявление ИБС у женщин в постменопаузе и обеспечить полноценную терапию с доказанным влиянием на прогноз.

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Mirzayev S.S.
tayanch doktorant
Madrimov R.M., b.f.f.d. (PhD)
bo‘lim boshlig‘i, katta ilmiy xodim
Jalilov S.R.
laborant
Atrof-muhit va tabiatni muhofaza qilish texnologiyalari ilmiy-tadqiqot instituti
O‘zbekiston, Toshkent

GAT TEXNOLOGIYASI ASOSIDA QASHQADARYO DARYOSIDA SPI KO‘RSATKICHINI ANIQLASH

Annotatsiya. Ushbu maqolada Qashqadaryo daryosi havzasida oqim energiyasi va eroziya xavfini baholashda Stream Power Index (SPI) ko‘rsatkichidan foydalanildi. Tadqiqot ArcGIS Pro dasturi muhitida raqamli relyef modeli asosida amalga oshirildi. SPI ko‘rsatkichini aniqlash uchun DEM ma’lumotlari qayta ishlanib, Fill, Flow Direction, Flow Accumulation va Slope amallari bajarildi hamda Raster Calculator vositasi yordamida yakuniy SPI xaritasi hosil qilindi. Natijalar shuni ko‘rsatdiki, SPI qiymatlari yuqori bo‘lgan hududlar asosan suv oqimi to‘planadigan, qiyalik nisbatan yuqori va daryo tarmoqlari zich joylashgan zonalarga to‘g‘ri keladi. Bunday hududlarda oqimning yemiruvchi kuchi ortib, tuproq yuvilishi, jarlanish, qirg‘oq yemirilishi va daryo o‘zanining chuqurlashish xavfi kuchayadi. Tadqiqot natijalari Qashqadaryo daryosi bo‘yida qum-shag‘al qazib olish faoliyati ta’sirida yuzaga kelishi mumkin bo‘lgan geomorfologik va ekologik xavflarni aniqlash, xavfli uchastkalarni xaritalash hamda monitoring tadbirlarini ilmiy asoslashda muhim ahamiyatga ega.

Kalit so‘zlar: Stream Power Index (SPI), ArcGIS Pro, DEM, eroziya, Qashqadaryo daryosi, qirg‘oq yemirilishi.

Mirzayev S.S.
PhD student
Madrimov R.M., PhD in Biological Sciences
head of department, senior researcher
Jalilov S.R.
laboratory assistant
Research Institute of Environmental and Nature Protection Technologies
Uzbekistan, Tashkent

DETERMINING THE SPI OF THE KASHKADARYA RIVER USING GIS TECHNOLOGY

Abstract. This article uses the Stream Power Index (SPI) indicator to assess flow energy and erosion risk in the Kashkadarya River basin. The study was carried out in the ArcGIS Pro software environment based on a digital elevation model. To determine the SPI indicator, DEM data were processed, the Fill, Flow Direction, Flow Accumulation, and Slope operations were performed, and the final SPI map was generated using the Raster Calculator tool. The results showed that areas with high SPI values mainly correspond to zones where water flow accumulates, the slope is relatively high, and river networks are densely distributed. In such areas, the erosive power of the flow increases, and the risk of soil washout, gully formation, bank erosion, and deepening of the river channel becomes stronger. The results of the study are important for identifying geomorphological and ecological risks that may arise under the influence of sand and gravel extraction activities along the Kashkadarya River, mapping hazardous sections, and scientifically substantiating monitoring measures.

Keywords: Stream Power Index (SPI), ArcGIS Pro, DEM, erosion, Kashkadarya River, bank erosion.

Kirish. Daryo havzalarida yuz beradigan eroziya jarayonlari asosan relyef shakli, qiyalik darajasi, suv oqimining to‘planish xususiyati va daryo tarmoqlarining zichligi bilan chambarchas bog‘liq. Ayniqsa tog‘oldi va adir hududlarida suv oqimining relyef bo‘ylab yuqori energiya bilan harakatlanishi tuproq yuvilishi, jarlanish, daryo o‘zanining chuqurlashishi hamda qirg‘oq yemirilishi kabi geomorfologik jarayonlarni kuchaytiradi. Shu sababli daryo havzalarida oqim energiyasini fazoviy baholash eroziya xavfini aniqlash, xavfli uchastkalarni ajratish va monitoring ishlarini rejalashtirishda muhim ahamiyatga ega [1].

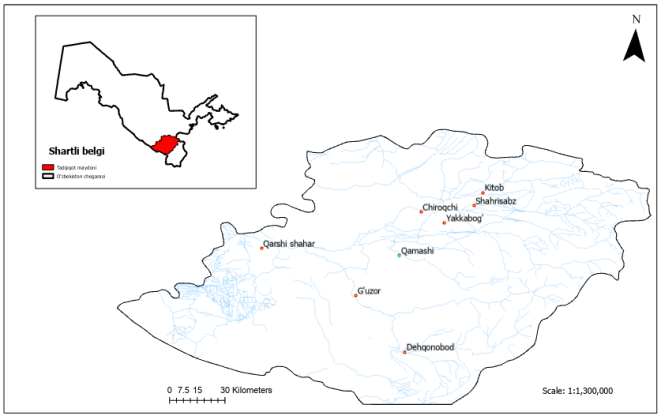
So‘nggi yillarda raqamli relyef modellari va GIS texnologiyalari asosida daryo havzalarining gidrologik va geomorfologik xususiyatlarini baholash keng qo‘llanilmoqda. Bunday yondashuvlarda Stream Power Index (SPI), Topographic Wetness Index (TWI), Sediment Transport Index (STI), LS-factor va boshqa relyefga bog‘liq ko‘rsatkichlar yordamida suv oqimining eroziya hosil qilish salohiyati tahlil qilinadi. SPI ko‘rsatkichi suv oqimining eroziya kuchini baholashda muhim indikatorlardan biri bo‘lib, u asosan oqim to‘planish maydoni va qiyalik burchagi asosida aniqlanadi. Raqamli balandlik modeli (DEM) ma’lumotlaridan keng foydalanish va Geografik axborot tizimiga (GAT) asoslangan tahlil usullaridagi yutuqlar sirt topografiyasini yuqori aniqlik va realizm bilan tasvirlash imkonini berdi [2].

Stream power tushunchasining fizik asoslari Bagnold tomonidan rivojlantirilgan bo‘lsa, DEM va GIS asosida qo‘llaniladigan SPI ko‘rsatkichi Moore, Grayson va Ladson tomonidan 1991-yilda raqamli relyef tahlili doirasida keng ilmiy muomalaga kiritilgan [3]. Xalqaro tadqiqotlarda SPI ko‘rsatkichi daryo havzalarida eroziya xavfini aniqlash, jarlanishga moyil hududlarni baholash va

cho‘kindi tashilishi ehtimoli yuqori bo‘lgan zonalarni ajratishda qo‘llanilmoqda. Jumladan, Seyhan daryosi havzasida SPI va TWI ko‘rsatkichlari 30 m o‘lchamdagi DEM asosida GIS muhitida hisoblanib, yuqori SPI qiymatlari qiyalik yuqori va drenaj tarmoqlari zich joylashgan hududlarda eroziya sezuvchanligi ortishini ko‘rsatgan. SPI — oqim energiyasini oson topish usuli. SPI sirt oqimi natijasida yuzaga keladigan eroziya jarayonining kuchini ko‘rsatadi. U suv yig‘ish maydoni va daryoning qiyalik qismi yordamida o‘lchanadi. SPI oqim to‘planishi va qiyalikning hissa qo‘shadigan maydonidan kelib chiqqan ikkilamchi topografik atributdir. SPI kanalning eroziya kuchini aniqlaydi va cho‘kish (past yoki salbiy qiymatlar uchun) va eroziya maydonlari (musbat qiymatlar) uchun topografik potentsialni ifodalaydi. [4, 5, 6]

Qashqadaryo daryosi O‘zbekiston janubidagi muhim suv obyektlaridan biri bo‘lib, uning qirg‘oqbo‘yi hududlari xo‘jalik faoliyati, sug‘oriladigan yerlar, aholi punktlari va noruda materiallardan foydalanish bilan bog‘liq bosim ostida qolmoqda. Ayniqsa daryo o‘zani va qirg‘oqbo‘yi hududlarida qum-shag‘al qazib olish ishlari tabiiy gidromorfologik muvozanatga ta’sir ko‘rsatishi mumkin [7, 8].Yuqori SPI qiymatlariga ega zonalarda oqim energiyasi yuqori bo‘lgan tabiiy hududlar antropogen ta’sir natijasida daryo o‘zanining chuqurlashishi, qirg‘oq yemirilishi va cho‘kindi transportining o‘zgarishi xavfi yanada ortadi. Shu nuqtayi nazardan, Qashqadaryo daryosi hududida SPI ko‘rsatkichini ArcGIS Pro dasturi muhitida hisoblash va xaritalash ilmiy-amaliy ahamiyatga ega. Ushbu tadqiqotning asosiy maqsadi raqamli relyef modeli asosida Qashqadaryo daryosi bo‘yicha oqim energiyasini oddiy, tezkor va takrorlanadigan GIS usuli yordamida aniqlashdan iborat. Tadqiqot natijalari yuqori oqim energiyasiga ega eroziya xavfli uchastkalarni ajratish, qum-shag‘al qazib olish faoliyati bilan bog‘liq xavflarni baholash hamda daryo qirg‘oqlarini muhofaza qilishga qaratilgan monitoring tadbirlarini asoslashda foydalanilishi mumkin

Tadqiqot maydoni va metodikasi. Tadqiqot obyekti sifatida Qashqadaryo havzasi tanlab olindi (1-rasm). Qashqadaryo daryosi O‘zbekiston Respublikasining janubiy qismida joylashgan muhim gidrografik obyektlardan biri bo‘lib, viloyat hududida tabiiy relyef, daryo o‘zani, qirg‘oqbo‘yi zonalari va antropogen faoliyat o‘zaro ta’sirda shakllangan murakkab geomorfologik tizimni hosil qiladi. Daryo havzasida tog‘oldi, adir va tekislik relyef shakllarining almashinishi suv oqimi tezligi, oqim yo‘nalishi, qiyalik darajasi va eroziya jarayonlarining hududiy farqlanishiga bevosita ta’sir ko‘rsatadi.



1-rasm. Tadqiqot obekti

Tadqiqotda Qashqadaryo daryosi hududida oqim energiyasini baholash uchun raqamli relyef modeli (DEM) va ArcGIS Pro dasturi imkoniyatlaridan foydalanildi. Asosiy ma’lumot manbasi sifatida raqamli relyef modeli tanlanib, fazoviy aniqligi 30 m bo‘lgan (SRTM GL1 Global) asosida daryo havzasining qiyalik darajasi, oqim yo‘nalishi va suv to‘planish xususiyatlari aniqlandi. DEM ma’lumotlari ArcGIS Pro muhitida qayta ishlanib, gidrologik tahlil uchun tayyor holatga keltirildi.

SPI ko‘rsatkichini hisoblash jarayoni bir nechta ketma-ket bosqichlardan iborat bo‘ldi. Dastlab DEM ma’lumotlaridagi sun’iy chuqurliklar va noaniqliklarni bartaraf etish maqsadida Fill amali bajarildi. Bu bosqich suv oqimining relyef bo‘ylab to‘g‘ri yo‘nalishini aniqlashda muhim hisoblanadi. Keyingi bosqichda Flow Direction amali yordamida har bir piksel bo‘yicha suv oqimining qaysi yo‘nalishda harakatlanishi aniqlandi. Shundan so‘ng Flow Accumulation amali bajarilib, yuqori oqimdan kelib to‘planadigan suv miqdorini ifodalovchi raster qatlam hosil qilindi.

Qiyalik darajasini aniqlash uchun Slope amali qo‘llanildi. Ushbu qatlam suv oqimining relyef bo‘ylab harakatlanish tezligi va energiyasini baholashda asosiy omillardan biri hisoblanadi. Chunki qiyalik ortgan sari suv oqimining yemiruvchi kuchi ham kuchayadi. Stream Power Index quyidagi formula asosida hisoblandi:

$$SPI = FA * 30 * \tan(Slope * 0.01745) \quad (1)$$

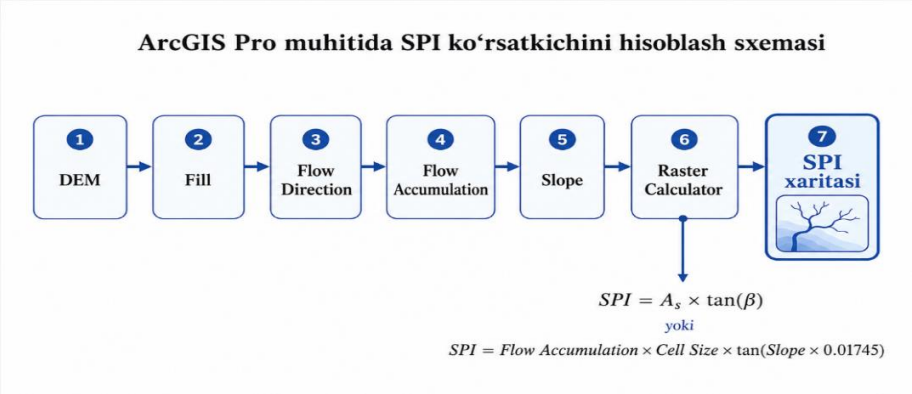
Bu yerda FA *Flow Accumulation, ya’ni oqim to‘planishi*

β *qiyalik burchagi*

tanβ *qiyalikning tangens qiymati*

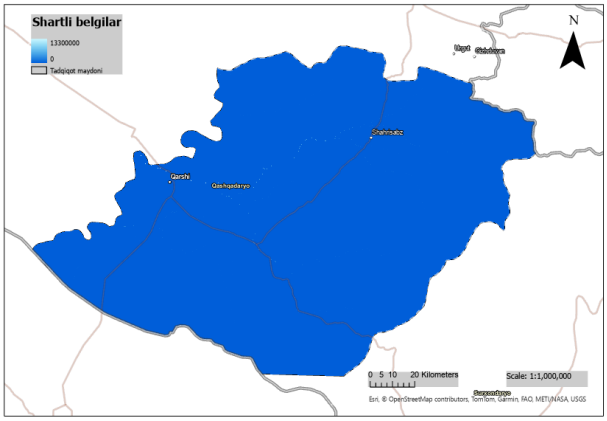
Slope *qiyalik*

1-jadval. Metodik sxema



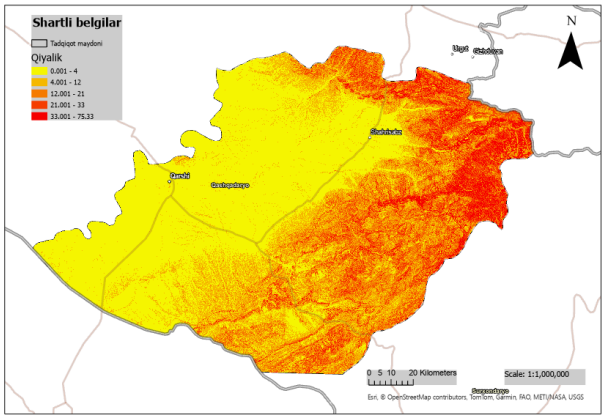
Tadqiqot metodikasining asosiy afzalligi shundaki, SPI ko‘rsatkichi DEM ma’lumotlari asosida qisqa vaqt ichida hisoblanadi va daryo havzasida oqim energiyasi yuqori bo‘lgan hududlarni fazoviy jihatdan aniqlash imkonini beradi. Bu esa Qashqadaryo daryosi bo‘yida qum-shag‘al qazib olish ishlari olib borilayotgan yoki rejalashtirilayotgan hududlarda eroziya xavfini dastlabki baholash, monitoring zonalarini belgilash va daryo qirg‘oqlarini muhofaza qilish tadbirlarini ilmiy asoslashda muhim ahamiyatga ega.

Natijalar va muhokama. ArcGIS Pro dasturi yordamida fill asbobida kamchiliklari to‘ldirilgan 30 m li DEM xarita flow direction asbobida oqim yo‘nalishi topildi. Hosil bo‘lgan raster xaritadan flow accumulation asbobida oqim to‘planishi aniqlandi (2-rasm).



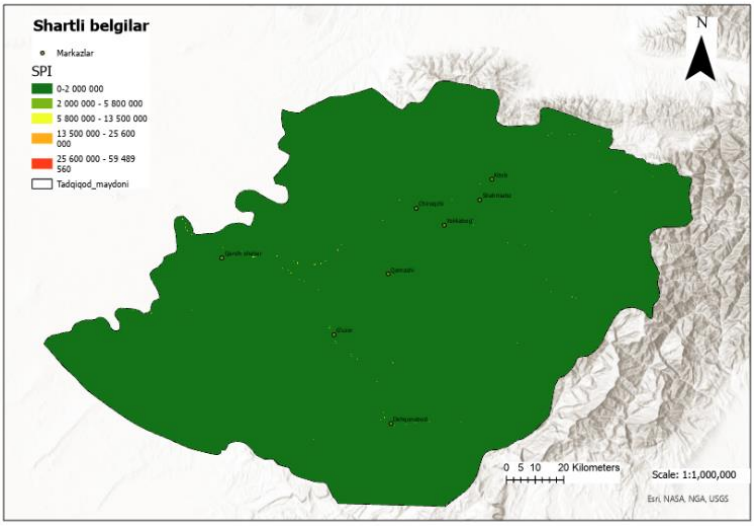
2-rasm. Tadqiqot hududida oqim to‘planishi

Shu bilan birga DEM xaritadan slope asbobida qiyalik darajasi topildi (3-rasm). Qiyalik qiymatlari 0-75,33 gacha bo‘lib, bu hududda tekisliklardan tortib tik yonbag‘irlargacha bo‘lgan relyef shakllari mavjudligini ko‘rsatadi.



3-rasm. Qiyalik

Raster calculator yordamida (1) formuladan foydalanib SPI ko‘rsatkichi hosil qilindi (4-rasm).



4-rasm. SPI natijasi

SPI qiymatlari $5,9*10^6$ gacha yetgani aniqlandi. Bu SPI uchun odatiy qiymat hisoblanib, odatda bir necha barobar kichik qiymatga aylantirishadi [1]. Natija shuni ko‘rsatadiki, umumiy baholanganda Qashqadaryo daryosida oqim energiyasi o‘rtacha, juda tez ham, juda sekin ham emas. Ammo cho‘kindi olib yurish uchun yetarli miqdorda oqim energiyasiga ega. Bu dala tadqiqotlarida ham isbotini topgan [8[.

SPI qiymatlari hudud bo‘yicha notekis taqsimlangan bo‘lib, past qiymatlar tekisliklarda, yuqori qiymatlar esa qiyalik katta va suv oqimi to‘planadigan hududlarda kuzatildi. Ayniqsa daryo o‘zani va unga yaqin hududlarda yuqori SPI qiymatlari aniqlanib, bu joylarda oqim energiyasi yuqori ekanligini ko‘rsatdi.

2-jadval. SPI ko‘rsatkichlarini tavsifi

SPI sinfi	Tavsifi	Geomorfologik mazmuni
Past SPI	Oqim energiyasi past	Eroziya xavfi nisbatan past
O‘rta SPI	Oqim shakllanishi mavjud	Mahalliy eroziya ehtimoli bor
Yuqori SPI	Oqim energiyasi yuqori	Jarlanish, o‘zan chuqurlashishi va qirg‘oq yemirilishi xavfi yuqori

Yuqori SPI zonalari eroziya jarayonlari, qirg‘oq yemirilishi va o‘zan chuqurlashishi ehtimoli yuqori bo‘lgan hududlar sifatida baholandi. Ushbu natijalar daryo havzasida xavfli uchastkalarni aniqlash va monitoring qilish uchun muhim asos bo‘lib xizmat qiladi.

Tadqiqot natijalari Qashqadaryo daryosi hududida SPI ko‘rsatkichidan oqim energiyasini baholashda samarali foydalanish mumkinligini ko‘rsatdi. SPI ko‘rsatkichi oddiy tuzilishga ega bo‘lsa-da, u daryo havzasida suv oqimining relyef bilan bog‘liq energiyasini fazoviy jihatdan ifodalash imkonini beradi. Indeksning asosiy afzalligi shundaki, u faqat raqamli relyef modeli asosida hisoblanadi va ArcGIS Pro muhitida qisqa vaqt ichida xaritalashtiriladi. Bu esa katta hajmdagi dala kuzatuvlarisiz ham eroziya xavfi yuqori bo‘lgan hududlarni dastlabki bosqichda aniqlash imkonini beradi. SPI qiymatining yuqori bo‘lishi suv oqimining relyef bo‘ylab katta energiya bilan harakatlanishini bildiradi. Bunday sharoitda oqimning yemiruvchi kuchi ortadi, natijada tuproq yuvilishi, jarlanish, o‘zan chuqurlashishi va qirg‘oq yemirilishi kabi jarayonlar faollashadi. Umuman olganda, olingan natijalar Qashqadaryo daryosi bo‘yida oqim energiyasi yuqori bo‘lgan hududlarni aniqlashda SPI ko‘rsatkichining ilmiy va amaliy ahamiyatga ega ekanligini tasdiqlaydi.

Xulosa. Mazkur tadqiqotda SPI ko‘rsatkichi Qashqadaryo daryosi hududida oqim energiyasini baholash uchun dastlabki GIS yondashuv sifatida qo‘llanildi. Bu yondashuvning amaliy ahamiyati shundaki, u qum-shag‘al qazib olishga ruxsat berish, monitoring nuqtalarini tanlash va daryo qirg‘oqlarini muhofaza qilish tadbirlarini rejalashtirishda yordam berishi mumkin. Qum-shag‘al qazib olish jarayonida daryo o‘zanidan cho‘kindi materiallarning olib tashlanishi oqimning tabiiy muvozanatini buzishi mumkin. Buning natijasida daryo tubining chuqurlashishi, qirg‘oqlarning yemirilishi, oqim yo‘nalishining o‘zgarishi va pastki oqim hududlarida cho‘kindi balansining buzilishi kuzatiladi. Agar bunday qazib olish ishlari yuqori SPI qiymatlariga ega zonalarda amalga oshirilsa, mavjud tabiiy eroziya jarayonlari yanada kuchayishi ehtimoli ortadi. Xuddi shu kabi vaziyat Qashqadaryo daryosida kuzatilgan:

- Yuqori SPI qiymatlari asosan qiyalik katta bo‘lgan, suv oqimi to‘planadigan hamda daryo o‘zani va unga yaqin hududlarda kuzatildi. Bunday zonalarda tuproq yuvilishi, jarlanish, qirg‘oq yemirilishi va daryo o‘zanining chuqurlashishi xavfi yuqori bo‘lishi mumkin.

- Qashqadaryo daryosi bo‘yida qum-shag‘al qazib olish ishlari yuqori SPI qiymatlariga ega zonalarda olib borilsa, tabiiy eroziya jarayonlari antropogen ta’sir natijasida yanada kuchayishi ehtimoli mavjud. Shu sababli bunday hududlar xavfli uchastkalar sifatida alohida monitoring qilinishi lozim.

- SPI xaritasi Qashqadaryo daryosi hududida oqim energiyasi yuqori bo‘lgan zonalarni tezkor aniqlash, eroziya xavfini dastlabki baholash, qum-shag‘al qazib olish faoliyatini tartibga solish va daryo qirg‘oqlarini muhofaza qilish tadbirlarini ilmiy asoslashda muhim amaliy ahamiyatga ega.

Shu bilan birga, SPI ko‘rsatkichi eroziya xavfini baholashda yagona va yakuniy mezon sifatida emas, balki dastlabki geomorfologik indikator sifatida qaralishi kerak. Chunki eroziya jarayonlariga faqat oqim energiyasi emas, balki tuproq tarkibi, geologik tuzilish, o‘simlik qoplami, yog‘in miqdori, daryo suvi sarfi va antropogen faoliyat kabi boshqa omillar ham ta’sir qiladi. Shu sababli kelgusida SPI natijalarini RUSLE, TWI, STI, NDVI kabi boshqa GIS ko‘rsatkichlari hamda dala kuzatuvlari bilan solishtirish tadqiqotning aniqligini oshiradi.

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Орифжонова О.Ш.
студент
Ботиров Ф.У.
доцент физического факультета
Нуритдинов С.Н.
профессор физического факультета
Национальный университет Узбекистана имени Мирзо Улугбека
Узбекистан, г. Ташкент

ЧЁРНЫЕ ДЫРЫ В АСИММЕТРИЧНЫХ СПИРАЛЬНЫХ ГАЛАКТИКАХ: РОСТ, РЕГУЛИРУЕМЫЙ БАЛДЖЕМ, И УПЛОЩЕНИЕ СООТНОШЕНИЯ M_{BH}–Σ

Аннотация: В работе проверяется, влияет ли асимметрия диска типа m = 1 на массу центральной сверхмассивной чёрной дыры M_{BH}. Для 572 асимметричных галактик M_{BH} не коррелирует с амплитудой асимметрии A_1 ($r = -0{,}02$), но в трёх интервалах расстояний коррелирует с дисперсией скоростей звёзд балджа ($r = 0{,}70; 0{,}61; 0{,}52$) и квадратично зависит от морфологического типа ($R = 0{,}71$). Полученные соотношения M_{BH}–σ_{bulge} в два-три раза положе опубликованных, что объясняется большой долей псевдобалджей. Рост чёрной дыры определяется структурой балджа, а не асимметрией диска.

Ключевые слова: спиральные галактики, асимметрия диска, балдж, псевдобалдж, сверхмассивная чёрная дыра.

Orifjonova O.Sh.
student
Botirov F.U.
associate professor, Faculty of Physics
Nuritdinov S.N.
professor, Faculty of Physics
National University of Uzbekistan named after Mirzo Ulugbek
Uzbekistan, Tashkent

BLACK HOLES IN LOPSIDED SPIRAL GALAXIES: BULGE-REGULATED GROWTH AND THE FLATTENING OF THE M_{BH}–σ RELATION

Annotation: We test whether m = 1 disc asymmetry affects the mass M_{BH} of the central supermassive black hole. For 572 lopsided galaxies M_{BH} is uncorrelated with the asymmetry amplitude A_1 ($r = -0.02$), but in three distance bins it correlates with the bulge velocity dispersion ($r = 0.70, 0.61, 0.52$) and depends quadratically

on morphological type (R = 0.71). The derived M_{BH}–σ_{bulge} relations are two to three times shallower than published ones, which we attribute to the high fraction of pseudobulges. Black hole growth is governed by bulge structure, not by disc asymmetry.

Keywords: spiral galaxies, lopsidedness, bulges, pseudobulges, supermassive black holes.

1. Введение

Около трети дисковых галактик демонстрируют глобальную асимметрию (lopsidedness) в распределении звёзд и газа, при которой одна половина диска протяжённее или ярче другой [1–3]. Асимметрия описывается азимутальной фурье-модой $m = 1$ поверхностной плотности, нормированная амплитуда которой A_1 служит стандартной мерой асимметрии [4]. В качестве её причин рассматриваются приливные взаимодействия и малые слияния, асимметричная аккреция газа, асимметричное гало тёмной материи и глобальные неустойчивости самогравитирующего диска [4–7]; такие неустойчивости могут порождать и другие неосесимметричные и кольцевые структуры [8].

Возмущение $m = 1$ создаёт гравитационные моменты, направляющие газ к центру, поэтому асимметричные диски должны подпитывать внутренние области галактики и способствовать вековому росту балджа [4–6]. Однако балджи бывают двух типов: классические балджи – динамически горячие сфероиды, сформированные слияниями, а псевдобалджи – дископодобные структуры, выросшие секулярно из вещества диска [9–11]. Нелинейная космогония балджей спиральных галактик рассматривалась в [12]. Массы сверхмассивных чёрных дыр тесно коррелируют с дисперсией скоростей звёзд классических балджей [13–18], тогда как чёрные дыры в псевдобалджах сильно отклоняются от этого соотношения и не коррелируют с дисками [18–20]. В нашей предыдущей работе были найдены систематические зависимости характеристик балджей от массы центральной чёрной дыры [21].

Отсюда возникает вопрос, специфичный для асимметричных галактик: оставляет ли асимметрия диска через приток газа статистический след на $M_{\rm BH}$, или $M_{\rm BH}$ регулируется только балджем? В настоящей работе мы отвечаем на него эмпирически, сравнивая зависимость $M_{\rm BH}$ от A_1 с её зависимостями от параметров балджа и глобальных параметров галактики, и исследуем, как население балджей асимметричных спиралей формирует соотношение $M_{\rm BH}$–$\sigma_{\rm bulge}$.

2. Данные и метод

Выборка составлена на основе каталога асимметричных галактик, содержащего наблюдаемые и производные физические параметры. Основной блок включает 572 галактики, для которых известны как A_1, так и наблюдательная оценка $M_{\rm BH}$; ещё восемь галактик с модельными оценками масс рассматривались лишь как вспомогательный материал. Для контроля точности измерений и эффектов селекции галактики разделены на три

интервала расстояний: $D \leq 10$ Мпк, $10 < D \leq 50$ Мпк и $D > 50$ Мпк. Помимо $\log(M_{BH}/M_{\odot})$ и A_1 использованы морфологический тип T (индикатор выраженности балджа, поскольку от Sa к Sd отношение «балдж/полная светимость» уменьшается, а доля псевдобалджей растёт [9, 10]), дисперсия скоростей звёзд балджа σ_{bulge}, звёздная масса M_*, максимальная скорость вращения газа $V_{max,gas}$ и абсолютная звёздная величина в полосе B M_B. Каждая корреляция вычислялась по галактикам, для которых известны обе величины, поэтому число объектов различается для разных соотношений.

Линейные связи оценивались коэффициентом корреляции Пирсона r; его значимость – по t-статистике, а 95%-ные доверительные интервалы – с помощью z-преобразования Фишера. Тренды аппроксимировались методом наименьших квадратов в виде $\log M_{BH} = a\ x + b$. Для зависимости от T использовалась квадратичная аппроксимация, качество которой характеризуется коэффициентом множественной корреляции R. Для сравнения с литературой соотношения M_{BH}–σ_{bulge} представлены в виде $\log M_{BH} = \alpha + \beta \log(\sigma_{bulge}/200$ км/с).

3. Результаты

3.1. Отсутствие связи с асимметрией диска. Для 572 галактик получено $r = -0{,}02$ ($p = 0{,}63$) с 95%-ным доверительным интервалом [−0,10; 0,06], что исключает даже слабую линейную зависимость. Средняя масса чёрной дыры в интервалах A_1 остаётся на уровне $\log(M_{BH}/M_{\odot}) \approx 7{,}4$–$7{,}7$ во всём диапазоне $0 \leq A_1 \leq 1$: сильно и слабо асимметричные галактики содержат чёрные дыры одинаковой типичной массы. Восемь объектов с модельными массами дают незначимое $r = 0{,}39$ ($p = 0{,}34$).

3.2. Параметры балджа и глобальные параметры. Напротив, M_{BH} коррелирует с σ_{bulge} во всех интервалах расстояний (табл. 1, рис. 1): $\log M_{BH} = 2{,}40 \log \sigma_{bulge} + 2{,}55$ ($r = 0{,}70$) при $D \leq 10$ Мпк, $\log M_{BH} = 2{,}19 \log \sigma_{bulge} + 3{,}07$ ($r = 0{,}61$) при $10 < D \leq 50$ Мпк и $\log M_{BH} = 1{,}50 \log \sigma_{bulge} + 4{,}61$ ($r = 0{,}52$) при $D > 50$ Мпк. Связь наиболее сильна там, где данные наиболее точны, и это единственное соотношение, сила которого не возрастает к дальнему интервалу, что указывает на физическую, а не селекционную природу связи. Для спиральных галактик M_{BH} квадратично зависит от морфологического типа ($R = 0{,}71$), уменьшаясь от $\log(M_{BH}/M_{\odot}) \approx 8$–$9$ у ранних спиралей ($T \approx 1$–3) до ≈ 5–6 у галактик Sc–Sd ($T \approx 6$–8), т. е. примерно на три порядка по мере уменьшения выраженности балджа.

Корреляции с глобальными параметрами слабее в ближнем интервале и усиливаются с расстоянием. Для $V_{max,gas}$ наклоны практически одинаковы во всех интервалах (0,0046; 0,0049 и 0,0051), поэтому рост r отражает меньший разброс и иной состав дальней подвыборки, а не изменение самого соотношения. Корреляция с M_* ($r = 0{,}43$ и $0{,}64$) слабее, чем с σ_{bulge}, что ожидаемо, если чёрная дыра связана с балджем, а не со всей галактикой.

Таблица 1. Коэффициенты корреляции Пирсона r (в скобках – наклон a) для $\log M_{BH}$ и параметров галактики

Параметр	$D \leq 10$ Мпк	$10 < D \leq 50$ Мпк	$D > 50$ Мпк
$\log \sigma_{bulge}$	0,70 (2,40)	0,61 (2,19)	0,52 (1,50)
$V_{max,gas}$	0,28 (0,0046)	0,42 (0,0049)	0,66 (0,0051)
M_B	−0,33 (−0,20)	−0,49 (−0,31)	−0,95 (−0,51)
$\log M_*$	0,43 (0,26)	0,64 (0,45)	полож. тренд

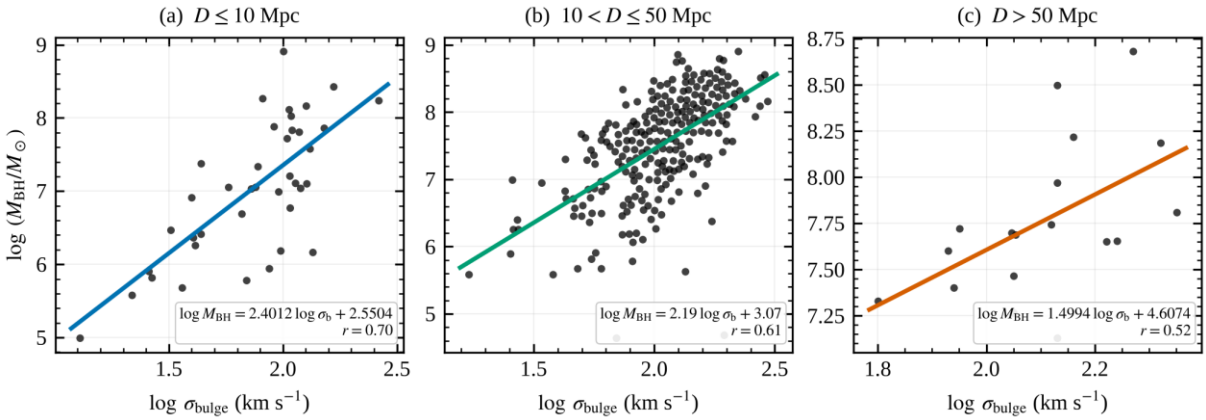


Рисунок 1. Зависимость массы чёрной дыры от дисперсии скоростей звёзд балджа: (a) $D \leq 10$ Мпк, (b) $10 < D \leq 50$ Мпк, (c) $D > 50$ Мпк. Линии – линейные аппроксимации; их уравнения и r приведены на каждой панели.

4. Обсуждение

4.1. Почему асимметрия не влияет на чёрную дыру. Сфера влияния чёрной дыры $r_{infl} \sim GM_{BH}/\sigma_{bulge}^2$ составляет от нескольких до нескольких десятков парсек, тогда как A_1 измеряется на килопарсековых радиусах, где потенциал определяется диском и тёмным гало. Асимметрия задаётся внешними возмущениями, асимметричной аккрецией и динамикой системы «диск–гало» [4, 6, 7], действующими в течение нескольких динамических времён; даже если она подпитывает центр газом, её вклад в M_{BH} размывается длительной и разнообразной историей роста чёрной дыры.

4.2. Уплощение соотношения M_{BH}–σ. При σ_{bulge} = 200 км/с все наши соотношения дают $\log M_{BH}$ = 8,06–8,11, что хорошо согласуется с нуль-пунктами 8,11–8,49 опубликованных калибровок (табл. 2, рис. 2). Однако при малых дисперсиях наши наклоны β = 1,5–2,4 в два-три раза меньше эталонных значений 4,0–5,6, и при σ_{bulge} = 50 км/с они предсказывают $\log M_{BH} \approx$ 6,6–6,8 вместо 4,9–5,9. Эталонные соотношения калиброваны в основном по эллиптическим галактикам и классическим балджам, тогда как в нашей выборке преобладают спирали, центральные компоненты которых при малых σ_{bulge} являются в основном псевдобалджами, не следующими классическому соотношению [18–20]. Смесь классических балджей при больших σ_{bulge} и псевдобалджей при малых σ_{bulge} даёт более пологое среднее соотношение; разбавление регрессии из-за ошибок σ_{bulge} дополнительно уменьшает наклон.

Той же смесью объясняется и квадратичная зависимость M_{BH} от T. Таким образом, асимметрия может способствовать секулярному росту псевдобалджей [6, 9], но M_{BH} определяется уже сформировавшимся балджем, прежде всего его классической, динамически горячей компонентой [12, 21].

Таблица 2. Соотношения M_{BH}–σ_{bulge} в виде $\log M_{BH} = \alpha + \beta \log(\sigma_{bulge}/200$ км/с)

Соотношение	α	β	log M_{BH} при 200 км/с	log M_{BH} при 50 км/с
Данная работа, $D \leq 10$ Мпк	8,08	2,40	8,08	6,63
Данная работа, $10 < D \leq 50$ Мпк	8,11	2,19	8,11	6,79
Данная работа, $D > 50$ Мпк	8,06	1,50	8,06	7,15†
Ferrarese, Merritt [13]	8,11	4,80	8,11	5,22
Tremaine и др. [15]	8,13	4,02	8,13	5,71
Gültekin и др. [16]	8,12	4,24	8,12	5,57
McConnell, Ma [17]	8,32	5,64	8,32	4,92
Kormendy, Ho [18]	8,49	4,38	8,49	5,85

† Экстраполяция за пределы диапазона σ_{bulge} дальней подвыборки.

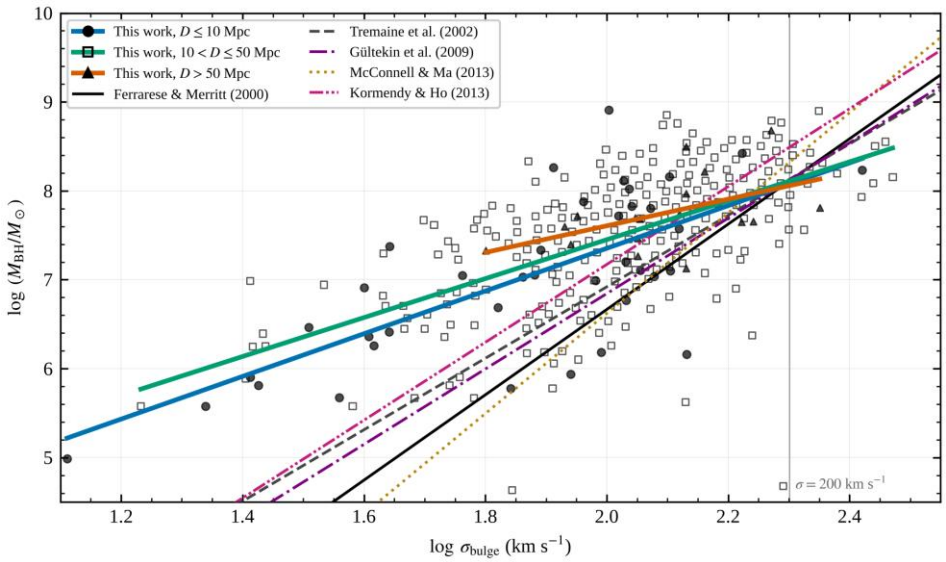


Рисунок 2. Соотношения M_{BH}–σ_{bulge}, полученные в данной работе (цветные сплошные линии; чёрные символы – галактики трёх интервалов), в сравнении с опубликованными соотношениями [13, 15–18]. Вертикальная линия отмечает $\sigma_{bulge} = 200$ км/с.

4.3. Ограничения. Сильные корреляции с $V_{max,gas}$ и M_B при $D > 50$ Мпк ($r = 0{,}66$ и $-0{,}95$) обусловлены селекцией мальмквистовского типа, отбирающей массивные яркие галактики, поэтому наши выводы опираются на ближний и промежуточный интервалы. Разложение на балдж и диск с определением отношения «балдж/полная светимость» и индекса Серсика [10, 11] позволило бы аппроксимировать классические балджи и псевдобалджи раздельно, а регрессионные методы, учитывающие ошибки обеих

переменных, устранили бы смещение наклонов; эти вопросы будут рассмотрены в дальнейшей работе.

5. Заключение

1. Для 572 асимметричных галактик масса центральной чёрной дыры не зависит от асимметрии диска (r = −0,02, 95%-ный доверительный интервал [−0,10; 0,06]); среднее log M_{BH} ≈ 7,4–7,7 одинаково для слабо и сильно асимметричных дисков.

2. M_{BH} определяется балджем: она коррелирует с σ_{bulge} во всех интервалах расстояний (r = 0,70; 0,61; 0,52) и квадратично уменьшается вдоль хаббловской последовательности (R = 0,71) – от $\log(M_{BH}/M_{\odot})$ ≈ 8–9 у галактик Sa–Sb до ≈ 5–6 у Sc–Sd.

3. Соотношения M_{BH}–σ_{bulge} для асимметричных галактик согласуются с опубликованными калибровками при σ_{bulge} ≈ 200 км/с, но значительно положе при малых дисперсиях (β ≈ 1,5–2,4) вследствие большой доли псевдобалджей и разбавления регрессии.

4. Асимметрия диска и рост чёрной дыры не связаны: первая отражает крупномасштабную динамику системы «диск–гало», второй – структуру балджа.

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Подвигайло А.А., к.и.н.
доцент кафедры социологии и управления
Белгородский государственный технологический
университет им. В.Г. Шухова
Россия, г. Белгород

ИЗ ИСТОРИИ ПОЯВЛЕНИЯ И РАЗВИТИЯ БПЛА

Аннотация: Первые беспилотные летательные аппараты появились в Австрийской империи: это были воздушные шары, которые с помощью специальных устройств сбрасывали бомбы. С появлением радиосвязи авиации начался новый этап развития беспилотных летательных аппаратов – появились беспилотные самолёты и самолёто-снаряды. Большое влияние на развитие беспилотной авиации оказал арабо-израильский конфликт 1973 года: радио-управляемые бпла стали использоваться для преодоления систем ПВО. Именно в 1970-х годах прошлого столетия оформилась идея малогабаритного компактного аппарата для разведки и нанесения ударов по противнику, и данная идея доминирует на поле боевых действий и по сей день.

Ключевые слова: беспилотный летательный аппарат, дрон, авиация, конфликт.

Podvigaylo A.A., Candidate of Historical Sciences
associate professor, Department of Sociology and Management
Belgorod State Technological University named after V.G. Shukhov
Russia, Belgorod

FROM THE HISTORY OF THE EMERGENCE AND DEVELOPMENT OF UAVS

Abstract: The first unmanned aerial vehicles appeared in the Austrian Empire: they were balloons that dropped bombs using special devices. With the advent of radio communication, aviation entered a new phase of development, leading to the creation of unmanned aircraft and aircraft-missiles. The 1973 Arab-Israeli conflict had a significant impact on the evolution of unmanned aviation, as radio-controlled UAVs were used to overcome air defense systems. It was in the 1970s of the last century that the idea of a small-sized compact device for reconnaissance and strikes against the enemy was formed, and this idea dominates the battlefield to this day.

Keywords: unmanned aerial vehicle, drone, aviation, conflict.

Любое современное общество, и российское в том числе, теперь уже не мыслит своё будущее без развития технологий беспилотных летательных аппаратов. Аббревиатура «бпла» или «дрон» (от английского слова «drone» –

трутень) сегодня у всех на слуху. Огромные массы новостной информации пестрят сообщениями о изобретении новых беспилотных аппаратов с выдающимися характеристиками, о перспективах развития беспилотной авиации и том технологическом прорыве, который будет совершён человечеством в развитии новых технологий.

Беспилотные летательные аппараты стремительно развиваются, постепенно вытесняя традиционную авиацию с занятых ею когда-то технологических вершин. А ведь мало кто знает, что история беспилотных летательных аппаратов уходит далеко в историю человеческой цивилизации и насчитывает более полутора веков.

По праву, можно считать первым летательным аппаратом, который изобрело человечество – воздушный шар. В 1783 году братья французы Жозеф-Мишель и Жак-Этьен Монгольфье подняли в воздух первый воздушный шар прорубив тем самым человечеству лестницу в небо. Однако, изобретение братьев Монгольфье заинтересовало прежде всего военных. И с той далёкой поры проблематика развития беспилотных систем находится под плотным контролем силовых структур во всём мире[3].

Французский император Наполеон стал использовать воздушные шары для наблюдения за перемещением противника на местности. Позже, австрийская армия решила использовать воздушные шары не для наблюдения за противником на поле боя, а в именно в качестве «бпла». В 1849 году восстал, входивший в состав Австрийской Империи, итальянский город Венеция. К удивлению жителей города, 12 июня 1849 года над Венеций возникли воздушные шары, которые автоматически сбрасывали на город бомбы. Серьёзных разрушений бомбардировка городу не принесла, но произвела на его жителей паническое воздействие: согласно австрийским данным, на Венецию было сброшено около 100 бомб. Так, в XIX столетии воздушный шар трансформировался в беспилотный бомбардировщик[3].

Стремительное развитие науки и техники во второй половине XIX века постепенно отодвигало воздушный шар на второй план: на первый план выходила авиация. В 17 декабря 1903 года американцы – братья Уилбер и Орвил Райты подняли в воздух первый в истории самолёт «Флайер-1» - начиналась эпоха авиации. Первыми самолётами управлял специально подготовленный человек – пилот.

На фоне появления нового чуда науки и техники – аэроплана (самолёта), произошли важные научные открытия в области радиосвязи и беспроводной передачи радиосигнала. Среди них научные труды, как «Динамика точки переменной массы» И.В.Мещерского; «Исследование мировых пространств реактивными приборами» К.Э.Циолковского; изобретение радиотелеграфа профессором А.С.Поповым, что дало толчок началу работ над использованием беспроволочного способа связи для дистанционного управления летательными аппаратами[6].

С появлением радио и приёмников радиосигнала появилась возможность управления дроном по радио, – правда, беспилотный аппарат

был не летающий, а плавающий, – протестировали в 1899 году. Автором принципиально новой технологии – известный ученый и изобретатель Никола Тесла[4].

Первая Мировая война активизировала работы по созданию беспилотных летательных аппаратов. Так в 1917 году американским инженером-изобретателем Арчибальдом Маклишем был создан первый в мире беспилотный летающий аппарат «Kettering bug» или «Жук Кеттеринга». Беспилотник представлял собой «летающую торпеду», но, по сути, это был прообраз крылатой ракеты способной нести боеголовку на 120 км. В том же 1917 году инженерами Питером Купером и Элмером Сперри был создан первый автоматический гироскопический стабилизатор, который выравнивал летательный аппарат в полете, и это сделало возможной постройку беспилотного самолета. С использованием новой технологии переделали военный гидроплан «Curtiss_N-9» переделали в беспилотник, управлявшийся по радио. Он налетал 50 миль испытательных полетов с 300-фунтовой бомбой, но ни разу не использовался в бою. После войны, в сентябре 1924 года в Соединенных Штатах в режиме радиоуправления гидросамолет «Curtiss F-5L» совершил первый автономный полет. Машина взлетела, выполнила маневрирование в воздухе, а затем оператор посадил ее на воду. В период с 1933 по 1945 годы в Британии и США для тренировки военных лётчиков производились радиоуправляемые самолёты-мишени De Havilland DH82B «Queen Bee»[4].

Грядущая Вторая Мировая война подстёгивала гонку вооружений и будущие участники конфликта уделяли не мало внимания развитию беспилотных систем. Однако, ещё больших успехов в развитии беспилотных летательных аппаратов достигла гитлеровская Германия: немцы создали несколько модификаций беспилотного самолёто-снаряда ФАУ-1 (или V-1, по своей сути ФАУ-1 – это крылатая ракета). Эти самолёто-снаряды летели на дальность 240 км и применялись немцами для бомбардировок Великобритании [4].

На полях Второй Мировой войны, союзники Германии – японцы, так же вели свою беспилотную войну со своим главным соперником – США. Японский военно-промышленный не позволял армии Страны Восходящего солнца освоить дорогостоящие и ресурсо-затратные немецкие технологии самолёто-снарядов, поэтому японцы пошли по проторенному пути – стали использовать воздушные шары (проект «Фу-Го»). При этом применение японцами воздушных шаров как боевых БПЛА стало самым массовым за всю Вторую Мировую. С ноября 1944 года по май 1945-го через Тихий океан в сторону США японцами было отправлено около 9300 шаров. Однако, количество не превратилось в качество: США достигли не более 10% от запушенных японцами шаров, не причинив американским промышленным и военным объектам никакого вреда[3].

Окончание Второй Мировой войны не привело к разрядке мировой напряжённости. Победа над гитлеровской Германией, не сплотила страны

бывшей антигитлеровской коалиции (СССР, Великобритания и США), а наоборот обострило соперничество между ними. Начавшееся противостояние между бывшими союзниками привело к началу «Холодной войны», которая сопровождалась гонкой вооружений и вооружёнными конфликтами в странах периферии в латинской Америке, Африке и Юго-Восточной Азии. Противники: СССР и страны Варшавского договора и, соответственно, США и НАТО, добились стремительного прогресса в развитии военных технологий: появилось ракетно-ядерное оружие, реактивная авиация, космические спутники. Стремительное развитие и совершенствование военных технологий не оставило в стороне и беспилотную авиацию.

В конце 1950-х в США на основе реактивных беспилотных мишеней были спроектированы разведывательные дроны. В разных модификациях эти беспилотные системы производились вплоть до начала XXI века. В 1959 на вооружение в ВМС США был принят беспилотный вертолёт «Gyrodyne QH-50 DASH» (Drone Anti-Submarine Helicopter) вооружённый глубинными бомбами и торпедами. Этот беспилотный вертолёт был снят с вооружения в 1969 году так как показал низкую эффективность[2].

США активно вели разведку в небе СССР, применяя для шпионажа довольно совершенные высотные самолёты-разведчики Lockheed U-2, пока в 1960 году этот самолёт под управлением Фрэнсиса Пауэрса не был сбит в небе над свердловской областью. В последствии США потеряли ещё два самолёта-разведчика и обратили особое внимание на беспилотные системы. Так был создан беспилотный самолёт-раздведчик «Fire Fly» (Светлячок), который активно применялся во время войны во Вьетнаме. В 1966 году появляется одноразовый «Локхид» D-21 – высота полета до 30 км, дальность – 2 000 км [2].

Большое влияние на развитие беспилотной авиации оказал арабо-израильский конфликт 1973 года. В ходе этого конфликта Израиль использовал небольшие радио-управляемые бпла для определения позиций арабских ПВО, после чего по ним наносила удары израильская авиация. После окончания «Войны Судного дня», Израиль громко заявил о себе как об одном из лидеров в области производства беспилотных летательных аппаратов. Два молодых авиа-инженера Иегуда Мази и Элвин Эллис создали небольшой простой дрон начинённый самой современной на тот момент электроникой. Проект Мази и Эллиса заинтересовал одну из израильских фирм. К концу 1970-х годов на базе прототипа, созданного вышеуказанными инженерами, в серийное производство запустили бпла "Мастиф" и "Скаут", которые производились фирмами "Тадиран" и "Израэль эркрафт индастриз" (IAI). Лидерство Израиля в области беспилотных технологий вынуждены были признать даже США, которые приобрели у Израиля патент и на базе беспилотника «Мастиф» запустили производство разведывательного БПЛА RQ-2 «Pioneer»[1].

В настоящее время в Израиле разработкой, производством и экспортом беспилотных систем занимаются порядка 10 фирм, которые создали в общей

сложности более 70 типов аппаратов. Не отстают от Израиля и США: В 1994 году на смену «Пионеру» пришел ударный RQ-1 «Predator», в 2007 году на вооружение ВВС США приняли разведывательно-ударный комплекс MQ-9 Reaper (Жнец). Для разведки на стратегическом уровне ВВС и ВМС США используют RQ-4 Global Hawk. В 2012 году беспилотных аппаратов в армии США насчитывалось 7494 единиц и количество их (равно как и качество) постоянно возрастало[4].

Таким образом, беспилотные летательные аппараты имеют на своём счету более чем полуторавековую историю. По мере научно-технического прогресса и появления более совершенных пилотируемых систем (самолёт) развивалась и беспилотная тематика. До поры до времени беспилотные системы рассматривались как вспомогательное средство для разведки и в отдельных случаях нанесения ударов по противнику. Однако концепция применения бпла постепенно менялась. В начале 70-х годов оформилась идея малогабаритного компактного аппарата для разведки и нанесения ударов по противнику, которая на данный момент активно реализуется на практике во всём мире. Беспилотные аппараты постепенно превратились в серьёзный фактор на поле боя, который может стать решающим для победы одной из сторон.

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Султонова С.Х.
и.о. доцента кафедры «Журналистика и языки»
Университет «Альфраганус»
Узбекистан, г. Ташкент

ОТ ОБЩЕЙ ЛЕКСИКИ К ЯЗЫКУ ПРОФЕССИИ: НЕЙРОСЕТИ И LMS В ОБУЧЕНИИ РУССКОМУ ЯЗЫКУ СТУДЕНТОВ-СТОМАТОЛОГОВ

Аннотация: Статья посвящена актуальной задаче профессионально ориентированной языковой подготовки студентов нефилологических специальностей. Цель работы – методически осмыслить возможности интеграции LMS и нейросетевых инструментов в обучение русскому языку студентов-стоматологов первого курса уровня B1. Исследование имеет описательно-методический характер и основано на систематизации практики межфакультетского преподавания русского языка в Alfraganus University (180 студентов, шесть академических групп). Предложена модель поэтапного перехода от общеупотребительной лексики к самостоятельному профессионально-речевому продукту и выделены лексические, грамматические, коммуникативные и цифровые трудности студентов. Обоснован принцип «нейросеть не вместо студента, а перед студентом», реализуемый по схеме «AI-материал → критический анализ → авторский продукт студента».

Ключевые слова: русский язык, профессионально ориентированное обучение, студенты-стоматологи, профессиональная лексика, LMS, генеративный искусственный интеллект, нейросети.

Sultonova S.Kh.
acting associate professor, Department of Journalism and Languages
Alfraganus University
Uzbekistan, Tashkent

FROM GENERAL VOCABULARY TO THE LANGUAGE OF THE PROFESSION: NEURAL NETWORKS AND LMS IN TEACHING RUSSIAN TO DENTISTRY STUDENTS

Abstract: The article addresses the pressing task of profession-oriented language training for students of non-philological specialties. The aim is to examine methodologically how an LMS and neural network tools can be integrated into teaching Russian to first-year dentistry students at the B1 level. The study is descriptive and methodological; it systematizes the practice of teaching Russian at

Alfraganus University (180 students, six academic groups). A model of gradual transition from general vocabulary to an independent professional speech product is proposed, and lexical, grammatical, communicative and digital difficulties of students are identified. The principle "the neural network not instead of the student, but before the student" is substantiated and implemented through the sequence "AI material → critical analysis → the student's own product".

Keywords: Russian language, profession-oriented teaching, dentistry students, professional vocabulary, LMS, generative artificial intelligence, neural networks.

Введение

Современная языковая подготовка студентов нефилологических направлений выходит за пределы усвоения общеупотребительной лексики и базовых грамматических конструкций: для будущего специалиста язык становится инструментом учебной, профессиональной и межличностной коммуникации. Поэтому преподавание русского языка в межфакультетской аудитории требует постепенного перехода от общего владения языком к способности решать задачи конкретной профессиональной сферы [1].

Для студентов медицинских специальностей этот переход особенно значим. Профессиональная коммуникация включает выяснение жалоб, описание симптомов, объяснение диагностических и лечебных процедур, формулирование рекомендаций и взаимодействие с пациентом. В стоматологии дополнительную специфику создают названия частей полости рта, заболеваний и состояний, характеристика боли, стоматологические манипуляции и речевые модели общения «*врач – пациент*».

Знание отдельных терминов ещё не означает владения профессиональной речью. Студент может понимать слова «десна», «эмаль», «кариес», «пломба», «воспаление», но испытывать трудности, когда нужно задать пациенту вопрос, описать локализацию боли или сформулировать рекомендацию. Поэтому методически значим переход: термин → словосочетание → грамматическая конструкция → предложение → профессиональная речевая ситуация → самостоятельное высказывание.

Для студентов уровня B1 профессионализация речи должна опираться на уже сформированную языковую базу. Так, слово «боль» постепенно включается в сочетания и конструкции: острая боль; боль в зубе; жаловаться на боль; боль усиливается при накусывании; где именно вы чувствуете боль? Аналогично глагольная модель «болеть» расширяется до профессионально значимых высказываний: у пациента болит зуб; зуб болит второй день; пациент жалуется на ночную боль.

Цифровизация высшего образования создаёт дополнительные средства для организации такой работы; её успешность во многом зависит от цифровой компетентности преподавателя [2]. LMS позволяет структурировать учебные материалы, задания, самостоятельную работу и обратную связь. Генеративный искусственный интеллект (GenAI) может использоваться для

создания вариативного языкового материала, моделирования диалогов, сопоставления формулировок и редактирования текста [3]. Обзоры GenAI в языковом образовании показывают широкий спектр таких функций, но одновременно подчёркивают риски, связанные с качеством контента, чрезмерной зависимостью от технологии и академической добросовестностью [4–6].

В связи с этим принципиально важно разграничивать нейросеть как генератор готового ответа и нейросеть как инструмент языкового анализа, тренировки, сопоставления и редактирования. Во втором случае сгенерированный текст становится промежуточным учебным объектом: студент анализирует профессиональную лексику и грамматику, оценивает коммуникативную уместность, исправляет недостатки и создаёт собственный вариант.

Цель статьи – описать и методически осмыслить возможности интеграции LMS и нейросетевых инструментов в профессионально ориентированное обучение русскому языку студентов-стоматологов первого курса Alfraganus University и определить способы организации перехода от общеупотребительной лексики и базовых грамматических моделей к профессиональной русскоязычной коммуникации.

Для достижения цели решались следующие **задачи**: 1) определить основные языковые трудности студентов-стоматологов уровня B1 при переходе к профессионально ориентированной речи; 2) установить способы интеграции лексического, грамматического и профессионально-терминологического материала; 3) определить функции LMS в организации профессионально ориентированного языкового курса; 4) определить методически обоснованные функции нейросетевых инструментов; 5) разработать поэтапную модель перехода от общей лексики к самостоятельному профессионально-речевому продукту студента.

Материалы и методы

Работа имеет описательно-методический характер и основана на анализе практики межфакультетского преподавания русского языка студентам стоматологического направления Alfraganus University. Использованы методы педагогического наблюдения, анализа учебных материалов, методической систематизации и педагогического моделирования.

Педагогический контекст составили 180 студентов первого курса бакалавриата специальности «Стоматология» (шесть академических групп по 30 человек) с уровнем владения русским языком B1. Студенты рассматриваются как участники описываемого образовательного процесса, а не как экспериментальная выборка: деление на экспериментальную и контрольную группы и стандартизированная входная и итоговая диагностика не проводились.

Исходным принципом являлась постепенная профессионализация имеющихся языковых знаний: знакомая языковая единица → расширение значения и сочетаемости → профессиональный термин → грамматическая

модель → профессиональная речевая ситуация → самостоятельное высказывание.

Профессионально значимая лексика включала анатомические наименования (зуб, десна, язык, челюсть, эмаль, корень зуба, полость рта), обозначения жалоб и симптомов (боль, чувствительность, кровоточивость, отёк, воспаление), характеристики боли и состояния, названия распространённых стоматологических состояний, диагностических и лечебных действий, а также языковые модели рекомендаций пациенту.

Профессиональная лексика интегрировалась с грамматическими моделями: жаловаться на + винительный падеж; боль в области + родительный падеж; проблемы с + творительный падеж; чувствительность к + дательный падеж. Грамматическая форма рассматривалась как средство выполнения профессиональной речевой задачи, а единица речевой деятельности последовательно усложнялась: слово → словосочетание → грамматическая модель → предложение → микродиалог → профессиональная ситуация → самостоятельное высказывание.

Для методической систематизации использовались три типовые учебно-профессиональные ситуации: «Первичный приём пациента», «Жалобы и симптомы», «Рекомендации после стоматологической процедуры». Они не предполагали самостоятельного клинического решения студентом.

LMS рассматривалась как средство организации образовательной траектории: учебный материал → лексико-грамматическая тренировка → профессиональная ситуация → самостоятельное задание → представление результата → обратная связь → коррекция. Нейросетевые инструменты использовались как вспомогательное средство генерации вариативного языкового материала, анализа, сопоставления и редактирования. В основу был положен принцип «нейросеть не вместо студента, а перед студентом»: получить → прочитать → проверить → проанализировать → исправить → дополнить → создать собственный вариант.

Выявленные трудности систематизировались в четыре группы – лексические, грамматические, коммуникативные и цифровые, что позволило определить различные способы педагогической коррекции.

Результаты

Методическая систематизация позволила определить общую модель профессионализации русской речи: общеупотребительная лексика → лексико-грамматическая модель → профессиональная стоматологическая лексика → профессиональная речевая ситуация → LMS-задание → нейросетевая поддержка → самостоятельный профессионально-речевой продукт. Её реализация показана на примере трёх сценариев.

Сценарий «Первичный приём пациента» ориентирован на умение устанавливать первичный речевой контакт и получать информацию с помощью вопросов. Знакомые модели «что? где? когда? как? как давно?» получают профессиональное содержание: «Что вас беспокоит?», «Где именно вы чувствуете боль?», «Когда появилась боль?», «Есть ли чувствительность к

холодному или горячему?». Лексический материал расширяется от базовых единиц «болеть, боль, зуб, десна» к сочетаниям «острая боль», «ноющая боль», «чувствительность зубов», «кровоточивость дёсен», «боль при накусывании», которые затем включаются в модели «я жалуюсь на...», «боль появилась...», «боль усиливается при...».

В LMS задания усложняются от соотнесения жалобы и вопроса врача до восстановления диалога и самостоятельного составления вопросов пациенту. Нейросетевой вариант диалога используется для анализа профессиональной лексики, грамматических моделей и последовательности вопросов, после чего студент создаёт собственный диалог.

Сценарий «Жалобы и симптомы» организует переход от называния симптома к его характеристике: боль → сильная боль → сильная боль в зубе → боль усиливается ночью → пациент жалуется на сильную боль, которая усиливается ночью. Ведущими становятся конструкции «пациент жалуется на...», «у пациента наблюдается...», «боль локализуется в области...», «боль усиливается при...», «чувствительность к...». Студент получает карточку с отдельными признаками и преобразует их в связное описание, затем выполняет аналогичное задание без готовой модели.

Нейросетевой текст сопоставляется с собственным вариантом студента по критериям лексической точности, грамматической правильности, полноты, последовательности и уместности. Тем самым работа с ИИ переводится из режима получения ответа в режим языковой рефлексии.

Сценарий «Рекомендации после стоматологической процедуры» требует перехода к передаче информации пациенту. Используются конструкции «Вам необходимо...», «Вам следует...», «Рекомендуется...», «Не следует...»; знакомая глагольная лексика приобретает новую профессиональную функцию. Особое внимание уделяется различию между терминологически насыщенным профессиональным сообщением и понятным пациенту объяснением. В LMS студент формулирует рекомендации сначала с лексическими опорами, затем без них. Нейросетевые рекомендации рассматриваются только как языковой материал: студент анализирует конструкции, доступность формулировок и элементы, требующие профессиональной проверки, что разграничивает языковую тренировку и клиническое решение.

Для предотвращения механического копирования сформулирована модель «AI-материал → критический языковой анализ → авторский продукт студента». Обязательное промежуточное действие включает проверку, классификацию, сопоставление, исправление или трансформацию сгенерированного материала. Функции компонентов модели разграничены в таблице 1.

Таблица 1. Функциональное разграничение компонентов модели

Компонент	Основная функция	Пример	Конечная роль
LMS	Организация последовательности	Материал → задание → сдача → обратная связь	Управление траекторией
Нейросеть	Вариативный языковой материал	Диалог, ситуация, альтернативная формулировка	Объект анализа
Преподаватель	Методическое управление	Задача, критерии, коррекция	Педагогическое руководство
Студент	Самостоятельная деятельность	Диалог, описание, рекомендации	Автор конечного продукта

Выделены четыре группы трудностей. Лексические связаны с переходом от узнавания термина к его активному употреблению; грамматические – с управлением и сочетаемостью; коммуникативные – с построением последовательного профессионального сценария; цифровые – с механическим копированием и некритичным доверием к AI-ответу.

Основной результат методического анализа состоит в том, что переход студента уровня B1 к профессиональной коммуникации целесообразно организовывать не по принципу «выучить больше медицинских терминов», а по принципу «научиться выполнять профессионально значимые речевые действия средствами русского языка».

Обсуждение

Предложенная модель показывает, что профессионализация языковой подготовки требует разграничивать знание термина и способность использовать его в профессиональном речевом действии. Термин освоен полноценно, когда студент знает его сочетаемость, грамматическое окружение, коммуникативную функцию и способен включить его в связное высказывание. Интеграция лексики и грамматики позволяет перейти от логики «правило → упражнение» к логике «профессиональная речевая задача → необходимая грамматическая модель → применение → самостоятельное высказывание», в которой грамматическая форма получает конкретную профессиональную функцию.

Профессиональная коммуникация осваивается и как система речевых сценариев: грамматически правильные отдельные вопросы ещё не гарантируют логичного первичного опроса пациента. Поэтому единицей обучения постепенно становится сценарий: установление контакта → жалоба → локализация → характеристика → время появления → условия изменения симптома.

LMS в данной модели ценна не как цифровое хранилище, а как средство управления последовательностью действий, тогда как нейросетевой инструмент используется для создания вариативного языкового материала.

Такое функциональное разграничение позволяет избежать формальной цифровизации.

Обзоры GenAI в языковом образовании подтверждают многообразие его ролей – от генерации содержания и обратной связи до тьюторской и коммуникативной поддержки, но одновременно фиксируют риски, связанные с качеством контента, чрезмерной зависимостью и академической добросовестностью [4–6]. Обзор 41 публикации подчёркивает потребность в дополнительных эмпирических исследованиях и ответственной интеграции GenAI [4]. Систематический обзор 36 исследований ChatGPT в языковом образовании показывает их концентрацию в высшей школе и внимание к самостоятельному обучению, генерации содержания и этическим вопросам [5]. Обзор 49 эмпирических исследований описывает GenAI как источник обратной связи, тьютора, когнитивный стимул и партнёра по взаимодействию, отмечая риск чрезмерной зависимости и проблемы качества контента [6].

Эти данные согласуются с принципом «нейросеть не вместо студента, а перед студентом». Если AI-текст становится конечным ответом, самостоятельная языковая деятельность сокращается; если он становится объектом анализа, студент читает, проверяет, сопоставляет, редактирует и создаёт собственный текст.

В медицинском образовательном контексте необходимо различать языковую правильность, коммуникативную уместность и профессиональную достоверность. Грамматически корректный нейросетевой текст не является автоматически клинически достоверным, поэтому AI-материал в модели используется прежде всего для языковой тренировки, а профессиональное содержание требует проверки. Методически важно также различать профессиональный терминологический язык и язык общения с пациентом: будущий стоматолог должен уметь преобразовывать специализированное содержание в понятное адресату сообщение, то есть управлять степенью терминологической насыщенности речи.

Выделение лексических, грамматических, коммуникативных и цифровых трудностей позволяет перейти к дифференцированной коррекции: тип трудности → причина → соответствующее упражнение → повторное профессиональное действие.

Ограничения исследования связаны с его описательно-методическим дизайном. Несмотря на масштаб педагогического контекста (180 студентов), контрольная группа и стандартизированные измерения не использовались, поэтому статья не устанавливает причинно-следственной связи между цифровыми инструментами и повышением языковых результатов.

Заключение

Профессионально ориентированное обучение русскому языку студентов-стоматологов предполагает переход от общеупотребительных языковых средств к способности решать средствами русского языка коммуникативные задачи будущей деятельности. Осмысление практики

Alfraganus University позволило систематизировать этот переход для студентов первого курса уровня B1 и сформулировать следующие выводы.

1. Профессионализация речи не сводится к расширению терминологического словаря; её основная последовательность: профессиональное слово → лексическая сочетаемость → грамматическая модель → коммуникативная функция → профессиональная речевая ситуация → самостоятельное высказывание.

2. Предложенная модель интегрирует лексико-грамматическую работу, профессиональные речевые ситуации, LMS-задания и нейросетевую поддержку, завершаясь самостоятельным профессионально-речевым продуктом студента.

3. LMS обеспечивает организацию образовательной траектории, а нейросеть – вариативный языковой материал для анализа, сопоставления и редактирования; принцип «нейросеть не вместо студента, а перед студентом» конкретизирован моделью «AI-материал → критический языковой анализ → авторский продукт студента».

4. В медицинском контексте генеративный ИИ не должен использоваться как автономный источник клинических рекомендаций; необходимо различать языковую правильность, коммуникативную уместность и профессиональную достоверность.

5. Разграничение лексических, грамматических, коммуникативных и цифровых трудностей позволяет выбирать дифференцированные способы коррекции.

Обобщённо концепция формулируется так: не термин ради термина, а термин для профессионального речевого действия; не грамматика отдельно от речи, а грамматика как средство профессиональной коммуникации; не LMS ради LMS, а LMS для организации образовательной траектории; не нейросеть ради готового ответа, а нейросетевой текст как объект анализа; не AI-текст как результат, а самостоятельный профессионально-речевой продукт студента.

Модель может быть адаптирована к другим медицинским и нефилологическим направлениям при замене терминологического содержания и профессиональных ситуаций. Перспективой дальнейшей работы является её эмпирическая апробация с входной и итоговой диагностикой и рубрикой оценивания профессионально-речевого продукта.

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Тургунова Г.Б., д.ф.с.-х.н.
старший преподаватель
Андижанский институт сельского хозяйства и агротехнологий
Узбекистан, г. Андижан

ПОВЫШЕНИЕ ЗАСУХОУСТОЙЧИВОСТИ ТОМАТА: ИНТЕГРИРОВАННЫЙ ПОДХОД К СОРТОВОМУ ПОДБОРУ, ПОДГОТОВКЕ СЕМЯН И УПРАВЛЕНИЮ ВОДНЫМ РЕЖИМОМ

Аннотация: Рассмотрены способы повышения засухоустойчивости томата (Solanum lycopersicum L.) посредством сортового подбора, подготовки семян и оптимизации орошения. Обоснована необходимость адаптированных технологий для повышения урожайности и эффективности использования воды.

Ключевые слова: томат, засухоустойчивость, сортовой подбор, агротехника, орошение, влажность, почва, урожайность.

Turgunova G.B., PhD in Agricultural Sciences
senior lecturer
Andijan Institute of Agriculture and Agricultural Technologies
Uzbekistan, Andijan

INCREASING DROUGHT TOLERANCE IN TOMATO: AN INTEGRATED APPROACH TO VARIETY SELECTION, SEED TREATMENT, AND WATER MANAGEMENT

Abstract. Methods for improving drought resistance in tomato (Solanum lycopersicum L.) through cultivar selection, seed preparation, and optimized irrigation are considered. The need for adapted technologies to increase yield and water-use efficiency is substantiated.

Keywords: tomato, drought resistance, cultivar selection, agricultural practices, irrigation, soil moisture, soil, yield.

ВВЕДЕНИЕ. Ограниченность водных ресурсов требует внедрения технологий, обеспечивающих стабильную урожайность томата при рациональном использовании поливной воды. Засуха нарушает транспирацию, фотосинтез, рост и формирование плодов. Устойчивость растений зависит от генотипа, интенсивности стресса, температуры и фазы развития [2, 3]. Цель работы – обобщить научные подходы к повышению засухоустойчивости томата и определить перспективы их применения в орошаемом земледелии.

Материалы и методы. Проведён аналитический обзор публикаций о генетических и физиологических механизмах засухоустойчивости, предпосевном праймировании и дефицитном орошении [1, 4]. Собственные эксперименты не проводились; количественные показатели приведены по опубликованным исследованиям. Рассмотрены сортовой подбор, подготовка семян, сохранение почвенной влаги и регулирование полива.

РЕЗУЛЬТАТЫ АНАЛИЗА ЛИТЕРАТУРЫ И ОБСУЖДЕНИЕ. Сортовой подбор и подготовка семян. Выбор генотипа определяет потенциальную устойчивость томата к засухе. При оценке сортов необходимо учитывать развитие корневой системы, водное состояние листьев, устьичную проводимость, фотосинтез, количество и массу плодов, товарную урожайность и стабильность завязывания [2]. Снижение транспирации помогает экономить воду, однако чрезмерное закрытие устьиц ограничивает фотосинтез. Скороспелость также может снижать воздействие засухи, но не является прямым доказательством устойчивости тканей.

Для условий Узбекистана целесообразно испытывать районированные и перспективные генотипы при различном водоснабжении в сопоставимых условиях выращивания.

Праймирование – контролируемое предварительное увлажнение семян – способствует активации процессов прорастания. Эффективность гидропраймирования, осмопраймирования и других обработок зависит от генотипа, качества семян и условий выращивания [1]. Улучшение всхожести не гарантирует сохранения урожая при продолжительной засухе. Поэтому обработанные семена необходимо сравнивать с контролем по всхожести, развитию корней и побегов, приживаемости рассады, урожайности и качеству плодов.

Агротехнические меры сохранения влаги. Рациональная обработка почвы способствует развитию корней и уменьшению потерь влаги. Уплотнение ограничивает рост корневой системы, а чрезмерная обработка может нарушать структуру почвы и усиливать испарение. Мульчирование органическими материалами или подходящими покрытиями снижает испарение и сдерживает сорняки. Сорную растительность необходимо своевременно удалять, особенно на ранних этапах развития томата.

Сбалансированное питание поддерживает рост и устойчивость растений. Избыточное азотное питание может усиливать развитие листового аппарата и повышать потребность в воде, тогда как дополнительное внесение калия целесообразно прежде всего при его дефиците. Сроки высадки и густоту стояния следует согласовывать с особенностями сорта и температурными условиями.

Управление орошением по фазам развития. Полив необходимо регулировать с учётом фенологической фазы, влажности корнеобитаемого слоя, температуры и состояния растений. Приживание рассады требует достаточного увлажнения, а в период вегетативного роста важно поддерживать развитие корней и листьев. Наиболее критичны бутонизация,

цветение и завязывание плодов: недостаток воды при высокой температуре снижает завязываемость. При наливе плодов дефицит влаги уменьшает их массу и товарную урожайность.

В период созревания полив корректируют с учётом назначения продукции. Умеренный дефицит в отдельных условиях может изменять концентрацию растворимых веществ, однако сильный стресс уменьшает размер плодов и общий урожай [3]. Капельное орошение обеспечивает подачу воды непосредственно в корнеобитаемую зону, но его эффективность зависит от равномерности распределения воды и обоснованности поливных норм.

В двухлетнем исследовании S.Mukherjee и соавторов капельное орошение при режиме − 10 кПа снизило водопотребление на 22,6% и 19,8% в 2020 и 2021 гг. соответственно. Урожайность была на 28% и 22% выше, чем при бороздковом орошении [4]. Эти результаты характеризуют конкретный эксперимент и требуют проверки в других почвенно-климатических условиях.

Таблица 1.

Основные задачи управления водным режимом томата

Фаза развития	Задача полива	Последствия дефицита
Приживание рассады	Обеспечение укоренения	Замедление приживаемости
Вегетативный рост	Поддержание развития корней и листьев	Снижение прироста биомассы
Цветение	Сохранение репродуктивной функции	Уменьшение завязываемости
Налив плодов	Обеспечение роста плодов	Снижение массы и урожайности
Созревание	Регулирование полива с учётом качества продукции	Уменьшение размера плодов при сильном стрессе

Для контроля полива рекомендуется использовать датчики влажности почвы или тензиометры, устанавливаемые с учётом глубины корней и свойств почвы. Универсальные поливные нормы без местной проверки недостаточно обоснованы.

Оценка эффективности комплексной технологии. Засухоустойчивость следует оценивать по совокупности физиологических и хозяйственных показателей: урожайности, доле товарных плодов, их средней массе и количеству, влажности почвы, объёму поливной воды и водопродуктивности. Дополнительно можно измерять относительное содержание воды в листьях, их температуру, устьичную проводимость и фотосинтез.

Полевые опыты должны включать контроль, повторности и сопоставимые условия выращивания. При совместном изучении сортов, обработки семян и режимов орошения необходимо учитывать влияние

каждого фактора и их взаимодействие. Для Узбекистана перспективны локальные испытания сортов при разных режимах водоснабжения с контролем урожайности, качества и расхода воды.

ЗАКЛЮЧЕНИЕ. Повышение засухоустойчивости томата требует сочетания генетических и агротехнических методов. Сортовой подбор, предпосевное праймирование, сохранение почвенной влаги, сбалансированное питание и рациональное орошение способствуют снижению потерь урожая. Особое значение имеет обеспечение растений водой в периоды цветения, завязывания и налива плодов. Для условий Узбекистана необходимо разрабатывать и экспериментально проверять адаптированные технологии, оценивая их по урожайности, качеству продукции и водопродуктивности.

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Тургунова Г.Б., д.ф.с.-х.н.
старший преподаватель
Андижанский институт сельского хозяйства и агротехнологий
Узбекистан, г. Андижан
Раззокова Г.А.
ассистент-преподаватель
Международный сельскохозяйственный университет
Узбекистан, Ташкентская область, Кибрайский район

ОТБОР СЕЛЕКЦИОННЫХ МАТЕРИАЛОВ ТОМАТА, УСТОЙЧИВЫХ К ЗАСУХЕ И ДЕФИЦИТУ ВОДЫ

Аннотация: В статье обобщены современные данные о засухоустойчивости генотипов томата и её значении для создания высокоурожайного селекционного материала. Рассмотрены влияние водного дефицита на продуктивность и физиологические процессы, а также генетические механизмы устойчивости. Показано, что засухоустойчивость является количественным признаком, зависящим от генотипа и условий среды. При сокращении орошения на 50% у местных генотипов выявлено снижение урожайности и массы плодов, при этом отдельные формы характеризовались меньшими потерями. В популяции из 201 рекомбинантной инбредной линии выявлено 15 QTL, связанных с устойчивостью к водному дефициту на хромосомах 1, 3, 4, 8, 9, 10 и 12. Обоснована перспективность использования местных сортов и диких видов Solanut в селекции и необходимости комплексного отбора по устойчивости, урожайности и качеству плодов.

Ключевые слова: томат, Solanum lycopersicum L., генотип, засуха, водный дефицит, засухоустойчивость, селекция, урожайность, QTL, физиологические признаки, корневая система, местные сорта, селекционный материал.

Turgunova G.B., PhD in Agricultural Sciences
senior lecturer
Andijan Institute of Agriculture and Agrotechnologies
Uzbekistan, Andijan
Razzokova G.A.
assistant lecturer
International Agriculture University
Uzbekistan, Tashkent Region, Kibray District

SELECTION OF TOMATO BREEDING MATERIAL RESISTANT TO DROUGHT AND WATER DEFICIT

Abstract: This article summarizes current knowledge on drought resistance in tomato genotypes and its importance for developing high-yielding breeding material. The effects of water deficit on productivity and physiological processes, as well as the genetic mechanisms underlying drought resistance, are discussed. Drought resistance is shown to be a quantitative trait influenced by genotype and environmental conditions. A 50% reduction in irrigation resulted in decreased yield and fruit weight in local genotypes, although some accessions exhibited smaller losses. In a population of 201 recombinant inbred lines, 15 quantitative trait loci (QTLs) associated with water-deficit tolerance were identified on chromosomes 1, 3, 4, 8, 9, 10, and 12. The use of local varieties and wild Solanum species in breeding programs is considered promising. The importance of integrated selection based on drought resistance, yield, and fruit quality is emphasized.

Keywords: tomato, Solanum lycopersicum L., genotype, drought, water deficit, drought resistance, breeding, yield, QTL, physiological traits, root system, local varieties, breeding material.

Актуальность темы и анализ литературы. Томат относится к важнейшим овощным культурам мирового сельского хозяйства, однако его продуктивность существенно зависит от обеспеченности водой. Недостаток влаги особенно опасен в периоды цветения, оплодотворения и формирования плодов, когда нарушение водного баланса приводит к снижению устьичной проводимости, ограничению поступления углекислого газа, уменьшению интенсивности фотосинтеза и нарушению формирования репродуктивных органов. В результате сокращаются количество завязавшихся плодов, их масса и конечная урожайность. При этом реакция растений на водный дефицит существенно различается в зависимости от генотипа, продолжительности и интенсивности стресса, фазы развития и условий выращивания [4].

Особое значение проблема приобретает в регионах с высокой температурой воздуха и ограниченными водными ресурсами. Для селекции в таких условиях недостаточно получить растение, способное сохранять жизнеспособность при засухе. Практическая ценность генотипа определяется прежде всего его способностью поддерживать хозяйственно значимую продуктивность при ограниченном водоснабжении. Поэтому современная селекция ориентируется на сочетание адаптивности с высокой урожайностью, стабильным плодообразованием и приемлемым качеством плодов [7].

Одним из перспективных источников адаптивных признаков являются местные сорта и староместные формы. В процессе длительного выращивания в конкретных экологических условиях они подвергались естественному и искусственному отбору, вследствие чего часть таких генотипов сохранила признаки, обеспечивающие адаптацию к локальным стрессовым факторам. Исследования крупных коллекций томата подтверждают наличие значительной генетической вариабельности по урожайности, физиологическим характеристикам и реакции на водный дефицит. Исследование 165 генотипов показало широкое разнообразие признаков при

достаточном и ограниченном водоснабжении, а реакция на водный дефицит различалась в зависимости от генотипа и типа плодов [3].

Более детально различия между местными генотипами были показаны в исследовании, опубликованном в 2024 г. При сравнении режимов оптимального водоснабжения и 50%-ного сокращения орошения установлены существенные различия по урожайности, массе плода и физиологическим показателям. Исследование было направлено именно на комплексное выявление генотипов, сохраняющих продуктивность при водном дефиците.

Таблица 1.

Влияние водного дефицита на основные показатели томата

Показатель	**Изменение при недостатке влаги**
Урожайность	снижение в среднем на 44%
Средняя масса плода	снижение на 29%
Fv/Fm	снижение на 8,2% после 14 суток стресса
Fv/Fo	снижение на 35,5% после 14 суток стресса
Снижение урожая отдельных генотипов	от незначительного до 73,6%
Снижение количества плодов	5,9–45,5%
Снижение средней массы плода	9,5–59,4%

**Источник: составлено по данным Grozeva et al. [1].*

Полученные результаты показывают, что среднее снижение урожайности не отражает всего разнообразия генотипической реакции. Существенный разброс показателей между формами свидетельствует о наличии различий в способности растений поддерживать водный статус, фотосинтетическую активность и репродуктивную функцию при стрессе. Поэтому при селекции необходимо оценивать не только абсолютную урожайность, но и степень её изменения при переходе от оптимального к ограниченному водоснабжению.

Генетическая природа засухоустойчивости подтверждается результатами молекулярно-генетических исследований. X.Li и соавторы изучили популяцию из 201 рекомбинантной инбредной линии, полученную от скрещивания *Solanum pimpinellifolium* и *S.lycopersicum*. С использованием генетического картирования были выявлены 15 QTL, связанных с устойчивостью к засухе и солевому стрессу на стадии проростков. Соответствующие локусы располагались на хромосомах 1, 3, 4, 8, 9, 10 и 12.

Таблица 2.

Генетические показатели устойчивости томата к водному дефициту

Показатель	**Результат**
Исследованная популяция	201 рекомбинантная инбредная линия
Родительские формы	*S. pimpinellifolium* × *S. lycopersicum*
Количество выявленных QTL	15
Хромосомы с выявленными QTL	1, 3, 4, 8, 9, 10, 12
Доля фенотипической изменчивости отдельных QTL	4,91–15,86%
Кандидатные гены основных локусов	*SlMSRB1*, *SlBRL1*
Генетический характер признака	сложный, количественный

***** *Источник: X.Li et al. [2].*

Таким образом, засухоустойчивость нельзя рассматривать как признак, контролируемый одним геном. Каждый отдельный локус объясняет только часть фенотипической изменчивости, а конечное проявление признака зависит от взаимодействия генотипа со средой. Это повышает значение комплексного отбора и одновременной оценки физиологических, морфологических и хозяйственных признаков.

Новые сведения о молекулярных механизмах устойчивости получены при изучении гена BBX18. В исследовании X.Li и соавторов установлено, что природный вариант BBX18 связан с различиями в реакции томата на засуху. Белок BBX18 взаимодействует с APX1 и участвует в регуляции его экспрессии. Авторы показали, что природные варианты этого гена различаются между дикими и культурными формами томата, а изменение BBX18 может влиять на устойчивость растений к водному дефициту [2].

Значительный интерес представляет также материал, полученный из местных форм и диких видов томата. В исследовании V.Cirillo и соавторов изучались генотипы различного происхождения, включая местные формы и беккросс-инбредные линии *Solanum pennellii*. Среди десяти исследованных образцов генотип T150 был выделен как форма, проявившая устойчивость к недостатку воды, тогда как T292 характеризовался устойчивостью к дефициту азота.

Методика исследования. Настоящая работа представляет собой аналитический обзор современных научных исследований, посвящённых физиологическим, генетическим и селекционным механизмам засухоустойчивости томата. В качестве источников использованы научные публикации, в которых изучались местные сорта, селекционные линии, культурные генотипы и генетический материал дикого происхождения. Основное внимание уделено исследованиям, опубликованным в 2024–2026 гг.,

дополненным более ранними работами, имеющими значение для понимания генетической основы признака.

Для комплексной оценки засухоустойчивости целесообразно использовать три взаимосвязанные группы показателей. К морфологическим признакам относятся развитие и распределение корневой системы, площадь листовой поверхности, высота растения, количество цветков и плодов. Физиологическая группа включает относительное содержание воды в листьях, интенсивность фотосинтеза, устьичную проводимость, содержание хлорофилла и параметры флуоресценции хлорофилла. Хозяйственную ценность характеризуют количество плодов на растении, средняя масса плода, урожай с растения, общая урожайность и стабильность продуктивности при различных режимах водоснабжения. При необходимости эти показатели дополняются биохимическими параметрами, включая содержание пролина и активность антиоксидантных ферментов.

Для изучения генетической основы признака применяются QTL-картирование, SNP-маркеры, генотипирование и анализ генов-кандидатов. Однако молекулярные показатели не должны использоваться изолированно. Выявление потенциально благоприятного аллеля необходимо подтверждать фенотипической оценкой растения в условиях контролируемого и полевого водного дефицита.

Таблица 3.

Основные признаки, рекомендуемые для оценки засухоустойчивости томата

Группа признаков	Признак	Значение для селекции
Морфологические	Развитие корневой системы	Способность использовать почвенную влагу
	Площадь листьев	Ростовой и фотосинтетический потенциал
Физиологические	Относительное содержание воды	Сохранение водного состояния тканей
	Устьичная проводимость	Регулирование потери воды
	Интенсивность фотосинтеза	Сохранение ассимиляционной активности
Физиологические	Содержание хлорофилла	Состояние фотосинтетического аппарата
Биохимические	Содержание пролина	Осмотическая адаптация
	Активность антиоксидантных ферментов	Защита клеток от окислительного стресса
Хозяйственные	Количество плодов	Компонент урожайности
	Средняя масса плода	Компонент индивидуальной продуктивности
	Урожайность	Основной показатель селекционной ценности
	Стабильность урожая	Оценка адаптивности генотипа

**Источник:составлено автором на основе анализа научной литературы [1–5].*

Результаты и обсуждение. Действие водного дефицита на томат начинается с нарушения водного баланса растения. При уменьшении доступной влаги усиливается регуляция транспирации посредством закрытия устьиц. Это позволяет временно ограничить потерю воды, однако одновременно снижает поступление углекислого газа в лист и ограничивает фотосинтез. При продолжительном стрессе изменяются рост корневой системы и надземных органов, нарушается формирование репродуктивных органов и снижается способность растения поддерживать стабильную урожайность.

Корневая система играет важную роль в адаптации к водному дефициту, однако сама по себе высокая корневая масса не может служить универсальным критерием устойчивости. Для селекции имеют значение глубина распространения корней, их разветвлённость, соотношение корневой и надземной биомассы, а также способность обеспечивать растение водой на протяжении всего периода вегетации. Исследование V.Cirillo и соавторов также показывает значение изменений соотношения корневой и надземной частей при недостатке воды [4].

Особенно чувствительной фазой является цветение и плодообразование. Недостаток воды в этот период способен приводить к снижению жизнеспособности цветков, уменьшению количества завязей и последующему сокращению числа плодов. Поэтому генотипы, сохраняющие репродуктивную способность при ограниченном водоснабжении, представляют значительный интерес для селекции.

Результаты исследования местных генотипов томата показывают значительную вариабельность реакции растений на водный дефицит. При сокращении водоснабжения наблюдалось уменьшение урожайности, массы плодов и физиологических показателей, однако степень изменения этих характеристик зависела от генотипа.

Таблица 4.

Изменение показателей отдельных генотипов томата при водном дефиците

Показатель	**Диапазон изменения**
Завязываемость плодов при сокращённом орошении	27,2–69,2%
Завязываемость при оптимальном орошении	61,7–79,2%
Снижение урожая отдельных генотипов	до 73,6%
Снижение количества плодов	5,9–45,5%
Снижение средней массы плода	9,5–59,4%

**Источник: S.Grozeva et al. [1].*

Современные полевые исследования также свидетельствуют о существенных различиях между генотипами. В работе 2026 г. были изучены шесть индетерминантных генотипов томата – E7, E8, E36, E40, E103 и PDVIT

– с использованием физиологических, метаболомных и геномных показателей. Исследование было опубликовано 28 августа 2026 г. и направлено на выявление признаков, связанных с устойчивостью местных генотипов к засухе.

Таблица 5.

Реакция генотипов томата на водный дефицит

Генотип	**Общая характеристика реакции**
E7	выраженное снижение физиологической активности при сильном водном дефиците
PDVIT	относительно стабильная продуктивность и ограниченные метаболические изменения
E8, E36, E40, E103	промежуточная реакция, зависящая от условий стресса

**Источник: S.Francesca et al. [5].*

Следует подчеркнуть, что результаты отдельных генотипов нельзя автоматически переносить на все условия выращивания. Сила реакции зависит от режима орошения, продолжительности стресса, температуры, фазы развития и генетического происхождения материала. Поэтому полевые данные должны рассматриваться в связи с конкретными условиями эксперимента.

Эти результаты имеют непосредственное значение для селекционной работы. Отбор только по урожайности при оптимальном водоснабжении может привести к получению материала, который не сохраняет продуктивность при ограничении воды. Поэтому перспективные генотипы необходимо оценивать как при достаточном, так и при дефицитном водоснабжении. При этом целесообразно рассчитывать не только абсолютную урожайность, но и относительное снижение урожая, стабильность числа плодов и массы плода, а также способность растений восстанавливаться после прекращения стрессового воздействия.

Местные сорта представляют особый интерес именно потому, что они могут содержать адаптивные аллели, утраченные или ослабленные в процессе направленной селекции на высокую продуктивность в благоприятных условиях. Исследование 165 генотипов показало широкую вариабельность урожайности и других хозяйственно ценных признаков, а также различную реакцию генотипов на водный дефицит. Авторы рассматривают местные формы как потенциальный источник признаков для уменьшения потерь урожая и улучшения качества плодов при дефиците воды.

Перспективным направлением является использование дикорастущих видов *Solanum*, в том числе *S.pennellii*. Дикие родственники культурного томата могут служить источниками аллелей, связанных с адаптацией к дефициту воды и другим стрессовым факторам. Исследования с участием

S.pennellii подтверждают возможность выявления генотипов, характеризующихся устойчивостью к водному дефициту.

Однако включение такого материала в селекционный процесс требует последующего отбора, поскольку высокая стрессоустойчивость может сочетаться с нежелательными признаками – низкой массой плодов, неудовлетворительными качественными показателями или недостаточной общей продуктивностью.

Современные исследования показывают, что водный дефицит способен не только снижать урожайность, но и изменять качество плодов. В исследовании M.Fullana-Pericàs и соавторов у 165 генотипов при водном дефиците отмечалась общая тенденция к снижению урожайности и одновременно к изменению ряда показателей качества плодов. При этом реакция существенно зависела от генотипа и типа плодов [6].

Данные более позднего исследования средиземноморских местных сортов также показывают, что сокращение водоснабжения на 35 и 50% в целом отрицательно влияло на урожайность и рост растений, однако отдельные генотипы сохраняли высокую продуктивность в условиях ограниченного водоснабжения. Авторы также выявили улучшение отдельных показателей качества плодов при дефицитном орошении.

Таблица 6.

Предлагаемая последовательность создания засухоустойчивого высокоурожайного селекционного материала

Этап	Основная задача	Основные критерии
1. Подбор родителей	Формирование исходной комбинации признаков	Устойчивость, урожайность, качество
2. Гибридизация	Объединение ценных признаков	Генетическая совместимость
3. Получение потомства	Расширение генетической изменчивости	Вариабельность признаков
4. Стресс-тестирование	Выявление устойчивых растений	Сохранение роста и жизнеспособности
5.Физиологический отбор	Оценка механизмов устойчивости	Водный статус, фотосинтез, устьичная проводимость
6. Хозяйственная оценка	Определение продуктивности	Количество и масса плодов, урожайность
7. Молекулярный анализ	Подтверждение генетической основы	QTL, SNP и гены-кандидаты
8. Полевое испытание	Оценка стабильности	Устойчивость в различных условиях
9.Выделение перспективных линий	Комплексный отбор	Устойчивость + урожайность + качество

*****Источник: составлено автором на основе анализа научной литературы [1–8].*

Важным направлением современной селекции является объединение физиологических и генетических данных. Выявленные QTL могут использоваться для ускорения отбора, однако отдельный локус не должен рассматриваться как самостоятельный и достаточный критерий засухоустойчивости. В исследовании X.Li и соавторов выявленные QTL объясняли только часть фенотипической изменчивости, что подтверждает количественный характер признака.

Молекулярные исследования дополняют эту картину. В частности, изучение BBX18 показало, что отдельные гены могут существенно влиять на реакцию томата на водный дефицит через регуляцию антиоксидантной защиты. Однако наличие определённого аллеля само по себе не заменяет полевой фенотипической оценки.

С практической точки зрения перспективный генотип должен характеризоваться не просто способностью переносить водный стресс, а комплексом признаков: сохранением водного статуса, поддержанием фотосинтетической активности, стабильным цветением и плодообразованием, относительно небольшим снижением урожайности, способностью восстанавливаться после стресса и приемлемым качеством плодов. Именно такой подход позволяет перейти от формального отбора «засухоустойчивых» растений к созданию хозяйственно ценного селекционного материала.

Заключение. Анализ современных исследований показывает, что засухоустойчивость томата является сложным количественным признаком, формирующимся в результате взаимодействия генотипа и условий среды. Водный дефицит влияет на водный баланс, фотосинтез, рост, цветение, плодообразование и урожайность, однако степень этих изменений значительно различается между генотипами. Исследования местных форм подтверждают наличие существенной генотипической вариабельности по реакции на ограниченное водоснабжение.

Генетические исследования подтверждают полигенную природу признака. В популяции из 201 рекомбинантной инбредной линии выявлено 15 QTL, связанных с устойчивостью к водному дефициту на стадии проростков. Они расположены на семи хромосомах, что свидетельствует о совокупном действии нескольких генетических факторов.

Исследования отдельных генов также показывают возможность выявления конкретных молекулярных механизмов устойчивости. В частности, BBX18 связан с регуляцией реакции томата на засуху через взаимодействие с APX1 и регулирование антиоксидантной системы. Эти данные расширяют возможности использования молекулярных маркеров и генов-кандидатов в селекционной работе.

Перспективными источниками адаптивных признаков являются местные сорта, староместные формы и дикие виды рода *Solanum*. Их использование позволяет расширить генетическую основу культурного томата и выявить новые источники устойчивости к водному дефициту. Работы с

S.pennellii демонстрируют возможность выделения генотипов, сохраняющих продуктивность при недостатке воды.

Вместе с тем перенос стрессоустойчивости должен сопровождаться отбором по урожайности, качеству плодов, стабильности плодоношения и способности растений сохранять продуктивность в различных условиях водоснабжения. Исследования средиземноморских местных сортов показывают, что реакция на дефицит воды может существенно различаться между генотипами, а отдельные формы способны сохранять относительно высокую продуктивность и качество плодов при сокращённом орошении.

Таким образом, создание высокоурожайного засухоустойчивого селекционного материала должно основываться на сочетании традиционной гибридизации и отбора с физиологической оценкой и современными молекулярно-генетическими методами. Наиболее информативным является комплексный подход, при котором одновременно учитываются физиологические показатели, параметры корневой системы, репродуктивная устойчивость, урожайность, качество плодов и генетические маркеры. Такой подход создаёт научную основу для получения селекционного материала, адаптированного к условиям ограниченного водоснабжения.

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Лапова М.С.
магистрант 2 курса, группа 215-ЗМГПд
ЧОУ ВО «Сибирский юридический университет»
Россия, г. Омск

ПРАВА ПОТРЕБИТЕЛЕЙ ФИНАНСОВЫХ УСЛУГ В ЭПОХУ ПЛАТФОРМЕННОЙ ЭКОНОМИКИ: СПЕЦИФИКА И ЗАЩИТА НА ПРИМЕРЕ БАНКОВ МАРКЕТПЛЕЙСОВ OZON И WILDBERRIES

Аннотация. *В статье исследуются трансформационные процессы на российском рынке розничных финансовых услуг, вызванные экспансией крупнейших e-commerce платформ. Предметом анализа выступает специфика правового статуса и особенности защиты прав потребителей, пользующихся услугами АО «Озон Банк» и ООО «Вайлдберриз Банк». Автор выявляет ключевые риски для граждан, возникающие на стыке торгового и финансового законодательства, включая скрытый мисселинг, дискриминационные ценовые условия и проблемы односторонней блокировки транзакционных счетов. В работе оцениваются регуляторные инициативы Банка России и судебная практика, а также предлагаются меры по совершенствованию досудебной защиты прав клиентов «цифровых» банков.*

Ключевые слова: *финансовые услуги, защита прав потребителей, маркетплейсы, Озон Банк, Вайлдберриз Банк.*

Lapova M.S.
second-year master's student, group 215-ЗМГПд
Siberian Law University
Russia, Omsk

RIGHTS OF FINANCIAL SERVICES CONSUMERS IN THE ERA OF PLATFORM ECONOMY: SPECIFICITY AND PROTECTION BY THE EXAMPLE OF OZON AND WILDBERRIES MARKETPLACE BANKS

Abstract. *The article examines the transformational processes in the Russian retail financial services market caused by the expansion of the largest e-commerce platforms. The subject of the analysis is the specifics of the legal status and the features of consumer rights protection using the services of JSC "Ozon Bank" and LLC "Wildberries Bank". The author identifies the key risks for citizens arising at the intersection of trade and financial legislation, including hidden misselling, discriminatory pricing conditions and the problems of unilateral blocking of transactional accounts. The paper assesses the regulatory initiatives of the Bank of*

Russia and judicial practice, and also proposes measures to improve the pre-trial protection of rights of "digital" banks clients.

Keywords: *financial services, consumer protection, marketplaces, Ozon Bank, Wildberries Bank.*

Введение

Современный этап развития финансового сектора Российской Федерации характеризуется глубоким проникновением цифровых платформ (маркетплейсов) в традиционный банковский бизнес. Стремясь снизить издержки на эквайринг и замкнуть транзакционный цикл внутри собственных экосистем, крупнейшие операторы электронной коммерции Ozon и Wildberries создали и активно развивают собственные кредитные организации АО «Озон Банк» и ООО «Вайлдберриз Банк». [1, 2, 3]

К 2026 году совокупный объем эмиссии электронных кошельков и карт банками маркетплейсов превысил десятков миллионов единиц, что вывело их в число лидеров по темпам прироста клиентской базы в ритейле. [1, 2]

Однако стремительный рост данного сегмента обнажил правовой дуализм: потребитель зачастую не разграничивает гражданско-правовые отношения с торговой площадкой (купля-продажа товара) и финансовые правоотношения с банком этой площадки. Данный фактор, сопряженный со специфическими маркетинговыми практиками маркетплейсов, формирует новые регуляторные риски и уязвимости для розничных клиентов, что обуславливает высокую актуальность темы исследования. [1]

1. Правовая природа экосистем e-commerce

Правовое регулирование деятельности банков маркетплейсов базируется на синергии Федерального закона № 395-1 «О банках и банковской деятельности», Закона РФ № 2300-1 «О защите прав потребителей» и Федерального закона № 353-ФЗ «О потребительском кредите (займе)». [1, 2]

Специфика «Озон Банка» и «Вайлдберриз Банка» заключается в их высокой интеграции в интерфейс материнских платформ. Финансовая услуга здесь выступает стимулятором основного торгового оборота. Потребителю в один клик предлагаются: открытие виртуальных накопительных счетов и дебетовых карт; программы лояльности и дифференцированное ценообразование (скидки при оплате «своей» картой); целевые потребительские займы и рассрочки, включая сервисы отложенных платежей и рассрочек. [1, 2, 3, 4, 5]

Основная теоретико-правовая проблема заложена в феномене «вынужденного согласия» потребителя. Пользуясь доминирующим положением на рынке e-commerce, платформы обязывают граждан открывать счета в подконтрольных банках под угрозой лишения скидок или применения наценок. С позиции антимонопольного законодательства и ст. 16 Закона «О защите прав потребителей», обусловливание приобретения одних товаров (услуг) обязательным приобретением других недопустимо. Тем не менее, юридическое разделение юридических лиц (ООО «Интернет Решения» и АО

«Озон Банк») позволяет экосистемам обходить классические законодательные запреты. [1, 2, 3]

2. Специфические риски потребителей и нарушения на практике

Анализ правоприменительной практики и жалоб граждан, направляемых в Службу по защите прав потребителей Банка России, позволяет классифицировать ключевые правонарушения в сфере банковского обслуживания на маркетплейсах. [1]

• Непрозрачность условий и скрытый мисселинг.

При оформлении «рассрочки» на товар в интерфейсе маркетплейса потребитель зачастую не осознает, что заключает полноценный договор потребительского кредита с банком-партнером или МФО экосистемы. Информационные блоки («баннеры») маскируют полную стоимость кредита) процентные ставки и штрафные санкции, акцентируя внимание лишь на размере ежемесячного платежа. Это нарушает ст. 10 Закона «О защите прав потребителей» в части предоставления достоверной и доступной информации. [1]

• Одностороннее ограничение распоряжения средствами.

Одной из наиболее острых проблем является массовая автоматизированная блокировка электронных кошельков и карт («Озон Счет», «ВБ Кошелек») в рамках комплаенс-процедур по Федеральному закону № 115-ФЗ. В отличие от классических банков с развитой сетью отделений, цифровые банки маркетплейсов не имеют физических офисов. Потребитель, чей счет заблокирован из-за рядового перевода, сталкивается с невозможностью оперативно предоставить оправдательные документы через чат технической поддержки. В результате нарушается ст. 858 ГК РФ, ограничивающая права клиента на распоряжение денежными средствами без решения суда или уполномоченного органа. [1, 2, 3]

• Риск трансграничной утечки и нецелевого использования данных.

Поскольку коммерческие банки маркетплейсов аккумулируют огромные массивы информации (транзакционный профиль, геолокация, история покупок, биометрия), возникает угроза нарушения Федерального закона № 152-ФЗ «О персональных данных». Пользователь, подписывая сквозное пользовательское соглашение экосистемы, автоматически разрешает передачу своих финансовых данных третьим лицам (маркетинговым агентствам, продавцам платформ), что размывает понятие банковской тайны (ст. 26 ФЗ «О банках и банковской деятельности»). [1]

3. Механизмы защиты прав потребителей и роль регуляторов

Защита прав клиентов АО «Озон Банк» и ООО «Вайлдберриз Банк» носит комплексный характер и реализуется посредством взаимодействия нескольких государственных институтов. [1]

• Банк России (Центральный Банк): осуществляет поведенческий надзор. По действующим в 2026 году стандартам, при выявлении недобросовестных практик (автоматические «галочки» при оформлении кредитов, сокрытие потребительского кредита) регулятор вправе предписать

банку приостановить продажи конкретного продукта или наложить оборотный штраф. [1]

• Служба финансового уполномоченного: является обязательной досудебной инстанцией при рассмотрении имущественных споров заемщиков и вкладчиков с банками маркетплейсов на сумму до 500 тыс. рублей. Гражданин обязан сначала направить банку электронную претензию (срок ответа 15 рабочих дней), и лишь затем обращаться к омбудсмену. [1, 2]

• Роспотребнадзор: контролирует соблюдение правил розничной торговли. Ситуации, когда маркетплейс отказывает в возврате средств за бракованный товар на карту стороннего банка, принуждая к зачислению денег на внутриплатформенный кошелек, квалифицируются Роспотребнадзором как прямое нарушение прав потребителя. [1, 2]

Заключение и предложения по совершенствованию законодательства

Проведенное исследование доказывает, что интеграция банковских институтов в структуры российских маркетплейсов создала уникальную регуляторную среду, где классические инструменты защиты прав потребителей упираются в платформенные алгоритмы. Для ликвидации правовых пробелов и минимизации рисков розничных клиентов мной может быть предложено:

• Введение понятия «Цифровой банковский комплаенс без отделений»: нормативно закрепить в ФЗ № 115-ФЗ обязанность банков, не имеющих физической сети офисов (таких как Озон Банк и Вайлдберриз Банк), разблокировать транзакционные счета граждан в течение 48 часов, если верификация личности и документов может быть осуществлена через государственные сервисы (ЕБС, Портал «Госуслуги»).

• Запрет ценовой дискриминации (экосистемный паритет): дополнить ст. 16 Закона «О защите прав потребителей» положением, прямо запрещающим торговым агрегаторам устанавливать базовые розничные цены на товары в зависимости от выбора платежного инструмента потребителя (внутренний банк маркетплейса vs сторонние коммерческие банки). Скидки должны носить исключительно характер кэшбэка, финансируемого из чистой прибыли финтех-структуры, а не за счет искусственного завышения цен для сторонних плательщиков. [1, 2, 3]

• Регулирование BNPL-продуктов: Окончательно закрепить законодательные рамки для сервисов гибкой рассрочки маркетплейсов («Сплит», «Долями», «Рассрочка Ozon»), приравняв их по уровню раскрытия информации и защите прав к классическому потребительскому кредитованию. [1, 2]

Предложенные тезисы позволят сбалансировать права участников платформенного рынка и гарантировать соблюдение имущественных интересов граждан в условиях цифровизации экономики.

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Хомидов Ш.Г., магистр
преподаватель кафедры противодействия экономическим преступлениям и легализации преступных доходов
Правоохранительная академия Республики Узбекистан
Узбекистан
ORCID: 0009-0000-1387-029X

ВОПРОСЫ СНИЖЕНИЯ ЭКОНОМИЧЕСКИХ ПОСЛЕДСТВИЙ КОРРУПЦИОННЫХ ПРЕСТУПЛЕНИЙ

Аннотация. Актуальность исследования обусловлена тем, что коррупционные преступления создают не только прямой имущественный ущерб, но и вторичные экономические потери в виде искажения конкуренции, роста транзакционных издержек, снижения эффективности государственных расходов и недополученных доходов. Цель статьи – разработать прикладной подход к измерению и снижению экономических последствий коррупционных преступлений на основе риск-ориентированного контроля, цифровой аналитики, предупреждения конфликта интересов и усиления возврата активов. Методология включает нормативно-правовой и сравнительно-институциональный анализ, систематизацию научной литературы и анализ открытых административных данных Республики Узбекистан. В результате предложены паспорт экономического ущерба по коррупционным делам, коэффициент чистого экономического эффекта антикоррупционного контроля и комплекс мер, связывающий профилактику, выявление, возмещение ущерба и оценку результативности.

Ключевые слова: коррупция, экономический ущерб, государственные расходы, комплаенс-контроль, конфликт интересов, цифровизация, возврат активов.

Khomidov Sh.G., master of science
lecturer, Department for Combating Economic Crimes and Money Laundering
Law Enforcement Academy of the Republic of Uzbekistan
Uzbekistan
ORCID: 0009-0000-1387-029X

ISSUES OF REDUCING THE ECONOMIC CONSEQUENCES OF CORRUPTION-RELATED CRIMES

Abstract. The relevance of the study stems from the fact that corruption-related crimes generate not only direct property losses but also secondary economic costs, including distorted competition, higher transaction costs, reduced efficiency of public spending and foregone revenues. The article aims to develop an applied framework for measuring and reducing the economic consequences of corruption-

related crimes through risk-based control, digital analytics, conflict-of-interest prevention and stronger asset recovery. The methodology combines legal and comparative institutional analysis, a review of academic literature and analysis of open administrative data from Uzbekistan. The study proposes an economic-damage passport for corruption cases, a net economic-effect coefficient for anti-corruption control, and an integrated set of measures linking prevention, detection, compensation and performance assessment.

Keywords: corruption, economic damage, public expenditure, compliance control, conflict of interest, digitalization, asset recovery.

ВВЕДЕНИЕ

Коррупционные преступления относятся к числу правонарушений, экономический эффект которых значительно шире размера взятки, стоимости присвоенного имущества или суммы завышения цены отдельного государственного контракта. Их последствия проявляются одновременно в бюджетной, инвестиционной, конкурентной и социальной сферах. Коррупционная рента перераспределяет ресурсы в пользу участников неправомерной сделки, тогда как общество несет прямой ущерб, издержки последующего восстановления, потери от неэффективного распределения ресурсов и снижение качества публичных услуг. В классической экономической литературе коррупция связывается с ухудшением инвестиционного климата и экономического роста, а современные обзоры подчеркивают институциональную неоднородность ее форм и каналов воздействия [8–10]. Современный обзор Olken и Pande специально рассматривает как масштабы коррупции, так и ее последствия для эффективности и реакцию на различные меры контроля.

Для Республики Узбекистан вопрос приобретает особое значение в условиях расширения цифрового государственного управления, модернизации публичных закупок и формирования специализированных механизмов комплаенс-контроля. Закон Республики Узбекистан «О противодействии коррупции» закрепляет институциональную систему противодействия коррупции и предусматривает системный анализ коррупционной ситуации, выявление сфер повышенного риска, причин и условий совершения коррупционных правонарушений [1]. Закон «О государственных закупках» прямо устанавливает приоритет мер по предупреждению коррупции, требования открытости, добросовестной конкуренции и внутреннего контроля [2]. С 6 декабря 2024 г. действует Закон «О конфликте интересов», предусматривающий раскрытие и урегулирование конфликтов интересов, специальные подразделения и контроль за полным возмещением ущерба, причиненного конфликтом интересов [3].

Цель исследования состоит в разработке прикладной модели снижения экономических последствий коррупционных преступлений, в которой результативность государства оценивается не только количеством выявленных правонарушений и привлеченных к ответственности лиц, но

также стоимостью предотвращенных потерь, объемом возмещенного ущерба, скоростью возврата активов и сокращением повторяющихся коррупционных рисков. Для достижения цели поставлены задачи: систематизировать каналы экономического ущерба; определить пригодные для практики показатели; оценить потенциал действующих инструментов профилактики; сформулировать предложения, которые могут быть адаптированы к итоговым выводам диссертационного исследования автора.

ОБЗОР ЛИТЕРАТУРЫ И ТЕОРЕТИЧЕСКАЯ ОСНОВА

Экономическая теория коррупции исходит из того, что злоупотребление публичными полномочиями способно изменять стимулы хозяйствующих субъектов, структуру государственных расходов и распределение инвестиций. P. Mauro показал эмпирическую связь коррупции с инвестиционной активностью и экономическим ростом [8]. J. Svensson, обобщая эмпирические исследования, подчеркивал, что коррупция является результатом взаимодействия институтов, стимулов и возможностей для извлечения ренты, поэтому универсальная мера противодействия обычно уступает комбинации взаимодополняющих инструментов [9]. B. Olken и R. Pande систематизировали микроэкономические свидетельства о потерях от коррупции, механизмах контроля и трудностях точного измерения скрытых коррупционных практик [10].

Для целей настоящего исследования принципиально различать сумму неправомерной выгоды и общественный экономический ущерб. Первая характеризует частный доход участника коррупционной схемы, тогда как второй включает более широкий набор потерь. Например, при завышенной закупочной цене государственный ущерб не исчерпывается возможной взяткой: он может включать разницу между контрактной и конкурентной ценой, расходы на повторную закупку, стоимость задержки проекта, ухудшение качества объекта, судебные и контрольные издержки. Аналогично незаконное предоставление лицензии или земельного ресурса может создавать потери вследствие упущенных бюджетных поступлений и вытеснения более эффективного участника рынка.

Международная нормативная рамка также ориентирует антикоррупционную политику на профилактику и восстановление имущественного положения. Конвенция ООН против коррупции сочетает меры предупреждения, криминализации, международного сотрудничества и возвращения активов [11]. Институциональная работа UNODC по возвращению активов охватывает, в частности, финансовое раскрытие, бенефициарную собственность и конфискацию доходов от преступлений. В рекомендациях ОЭСР по публичной добропорядочности и государственным закупкам акцент сделан на управлении рисками, прозрачности, подотчетности и контроле. Следовательно, экономическая оценка антикоррупционной политики должна учитывать не только репрессивный результат, но и предупрежденный ущерб.

МЕТОДЫ И МАТЕРИАЛЫ ИССЛЕДОВАНИЯ

Исследование носит прикладной междисциплинарный характер и использует четыре взаимосвязанных метода. Во-первых, проведен нормативно-правовой анализ законодательства Республики Узбекистан о противодействии коррупции, государственных закупках и конфликте интересов. Во-вторых, применен сравнительно-институциональный подход для сопоставления национальных механизмов с принципами Конвенции ООН против коррупции и рекомендациями ОЭСР. В-третьих, выполнен аналитический обзор научных работ об экономических последствиях коррупции. В-четвертых, использован описательный анализ открытых административных показателей, опубликованных официальными органами Республики Узбекистан.

В работе сознательно не предпринимается попытка оценить общий «размер коррупции» в экономике страны. Скрытый характер коррупционных сделок, различия в методах учета и отсутствие единой базы для монетизации косвенных потерь делают такую оценку методологически уязвимой. Вместо этого предлагается case-based подход: экономические последствия должны рассчитываться по конкретному делу, проекту, закупке или рисковому процессу на основе документируемых компонентов ущерба. Такой подход позволяет связывать профилактическую работу с измеримым финансовым результатом без необоснованной экстраполяции отдельных случаев на всю экономику. Сложности измерения коррупции и адаптации поведения к антикоррупционным мерам подробно отмечаются и в современной экономической литературе.

ИСТОЧНИКИ ДАННЫХ

Эмпирическая часть опирается на официальные открытые источники. Основной массив составляют акты национального законодательства в базе LexUZ, материалы официального веб-сайта Президента Республики Узбекистан о результатах комплаенс-контроля и планах цифровизации, а также международные правовые и методические документы. По официальным данным, опубликованным 10 декабря 2025 г., подразделения внутреннего контроля провели более 11 тыс. проверок, предотвратили неправомерное использование средств на 793 млрд сумов, выявили финансовые ошибки и нарушения почти на 2 трлн сумов и обеспечили возмещение 478 млрд сумов ущерба. Отдельно сообщалось, что внутренние антикоррупционные подразделения в ходе более 700 контрольных мероприятий выявили нарушения на 354 млрд сумов, предотвратили неправомерное использование около 550 млрд сумов и выявили 1 397 случаев конфликта интересов [5].

Эти показатели в статье рассматриваются как административные результаты контрольной деятельности, а не как оценка совокупного коррупционного ущерба. Категории могут частично пересекаться, методика их формирования в опубликованном сообщении не раскрыта, поэтому арифметическое суммирование показателей было бы некорректным. Их

ценность состоит в другом: они демонстрируют возможность переводить часть антикоррупционной деятельности из категории «процессуальных действий» в измеримые показатели предотвращения и восстановления экономических ресурсов. Это осторожная интерпретация официально опубликованных отдельных категорий, а не утверждение об их статистической взаимной исключительности.

АНАЛИЗ ЭКОНОМИЧЕСКИХ ПОСЛЕДСТВИЙ КОРРУПЦИОННЫХ ПРЕСТУПЛЕНИЙ

Предлагается рассматривать совокупный экономический ущерб коррупционного преступления как многокомпонентную величину:

$$\mathbf{D = D_1 + D_2 + D_3 + D_4 + D_5,}$$

где $\mathbf{D_1}$ – прямой имущественный или бюджетный ущерб; $\mathbf{D_2}$ – потери доходов бюджета и государственных организаций; $\mathbf{D_3}$ – дополнительные транзакционные и восстановительные расходы; $\mathbf{D_4}$ – рыночные потери от ограничения конкуренции и неэффективного распределения ресурсов; $\mathbf{D_5}$ – измеримые социально-экономические потери, непосредственно связанные с ухудшением качества или задержкой публичной услуги.

Формула является авторской аналитической конструкцией и предназначена не для автоматического судебного расчета, а для управленческой оценки последствий.

Наиболее надежно поддаются монетизации D_1–D_3, поскольку они могут подтверждаться бухгалтерскими документами, сравнением рыночных цен, данными контрактов, платежей и затрат на восстановление. D_4 и D_5 требуют осторожного применения эконометрических, сравнительных или экспертных методов. Поэтому в официальной практике целесообразно разграничивать «доказанный ущерб», «оценочный экономический ущерб» и «предотвращенный риск». Такое разграничение повышает сопоставимость данных и снижает риск двойного учета.

Особая зона риска – государственные закупки. Законодательство Узбекистана прямо устанавливает приоритет предупреждения коррупции, открытость и прозрачность закупочных процедур, добросовестную конкуренцию и внутренний контроль [2]. С экономической точки зрения профилактика на стадии подготовки технического задания, определения начальной цены, проверки аффилированности и оценки предложений зачастую выгоднее, чем последующее уголовное преследование после исполнения завышенного или некачественного контракта. Именно поэтому цифровая проверка аффилированности, ценовых аномалий и повторяемости победителей должна быть встроена в закупочный цикл до совершения платежа.

Второй канал связан с конфликтом интересов. Закон № ЗРУ-931 устанавливает обязанности и ограничения, направленные на предупреждение конфликта интересов, включая запрет извлечения личной выгоды путем злоупотребления служебным положением, правила раскрытия информации и институциональные полномочия по устранению последствий конфликтов [3].

Агентству также предоставлено полномочие контролировать достижение полного возмещения вреда интересам граждан, организаций, общества или государства, причиненного в результате конфликта интересов. Экономически это позволяет перейти от формального сбора деклараций к риск-ориентированной верификации: сведения о связанных лицах целесообразно сопоставлять с реестрами юридических лиц, закупок, лицензий, государственных активов и иных решений, создающих имущественную выгоду.

Третий канал – недостаточное восстановление утраченных ресурсов после выявления преступления. Уголовно-правовая реакция без эффективного возмещения ущерба оставляет часть экономического эффекта коррупции на стороне нарушителя или связанных лиц. Поэтому показатель «доля фактически возмещенного ущерба» должен сопровождаться показателями срока ареста активов, срока взыскания, доли возвращенных активов и стоимости процедур возврата. Международные механизмы UNODC в сфере asset recovery также охватывают обнаружение, замораживание, конфискацию и возвращение преступных активов.

Четвертый канал – вторичные расходы бизнеса и граждан. Бюрократическое решение, искусственная задержка, коррупционная лицензия или дискриминационный доступ к ресурсу формируют платежи времени, юридические расходы и упущенные возможности. Официальные материалы 2025 г. указывают на необходимость смещения фокуса от последствий к причинам коррупции, усиления цифрового контроля и оценки государственных органов также по количеству предотвращенных случаев [4]. Такой подход экономически оправдан: снижение возможностей для коррупционной транзакции одновременно сокращает потенциальные издержки государства и частного сектора.

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ

Первый результат – разработан **«паспорт экономических последствий коррупционного дела»**. Его предлагается формировать с момента выявления факта, способного причинить существенный имущественный ущерб, и актуализировать до полного исполнения решений о взыскании. Паспорт должен включать: идентификатор дела или контрольного материала; вид актива или бюджетной операции; доказанный прямой ущерб; недополученные доходы; расходы на восстановление; оценочные косвенные потери с указанием методики; сумму арестованных активов; сумму фактически возмещенного ущерба; предотвращенный ущерб; сроки взыскания; сведения об ответственном органе. Публичная версия паспорта должна содержать агрегированные данные без раскрытия охраняемой законом информации.

Второй результат – предложен **коэффициент чистого экономического эффекта антикоррупционного контроля (КЧЭАК)**:

$$K = (P + R - C) / C,$$

где **P** – документированная стоимость предотвращенного ущерба, **R** – фактически возмещенный ущерб за отчетный период, **C** – прямые расходы на соответствующую контрольную функцию.

Показатель является авторским управленческим инструментом и не должен подменять оценку законности, прав человека и качества профилактики. Его назначение – сопоставлять экономическую отдачу отдельных профилактических мероприятий и выявлять процессы, где автоматизация либо изменение процедуры дает наибольший финансовый эффект.

Третий результат – предложена трехуровневая модель приоритизации рисков. На уровне «операция» анализируются конкретные закупки, разрешения, платежи и распоряжение активами. На уровне «организация» оцениваются концентрация прямых договоров, повторяемость поставщиков, частота конфликтов интересов, жалоб и отмененных решений, а также доля восстановленного ущерба. На уровне «сектор» используются агрегированные показатели коррупционных рисков, уровня бюрократии, жалоб и цифровизации. Такой подход согласуется с официально обозначенными планами интеграции баз данных и создания центра анализа рисков для автоматического обнаружения коррупционных угроз и аффилированности в государственных закупках [5].

Таблица 1. Отдельные официально опубликованные результаты контрольной деятельности

Показатель	Значение	Интерпретация в исследовании
Проверки подразделений внутреннего контроля	более 11 000	масштаб контрольной активности
Предотвращено неправомерное использование средств	793 млрд сумов	пример измеримого ex ante эффекта
Выявлены финансовые ошибки и нарушения	почти 2 трлн сумов	не тождественно совокупному коррупционному ущербу
Возмещено ущерба	478 млрд сумов	пример восстановительного эффекта
Контрольные мероприятия антикоррупционных подразделений	более 700	отдельный массив контрольной активности
Предотвращено неправомерное использование	около 550 млрд сумов	не суммируется автоматически с 793 млрд
Выявлено конфликтов интересов	1 397 случаев	индикатор нефинансового коррупционного риска

Источник: составлено автором по официальным данным, опубликованным 10.12.2025 на веб-сайте Президента Республики Узбекистан [5].

ОБСУЖДЕНИЕ

Предложенная модель меняет логику оценки антикоррупционной политики: от преимущественного учета выявленных нарушений — к управлению экономическим риском на всем жизненном цикле коррупционного события. Такая логика особенно важна для закупок и распоряжения государственными активами, где после исполнения сделки возврат средств может быть существенно сложнее предотвращения сомнительного платежа. Вместе с тем денежные показатели не должны становиться единственным критерием эффективности. Контрольное подразделение может демонстрировать большой объем «предотвращенных» сумм за счет завышенной исходной оценки риска; поэтому методика должна устанавливать единые доказательственные стандарты, внешний аудит выборки и запрет повторного учета одного и того же эффекта несколькими органами.

Официальные данные 2025 г. подтверждают практическую актуальность такой постановки задачи. Государственная политика ориентируется на цифровизацию комплаенс-контроля, межведомственную интеграцию данных, автоматическое выявление рисков в закупках и повышение роли профилактики [5]. В июле 2025 г. также было официально сообщено, что 75% коррупционных случаев относились к так называемой бытовой коррупции, преимущественно на городском и районном уровнях, и подчеркивалась необходимость оценивать деятельность органов по числу предотвращенных случаев, а не только по последствиям [4]. Это усиливает аргумент в пользу локальных риск-карт и измерения затрат граждан и бизнеса на взаимодействие с публичными сервисами.

При внедрении алгоритмического риск-скоринга необходимо учитывать ограничения. Автоматический сигнал должен служить основанием для дополнительной проверки, но не заменять правовую оценку и презумпцию невиновности. Модель риска должна быть документируемой, проверяемой на ошибки и дискриминационные эффекты, а доступ к персональным и коммерческим данным — разграниченным. Экономическая эффективность цифрового контроля возникает не из самого факта применения искусственного интеллекта, а из способности своевременно предотвращать конкретный ущерб при соблюдении законности.

Отдельного внимания требует компенсационный компонент. Закон Республики Узбекистан № ЗРУ-1161 от 27 июля 2026 г. регулирует возмещение материального и морального вреда, причиненного незаконными решениями, действиями или бездействием государственных органов и должностных лиц; его вступление в силу предусмотрено на **28 января 2027 г.** [6]. Закон определяет материальный вред таким образом, что он включает реальные расходы/утрату имущества, а также недополученный доход. Хотя данный закон не является специальным актом о коррупционных преступлениях, закрепленные в нем категории реального ущерба и упущенной выгоды методологически подтверждают важность более полного

учета экономических последствий незаконной публичной деятельности. В статье этот акт используется как перспективный элемент правовой среды, а не как уже действующее регулирование.

АВТОРСКИЕ ПРЕДЛОЖЕНИЯ

Предложение 1. Закрепить ведомственный стандарт **«Паспорт экономических последствий коррупционного правонарушения»** для дел и контрольных материалов, связанных с бюджетными средствами, государственными активами, закупками, лицензированием и иными экономически значимыми решениями. Стандарт должен раздельно фиксировать доказанный ущерб, оценочный косвенный ущерб, предотвращенный ущерб и фактически возвращенные средства.

Предложение 2. Включить в KPI подразделений антикоррупционного и внутреннего контроля показатели не только количества проверок и выявленных нарушений, но и доли предотвращенного ущерба, коэффициента возмещения, среднего срока возврата активов и повторяемости аналогичного риска. Денежные KPI следует сопровождать независимой верификацией, чтобы исключить завышение «предотвращенного» эффекта. Такой подход концептуально согласуется с официальным акцентом на измерении предотвращенных случаев и финансового результата контроля.

Предложение 3. Создать межведомственный модуль риск-аналитики для автоматизированного сопоставления данных о государственных закупках, связанных лицах и конфликтах интересов, бенефициарном владении, лицензиях, земельных и кадастровых решениях, судебных актах и движении государственных активов. Сигналы системы должны ранжироваться по вероятности и потенциальной стоимости ущерба. Предложение развивает уже официально заявленную идею интеграции баз данных и Risk Analysis Center для обнаружения коррупционных угроз и аффилированности.

Предложение 4. Для государственных закупок ввести обязательную экономическую проверку высокорисковых контрактов до заключения или оплаты: анализ рыночного диапазона цен, аффилированности, концентрации победителей, дробления закупок, необычных изменений условий и отклонений от конкурентных процедур. Приоритет профилактики уже закреплен действующим законодательством о закупках [2], поэтому предложение развивает существующий принцип на уровне аналитической технологии.

Предложение 5. Связать реестр конфликтов интересов с финансово значимыми решениями конкретного сотрудника. Проверка должна отвечать не только на вопрос, подана ли декларация, но и на вопрос, возникла ли экономическая выгода у связанного лица. Такой подход превращает институт конфликта интересов из формального комплаенса в инструмент предупреждения имущественного ущерба [3]. Закон уже предусматривает формы раскрытия потенциального конфликта, ограничения на извлечение личной выгоды и полномочия по устранению решений и сделок, затронутых конфликтом.

Предложение 6. Установить обязательный план возмещения ущерба и возврата активов по каждому завершенному коррупционному делу с существенным имущественным эффектом. План должен содержать сумму требований, найденные и арестованные активы, механизм взыскания, ответственный орган и контрольные сроки. Оценка работы должна основываться на фактически возвращенной стоимости, а не только на сумме заявленного ущерба.

Предложение 7. Развивать защищенные каналы для сообщений о коррупционных рисках, особенно в закупках и распоряжении активами, и использовать информацию заявителей как источник раннего предупреждения. Официально в декабре 2025 г. были представлены предложения о механизмах защитных ордеров и реальных стимулов для лиц, сообщающих о коррупции [5].

Предложение 8. Проводить ежегодную публичную оценку экономического эффекта антикоррупционной профилактики по единой методике: предотвращенные потери, возмещенный ущерб, стоимость контрольных мер, динамика повторных нарушений и отраслевые риски. Публикация агрегированных данных повысит сопоставимость работы органов и позволит направлять ресурсы в сферы, где предельный профилактический эффект выше.

ЗАКЛЮЧЕНИЕ

Экономические последствия коррупционных преступлений не сводятся к размеру взятки или сумме прямого бюджетного ущерба. Они включают недополученные доходы, дополнительные восстановительные и транзакционные расходы, потери от искажения конкуренции, снижение качества государственных услуг и иные измеримые вторичные эффекты. Поэтому эффективная антикоррупционная политика должна объединять уголовно-правовую реакцию с экономической диагностикой, предупреждением и восстановлением ресурсов.

Исследование показывает целесообразность перехода к case-based измерению ущерба с четким разделением доказанного, оценочного и предотвращенного экономического эффекта. Предложенные паспорт экономических последствий, коэффициент чистого экономического эффекта контроля и многоуровневая риск-аналитика создают основу для более объективной оценки профилактики. Их практическая ценность состоит в возможности ранжировать коррупционные риски не только по вероятности, но и по потенциальной стоимости для государства и общества.

Для Узбекистана данная модель согласуется с действующим курсом на приоритет профилактики в государственных закупках, регулирование конфликта интересов, цифровизацию комплаенс-контроля и интеграцию данных [1–5]. Действующее законодательство действительно ставит профилактику коррупции в центр закупочного регулирования, а официальные планы предусматривают интеграцию данных и автоматическое выявление рисков. Наиболее перспективным направлением является формирование

единого контура **«риск — предотвращение — выявление — арест активов — возмещение — анализ причин»**, в котором каждое звено имеет измеримый результат. Реализация предложений способна уменьшить не только число коррупционных эпизодов, но прежде всего их совокупную экономическую цену.

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