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Johannes Keller
Editor-in-Chief

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ANALYSIS OF THE POSSIBILITIES OF APPLYING ARTIFICIAL INTELLIGENCE ALGORITHMS IN TRANSPORT AND LOGISTICS PROCESS MANAGEMENT

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Abstract

This paper analyzes the possibilities of applying artificial intelligence (AI) algorithms in the management of transport and logistics processes. The study examines the role of modern technologies in key logistics functions, such as freight transportation, route optimization, warehouse management, and demand forecasting. Furthermore, it highlights the potential for reducing costs, saving time, and improving service quality through the use of machine learning and neural network-based algorithms. As a result, the study demonstrates that the integration of artificial intelligence enhances the efficiency of transport and logistics systems, minimizes human error, and facilitates the automation of decision-making processes.

Keywords

artificial intelligence, transport logistics, machine learning, neural networks, route optimization, demand forecasting, warehouse management, automation, real-time monitoring, transport systems efficiency.

Transport va logistika jarayonlarini boshqarishda sun'iy intellekt algoritmlarini qo‘llash imkoniyatlarini tahlil qilish

Jizzax Politexnika instituti talabasi
Aliqulov G`olibjon Sherzod o`g`li

Annotatsiya: Ushbu ishda transport va logistika jarayonlarini boshqarishda sun’iy intellekt algoritmlarini qo‘llash imkoniyatlari tahlil qilinadi. Tadqiqotda yuk tashish, marshrutlarni optimallashtirish, ombor boshqaruvi hamda talabni prognoz qilish kabi asosiy logistika jarayonlarida zamonaviy texnologiyalarning o‘rni ko‘rib chiqiladi. Shuningdek, mashinali o‘rganish va neyron tarmoqlar asosida ishlovchi algoritmlar yordamida xarajatlarni kamaytirish, vaqtni tejash va xizmat sifatini oshirish

imkoniyatlari yoritiladi.Natijada sun’iy intellektdan foydalanish transport-logistika tizimlarining samaradorligini oshirish, inson omiliga bog‘liq xatolarni kamaytirish va qaror qabul qilish jarayonlarini avtomatlashtirishga xizmat qilishi asoslab beriladi.

Kalit so`zlar: sun’iy intellect, transport logistika mashinali o‘rganish,neyron tarmoqlar, marshrut optimallashtirish ,talabni prognozlash, ombor boshqaruv,avtomatlashtirish real vaqt monitoring,itransport tizimlari samaradorligi.

Bugungi kunda global iqtisodiyotda transport va logistika tizimlari muhim ahamiyatga ega. Raqamlashtirish jarayonlari tezlashgani sari logistika tizimlariga qo‘yiladigan talablar ham oshmoqda. Shu sababli, an’anaviy boshqaruv usullari o‘rnini zamonaviy texnologiyalar, xususan, sun’iy intellekt egallamoqda.Bir qator rivojlangan davlatlar logistika rivojlantirish yo`lida o`z iqtisodiyotini ham kengaytirib bormoqda.Misol uchun AQSH,Yevropa davlatlari va Yaqin G`arb ham chetda qolmayapdi.Ular raqamli texnologiya va su`iy intelektdan foydalanib o`z extiyojlarini samaradorligini ikki xissa oshirmqodalar. Sun’iy intellekt logistika tizimlarida katta hajmdagi ma’lumotlarni qayta ishlash, tezkor qaror qabul qilish va jarayonlarni avtomatlashtirish imkonini beradi. 2025–2026 yillarda SI asosan marshrut optimallashtirish, bashoratli texnik xizmat, talab prognozi, avtonom transport va ombor avtomatizatsiyasi yo‘nalishlarida qo‘llanilmoqda. Natijada transport xarajatlari 20–25% ga, ombor ish unumdorligi esa 35–50% ga oshishi mumkin.Keling ko`rib chiqamiz :

1.Marshrut optimallashtirish (Route Optimization)

SI algoritmlari (genetik algoritmlar, reinforcement learning) trafik, ob-havo, yo‘l holati, yoqilg‘i narxi va yetkazib berish muddatlarini hisobga olib, eng qisqa va tejamkor yo‘llarni topadi. Natijada bo‘sh yurishlar kamayadi, yoqilg‘i tejaydi va yetkazib berish tezligi oshadi.Misollar va foydalar:Amazon va Uber Freight kabi kompaniyalar ML yordamida marshrutlarni real vaqt rejimida o‘zgartirgan.Natijada:Xarajatlar 15–42% ga kamayadi, yetkazib berish vaqti qisqaradi.(1-2-rasm)



1-2-Tanlangan marshrut bo‘yicha kelish vaqti SI li raqamli avtomatlashtirilgan tizim

2. Omborxona avtomatizatsiyasi va bashoratli texnik xizmat (Warehouse Automation)

SI robotlarni (AGV, robot qo‘llar) boshqaradi, inventarizatsiyani real vaqtda kuzatadi va uskunalarning nosozliklarini oldindan bashorat qiladi. Natija: omborxona samaradorligi 35% oshadi, inventarizatsiya xatolari kamayadi.Omborxona avtomatizatsiyasi bozori 2028-yilga qadar 69 milliard dollarga yetadi.

Misol: Ocado va Alibaba omborxonalari SI bilan to‘liq avtomatlashtirilgan.(3-4-rasm)



3-4-rasmlar:Avtomatlashtirilgan robotlar tizimlari va yagona dastur asosida ishlash tizimi:

Funksiya	SI algaritmi robot vazifasi
Saralash	Tasvirni tanish orqali mahsulot turini aniqlash.
Joylashtirish	Ombor maydonidan maksimal darajada foydalanish uchun 3D-modellashtirish.
Xavfsizlik	Xodimlar va robotlar to'qnashuvining oldini olish.

Omborlarni avtomatlashtirish (Smart Warehousing)

Zamonaviy omborlarda SI bilan jihozlangan robotlar (masalan, Amazon robotlari) mahsulotlarni saralaydi va joylashtiradi.(5-6-rasmlar)



5-6-rasmlar:Omborxona uchun ixtisoslashgan SI li texnologiya:

4. Talabni bashorat qilish va ta’minot zanjirini optimallashtirish (Demand Forecasting & Supply Chain Optimization)

Neyron tarmoqlar (LSTM, SARIMA) o‘tmish ma’lumotlar, bozor trendlari va tashqi omillarni tahlil qilib, talabni aniq bashorat qiladi. Bu ortiqcha zaxiralarni 35% ga kamaytiradi va xizmat sifatini 65% oshiradi.(7-rasm)



7-rasm:Ta’minot zanjiri boshqaruvi tizimi

O‘zbekiston kabi ichki va xalqaro savdoga bog‘liq mamlakatlarda SI logistika samaradorligini oshirish, xarajatlarni kamaytirish va global raqobatbardoshlikni kuchaytirish uchun katta imkoniyat beradi.O‘zbekiston logistika tizimida SI ni joriy etish xalqaro savdoni oshiradi, xarajatlarni kamaytiradi va “Raqamli O‘zbekiston” strategiyasiga mos keladi. Amazon tajribasi shuni ko‘rsatadiki, SI joriy etilganda

logistika jarayonlari sezilarli darajada yaxshilanadi.Bindan tashqari,ichki yo`l infratuzilmasi ,bojxona tekshuruvlarni raqamlshtirish kabi muammolarni raqamli texnologiyalarga o`zgartirish kerak.Buning natijasida quyidagilar o`zgarishlarni ko`rishimiz mumkin.1.Xarajatlar kamayishi (transportda 25% gacha).2.Tezroq yetkazib berish va mijozlar qoniqishi.3.Barqarorlik (yoqilg‘i tejash orqali chiqindilar kamayadi).4.Real vaqt qaror qabul qilish:Qiyinchiliklar (lekin ular yengiladi): Ma’lumotlar sifati, eski tizimlar bilan integratsiya va dastlabki investitsiyalar. Ammo natija juda yuqori.

Xulosa:2026 yilda SI agentlik tizimlari (o‘zi qaror qabul qiluvchi) va o‘zini-o‘zi tiklovchi zanjirlar asosiy trend bo‘ladi. Transport logistikasini boshqarishda SI nafaqat imkoniyat, balki zaruratga aylanmoqda.: SI nafaqat xarajatlarni kamaytiradi, balki ekologik toza transport (yoqilg‘i tejash orqali) va raqobatbardoshlikni oshiradi. 2026–2028 yillarda SI bozori 20% dan ortiq o‘sish ko‘rsatadi. Kompaniyalar SI ni bosqichma-bosqich joriy etishni boshlashlari tavsiya etiladi: avval yo‘nalish optimallashtirishdan, keyin avtonomiyaga o‘tish.

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The Impact of Climate Change on Migration Dynamics in the European Union: Challenges and Future Perspectives

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Abstract

Climate change has emerged as a defining global challenge of the twenty-first century, deeply altering economic systems, environmental sustainability, human security, and human mobility. Environmental degradation, rising temperatures, sea-level rise, and escalating extreme weather events increasingly drive population movements both within and across national borders. While traditionally viewed primarily as a destination for international migrants, the European Union (EU) faces growing climate-induced mobility pressures from both internal shifts and external inflows. Rather than acting as an isolated, direct cause, climate change operates as a threat multiplier, such as interacting with existing socioeconomic inequalities, political instability, localized labor dynamics, and demographic trends. This article evaluates how climate change shapes EU migration dynamics by analyzing contemporary theoretical frameworks, empirical trends, and policy responses. Adopting a qualitative methodology rooted in literature analysis and secondary data from international institutions, this paper maps the core challenges facing the EU, including policy fragmentation, legal protection gaps for environmentally displaced persons, and regional disparities. Finally, it outlines strategic paths to strengthen climate adaptation and build unified migration governance mechanisms within the European framework.

Keywords

climate change, migration dynamics, European Union, environmental migration, climate migrants, migration governance

1. Introduction

Migration has historically represented an essential component of human adaptation to environmental, economic, and geopolitical changes. In the modern era, however, anthropogenic climate change has drastically accelerated the environmental stressors

driving human mobility. Intensifying phenomena like prolonged droughts, water scarcity, erratic precipitation, and sea-level rise threaten basic livelihoods, particularly in regions dependent on agriculture and natural resources. Crucially, climate change rarely acts in a vacuum. Instead, it compounds existing socioeconomic vulnerabilities and institutional weaknesses, amplifying the pressure on people to move (Black et al., 2011). The European Union occupies a highly complex structural position within these dynamics. It remains a primary target for external migration flows from regions highly vulnerable to climate disruptions, such as Sub-Saharan Africa, North Africa, and the Middle East. Simultaneously, internal environmental degradation is unevenly accelerating within Europe's own borders. Southern Europe faces acute heat stress and desertification, while northern and coastal zones confront rising sea levels and systemic flooding. While international bodies warn that climate-induced displacement will swell significantly in the coming decades, deep uncertainties remain regarding the exact scale, direction, and structural characteristics of these trends. This paper addresses three core inquiries:

1. How does climate change structurally alter migration patterns into and within the EU?
2. What systemic institutional, legal, and socioeconomic challenges emerge from these dynamics?
3. What forward-looking policy frameworks can improve unified climate and migration governance?

2. Literature Review and Theoretical Framework

Evolution of Environmental Migration Theory

Early academic approaches frequently suffered from environmental determinism, viewing ecological degradation as a direct, linear cause of population displacement. Contemporary migration scholarship has corrected this, framing human mobility as a multidimensional process shaped by overlapping economic, social, political, demographic, and environmental vectors (Black et al., 2011). Stephen Castles and Mark J. Miller (2009) argued that migration must be analyzed as an integrated social transformation where climate change affects human movement indirectly by reshaping

local labor markets, disrupting established social networks, and straining state institutions. Black et al. (2011) formulated a foundational framework categorizing five interconnected drivers of migration: environmental, economic, political, demographic, and social. Their model demonstrates that an environmental event only triggers migration based on how it filters through existing socioeconomic safety nets and household resilience (Black et al., 2011; Hunter et al., 2015). John W. Berry (1997) also contributed valuable insights into how environmental and cultural shifts alter the long-term adaptation and acculturation strategies of moving populations, highlighting that mobility itself is an effort to re-establish stability.

The Push-Pull Matrix in the Climate Era

This study synthesizes classical Push-Pull Theory with contemporary Environmental Migration Theory. In this synthesized model, climate change alters the traditional baseline of both origin and destination regions. Climate-induced push factors in places of origin include severe drought, systemic agricultural collapse, sudden-onset disasters like floods and wildfires, chronic water stress, resource competition, and the widespread loss of rural livelihoods (Black et al., 2011). Conversely, EU-specific pull factors include robust social protection systems, structural labor demands across key sectors, relative political stability, the rule of law, and advanced climate-resilient infrastructure.

Table 1: Synthesized Push-Pull Climate Migration Framework

Dimension	Push Factors (Regions of Origin)	Pull Factors (EU Destination Countries)
Environmental & Climatic	Severe droughts, desertification, sea-level rise, flash floods, agricultural failure	Advanced climate-resilient infrastructure, effective emergency response systems
Economic	Rural underemployment, loss of agrarian livelihoods, acute food insecurity	Structural labor shortages, higher relative wages, diverse economic opportunities

Social & Demographic	Population pressure, breakdown of community resilience, localized displacement	Existing migrant networks, high human development index, social safety nets
Institutional & Political	Weak state capacity, resource-driven conflicts, political instability	Political stability, strong rule of law, institutional human rights protections

Ultimately, Environmental Migration Theory asserts that migration can serve as a proactive household risk-diversification strategy rather than a desperate flight from catastrophe (Hunter et al., 2015). However, the capacity to use mobility as adaptation is unequal, often leaving the most vulnerable populations trapped in high-risk zones due to a lack of capital (Cattaneo et al., 2019).

3. Methodology

This study utilizes a qualitative research design rooted in systematic secondary data analysis and an extensive interdisciplinary literature review. To map the intersections of climate change and European policy, we analyzed legislative documents, academic monographs, and empirical reports published between 2010 and 2025 by leading international repositories. Core sources include data from intergovernmental bodies such as the International Organization for Migration (IOM), the United Nations High Commissioner for Refugees (UNHCR), and the Intergovernmental Panel on Climate Change (IPCC). We also examined European Union institutions, including European Commission policy briefs, Eurostat datasets, and the New Pact on Migration and Asylum framework documentation, alongside peer-reviewed studies spanning environmental science, European integration, and macro-demographics.

4. Climate Change as a Threat Multiplier

To properly evaluate mobility, environmental hazards must be split into two operational timelines:

- ✓ **Sudden-Onset Events:** Flash floods, intense wildfires, and severe storms cause immediate, highly visible, and primarily internal or short-term displacement (Black et al., 2011).

✓ **Slow-Onset Processes:** Gradual desertification, soil salinization, rising average temperatures, and sea-level rise erode local economies over generations (Cattaneo et al., 2019).

Table 2: Comparison of Sudden-Onset vs. Slow-Onset Climate Drivers

Feature	Sudden-Onset Events	Slow-Onset Processes
Examples	Flash floods, severe storms, heatwaves, wildfires	Desertification, soil salinization, sea-level rise, temperature increase
Time Horizon	Immediate (hours to days)	Cumulative (years to decades)
Primary Geographic Impact	Highly localized or sub-regional	Broad ecological zones across multiple regions
Mobility Pattern	Temporary, short-distance, primarily internal displacement	Permanent, multi-stage (Rural Urban International)
Policy Challenge	Emergency humanitarian response and immediate relief	Long-term economic restructuring, legal status, climate adaptation funding

Slow-onset degradation directly disrupts rural agrarian economies. As crop yields drop, rural underemployment spikes, triggering a well-documented two-stage migration pathway where distressed rural populations first move to swelling urban centers internally, before eventually contributing to international and EU-bound inflows (Black et al., 2011). Because environmental shifts are structurally bound to bad governance, demographic pressures, and economic inequality, the resulting human mobility must be managed as a complex demographic transition rather than an isolated emergency (Hunter et al., 2015).

5. Migration Dynamics in the European Union

The Internal Dimension

Within the EU, climate change is widening the socioeconomic divide between Northern and Southern member states. The Mediterranean basin is experiencing rapid aridification, characterized by severe heatwaves, water rationing, and catastrophic

wildfires. These changes directly threaten Southern Europe's agricultural output and tourism sectors. Over time, this ecological degradation risks driving internal labor migration northward, toward member states perceived as more economically and environmentally stable, potentially worsening regional demographic imbalances (Cattaneo et al., 2019).

The External Dimension

Externally, the EU borders regions highly susceptible to climate shocks, most notably Sub-Saharan Africa, North Africa, and the Middle East. In these areas, water scarcity and food insecurity act as explosive catalysts when combined with existing political instability. The 2015 European migration crisis highlighted how quickly geopolitical conflicts can engulf an entire region when compounded by underlying resource scarcity. As climate pressures intensify outside the EU's borders, indirect migration pressures on the bloc's external frontiers are fundamentally projected to rise.

6. Systemic Challenges Facing the EU

- ***Legal and Institutional Protection Gaps:*** Under current international law, such as the 1951 Refugee Convention, legal refugee status is strictly tied to a well-founded fear of persecution based on race, religion, nationality, membership of a particular social group, or political opinion. Climate displacement does not qualify under these criteria. Consequently, individuals displaced because of environmental degradation face profound legal uncertainty regarding their status and rights, creating severe protection gaps for vulnerable populations.
- ***Policy Fragmentation:*** Migration and climate policies within the European Union frequently operate within separate, siloed institutional frameworks. Environmental policies traditionally focus on emissions mitigation and infrastructure adaptation, while migration portfolios focus heavily on border security, asylum quotas, and labor market entry. This separation reduces institutional effectiveness, as climate-related migration requires integrated approaches addressing both environmental and human mobility dimensions simultaneously.
- ***Socioeconomic Integration and Public Polarization:*** When climate-induced inflows occur without robust local integration frameworks, receiving

communities experience structural strains. Real or perceived competition over affordable housing, entry-level employment, and public services can inflame social tensions. If migration is framed poorly in public discourse, it fuels political polarization, making evidence-based governance significantly harder to implement.

- ***The Asymmetry of Climate Impacts:*** Climate impacts are deeply uneven across Europe. Southern member states face immediate ecological pushes, yet they often bear a disproportionate burden of initial migrant arrivals due to geographic proximity. This asymmetric exposure strains the EU's internal solidarity mechanisms and complicates efforts to establish a unified border and asylum framework.

7. Future Perspectives and Policy Directions

To successfully navigate climate-related migration, the European Union must transition from reactive crisis management to proactive, structural governance.

Table 3: Matrix of Systemic Challenges and Strategic Policy Responses

Systemic Challenge	*Specific Gap / Vulnerability*	*Strategic Policy Direction*
Legal Protection Gap	Non-coverage of climate displaced persons under the 1951 Refugee Convention	Codify complementary legal definitions and temporary protection pathways within EU asylum frameworks
Policy Fragmentation	Siloed management of European Green Deal and EU Migration portfolios	Integrate human mobility indicators directly into National Adaptation Plans (NAPs) and climate policies
External Instability	Agricultural collapse and resource conflicts in vulnerable origin regions	Scale up targeted climate adaptation funding, green infrastructure, and resilient agriculture support
Unregulated Flows	Over-reliance on irregular migration routes and	Expand regulated legal channels, including circular

	overburdened asylum systems	migration programs and green tech visas
Internal Asymmetry	Disproportionate pressure on Southern EU Member States due to geographic position	Reform solidarity mechanisms to equitably distribute financial, operational, and integration burdens

- **Scale Up External Climate Adaptation Support:** The EU must direct international development funding toward climate-resilient infrastructure in vulnerable origin countries. Investing in sustainable agriculture, smart water management, and early-warning disaster systems allows populations to remain in their home communities by choice rather than fleeing out of economic necessity.
- **Codify Legal Status and Protection Standards:** The EU should lead the international community in establishing clear legal definitions and temporary or permanent protection pathways for environmentally displaced persons. This includes expanding complementary protection mechanisms that safeguard individuals who cannot return to their home countries due to severe environmental degradation.
- **Harmonize Climate and Migration Portfolios:** Policymakers must break down institutional barriers by integrating human mobility into environmental plans, such as the European Green Deal, and incorporating long-term climate projections directly into future migration management systems.
- **Expand Regulated Labor Mobility and Adaptation Pathways:** Instead of relying solely on restrictive asylum frameworks, the EU should implement managed legal channels, such as circular migration programs, green tech educational visas, and targeted regional labor quotas. This transforms migration into a mutual adaptation strategy that fills domestic labor shortages while easing economic pressure on origin countries.

8. Conclusion

Climate change is fundamentally redefining the landscape of human mobility, acting not as an isolated cause of migration but as a profound threat multiplier. The European Union can no longer afford to treat environmental migration as a distant,

external contingency. Addressing this reality requires dismantling policy fragmentation, closing persistent legal protection gaps, and investing heavily in both domestic and international climate resilience. By pivoting toward an integrated framework that views managed migration as a viable adaptive strategy, the EU can balance its humanitarian obligations with long-term socioeconomic stability.

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VICTIMS OF REPRESSION — THOSE WHO SACRIFICED THEIR LIVES FOR THE FREEDOM OF THE NATION

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ANNOTATION

This article describes the efforts of our Jadids, who are considered our national pride, and the oppression and oppression they faced, the unjust accusations they were accused of, the re-examination of their names after independence, and the positive work done to perpetuate their memory.

Keywords

repression, oppression, injustice, new, Fitrat, Cholpon.

QATAG'ON QURBONLARI — MILLAT OZODLIGI YO'LIDA JON FIDO QILGANLAR

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ANNOTASIYA

Ushbu maqolada milliy faxrimiz hisoblangan jadidlarimizning qilgan sa'y-harakatlari va ularga ko'rsatilgan jabr-zulm, ularga nohaq ayblar qo'yilishi, mustaqillikdan keyin ularning nomlarini qayta oqlanishi, ularni xotirasini abadiylashtirishga qilingan ijobiy ishlar bayon etilgan.

Kalit so'zlar:qatog'on, jabr-zulm, nohaqliklar, jadid, Fitrat, Cho'lpon.

АННОТАЦИЯ

В этой статье рассказывается о деятельности наших джадидов, считающихся нашей национальной гордостью, о притеснениях и гонениях, с которыми они столкнулись, о несправедливых обвинениях, с которыми им пришлось столкнуться, о переосмыслении их имён после обретения независимости и о позитивной работе, проделанной для увековечения их памяти

Ключевые слова: репрессии, угнетение, несправедливость, новый, Фитрат, Чолпон.

1930-yillarda O‘zbekiston SSRda qatag‘on siyosati birinchi navbatda o‘zaro bog‘liq ikkita maqsadga xizmat qildi: Sovet hokimiyatini mustahkamlash va potentsial muxolifatni bostirish. Iosif Stalin boshchiligidagi Sovet rahbariyati Sovet Ittifoqining ekspansionistik kun tartibining ajralmas qismi bo‘lgan yangi tashkil etilgan O‘zbekiston SSR ustidan nazoratni mustahkamlashga intildi. Qatag‘on siyosatini amalga oshirish orqali Sovet hukumati O‘z hokimiyatiga har qanday tahdidlarni bartaraf etishni va mintaqadagi norozi ovozlarni bostirishni maqsad qilgan[1].Stalincha totalitar-mustabid tuzum bedodligi va zulmning haddan ziyod kuchayib borishi davomida nafaqat yurtparvar milliy kadrlar, fidoyi ziyolilarning hayot tarzi, qismati zavol topdi, balki shu bilan birga millionlab yurt fuqarolarining oddiy insoniy qadr-qimmati, or-nomusi toptaldi, tahqirlandi[2].30-yillardagi qatag‘onda o‘zbek xalqining eng iste’dodli namoyandalari yo‘q qilindi. Ularga turli ayblar qo‘yilib, har xil bahonalar bilan qatl qilindi. Biroq, sho‘ro tuzumini maqtab, “xalqlar otasi” ni kuylagan ayrim shoirlarga ham kun berilmadi. Sababi, ularning beqiyos iste’dod ekanligi, bir kun kelib baribir o‘z xalqiga yon bosishini oldindan payqagan qizil imperiyachilar ularni ham otib tashlagan.XX asrning 30-yillariga kelib jahon xaritasida mutlaqo qayd etilmagan “Gulag” lagerlari tashkil topdi. Uning fuqarolari haq-huquqsiz Sovet Ittifoqi qahramonlari, mashhur fan arboblari, mohir diplomatlar, shoirlar, yozuvchilar, rassomlar yoki nomlari hech kimga ma’lum bo‘lmagan ishchilar, kolxozchilar va boshqa kasb egallari edi. Bu albatta sovet davlatining qatag‘onlik siyosati natijasi edi. Turkiston ozodligi uchun kurashganlarni “Bosmachi” tamg‘asi bilan yo‘q qilinib tashlandi. So‘ng aholini mehnat qilib biror narsa orttirgan o‘rta hol qismi bu baloga giriftor etildi.So‘ng aholini mehnat qilib biror narsa orttirgan o‘rta hol qismi bu baloga giriftor etildi.Rahbar kadrlar, ayniqsa, o‘z xalqi, yurtining milliy manfaatlarini himoya qilib, uning istiqbolini ko‘zlab, o‘zida kuch, iroda topib, bor haqiqatni aytishga jur’at qilgan millat vakillari birinchi navbatda hukmron Markaz uyushtirgan qatag‘onga duchor bo‘ldi. Buning yorqin ifodasini Sovet mafkurachilari tomonidan o‘zbek milliy kadrlari sha’nini bulg‘ashga qaratilgan, atayin ta’qib chiqarilgan “18 lar guruhi”, “lnog’omovchilar”,

“Qosimovchilar” guruhlari misolida ko‘rish mumkin.Mustabid tuzum hukmdorlari va ularning chaqqon dastyorlarning yeng shimarib qilgan “sa’y-harakatlari” natijasida 1937-1938-yillar davomida O‘zbekistonda bir qator yirik aksilinqilobiy tuzilmalar tuzilgan, faoliyat yuritmoqda, degan soxta ma’lumotlar to‘plandi. Mana shunday soxta ma’lumotlar asosida respublika rahbarlari A.Ikromov va F.Xo‘jayev boshchiligidagi “Burjua-millatchilik aksilinqilobiy tashkiloti markazi”, Abdurauf Qoriyev rahbar bo‘lgan “Musulmon ruhoniylarning millatchi-isyonkor tashkiloti”, “Aksilinqilobiy o‘ng trotskiychi josuslar tashkiloti markazi”, “Buxoro va Turkiston baxt-saodati” nomli aksilinqilobiy tashkiloti, I.Ortiqov boshliq Yoshlarning aksilinqilobiy burjua-millatchilik tashkiloti”, “Ingliz josuslik rezidenturasi”, “Yapon josuslik-qo‘poruvchilik rezidenturasi” kabi tashkilotlar Sovet hokimiyatiga qarshi faoliyat yuritmoqda deb e’lon qilindi, ularni tuzishda gumon qilinganlar qatag‘on qilindi. 1937-1938 yillarda SSSRda “katta terror” nomli keng ko‘lamli yirik qatag‘on operatsiyasi amalga oshiriladi[3]. “Xalqlar qotili” Stalinning ushbu shafqatsiz kampaniyasi sabab millionlab odamlar turli bo‘hton va tuhmatlar bilan hibsga olinib, otib tashlanadi. Ular orasida o‘zbek xalqining jonkuyar farzandlari **Mahmudxo‘ja Behbudiy, Abdulla Avloniy, Is’hoqxon Ibrat,** Abdulla Qodiriy, Abdulhamid Cho‘lpon, Abdurauf Fitrat, Fayzulla Xo‘jayev, Sa’dullaxo‘ja Tursunxo‘jayev, Qayum Ramazon, Majid Qodiriy, Ziyo Saidov kabilar ham bor edi. Katta terror» davrida, ya’ni 1937-1939 yillarda O‘zSSR «maxsus uchligi» tomonidan 41 ming nafardan ko‘proq kishi qamoqqa tashlangan. Shulardan 37 mingdan ko‘prog‘i sudlanib, 6 ming 920 kishi otib tashlangan.

Vatanimiz istiqloli, xalqimizning ozodligi va erkinligi, kelajak avlodlarning tinch va farovon hayotini ta’minlash yo‘lida mardona kurash olib borib aziz jonlarini fido qilgan, mustabid tuzum davrida qatag‘on qilingan ajdodlarimiz xotirasini abadiylashtirish, ularning faoliyati va merosini o‘rganish hamda targ‘ib etish borasida bir qator ishlar amalga oshirilmoqda[4].Jumladan, o‘tgan davrda ushbu yo‘nalishda muhim farmon va qarorlar qabul qilindi. Yurtimizda 2001-yildan buyon har yili 31-avgust — “Qatag‘on qurbonlarini yod etish kuni” sifatida keng nishonlab kelinmoqda. “Shahidlar xotirasi” yodgorlik majmuasi barpo etildi. “Shahidlar xotirasi” jamoat fondi, Qatag‘on qurbonlari xotirasi davlat muzeyi hamda hududlardagi oliy ta’lim muassasalari

qoshida uning bo‘limlari tashkil etildi.Mahmudxo‘ja Behbudiy, Abdulla Avloniy, Is’hoqxon Ibrat, Abdurauf Fitrat, Abdulhamid Cho‘lpon, Abdulla Qodiriy kabi ulug‘ ma’rifatparvar ajdodlarimiz xotirasiga bag‘ishlangan muhtasham haykallar, muzeylar bunyod etildi, ijod maktablari faoliyati yo‘lga qo‘yildi. Siyosiy qatag‘on yillarida nohaq qurbon bo‘lgan yurtdoshlarimizning nomlarini aniqlash, ularning qoldirgan merosini o‘rganish va keng jamoatchilikka yetkazishga qaratilgan ilmiy-tadqiqot ishlari, badiiy va hujjatli asarlar yaratilmoqda. Nima qilib bo‘lsa ham qaram davlatlarning xalqini ongsizlashtirishga qilingan harakatlar natijasida millatning eng ziyoliylari qurbon bo‘lishdi. Jabrini esa xalq ko‘rdi va butun bir millat qorong‘ulik domiga sho‘ng‘idi.

Qatag’onlarni xotirlash va e’zozlash, xalq ozodligi yo’lida qurbon bo’lgan ajdodlarimizning porloq xotirasini tiklash maqsadida 2002 yil 31 avgust kuni O‘zbekiston Respublikasi Prezidenti I. A. Karimov tashabbusi bilan “qatag’on qurbonlari xotirasi” muzeyi ochildi[5]. “Qatag’on qurbonlari xotirasi” muzeyi “Shahidlar xotirasi” maydonining markazida joylashgan bo‘lib, maydonga yanada ko‘rk va fayz bag‘ishlab turibdi. Muzey zali yorug‘ va shinam. Zal markazida “Iztirob haykali” o’rnatilgan. Unda farzandini kutayotgan ota-ona, o’z yorini sog’ingan ayol, ota mehriga to’ymagan bola tasvirlangan. Devorlarga muzeyni bo’limlarga ajratuvchi, mavzularga oid, o’sha davrlarga xos lavha – suratlar osilgan. Muzey 7 bo‘limdan iborat. 1. XIX asr o’rtalari va oxirlari. 2. 20-yillardagi qatag’on. 3. “quloq”lashtirish davri. 4. 30-yillardagi qatag’on. 5. 40-50-yillardagi qatag’on. 6. 80-yillardagi qatag’on. 7. Mustaqillik yillarida qatag’onlarni xotirlash va e’zozlash. Har bir bo’limda shu davrga oid hujjatlar, mahfiy qog’ozlar, rasmlar, davr lavhalari va eksponatlar bor.

Xulosa qilib aytganda millatimizni ilmli qilishiga harakat qilgan bizning jadidlarimiz qonxo‘r sovetlar tomonidan yo‘q qilindi. Xalqimizni ongsizlashtirish maqsadida avvalo ilmli kishilarimizga ko‘z tikdi va ular o‘zlari uchun bu katta xavf ekanligini anglashdi. Ko‘pchilik jadidlarimiz qatag‘on qilingan bo‘lsada ularning bizga qoldirgan merosi o‘chmadi va bu xalqni uyg‘otishda muhim ahamiyat kasb etdi. Hozirda jadidlarimizning xotirasini abadiylashtirishga qilingan harakatlar yildan-yilga oshmoqda.

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The effect of agronomic practices on cotton yield of cotton varieties on irrigation-eroded lands

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Abstract

The paper presents data on the effects of plant population density and fertilizer application rates on the growth, development, and seed cotton yield of the cotton varieties Andijan-35 and Sulton grown on the washed and depositional sections of irrigation-eroded sloping lands.

Keywords

irrigation erosion, washed and depositional sections of sloping lands, mineral fertilizer rates, Andijan-35 and Sulton cotton varieties, seedling emergence, plant population density, growth and development, seed cotton yield.

Introduction

In many countries around the world, the factors causing soil erosion have been identified, classification systems based on the degree of erosion have been developed and mapped, and effective methods and techniques for the efficient use of irrigation water on erosion-prone lands have been introduced. In addition, agrotechnologies aimed at reducing soil particle loss, preserving and improving soil fertility, and producing high and high-quality yields of agricultural crops have been developed and implemented. Nevertheless, the efficient use of land, water, fertilizers, and other resources, the development of resource-saving agrotechnologies, and ensuring food security, supplying raw materials for industry, and providing nutritious feed for livestock remain among the most pressing challenges.

In the Republic of Uzbekistan, approximately 722 thousand hectares of land are affected by irrigation erosion, 1,812 thousand hectares of cultivated land are affected by wind erosion, and a total of 1,929 thousand hectares are subject to combined water and

wind erosion. Therefore, preventing erosion processes, maintaining and improving soil fertility, and obtaining high and high-quality crop yields remain among the most important priorities of modern agriculture.

Scientific research was conducted to investigate the effects of different plant population densities and fertilizer application rates on the growth, development, and productivity of the cotton varieties Andijan-37 and Sulton grown on the washed and depositional sections of irrigation-eroded light sieroz soils in Andijan Region (Table 1). The field experiments were carried out in accordance with the methodological guidelines Methods for Conducting Field Experiments (Tashkent, 2007).

In the experiment evaluating the optimum plant population density of cotton varieties according to the slope conditions of irrigation-eroded lands and different fertilizer application rates, the soil bulk density was determined before sowing. In the washed section of the slope, the bulk density was 1.28 g/cm³ in the 0–30 cm soil layer and 1.33 g/cm³ in the 30–50 cm layer. In the depositional section, the corresponding values ranged from 1.26 to 1.31 g/cm³. By the end of the growing season, the soil bulk density in the washed section increased by 0.05–0.10 g/cm³ in the 0–30 cm layer and by 0.04–0.06 g/cm³ in the 30–50 cm layer, whereas in the depositional section the increase amounted to 0.03–0.07 g/cm³ and 0.02–0.06 g/cm³ respectively.

Analysis of the soil humus content showed that, in the eroded section of the slope, the humus content before the experiment was 1.17% in the 0–30 cm soil layer and 0.87% in the 30–50 cm layer. By the end of the growing season, due to nutrient uptake by plants and the loss of humus associated with irrigation-induced soil erosion, the humus content decreased. In the plots planted with the Andijan-37 cotton variety and fertilized at a rate of $N_{180}P_{110}K_{80}$ kg/ha, maintaining a plant population of 80–90 thousand plants/ha resulted in humus contents of 0.89% and 0.65% in the respective soil layers. When the plant population was increased to 120–130 thousand plants/ha, the humus content declined to 0.75% and 0.63%, respectively. Under the higher fertilizer rate of $N_{200}P_{140}K_{100}$ kg/ha, the corresponding values were 0.89% and 0.69%, and 0.85% and 0.65%, respectively. In the corresponding treatments planted with the Sulton variety, the

humus contents were 0.89%, 0.80%, 0.85%, 0.71%, 0.86%, 0.81%, 0.84%, and 0.63%, respectively.

Table 1

Experimental Layout

<table>
<tr><th>№</th><th colspan="2">Slope section</th><th colspan="2">Cotton varieties</th><th>Mineral fertilizer rate, kg ha</th><th>Plant density, thousand plants/ha</th></tr>
<tr><td>1</td><td rowspan="9">Washed section of the soil on sloping land</td><td rowspan="9">Depositional section of the slope</td><td rowspan="9">Andijan-37</td><td rowspan="9">Sulton</td><td rowspan="3">N_{160} P_{110} K_{80}</td><td>80-90</td></tr>
<tr><td>2</td><td>100-110</td></tr>
<tr><td>3</td><td>120-130</td></tr>
<tr><td>4</td><td rowspan="3">N_{200} P_{140} K_{100}</td><td>80-90</td></tr>
<tr><td>5</td><td>100-110</td></tr>
<tr><td>6</td><td>120-130</td></tr>
<tr><td>7</td><td rowspan="3">N_{240} P_{170} K_{120}</td><td>80-90</td></tr>
<tr><td>8</td><td>100-110</td></tr>
<tr><td>9</td><td>120-130</td></tr>
</table>

In the depositional section of the slope, where soil particles transported by irrigation erosion accumulated, the humus content increased by 0.08–0.25% across the experimental treatments owing to the deposition of eroded soil materials in the lower part of the field. Nevertheless, by the end of the growing season, the humus content decreased in all treatments as a result of plant nutrient uptake and the effects of irrigation erosion. The total nitrogen content was considerably lower in the eroded soils, amounting to 0.086% and 0.073%, respectively. By the end of the growing season, it had decreased by 0.012–0.020 percentage points. Irrigation-eroded soils were also characterized by the accumulation of carbonates. Part of the phosphorus applied as fertilizer underwent retrogradation (phosphorus fixation), and consequently, by the third year of the study, a slight increase in the soil phosphorus content was observed.

It is well known that each cotton variety requires specific agronomic practices depending on the prevailing soil and climatic conditions.

Achieving an early, abundant, and high-quality cotton yield on irrigation-eroded lands remains one of the key challenges of modern cotton production. Therefore, the

development and implementation of variety-specific agrotechnologies tailored to the biological characteristics of each cotton variety and the conditions of irrigation-eroded soils are of great importance for sustainable and efficient cotton cultivation.

On 1 June, plants of the Sulton cotton variety grown in the lower depositional section of the slope, where eroded soil particles had accumulated, reached a height of 21.8–23.0 cm, exceeding the height of the Andijan-37 variety by 3.0–3.5 cm. Accordingly, the number of true leaves also increased (Treatments 28–36). In the eroded upper section of the slope, plant height was 2–3 cm lower than that observed in the depositional section, although the varietal differences remained consistent.

It should be noted that, for both cotton varieties and under both slope conditions, increasing plant population density in combination with the respective mineral fertilizer rates (Treatments 4–8, 13–18, 22–27, and 31–36) promoted more vigorous plant growth. In these treatments, plant height exceeded that of the other treatments by 5–6 cm, while maintaining the varietal characteristics. A corresponding increase in the number of fruiting branches and fruiting structures was also observed. Similar trends were recorded during the August observations. During this period, both cotton varieties exhibited accelerated vegetative growth, each expressing its characteristic growth pattern. Furthermore, plant population density and fertilizer application rates created favorable conditions for the formation of reproductive organs and boll development. For example, under fertilizer rates of $N_{200}P_{140}K_{100}$ kg/ha and $N_{240}P_{170}K_{120}$ kg/ha, applied in the above-mentioned treatments at both slope positions, vegetative growth was somewhat reduced compared with the other treatments; however, the number of fruiting branches and fruiting structures increased. Regarding boll formation, the greatest number of bolls was recorded in Treatments 1–3, 10–12, 19–21, and 28–30, where plant population was maintained at 80–85 thousand plants/ha. In these treatments, the average number of bolls per plant exceeded that of the other treatments by 1.5–2.0 bolls. In the remaining treatments, boll formation decreased as plant population density increased.

In both cotton varieties, under both slope conditions, plant growth was influenced by mineral fertilizer rates. When the plant population was maintained at 110 thousand plants/ha, vigorous vegetative growth was observed under all fertilizer application rates

(Treatments 4–8, 13–18, 22–27, and 31–36). In these treatments, plants were on average 5–10 cm taller than those in the remaining treatments, while the characteristic differences between the varieties were maintained. Correspondingly, the number of fruiting branches and reproductive structures also increased. Similar trends were observed in the development of yield components. During August, the growth of both cotton varieties became even more vigorous, with each variety exhibiting its characteristic pattern of development. It was evident that the combination of plant population density and fertilizer application rates created favorable conditions for the formation of reproductive organs and boll development. For example, at both slope positions, the application of fertilizers at rates of $N_{200}P_{140}K_{100}$ kg/ha and $N_{240}P_{170}K_{120}$ kg/ha resulted in slightly reduced vegetative growth compared with the other treatments; however, an increase in the number of fruiting branches and reproductive structures was observed. In particular, the greatest boll formation occurred in Treatments 1–3, 10–12, 19–21, and 28–30, where the plant population was maintained at 80–85 thousand plants/ha. Under these conditions, the average number of bolls per plant increased by 1.5–1.9 bolls compared with the other treatments. In the remaining treatments, boll formation decreased as plant population density increased.

Observations conducted on 1 September showed that, under both slope conditions, the greatest number of bolls was recorded in Treatments 1–3, 10–12, 19–21, and 28–30, where the cotton varieties received fertilizer at rates of $N_{200}P_{140}K_{100}$ kg/ha and $N_{240}P_{170}K_{120}$ kg/ha, and the plant population was maintained at 80–85 thousand plants/ha. In these treatments, the number of bolls increased by an average of 1.5–2.0 bolls per plant compared with the other treatments. The corresponding numbers of bolls per plant were 7.7–9.0, 8.1–8.4, 8.3–9.1, and 7.7–8.3, respectively (Treatments 1–3, 10–12, 19–21, and 28–30). No significant differences were observed between the Andijan-37 and Sulton cotton varieties. The results indicate that both the Andijan-37 and Sulton cotton varieties can produce high and good-quality seed cotton yields under different slope conditions when cultivated with mineral fertilizer application rates of $N_{200}P_{140}K_{100}$ kg/ha and $N_{240}P_{170}K_{120}$ kg/ha.

It should be noted that, under both slope conditions, the number of bolls formed on the cotton plants increased in all treatments in relation to plant population density. For example, in all treatments where the plant population was maintained at 80–85 thousand plants/ha, the average number of bolls per plant was 1.5–2.0 higher than in the other treatments. In treatments with higher plant populations, the total number of bolls per unit area increased primarily due to the greater number of plants.

This can be explained by the fact that, in both cotton varieties, increased plant density within the rows resulted in reduced plant height. Under these conditions, the proportion of weak plants increased, and consequently, the number of bolls formed per individual plant decreased. However, this did not have a significant negative effect on seed cotton yield. On the contrary, under both slope conditions, yield increased across all treatments of both cotton varieties as plant population increased, reflecting the varietal characteristics and the greater number of plants per unit area.

The pattern observed in the formation of yield components in the experimental treatments was also reflected in the maturation of seed cotton. Under both slope conditions, the ripening period varied depending on plant population density. In addition, the seed cotton yield differed among the cotton varieties grown under these conditions. In the eroded section of the slope, the Andijan-37 cotton variety, grown at plant populations of 82.3–84.7 thousand plants/ha and 101.8–103.5 thousand plants/ha, produced seed cotton yields of 31.4–31.3 s/ha and 32.6–32.4 c/ha, respectively, when fertilized at rates of $N_{200}P_{140}K_{100}$ kg/ha and $N_{240}P_{170}K_{120}$ kg/ha. Compared with the fertilizer rate of $N_{160}P_{110}K_{80}$ kg/ha, these treatments produced an additional 1.7–1.6 s/ha and 1.4–1.2 s/ha of seed cotton, respectively (Treatments 2–3 and 5–6). Similarly, the Sulton cotton variety, grown at plant populations of 84.0–84.7 thousand plants/ha and 102.6–105.6 thousand plants/ha, produced seed cotton yields of 33.2–33.2 s/ha and 32.4–33.3 c/ha, respectively, under the same fertilizer application rates. Compared with the application of $N_{160}P_{110}K_{80}$ kg/ha, these treatments provided an additional 2.0–2.3 s/ha and 1.1 s/ha of seed cotton yield.

Thus, in the eroded section of the slope, the Andijan-37 cotton variety produced a seed cotton yield that was 1.5 s/ha higher than that of the Sulton variety. A similar trend

was observed in the lower depositional section of the slope, where eroded soil particles had accumulated, and both cotton varieties produced nearly identical seed cotton yields. It should be noted that although some year-to-year variation in seed cotton yield was observed during the experimental period, the overall relationships between fertilizer application rates, plant population density, and yield remained consistent. For example, the Sulton cotton variety, grown at average plant populations of 86.9–87.4 thousand plants/ha and 103.2–105.0 thousand plants/ha, produced seed cotton yields of 32.2–32.6 s/ha and 33.4–33.8 c/ha, respectively, under the above-mentioned fertilizer regimes. Compared with the application of $N_{160}P_{110}K_{80}$ kg/ha, these treatments produced an additional 2.2–2.6 s/ha and 2.8–3.2 s/ha of seed cotton, respectively (Figure 1).

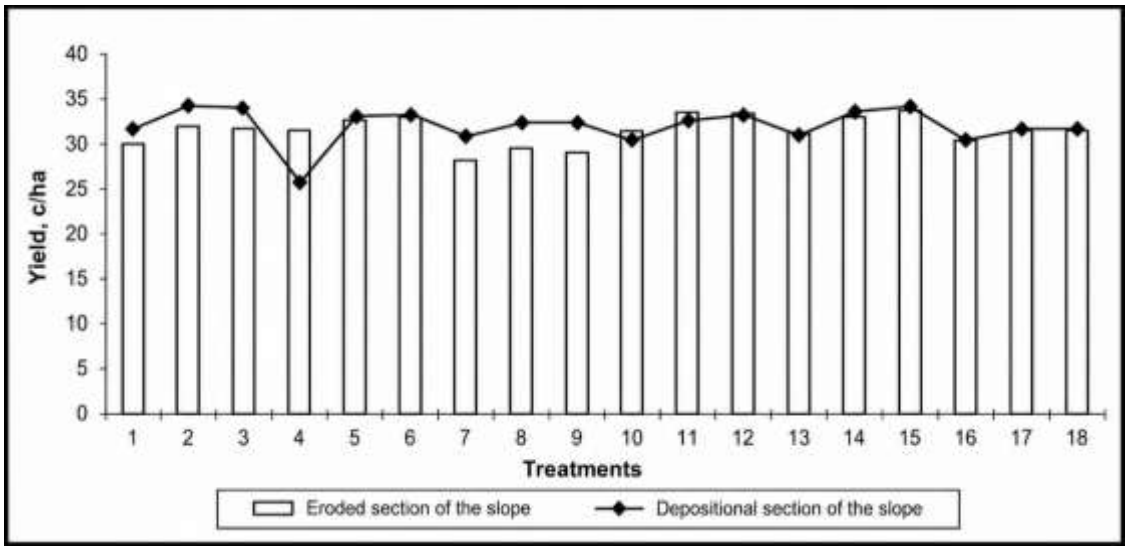

Figure 1. Effect of plant population density and mineral fertilizer rates on seed cotton yield under different slope conditions, c/ha.

Conclusion

Based on the results of the present study, the following recommendations can be made. To achieve high seed cotton yields of the Andijan-37 and Sulton cotton varieties on irrigation-eroded lands, it is recommended to maintain a plant population of 120–130 thousand plants/ha in the eroded section of the slopeand 80–90 thousand plants/ha in the depositional section, where eroded soil particles accumulate. For the eroded section of the slope, the recommended fertilizer application rate is 200 kg/ha nitrogen, 140 kg/ha phosphorus, and 100 kg/ha potassium, whereas for the lower depositional section the

recommended rates are 160 kg/ha nitrogen, 112 kg/ha phosphorus, and 80 kg/ha potassium.

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ORGANIZATIONAL AND ECONOMIC MECHANISMS FOR IMPROVING THE QUALITY MANAGEMENT SYSTEM IN EDUCATIONAL INSTITUTION MANAGEMENT

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Abstract

This article examines the organizational and economic mechanisms for improving the quality management system in educational institution management. It analyzes the role of modern management approaches, strategic planning, efficient resource utilization, and quality assessment systems in enhancing the quality of education. The study also proposes practical recommendations for improving management mechanisms aimed at increasing the effectiveness and competitiveness of educational institutions.

Keywords

educational institution, management, quality management system, education quality, organizational and economic mechanisms, strategic management, efficiency, quality assessment, innovative management.

TA’LIM MUASSASALARI BOSHQARUVIDA SIFAT MENEJMENTI TIZIMINI TAKOMILLASHTIRISHNING TASHKILIY-IQTISODIY MEXANIZMLARI

ОРГАНИЗАЦИОННО-ЭКОНОМИЧЕСКИЕ МЕХАНИЗМЫ СОВЕРШЕНСТВОВАНИЯ СИСТЕМЫ МЕНЕДЖМЕНТА КАЧЕСТВА В УПРАВЛЕНИИ ОБРАЗОВАТЕЛЬНЫМИ УЧРЕЖДЕНИЯМИ

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Annotatsiya: Mazkur maqolada ta’lim muassasalari boshqaruvida sifat menejmenti tizimini takomillashtirishning tashkiliy-iqtisodiy mexanizmlari tahlil qilinadi. Ta’lim sifatini oshirishda zamonaviy boshqaruv yondashuvlari, strategik rejalashtirish, resurslardan samarali foydalanish hamda sifatni baholash tizimining o‘rni yoritilgan. Shuningdek, ta’lim muassasalari faoliyati samaradorligini oshirishga xizmat

qiluvchi boshqaruv mexanizmlarini takomillashtirish bo‘yicha ilmiy-amaliy tavsiyalar ishlab chiqilgan.

Kalit so‘zlar: ta’lim muassasasi, boshqaruv, sifat menejmenti, ta’lim sifati, tashkiliy-iqtisodiy mexanizmlar, strategik boshqaruv, samaradorlik, sifatni baholash, innovatsion boshqaruv.

В статье рассматриваются организационно-экономические механизмы совершенствования системы менеджмента качества в управлении образовательными учреждениями. Проанализирована роль современных подходов к управлению, стратегического планирования, эффективного использования ресурсов и системы оценки качества в повышении качества образования. Разработаны научно-практические рекомендации по совершенствованию механизмов управления, направленных на повышение эффективности и конкурентоспособности образовательных учреждений.

Ключевые слова: образовательное учреждение, управление, система менеджмента качества, качество образования, организационно-экономические механизмы, стратегическое управление, эффективность, оценка качества, инновационное управление.

Globallashuv, raqamli transformatsiya va bilimlarga asoslangan iqtisodiyotning jadal rivojlanishi ta’lim tizimi oldiga yangi vazifalarni qo‘ymoqda. Ushbu sharoitda ta’lim muassasalari faoliyatining samaradorligini oshirish, ta’lim xizmatlari sifatini ta’minlash hamda xalqaro standartlarga mos boshqaruv tizimini shakllantirish dolzarb masalalardan biri hisoblanadi. Mamlakatning ijtimoiy-iqtisodiy taraqqiyoti, inson kapitalini rivojlantirish va raqobatbardosh kadrlar tayyorlash ko‘p jihatdan ta’lim muassasalarida boshqaruvning samaradorligi hamda sifat menejmenti tizimining qay darajada tashkil etilganiga bog‘liq.

So‘nggi yillarda ta’lim sohasida amalga oshirilayotgan islohotlar boshqaruv tizimini modernizatsiya qilish, ta’lim sifatini oshirish va ta’lim muassasalarining institutsional salohiyatini mustahkamlashga qaratilgan. Bunda strategik rejalashtirish, natijadorlikka yo‘naltirilgan boshqaruv, raqamli texnologiyalarni joriy etish, ichki sifatni ta’minlash tizimlarini rivojlantirish hamda resurslardan oqilona foydalanish

alohida ahamiyat kasb etadi. Shu bilan birga, ta’lim muassasalarida sifat menejmenti tizimini zamonaviy talablar asosida takomillashtirish boshqaruv samaradorligini oshirishning muhim omili sifatida namoyon bo‘lmoqda.

Xalqaro amaliyot shuni ko‘rsatadiki, ta’lim sifatini ta’minlashda sifat menejmenti tamoyillarini boshqaruv jarayonlariga integratsiya qilish, manfaatdor tomonlarning ehtiyojlarini inobatga olish, faoliyat natijalarini muntazam monitoring qilish va uzluksiz takomillashtirish tamoyiliga amal qilish yuqori natijalarga erishish imkonini beradi. Ayniqsa, sifat menejmentining zamonaviy konsepsiyalari, jumladan, Total Quality Management (TQM), ISO 21001 standarti, EFQM mukammallik modeli hamda natijadorlikka asoslangan boshqaruv yondashuvlari ta’lim muassasalari faoliyatini samarali tashkil etishda muhim metodologik asos bo‘lib xizmat qilmoqda.

“Sifat menejmenti” (quality management) – bu sifatga yo‘naltirilgan rahbarlik va boshqarishning muvofiqlashtirilgan faoliyatidir. U sifat menejmenti tamoyillari va dastaklaridan foydalanishga asoslangan, menejmentning barcha funksiyalarini nazarda tutgan holda tashkilotga ta’sir etuvchi uzluksiz jarayon hisoblanadi.

Sifatli mahsulotga cheklovsiz harajatlar hisobiga bajarilgan mukammal mahsulotlar taalluqli bo‘lib, kamyoblik va qimmatlilik ushbu tushunchaning ikkita farq qiluvchi qirralari hisoblanadi. Ushbu nuqtai nazardan sifat maqom va ustunlikni aks ettirish uchun qo‘llaniladi.

Binobarin, sifatni nisbiy tushuncha sifatida ham qo‘llash mumkin. Ushbu holatda sifat mahsulot yoki xizmatning belgisi (o‘ziga xos xususiyati, atributi) hisoblanmaydi. Sifat to‘g‘risida mahsulot yoki xizmatning mavjud standartlar yoki unga qo‘yilgan talablarga javob berganida gapirish mumkin.

Shunga ko‘ra, sifat o‘z-o‘zidan yakuniy natija bo‘la olmaydi. U faqatgina uning yordamida yakuniy mahsulotning standartga mosligini aniqlash vositasidir. Sifatni nisbiy tushunishda sifatli mahsulot yoki xizmat qimmat yoki mushkul, chiroyli yoki mujmal bo‘lishi shart emas. Shuningdek, u o‘ziga xos, oddiy, siyqasi chiqqan va odatiy bo‘lmasligi mumkin.

Sifat nisbiy tushuncha sifatida ikkita qirraga ega:

- birinchi – bu standart yoki unga qo‘yilgan talabga mos kelishi;

- ikkinchi – iste’molchilar talabiga mos kelishi.

Quality management systems. Bu so‘z inglizcha so‘z birikmasi bo‘lib, “Sifat menejmenti tizimi” (SMT) ma’nosini anglatadi, yana ham aniqrog‘i “Sifatli boshqaruv tizimi” (SBT) deb tarjima qilinsa, bu so‘zning mazmun mohiyatini ISO 9000 konsepsiyasiga hamohang tarzda o‘girilganini bildiradi. YA’ni “Sifatli boshqaruv tizimi” – ISO xalqaro standartining konsepsiyasiga mos tushadi.

Hozirgi vaqtga kelib, zamonaviy sifat menejmenti – bu rahbarlik va qo‘llab-quvvatlashning samarali tarkibi bo‘lib, qo‘yilgan vazifalarning bajarilishini ta’minlaydi. OTMda sifat menejmenti g‘oyalari va usullaridan foydalanish barcha bo‘g‘inlarda:

OTM darajasida, uning bo‘limlarida, fakultet va kafedralarida, talabalar bilimi, malakasi va ko‘nikmalari shakllanadigan va iste’molchilar uchun “qadriyatlar, qiymatlar” yaratiladigan auditoriyalarida amalga oshirilishi zarurdir.

Sifat menejmenti aniq tamoyil va konsepsiyalarga, ularni xayotga tadbiq etishning amaliy modellariga tayanadi. Eng ko‘p tarqalgan sifati menejmenti modeli 9000 seriyasidagi ISO xalqaro standartlar modeli hisoblanadi. Uning tarkibida ta’lim muassasalarining sifat tizimi Namunaviy modeli ishlab chiqilgan.

Sifat menejmentining zamonaviy modellari asosida to‘liq sifat (Total Quality), TQM tamoyillari va jarayonli yondoshuv g‘oyasi yotadi.

Aynan ana shu yondoshuvlar o‘qituvchi faoliyatida o‘zining aksini topishi lozim.

Ta’lim muassasalarida boshqaruv jarayonining asosiy tamoyillari. Ta’lim muassasalarida boshqaruv jarayonini samarali tashkil etish muayyan tamoyillarga tayanishni talab etadi. Mazkur jarayonda eng muhim omillardan biri - jamoaning o‘ziga xos xususiyatlarini hisobga olishdir. Ta’lim tashkilotlarida, odatda, yuqori saviyaga ega bo‘lgan ziyoli va malakali mutaxassislar faoliyat yuritadi. Hatto texnik xodimlar ham ma’lum darajada bilimli va muloqot madaniyatiga ega bo‘lgan shaxslar bo‘lgani sababli rahbar tomonidan boshqaruv jarayonida muvozanatli yondashuv, hurmat va konstruktiv muloqot muhim ahamiyat kasb etadi. Bunday muhitda samarali boshqaruv faqat buyruqbozlik orqali emas, balki o‘zaro hurmat, ishonch va hamkorlikka asoslangan boshqaruv uslubi orqali amalga oshiriladi. Boshqaruv jarayonida muntazamlik tamoyili alohida o‘rin tutadi. Rejalashtirilgan ishlarning tizimli ravishda amalga oshirilishi,

faoliyatning doimiy nazorat ostida bo‘lishi hamda intizomiy talablarning izchil qo‘llanishi tashkilot faoliyatining barqarorligini ta’minlaydi. Muntazamlik uzoq muddat davomida sezilarli natijalarni yuzaga keltiradigan muhim omil hisoblanadi.

Xulosa qilib aytadigan bo’lsak, ta’lim muassasalari boshqaruvi samaradorligini oshirishning tashkiliy-iqtisodiy asoslarini takomillashtirish ta’lim tizimini modernizatsiya qilishning muhim sharti hisoblanadi. Zamonaviy boshqaruv texnologiyalarini joriy etish, strategik rejalashtirishni rivojlantirish, raqamli transformatsiyani jadallashtirish hamda moliyaviy resurslardan oqilona foydalanish boshqaruv samaradorligini sezilarli darajada oshiradi. Natijada ta’lim sifati yuksaladi, ta’lim muassasalarining raqobatbardoshligi ortadi va ularning barqaror rivojlanishi ta’minlanadi.

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RESULTS OF RESEARCH CONDUCTED ON VARIOUS APPLE ROOTSTOCKS UNDER THE SOIL AND CLIMATE CONDITIONS OF FERGANA REGION

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Abstract

Studies conducted under low-fertility, stony-gravelly soil conditions confirmed that apple trees on dwarf and semi-dwarf rootstocks come into bearing earlier than seedlings with a strong (vigorous) root system. Because the growth vigor of interstock (interkalyar) seedlings is limited, such seedlings can be planted more densely per unit area, making it possible to establish intensive orchards with at least 1,000 trees per hectare.

Keywords

rootstock, adaptive, M-9, MM106, interstock, vigorous, yield, dwarf, semi-dwarf, trunk girth, cross-sectional area.

FARG‘ONA VILOYATI TUPROQ-IQLIM SHAROITIDA OLMANING TURLI PAYVANDTAGLARI BO‘YICHA O‘TKAZILGAN TADQIQOT NATIJALARI

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Annotatsiya. Unumdorligi past tosh-shag‘alli tuproq sharoitida o‘tkazilgan tadqiqotlar pakana va yarimpakana payvandtagli olma daraxti kuchli ildiz tizimiga ega bo‘lgan ko‘chatlarga nisbatan hosilga ertaroq kirishini tasdiqladi. Interkalyar k’chatlarda ‘sish kuchining cheklanishi sababli, bunday k’chatlarni maydaon birligida zichroq, gektariga kamida 1000 tupgacha joylashtirib intensiv bog`lar barpo qilish mumkin.

Kalit so‘zlar. Payvandtag, adaptiv, M-9, MM106, interkalyar, kuchli o‘suvchi, hosildorlik, pakana, yarimpakana, tana aylana uzunligi, ko‘ndalang kesim yuzasi.

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РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ РАЗЛИЧНЫХ ПОДВОЕВ ЯБЛОНИ В ПОЧВЕННО-КЛИМАТИЧЕСКИХ УСЛОВИЯХ ФЕРГАНСКОЙ ОБЛАСТИ

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Аннотация. Исследования, проведенные в условиях каменисто-гравийных почв с низким плодородием, подтвердили, что яблоня с карликовым и полукарликовым подвоем начинает плодоносить раньше, чем саженцы с сильной корневой системой.

В связи с ограничением силы роста в интеркалярных саженцах, такие саженцы можно размещать более плотно, не менее 1000 штук на гектар, создавая интенсивные сады.

Ключевые слова. Подвой, адаптивный, М-9, ММ106, интеркалярный, сильнорастущий, урожайность, карликовый, полукарликовый, длина окружности тела, площадь поперечного сечения.

Introduction

Intensifying horticulture requires the use of low-vigor rootstocks that enable dense tree planting and the creation of new orchard structures, forming a canopy that makes more efficient use of the substances produced within plant tissues, and correctly choosing the tree-planting scheme [8; 11]. It is known that designing an intensive orchard consists of developing variety–rootstock combinations and canopy-formation systems suited to growth vigor, which in turn gives fruit trees optimal optical and physiological characteristics [4].

For this reason, the rootstock is an essential component of an intensive orchard, since the variety's valuable economic traits, productivity, earliness of fruiting, growth vigor, fruit quality, and adaptability all depend on it [1].

In particular, a number of studies have confirmed that interstock seedlings with a strong root system show increasing yields over the years and, in terms of long-term indicators, outperform dwarf rootstocks [2; 3; 7; 9; 12].

The rootstock selected for a given soil and climate condition determines the degree

of adaptability to environmental stress factors, the dynamics of increasing yield, the stability of fruit-bearing for the variety–rootstock combination, and the commercial and consumption quality of the fruit.For this reason, a long-term experiment was established at the Fergana Scientific Experimental Station with the aim of selecting rootstocks suited to local conditions, giving them an objective evaluation, and covering the full multi-year cycle from planting through orchard maturity to the decline of yield.

Materials and Methods

Research on four types of rootstocks — M-9, MM-106, interstock, and vigorous seedling rootstocks — planted in 2020 in low-fertility, stony-gravelly soil conditions of Fergana region is being conducted using generally accepted methodology [12].

Statistical analysis was performed according to the method of B.A. Dospekhov [13]. M-9 rootstock was used in preparing the interstock seedlings.

Results and Discussion

In the fourth year after planting, the yield of 'Golden Delicious' apple seedlings varied depending on the rootstock. In particular, in 2023 the yield per hectare was 64 centners (quintals) for M-9, 32 centners for MM-106, 17.3 centners for the interstock, and 7.6 centners for the vigorous rootstock (Table 1). Observations showed a steady increase in apple yield over time. In 2023, apple trees on M-9 rootstock produced 2.8 kg per tree (56 c/ha); in 2024, 5.6 kg (112 c/ha); and in 2025, 10.2 kg and 204 c/ha, respectively.

On MM-106 rootstock, the yield per tree was 3.2 kg, giving 32 c/ha. In 2024 this rose to 8.3 kg and 83.3 c/ha, and in 2025 to 15.6 kg and 156 c/ha. Yield on the interstock rootstock rose from 14 c/ha in 2023 to 59.9 c/ha in 2024 and 78.6 c/ha in 2025. On the vigorous seedling rootstock, yield rose from 7.6 c/ha in 2023 to 55.6 c/ha in 2025. Although, starting in 2024, per-tree yield was highest for MM-106, the interstock, and the vigorous rootstock, the highest overall yield per hectare was recorded for M-9, which had the greatest planting density — 2,000 trees per hectare.

Our research once again confirmed that seedling density is the strongest factor influencing yield across rootstocks. Thus, apple orchards established on this basis reached their sixth year

No.	Rootstock name	Seedling density, trees/ha	2023		2024		2025		Average over 3 years		
			Yield per tree, kg	Yield, c/ha	Yield per tree, kg	Yield, c/ha	Yield per tree, kg	Yield, c/ha	Yield per tree, kg	Yield, c/ha	Additional yield, c/ha
1	M-9	2000	2.8	56	5.6	112.0	10.2	204.0	6.2	124.0	–
2	MM-106	1000	3.2	32	8.3	83.3	15.6	156.0	9.0	90.4	-33.6
3	Interstock	666	2.1	14.0	9	59.9	11.8	78.6	7.6	50.8	-73.2
4	Vigorous (seedling)	400	1.9	7.6	9.1	36.4	13.9	55.6	8.3	33.2	-90.8
	LSD05 **LSD05**		3.6 c/ha 12.2%		5.2 c/ha 7.1%		7.0 c/ha 5.7%				

Table 1. Yield of apple trees on different rootstocks ('Golden Delicious' variety, planted n 2020).

(2025), by which point a direct relationship was found between yield per unit area and seedling density for each rootstock. Thus, the studies confirmed that apple trees on dwarf and semi-dwarf rootstocks come into bearing earlier than seedlings with a strong root system.

Analysis of the data on growth vigor showed that these processes are directly related to rootstock type. In particular, in 2023 seasonal shoot growth on M-9 and MM-106 rootstocks was 48.4–56.7 cm, while on the interstock and vigorous rootstocks it was 37.2 and 46.2 cm, respectively (Table 2).

No.	Rootstock name	Annual shoot growth, cm			Canopy diameter, m			Trunk girth, cm			Trunk cross-sectional area, cm2			Yield per tree, kg			Yield per unit trunk cross-section, kg/cm2		
		2023	2024	2025	2023	2024	2025	2023	2024	2025	2023	2024	2025	2023	2024	2025	2023	2024	2025
1	M-9	48.4	77.1	48.4	1.3	1.8	2.0	14.0	21.2	23.8	16.7	35.9	45.3	2.8	5.6	10.2	0.17	0.16	0.22
2	MM-106	56.7	83.8	49.3	1.8	1.9	2.2	15.3	21.0	23.3	20.0	35.0	43.0	3.2	8.3	15.6	0.16	0.24	0.36
3	Interstock	37.2	87.3	51.7	1.7	2.0	2.1	13.8	21.9	23.8	16.3	38.2	45.3	2.1	9.0	11.8	0.20	0.24	0.26
4	Vigorous (seedling)	46.2	91.1	54.0	1.5	2.4	2.3	17.2	25.1	27.2	25.3	49.9	58.1	1.9	9.1	13.9	0.08	0.18	0.24

Table 2. Growth and development processes and yield load of apple trees on different rootstocks

However, by 2024 the highest annual shoot growth was recorded for the interstock

(87.3 cm) and vigorous (91.1 cm) rootstocks, which have strong root systems. In 2025 the same pattern by rootstock persisted for shoot growth.

In terms of canopy diameter, the vigorous rootstock (2.4 m) again showed the greatest growth in 2024, while M-9 showed the least growth (1.8 m). In 2025 as well, MM-106 and the vigorous rootstock led in canopy growth. The experiment showed that the interstock rootstock acted as a limiting factor for canopy growth: canopy size on the interstock rootstock was noticeably smaller than on the vigorous rootstock over the three years (1.7–2.0–2.1 m), and was nearly the same as MM-106.

Grafting M-9 onto the trunk of a vigorously growing wild seedling rootstock, to prepare interstock seedlings, significantly limits the growth of the resulting canopy.

Because the growth vigor of interstock seedlings is limited in this way, such seedlings can be planted more densely per unit area, making it possible to establish intensive orchards with at least 1,000 trees per hectare. The highest values for trunk girth and the corresponding cross-sectional area over 2023–2024–2025 were found, respectively, on the vigorous rootstock (17.2–25.1–27.2 cm and 25.1–49.9–58.1 cm^2).

Analysis of yield per unit of trunk cross-sectional area showed that apple trees on the interstock and MM-106 rootstocks outperformed those on the dwarf (M-9) and vigorous rootstocks.

Specifically, yield per unit cross-sectional area on the interstock rootstock over 2023–2024–2025 was 0.20–0.24–0.26 kg/cm^2, and on MM-106 it was 0.16–0.24–0.36 kg/cm^2, whereas relatively lower values were recorded on M-9 (0.17–0.16–0.22 kg/cm^2) and the vigorous rootstock (0.08–0.18–0.24 kg/cm^2).

Conclusions and Recommendations

Our research confirmed that, under low-fertility, stony-gravelly soil conditions, M-9 and MM-106 rootstocks show more rapid development and earlier entry into bearing during the early years of apple tree life compared with the vigorous and interstock rootstocks.

Given the relatively limited growth vigor of interstock seedlings, it is recommended that such seedlings be planted more densely per unit area, at a rate of at least 1,000 trees per hectare, to establish intensive orchards.

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HIP AND KNEE JOINT ARTHROPLASTY: AN IMPORTANT FACTOR IN REDUCING DISABILITY, RESTORING INDEPENDENT LIVING, AND ENSURING SOCIAL AND PROFESSIONAL INTEGRATION

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Abstract

The article analyzes the role of hip and knee arthroplasty in reducing disability, restoring physical function, decreasing the need for personal care, and helping patients return to independent living and employment. The need to improve the arthroplasty system in Uzbekistan through a national registry, objective assessment of healthcare needs, and integration of medical and vocational rehabilitation is substantiated. It is proposed to assess treatment outcomes not only by the number of operations performed, but also by functional recovery, independence, and social integration.

Keywords

arthroplasty, hip joint, knee joint, osteoarthritis, disability, rehabilitation, independent living, return to work, social integration.

ЧАНОҚ-СОН ВА ТИЗЗА БЎҒИМЛАРИНИ ЭНДОПРОТЕЗЛАШ: НОГИРОНЛИКНИ КАМАЙТИРИШ, МУСТАҚИЛ ҲАЁТГА ҚАЙТАРИШ ВА ИЖТИМОИЙ-КАСБИЙ ИНТЕГРАЦИЯНИ ТАЪМИНЛАШНИНГ МУҲИМ ОМИЛИ.

Ногиронлиги булган шахсларни реабилитация килиш ва протезлаш Миллий маркази.

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Аннотация. Мақолада чаноқ-сон ва тизза бўғимларини эндопротезлашнинг оғриқни камайтириш, ҳаракат функциясини тиклаш, ногиронлик ва ташқи парваришга эҳтиёжни камайтириш, беморни мустақил ҳаётга ва меҳнат фаолиятига қайтаришдаги аҳамияти таҳлил қилинган. Ўзбекистонда эндопротезлаш хизматини такомиллаштириш, миллий реестрни жорий этиш,

эҳтиёжни объектив баҳолаш, реабилитация ва касбий реабилитацияни эндопротезлаш жараёнининг узвий қисмига айлантириш бўйича таклифлар ишлаб чиқилган. Эндопротезлаш самарадорлигини операциялар сони билан эмас, балки функционал тикланиш, мустақиллик ва ижтимоий интеграция натижалари билан баҳолаш зарурлиги асосланган.

Калит сўзлар: эндопротезлаш, чаноқ-сон бўғими, тизза бўғими, остеоартроз, ногиронлик, реабилитация, мустақил ҳаёт, меҳнатга қайтиш, ижтимоий интеграция.

Резюме. В статье проанализировано значение эндопротезирования тазобедренного и коленного суставов в снижении инвалидности, восстановлении двигательной функции, уменьшении потребности в постороннем уходе и возвращении пациентов к самостоятельной жизни и трудовой деятельности. Обоснована необходимость совершенствования системы эндопротезирования в Узбекистане посредством создания национального регистра, объективной оценки потребности, интеграции медицинской и профессиональной реабилитации. Предложено оценивать эффективность лечения не только по количеству операций, но и по функциональным и социальным результатам.

Ключевые слова: эндопротезирование, тазобедренный сустав, коленный сустав, остеоартроз, инвалидность, реабилитация, самостоятельная жизнь, возвращение к труду, социальная интеграция.

Чаноқ-сон ва тизза бўғимларининг оғир остеоартрози аҳолининг ҳаракатланиш қобилияти, ўз-ўзига хизмат қилиши, меҳнат фаолияти ва ижтимоий ҳаётда иштирокини жиддий чеклайди. Жаҳон соғлиқни сақлаш ташкилоти маълумотларига кўра, 2019 йилда дунёда тахминан **528 млн киши остеоартроз** билан яшаган. Таянч-ҳаракат тизими касалликлари эса глобал миқёсда ногиронлик билан яшалган йилларнинг катта қисмини ташкил этади (World Health Organization, 2022; World Health Organization, 2023). Шу сабабли оғир остеоартрозни самарали даволаш нафақат тиббий, балки ижтимоий-иқтисодий аҳамиятга эга.

Касалликнинг III–IV босқичларида консерватив даволаш самараси чекланган беморларда чаноқ-сон ёки тизза бўғимини эндопротезлаш оғриқни камайтириш, ҳаракат функциясини тиклаш, ташқи парваришга эҳтиёжни қисқартириш ва беморни мустақил ҳаётга қайтаришнинг энг самарали усулларидан бири ҳисобланади (World Health Organization, 2023).

Халқаро тажриба ва Ўзбекистондаги ҳолат

Эндопротезлаш ҳажми мамлакатнинг ортопедик ёрдам имкониятлари ва аҳоли эҳтиёжини баҳолашда муҳим индикатор ҳисобланади. Мавжуд маълумотларга кўра:

Мамлакат/ҳудуд	Йил	Чаноқ-сон эндопротезлаш, 100 минг аҳолига	Тизза эндопротезлаш, 100 минг аҳолига
Европа Иттифоқи, ўртача	2022	**202**	**134**
АҚШ	2023, тахминий	**150–160**	**320–330**
Россия	2019, тахминий	**57**	**43**
Ўзбекистон	2022	**миллий кўрсаткич очиқ эмас**	**миллий кўрсаткич очиқ эмас**

Европа Иттифоқида 2022 йилда ҳар 100 минг аҳолига ўртача **202 та чаноқ-сон ва 134 та тизза эндопротезлаш** операцияси тўғри келган (OECD/European Union, 2024). АҚШда тизза эндопротезлаш кўрсаткичи янада юқори — тахминан **320–330 та/100 минг аҳоли** даражасида.

Ўзбекистонда эса 2022 йилда Соғлиқни сақлаш вазирлиги маълумотига кўра, муайян соғломлаштириш акциялари доирасида **670 та чаноқ-сон ва 28 та тизза бўғими эндопротезлаш операцияси бепул** амалга оширилган (Ўзбекистон Республикаси Соғлиқни сақлаш вазирлиги, 2022). Бироқ ушбу рақам мамлакатда бажарилган умумий операциялар сонини ифодаламайди. Давлат, хусусий ва бошқа молиялаштириш манбалари ҳисобидан амалга оширилган барча операцияларни қамраб олувчи ягона очиқ миллий статистика мавжуд эмас.

Шунинг учун Ўзбекистонда асосий муаммолардан бири **эндопротезлашга бўлган ҳақиқий эҳтиёж билан мавжуд хирургик қувват ўртасидаги тафовутни аниқ баҳолай олмасликдир**.

Муаммонинг тиббий-ижтимоий жиҳати

Эндопротезлаш самарадорлигини фақат операциялар сони билан баҳолаш етарли эмас. Операциянинг ҳақиқий ижтимоий натижаси беморнинг:

- оғриқсиз ҳаракатланиши;
- юриш қобилияти тикланиши;
- ўз-ўзига хизмат қилиши;
- ташқи парваришга эҳтиёжининг камайиши;
- оилавий ва ижтимоий ҳаётга қайтиши;
- меҳнат фаолиятини тиклаши

билан белгиланади.

Айниқса, икки томонлама чаноқ-сон ёки тизза бўғимлари зарарланишида функционал чекланиш кучаяди ва беморнинг бошқа шахс ёрдамига эҳтиёжи ортиши мумкин. Шу сабабли эндопротезлашга номзодларни баҳолашда нафақат рентгенологик ўзгаришлар, балки **функционал ҳолат, кундалик фаолият ва меҳнат қобилияти** ҳам ҳисобга олиниши зарур.

Тизза остеоартрози бўйича ўтказилган йирик когорт тадқиқотларида рентгенологик ўзгаришларнинг кучайиши функционал чекланиш билан боғлиқ экани кўрсатилган (White et al., 2010). Бу эса беморни баҳолашда тасвирий текширув натижаларидан ташқари унинг реал функционал ҳолатини ҳам ҳисобга олиш зарурлигини кўрсатади.

Тадқиқотлар эндопротезлашдан кейин оғриқ ва жисмоний функция сезиларли яхшиланишини кўрсатади. Хусусан, бир томонлама ва бир вақтда икки томонлама чаноқ-сон эндопротезлаш натижаларини ўрганган тадқиқотда ҳар икки гуруҳда ҳам оғриқ ва жисмоний функциянинг узоқ муддатли яхшиланиши қайд этилган (Ristolainen et al., 2023).

Шу билан бирга, операциядан кейинги реабилитация етарли даражада ташкил этилмаса, мушак кучсизлиги, ҳаракат ҳажмининг чекланиши ва нотўғри

юриш стереотипи сақланиб қолиши мумкин. Шу нуқтаи назардан реабилитацияни эндопротезлашнинг ажралмас қисми сифатида ташкил этиш зарур (World Health Organization, 2023).

Меҳнатга қайтиш — муҳим ижтимоий-иқтисодий натижа

Эндопротезлашнинг аҳамияти айниқса меҳнатга лаёқатли ёшдаги беморлар учун юқори. 48 та тадқиқот ва 9267 нафар бемор маълумотларини қамраб олган тизимли шарҳ ва мета-таҳлилда чаноқ-сон эндопротезлашдан кейин операциягача ишлаган беморларнинг **87,9%и меҳнатга қайтгани** кўрсатилган (Soleimani et al., 2023).

Демак, эндопротезлашни:

даволаш → функционал тикланиш → мустақиллик → меҳнатга қайтиш → оила даромадини тиклаш → ижтимоий интеграция

занжирида кўриш лозим.

Бу нуқтаи назардан эндопротезлашга сарфланган маблағни фақат тиббий харажат эмас, балки **инсон капиталига инвестиция** сифатида баҳолаш мақсадга мувофиқ.

Ўзбекистондаги асосий тизимли камчиликлар

Таҳлил Ўзбекистонда қуйидаги муаммолар мавжудлигини кўрсатади:

1. Эндопротезлашнинг ягона миллий реестри мавжуд эмаслиги

Умумий операциялар сони, навбат, қайта операциялар ва узоқ муддатли натижаларни аниқ баҳолаш қийин.

2. 100 минг аҳолига ҳисобланган миллий индикаторларнинг очиқ эмаслиги

Ҳудудлар ва халқаро кўрсаткичлар билан объектив таққослаш имконияти чекланган.

3. Операция ва реабилитация ўртасида узвийликнинг етарли эмаслиги

Жарроҳликдан кейинги функционал тикланиш ягона жараён сифатида ташкил этилиши зарур (World Health Organization, 2023).

4. Натижаларни фақат операция сони билан баҳолаш хавфи

Беморнинг мустақиллиги, парваришга эҳтиёжи ва меҳнатга қайтиши каби кўрсаткичлар тизимли ҳисобга олинмайди.

5. Касбий реабилитациянинг етарлича шаклланмаганлиги

Меҳнатга лаёқатли беморларни ишга босқичма-босқич қайтариш механизмлари зарур. Чаноқ-сон эндопротезлашдан кейин меҳнатга қайтишнинг юқори даражаси бу йўналишнинг муҳимлигини кўрсатади (Soleimani et al., 2023).

6. Молиялаштиришнинг тўлиқ тикланиш принципига асосланмаганлиги

Операция билан бирга реабилитация харажатларини ҳам ягона тиббий хизмат пакети сифатида кўриш лозим.

Соҳани ривожлантириш бўйича таклифлар

Ўзбекистонда эндопротезлаш тизимини такомиллаштириш учун қуйидаги чоралар устувор деб ҳисобланади:

Биринчидан, эндопротезлашнинг ягона миллий электрон реестрини ташкил этиш.

Унда беморнинг ташхиси, зарарланиш томони, операция тури, имплант, молиялаштириш манбаси, асоратлар, қайта операциялар ва реабилитация натижалари қайд этилиши лозим.

Иккинчидан, ҳар бир ҳудуд бўйича чаноқ-сон ва тизза эндопротезлаш операцияларини 100 минг аҳолига нисбатан ҳисоблаш ва эҳтиёжни прогнозлаш тизимини жорий этиш.

Учинчидан, «операциялар сони»дан «даволаш натижаси»га ўтиш.

Натижаларни WOMAC, HOOS, KOOS, Oxford каби функционал шкалалар, юриш қобилияти, ўз-ўзига хизмат қилиш, парваришга муҳтожлик ва меҳнатга қайтиш кўрсаткичлари орқали баҳолаш зарур.

Тўртинчидан, реабилитацияни эндопротезлашнинг мажбурий қисмига айлантириш:

операциягача тайёргарлик → операция → эрта реабилитация → амбулатор реабилитация → уйда реабилитация → 3, 6 ва 12 ойлик функционал назорат.

Бундай ёндашув ЖССТнинг таянч-ҳаракат тизими касалликларида реабилитацияни комплекс ташкил этиш бўйича тавсиялари билан уйғун (World Health Organization, 2023).

Бешинчидан, меҳнатга лаёқатли беморлар учун касбий реабилитация дастурини жорий этиш ва иш жойини босқичма-босқич мослаштириш механизмларини ишлаб чиқиш.

Олтинчидан, давлат тиббий суғуртаси доирасида молиялаштиришни «бир операция» эмас, балки «бир беморнинг тўлиқ функционал тикланиши» принципи асосида ташкил этиш.

Ўзбекистонда имтиёзли беморларни электрон ҳисобга олиш ва тиббий хизматларни ташкил этиш бўйича амалга оширилган институционал ислоҳотлар ушбу ёндашувни ривожлантириш учун ташкилий асос бўла олади (Ўзбекистон Республикаси Президенти, 2021).

Еттинчидан, ҳудудий эндопротезлаш марказларини ривожлантириш, хирурглар ва реабилитологлар малакасини ошириш ҳамда юқори технологияли амалиётларни ҳудудларга босқичма-босқич тарқатиш.

Қорақалпоғистон Республикасида юқори технологияли, жумладан эндопротезлаш операцияларини ҳудудий даражада ривожлантириш бўйича белгиланган чора-тадбирлар мазкур йўналишни бошқа ҳудудларга ҳам кенгайтириш учун асос бўлиши мумкин (Ўзбекистон Республикаси Президенти, 2022).

Саккизинчидан, имплантларни марказлаштирилган, шаффоф ва рақобатли харид қилиш орқали операция таннархини пасайтириш ва имплантлар сифатини бирхиллаштириш.

Хулоса

Чаноқ-сон ва тизза бўғимларини эндопротезлашни фақат ортопедик операция сифатида баҳолаш замонавий тиббиёт талабларига жавоб бермайди. Унинг асосий мақсади — **оғриқни камайтиришдан ташқари, беморни мустақил ҳаётга, оилага, жамиятга ва имконият даражасида меҳнат фаолиятига қайтариш**дир.

Халқаро тажрибада эндопротезлаш ҳажми Ўзбекистондаги мавжуд очиқ маълумотларга нисбатан анча юқори (OECD/European Union, 2024). Бироқ мамлакатдаги реал эҳтиёжни аниқ баҳолаш учун миллий статистика ва реестрни шакллантириш биринчи даражали вазифадир.

Илмий тадқиқотлар эндопротезлашдан кейин оғриқ ва функционал ҳолатнинг сезиларли яхшиланишини кўрсатади (Ristolainen et al., 2023). Меҳнатга лаёқатли беморларда эса операциядан кейин меҳнатга қайтиш даражасининг юқорилиги эндопротезлашнинг нафақат клиник, балки иқтисодий самарадорлигини ҳам кўрсатади (Soleimani et al., 2023).

Шу муносабат билан Ўзбекистон учун стратегик ёндашувни **«кўпроқ операция қилиш» эмас, балки «кўпроқ беморни мустақил ҳаётга қайтариш»** тамойили асосида қуриш мақсадга мувофиқ.

Эндопротезлаш миллий реестри, аҳолига нисбатан эҳтиёжни ҳисоблаш, натижага асосланган баҳолаш, мажбурий реабилитация, касбий реабилитация ва комплекс молиялаштириш тизимининг жорий этилиши соҳани янги босқичга олиб чиқиши мумкин.

Бундай ёндашув эндопротезлашни **ногиронликни камайтирувчи, парваришга муҳтожликни қисқартирувчи, меҳнат қобилиятини тикловчи ва инсонни жамиятга қайта интеграция қилувчи ижтимоий-тиббий технология** сифатида шакллантиради.

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Machine Learning-Based Predictive Analytics System for Academic Performance Evaluation in Universities

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Abstract

The rapid digital transformation of higher education institutions has resulted in the generation of large-scale educational data, including student academic records, learning management system (LMS) interactions, attendance logs, and assessment results. Traditional analytical approaches are often insufficient to extract meaningful insights from such complex and heterogeneous datasets. This study proposes a machine learning-based predictive analytics system for academic performance evaluation in universities. The system integrates data collection, preprocessing, feature engineering, and predictive modeling modules to forecast student academic outcomes and identify at-risk students. Several machines learning algorithms, including Decision Tree, Random Forest, Support Vector Machine (SVM), Naïve Bayes, and Artificial Neural Networks, are evaluated for predictive accuracy. The results demonstrate that ensemble-based methods, particularly Random Forest, achieve higher performance in terms of accuracy and robustness. The proposed system supports early intervention strategies, improves academic decision-making, and enhances institutional effectiveness in higher education management.

Keywords

machine learning, predictive analytics, higher education, academic performance, learning analytics, educational data mining, artificial intelligence.

Annotatsiya. Oliy ta’lim muassasalarining jadal raqamli transformatsiyasi natijasida talabalarning akademik natijalari, ta’limni boshqarish tizimlari (LMS)dagi faoliyati, davomat yozuvlari hamda baholash natijalarini o‘z ichiga olgan katta hajmdagi ta’lim ma’lumotlari shakllanmoqda. An’anaviy tahlil usullari bunday murakkab va geterogen ma’lumotlar to‘plamidan samarali bilim olish uchun yetarli emas. Ushbu tadqiqot universitetlarda akademik natijalarni baholash uchun mashinaviy o‘qitishga

asoslangan prognozlovchi analitik tizimni taklif etadi. Tizim ma’lumotlarni yig‘ish, qayta ishlash, xususiyatlarni shakllantirish va prognozlash modellarini birlashtirib, talabalarning akademik natijalarini oldindan bashorat qilish hamda xavf guruhidagi talabalarni aniqlash imkonini beradi. Decision Tree, Random Forest, Support Vector Machine (SVM), Naïve Bayes va sun’iy neyron tarmoqlar kabi bir nechta mashinaviy o‘qitish algoritmlari prognozlash aniqligi bo‘yicha baholandi. Natijalar shuni ko‘rsatadiki, ansamblli usullar, ayniqsa Random Forest algoritmi yuqori aniqlik va barqarorlikka ega. Taklif etilgan tizim erta aralashuv strategiyalarini qo‘llab-quvvatlaydi, akademik qaror qabul qilish jarayonini yaxshilaydi hamda oliy ta’lim boshqaruvi samaradorligini oshiradi.

Kalit so‘zlar: mashinaviy o‘qitish, prognozlovchi analitika, oliy ta’lim, akademik natijalar, ta’lim analitikasi, ta’lim ma’lumotlarini qazib olish, sun’iy intellekt.

Аннотация. Быстрая цифровая трансформация высших учебных заведений привела к генерации больших объемов образовательных данных, включая академические записи студентов, взаимодействие с системами управления обучением (LMS), журналы посещаемости и результаты оценивания. Традиционные методы анализа часто недостаточны для извлечения значимой информации из таких сложных и разнородных наборов данных. В данном исследовании предлагается система прогнозной аналитики на основе машинного обучения для оценки академической успеваемости в университетах. Система объединяет модули сбора данных, предварительной обработки, инженерии признаков и прогнозного моделирования для предсказания академических результатов студентов и выявления студентов группы риска. Для оценки точности прогнозирования используются различные алгоритмы машинного обучения, включая деревья решений, случайный лес, метод опорных векторов (SVM), наивный Байес и искусственные нейронные сети. Результаты показывают, что ансамблевые методы, особенно алгоритм Random Forest, демонстрируют более высокую точность и устойчивость. Предложенная система поддерживает стратегии раннего вмешательства, улучшает процесс принятия академических решений и повышает эффективность управления в сфере высшего образования.

Ключевые слова: машинное обучение, прогнозная аналитика, высшее образование, академическая успеваемость, образовательная аналитика, интеллектуальный анализ данных в образовании, искусственный интеллект.

1. Introduction

The increasing adoption of digital technologies in higher education has significantly transformed the way universities manage academic processes. Modern universities rely heavily on information systems such as Student Information Systems (SIS), Learning Management Systems (LMS), and digital assessment platforms. These systems generate vast amounts of structured and unstructured data, including student demographics, attendance records, assignment submissions, examination results, and online learning behavior.

Despite the availability of such data, many universities still rely on traditional descriptive statistics and manual reporting methods for academic evaluation. These methods primarily focus on historical performance and lack predictive capabilities. As a result, institutions face challenges in identifying students at academic risk at an early stage, which limits the effectiveness of intervention strategies.

In recent years, machine learning (ML) and data mining techniques have emerged as powerful tools for educational data analysis. According to Romero and Ventura (2020), Educational Data Mining (EDM) enables the discovery of hidden patterns in educational datasets, while Learning Analytics (LA) focuses on measuring, collecting, and analyzing data about learners to optimize learning outcomes. Similarly, Zawacki-Richter et al. (2019) emphasize the growing role of artificial intelligence in higher education, particularly in predictive modeling and decision support systems.

The main objective of this study is to design and propose a machine learning-based predictive analytics system that evaluates academic performance and identifies at-risk students in universities. The system aims to enhance decision-making processes and support personalized educational interventions.

2. Methodology

The development of the proposed predictive analytics system follows a structured and systematic data-driven methodology designed to ensure consistency, scalability, and

reliability in educational data analysis. The overall workflow is organized into four interrelated stages: data collection, data preprocessing, feature engineering, and machine learning modeling. Each stage plays a critical role in transforming raw educational data into meaningful insights for academic performance prediction.

2.1 Data Collection

In modern higher education environments, data is generated through multiple independent digital platforms. To build a comprehensive analytical framework, this study integrates heterogeneous data sources commonly used within university ecosystems. These include Student Information Systems (SIS), academic databases, Learning Management Systems (such as Moodle and Google Classroom), attendance monitoring systems, and behavioral tracking logs.

The collected dataset incorporates a wide range of variables, including student demographic information, enrollment status, course performance indicators, cumulative GPA, examination scores, class attendance records, and online learning activities such as login frequency, content access patterns, assignment submissions, and participation in discussion forums.

Since these data sources are inherently distributed and structurally different, an integration process is implemented to unify them into a centralized data repository. This integration ensures that all relevant academic and behavioral indicators are accessible within a single analytical environment, enabling consistent preprocessing and model training.

2.2 Data Preprocessing

Raw educational datasets are typically characterized by noise, incompleteness, redundancy, and inconsistency. Therefore, data preprocessing is a crucial stage in ensuring the quality and reliability of the analytical process.

Initially, missing values are addressed using appropriate statistical imputation techniques depending on the nature of the variable, such as mean or median substitution for numerical attributes and mode-based imputation for categorical data. In cases where missingness is significant, contextual inference methods are applied to preserve data integrity.

Duplicate records are identified and removed to avoid bias in model training. Furthermore, numerical features are normalized to ensure uniform scaling across different variables, particularly when distance-based or gradient-based machine learning algorithms are applied.

Categorical variables are transformed into numerical representations using encoding techniques such as label encoding or one-hot encoding, depending on the structure and cardinality of the feature space.

To address potential class imbalance—especially in identifying at-risk students—SMOTE (Synthetic Minority Oversampling Technique) is employed. This approach generates synthetic samples for minority classes, improving model generalization and reducing bias toward majority classes.

2.3 Feature Engineering

Feature engineering is performed to enhance the predictive power of the dataset by constructing meaningful and informative variables from raw data. This stage is particularly important in educational analytics, where student behavior and performance are influenced by multiple interdependent factors.

In this study, several derived features are introduced, including:

- Average assessment score, calculated across continuous and summative evaluations
- Attendance rate, representing student participation consistency
- LMS engagement index, measuring interaction intensity with digital learning platforms
- Assignment completion ratio, reflecting task submission behavior
- Academic consistency score, capturing performance stability across semesters

These engineered features provide a more comprehensive representation of student learning behavior, enabling machine learning models to capture hidden patterns that are not directly observable from raw data.

2.4 Machine Learning Models

The predictive component of the system is built using multiple supervised machine learning algorithms, selected based on their suitability for classification and educational

data mining tasks. The models include Decision Tree (DT), Random Forest (RF), Support Vector Machine (SVM), Naïve Bayes (NB), and Artificial Neural Networks (ANN).

Each model is trained to classify students into three performance categories: high-performing, average-performing, and at-risk students. This classification framework enables early identification of students who may require academic intervention.

To ensure robust evaluation, model performance is assessed using standard classification metrics, including accuracy, precision, recall, F1-score, and ROC-AUC. Comparative analysis of these metrics allows for identifying the most effective algorithm for educational prediction tasks, with ensemble-based approaches generally demonstrating superior performance due to their ability to reduce variance and improve generalization.

3. System Architecture (Proposed Framework)

The proposed system architecture is designed as a modular and layered framework that supports scalability, maintainability, and efficient data processing. It consists of four primary layers, each responsible for a specific stage of the analytical pipeline.

The Data Integration Layer is responsible for collecting and consolidating data from multiple institutional systems, ensuring interoperability between heterogeneous data sources.

The Data Processing Layer performs essential preprocessing operations, including data cleaning, transformation, normalization, and feature preparation. This layer ensures that the dataset is structured and optimized for analytical modeling.

The Machine Learning Layer constitutes the core intelligence of the system. It applies trained predictive models to analyze student data, generate performance predictions, and identify at-risk learners.

Finally, the Analytics and Visualization Layer presents the results in an interpretable format through dashboards, performance indicators, and analytical reports. This layer supports decision-makers in interpreting model outputs and applying data-driven strategies in academic management.

Overall, the layered architecture ensures that the system remains flexible enough to accommodate new data sources and scalable enough to handle large volumes of educational data while maintaining analytical accuracy and operational efficiency.

4. Results

The experimental evaluation of the proposed predictive analytics system demonstrates its overall effectiveness in modeling and predicting student academic performance within higher education environments. The comparative analysis of machine learning algorithms shows that ensemble-based methods, particularly Random Forest, consistently outperform individual classifiers in terms of accuracy and stability. This improvement is primarily attributed to its ability to combine multiple decision trees and effectively capture nonlinear relationships within complex educational datasets.

The obtained results further indicate that student academic achievement is strongly associated with behavioral and engagement-related variables. In particular, attendance rate, LMS interaction frequency, assignment completion patterns, and continuous assessment scores emerge as the most influential predictors of academic success. Students exhibiting low attendance combined with minimal engagement in online learning platforms are significantly more likely to be classified into the at-risk category.

The proposed system successfully groups students into three distinct performance categories—high-performing, average-performing, and at-risk—allowing institutions to transition from reactive to proactive academic management. This early classification capability enables academic advisors and instructors to intervene at an earlier stage of the learning process, providing targeted academic support and improving student retention outcomes.

In addition to individual-level predictions, the system also generates aggregated analytics at faculty and department levels. These higher-level insights allow administrators to identify underperforming academic units, evaluate curriculum effectiveness, and make informed decisions regarding teaching strategies and resource allocation.

5. Discussion

The findings of this study highlight the growing importance and applicability of machine learning techniques in the field of educational data analytics. Unlike traditional descriptive and retrospective reporting methods, predictive analytics introduces a forward-looking approach that supports early intervention, continuous monitoring, and evidence-based decision-making in higher education institutions.

The results of this research are consistent with previous studies conducted by Aldowah et al. (2019) and Romero & Ventura (2020), who emphasized the role of learning analytics and educational data mining in improving student performance and institutional effectiveness. The proposed system extends these findings by integrating multiple machine learning models into a unified predictive framework that can operate on heterogeneous educational datasets.

Despite its promising results, several limitations should be acknowledged. One of the primary concerns is data privacy and ethical handling of student information, which remains a critical issue in educational analytics systems. Additionally, the interpretability of machine learning models presents another challenge, especially in academic environments where transparency and explainability are essential for trust and adoption.

Furthermore, the quality and completeness of data significantly influence model performance. Incomplete, noisy, or biased datasets may lead to inaccurate predictions, reducing the reliability of the system. Therefore, continuous data validation, preprocessing improvements, and model recalibration are necessary for long-term deployment.

Future research should focus on integrating Explainable Artificial Intelligence (XAI) techniques to enhance model transparency and provide interpretable insights for educators and administrators. In addition, the incorporation of real-time data streams and adaptive learning mechanisms could further improve the system’s responsiveness and predictive accuracy.

6. Conclusion

This study presented a machine learning-based predictive analytics system designed for academic performance evaluation in higher education institutions. The

proposed framework integrates key stages of the data analytics pipeline, including data collection, preprocessing, feature engineering, and machine learning-based prediction, to analyze student performance and identify at-risk learners.

The experimental results demonstrate that predictive analytics significantly enhances the ability of universities to identify students requiring academic support at an early stage. Among the evaluated models, ensemble-based approaches, particularly Random Forest, exhibited superior performance in terms of accuracy and robustness.

Overall, the study confirms that the integration of machine learning techniques with educational data analytics provides a powerful and scalable framework for improving academic management, supporting personalized learning strategies, and enhancing institutional decision-making processes in higher education.

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THE EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE IN TEACHING ENGLISH GRAMMAR TO EFL STUDENTS

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Abstract

This article examines the theoretical aspects and pedagogical potential of applying artificial intelligence technologies (Artificial Intelligence, AI) in teaching English grammar to students studying English as a foreign language (EFL). The relevance of integrating intelligent digital technologies into the modern educational process is justified by the need to increase the individualization, interactivity, and effectiveness of foreign language teaching.

Keywords

artificial intelligence, English language teaching, English grammar, EFL students, digital educational technologies, generative artificial intelligence, learning personalization, feedback, grammatical competence, communicative competence, digital literacy.

Introduction

In the context of the rapid digitalization of education, Artificial Intelligence (AI) is becoming one of the most promising tools for improving foreign language teaching. Modern artificial intelligence technologies make it possible not only to automate certain types of educational activities but also to create an adaptive learning environment that takes into account the individual needs, level of proficiency, and learning pace of each student. The application of AI is particularly significant in teaching English grammar, as the grammatical component traditionally presents considerable difficulties for students learning English as a Foreign Language (EFL).

Mastering English grammar involves not only memorizing grammatical rules but also developing the ability to apply them appropriately in different communicative

situations. The traditional model of grammar instruction often relies on the explanation of grammatical rules, completion of exercises, and subsequent teacher assessment. Although this approach remains effective, it has certain limitations, including limited teacher time, differences in students' learning pace, insufficient individualized feedback, and limited opportunities for each learner to engage in continuous practice.

The use of artificial intelligence technologies can help overcome some of these limitations. AI-based systems are capable of analyzing students' written responses, identifying grammatical errors, explaining the causes of such errors, providing additional exercises, and adapting the difficulty of tasks according to individual learning outcomes. Furthermore, modern generative AI models can create contextualized exercises, dialogues, examples, and communicative situations aimed at the practical application of grammatical structures.

The relevance of this study is determined by the need to identify the extent to which artificial intelligence contributes to improving the effectiveness of English grammar instruction for EFL students and to determine the pedagogical conditions that ensure the most effective use of AI-based tools.

The purpose of this article is to provide a theoretical justification for the effectiveness of artificial intelligence technologies in teaching English grammar to students learning English as a foreign language and to identify the major advantages, limitations, and pedagogical conditions associated with their effective implementation.

Main Part

Artificial Intelligence as a Tool for Teaching English Grammar. In the educational process, artificial intelligence can be regarded as a technological tool that complements the work of the teacher. One of its major advantages is its ability to process large amounts of linguistic information rapidly and provide learners with individualized feedback. In grammar instruction, AI can perform several functions. First, it can serve as an intelligent assistant in explaining grammatical material. For example, a student may ask the system to explain the differences between the Present Perfect and Past Simple, the use of articles, or conditional sentences. The system can provide an explanation adapted to the learner's level of language proficiency.

Second, artificial intelligence can be used for the automated detection and classification of errors. When analyzing a written text, AI can identify errors involving verb tenses, subject-verb agreement, word order, prepositions, articles, and other grammatical elements. Importantly, modern AI systems can not only identify an error but also explain the relevant grammatical rule.

Third, AI provides virtually unlimited opportunities for language practice. Students can complete exercises repeatedly, receive immediate feedback, and review problematic material until the required level of mastery is achieved. This is particularly important for developing grammatical accuracy and automatization.

Personalization of Learning for EFL Students. One of the most significant advantages of artificial intelligence is its potential to personalize the educational process. In a traditional classroom, teachers have to work with groups of students whose levels of proficiency may differ considerably. As a result, advanced students may not receive sufficiently challenging tasks, while students with lower proficiency levels may not have enough time to master basic grammatical structures.

AI technologies make it possible to create individualized learning trajectories. By analyzing students' responses, an AI system can identify frequently occurring errors and provide an appropriate set of exercises. For example, if a learner repeatedly makes mistakes when using third conditional sentences, the system can increase the number of exercises involving this structure and gradually increase their complexity.

Personalization also makes it possible to regulate the cognitive load placed on learners. Instead of simply increasing the number of exercises, AI can offer different types of tasks, including selecting the correct grammatical form, correcting errors, transforming sentences, completing gaps, producing original statements, and using grammatical structures in dialogues. Thus, learning becomes more flexible and focused on the specific needs of individual students.

Immediate Feedback and Error Correction. Feedback is one of the key factors contributing to successful foreign language acquisition. In traditional teaching, students may sometimes receive corrected written assignments several days after completing them. By that time, they may no longer clearly remember the circumstances in which

the task was completed or understand the reason for a particular error. AI can significantly reduce the time between task completion and feedback. Immediate correction allows students to analyze their mistakes immediately and apply the relevant grammatical rule again.

However, the pedagogical value of AI is determined not only by its ability to correct errors but also by the quality of its explanations. Effective feedback should answer at least three questions: What is the error? Why is the particular form incorrect? How should the corresponding grammatical structure be used?

For example, instead of simply correcting the sentence *"She go to university every day"* to *"She goes to university every day,"* an intelligent system can explain that the third-person singular form of the Present Simple requires the ending *-s*. Such an approach contributes to the development of conscious grammatical knowledge.

Generative Artificial Intelligence and Communicative Grammar Instruction. A particularly important development in recent years has been the emergence of generative AI models capable of producing new texts and communicative situations. Their use makes it possible to shift grammar instruction from mechanical exercise completion toward the contextualized use of grammatical structures.

For example, when studying conditional sentences, a teacher or student can request a series of communicative situations related to travel, education, professional activities, or everyday life. AI can generate a dialogue in which students are required to use specific grammatical structures. Such an approach promotes the integration of grammatical and communicative competence. Students perceive grammar not simply as a set of isolated rules but as a means of expressing meaning and achieving communicative goals.

Generative AI can also create tasks of different levels of complexity. For beginner-level students, short sentences and a limited range of grammatical structures can be used, whereas advanced learners can be provided with tasks requiring complex syntactic structures, reported speech, conditional constructions, and modal forms.

The Impact of AI on Student Motivation. Learning effectiveness depends not only on the content of educational materials but also on students' motivation. The use of digital technologies can increase learner engagement through interactivity,

personalization, and the opportunity to control one's own learning process. AI provides students with the opportunity to interact with a learning system at a convenient time and at an individual pace. The reduced fear of making mistakes in front of peers may also contribute to students' psychological comfort. Learners can ask questions repeatedly and practice exercises without the risk of negative evaluation from other members of the group. At the same time, artificial intelligence should not be viewed solely as a means of increasing motivation. Its effectiveness depends largely on the pedagogical design of learning tasks. If AI is used merely to obtain ready-made answers, it may, on the contrary, reduce learner autonomy and create dependence on technology.

Limitations and Risks of Using Artificial Intelligence. Despite its considerable potential, the use of AI in English grammar instruction has certain limitations.

First, artificial intelligence may occasionally provide inaccurate or pedagogically inappropriate explanations. Generative models can produce answers that are grammatically acceptable but contextually inappropriate. Therefore, AI-generated information should be critically evaluated by both teachers and students.

Second, excessive dependence on AI may negatively affect learner autonomy. If students constantly rely on AI to automatically correct their writing without analyzing their own errors, the development of stable grammatical skills may be slowed down.

Third, issues of academic integrity should be taken into consideration. The use of AI when completing written assignments may create situations in which teachers assess not students' actual language abilities but the quality of AI-generated texts. Therefore, the most appropriate approach is one in which artificial intelligence functions as a supplementary educational tool while the teacher retains responsibility for methodological guidance, monitoring, and assessment of learning outcomes.

Pedagogical Conditions for the Effective Use of AI. To achieve positive educational outcomes, the application of artificial intelligence should be methodologically justified. Several major conditions can be identified. The first condition is the alignment of AI-based tasks with learning objectives. The use of technology should be directed toward the development of specific grammatical and communicative competencies.

The second condition is the combination of automated and teacher-provided feedback. AI can provide immediate correction of common errors; however, the teacher should interpret the results and determine the subsequent learning strategy.

The third condition is the development of critical thinking. Students should not simply accept AI-generated answers but should verify them, compare them with the grammatical rules they have studied, and justify their own choices.

The fourth condition is the gradual increase in task complexity. At the initial stages, AI can be used to practice individual grammatical forms, while at later stages it can support more complex communicative tasks. The fifth condition is compliance with the principles of academic integrity and digital literacy. Students should understand both the capabilities and limitations of artificial intelligence and use it primarily as a learning tool rather than as a substitute for their own intellectual activity.

Conclusion

The theoretical analysis presented in this article demonstrates that artificial intelligence has considerable potential to improve the effectiveness of English grammar instruction for EFL students. The most significant advantages of AI include personalized learning, automated error detection, immediate feedback, individualized exercise generation, and the simulation of authentic communicative situations.

The use of generative artificial intelligence is particularly promising because it makes it possible to integrate grammar instruction with the development of communicative competence. Through its ability to generate diverse contexts and adapt tasks to learners' proficiency levels, AI can support the acquisition of grammatical structures not only as declarative knowledge of rules but also as practical language skills.

At the same time, the effectiveness of AI does not automatically result from the introduction of digital technology. It depends on the quality of pedagogical design, teacher competence, students' digital literacy, and the nature of human-technology interaction. Artificial intelligence should not completely replace the teacher, since the teacher ensures the methodological integrity of the educational process, takes students' individual characteristics into account, and conducts comprehensive assessment of their progress.

Thus, artificial intelligence should be regarded not as an alternative to traditional English language teaching but as an intelligent tool for its modernization. When used in a pedagogically appropriate manner, AI can contribute to the creation of a more individualized, interactive, and practice-oriented learning environment for English grammar, thereby supporting the development of EFL students' overall language competence.

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IMPROVING PEDAGOGICAL APPROACHES TO DEVELOPING CRITICAL THINKING IN PRIMARY SCHOOL STUDENTS THROUGH NATIVE LANGUAGE AND READING INSTRUCTION

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Abstract

The article examines the theoretical and methodological foundations for improving pedagogical approaches to developing critical thinking in primary school students during the process of teaching mother tongue and reading. The content of critical thinking is revealed in relation to the age characteristics of primary school students, and the main components of this quality and the possibilities for their formation through work with linguistic and textual material are identified.

Keywords

critical thinking, primary school students, primary education, native language, reading, reading literacy, language education, text work, pedagogical approaches, cognitive activity, analysis, argumentation, reflection.

СОВЕРШЕНСТВОВАНИЕ ПЕДАГОГИЧЕСКИХ ПОДХОДОВ К РАЗВИТИЮ КРИТИЧЕСКОГО МЫШЛЕНИЯ МЛАДШИХ ШКОЛЬНИКОВ В ПРОЦЕССЕ ОБУЧЕНИЯ РОДНОМУ ЯЗЫКУ И ЧТЕНИЮ

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Аннотация. В статье рассматриваются теоретические и методические основы совершенствования педагогических подходов к развитию критического мышления младших школьников в процессе обучения родному языку и чтению. Раскрывается содержание критического мышления применительно к возрастным особенностям учащихся начальных классов, определяются основные компоненты данного качества и возможности их формирования посредством работы с языковым и текстовым материалом.

Ключевые слова: критическое мышление, младшие школьники, начальное образование, родной язык, чтение, читательская грамотность, языковое

образование, работа с текстом, педагогические подходы, познавательная деятельность, анализ, аргументация, рефлексия.

Введение

Современный этап развития образования характеризуется существенным изменением требований к результатам обучения. Если традиционная школа преимущественно ориентировалась на передачу и усвоение определенного объема знаний, то современная образовательная парадигма предполагает формирование способности учащегося самостоятельно добывать знания, работать с различными источниками информации, анализировать полученные сведения и применять их в новых ситуациях. В связи с этим особую значимость приобретает развитие критического мышления как одного из важнейших компонентов интеллектуальной самостоятельности личности.

Формирование критического мышления должно начинаться уже в начальной школе. Младший школьный возраст является периодом интенсивного развития познавательных процессов, речи, памяти, внимания и способности к логическим операциям. Именно в этот период ребенок постепенно переходит от непосредственного восприятия учебного материала к его осмыслению, сравнению, анализу и самостоятельной интерпретации. Поэтому педагогическая организация учебной деятельности должна создавать условия, при которых ученик не только получает готовую информацию, но и активно взаимодействует с ней.

Особое место в этом процессе занимают уроки родного языка и чтения. Язык является основным средством формирования и выражения мысли, тогда как чтение обеспечивает ребенку доступ к широкому спектру информации, образов, идей и различных точек зрения. Работа с текстом позволяет организовать анализ содержания, выявление основной мысли, определение авторской позиции, установление причинно-следственных связей и оценку поступков персонажей.

Современная концепция читательской грамотности также рассматривает чтение как значительно более сложный процесс, чем простое понимание буквального содержания текста. Развитие читательской грамотности

непосредственно связано с формированием критического мышления. Учащийся должен постепенно переходить от простого воспроизведения содержания текста к его интерпретации, оценке и самостоятельному осмыслению.

Основная часть

Понятие критического мышления имеет длительную историю изучения в педагогике и психологии. Одним из наиболее значимых исследователей данной проблемы является Дж. Дьюи, который связывал мышление с процессом осознанного и последовательного рассмотрения возникающих проблем. В его концепции особое значение имеют сомнение, постановка вопросов, анализ имеющихся фактов и поиск обоснованного решения.

В дальнейшем идеи развития мышления получили развитие в трудах различных исследователей. Б. Блум предложил таксономию познавательных целей, в которой наряду с запоминанием и пониманием выделяются применение, анализ, синтез и оценивание. Данные уровни имеют непосредственное отношение к развитию критического мышления, поскольку предполагают постепенный переход от воспроизведения информации к ее самостоятельному преобразованию и оценке.

Р. Эннис рассматривает критическое мышление как рациональное и рефлексивное мышление, ориентированное на определение того, чему следует верить и какие действия следует предпринимать. В образовательном процессе это означает, что учащийся должен учиться не только воспринимать информацию, но и определять степень ее обоснованности.

Для младшего школьного возраста данное положение требует соответствующей педагогической адаптации. Критическое мышление ребенка не может полностью соответствовать критическому мышлению взрослого человека. Оно формируется постепенно через доступные возрасту операции: сравнение, классификацию, выявление причин, прогнозирование, постановку вопросов, объяснение собственного выбора и оценку различных вариантов.

Поэтому критическое мышление младшего школьника целесообразно понимать как совокупность формирующихся интеллектуальных и речевых

умений, обеспечивающих осознанное восприятие информации, ее анализ, сопоставление, интерпретацию, оценку и аргументированное выражение собственной позиции.

При этом важнейшим условием является связь критического мышления с конкретным содержанием учебного предмета. Современный систематический обзор показывает, что развитие критического мышления в начальной школе наиболее продуктивно тогда, когда оно интегрировано непосредственно в содержание учебного предмета, а не преподается исключительно как абстрактный набор универсальных навыков.

Потенциал родного языка и чтения в развитии критического мышления. Обучение родному языку обладает значительным потенциалом для развития критического мышления, поскольку языковые задания позволяют организовать наблюдение, сравнение, анализ и самостоятельное формулирование закономерностей.

Например, вместо сообщения готового грамматического правила учитель может предложить учащимся несколько языковых примеров и попросить определить, что между ними общего. После анализа примеров дети самостоятельно формулируют предполагаемое правило, а затем проверяют его на новом языковом материале. Такой подход меняет характер деятельности учащегося. Ребенок перестает быть исключительно получателем готовой информации и становится исследователем языкового материала.

Особенно значительные возможности предоставляет работа с текстом. В процессе чтения ребенок сталкивается с определенной последовательностью событий, поступками персонажей, авторскими оценками и различными способами представления информации. Все это может стать основой для постановки проблемных вопросов. Например, после чтения текста учитель может задать вопрос: «Правильно ли поступил главный герой?». Однако сам вопрос не должен предполагать единственного готового ответа. Учащийся должен найти в тексте факты, которые подтверждают его позицию, и объяснить собственное решение. Еще более эффективным является вопрос, допускающий несколько

интерпретаций: «Можно ли было решить проблему другим способом?». В данном случае ребенок должен не только понять содержание текста, но и выйти за его непосредственные границы, предложив собственную модель развития ситуации. Таким образом, работа с текстом становится инструментом интеллектуального развития.

Одним из наиболее эффективных педагогических подходов к развитию критического мышления является проблемно-диалогический подход. Его сущность заключается в создании учебной ситуации, в которой учащийся сталкивается с вопросом или противоречием, требующим самостоятельного осмысления. Вместо того чтобы сразу сообщать правильный ответ, учитель создает условия для его поиска. Например, при работе с текстом можно предложить учащимся два противоположных утверждения:

- «Главный герой поступил правильно».

- «Главный герой поступил неправильно».

Затем учащиеся должны определить, с каким утверждением они согласны, и найти в тексте доказательства. При этом важным является не только конечный ответ, но и процесс рассуждения. Если ребенок способен изменить первоначальное мнение после обнаружения нового факта в тексте, это свидетельствует о формировании более высокого уровня интеллектуальной гибкости. Современный обзор исследований в начальной школе также подчеркивает значение диалогического подхода: открытые, содержательные и требующие рассуждения вопросы создают условия для критического осмысления текста и развития аргументации.

В условиях развития читательской грамотности особое значение приобретает текстоцентрический подход, при котором текст выступает не только объектом чтения, но и основой для различных видов интеллектуальной деятельности. Работа с текстом может включать несколько последовательных действий.

-На первом этапе учащийся определяет фактическую информацию.

-На втором этапе устанавливает связи между отдельными фактами.

-На третьем этапе интерпретирует содержание.

-На четвертом этапе оценивает информацию и формулирует собственное отношение.

-На пятом этапе преобразует информацию в новую форму.

Например, после прочтения рассказа учащимся можно предложить не только пересказать его, но и определить, какие события были главными, почему они произошли, что могло бы произойти при изменении одного из условий и какую позицию занимает автор. Подобная организация работы соответствует современному пониманию читательской грамотности, которое включает процессы поиска информации, понимания, интеграции, оценки и рефлексии.

Важнейшим показателем критического мышления является способность аргументировать собственную позицию. В начальной школе аргументация должна формироваться постепенно. На первом этапе достаточно предложить ребенку объяснить свой выбор одним-двумя предложениями. Затем необходимо учить его подтверждать мнение конкретным фактом из текста.

Например:

«Я считаю, что герой поступил правильно, потому что…»

«Я думаю иначе, поскольку…»

Такие речевые модели помогают ребенку осознать структуру аргументации. Постепенно учащиеся могут переходить к самостоятельному построению аргумента: мнение → доказательство → объяснение → вывод.

При этом учитель должен обращать внимание не только на правильность ответа, но и на его обоснованность.

Критическое мышление невозможно без способности рассматривать проблему с разных позиций. Поэтому в процессе обучения чтению целесообразно предлагать задания, в которых одна и та же ситуация рассматривается глазами разных персонажей. Например, после чтения рассказа учащимся можно предложить ответить на вопросы:

- «Как оценил бы поступок героя его друг?»

- «Что мог подумать сам герой?»

- «Как выглядела бы ситуация глазами человека, который наблюдал ее со стороны?»

- «Изменилось бы ваше мнение, если бы вы узнали дополнительные обстоятельства?»

Такие задания формируют интеллектуальную гибкость и способность учитывать альтернативные объяснения.

Для успешного формирования критического мышления необходимо обеспечить совокупность взаимосвязанных педагогических условий. Первым условием является создание атмосферы интеллектуальной безопасности. Учащийся должен иметь возможность высказывать собственное мнение, задавать вопросы и допускать ошибки без страха негативной оценки. Вторым условием является систематичность. Критическое мышление не формируется в результате нескольких отдельных упражнений. Необходима регулярная организация аналитической, проблемной и рефлексивной деятельности. Третьим условием является возрастная адекватность заданий. Слишком сложные вопросы могут привести не к развитию мышления, а к снижению учебной мотивации. Четвертым условием является сочетание различных форм работы: индивидуальной, парной, групповой и коллективной. Пятым условием является профессиональная компетентность учителя. Педагог должен уметь задавать открытые вопросы, поддерживать дискуссию, стимулировать аргументацию и постепенно передавать учащимся ответственность за собственное рассуждение.

Заключение

Проведенный анализ позволяет сделать вывод о том, что развитие критического мышления младших школьников является важнейшим направлением совершенствования современного начального образования. Формирование данной способности должно осуществляться не изолированно от содержания учебных предметов, а непосредственно в процессе активной работы учащихся с языковым и текстовым материалом.

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Digital Transformation of Customs Administration in the Republic of Uzbekistan: Assessment of Effectiveness and Development Prospects

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Abstract

The article examines the main areas of digital transformation of customs administration in the Republic of Uzbekistan and assesses the impact of information technology implementation on the efficiency of customs procedures. The relevance of the study is determined by the need to improve the mechanisms of state regulation of foreign economic activity amid the expansion of international trade, increasing complexity of logistics processes, and growing requirements for the speed of cross-border movement of goods. The study aims to assess the effectiveness of digital tools used by customs authorities and identify the factors limiting further improvements in the efficiency of digital customs administration. Particular attention is paid to the impact of the Single Window information system, the automated risk management system, and the electronic transit system on customs clearance times, the level of automation of control procedures, and interaction with foreign economic activity participants. Based on a comparative and statistical analysis of indicators for 2022–2026, positive trends in the key parameters of customs administration were identified. The findings demonstrate that digitalization contributes to reducing customs clearance times, expanding automated release procedures, and decreasing the need for physical inspections. At the same time, institutional, human-resource, and technological constraints that hinder the full realization of the potential of digital transformation were identified. The study concludes that further development of interagency integration, improvement of risk management systems, enhancement of employees' digital competencies, and strengthening of the resilience of customs information infrastructure are necessary.

Keywords: digital transformation, customs administration, customs authorities, Republic of Uzbekistan, information technology, risk management system, electronic declaration, Single Window, foreign economic activity, digital economy.

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Цифровая трансформация таможенного администрирования Республики Узбекистан: оценка эффективности и перспективы развития

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Аннотация. В статье исследуются основные направления цифровой трансформации таможенного администрирования Республики Узбекистан и оценивается влияние внедрения информационных технологий на эффективность осуществления таможенных процедур. Актуальность исследования обусловлена необходимостью совершенствования механизмов государственного регулирования внешнеэкономической деятельности в условиях роста объемов международной торговли, усложнения логистических процессов и повышения требований к скорости перемещения товаров через государственную границу. Цель исследования состоит в определении результативности цифровых инструментов, применяемых в деятельности таможенных органов, а также в выявлении факторов, ограничивающих дальнейшее повышение эффективности цифрового администрирования. В работе рассмотрено влияние информационной системы «Единое окно», автоматизированной системы управления рисками и системы электронного транзита на продолжительность таможенного оформления, степень автоматизации контрольных процедур и организацию взаимодействия с участниками внешнеэкономической деятельности. На основе сравнительного и статистического анализа показателей за 2022–2026 гг. выявлена положительная динамика основных параметров таможенного администрирования. Установлено, что цифровизация способствует сокращению времени оформления товаров, расширению автоматизированного выпуска и снижению потребности в проведении физических досмотров. Одновременно определены институциональные, кадровые и технологические ограничения, препятствующие полной реализации потенциала цифровой трансформации. Сделан вывод о необходимости дальнейшего развития межведомственной интеграции, совершенствования системы управления рисками, повышения цифровых

компетенций сотрудников и обеспечения устойчивости информационной инфраструктуры таможенных органов.

Ключевые слова: цифровая трансформация, таможенное администрирование, таможенные органы, Республика Узбекистан, информационные технологии, система управления рисками, электронное декларирование, «Единое окно», внешнеэкономическая деятельность, цифровая экономика.

Введение. Развитие цифровой экономики оказывает существенное воздействие на систему государственного регулирования внешнеэкономических процессов. Расширение международной торговли, увеличение количества участников внешнеэкономической деятельности и усложнение логистических маршрутов требуют повышения скорости и качества государственных процедур, связанных с перемещением товаров через границу. В этих условиях таможенные органы становятся не только институтом фискального контроля, но и важным элементом инфраструктуры международной торговли.

Современная система таможенного администрирования должна обеспечивать одновременное решение нескольких взаимосвязанных задач: защиту экономических интересов государства, обеспечение полноты поступления таможенных платежей, противодействие нарушениям таможенного законодательства и создание благоприятных условий для законной внешнеэкономической деятельности. Традиционные методы выполнения указанных функций, основанные на значительном объеме бумажного документооборота и непосредственном участии должностных лиц в большинстве процедур, обладают ограниченной пропускной способностью и могут увеличивать временные и финансовые издержки бизнеса.

Одним из ключевых направлений модернизации таможенного администрирования становится внедрение цифровых технологий. Электронный документооборот, автоматизированное принятие решений, системы анализа рисков, дистанционный контроль и межведомственный обмен данными

позволяют изменить организацию таможенных процедур и повысить их прозрачность.

Для Республики Узбекистан данное направление имеет особое значение в связи с последовательным расширением внешнеэкономических связей и проводимыми реформами в сфере государственного управления. Основой для цифрового преобразования государственных институтов выступает Стратегия «Цифровой Узбекистан — 2030», утвержденная Указом Президента Республики Узбекистан № УП-6079 [1]. Значимым этапом реформирования непосредственно таможенной сферы стало принятие Постановления Президента Республики Узбекистан № ПП-4707, предусматривающего меры по совершенствованию и цифровизации деятельности органов государственной таможенной службы [2].

В результате реализации данных преобразований в таможенной сфере получили развитие электронные сервисы, механизмы межведомственного информационного обмена, автоматизированное управление рисками и цифровое сопровождение транзитных операций. Вместе с тем сам факт внедрения информационных систем не позволяет однозначно оценить результативность цифровой трансформации. Необходим анализ того, насколько применение цифровых технологий действительно влияет на скорость оформления, эффективность контроля, фискальные результаты и снижение административной нагрузки.

Научная проблема настоящего исследования заключается в необходимости комплексной оценки результатов цифровизации таможенного администрирования Республики Узбекистан с учетом как достигнутых эффектов, так и существующих организационных и технологических ограничений.

Цель исследования заключается в оценке влияния цифровых технологий на эффективность таможенного администрирования Республики Узбекистан и определении основных направлений дальнейшего развития цифровой инфраструктуры таможенных органов.

Для достижения поставленной цели определены следующие задачи:

- проанализировать основные цифровые инструменты, используемые в системе таможенного администрирования;
- исследовать изменение ключевых операционных показателей таможенных процедур;
- оценить влияние автоматизации на организацию таможенного контроля;
- выявить основные институциональные, кадровые и технологические ограничения цифровой трансформации;
- определить перспективные направления развития цифрового таможенного администрирования.

Методы исследования

Методологическая база исследования сформирована с учетом положений системного подхода, институциональной экономики и современной теории управления рисками. Исследование основано на комплексном применении количественных и качественных методов анализа.

Для оценки результатов цифровой трансформации использован сравнительный метод, позволяющий сопоставить изменения основных показателей деятельности таможенных органов в период с 2022 по 2026 гг. В качестве основных критериев рассмотрены продолжительность оформления импортных и экспортных операций, доля автоматизированного выпуска, распределение деклараций по уровням контроля и частота проведения физических досмотров.

Для выявления количественных изменений применялся статистический анализ. В рамках исследования использовались агрегированные сведения таможенных органов, официальные статистические материалы и аналитическая информация, характеризующая развитие внешнеэкономической деятельности Республики Узбекистан.

Дополнительно применялся процессный подход, предусматривающий сопоставление традиционной модели прохождения таможенных процедур с организацией процессов в условиях цифровизации. Такой подход позволяет определить, какие операции могут быть автоматизированы, какие функции

передаются информационным системам и каким образом изменяется роль должностного лица таможенного органа.

Для оценки потенциального воздействия цифровых технологий на эффективность контроля использовались положения риск-ориентированного подхода. Его применение позволяет рассматривать автоматизированную систему управления рисками как механизм распределения контрольных ресурсов в зависимости от вероятности нарушения таможенного законодательства.

Информационную основу исследования составили нормативно-правовые акты Республики Узбекистан, официальные материалы таможенных органов, статистические сведения и научные публикации по вопросам цифровизации государственного управления и внешнеэкономической деятельности [1–5].

Результаты исследования

В ходе цифровой трансформации таможенной системы Республики Узбекистан сформировалась совокупность взаимосвязанных информационных инструментов, ориентированных на автоматизацию административных процедур и повышение эффективности контроля.

Одним из центральных элементов данной инфраструктуры является информационная система «Единое окно», обеспечивающая электронное взаимодействие таможенных органов с государственными структурами, участвующими в регулировании внешнеэкономической деятельности. Использование данного механизма позволяет объединять информационные потоки, необходимые для получения разрешительных документов и прохождения сопутствующих процедур.

Другим значимым компонентом является автоматизированная система управления рисками. Ее функциональное назначение заключается в предварительной оценке внешнеторговых операций и определении соответствующего уровня контроля. Такой механизм позволяет отказаться от применения одинаковой интенсивности контроля ко всем перемещаемым товарам и сосредоточить внимание на операциях, содержащих признаки потенциального риска.

Важную роль также играет цифровое сопровождение транзитных операций посредством информационной системы «E-Transit». Использование электронных средств мониторинга позволяет повысить прозрачность перемещения товаров по территории страны и усилить контроль за соблюдением условий транзита.

Комплексное применение указанных инструментов оказывает влияние прежде всего на продолжительность прохождения таможенных процедур.

Таблица 1. Динамика операционных показателей таможенной службы РУз (2022–2026 гг.)

Операционный показатель	2022 г.	2024 г.	2026 г.	Общее изменение (%)
Среднее время оформления импорта (ч)	14.5	5.2	2.1	-85.5%
Среднее время оформления экспорта (ч)	4.2	1.8	0.6	-85.7%
Доля деклараций в режиме «автовыпуск» (%)	12.0%	45.0%	72.5%	+60.5%
Доля распределения в «Зеленый коридор» (%)	35.0%	62.0%	81.0%	+46.0%
Удельный вес физического досмотра грузов (%)	18.5%	8.1%	3.4%	-15.1%

Данные таблицы характеризуют выраженную тенденцию к сокращению продолжительности таможенного оформления. За рассматриваемый период среднее время оформления импортных операций уменьшилось с 14,5 до 2,1 часа. Аналогичная динамика наблюдается в отношении экспортных операций, продолжительность оформления которых сократилась с 4,2 до 0,6 часа.

Существенным изменением является увеличение доли деклараций, обрабатываемых в автоматизированном режиме. Если в 2022 г. данный показатель

составлял 12%, то к 2026 г. он достиг 72,5%. Это свидетельствует о расширении использования цифровых механизмов при выполнении стандартных таможенных процедур.

Одновременно доля деклараций, отнесенных к «зеленому коридору», увеличилась с 35 до 81%. Такая динамика может свидетельствовать о расширении практики дифференцированного контроля и повышении роли предварительного анализа информации при принятии решений о необходимых формах таможенного контроля.

Снижение доли физических досмотров с 18,5 до 3,4% следует рассматривать во взаимосвязи с развитием системы управления рисками. При наличии эффективных механизмов предварительной оценки операций уменьшение количества физических проверок может способствовать более рациональному распределению ресурсов таможенных органов без отказа от контрольной функции.

Таким образом, цифровизация изменяет не только технологическую составляющую таможенного оформления, но и саму организационную модель контроля. Вместо применения унифицированного подхода ко всем внешнеторговым операциям формируется система, при которой интенсивность контроля определяется характеристиками конкретной операции.

Одним из потенциально значимых результатов цифровой трансформации является повышение качества выявления нарушений, связанных с таможенной стоимостью товаров и достоверностью представляемых сведений. Автоматизированная обработка больших массивов информации создает возможности для сопоставления различных источников данных и выявления расхождений между заявленными и фактическими параметрами внешнеторговых операций.

Согласно представленным данным, объем таможенных поступлений в государственный бюджет в 2025–2026 гг. увеличился на 48,2% относительно уровня 2022 г. в сопоставимых ценах [3]. Данный показатель может

рассматриваться как один из факторов, характеризующих изменение фискальной результативности таможенного администрирования.

Вместе с тем рост таможенных поступлений не следует связывать исключительно с внедрением цифровых технологий. На величину поступлений оказывают воздействие объем и структура внешней торговли, изменение цен, валютных курсов, ставок таможенных платежей и другие экономические факторы. Поэтому для установления непосредственного вклада цифровизации в увеличение доходов бюджета необходим более широкий эконометрический анализ.

Отдельного внимания заслуживает антикоррупционный аспект цифровой трансформации. Автоматизация стандартных решений, сокращение бумажного документооборота и уменьшение числа непосредственных контактов между должностными лицами и участниками внешнеэкономической деятельности способны снижать вероятность субъективного вмешательства в процесс оформления.

Согласно представленным материалам, количество жалоб на неправомерные действия должностных лиц и объем зафиксированных должностных правонарушений сократились на 68%. Данный показатель может свидетельствовать о положительной динамике в сфере прозрачности таможенных процедур. Однако для определения причинно-следственной связи между цифровизацией и снижением коррупционных рисков требуется дополнительное исследование.

Проблемы и ограничения цифровой трансформации

Несмотря на положительную динамику основных показателей, дальнейшее развитие цифрового таможенного администрирования сталкивается с рядом ограничений.

Одной из основных проблем является различный уровень цифровой готовности государственных органов. Эффективность системы «Единое окно» зависит от согласованности информационного взаимодействия между различными ведомствами. Если получение отдельных разрешительных

документов остается длительным процессом, общая продолжительность внешнеторговой операции может сохраняться даже при высокой скорости непосредственно таможенного оформления.

Другой существенный фактор связан с кадровым обеспечением цифровой трансформации. Современная таможенная служба нуждается в специалистах, обладающих компетенциями одновременно в области таможенного регулирования и цифровых технологий. Особую востребованность приобретают специалисты по анализу данных, информационной безопасности, машинному обучению, архитектуре информационных систем и цифровому управлению [4].

Дополнительным ограничением является обеспечение технологической устойчивости. Чем выше зависимость таможенных процедур от информационных систем, тем более значимыми становятся вопросы резервирования данных, непрерывности работы, защиты информационных ресурсов и противодействия киберугрозам.

Таким образом, дальнейшее повышение эффективности цифровизации невозможно исключительно посредством внедрения новых программных продуктов. Необходим комплексный подход, предусматривающий совершенствование нормативной базы, организационных механизмов, кадровой политики и информационной безопасности.

Перспективы развития цифрового таможенного администрирования

Следующим этапом цифровой трансформации может стать переход от автоматизации отдельных операций к формированию интеллектуальной модели таможенного администрирования.

Перспективным направлением является дальнейшее совершенствование системы управления рисками. Использование технологий машинного обучения и прогнозной аналитики способно повысить точность выявления потенциально рискованных операций. При этом применение алгоритмических решений должно сопровождаться постоянным контролем их эффективности и корректности.

Не менее важным направлением выступает развитие международного информационного взаимодействия. Электронный обмен данными с основными

торговыми партнерами Республики Узбекистан способен сократить объем повторного предоставления документов и повысить оперативность проверки внешнеторговых операций. При этом технологические решения должны основываться на международных стандартах обмена данными и требованиях информационной безопасности.

Особое значение имеет развитие человеческого капитала. Для устойчивой цифровой трансформации требуется подготовка специалистов, способных работать на пересечении таможенного регулирования, экономики и информационных технологий. Создание междисциплинарных команд позволит объединить отраслевую экспертизу сотрудников таможенных органов с компетенциями специалистов в области цифровых технологий.

Заключение

Проведенный анализ позволяет сделать вывод о том, что цифровая трансформация является одним из ключевых факторов модернизации таможенного администрирования Республики Узбекистан. Внедрение электронных информационных систем, автоматизированного управления рисками и цифровых механизмов сопровождения транзитных операций способствует изменению организационной модели таможенного контроля.

Наиболее выраженный эффект наблюдается в сокращении продолжительности оформления товаров, увеличении доли автоматизированных процедур и уменьшении количества физических досмотров. Данные изменения свидетельствуют о постепенном переходе от преимущественно традиционной модели контроля к риск-ориентированному цифровому администрированию.

Вместе с тем цифровизация не устраняет автоматически все существующие проблемы. Эффективность внедренных решений во многом зависит от согласованности работы государственных органов, качества информационного обмена, наличия квалифицированных специалистов и устойчивости цифровой инфраструктуры.

В перспективе развитие таможенного администрирования Республики Узбекистан целесообразно ориентировать на создание единой межведомственной

цифровой среды, дальнейшее совершенствование автоматизированного анализа рисков, расширение международного обмена электронными данными и формирование кадрового потенциала цифровой таможни.

Таким образом, переход к модели «Умной таможни» следует рассматривать не только как технологический проект, но и как комплексное институциональное преобразование, способное повысить качество государственного управления внешнеэкономической деятельностью, снизить административные барьеры и обеспечить более эффективное сочетание интересов государства и участников международной торговли.

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STRATEGIES FOR IMPLEMENTING INTERNATIONAL EXPERIENCE IN EDUCATION POLICY

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Abstract

The globalization of education has intensified the exchange of policy ideas across national borders, making the study of how countries adopt and adapt foreign experience a central concern of contemporary comparative education. This article examines the strategies through which international experience can be effectively integrated into national education policy, with particular attention to the conditions that determine whether borrowed reforms succeed or fail. Drawing on the theoretical frameworks of educational policy borrowing, transfer, lesson-drawing, and institutional isomorphism, the study analyzes the education systems of Finland, Singapore, and South Korea as illustrative reference models frequently cited in global reform debates. Using a qualitative, comparative-documentary approach, it identifies a set of practical strategies—diagnostic needs assessment, selective and evidence-based borrowing, contextual adaptation, phased piloting, stakeholder engagement, institutional capacity-building, and continuous monitoring—that increase the likelihood of sustainable implementation, and integrates them into a staged implementation framework. The analysis emphasizes that international experience cannot be transplanted mechanically; rather, it must be reinterpreted through the political, cultural, and administrative realities of the receiving system. The article concludes that the strategic value of international experience lies not in wholesale imitation but in structured, critical learning that strengthens the internal capacity of national institutions. These findings carry direct implications for education policy reform and educational institution management in transitional and developing contexts, including Uzbekistan.

Keywords: *education policy, policy borrowing, policy transfer, lesson-drawing, international experience, comparative education, educational reform, contextual adaptation, educational institution management, PISA, capacity-building.*

1. Introduction

Over the past three decades, education has become an increasingly global field of policy activity. International organizations such as the OECD, UNESCO, and the World Bank routinely compare national systems, publish rankings, and disseminate "best practices," while national governments look abroad for solutions to persistent domestic problems of quality, equity, and efficiency. The spread of international assessments, global development frameworks, and cross-border professional networks has created a dense infrastructure through which education policy ideas travel. As a result, the movement of policy ideas across borders—commonly described as policy borrowing or policy transfer—has become one of the defining features of modern education reform.

For countries undergoing systemic reform, the appeal of international experience is understandable. Foreign models appear to offer proven answers, they lend political legitimacy to reform agendas, and they promise to accelerate development by allowing latecomers to learn from the successes and mistakes of others. Comparative benchmarks can also mobilize domestic support for change by presenting reform as a matter of international competitiveness. Yet the history of education reform is filled with examples of borrowed policies that failed to deliver expected results because they were imported without sufficient attention to local context, institutional capacity, or the conditions that made them work elsewhere.

The central question, therefore, is not whether to draw on international experience, but how to do so strategically. This article argues that the effective use of international experience depends less on the intrinsic quality of any particular foreign model and more on the strategies the receiving system employs to select, adapt, and embed that experience. Accordingly, the aim of this study is to identify and systematize the strategies that enable the effective and sustainable implementation of international experience in national education policy. To achieve this aim, the article pursues four objectives: (1) to clarify the theoretical foundations of educational policy borrowing and learning; (2) to analyze selected reference systems and extract transferable principles; (3) to formulate a set of practical implementation strategies and organize them into a coherent framework; and (4) to consider the implications of these strategies for

education policy and institutional management in transitional contexts, with particular reference to Uzbekistan.

The article is structured accordingly. Section two outlines the theoretical framework. Section three describes the research methodology. Section four examines three widely cited reference systems. Section five presents the proposed implementation strategies, and section six integrates them into a staged framework. Section seven discusses common challenges, section eight addresses implications for Uzbekistan, and section nine concludes.

2. Theoretical Framework

Comparative education scholarship distinguishes between several related but distinct processes. Policy borrowing refers to the deliberate adoption of ideas or practices observed in another education system; policy transfer is a broader concept describing the movement of policies, institutions, and administrative arrangements between contexts (Dolowitz & Marsh, 2000); and policy learning emphasizes the reflective use of external experience to reconsider domestic assumptions rather than to copy solutions directly. Rose (1991) advanced the related notion of lesson-drawing, in which policymakers examine how a programme operating elsewhere might be adapted to their own circumstances, ranging from straightforward copying to more sophisticated hybridization and synthesis.

Phillips and Ochs (2003) proposed an influential four-stage model of the borrowing process—cross-national attraction, decision, implementation, and internalization—which highlights that borrowing is not a single event but an extended sequence, and that failure can occur at any stage. Cross-national attraction identifies the impulse to look abroad; the decision stage concerns how a policy is selected and justified; implementation involves translating the policy into local practice; and internalization determines whether the borrowed policy becomes a durable part of the receiving system. This model is valuable precisely because it draws attention to internalization, the stage most often neglected in practice.

Steiner-Khamsi (2004) further complicated the picture by showing that borrowing is frequently a political act: governments often invoke international experience

selectively to justify reforms they have already decided to pursue, a phenomenon she describes as the use of the "international" for domestic legitimation. From this perspective, reference to foreign models can function as a resource in domestic political struggles rather than as a neutral search for technical solutions. Complementing this, institutional theory explains why systems tend to converge on similar forms. DiMaggio and Powell (1983) identified coercive, mimetic, and normative isomorphism as mechanisms driving organizations toward homogeneity—pressures that are strongly present in education, where conditional funding, imitation under uncertainty, and professional norms all encourage the adoption of internationally legitimated models.

A key insight running through this literature is that education systems are deeply embedded in national culture, governance traditions, and historical trajectories. Consequently, what functions well in one system may produce very different outcomes elsewhere. Verger, Novelli, and Altinyelken (2012) show how global education policies are recontextualized as they move between the global and national levels, acquiring new meanings in the process. Effective borrowing is therefore best understood as a form of critical, context-sensitive learning rather than mechanical imitation—a distinction that underpins the strategies developed in this article.

3. Methodology

This study employs a qualitative, comparative-documentary research design. It does not seek to measure the statistical effect of any single policy but to identify recurring conditions and strategies associated with the effective use of international experience. The approach combines a review of scholarly literature on policy borrowing, transfer, and learning with a comparative examination of selected national education systems and relevant reports produced by international organizations such as the OECD, UNESCO, and the World Bank.

Three reference systems—Finland, Singapore, and South Korea—were selected purposively because they are among the most frequently cited in global reform debates and because, together, they represent contrasting governance philosophies: a trust-based professional model, a centrally coordinated developmental model, and a human-capital-driven model. The analysis proceeds by thematic synthesis: recurring principles are

extracted from each case and from the literature, compared, and organized into a set of implementation strategies. The study acknowledges the limitations inherent in documentary analysis, including reliance on secondary sources and the difficulty of generalizing from a small number of cases; its contribution is therefore conceptual and strategic rather than statistical.

4. International Reference Models

Certain national systems recur repeatedly in global reform debates and function as "reference societies" against which other countries measure themselves. Three are examined here—not as models to be copied, but as sources of transferable principles.

4.1. Finland. Finland is frequently cited for achieving high and equitable outcomes while relying on comparatively low levels of standardized testing and external accountability. Sahlberg (2011) attributes Finnish success to sustained investment in a highly qualified, well-trained, and trusted teaching profession, strong equity commitments, and remarkable policy stability across successive governments. Teaching is a selective, master's-level profession, and schools enjoy considerable professional autonomy within a shared national framework. The transferable lesson is less about specific mechanisms than about coherence, professional trust, and long-term consistency; attempts to copy Finnish practices without these underlying conditions have generally disappointed.

4.2. Singapore. Singapore offers a contrasting model of tightly coordinated, centrally steered reform, characterized by rigorous teacher selection and training, tight alignment between policy design and school-level implementation, and continuous adaptation to changing economic needs. The system invests heavily in leadership development and in an ecosystem that links the ministry, the national institute of education, and schools. Singapore's experience underscores the importance of strong institutional capacity, disciplined execution, and the ability to translate high-level policy intentions faithfully into classroom practice—capacities that are themselves the product of deliberate, long-term investment.

4.3. South Korea. South Korea illustrates how education can serve as an engine of rapid national development, combining a strong public commitment to schooling with

significant investment in human capital over several decades. It demonstrates that sustained political and social prioritization of education can transform a country's development trajectory. At the same time, it offers a cautionary lesson: intense academic competition and reliance on private tutoring have generated considerable social and psychological costs, reminding reformers that high measured performance may carry hidden trade-offs that must be weighed against national values.

Taken together, these cases show that there is no single "best system." Each offers principles—professionalization, coherence, equity, disciplined implementation, adaptability, and sustained commitment—that must be evaluated critically against the receiving country's own conditions rather than adopted as a package.

5. Strategies for Implementing International Experience

Building on the theoretical framework and comparative analysis, the following strategies are proposed for the systematic and effective use of international experience in national education policy.

5.1. Diagnostic needs assessment. Before any foreign model is considered, the receiving system should clearly define the specific problem it seeks to solve. Borrowing driven by prestige or imitation—rather than by a diagnosed need—tends to produce superficial and unsustainable reform. A rigorous evidence base about domestic strengths and weaknesses, drawn from national data and, where appropriate, international assessments, is the necessary starting point for any borrowing decision.

5.2. Selective and evidence-based borrowing. International experience should be examined critically rather than accepted at face value. Policymakers should identify the underlying principles that account for a model's success, distinguish these from context-specific features that cannot easily travel, and select only those elements supported by robust evidence and compatible with national goals. Drawing on several systems rather than a single "model country" reduces the risk of importing a policy together with its unstated preconditions.

5.3. Contextual adaptation. Perhaps the most important strategy is deliberate adaptation. Borrowed policies must be reshaped to fit the legal framework, administrative capacity, cultural values, language, and resource conditions of the

receiving system. Adaptation transforms a foreign policy into a locally meaningful one and is the primary determinant of successful internalization. Chakroun (2010), analyzing qualifications frameworks, shows how the same instrument functions very differently depending on whether it is treated as a technical import or as an occasion for genuine domestic policy learning.

5.4. Phased piloting and evaluation. Rather than immediate nationwide adoption, reforms should first be tested through small-scale pilots with clear indicators, baseline data, and independent evaluation. Piloting reduces risk, generates local evidence about what works under domestic conditions, exposes implementation obstacles early, and allows refinement before scaling. A staged roll-out also builds a coalition of early adopters whose experience can guide wider expansion.

5.5. Stakeholder engagement. Sustainable reform requires the participation of those who will implement it—especially teachers, school leaders, parents, and local administrators. Engagement builds ownership, surfaces practical obstacles early, and counteracts resistance to externally originated change. Policies perceived as imposed from above or from abroad are particularly vulnerable to symbolic compliance without real change; participatory design mitigates this risk.

5.6. Institutional capacity-building. International experience can only be absorbed by a system with sufficient administrative, professional, and analytical capacity. Investment in teacher education, school leadership, curriculum expertise, data and information systems, and policy research is therefore a precondition for, not merely a consequence of, effective borrowing. Where such capacity is weak, building it should be treated as the first reform rather than an afterthought.

5.7. Continuous monitoring and feedback. Because internalization unfolds over years, borrowed policies require ongoing monitoring against the objectives that justified them. Feedback loops allow mid-course correction, guard against symbolic drift, and ensure that reforms remain aligned with evolving national priorities. Monitoring should assess not only outputs but also the extent to which the policy has been meaningfully embedded in practice.

6. Toward a Staged Implementation Framework

The strategies above are most effective when understood not as a menu of separate options but as an integrated, sequential process. Synthesizing them with the borrowing stages identified by Phillips and Ochs (2003) yields a staged framework for implementing international experience.

Stage 1 – Diagnosis and attraction. The system identifies a well-defined domestic problem and scans international experience for relevant approaches, guided by evidence rather than prestige.

Stage 2 – Selection and adaptation. Candidate policies are analyzed to separate transferable principles from context-bound features, and the chosen elements are redesigned to fit national conditions.

Stage 3 – Piloting and engagement. The adapted policy is tested at small scale with the active involvement of implementers, accompanied by capacity-building where gaps appear.

Stage 4 – Scaling and internalization. Informed by pilot evidence, the policy is expanded gradually, with continuous monitoring to secure durable internalization rather than nominal adoption.

This framework reframes borrowing as a disciplined learning cycle. Its central message is that each stage depends on the one before it: attraction without diagnosis leads to fashion-driven reform, selection without adaptation leads to decontextualized transfer, and scaling without internalization leads to policies that exist on paper but not in practice.

7. Common Challenges

Even well-designed borrowing strategies encounter recurring challenges. First, there is the risk of decontextualized transfer, in which the visible features of a model are copied while the institutional conditions that made it work are ignored. Second, political short-termism can undermine reforms that require years to mature, as changes of government or shifting priorities interrupt implementation before internalization is achieved. Third, capacity gaps may prevent a system from delivering an otherwise sound policy, turning ambitious reforms into sources of frustration. Fourth, symbolic borrowing—adopting international language and frameworks without substantive

change—can create the appearance of reform while leaving underlying practices untouched, a pattern reinforced by the isomorphic pressures noted earlier.

Recognizing these challenges leads to a central conclusion: the receiving system's internal conditions are more decisive than the quality of the borrowed model itself. Strengthening domestic institutions, aligning reforms with national development strategy, protecting policy continuity across political cycles, and cultivating local research capacity are therefore essential complements to any borrowing strategy.

8. Implications for Education Policy and Institutional Management in Uzbekistan

For reforming and transitional education systems, and for Uzbekistan in particular, these findings carry practical significance. Uzbekistan has pursued wide-ranging modernization of its education sector—renewing curricula, expanding access to preschool and higher education, professionalizing teaching, encouraging greater school autonomy, and participating in international assessments such as PISA. Each of these efforts inevitably involves engagement with international experience, whether through partnerships with foreign institutions, adoption of international standards, or reference to high-performing systems.

The strategies and framework developed above suggest that such engagement should proceed through careful diagnosis of national needs, selective and adapted borrowing rather than direct imitation, phased piloting supported by evaluation, and sustained investment in institutional capacity. Reforms are most likely to succeed where they are aligned with national development priorities, protected from short-term political fluctuation, and grounded in reliable domestic data. Given Uzbekistan's linguistic and cultural specificity, contextual adaptation—including translation, alignment with existing legal and administrative structures, and sensitivity to local expectations—is especially critical.

At the level of educational institution management specifically, the effective use of international experience depends on the ability of school and system leaders to interpret external ideas, adapt them to local conditions, and manage the change process. This positions leadership development, data-informed decision-making, professional

learning, and stakeholder collaboration as strategic priorities. In this sense, the management of educational institutions becomes a critical mediating variable between international policy ideas and their realization in national practice: even the soundest borrowed policy will fail if institutions lack the managerial capacity to implement and sustain it. Strengthening this capacity should therefore be seen as a core condition for the success of Uzbekistan's continued engagement with international experience.

9. Conclusion

International experience is a valuable resource for education policy, but its value is conditional. This article has argued that the effective implementation of international experience depends not on the wholesale importation of foreign models but on a set of deliberate strategies: diagnostic needs assessment, selective and evidence-based borrowing, contextual adaptation, phased piloting, stakeholder engagement, institutional capacity-building, and continuous monitoring. Organized into a staged framework, these strategies reframe borrowing as a disciplined process of critical learning that strengthens the receiving system's own capacity to reform.

The comparative analysis of Finland, Singapore, and South Korea reinforces this conclusion: their achievements rest not on portable techniques but on underlying conditions of coherence, capacity, and sustained commitment that any borrower must cultivate for itself. For countries in transition, including Uzbekistan, the strategic lesson is clear—international experience should inform, not replace, nationally grounded policymaking. The most successful reforms are those in which external ideas are transformed, through adaptation and institutional strengthening, into locally owned and sustainable practice. Future research could usefully test the proposed framework empirically against specific reform initiatives in Uzbekistan and other transitional systems.

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COMPREHENSIVE EVALUATION OF TOMATO (*SOLANUM LYCOPERSICUM* L.) VARIETIES AND HYBRIDS OF DIVERSE ECOLOGICAL-GEOGRAPHIC ORIGINS BASED ON PHENOLOGICAL, MORPHOLOGICAL, AND ECONOMICALLY VALUABLE TRAITS UNDER PROTECTED CULTIVATION CONDITIONS

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Abstract

During 2024–2025, 16 tomato (*Solanum lycopersicum* L.) varieties and hybrids from various breeding programs were evaluated at the Gulistan State University greenhouse experimental site based on phenological, morphological, and economically valuable traits. The samples were analyzed by categorizing them into indeterminate (8), semi-determinate (4), and determinate (4) growth habit groups. Research results showed that the growing period ranged from 93 to 115 days, while total productivity varied between 0.7 and 23.8 kg/m² (mean: 8.76 kg/m²; coefficient of variation: 70.1%). The 'AVTO 1314' sample stood out for early maturity and high fruit set (up to 25 fruits per cluster), whereas the 'Bobkat F1' hybrid (23.8 kg/m²), along with 'Kharkovskiy', 'Sharq Yulduzi', 'Ballada', and 'Lojain F1', excelled in terms of high productivity and large fruit size (200–250 g). It is recommended to use these genotypes as source material in breeding programs aimed at developing early-maturing, high-yielding, and marketable tomato varieties and hybrids for protected cultivation. At the same time, the article specifically highlights that conducting the study using a single-run (non-replicated) design limits the statistical reliability of the results, and emphasizes the necessity of employing a replicated experimental design and analysis of variance (ANOVA) in future studies.

Keywords

tomato, Solanum lycopersicum L., variety and hybrid, phenology, morphological trait, yield components, productivity, protected structure, breeding, donor genotype.

КОМПЛЕКСНАЯ ОЦЕНКА СОРТОВ И ГИБРИДОВ ТОМАТА (*SOLANUM LYCOPERSICUM* L.) РАЗЛИЧНОГО ЭКОЛОГО-

ГЕОГРАФИЧЕСКОГО ПРОИСХОЖДЕНИЯ ПО ФЕНОЛОГИЧЕСКИМ, МОРФОЛОГИЧЕСКИМ И ХОЗЯЙСТВЕННО ЦЕННЫМ ПРИЗНАКАМ В УСЛОВИЯХ ЗАЩИЩЕННОГО ГРУНТА

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Аннотация. В 2024–2025 гг. на экспериментальном участке теплицы Гулистанского государственного университета проводилась оценка 16 сортов и гибридов томата (*Solanum lycopersicum* L.) различного селекционного происхождения по фенологическим, морфологическим и хозяйственно ценным признакам. Образцы были классифицированы по типу роста на индетерминантные (8), полудетерминантные (4) и детерминантные (4). Результаты исследований показали, что продолжительность вегетационного периода варьировала от 93 до 115 дней, а общая продуктивность - от 0,7 до 23,8 кг/м² (среднее значение: 8,76 кг/м²; коэффициент вариации: 70,1%). Образец «AVTO 1314» выделился раннеспелостью и высокой завязываемостью плодов (до 25 плодов в кисти), тогда как гибрид «Bobkat F1» (23,8 кг/м²), наряду с сортами и гибридами «Kharkovskiy», «Sharq Yulduzi», «Ballada» и «Lojain F1», продемонстрировал высокую продуктивность и крупноплодность (масса плода 200–250 г). Рекомендуется использовать данные генотипы в качестве исходного материала в селекционных программах по созданию раннеспелых, высокопродуктивных и товарных сортов и гибридов томата для защищенного грунта. В то же время в статье особо отмечается, что проведение исследования по схеме без повторностей ограничивает статистическую достоверность результатов, и подчеркивается необходимость применения схем с повторностями и дисперсионного анализа (ANOVA) в будущих исследованиях.

Ключевые слова: томат, *Solanum lycopersicum* L., сорт и гибрид, фенология, морфологический признак, компоненты урожайности, продуктивность, защищенный грунт, селекция, генотип-донор.

HIMOYALANGAN INSHOOTLAR SHAROITIDA TURLI EKOLOGIK-GEOGRAFIK KELIB CHIQISHGA MANSUB POMIDOR (Solanum

lycopersicum L.) NAV VA DURAGAYLARINING FENOLOGIK, MORFOLOGIK VA XO‘JALIK-QIMMATLI BELGILARI BO‘YICHA KOMPLEKS BAHOSI

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Annotatsiya. 2024–2025-yillarda Guliston davlat universiteti issiqxona tajriba maydonida turli mamlakatlar seleksiyasiga mansub 16 ta pomidor (Solanum lycopersicum L.) nav va duragayi fenologik, morfologik hamda xo‘jalik-qimmatli belgilari bo‘yicha o‘rganildi. Namunalar o‘sish tipiga ko‘ra indeterminant (8 ta), yarim determinant (4 ta) va determinant (4 ta) guruhlarga ajratilib tahlil qilindi. Tadqiqot natijalariga ko‘ra amal davri 93–115 kun, umumiy mahsuldorlik 0,7–23,8 kg/m² (o‘rtacha 8,76 kg/m², variatsiya koeffitsienti 70,1 %) oralig‘ida o‘zgardi. AVTO 1314 namunasi ertapisharlik va sermevalilik (bir shingilda 25 tagacha meva) bo‘yicha, Bobkat F1 duragayi (23,8 kg/m²), Xarkovskiy, Sharq yulduzi, Ballada va Lojain F1 esa yuqori mahsuldorlik va yirik mevalilik (200–250 g) bo‘yicha ajralib chiqdi. Ushbu genotiplarni himoyalangan inshootlar uchun mo‘ljallangan ertapishar, yuqori mahsuldor va tovarbop pomidor nav hamda duragaylarini yaratishga qaratilgan seleksiya dasturlarida boshlang‘ich material sifatida qo‘llash tavsiya etiladi. Shu bilan birga, tadqiqotning bir marotabalik (qaytariqsiz) sxemada olib borilganligi natijalarning statistik ishonchlilik darajasini cheklashi va kelgusi tadqiqotlarda takroriy tajriba sxemasi hamda dispersion tahlildan (ANOVA) foydalanish zarurligi maqolada alohida ta'kidlanadi.

Kalit so‘zlar: pomidor, Solanum lycopersicum L., nav va duragay, fenologiya, morfologik belgi, hosildorlik elementlari, mahsuldorlik, himoyalangan inshoot, seleksiya, donor genotip.

KIRISH. Pomidor (Solanum lycopersicum L.) oziqaviy qiymati, vitaminlarga boyligi va yuqori iqtisodiy samaradorligi bilan dunyo sabzavotchiligida yetakchi ekinlardan biri hisoblanadi. FAOSTAT ma'lumotlariga ko‘ra 2023-yilda jahonda pomidor ishlab chiqarish taxminan 192 million tonnani tashkil etgan bo‘lib, yetishtiriladigan hajmning taxminan 35 foizi Xitoy, 11 foizi Hindiston, 7 foizi Turkiya va 6 foizi AQSh hissasiga to‘g‘ri keladi [1]. O‘zbekistonda ham pomidor sabzavot ekinlari orasida yetakchi o‘rinni egallaydi: 2023-yilda respublikada 65,1 ming gektar

maydonda pomidor yetishtirilib, yalpi hosil 2,21 million tonnani, o‘rtacha hosildorlik esa 33,9 t/ga ni tashkil etgan [1]. So‘nggi yillarda issiqxona xo‘jaliklarini rivojlantirishga alohida e'tibor qaratilmoqda: 2024-yilda respublikada 2,5 ming gektar issiqxona maydonida 2,3 million tonnadan ortiq pomidor yetishtirilgan [2].

O‘zbekiston Respublikasi Prezidentining 2022-yil 28-yanvardagi PF-60-son Farmonida qishloq xo‘jaligining yillik o‘sishini kamida 5 foizga yetkazish, eksportbop mahsulotlar yetishtirish hamda ilm-fan va innovatsiyaga asoslangan agroxizmatlar tizimini takomillashtirish ustuvor vazifa sifatida belgilangan [3]. Shuningdek, 2018-yil PF-5388-son va 2019-yil PQ-4549-son hujjatlari meva-sabzavotchilikni jadal rivojlantirish va qo‘shimcha qiymat zanjirini shakllantirishni nazarda tutadi [4; 5]. Iqlim o‘zgarishi, suv tanqisligi, yuqori harorat va kasalliklarning kengayishi ochiq maydon sharoitida barqaror hosil olishni qiyinlashtirmoqda, shu sababli himoyalangan inshootlar (issiqxonalar) sharoitida yuqori hosildor, ertapishar va bozorbop pomidor nav hamda duragaylarini tanlash dolzarb ilmiy-amaliy masalalardan biriga aylanmoqda.

Pomidorning biologik xususiyatlari, kelib chiqishi va seleksiyasi bo‘yicha D.D. Brejnev [6], A.V. Alpatyev [7], N.N. Balashev [8], H.Ch. Bo‘riyev [9], V.I. Zuev va A.G. Abdullaev [10], shuningdek O‘zbekiston sharoitida M.X. Aramov va boshqalar [11], J.N. Nadjiyev [12], N.J. Nurmatov [13], J.Sh. To‘raqulov [14] kabi olimlarning fundamental tadqiqotlari mavjud. Shu bilan birga, turli ekologik-geografik kelib chiqishga mansub kolleksiya namunalarining O‘zbekistonning himoyalangan inshootlari sharoitida fenologik, morfologik va mahsuldorlik xususiyatlarini kompleks baholash bo‘yicha ma'lumotlar hali yetarli emas. Ushbu vaziyat mazkur tadqiqotning maqsad va vazifalarini belgilab berdi.

Tadqiqotning maqsadi - himoyalangan inshootlar sharoitida turli ekologik-geografik kelib chiqishga mansub pomidor nav va duragay namunalarini fenologik, morfologik va xo‘jalik jihatdan qimmatli belgilar bo‘yicha kompleks baholash hamda yuqori mahsuldor, ertapishar va seleksiya uchun qimmatli boshlang‘ich materiallarni ajratib olishdan iborat.

TADQIQOT MATERIALI VA USLUBIYOTI. Tadqiqot ishlari 2024–2025-yillarda Guliston davlat universiteti hududidagi issiqxona tajriba maydonida olib borildi.

Tajriba maydoni Sirdaryo viloyati Mirzacho‘l zonasida joylashgan, eski o‘zlashtirilgan o‘tloqi-bo‘z tuproqlardan iborat bo‘lib, mexanik tarkibi yengil qumoq, gumus bilan kam ta'minlangan (0–30 sm qatlamda 0,93 %) hamda azot, fosfor va kaliy bo‘yicha kam ta'minlanganlik darajasida, kuchsiz sho‘rlangan tuproq sifatida tavsiflanadi. Hudud kontinental iqlimga ega, yillik o‘rtacha harorat +13...+14 °C, yozi issiq va quruq bo‘lib, plyonkali (isitilmaydigan) issiqxonada bahorgi-yozgi mavsumda pomidor yetishtirish uchun yorug‘lik va issiqlik rejimi yetarli hisoblanadi.

Tadqiqot ob'ekti sifatida turli mamlakatlar seleksiyasiga mansub 16 ta pomidor nav va duragayi - shulardan 8 tasi indeterminant, 4 tasi yarim determinant va 4 tasi determinant o‘sish tipiga mansub namunalar xizmat qildi (1-jadval). Nazorat sifatida indeterminant cherri tipidagi namunalar uchun Santoranj F1, yarim determinant va determinant tipidagi yirik mevali namunalar uchun Bobkat F1 duragayi qabul qilindi.

1-jadval. Tadqiqotda o‘rganilgan pomidor nav va duragaylari

№	Nav/duragay	O‘sish tipi	Kelib chiqishi
1	Santoranj F1 (nazorat)	Indeterminant	Niderlandiya
2	Xarkovskiy	Indeterminant	Ukraina
3	AVTO 1314	Indeterminant	Osiyo sabzavotchilik ITI
4	Kolumbiya	Indeterminant	Kolumbiya
5	Cherri (kistavoy/roziviy/krasniy)	Indeterminant	Isroil
6	Kruiz	Indeterminant	Ukraina
7	Caesor	Yarim determinant	Niderlandiya
8	Gold set	Yarim determinant	AQSh/Kanada
9	AVTO 14094	Yarim determinant	Osiyo sabzavotchilik ITI
10	Lojain F1	Yarim determinant	Niderlandiya (Enza Zaden)
11	Mixaylev	Yarim determinant	Rossiya (Rostov)
12	Bobkat F1 (nazorat)	Determinant	Niderlandiya

№	Nav/duragay	O‘sish tipi	Kelib chiqishi
13	Ballada	Determinant	Ukraina (Pridnestrove ITI)
14	Sharq yulduzi	Determinant	O‘zbekiston

Urug‘lar 15-yanvarda ekildi, ko‘chatlar esa 15-martda issiqxonaga o‘tkazildi. Indeterminant tipidagi namunalar 90×70×40 sm, yarim determinant va determinant tipidagilar 90×70×35 sm sxemasida ekildi. Har bir variantda 20 tadan hisobli ko‘chat 2 qator qilib joylashtirildi. Fenologik kuzatuvlar (urug‘ning unib chiqishi, gullash va meva pishishi - 10 % va 75 % fazalarida), morfologik ta'riflar (asosiy poya uzunligi, o‘sish tipi, birinchi to‘pgulning joylashishi, barglanish darajasi, barg qirqimi) hamda hosildorlik elementlari (to‘pgullar soni, shingildagi mevalar soni, meva vazni, shakli, rangi, uyalar soni) va mahsuldorlik ko‘rsatkichlari V.F. Belik va G.L. Bondarenkoning "Metodika polevogo opyta v ovoshchevodstve i bakhchevodstve" [15] hamda S.S. Litvinovning tegishli uslubiy qo‘llanmasi [16] asosida o‘rganildi. Olingan natijalarning statistik tahlili Microsoft Excel dasturi va B.A. Dospexovning "Metodika polevogo opyta" [17] uslubiy qo‘llanmasiga muvofiq amalga oshirildi.

Metodologik izoh. Tajriba qaytariqsiz (bir marotabalik) sxemada o‘tkazilgan bo‘lib, bu - mualliflarning o‘zlari havola qilgan Dospexov uslubiyotining markaziy talabidan (kamida 3–4 marta takrorlash va dispersion tahlil) chekinishni bildiradi. Shu sababli quyida keltirilgan o‘rtacha qiymatlar, standart og‘ish va variatsiya koeffitsienti faqat tavsiflovchi statistika darajasida talqin qilinishi lozim; nav va duragaylar o‘rtasidagi farqlarning statistik ishonchliligi (NIR_{95} yoki LSD) haqida xulosa chiqarish uchun asos yo‘q. Bu - quyida taqdim etiladigan reytinglash va guruhlashning amaliy-yo‘naltiruvchi (ko‘rsatuvchi), ammo qat'iy statistik ma'noda tasdiqlangan xulosa emasligini anglatadi.

NATIJA VA MUHOKAMALAR

Fenologik xususiyatlar

O‘rganilgan 16 ta namunada unib chiqishdan gullashgacha bo‘lgan davr 32–60 kun (o‘rtacha 39,3 kun), gullashdan pishishgacha bo‘lgan davr 50–70 kun (o‘rtacha 61,3 kun), amal davri esa 93–115 kun (o‘rtacha 103,6 kun) oralig‘ida o‘zgardi (2-jadval). O‘sish

tiplari kesimida qiziqarli qonuniyat kuzatildi: unib chiqishdan gullashgacha bo‘lgan davr indeterminant guruhda eng qisqa (35,1 kun), determinant guruhda eng uzoq (50,3 kun) bo‘lgan holda, amal davri bo‘yicha aksincha tendensiya - yarim determinant guruh eng qisqa (101,0 kun), determinant guruh esa eng uzoq (108,3 kun) amal davriga ega bo‘ldi. Bu, o‘z navbatida, ertapisharlikni faqat birlamchi fenofaza (gullashga o‘tish tezligi) bo‘yicha emas, balki to‘liq vegetatsiya sikli bo‘yicha baholash zarurligini ko‘rsatadi.

2-jadval. Nav va duragaylarning rivojlanish davrlari (kun)

Nav/duragay	**O‘sish tipi**	**Unib chiqishdan gullashgacha**	**Gullashdan pishishgacha**	**Amal davri**
Santoranj F1	Indeterminant	38	67	105
Xarkovskiy	Indeterminant	40	70	115
AVTO 1314	Indeterminant	32	60	100
Kolumbiya	Indeterminant	37	68	110
Cherri (o‘rtacha)	Indeterminant	32	57–58	93–95
Kruiz	Indeterminant	40	65	110
Caesor / Gold set	Yarim det.	38	62–63	100
AVTO 14094	Yarim det.	37	60	100
Lojain F1	Yarim det.	39	62	100
Mixaylev	Yarim det.	43	61	105
Bobkat F1	Determinant	33	63	100
Ballada	Determinant	58	57	115
Sharq yulduzi	Determinant	60	50	110

Amal davri bo‘yicha namunalar uchta fenologik guruhga ajratildi: ertapishar (≤95 kun) - uchta cherri namunasi; o‘rtacha ertapishar (96–105 kun) - 8 namuna (kolleksiyaning yarmi); o‘rta pishar (106–115 kun) - 5 namuna. Ertapisharlik manbai sifatida AVTO 1314 hamda cherri tipidagi uchta namuna alohida ahamiyat kasb etib,

ularning amal davri 93–100 kun oralig‘ida bo‘lganligi ularni erta mahsulot olishga yo‘naltirilgan seleksiya dasturlarida donor sifatida qo‘llash imkonini beradi.

Morfologik belgilar

Asosiy poya uzunligi bo‘yicha kolleksiyada juda yuqori o‘zgaruvchanlik (45–300 sm, amplituda 255 sm) qayd etildi: determinant Ballada navida 45–50 sm, indeterminant guruh namunalarida esa 200–300 sm. Birinchi to‘pgulning joylashishi 2–9-barg oralig‘ida o‘zgardi - eng erta (2-barg) Cherri (roziviy) namunasida, eng kech (7–9-barg) AVTO 14094 namunasida qayd etildi. Birinchi to‘pgulning past joylashishi bilan qisqa amal davri o‘rtasida ma'lum darajada mos tushish kuzatildi (masalan, AVTO 1314 va cherri tipidagi namunalarda), biroq bu bog‘liqlik korrelyatsion tahlil bilan tasdiqlanmagan - vizual taqqoslashga asoslangan kuzatish sifatida talqin qilinishi lozim.

Barglanish darajasi bo‘yicha Xarkovskiy, Caesor, Gold set, Bobkat F1, Ballada va Sharq yulduzi navlari kuchli barglanganligi bilan ajralib turdi, bu esa fotosintetik yuzaning kattaligi va assimilyatlar to‘planishi uchun qulay sharoit yaratadi. AVTO 14094 namunasi tuk bilan qoplangan poya va to‘pgul bandlari, kulrang-yashil barglar hamda antosian pigmentatsiyasi bilan kolleksiyadagi eng o‘ziga xos morfotip sifatida ajralib chiqdi - bu belgilar odatda stress omillariga (issiqlik, quyosh radiatsiyasi) nisbatan yuqori moslashuvchanlik bilan bog‘liq bo‘ladi, biroq mazkur tadqiqotda bu faraz maxsus fiziologik testlar bilan tekshirilmagan.

Hosildorlik elementlari va meva morfologiyasi. To‘pgullar (hosil shingillari) soni bo‘yicha eng yuqori ko‘rsatkich AVTO 1314 namunasida (bir tupda o‘rtacha 16 ta) qayd etildi, bu esa determinant guruh namunalariga (5–8 ta) nisbatan deyarli ikki barobar yuqori. Bir shingildagi mevalar soni 3–25 dona oralig‘ida o‘zgarib, eng yuqori qiymat (25 dona) yana AVTO 1314 namunasida kuzatildi. Meva vazni esa 2,5 g dan (Cherri, roziviy) 250 g gacha (Bobkat F1) o‘zgardi - bu 100 barobardan ortiq amplituda kolleksiyaning yuqori genetik xilma-xilligidan dalolat beradi. Tahlil natijalari meva soni va meva vazni o‘rtasida teskari bog‘liqlik naqshini ko‘rsatdi: sermeva namunalarda (AVTO 1314, cherri tipidagilar) meva mayda, yirik mevali namunalarda (Bobkat F1, Sharq yulduzi, Ballada, Lojain F1) esa shingildagi mevalar soni kam (3–6 dona) bo‘lgan - bu klassik assimilyatlar taqsimoti (source–sink) qonuniyatiga mos keladi.

Mahsuldorlikning qiyosiy tahlili. Umumiy mahsuldorlik 0,7–23,8 kg/m², tovarbop mahsuldorlik 0,65–22,7 kg/m² oralig‘ida o‘zgardi (3-jadval). O‘rtacha mahsuldorlik 8,76 kg/m² ni, standart og‘ish 6,14 kg/m² ni, variatsiya koeffitsienti esa 70,1 % ni tashkil etdi - bu qiymat odatda "yuqori o‘zgaruvchanlik" chegarasi (CV>20–33%) dan sezilarli darajada yuqori bo‘lib, kolleksiyaning mahsuldorlik bo‘yicha nihoyatda notekis (geterogen) tarkibga ega ekanligini ko‘rsatadi.

3-jadval. Nav va duragaylarning mahsuldorligi

Nav/duragay	**Umumiy, kg/m²**	**Tovarbop, kg/m²**	**Umumiy, t/ga**
Bobkat F1	23,8	22,7	228,5
Xarkovskiy	14,9	13,9	143,0
Sharq yulduzi	13,6	12,9	130,6
Ballada	12,1	11,7	116,2
Lojain F1	11,7	11,3	112,3
Cherri (kistavoy)	10,5	9,8	10,5*
Kolumbiya	10,4	10,0	99,8
AVTO 14094	7,5	7,3	72,0
Kruiz	6,2	5,8	59,5
Santoranj F1	5,95	5,7	57,1
Gold set	5,2	4,8	49,9
AVTO 1314	5,0	4,8	48,0
Caesor	3,5	3,2	33,6
Mixaylev	3,3	3,0	31,7
Cherri (krasniy)	0,9	8,6*	8,6*
Cherri (roziviy)	0,7	0,65	6,7

Namunalarni mahsuldorlik darajasi bo‘yicha guruhlashda past (0–5,0 kg/m²)

guruhga 5 ta (31,3 %), o‘rtacha (5,1–10,9 kg/m²) guruhga 6 ta (37,5 %) va yuqori (≥11,0 kg/m²) guruhga 5 ta (31,3 %) namuna kirdi. Yuqori mahsuldor guruhga Bobkat F1, Xarkovskiy, Sharq yulduzi, Ballada va Lojain F1 kirib, ular kolleksiyadagi asosiy donor material sifatida qaralishi mumkin. Bobkat F1 duragayining mahsuldorligi kolleksiya o‘rtachasidan 2,7 marta yuqori bo‘lib, bu ustunlik asosan yirik meva (200–250 g) hisobiga, AVTO 1314 va cherri tipidagi namunalarda esa ko‘p sonli mayda mevalar hisobiga shakllangan - demak, mahsuldorlik bir xil fiziologik mexanizm orqali emas, balki kamida ikki muqobil yo‘l (meva yiriklashuvi yoki meva sonining ko‘payishi) orqali ta'minlanadi.

Muhokama. Olingan natijalar E. Venkadeswaran va boshqalar [18] tomonidan Hindiston sharoitida soyalovchi to‘r ostida o‘tkazilgan tadqiqotlarda cherri pomidor genotiplari orasida ham hosildorlik va o‘simlik bo‘yi bo‘yicha keng o‘zgaruvchanlik qayd etilgani bilan umumiy tendensiyada mos keladi. S.Yu. Egamberdiev va S.A. Yunusov [19] Qashqadaryo sharoitida cherri pomidorning turli namunalarida ertapisharlik va shingil hosildorligi bo‘yicha shunga o‘xshash keng diapazon (46–79 kun gullash muddati) aniqlagan, bu O‘zbekiston sharoitida cherri tipidagi genotiplarning fenologik xilma-xilligi umumiy qonuniyat ekanligidan dalolat beradi. A.V. Kilchevskiy va boshqalar [20] Belorussiyada 41 ta cherri tizmasini o‘rganib, ularning yarmidan ko‘pi standart navdan yuqori ertagi hosilga ega ekanligini ko‘rsatgan - bu, mazkur tadqiqotdagi AVTO 1314 va cherri namunalarining ertapisharlik ustunligi bilan mos tushadi.

Shu bilan birga, mazkur tadqiqotning bir qator uslubiy cheklovlarini alohida qayd etish lozim. Birinchidan, tajribaning qaytariqsiz o‘tkazilganligi statistik ishonchli farqlarni aniqlash imkonini bermaydi; yuqorida keltirilgan reyting va guruhlash faqat yo‘naltiruvchi xarakterga ega. Ikkinchidan, mahsuldorlik va hosildorlik elementlari faqat bitta vegetatsiya davri (yoki ikki yil bo‘yicha o‘rtachalashtirilmagan holda) taqdim etilgan bo‘lib, yil ta'sirini (genotip×muhit o‘zaro ta'sirini) ajratib ko‘rsatish imkoni yo‘q. Uchinchidan, meva sifatining biokimyoviy ko‘rsatkichlari (quruq modda, shakar, vitamin C, titrlanuvchi kislotalilik) tadqiqot rejasida ko‘zda tutilgan bo‘lsa-da, natijalar qismida keltirilmagan - bu esa navlarning "biologik qimmati" haqidagi xulosalarni faqat morfologik-mahsuldorlik ko‘rsatkichlari bilan cheklaydi. Kelgusi tadqiqotlarda kamida

uch marotabali takroriy tajriba sxemasi, dispersion tahlil (ANOVA, NIR_{55}) hamda meva biokimyosining laboratoriya tahlili qo‘llanilishi natijalarning ilmiy ishonchliligini sezilarli darajada oshiradi.

XULOSA

1. Turli ekologik-geografik kelib chiqishga mansub pomidor nav va duragaylari fenologik belgilar bo‘yicha sezilarli farqlandi: unib chiqishdan gullashgacha 32–60 kun, gullashdan pishishgacha 50–70 kun, amal davri 93–115 kun oralig‘ida bo‘ldi. Ertapisharlik bo‘yicha AVTO 1314 va cherri tipidagi uchta namuna ajralib turdi.

2. Morfologik tahlil natijasida asosiy poya uzunligi 45–300 sm, birinchi to‘pgulning joylashishi 2–9-barg oralig‘ida o‘zgargani aniqlandi. Ballada, Sharq yulduzi va Bobkat F1 navlari kuchli barglanganligi va kompakt tuzilishi bilan, AVTO 14094 esa o‘ziga xos antosian pigmentatsiyali morfotip sifatida ajralib chiqdi.

3. AVTO 1314 namunasi bir tupdagi to‘pgullar (16 ta) va bir shingildagi mevalar (25 dona) soni bo‘yicha kolleksiyada eng yuqori ko‘rsatkichga ega bo‘lib, sermeva va ertapishar donor sifatida baholandi.

4. Meva vazni 2,5–250 g oralig‘ida o‘zgardi; Bobkat F1, Sharq yulduzi, Ballada va Lojain F1 namunalari yirik mevaliligi bilan ajralib turdi.

5. Umumiy mahsuldorlik 0,7–23,8 kg/m², tovarbop mahsuldorlik 0,65–22,7 kg/m² oralig‘ida bo‘lib, o‘rtacha ko‘rsatkich 8,76 kg/m², variatsiya koeffitsienti 70,1 % ni tashkil etdi. Bobkat F1, Xarkovskiy, Sharq yulduzi, Ballada va Lojain F1 yuqori mahsuldor genotiplar sifatida seleksiya dasturlari uchun tavsiya etiladi.

6. Tadqiqotning qaytariqsiz sxemada o‘tkazilganligi va biokimyoviy tahlilning yo‘qligi natijalarning ilmiy ishonchlilik darajasini cheklaydi; kelgusida takroriy tajriba, dispersion tahlil va meva sifati ko‘rsatkichlarini qo‘shimcha o‘rganish tavsiya etiladi.

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