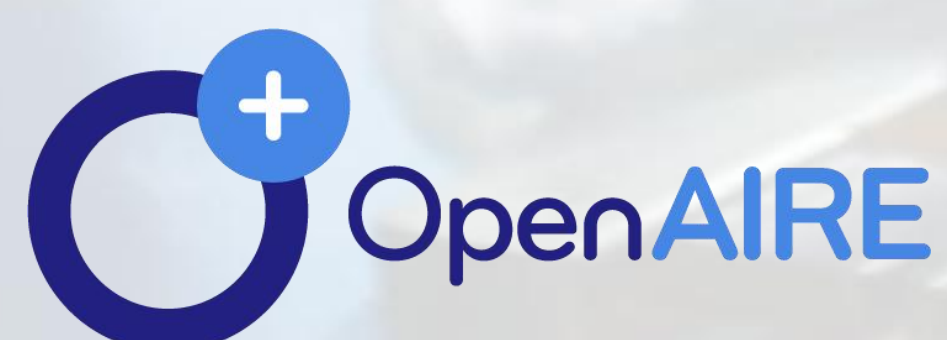


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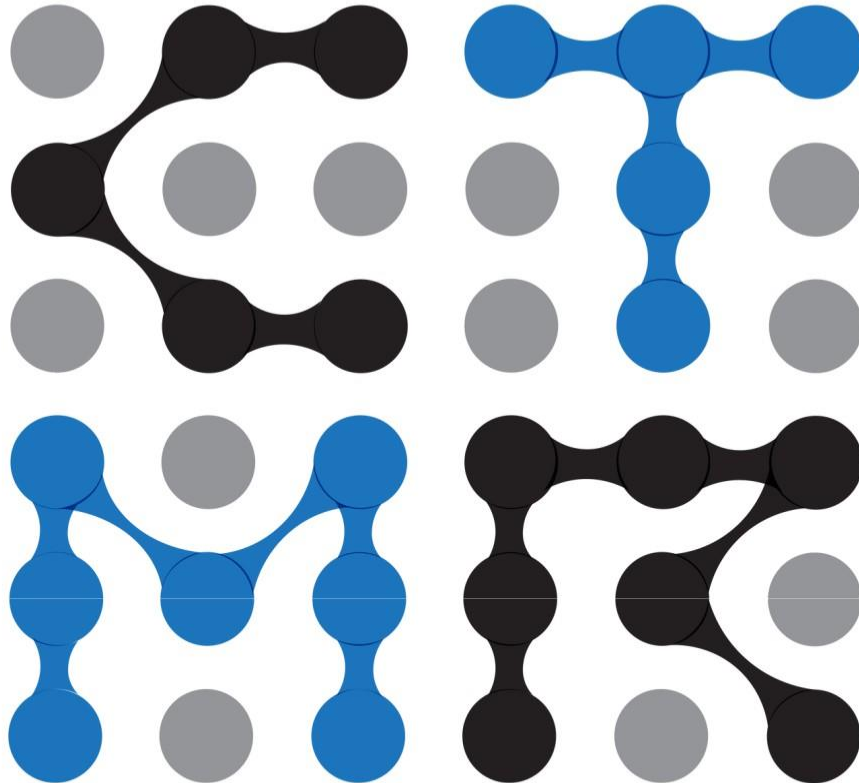
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Elmanov Muxammadali To`ra o`g`li
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Annotatsiya. Ushbu tezisda regbi sportini jismoniy madaniyat tizimiga joriy etishning pedagogik va metodik asoslari nazariy jihatdan yoritilgan. Regbi sportining ta'lim jarayonidagi o'rni, talabalarning jismoniy sifatlarini rivojlantirishdagi ahamiyati hamda jamoaviylik, irodaviylik va tezkor qaror qabul qilish ko'nikmalarini shakllantirishdagi pedagogik imkoniyatlari tahlil etilgan. Shuningdek, regbi mashg'ulotlarini tashkil etishning samarali usullari, o'quv jarayoniga integratsiya qilish yo'llari va zamonaviy jismoniy tarbiya tizimidagi o'rni ilmiy-nazariy jihatdan asoslab berilgan. Mazkur tezis regbi sportini jismoniy tarbiya va sport ta'limida qo'llashning muhim pedagogik vosita ekanligini ochib beradi.

Kalit so'zlar. regbi sporti, jismoniy madaniyat, pedagogik yondashuv, metodika, sport ta'limi, jismoniy tayyorgarlik, talaba-yoshlar, jamoaviylik, sport o'yinlari, ta'lim jarayoni.

Kirish

Hozirgi davrda jismoniy madaniyat va sport sohasini rivojlantirish, yoshlarning sog'lom turmush tarzini shakllantirish hamda ularning jismoniy tayyorgarligini oshirish ta'lim tizimining ustuvor yo'nalishlaridan biri hisoblanadi. Ayniqsa, oliy ta'lim muassasalarida jismoniy tarbiya jarayonini zamonaviy sport turlari asosida tashkil etish, talabalarning har tomonlama jismoniy rivojlanishini ta'minlashda muhim omil bo'lib xizmat qiladi. Shu nuqtai nazardan, jismoniy tarbiya mashg'ulotlarida yangi va samarali sport turlarini joriy etish dolzarb vazifalardan biri sanaladi. Bugungi kunda sport o'yinlari talabalarning jismoniy, funksional va psixologik tayyorgarligini oshirishda muhim vosita sifatida e'tirof etilmoqda. Bunday sport turlaridan biri bo'lgan regbi o'zining serharakatligi, jamoaviyligi va yuqori jismoniy yuklama talab etishi bilan boshqa sport o'yinlaridan ajralib turadi. Regbi sporti nafaqat jismoniy sifatlarni rivojlantiradi, balki talabalarda tezkor fikrlash, to'g'ri qaror qabul qilish, jamoada ishlash, intizom va mas'uliyat kabi muhim ijtimoiy-psixologik ko'nikmalarni ham shakllantiradi.

Rivojlangan mamlakatlar tajribasi shuni ko'rsatadiki, regbi sporti ta'lim tizimida samarali qo'llanilayotgan sport turlaridan biri bo'lib, talabalarning jismoniy faolligini oshirish, sog'lom turmush tarzini targ'ib etish va sportga bo'lgan qiziqishni kuchaytirishda muhim ahamiyat kasb etadi. Shu bilan birga, regbi mashg'ulotlarini to'g'ri tashkil etish, uning pedagogik va metodik asoslarini ishlab chiqish hamda o'quv jarayoniga moslashtirish masalalari ilmiy jihatdan yoritilishi zarur.

Shu bois regbi sportini jismoniy madaniyat ta'limiga joriy etishning pedagogik va metodik asoslarini tahlil qilish, uning ta'lim jarayonidagi o'rni va ahamiyatini ilmiy-nazariy jihatdan asoslab berish muhim masalalardan biri hisoblanadi. Mazkur maqolada regbi sportini jismoniy tarbiya tizimiga joriy etishning nazariy jihatlari, pedagogik imkoniyatlari va metodik yondashuvlari yoritib beriladi [1].

Regbi sportining jismoniy madaniyat tizimidagi o'rni va ahamiyati

Zamonaviy jismoniy madaniyat tizimida sport o'yinlari talaba-yoshlarning jismoniy va ma'naviy rivojlanishida muhim o'rin tutadi. Ayniqsa, jamoaviy sport turlari yoshlarning jismoniy tayyorgarligini oshirish, ularning ijtimoiy faolligini kuchaytirish va sog'lom turmush tarzini shakllantirishda samarali vosita hisoblanadi. Shunday sport turlaridan biri bo'lgan regbi sporti jismoniy madaniyat tizimida o'ziga xos o'rin egallaydi.

Regbi sporti yuqori darajadagi jismoniy faollikni talab qiluvchi, tezkorlik, kuch, chidamlilik va epchillik kabi jismoniy sifatlarni kompleks ravishda rivojlantiruvchi sport o'yinidir. Ushbu sport turi bilan muntazam shug'ullanish natijasida talabalarda yurak-qon tomir tizimi faoliyati yaxshilanadi, mushaklar kuchi va umumiy jismoniy tayyorgarlik darajasi oshadi. Shu bilan birga, regbi mashg'ulotlari talabalarning koordinatsion qobiliyatlarini rivojlantirish, harakatlar aniqligi va tezkorligini ta'minlashda ham muhim ahamiyat kasb etadi [2].

Jismoniy madaniyat tizimida regbi sportining ahamiyati nafaqat jismoniy rivojlanish bilan cheklanib qolmaydi. Mazkur sport turi talabalarda jamoaviylik, hamkorlik, o'zaro hurmat va intizom kabi ijtimoiy-psixologik fazilatlarni shakllantirishga ham xizmat qiladi. O'yin jarayonida har bir ishtirokchi jamoaning umumiy natijasi uchun mas'uliyatni his etadi, bu esa ularda liderlik qobiliyatlari, muammoli vaziyatlarda to'g'ri qaror qabul qilish va tezkor fikrlash ko'nikmalarini rivojlantiradi.

Bugungi kunda oliy ta'lim muassasalarida jismoniy tarbiya mashg'ulotlarini samarali tashkil etishda sport o'yinlaridan foydalanish muhim metodik vosita sifatida qaralmoqda. Regbi sporti o'zining dinamikligi va jamoaviy xarakteri bilan talabalarning dars jarayoniga qiziqishini oshiradi, ularni faol harakatga undaydi hamda mashg'ulotlarning samaradorligini ta'minlaydi. Shu sababli regbi sportini jismoniy madaniyat tizimiga joriy etish, uni o'quv mashg'ulotlari va sport to'garaklari orqali keng qo'llash dolzarb masalalardan biri hisoblanadi.

Shuningdek, regbi sporti yoshlar o'rtasida sog'lom turmush tarzini targ'ib qilish, bo'sh vaqtni mazmunli tashkil etish hamda sport madaniyatini shakllantirishda muhim vosita bo'lib xizmat qiladi. U talabalarning nafaqat jismoniy, balki ma'naviy va ijtimoiy jihatdan ham kamol topishiga ijobiy ta'sir ko'rsatadi. Shu bois regbi sportini jismoniy madaniyat tizimida samarali qo'llash, uning pedagogik va metodik imkoniyatlaridan to'liq foydalanish bugungi kun ta'lim jarayonining muhim vazifalaridan biri hisoblanadi [3].

Regbi sportini joriy etishning pedagogik asoslari

Regbi sportini jismoniy madaniyat tizimiga joriy etish, avvalo, ta'lim jarayonining pedagogik tamoyillari asosida amalga oshirilishi lozim. Zamonaviy pedagogik yondashuvlar jismoniy tarbiya mashg'ulotlarida talabalarning faolligini oshirish, ularning mustaqil fikrlashini rivojlantirish va jamoaviy hamkorlikni shakllantirishni asosiy vazifa sifatida belgilaydi. Shu nuqtai nazardan, regbi sporti o'zining jamoaviy va harakatchan xususiyati bilan ta'lim jarayonida samarali pedagogik vosita sifatida namoyon bo'ladi.

Pedagogik jihatdan regbi sportini joriy etish talabalarning yosh va jismoniy imkoniyatlarini hisobga olgan holda bosqichma-bosqich tashkil etilishi zarur. Dastlabki bosqichda talabalarga regbi o'yinining asosiy qoidalari, xavfsizlik texnikasi va elementar texnik harakatlari o'rgatiladi. Keyingi bosqichlarda esa o'yin taktikasi, jamoaviy hamkorlik va maxsus jismoniy mashqlar orqali ularning sport mahoratini rivojlantirish maqsadga muvofiqdir. Bu jarayonda individual yondashuv tamoyiliga amal qilish, har bir talabaning jismoniy tayyorgarlik darajasini inobatga olish muhim ahamiyatga ega.

Regbi mashg'ulotlari pedagogik nuqtai nazardan talabalarda irodaviy sifatlarni shakllantirishda ham muhim rol o'ynaydi. Mashg'ulotlar jarayonida qat'iyatlilik, jasorat, o'zaro yordam, jamoaviy mas'uliyat va intizom kabi fazilatlar rivojlanadi. Bu esa nafaqat sport faoliyatida, balki talabalarning kundalik hayotida ham ijobiy natijalar beradi. Shuningdek, regbi sporti talabalarning psixologik barqarorligini oshirish, stress holatlarini yengib o'tish va o'ziga bo'lgan ishonchni mustahkamlashda samarali vosita hisoblanadi [4].

Jismoniy tarbiya mashg'ulotlarida regbi sportini qo'llash o'qituvchidan yuqori pedagogik mahoratni talab etadi. O'qituvchi mashg'ulotlarni rejalashtirishda zamonaviy pedagogik texnologiyalardan, interaktiv metodlardan va differensial yondashuvdan foydalanishi zarur. Ayniqsa, amaliy mashg'ulotlarda ko'rgazmali vositalar, jamoaviy o'yin usullari va musobaqa elementlaridan foydalanish talabalarning qiziqishini oshiradi va dars samaradorligini ta'minlaydi. Shu bilan birga, regbi sportini ta'lim jarayoniga joriy etishda sog'lom va xavfsiz muhitni yaratish muhim pedagogik shartlardan biridir. Mashg'ulotlar jarayonida xavfsizlik qoidalariga qat'iy rioya qilish, jismoniy yuklamalarni me'yorlash va talabalarning sog'lig'ini nazorat qilish orqali jarohatlanishlarning oldini olish mumkin. Bu esa ta'lim jarayonining samaradorligini oshiradi va talabalarning sportga bo'lgan qiziqishini yanada kuchaytiradi.

Umuman olganda, regbi sportini jismoniy madaniyat tizimiga joriy etishning pedagogik asoslari talabalarning jismoniy, psixologik va ijtimoiy rivojlanishini ta'minlashga qaratilgan bo'lib, u zamonaviy ta'lim jarayonining muhim tarkibiy qismi sifatida qaraladi. Mazkur sport turini ta'lim tizimida samarali qo'llash orqali jismoniy tarbiya mashg'ulotlarining mazmuni boyitiladi va ularning tarbiyaviy ahamiyati yanada ortadi.

Regbi mashg'ulotlarini tashkil etishning metodik xususiyatlari

Regbi sportini jismoniy madaniyat tizimiga samarali joriy etish, avvalo, mashg'ulotlarni to'g'ri metodik asosda tashkil etishga bog'liqdir. Metodik jihatdan regbi mashg'ulotlari talabalarning yosh xususiyatlari, jismoniy tayyorgarlik darajasi va individual imkoniyatlarini hisobga olgan holda rejalashtirilishi zarur. Mashg'ulotlar nazariy va amaliy qismlarning uyg'unligi asosida tashkil etilib, talabalarning regbi o'yini haqidagi bilim va ko'nikmalarini bosqichma-bosqich shakllantirishga xizmat qilishi lozim [5].

Mashg'ulotlarning dastlabki bosqichida regbi sportining kelib chiqishi, o'yin qoidalari, xavfsizlik texnikasi va asosiy texnik harakatlari tushuntiriladi. Bu bosqichda talabalarga to'p bilan ishlash, to'pni uzatish, qabul qilish, yugurish va to'xtash kabi elementar harakatlar o'rgatiladi. Keyingi bosqichlarda esa jamoaviy o'yin elementlari, hujum va himoya taktikasi, tezkor qaror qabul qilish hamda o'yin jarayonida to'g'ri joylashish ko'nikmalari shakllantiriladi.

Regbi mashg'ulotlarini tashkil etishda interaktiv metodlardan foydalanish muhim ahamiyat kasb etadi. Jumladan, kichik guruhlarda ishlash, jamoaviy mashqlar, musobaqa elementlari va o'yin usullaridan foydalanish talabalarning mashg'ulotlarga bo'lgan qiziqishini oshiradi. Bu usullar orqali talabalarda jamoada ishlash, o'zaro hamkorlik qilish va o'yin jarayonida tezkor fikrlash ko'nikmalari rivojlanadi.

Metodik jihatdan mashg'ulotlar ketma-ketlik va tizimlilik tamoyili asosida tashkil etilishi lozim. Har bir mashg'ulot avvalgi darslarda o'rganilgan harakat va ko'nikmalarni mustahkamlashga qaratilib, yangi elementlar bilan boyitib boriladi. Jismoniy yuklamalar esa asta-sekin oshirib borilishi, talabalarning organizmiga mos ravishda taqsimlanishi zarur. Bu esa mashg'ulotlar samaradorligini oshirish bilan birga jarohatlanishlarning oldini olishga ham xizmat qiladi.

Shuningdek, regbi mashg'ulotlarida nazorat va baholash jarayonini to'g'ri tashkil etish muhim metodik omillardan biridir. Talabalarning jismoniy tayyorgarligi, texnik harakatlarni bajarish sifati va jamoaviy o'yin ko'nikmalari muntazam ravishda baholanib borilishi kerak. Bu jarayon o'qituvchiga mashg'ulotlarni yanada takomillashtirish, talabalarga esa o'z ustida ishlash va sport mahoratini oshirish imkonini beradi [6].

Umuman olganda, regbi mashg'ulotlarini metodik jihatdan to'g'ri tashkil etish jismoniy tarbiya mashg'ulotlarining samaradorligini oshirish, talabalarning jismoniy va funksional tayyorgarligini rivojlantirish hamda sportga bo'lgan qiziqishini kuchaytirishda muhim omil hisoblanadi. Mazkur

sport turini o'quv jarayoniga samarali integratsiya qilish orqali jismoniy madaniyat tizimining mazmuni boyitiladi va ta'lim jarayonining sifat ko'rsatkichlari yanada oshadi.

Xulosa

Xulosa qilib aytganda, regbi sportini jismoniy madaniyat tizimiga joriy etish zamonaviy ta'lim jarayonida muhim pedagogik va metodik ahamiyat kasb etadi. Mazkur sport turi talabalarning jismoniy sifatlarini kompleks rivojlantirish, ularning funksional imkoniyatlarini oshirish hamda sog'lom turmush tarzini shakllantirishda samarali vosita hisoblanadi. Shu bilan birga, regbi mashg'ulotlari talabalarda jamoaviylik, mas'uliyat, intizom va irodaviy sifatlarni rivojlantirishga xizmat qiladi.

Regbi sportini ta'lim jarayoniga joriy etishning pedagogik asoslari talabalarning yosh va individual xususiyatlarini hisobga olgan holda mashg'ulotlarni tashkil etish, zamonaviy pedagogik texnologiyalarni qo'llash hamda nazariy va amaliy mashg'ulotlar uyg'unligini ta'minlashni talab etadi. Metodik jihatdan esa mashg'ulotlarning tizimli, bosqichma-bosqich va xavfsizlik qoidalariga amal qilgan holda olib borilishi ta'lim samaradorligini oshiradi.

Shuningdek, regbi sportini jismoniy tarbiya mashg'ulotlariga integratsiya qilish talabalarning sportga bo'lgan qiziqishini oshiradi, ularning bo'sh vaqtini mazmunli tashkil etishga yordam beradi hamda jismoniy faollik darajasini yuksaltiradi. Bu esa o'z navbatida yoshlarning sog'lom, faol va ijtimoiy jihatdan yetuk shaxs bo'lib shakllanishiga ijobiy ta'sir ko'rsatadi.

Kelgusida regbi sportini jismoniy madaniyat tizimida kengroq qo'llash, uning pedagogik va metodik imkoniyatlarini yanada takomillashtirish hamda ta'lim jarayoniga samarali joriy etish bo'yicha ilmiy-uslubiy ishlarni davom ettirish maqsadga muvofiqdir. Mazkur sport turidan ta'lim jarayonida foydalanish jismoniy tarbiya mashg'ulotlarining mazmunini boyitadi va ularning samaradorligini oshirishga xizmat qiladi.

Foydalanilgan adabiyotlar

1. O'zbekiston Respublikasi Prezidentining jismoniy tarbiya va sportni rivojlantirishga oid qaror va farmonlari. – Toshkent, 2020–2023.
2. O'zbekiston Respublikasi Vazirlar Mahkamasining jismoniy tarbiya va sportni rivojlantirish to'g'risidagi me'yoriy hujjatlari. – Toshkent, 2021.
3. Salomov R.S. Sport mashg'ulotlarining nazariy asoslari. – Toshkent: O'qituvchi, 2015.
4. Kerimov F.A. Sport pedagogikasi va psixologiyasi. – Toshkent: Ilm Ziyo, 2018.
5. Matveyev L.P. Jismoniy tarbiya nazariyasi va metodikasi. – Moskva: Sport, 2010.
6. Platonov V.N. Sport trenirovkasi nazariyasi. – Kiev: Olimpiyskaya literatura, 2012.

**COST REDUCTION STRATEGIES THROUGH EFFICIENT ROVING WASTE
RECYCLING IN SPINNING MILLS**

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Abstract: *The increasing cost of raw cotton and growing environmental concerns have intensified the need for efficient waste management strategies in the textile industry. Roving waste generated during the roving and spinning processes represents a significant source of material loss in spinning mills. This study investigates cost reduction strategies achieved through efficient recycling of roving waste using improved mechanical processing methods. The research focuses on machine optimization, process parameter control, and blending strategies to enhance fiber recovery and reduce production costs. Experimental and analytical evaluations indicate that the effective recycling of roving waste can substantially decrease raw material consumption while maintaining acceptable yarn quality. The results demonstrate that roving waste recycling is not only economically beneficial but also supports sustainable and circular textile production.*

Keywords: *Roving waste, cost reduction, textile recycling, spinning mills, sustainable manufacturing*

INTRODUCTION

The global textile spinning sector operates under increasing economic and environmental pressures driven by volatile raw cotton prices, rising energy costs, and stricter sustainability requirements. Cotton fiber constitutes the largest share of production expenses in spinning mills, making raw material efficiency a decisive factor in overall profitability. Process-related waste generated during blowroom, carding, roving, and ring spinning stages contributes to material losses that directly impact cost structures and operational performance. Consequently, improving resource efficiency through systematic waste reduction and recycling strategies has become a strategic priority for modern spinning enterprises seeking both economic resilience and environmental compliance [1].

Roving waste is produced during the roving, ring spinning, and material handling stages due to machine stoppages, roving breakages, improper drafting, and operational inefficiencies. Traditionally, roving waste is either discarded or sold at a relatively low price, leading to economic losses. However, roving waste still contains reusable fibers that can be recovered and reintroduced into the production cycle if processed appropriately [2].

Efficient recycling of roving waste provides an effective solution to reduce raw material costs, decrease waste disposal expenses, and enhance sustainability. Recent advancements in waste processing machinery and process optimization techniques have made it possible to recycle roving waste with minimal deterioration of fiber properties [3]. This study aims to analyze cost reduction strategies achieved through efficient roving waste recycling in spinning mills, with particular emphasis on machine improvement, process optimization, and blending techniques.

Literature Review

Several studies have highlighted the economic and environmental benefits of textile waste recycling. Lawrence [4] emphasized that waste recycling in spinning mills significantly improves material utilization and reduces dependency on virgin fibers. According to Klein [5], controlled mechanical processing of spinning waste allows fiber recovery without excessive damage, provided that machine parameters are optimized.

Research by Das et al. [6] demonstrated that recycled cotton fibers could be successfully blended with virgin cotton up to certain proportions without severe degradation of yarn quality. Similarly, Rieter [7] reported that modern waste recycling systems can recover up to 70–85% of usable fibers from spinning waste, depending on waste type and processing conditions.

However, most existing studies focus on carding and spinning waste, while limited attention has been given specifically to roving waste recycling. This research addresses this gap by evaluating roving waste recycling as a cost reduction strategy in spinning mills.

Materials and Methods

Roving waste samples were collected from industrial cotton spinning mills during regular production operations. The waste consisted of broken roving ends, doffing waste, and handling losses. The collected material was visually inspected to remove foreign contaminants before processing.

An improved roving waste processing machine was employed for recycling.

The machine featured:

- A controlled feeding system to ensure uniform material input,
- Optimized opening elements to minimize fiber breakage,
- Adjustable drafting units,
- Reduced frictional losses through improved mechanical design.

These improvements were intended to increase fiber recovery efficiency and reduce energy consumption.

The following process parameters were systematically varied:

- Drafting ratio,
- Roller speed,
- Feed rate,
- Cleaning intensity.

Each parameter was optimized to balance fiber recovery and fiber quality.

Recycled roving waste fibers were blended with virgin cotton at different ratios (5%, 10%, 20%, and 30%). Yarn samples were produced under identical spinning conditions to evaluate the effect of recycled fiber content on yarn quality.

The performance of the recycling process was evaluated based on:

- Fiber recovery rate,
- Yarn tensile strength,
- Yarn evenness,
- Raw material cost savings.

Results

The improved roving waste processing machine achieved a fiber recovery rate of up to 80%, significantly higher than conventional waste handling methods. Optimized feeding and controlled opening reduced fiber damage during processing.

Yarn produced with up to 20% recycled roving waste showed acceptable tensile strength and evenness for medium-count yarns. At higher blending ratios, slight deterioration in quality was observed; however, the yarn remained suitable for non-critical applications.

The introduction of recycled roving waste resulted in a notable reduction in raw material costs. Mills using 20% recycled fibers achieved substantial savings in cotton consumption, leading to a shorter payback period for the recycling machine investment.

The results confirm that efficient roving waste recycling can significantly reduce production costs in spinning mills. Machine design optimization plays a crucial role in preserving fiber quality during recycling. Controlled processing parameters prevent excessive fiber breakage and ensure consistent material flow.

Blending strategies are critical in balancing cost reduction and yarn quality. Moderate blending ratios provide optimal economic benefits without compromising product performance. These findings are consistent with previous studies on spinning waste recycling [6], [7].

Efficient roving waste recycling supports sustainable textile manufacturing by reducing waste generation and lowering demand for virgin cotton. This contributes to reduced environmental impacts associated with cotton cultivation, such as water consumption and pesticide use [8]. Furthermore, recycling aligns with circular economy principles by extending the life cycle of textile materials.

Conclusion

This study demonstrates that efficient recycling of roving waste is an effective cost reduction strategy for spinning mills. By improving machine design, optimizing process parameters, and applying appropriate blending techniques, significant savings in raw material costs can be achieved while maintaining acceptable yarn quality. The adoption of advanced roving waste recycling systems enhances both economic performance and environmental sustainability in the textile industry.

REFERENCES

1. Muthu, S. S. (Ed.). *Sustainable Textile Production*. Woodhead Publishing, 2020.
2. Lawrence, C. A. *Fundamentals of Spun Yarn Technology*. CRC Press, 2003.
3. Klein, W. *The Rieter Manual of Spinning*. Rieter Machine Works Ltd., Winterthur, 2014.
4. Lawrence, C. A. "Recycling of Textile Waste." *Textile Progress*, Vol. 35, No. 4, 2004, pp. 1–44.
5. Klein, W. "Waste Reduction in Cotton Spinning." *Textile World*, Vol. 154, No. 2, 2004, pp. 36–41.
6. Das, A., Alagirusamy, R., & Kothari, V. K. "Recycling of Cotton Waste for Yarn Production." *Journal of the Textile Institute*, Vol. 101, No. 6, 2010, pp. 510–516.
7. Rieter. *Spinning Systems and Waste Recycling Technology*. Rieter Technical Publication, 2018.
8. Fletcher, K. *Sustainable Fashion and Textiles: Design Journeys*. Earthscan, 2014.

MECHANICAL VS. SOLVENT-BASED RECYCLING TECHNOLOGIES FOR ROVING WASTE: A COMPARATIVE REVIEW

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Abstract: The textile industry's transition toward a circular economy necessitates effective recycling of pre-consumer waste streams, particularly roving waste generated during spinning. This review provides a comparative analysis of mechanical and solvent-based recycling technologies for processing roving waste, evaluating their principles, efficiencies, and suitability for fiber recovery. Drawing on recent literature (2019–2025) and industrial case studies, including data from Uzbek spinning mills, the paper examines the strengths and limitations of each approach. Mechanical recycling, while cost-effective and widely adopted, often compromises fiber length and quality. In contrast, solvent-based regeneration offers the potential to produce fibers with virgin-like properties but faces challenges related to cost and solvent recovery. The comparative techno-economic assessment reveals that mechanical processes have lower immediate costs, whereas advanced solvent-based methods may yield higher-value end products, albeit with greater capital investment. The review concludes by identifying research gaps and proposing pathways for integrating these technologies to enhance material recovery and support sustainable textile manufacturing.

Keywords: Roving waste, mechanical recycling, solvent-based regeneration, textile waste, comparative analysis, fiber recovery, circular economy, spinning waste, recycling technologies, sustainable textiles.

Introduction

The textile industry is a major contributor to industrial waste worldwide, with spinning processes producing significant pre-consumer waste, including roving waste. Roving waste, generated during roving and spinning frame operations, represents valuable fibrous material that can be recycled or valorized if appropriate technologies are applied [1,2]. Despite its potential, roving waste is often under-researched compared to other waste streams, contributing to inefficiencies and environmental burdens.

Key points in this section:

1. Textile industry waste is increasing due to global production volume growth [4].
2. Roving waste emerges primarily during the drafting and twisting stages in spinning mills [1].
3. Recycling of roving waste supports circular economy goals and resource conservation [4].

Methods

This review synthesizes current research on roving waste generation, characterization, and processing technologies. Peer-reviewed journal articles, industrial case studies, and recent textile recycling reviews were analyzed.

The methodology involved:

1. Literature Survey: Systematic review of research articles from 2019–2025 on textile waste and roving waste processing [3, 4, 5, 7].
2. Inclusion Criteria: Studies involving spinning waste, recycling technologies, and circular economy integration.
3. Classification: Technologies were categorized into mechanical recycling, solvent-based regeneration, and digital/innovative pre-sorting methods.

Results

-Roving waste accounts for approximately 3.5–5.2% of total spinning output, as documented in detailed audits conducted at multiple spinning facilities, including mills in Uzbekistan [1].

-Primary causes of roving waste formation include mechanical inefficiencies, operator handling, and raw material variability.

-Roving waste contains relatively long staple fibers suited to reuse, though fiber quality degrades with repeated mechanical opening.

Mechanical Recycling: The most mature technology involves fiber opening, cleaning, carding, and rewinding to produce reusable slivers or yarns. Mechanical recycling remains dominant due to technological maturity and relatively low cost, though it may reduce fiber length and quality [8, 9].

Solvent-Based Regeneration: Advanced dissolution and regenerative systems can selectively process cellulosic waste into new fibers, potentially matching virgin fiber qualities. Such approaches show promise in producing regenerated textiles with improved properties, though industrial deployment remains limited by cost and solvent recovery challenges [5, 7].

Quantitative Findings and Comparisons

Life cycle and techno-economic evaluations reveal that mechanical processes consume less energy and preserve fiber integrity but may lag in material recovery quality compared with solvent-based methods [6].

Balancing environmental and economic metrics shows mechanical recycling has lower immediate costs, whereas advanced technologies may yield higher revenue but require larger capital investment.

Discussion

Sustainability Impact: Recycling roving waste reduces reliance on virgin materials and supports environmental sustainability targets. Multiple studies highlight the importance of integrating circular economy frameworks to reduce landfill and resource depletion [4].

Industrial Technology Gaps: Mechanical recycling is widely applied, but innovation is needed for high-quality regenerated fibers. Solvent-based systems show potential but require improvements in cost efficiency and solvent management [5,7].

Uzbekiston Contributions: In our previous research work, we quantitatively evaluates roving waste at Uzbek spinning mills, establishing baseline data for waste reduction strategies [1]. Additionally, utilization frameworks for cotton roving waste were outlined as part of national efforts to improve textile sustainability [2].

Applications of Recycled Roving Waste

Recycled roving fibers can be used to produce:

1. Lower-count yarns suitable for non-woven and industrial textiles.
2. Blends for denim and home textile products.
3. Value-added recycled cotton components in garments.

These applications contribute to sustainability while opening economic opportunities within textile value chains [3, 6].

Conclusion

Roving waste represents a critical yet under-exploited resource within textile manufacturing. Current recycling technologies range from established mechanical processes to advanced solvent regeneration and digital pre-sorting. While mechanical recycling dominates due to maturity and cost, innovations in solvent systems and digital technologies offer promising pathways for enhanced material recovery. Research contributions from Uzbekistan and other regions provide valuable empirical data that can support improved waste management and integration of circular economy principles in textile production.

REFERENCES

1. Sharifkhon Alikhonov & Husanhon Bobojanov, Roving Waste in Textile Manufacturing: Generation, Management, and Sustainable Solutions, *Journal of Multidisciplinary Research*, Vol. 3 No. 9 (2025).
2. Sharifkhon Alikhonov, Utilization of Cotton Roving Waste in Spinning, *Web of Technology: Multidimensional Research Journal* (2025).
3. S.R. Kushwah & S.B. Naik, A Review of Textile Recycling, *International Journal of Innovations in Engineering Research and Technology* — overview of textile recycling technologies including roving waste reuse.
4. Kuok Ho Daniel Tang, State of the Art in Textile Waste Management: A Review, *Textiles* (2023).
5. Birgit Stubbe et al., White Paper on Textile Fibre Recycling Technologies, *Sustainability* (2024) — overview of recycling tech.
6. Balancing textile waste recovery technologies, *Sustainable Production and Consumption* (2025) — comparative techno-economic evaluation.
7. J. Ghosh, Chemical Valorization of Textile Waste: Advancing Sustainable Recycling for a Circular Economy, *ACS Omega* (2025).
8. Cotton recycling: mechanical preparation process, *Cleaner Engineering and Technology* (2024) — mechanical recycling evaluation.
9. Sewin Kein, Advancements in Mechanical Recycling of Textiles: Processes and Innovations, *Journal of Fashion Technology & Textile Engineering* (2024).

PREVALENCE OF HODGKIN'S LYMPHOMA IN THE POPULATION OF KHORAZM PROVINCE

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This article provides a retrospective analysis of case histories and outpatient cards of patients living in the Khorezm region who were diagnosed with Hodgkin's lymphoma and who were treated at the Khorezm branch of the Republican Specialized Scientific and Practical Center of Oncology and Radiology during 2019-2023. The results of the analysis were studied, pathomorphological changes that occur in the lymph nodes of patients diagnosed with Hodgkin's lymphoma, and histological and immunohistochemical changes in microscopic forms of Hodgkin's lymphoma were described.

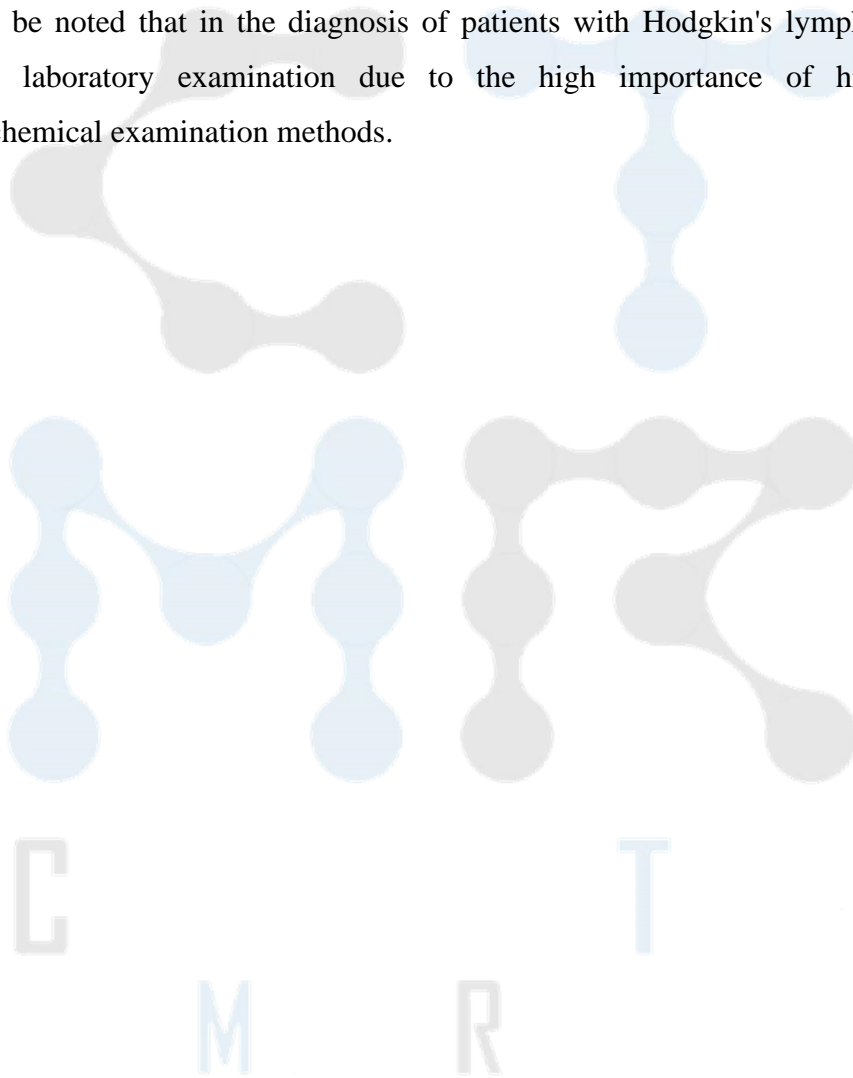
Relevance of the topic. Hodgkin lymphoma is a relatively rare tumor, accounting for 30% of all lymphomas. The authors note that the incidence of Hodgkin's lymphoma has been increasing in recent decades, in different age populations and among women in Asian countries. To this day, the exact cause of this disease remains unknown, but may be related to the increasing prevalence of lifestyle and metabolic risk factors. The proportion of obese women in Asian countries has increased faster than the global average, and the associated medical and social problems emphasize the importance of studying the various aspects of the disease, including its morphological features, especially in the context of regional characteristics.

Material and methods. During the years 2019-2023, the medical histories and patient cards of 80 patients with Hodgkin's lymphoma were treated retrospectively, histological and immunohistochemical examinations were conducted, and the results of the operations performed on the patients were studied at the Khorezm Branch of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology.

Discussion of the results obtained during the study. Research results of 80 patients who were diagnosed with Hodgkin's lymphoma and received treatment at the dispensary during 2019-2023 at Khorezm Branch of the Republican Scientific and Practical Center of Oncology were analyzed. The classic variant of the disease was detected in 31 (38.75) patients, of which 16 (20.0%) were in the neck lymph nodes, 2 (2.5%) were in the lymph nodes around the mesentery, 8 (10.0%) were in the axilla. lymph nodes and in 5 (6.25%) cases, the lymph nodes were identified in the lymph nodes; The variant of nodular sclerosis was detected in 26 (32.50%) patients, of which 14 (17.5%) were neck, 1 (1.25%) intestinal retention, 9 (11.25%) axilla, 2 (2.5 %) pelvic lymph, the lymph nodes were found in the lymph nodes; In the mixed variant, a total of 14 (17.50%)

patients were identified, of which 7 (8.75%) were identified in the neck, 1(1.25%) in the mesentery, 5(6.25%) in the axillary lymph node, and 1(1.25%) in the pelvic lymph node.; Low variant of lymphoid cells was detected in 9(11.25%) patients, and it was observed in 4(5.0%) patients. It was found in 3 (3.75%) patients in axillary lymph nodes and in 10 (12.50%) patients in the pelvic lymph node.

In conclusion, it can be said that the classic type of Hodgkin's lymphoma is observed more often than other types, and the first place of localization is the neck lymph nodes. It can be seen that the first closest lymph node can be damaged due to the decrease in immunity after acute viral diseases. It should also be noted that in the diagnosis of patients with Hodgkin's lymphoma, cytology prevails over laboratory examination due to the high importance of histological and immunohistochemical examination methods.



MODERN ECHODIAGNOSTICS OF NODULAR FORMATIONS OF THE THYROID GLAND IN PATIENTS

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Relevance of the topic: Modern methods of ultrasound diagnostics play an important role in the detection and differential diagnosis of focal pathologies of the thyroid gland. Ultrasonography is a minimally invasive, inexpensive and highly informative first-stage diagnostic method. Modern ultrasound diagnostics technologies allow us to detect structural changes in the thyroid gland and assess the risk of malignancy. Under focal pathology of the thyroid gland, we understand the presence of formations in the gland that differ in structure from the tissue. Focal pathology of the thyroid gland occurs in 4-20% of cases in adults, and in 0.2-1.5% of cases in children. When examined by palpation, nodular formations are detected in almost 5% of healthy people. The composition of focal pathology of the thyroid gland includes benign nodules and cysts, adenomas, and malignant tumors.

Thus, ultrasound diagnostics allows you to distinguish between various focal formations, and sometimes their variants. To increase the accuracy of diagnosis, additional ultrasound methods are used, including: 1) Doppler blood flow mapping method; 2) Sonoelastography - a method for assessing the stiffness of nodes; 3) MicroPure (Toshiba) technology - for detecting microcalcifications. These methods significantly increase the sensitivity, specificity and accuracy of diagnosis.

Goals and objectives. To study the effectiveness of using radiological diagnostic methods in determining the prevalence of focal changes in the thyroid gland among the population and modern ultrasound diagnostics of focal diseases of the thyroid gland in young patients.

Materials and methods. These examinations were conducted to identify changes in the structure of the thyroid gland of patients. The studies were conducted using ultrasound examination of the thyroid gland of patients who applied to the clinics of the "ULTRA VEDA" family enterprise with nodular diseases of the thyroid gland and students of the Urgench branch of the TTA from September 2024 to May 2025. Thyroid screening was conducted among volunteer students aged 17 to 21 years. During the study, the results of the examination of 113 patients were evaluated. Of these, 61 were women and 42 were men. Voluntary consent was given for diagnostic studies. Exography was performed on ultrasound scanners AplioXG (Toshiba, Japan) and Chison Cbit - 8 (China) in B mode with 7-14 MHz sensors, color Doppler and EDK, pulsed wave Doppler, tissue harmonics, three-dimensional reconstruction images. The following ultrasound signs were assessed: exogenousity, exostructure, shape, contours, presence of exogenous inclusions. In addition, according to the results of ultrasound examination, the characteristics of blood flow in nodular formations of the thyroid gland were also assessed.

Research results.

When conducting the study, taking into account the degree of proliferative changes in focal formations in the thyroid gland, in order to determine the diagnostic significance of the studied ultrasound parameters, the patients were retrospectively divided into 4 clinical groups according to the results of the examination:

Group I - Patients with single focal formations in the thyroid gland. These formations, the average size of which was 5-6 mm, required dynamic observation. Patients were under the supervision of an endocrinologist for half a year. (27 = patients)

Group II - Patients with single focal formations in the thyroid gland, the average size of which was 11-20 mm. All of these patients underwent fine needle aspiration biopsy (FNAB) and cytological examination. As a result of the study, it was confirmed that the formations were of good quality (benign tumor). (39 = patients)

Group III - Patients who underwent surgery due to nodular formations. Indications for surgery: the presence of multiple nodules, node growth, the size of a single node is more than 20 mm, the thyroid gland is enlarged on palpation and affects the function of neighboring organs (swallowing disorders, difficulty breathing, dizziness). However, local lymph nodes were not enlarged on ultrasound. (31 = patients)

Group IV - Patients who underwent surgery for various forms of thyroid cancer (17 patients). According to the histological results of the postoperative material: 5 patients (29.4%) - papillary cancer, 8 patients (47.0%) - follicular cancer, 4 patients (23.5%) - medullary cancer were detected. Thyroid cancer is usually detected by ultrasound as hypoechogenic, hypovascular nodular formations, often with unclear contours and highly echogenic and calcified areas. The non-encapsulated variant of papillary thyroid cancer is characterized by irregular, jagged tumor edges, which is a pathognomonic ultrasound sign. The encapsulated variant of papillary cancer and follicular cancer usually did not differ from adenomas and colloid nodules.

Conclusion. The above data show that radiological methods are of great importance in the timely and early detection of the prevalence of focal pathologies developing in thyroid diseases among the population, as well as in the correct and comparative diagnosis. This approach improves the early diagnosis of thyroid cancer and reduces the number of unnecessary radical surgeries.

ANALYSIS OF LAND COVER AND LAND USE INDICATORS OF THE SANGZAR RIVER BASIN

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Abstract: This article analyzes the land cover and land use types of the Sangzor River Basin based on a basin-wide approach. The study uses the QGIS program to identify land cover types in the basin area based on ESA WorldCover 2021 remote sensing data and calculate their area indicators. According to the results, pastures and agricultural lands predominate in the basin area, while forests and water bodies occupy a relatively small share. The location of settlements and sparsely vegetated areas is also analyzed. The results obtained show that the main direction of land use in the Sangzor River Basin is agriculture. The results of the study are important for the rational use of natural resources of the region and the development of environmental protection measures.

Keywords: Sangzor River Basin, basin approach, land cover, land use, QGIS, remote sensing.

Introduction. Currently, the basin approach has become one of the important scientific directions in natural geographical research and is studied as the main object of research in many scientific fields.

The belonging of a river or stream to a watershed determines the general content of nature use and is an important factor in land zoning. The ability to divide the main watershed into smaller natural units allows independent watersheds of tributaries to analyze the diversity of the territory (natural resource supply) and form information support for the land use structure.

In general, since river basins have their own natural boundaries, it is important to zone them, consider them as large and small basin geosystems, and analyze their natural geographical features. Currently, GAT technology programs are widely used to divide river basins into internal geosystems, study and analyze them.

Main part. Land cover and land use indicators of the Sangzor River Basin were processed and analyzed in QGIS based on ESA WorldCover 2021 data (global land cover at 10-meter resolution). During the research, remote sensing data were cut along the basin boundary, thematic types (forests, pastures, croplands, water bodies, bare land, and settlements) were separated, and land use types were analyzed (Figure 1).

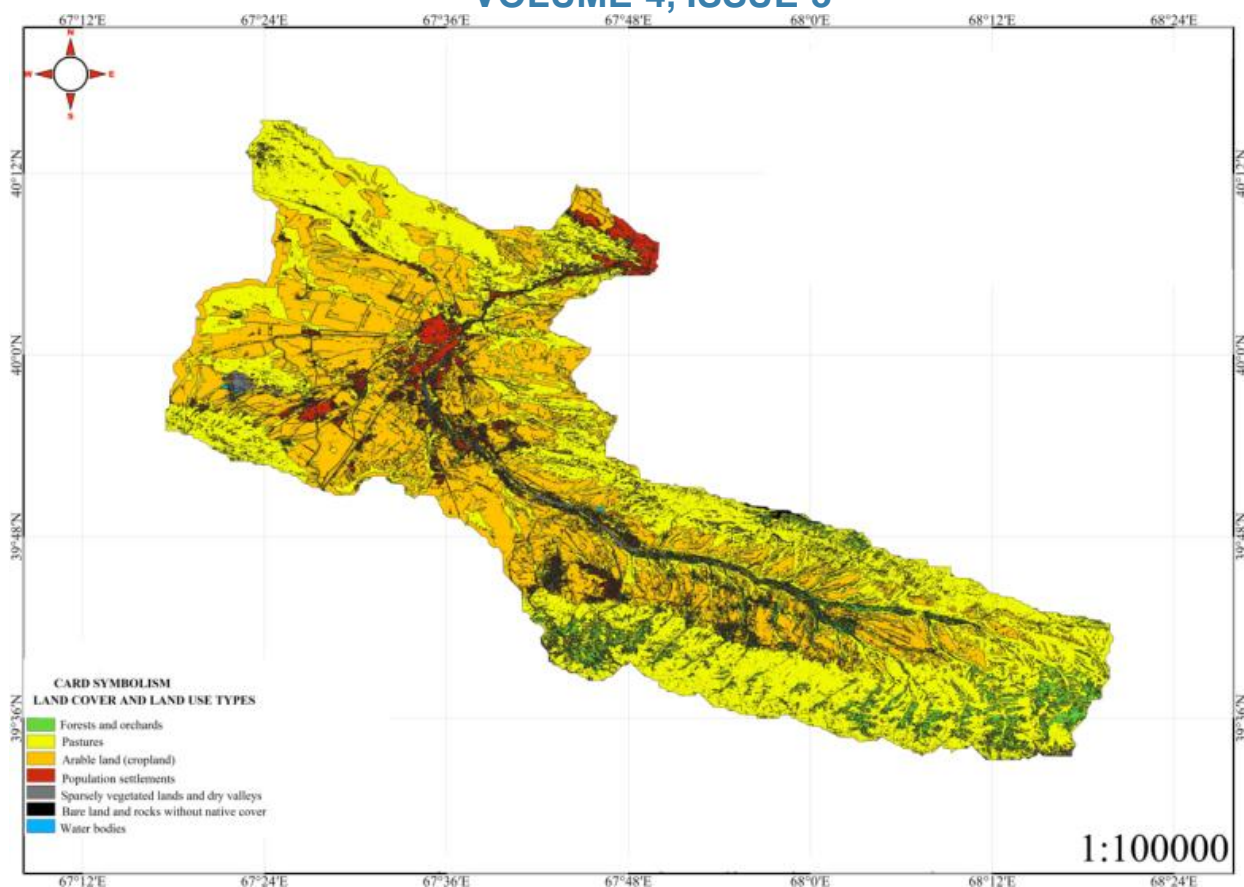


Figure 1. Sangzor River Basin Land Cover and Land Use Types Map

The raster data was vectorized and area indicators were determined for each land cover type. Analysis of the results showed that agricultural lands and pastures predominate in the basin, while forests and water bodies have a relatively small share (Table 1).

Table 1

Land cover and land use indicators of the Sangzor River Basin

№	Land cover and land use types	Area, sq. km.	Share, %
1	Forests and orchards	116,8	4,57
2	Pastures	1432,1	54,86
3	Arable land (cropland)	878,03	33,87
4	Population settlements	90,9	3,55
5	Sparsely vegetated lands and dry valleys	76,4	2,95
6	Bare land and rocks	1,4	0,0568
7	Water bodies	2,6	0,1084
8	Other fields	0,08	0,0032
Total		2598	100

Source: The table was developed by the author using QGIS based on ESA WorldCover 2021 data. The developed map analysis shows that pastures (1432.1 ha) predominate in the basin area, which mainly occupy large areas in the mountainous and foothill regions of Chumqor, Morguzar, Koytash (part of the basin area), Gobdin (part of the basin area). This indicates that the livestock sector of agriculture in the basin area is dominant. In second place are areas occupied by arable land (878.03 km²), such lands are located along the Sangzor river valley and along the bare lands of the rivers and streams. These areas are mainly used for dredging and irrigated agriculture.

Areas occupied by forests and orchards are distributed in the upper parts of the Morguzar and Chumqor mountains and along the banks of constantly flowing rivers. Such areas occupy more than 4.5 percent of the total basin area.

Settlements in the basin are densely located on the terraces of the Sangzor River, in the conical slopes of the streams, in the Galla-Arol basin and in the city of Jizzakh (in the basin). The share of settlements is 3.55%, which indicates a relatively sparse population in this area, but there is an anthropogenic load on land resources.

Land with sparse vegetation and no vegetation cover covers an area of 76.4 km², which indicates the complexity of natural conditions and the risk of land degradation. Such areas include quarries, and the area of water bodies has a small share in the basin.

In general, the results of the analysis show the predominance of agricultural land cover types in the Sangzor River basin and the need to protect natural ecosystems.

Conclusion. The results of the study showed that the analysis of land cover and land use structure in the Sangzor River basin based on a basin approach is important in determining the natural and geographical features of the area. Analysis based on ESA WorldCover 2021 data revealed that pastures and agricultural arable land dominate in the basin. This indicates that the livestock and agriculture sectors play an important role in the economy of the region. The relatively low share of forests, water bodies and other natural landscapes indicates the need to protect natural ecosystems. It was also found that the location of population settlements is mainly associated with the river valley and favorable relief conditions. The results of the study serve as a scientific basis for rational use of land resources, ensuring ecological sustainability and improving territorial planning in the Sangzor River Basin.

REFERENCES

1. Burrough P.A., McDonnell R.A. (1998). Principles of Geographical Information Systems. – Oxford: Oxford University Press. – 333 p.
2. European Space Agency (2021). ESA WorldCover 2021: Global Land Cover Map (10 m resolution). – Paris: ESA.
3. Luzgin B.N. (2008). Watershed-erosion rows of the Verkhneobskogo rechnogo basseyna: dis. ... kand. geogr. nauk. – Novosibirsk. – 186 p.
4. Murodov S. (2022). Climate and ecological problems of Uzbekistan. – Tashkent: Fan Publishing House. – 256 p.
5. Qosimov N. (2024). Analysis of land cover and land use of the Sangzor river basin // Journal of Natural Sciences. – Jizzakh, No. 3. – P. 45–50.
6. QGIS Development Team (2024). QGIS Geographic Information System. User Guide. – Open Source Geospatial Foundation Project.
7. Sun L., Shu C., et al. (2023). Mapping potential wetlands by a new framework method using random forest algorithm and big Earth data: A case study in China's Yangtze River Basin // Global Ecology and Conservation. - Vol. 42. – e02397.

Termiz iqtisodiyot va servis universiteti o'qituvchisi
Qaraqulov Azizbek Amonqulovich

Annotatsiya: Mazkur tezisda Shukur Xolmirzayev ijodida poeziyaning badiiy talqini masalasi tahlil qilinadi. Yozuvchi nasrida lirizm, ruhiy drammatizm, ramziylik va falsafiy mushohada unsurlarining uyg'unlashuvi ilmiy-estetik jihatdan asoslab beriladi. Asarlarda real voqelik tasviri bilan bir qatorda inson qalbining nozik qatlamlarini ochish, ichki monolog va ruhiy kechinmalar orqali poetik tafakkurni yuzaga chiqarish xususiyatlari yoritiladi. Shuningdek, tabiat tasvirining poetik parallelizm vazifasi, milliy ruh va qadriyatlarining badiiy ifodasi ham tahlil markaziga olinadi. Xulosa sifatida yozuvchi nasrida poeziya mustaqil janr emas, balki ichki ruhiy qatlam sifatida namoyon bo'lishi asoslab beriladi.

Kalit so'z: Shukur Xolmirzayev, poetik realizm, lirizm, ichki monolog, ruhiy drammatizm, ramziylik, falsafiy mushohada, milliy ruh, badiiy talqin, nasr va poeziya uyg'unligi.

Abstract: This thesis analyzes the artistic interpretation of poetry in the works of Shukur Xolmirzayev. The study substantiates, from a scientific and aesthetic perspective, the harmony of lyricism, psychological drammatism, symbolism, and philosophical reflection in the writer's prose. Alongside the depiction of real reality, the works reveal the subtle layers of the human soul, highlighting the emergence of poetic thinking through internal monologue and psychological experiences. The poetic parallelism of nature imagery, as well as the artistic expression of national spirit and values, are also examined. The conclusion argues that in the writer's prose, poetry appears not as an independent genre, but as an inner spiritual layer.

Keywords: Shukur Xolmirzayev, poetic realism, lyricism, internal monologue, psychological drammatism, symbolism, philosophical reflection, national spirit, artistic interpretation, harmony of prose and poetry.

Аннотация: В данной тезисе анализируется художественная интерпретация поэзии в творчестве Shukur Xolmirzayev. С научно-эстетической точки зрения обосновывается гармония лиризма, психологического драматизма, символизма и философского размышления в прозе писателя. Наряду с изображением реальной действительности в произведениях раскрываются тонкие слои человеческой души, проявление поэтического мышления через внутренний монолог и психологические переживания. Также рассматривается поэтическая функция пейзажных описаний, а также художественное выражение национального духа и ценностей. В заключение доказывается, что в прозе писателя поэзия выступает не как самостоятельный жанр, а как внутренний духовный пласт.

Ключевые слова: Шукур Холмирзаев, поэтический реализм, лиризм, внутренний монолог, психологический драматизм, символизм, философское размышление, национальный дух, художественная интерпретация, гармония прозы и поэзии.

O'zbek adabiyotida nasr taraqqiyotini yangi bosqichga ko'targan ijodkorlardan biri — Shukur Xolmirzayevdir. Uning asarlari hayotiyliigi, ruhiy teranligi, tabiiyligi va badiiy mukammalligi bilan ajralib turadi. Yozuvchi real voqelikni haqqoniy tasvirlash bilan birga, inson qalbining eng nozik qatlamlariga kirib borish, ruhiy holatlarni chuqur tahlil qilish mahoratini namoyon etadi. Shu bois Xolmirzayev nasrini o'rganishda undagi poetik tafakkur, lirizm va badiiy mushohada

masalasi alohida ilmiy-estetik ahamiyat kasb etadi. Uning ijodida poeziya alohida janr sifatida emas, balki nasrning ichki ruhiy qatlamida yashaydi, har bir obraz, tasvir va ruhiy kechinmada namoyon bo'ladi¹.

Avvalo, yozuvchi ijodining asosiy xususiyati — realizm va lirizm uyg'unligidir. Xolmirzayev hayotni bezab ko'rsatmaydi, voqelikni qanday bo'lsa, shunday tasvirlaydi. Biroq bu realizm quruq faktlar yig'indisi emas. U inson qalbi, ichki iztiroblari, orzu-armonlari va ma'naviy izlanishlari bilan boyitilgan. Natijada oddiy hayotiy voqea ham chuqur falsafiy va poetik mazmun kasb etadi. Yozuvchi uchun muhim narsa voqeaning o'zi emas, balki uning inson qalbida qanday aks etishidir.

Xolmirzayev asarlarida ichki monolog alohida o'rin tutadi. Qahramon ko'pincha tashqi harakatdan ko'ra ichki iztirob bilan yashaydi. Ruhiy drammatizm, sukut, o'yga cho'mish holatlari she'riy ohangni yuzaga keltiradi. Masalan, O'n sakkizga kirmagan kim bor asarida yoshlikning murakkab ruhiy kechinmalari nihoyatda nozik tasvirlanadi. Asardagi qahramon hayotning murakkab savollari oldida turadi: o'zlikni anglash, mas'uliyatni his qilish, muhabbat va insoniylik mezonlarini tushunish jarayoni uning ichki o'sishini belgilaydi. Bu jarayon oddiy tasvir emas, balki poetik umumlashtirish orqali ochiladi. Yoshlik bu yerda shunchaki biologik davr emas, balki qalb uyg'onishi, ruhiy pishish bosqichi sifatida talqin qilinadi.

Yozuvchi ijodida tabiat tasviri alohida poetik kuchga ega. Tabiat manzaralari dekorativ vazifani bajarmaydi; ular qahramon ruhiyatining badiiy paralleli sifatida xizmat qiladi. Sahro sukunati — yolg'izlikni, tog'lar salobati — qat'iyat va matonatni, yomg'irning mayinligi — iztirob va poklanishni anglatadi. Tabiat va inson o'rtasidagi uyg'unlik orqali yozuvchi hayot falsafasini ochadi. Bu jihat uning ko'plab hikoya va qissalarida namoyon bo'lib, nasrga she'riy kenglik va chuqurlik bag'ishlaydi.

Xolmirzayev tilining o'ziga xosligi ham poeziyaning badiiy talqinida muhim omildir. Uning uslubi sodda, ammo serma'no; ixcham, ammo ta'sirchan. Yozuvchi ortiqcha so'zbozlikdan qochadi, har bir jumlaning ehtiyotkorlik bilan quradi. Qisqa va lo'nda ifoda orqali kuchli estetik ta'sir hosil qiladi. Har bir so'z o'z o'rnida ishlatiladi, ortiqcha tasvir yoki balandparvozlikka yo'l qo'yilmaydi. Bu jihat nasrni she'riy ruh bilan boyitadi va o'quvchini chuqur mushohadaga chorlaydi.

Obrazlar tizimida ham ramziylik va umumlashtirish kuchli. Oddiy inson timsoli orqali katta ma'naviy masalalar ko'tariladi. Vijdon, sadoqat, muhabbat, yolg'izlik, jamiyat va shaxs munosabati kabi masalalar qahramonlar taqdiri orqali ochiladi. Qahramonlarning ichki iztirobi ko'pincha balandparvoz nutq bilan emas, balki sukut va ichki kechinmalar orqali ifodalanadi. Bu esa poeziyaga xos noziklikni yuzaga chiqaradi. O'quvchi voqeani faqat o'qibgina qolmay, uni his qiladi, qalban boshdan kechiradi.

Yozuvchi ijodida drammatizm ham poetik tus oladi. Ziddiyatlar sun'iy ravishda yaratilmaydi; ular inson qalbida tabiiy ravishda tug'iladi. Ichki kurash va ma'naviy tanlov jarayoni badiiy talqin markaziga chiqadi. Insonning o'z vijdoni bilan yuzma-yuz kelishi, tanlov oldida qolishi asarning asosiy dramatik kuchini tashkil etadi. Bu drammatizm o'quvchini ruhiy jihatdan larzaga soladi, uni mushohadaga undaydi.

Milliy ruh va qadriyatlar Xolmirzayev ijodining ajralmas qismidir. Yozuvchi milliylikni shior yoki tashqi belgilar orqali emas, balki inson ruhiyati orqali beradi. An'anaviy hayot tarzi, ota-ona

¹ Shukur Xolmirzayev. *Saylanma*. 1–2-jildlar. – Toshkent: G'afur G'ulom nomidagi nashriyot-matbaa ijodiy uyi, 2018.

va farzand o'rtasidagi munosabat, vatan tuyg'usi, sadoqat va oriyat masalalari poetik ifoda bilan uyg'unlashadi. Milliy qadriyatlar qahramonlarning ichki dunyosida yashaydi va ular orqali umumiy insoniy mazmunga ega bo'ladi.

Shuningdek, yozuvchi nasrida falsafiy mushohada kuchli. Hayotning ma'nosi, insonning jamiyatdagi o'rni, vaqt va xotira masalalari asarlarda nozik va chuqur tarzda talqin qilinadi. Bu falsafiylik quruq didaktika emas; u obraz va ruhiy holatlar orqali beriladi. Shu bois asar o'quvchiga tayyor xulosa bermaydi, balki uni mustaqil fikrlashga undaydi.

Xulosa qilib aytganda, Shukur Xolmirzayev nasrida poeziya mustaqil janr emas, balki ichki ruhiy qatlam sifatida yashaydi. Lirizm, ramziylik, ruhiy chuqurlik, ixcham va ta'sirchan til, dramatik ziddiyatlarning tabiiyligi — bularning barchasi yozuvchi nasrini poetik realizm darajasiga ko'taradi. Uning asarlari o'zbek adabiyotida nasr va poeziya uyg'unligining yorqin namunasi sifatida alohida o'rin tutadi. Xolmirzayev ijodi inson qalbini anglash, ruhiy poklanish va ma'naviy kamolot sari yetaklovchi badiiy maktabdir.

Foydalanilgan adabiyotlar

1. Toshboyev O. *Abadiy zamondosh*. – Toshkent: G'afur G'ulom nomidagi nashriyot-matbaa ijodiy uyi, 2018.
2. Shukur Xolmirzayev. *Saylanma*. 1-jild. – Toshkent: Sharq nashriyoti, 2006.
3. Karimov N. *XX asr o'zbek adabiyoti tarixi*. – Toshkent: O'qituvchi, 2010.
4. Qo'shjanov M. *Adabiyot nazariyasi*. – Toshkent: Tafakkur, 2005.
5. Yo'ldoshev Q. *Badiiy tahlil asoslari*. – Toshkent: Yangi asr avlodi, 2012.

ANALYSIS OF ADVERSE PROGNOSTIC FACTORS IN ENDOMETRIAL
CANCER

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Abstract. Endometrial cancer in patients over 50 years old, compared with the group of 60-75 years old, is characterized by a predominance of high-grade carcinomas (27.2% versus 12%, $p < 0.001$) due to the prevalence of non-endometrioid tumor histotype (16.98% versus 4.7%, $p = 0.005$). Extensive forms of the disease (FIGO stages III-IV) among women aged ≥ 70 years were observed in 17.6% of cases versus 6.7% in the comparison group ($p = 0.003$). The studied age groups were comparable in the extent of surgical treatment ($p = 0.637$) and adjuvant therapy performed in the postoperative period ($p = 0.749$).

Keywords: morphology, endometrioid adenocarcinoma.

Relevance. Population aging is the result of demographic changes, shifts in fertility and mortality patterns, and their ratios [1,3,5,7,9]. According to international criteria, a population is considered old if the proportion of individuals aged 55 and older exceeds 7% of the total population. According to statistics as of January 1, 2024, in Uzbekistan, 16% of the population, i.e., one in seven residents, is aged ≥ 55 years, and women account for 66.5% of the population in this age group [2,4,6,8,10].

Increasing life expectancy leads to an increase in the incidence of cancer among the elderly, which is a pressing issue in modern oncology. This issue requires a multidisciplinary approach, with mandatory implementation of a comprehensive geriatric assessment (CGA) to predict immediate and long-term treatment outcomes and select the optimal strategy, taking into account physical and mental status, social relationships, and satisfaction with quality of life [3,11].

Age is often a fundamental factor influencing treatment decisions for elderly cancer patients.

The results of a UK study assessing healthcare providers' biases in treating elderly breast cancer patients demonstrated that survey participants were significantly less likely to offer surgical treatment to older patients – 3% less likely for those over 50 years of age (compared to those aged 60), and 26% less likely for those aged 65 years. Thus, older age was a significant predictor of the decision to forgo surgical treatment.

Survey data also revealed that age was not a primary consideration among respondents, but was frequently mentioned alongside factors such as comorbidities, tumor biology, and reasons for avoiding surgery. Furthermore, there were responses indicating that there were cases in which older age was a clear factor for prescribing hormonal therapy over surgery, in contrast to younger patients, where the opposite was true. Some participants noted that treatment effectiveness is less important for older patients [1,13].

EC occupies a leading position in the structure of oncopathology in the female population [1, 14], with no potential for decline [2,15]. This is due to the increase in significant risk factors, particularly the ongoing aging of the population and obesity [60]. This creates the preconditions for an increase in the number of patients with a primary diagnosis of EC in the age group over 50 years.

A review of the literature revealed no studies in the domestic literature devoted to the clinical and morphological characteristics and long-term treatment outcomes of endometrial cancer in elderly and senile patients. Most foreign publications focus on the surgical aspects of treating patients in these age groups [3, 14].

Given that endometrial cancer treatment methods have changed significantly over the past 10 years and continue to change with the discovery of four molecular genetic variants of these tumors [14], the creation of an age-stratified registry of endometrial malignancies, taking into account new knowledge, will enable the development of unified clinical guidelines for this complex group of elderly patients.

Отправить отзыв Therefore, proper monitoring and recommendations to reduce the risk of recurrence are essential. While a significant number of studies are currently underway to identify prognostic factors influencing the course and outcome of EC, these factors should be studied separately for older individuals, which was the reason for conducting this study.

Objective of the study. To determine the clinical and morphological features and prognosis of endometrial cancer in patients over 50 years of age.

Materials and methods. The study included 136 patients who were examined and treated from 2022 to 2025 in the gynecology department of an oncology hospital in the Kharez region. Based on clinical, ultrasound, and other indications, the patients underwent surgical treatment (hysteroscopy with RDV) or hysterectomy) followed by morphological examination of the endometrial material. The results of the univariate analysis of qualitative variables influencing 5-year overall survival are presented in Table 38. Parameters that demonstrated statistical significance were then included in a multivariate regression analysis using the Cox proportional hazards model with stepwise inclusion of predictors. Factors influencing 5-year overall survival were as follows: age ≥ 70 years was associated with a 6.98-fold increased risk of death within 5 years, the p53abn molecular subgroup was associated with a 4-fold increased risk, and invasion of $> 1/2$ myometrium was associated with a 3.03-fold increased risk. These values were included in the prognostic model. The regression model was statistically significant ($df = 3$; $\chi^2 = 35.08$; $p < 0.0001$). The area under the receiver operating characteristic curve (ROC) was 0.841 ± 0.038 with a 95% CI of 0.772–0.895, indicating good discrimination between the presence and absence of risk for these factors in the studied cohort. The Harrell's C-index was 0.810 with a 95% CI of 0.751–0.870, indicating high predictive power of the resulting 5-year mortality risk model. The results of the univariate analysis of the qualitative indicators associated with 5-year EC recurrence are presented in Table 40. The indicators that demonstrated statistical significance were then included in a multivariate regression analysis using the Cox

proportional hazards model with stepwise inclusion of predictors. The p53abn subgroup was characterized by a significantly increased risk of 5-year EC recurrence (2.49-fold), cervical invasion (2.9-fold), the presence of LVI (4.57-fold), and dissemination of the pathological process through the peritoneum (3.96-fold). Including age group in the multivariate analysis demonstrated a trend toward statistical significance ($p = 0.0571$) in the increased risk of disease recurrence over 5 years. The area under the receiver operating characteristic (ROC) curve was 0.825 ± 0.036 with a 95% CI of 0.757–0.880, indicating good discrimination between the presence and absence of risk for these factors in the studied cohort. The Harrell's concordance index (Harrell's C-index) was 0.773 with a 95% CI of 0.714–0.832, indicating good predictive performance of the resulting model for 5-year recurrence risk. According to our study, endometrial cancer in women over 70 years of age was characterized by a predominance of high-grade carcinomas, which were observed in every third patient ($p < 0.001$), due to the prevalence of non-endometrioid neoplasms (16.98%) with a predominance of the serous histotype (7.55%) in their structure ($p = 0.005$). A similar distribution of the morphological structure of malignant endometrial neoplasms was demonstrated by researchers from Israel, who studied the effect of age on endometrial cancer outcomes (≤ 80 years vs. > 80 years). In the group of older patients, high-grade carcinomas were recorded in 45% of cases due to the predominance of serous tumors (17%), while in the comparison group, similar figures were 27% and 15%, respectively ($p = 0.018$) [15].

Conclusions. Thus, the study demonstrated that endometrial cancer in patients over 50 years of age is more aggressive based on the histological type of the tumor, its degree of differentiation, and the stage of the disease at diagnosis. Despite the absence of significant differences in the extent of surgical treatment and postoperative adjuvant therapy, the disease is characterized by worse long-term outcomes among older patients, as evidenced by statistically lower survival rates compared to patients aged 50-69.

BIBLIOGRAPHY

1. Endometrial cancer of the very elderly: management and survival in the Francogyn population / F.A. Martin, L. Dion, K. N. Timoh [et al.] // *Eur J Surg Oncol.* – 2023. – Vol. 49 (5). – P. 1023-1030.
2. Endometrial cancer: ESMO clinical practice guideline for diagnosis, treatment and follow-up / A. Oaknin, T.J. Bosse, C.L. Creutzberg [et al.] // *Ann Oncol.* – 2022. – Vol. 33 (9). – P. 860-877.
3. Endometrial carcinoma molecular subtype correlates with the presence of lymph node metastases / A. Jamieson, E.F. Thompson, J. Huvila [et al.] // *Gynecol Oncol.* – 2022. – Vol. 165 (2). P. 376-384.
4. Khamdamova M.T., Zhaloldinova M.M., Khamdamov I.B. The state of nitric oxide in the blood serum of patients with cutaneous leishmaniasis // *New Den Medicine.* - Bukhara, 2023. - № 5 (55). - P. 638-643.

5. Khamdamova M.T., Zhaloldinova M.M., Khamdamov I.B. The value of ceruloplasmin and copper in the blood serum of women wearing copper-containing intrauterine devices // *New Den Medicine*. - Bukhara, 2023. - № 6 (56). - P. 2-7.
6. Khamdamova M.T., Khasanova M.T. Various mechanisms of pathogenesis of endometrial hyperplasia in postmenopausal women (literature review) // *New Den Medicine*. - Bukhara, 2023. - № 8 (58). - P. 103-107.
7. Khamdamova M.T., Akramova D.E. Genetic aspects of genital prolapse in women of reproductive age // *New Den Medicine*. - Bukhara, 2024. - № 2 (64). - P.420-426.
8. Khamdamova M.T., Akramova D.E. Immediate and long-term results of surgical treatment of genital prolapse in elderly women // *New Den Medicine*. - Bukhara, 2025. - № 3 (77). - P. 201-207.
9. Khamdamova M.T., Akramova D.E. Efficiency of various methods of treatment of women with genital prolapse // *News of dermatovenerology and reproductive health*. - Tashkent, 2025. - № 2 (109). - P.30-33.
10. Khamdamova M.T., Khasanova M.T. genetic mechanisms of development of endometrial hyperplastic processes in women in menopausal age) // *New Den Medicine*. - Bukhara, 2025. - № 3 (77). - P. 207-211.
11. Khamdamova M.T., Khasanova M.T. Морфологические изменения эндометрия при гиперплазии // *Новости дерматовенерологии и репродуктивного здоровья*. - Ташкент. - 2025. - № 2 (109). - P. 12-14.
12. Khamdamova M.T., Umidova N.N. Генитальный эндометриоз – болезнь активных и деловых женщин // *Новости дерматовенерологии и репродуктивного здоровья*. - Ташкент. - 2025. - № 2 (109). - P. 33-14.
13. Khamdamova M.T., Akramova D.E. Генетические аспекты генитального пролапса у женщин репродуктивного возраста) // *New Den Medicine*. - Bukhara, 2024. - № 2 (64). - P. 420-426.
14. Evaluation of treatment effects in patients with endometrial cancer and POLE mutations: An individual patient data meta-analysis / J.N. McAlpine, D.S. Chiu, R.A. Nout [et al.] // *Cancer*. – 2021. - Vol. 127 (14). – P. 2409-2422.
15. Exclusion of older adults from cancer clinical trials: review of the literature and future recommendations / I.M. Bumanlag, J.A. Jaoude, M.K. Rooney [et al.] // *Semin Radiat Oncol*. – 2022. – Vol. 32 (2). – P. 125-134.

HOW AI HAS CHANGED THE ASSESSMENT OF STUDENTS IN MATHEMATICS

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In recent years, artificial intelligence has become one of the most discussed technologies in the world. AI refers to computer systems that can perform tasks which normally require human intelligence, such as learning, problem-solving and decision-making. While AI offers many advantages, it also brings certain challenges to society.

One of the main benefits of AI is that it makes our lives easier and more efficient. For example, AI is widely used in healthcare to help doctors diagnose diseases more accurately. In addition, companies like Tesla use AI technology to develop self-driving cars, which may reduce traffic accidents in the future. AI is also used in education, business and even social media platforms to improve user experience.

However, there are also some disadvantages of AI. Firstly, many people worry that AI will replace human workers. Robots and automated systems can perform tasks faster and cheaper than humans, which may lead to unemployment. Secondly, there are concerns about privacy and security. AI systems collect large amounts of personal data, and this information could be misused.

In my opinion, AI is a powerful tool that can greatly benefit society if it is used responsibly. Governments and companies should create clear rules to control how AI is developed and applied. By doing so, we can enjoy the advantages of AI while minimizing its negative effects.

Artificial Intelligence has significantly transformed the way students are assessed in mathematics. In the past, math assessment mainly depended on traditional methods such as written exams, quizzes, and homework checked manually by teachers. Although these methods were useful, they often focused only on final answers and did not always show how students thought through a problem. Today, AI is changing this process by making assessment faster, more personalized, and more detailed.

One of the biggest changes brought by AI is **instant feedback**. AI-powered platforms can check students' answers immediately and show whether they are correct or incorrect. More importantly, some systems can explain mistakes step by step. This helps students understand where they went wrong instead of simply seeing a low score. As a result, assessment becomes part of learning, not just a way to measure performance.

Another important change is **personalized assessment**. AI can analyze a student's level, strengths, and weaknesses, then provide tasks that match their needs. For example, if a student struggles with algebra but performs well in geometry, the system can offer more practice in algebra. This individualized approach makes math assessment more effective because it reflects each student's actual learning progress rather than comparing everyone in exactly the same way. AI has also improved **data collection and progress tracking**. Teachers can now use AI tools to monitor students' performance over time. These tools can identify patterns, such as repeated errors in fractions, equations, or word problems. With this information, teachers can better understand students' difficulties and adjust instruction accordingly. In this sense, assessment becomes more informative and supports better teaching decisions.

In addition, AI makes it possible to assess not only final answers but also the **problem-solving process**. Some advanced systems can evaluate the steps students take to solve a mathematical

task. This is especially important in mathematics because reasoning, logic, and method are just as valuable as the final result. By focusing on the process, AI encourages deeper understanding and critical thinking.

However, the use of AI in math assessment also brings some challenges. One concern is that students may become too dependent on technology and use AI tools to get answers without real understanding. Another issue is fairness, because not all students have equal access to digital devices and internet connection. Teachers also need to make sure that AI does not replace human judgment completely, since motivation, creativity, and classroom context still require a teacher's personal evaluation.

In conclusion, AI has changed the assessment of students in mathematics in many positive ways. It provides immediate feedback, supports personalized learning, tracks progress efficiently, and evaluates problem-solving processes more deeply. Despite some challenges, AI has the potential to make math assessment more accurate, supportive, and student-centered. For this reason, it is becoming an important part of modern education.

References

1. Miao, F., Holmes, W., Huang, R., & Zhang, H. (2023). *Guidance for generative AI in education and research*. UNESCO.
2. OECD. (2021). *AI and the future of skills, Volume 1: Capabilities and assessments*. OECD Publishing.
3. OECD. (2023). *Is education losing the race with technology? AI's progress in maths and reading*. OECD Publishing.
4. Opesemowo, O. A. G., Asije, M. O., Arigbabu, A. A., & Awofala, A. O. A. (2024). A systematic review of artificial intelligence in mathematics education: The emergence of 4IR. *European Journal of Mathematics and Science Education*.

HOW AI IS INFLUENCING THE ASSESSMENT OF STUDENTS IN PHYSICS

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Intorduction: Artificial Intelligence, or AI, is a very popular topic today. Many people think AI is only about robots, but it is actually in our smartphones and computers too. For example, when you use Google Maps or talk to Chatgpt, you are using AI. There are many good things about AI. First, it makes our life easier. It can find information very fast and help us with our homework or work. Second, AI can do boring tasks for us. This gives humans more time to do creative things. However, some people are worried about AI. They think that robots will take our jobs in the future. Also, some students use AI too much and stop thinking for themselves. This is a problem because we need to keep our brains active. In our opinion, AI is a great invention. It is like a powerful tool, such as a car or a computer. If we use it in a smart way, it will help us build a better world. We should not be afraid of it, but we must learn how to use it correctly.

Artificial Intelligence is changing the way students are assessed in physics by making evaluation more flexible, detailed, and learner-centered. Traditional assessment in physics usually includes written exams, numerical tasks, laboratory reports, and oral explanations. These methods remain valuable, but they do not always capture how students think through a problem. Recent guidance from UNESCO and OECD's work on assessment both support the idea that AI can reshape educational assessment by expanding what can be measured and how feedback is given.

One important influence of AI is the improvement of **formative assessment**. In physics, students often struggle with concepts, formulas, units, and the interpretation of graphs or experiments. AI-based tools can detect patterns in these mistakes and respond immediately with hints or corrective feedback. This makes assessment more useful for learning because it helps students improve during the learning process, not only after receiving a final mark. Research on AI in science education shows that AI tools are increasingly used to support ongoing learning and evaluation in science-related subjects.

AI also supports **adaptive assessment** in physics. Not all students face the same difficulties: one learner may have trouble with mechanics, another with electricity, and another with experimental reasoning. AI systems can analyze these differences and adjust the level or type of tasks accordingly. This allows assessment to become more individualized and helps teachers identify specific learning gaps more efficiently. OECD's assessment work and recent reviews in science education both point to the growing role of AI in creating more responsive and skills-based approaches to assessment.

Another major contribution is that AI can place greater emphasis on the **reasoning process**. In physics, reaching the correct answer is important, but the process of selecting principles, applying equations, and explaining results is equally important. Some AI-supported systems can analyze intermediate steps in problem solving, which gives a fuller picture of student understanding. This is especially valuable in physics because students may arrive at a correct answer by memorization or guessing without truly understanding the concept. Studies on AI in physics problem solving suggest that AI can be useful for supporting learning, while also showing that reasoning-intensive tasks remain challenging for current systems.

AI is also influencing assessment through **digital labs, simulations, and chatbot-based learning environments**. In modern physics classrooms, students increasingly interact with virtual

experiments and AI-supported study tools. These technologies can generate data about how students approach inquiry, solve problems, and respond to misconceptions. A recent study on chatbot conversations in physics education, for example, examined how interaction data could be used to identify misconceptions in a university physics course.

Despite these advantages, AI in physics assessment still has limitations. Current systems can support routine or structured tasks, but they are less reliable on complex problems that require spatial reasoning, visual interpretation, or deep conceptual integration. This means AI should not be treated as a fully independent assessor. Instead, it works best as a support tool that helps teachers provide faster feedback and better-targeted instruction. Recent research on AI performance in physics problem solving highlights both its promise and its current weaknesses in advanced reasoning tasks.

There are also ethical and practical concerns. UNESCO emphasizes that AI in education should be used with attention to transparency, fairness, and human oversight. In addition, unequal access to technology may create gaps between students who can benefit from AI tools and those who cannot. For this reason, the use of AI in physics assessment should remain balanced, responsible, and guided by teachers.

In conclusion, AI is influencing the assessment of students in physics by making it more adaptive, process-oriented, and continuous. It helps teachers track misconceptions, personalize tasks, and evaluate not only answers but also reasoning. At the same time, its limitations show that human judgment is still essential. When used carefully, AI can strengthen physics assessment and make it more meaningful for student learning.

References

1. Fayzullina, A. R. (2025). *Artificial intelligence in science education: A systematic review of applications, impacts, and challenges*. *Contemporary Educational Technology*.
2. OECD. (2021). *AI and the Future of Skills, Volume 1: Capabilities and Assessments*. OECD Publishing.
3. UNESCO. (2023). *Guidance for generative AI in education and research*.
4. UNESCO. (2025). *AI and education: Guidance for policy-makers*.

MASOFADAN ZONDLASH MA'LUMOTLARI ASOSIDA SUV OBYEKTLARINI ANIQLASH (NDWI indeksi yordamida)

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Annotatsiya. Ushbu mavzuda masofadan zondlash texnologiyalari, xususan sun'iy yo'ldosh tasvirlari yordamida suv obyektlarini aniqlash va monitoring qilishda keng qo'llaniladigan NDWI (Normalized Difference Water Index — Normallashtirilgan suv indeksi) metodologiyasi atroflicha tahlil qilinadi. Tezida NDWI indeksining fizik asoslari, matematik formulasi, turli sun'iy yo'ldosh platformalariga moslashuvi va Landsat, Sentinel-2 hamda MODIS ma'lumotlari bilan integratsiyasi ko'rib chiqiladi. O'zbekiston hududi misolida Orol dengizi va Amudaryo havzasidagi suv resurslarini monitoring qilishda NDWI ning samaradorligi baholanadi. Maqolada Google Earth Engine platformasida NDWI hisoblashning amaliy algoritmi, natijalarni tasniflash va aniqlik baholash metrikalari ham yoritiladi.

Kalit so'zlar: masofadan zondlash, NDWI, suv indeksi, sun'iy yo'ldosh tasvirlari, Landsat, Sentinel-2, Google Earth Engine, suv resurslari monitoring, Orol dengizi, spektral tahlil.

ABSTRACT. This article provides a comprehensive analysis of the NDWI (Normalized Difference Water Index) methodology widely used in remote sensing technologies for the detection and monitoring of water bodies using satellite imagery. The study examines the physical foundations of the NDWI index, its mathematical formula, adaptation to various satellite platforms, and integration with Landsat, Sentinel-2, and MODIS data. The effectiveness of NDWI in monitoring water resources in the Aral Sea basin and Amu Darya catchment area in Uzbekistan is evaluated. The article also covers a practical algorithm for NDWI computation on the Google Earth Engine platform, result classification, and accuracy assessment metrics.

Keywords: remote sensing, NDWI, water index, satellite imagery, Landsat, Sentinel-2, Google Earth Engine, water resources monitoring, Aral Sea, spectral analysis.

KIRISH

Bugungi kunda global iqlim o'zgarishi, suv resurslarining kamayib borishi va ekologik muammolarning keskinlashuvi suv obyektlarini muntazam monitoring qilish zaruratini kuchaytirmoqda.

Shu nuqtai nazardan, masofadan zondlash texnologiyalari suv obyektlarini aniqlash va monitoring qilishda muhim vosita sifatida keng qo'llanilmoqda. Sun'iy yo'ldosh tasvirlari asosida katta hududlarni qisqa vaqt ichida tahlil qilish, suv yuzalarining o'zgarishini kuzatish hamda ekologik holatni baholash imkoniyati mavjud. Bu esa masofadan zondlash usullarining samaradorligini yanada oshiradi.

Mazkur yo'nalishda spektral indekslardan foydalanish alohida ahamiyatga ega bo'lib, ular yordamida turli yer qoplami turlarini farqlash mumkin. Shunday indekslardan biri — NDWI (Normalized Difference Water Index) bo'lib, u suv obyektlarini aniqlashda keng qo'llaniladi. Ushbu indeks suv va quruqlik yuzalari o'rtasidagi spektral farqlarni aniqlash orqali suv hududlarini aniq ajratib ko'rsatish imkonini beradi. Dunyo miqyosida suv resurslari tobora

kuchayib borayotgan iqlim o'zgarishlari, aholi sonining o'sishi va sanoat faoliyatining kengayishi natijasida kamayib bormoqda. BMT ma'lumotlariga ko'ra, 2025 yilga kelib dunyo aholisining 40% dan ortig'i suv tanqisligiga duch kelishi kutilmoqda. Shu bois suv resurslarini aniq va tezkor monitoring qilish global ekologik muammoni hal etishning muhim shartiga aylanib qolmoqda.

Ayniqsa, daryo, ko'l, suv omborlari va boshqa gidrologik obyektlarning holatini aniqlash hamda ularni samarali boshqarish zamonaviy ilm-fan oldida turgan dolzarb masalalardan biri hisoblanadi. An'anaviy kuzatuv usullari ko'p vaqt va mablag' talab qilishi bilan birga, keng hududlarni qamrab olish imkoniyatining cheklanganligi bilan ajralib turadi.

An'anaviy usullar - bevosita o'lchash, gidrologik stansiyalar va yerda olib boriladigan tadqiqotlar - vaqt va moliyaviy jihatdan qimmat bo'lib, keng hududlarni qamrab ola olmaydi. Masofadan zondlash texnologiyalari esa bu muammoni tubdan hal qilish imkonini bermoqda. Sun'iy yo'ldosh tasvirlari yordamida bir vaqtning o'zida millionlab kvadrat kilometr hudud monitoring qilinishi mumkin.

NDWI (Normalized Difference Water Index) — 1996 yilda Stuart Gao tomonidan taklif etilgan bu indeks qisqa to'lqin uzunlikdagi infraqizil (NIR) va yashil spektr kanallari nisbatiga asoslanadi. Hozirga qadar NDWI dunyo bo'ylab ko'llar, daryolar, botqoqliklar va vaqtinchalik suv havzalarini aniqlashda eng keng qo'llaniladigan spektral indekslardan biri bo'lib qolmoqda.

O'zbekiston uchun bu masala ayniqsa dolzarbdir: XX asr ikkinchi yarmidan beri Orol dengizining qurib borishi, Sirdaryo va Amudaryoning suv miqdori kamayishi ekologik falokatga olib kelmoqda. Kosmik monitoring texnologiyalari bu o'zgarishlarni real vaqtda kuzatish va kerakli boshqaruv qarorlarini qabul qilish uchun zaruriy asos yaratadi.

NDWI indeksining tarixi va rivojlanishi

NDWI konsepsiyasi birinchi marta 1996 yilda Gao B.C. tomonidan "NDWI — o'simlik qoplamidagi suv tarkibini aniqlash uchun normallashtirilgan farq suv indeksi" nomli asarida nashr etilgan. Dastlabki formula NIR va SWIR (qisqa to'lqin uzunlikdagi infraqizil) kanallar asosida tuzilgan bo'lib, o'simlik barglari va tuproqdagi namligi aniqlashga mo'ljallangan edi.

1997 yilda McFeeters S.K. suv havzalarini bevosita aniqlash uchun moslangan MNDWI (Modified NDWI) formulasini taklif qildi. U NIR o'rniga yashil (Green) kanaldan foydalanish orqali suv, er va o'simlik o'rtasidagi farqni aniqroq aks ettirishga erishdi. Keyinchalik Xu H. (2006) MNDWI ni yanada takomillashtirdi va shahar infrastrukturasi fonida suv tanish aniqligini oshirdi.

So'nggi yillarda O'zbekistonda ham masofadan zondlash sohasida bir qator tadqiqotlar amalga oshirildi. TATU, NUUZ va O'zbekiston Milliy kosmik tadqiqotlar agentligi (O'zbekosmos) olimlari Orol dengizi, To'ytepa ko'li, Charvak suv ombori kabi ob'ektlarni monitoring qilishda NDWI ni muvaffaqiyatli qo'llashmoqda.

Spektral tahlilning fizik asoslari

Har qanday moddaning o'ziga xos spektral imzosi (spectral signature) mavjud. Suv molekulari elektromagnit nurlanishning turli to'lqin uzunliklariga har xil munosabatda bo'ladi: ko'rinadigan nurlanishning ko'k va yashil diapazonida suv yuqori qaytarish qobiliyatiga ega, NIR diapazonida esa deyarli barcha nurni yutadi. Shu farq NDWI hisoblashning asosini tashkil etadi.

Landsat-8/9 sun'iy yo'ldoshlarida OLI (Operational Land Imager) sensori 30 metrli fazoviy aniqlikda 11 ta spektral kanal bo'yicha ma'lumot to'playdi. Sentinel-2 esa 10 metrli aniqlikda 13 ta kanal taqdim etadi. Ushbu platformalarning kombinatsiyasida NDWI hisoblash suv obyektlarini 90% dan yuqori aniqlik bilan aniqlash imkonini beradi.

NDWI INDEKSINING MATEMATIK ASOSI VA HISOBLASH METODOLOGIYASI

Asosiy formula

NDWI indeksi quyidagi formula asosida hisoblanadi:

$$NDWI = (Green - NIR) / (Green + NIR)$$

Bu yerda: **Green** — ko‘rinadigan spektrning yashil kanali (Landsat-8 da Band 3: 0,53–0,59 μm);
NIR — yaqin infraqizil kanal (Landsat-8 da Band 5: 0,85–0,88 μm).

Indeks qiymati -1 dan $+1$ gacha o‘zgaradi. Ijobiy qiymatlar (odatda $> 0,3$) suv yuzasini, manfiy qiymatlar esa quruqlik va o‘simlikni bildiradi. Chegaraviy qiymat (threshold) odatda 0 yoki $0,1$ da belgilanadi, ammo har bir hududning o‘ziga xos xususiyatlariga qarab bu qiymat kalibrlangan holda qo‘llaniladi.

Modifikatsiyalangan MNDWI formulasi

McFeeters (1997) taklif etgan modifikatsiya shaharlar va inson faoliyati kuchli bo‘lgan hududlarda aniq natijalar beradi:

$$MNDWI = (Green - SWIR) / (Green + SWIR)$$

Bu yerda: **SWIR** — qisqa to‘lqinli infraqizil kanal (Landsat-8 da Band 6: 1,57–1,65 μm).
MNDWI quruq tuproq, beton va asfalt kabi sun‘iy yuzalar bilan suv o‘rtasidagi kontrastni oshiradi. Shahar muhitida amalga oshirilgan tadqiqotlar shuni ko‘rsatadiki, MNDWI NDWI ga nisbatan shahar kanallari va sun‘iy hovuzlarni aniqlashda 12–18% aniqroq natija beradi.

Sun‘iy yo‘ldosh platformalari va kanal muvofiqligi

1-jadval.

NDWI hisoblashda qo‘llaniladigan sun‘iy yo‘ldosh kanallari

Platforma	Yashil kanal	NIR kanal	SWIR kanal	Fazoviy aniqlik
Landsat-5/7 TM/ETM+	Band 2 (0.52–0.60)	Band 4 (0.77–0.90)	Band 5 (1.55–1.75)	30 m
Landsat-8/9 OLI	Band 3 (0.53–0.59)	Band 5 (0.85–0.88)	Band 6 (1.57–1.65)	30 m
Sentinel-2 MSI	Band 3 (0.56 μm)	Band 8 (0.84 μm)	Band 11 (1.61 μm)	10/20 m
MODIS Terra/Aqua	Band 4 (0.55 μm)	Band 2 (0.86 μm)	Band 6 (1.64 μm)	250–500 m
SPOT-6/7	Band 2 (0.53–0.60)	Band 4 (0.76–0.89)	—	6 m

Ma'lumotlarni tayyorlash

NDWI tahlilini samarali amalga oshirish uchun boshlang‘ich ma'lumotlarni to‘g‘ri tayyorlash hal qiluvchi ahamiyatga ega. Tayyorgarlik bosqichlari quyidagilarni o‘z ichiga oladi:

Atmosfera korreksiyasi. Xom kosmik tasvirlar atmosfera molekullari va aerazol zarrachalari tomonidan sochilgan yorug‘likni o‘z ichiga oladi. DOS (Dark Object Subtraction) yoki FLAASH/6S kabi algoritmlar yordamida bu ta’sir bartaraf etiladi va yuza qaytarish koeffitsientlari (surface reflectance) olinadi.

Bulutlarni maskalash. Bulutlar va ularning soyalari suv indeksi hisoblashda xatolik manbai hisoblanadi. QA_PIXEL (Landsat) yoki SCL (Sentinel-2) qatlamlari yordamida bulutli piksellar tahlildan chiqarib tashlanadi.

Geometrik korreksiya. Multivaqtlil tahlil uchun barcha tasvirlar bir xil koordinatlar tizimiga (WGS 84 / UTM) o‘tkazilishi shart. RMS (Root Mean Square) xatoligi 0,5 pikseldan oshmasligi tavsiya etiladi.

Google Earth Engine'da NDWI hisoblash

Google Earth Engine (GEE) — bulutli hisoblash platformasi bo'lib, petabayt hajmdagi kosmik ma'lumotlarni to'g'ridan-to'g'ri brauzer orqali qayta ishlash imkonini beradi. Quyida Sentinel-2 ma'lumotlari asosida NDWI hisoblashning JavaScript kodi keltirilgan:

```
// Sentinel-2 tasvirini yuklash va bulutlarni filtr qilish
var s2 = ee.ImageCollection('COPERNICUS/S2_SR_HARMONIZED')
  .filterBounds(aoi).filterDate('2023-05-01','2023-09-30')
  .filter(ee.Filter.lt('CLOUDY_PIXEL_PERCENTAGE', 10));
var ndwi = s2.median().normalizedDifference(['B3','B8']);
var water = ndwi.gt(0.1); // Chegaraviy qiymat = 0.1
```

Ushbu kod ortogonal kanal bo'yicha mediana composite (median kompozit) hosil qilib, NDWI ni avtomatik hisoblaydi va chegaraviy qiymat orqali suv piksellarini ajratib oladi. Natijada ikkilik (binary) maska olinadi: 1 — suv, 0 — quruqlik.

Natijalarni tasniflash va tekshirish

NDWI natijalarini baholashda quyidagi aniqlik metrikalari qo'llaniladi: Overall Accuracy (umumiy aniqlik), Kappa koeffitsienti, Producer's Accuracy va User's Accuracy. Yerdagi tekshirish nuqtalari (ground truth points) GPS yordamida olingan ma'lumotlar asosida shakllantiriladi.

2-jadval.

NDWI qiymatlarini tasniflash shkalasi

NDWI qiymati	Toifa	Tavsif	Rang belgisi
> 0,3	Suv	Ochiq suv yuzasi, ko'l, daryo	Ko'k (azraq)
0,1 – 0,3	Nam hudud	Botqoq, sohil chizig'i, ho'l er	Moviy
0,0 – 0,1	Chegaraviy zona	Nam tuproq, sug'oriladigan yer	To'q sariq
-0,1 – 0,0	Siyrak o'simlik	O'tloq, qurg'oqchil tuproq	Och yashil
< -0,1	Quruqlik	Cho'l, shahar, qo'riq	Qo'ng'ir

O'ZBEKISTON HUDUDI MISOLIDA NDWI TAHLILI**Orol dengizini monitoring qilish**

Orol dengizi — XX asrning eng yirik ekologik falokati sifatida tan olingan. 1960 yilda 68 000 km² maydonga ega bo'lgan bu havza bugungi kunda 10% dan kamroq suv yuzasini saqlaydi. Landsat arxivlari (1972 yildan buyon) NDWI yordamida dengizning yillik suv maydonini milodiy aniqlikda hisoblash imkonini beradi.

2000–2023 yillar davomida olib borilgan NDWI tahlili shuni ko'rsatadiki, Shimoliy Orol (Kichik Orol) suv maydoni 2005 yildan beri nisbatan barqarorlashgan — bu Qo'ng'iro't to'g'oni qurilishi natijasida yuz berdi. Janubiy Orol esa deyarli to'liq qurib, Orolqum cho'lga aylanib bormoqda. Yillik o'rtacha suv yuzasi kamayish tezligi 1985–2000 yillar orasida 650 km²/yil ni tashkil etgan.

Amudaryo va Sirdaryo havzasi

O'rta Osiyo yirik daryolari — Amudaryo va Sirdaryoni — NDWI yordamida monitoring qilish suv resurslarini boshqarishda muhim ahamiyatga ega. Sentinel-2 ning 10 metrli aniqligida daryo kanallarining kenglik o'zgarishi, to'g'onlar va suv omborlari holati yillik kesimda kuzatilishi mumkin.

Tadqiqotlar shuni ko'rsatadiki, ko'klamgi toshqin davrida (mart–may) Amudaryo deltasidagi suv yuzasi yoz oylariga (iyul–avgust) nisbatan o'rtacha 2,3 baravar katta. Bunday mavsumiy

dinamikani avtomatik kuzatish irrigatsiya tizimlarini optimal boshqarish, sel xavfini oldindan aniqlash va qishloq xo'jaligi suvini rejalashtirish uchun zarur.

Charvak suv ombori va boshqa ichki suv havzalari

Charvak suv ombori O'zbekistonning eng yirik sun'iy suv havzasi bo'lib, yillik sig'imi 2 milliard m³ dan iborat. NDWI tahlili asosida suv ombori maydoni yil davomida 3,5% dan 100% gacha to'lishi kuzatilgan. Ushbu ko'rsatkich suv ta'minoti rejalashtirish va gidroelektr stansiyasini boshqarishda amaliy foydalanilmoqda.

Bundan tashqari, Zarafshon daryosi, Dengizkul ko'li, Arnasoy ko'llar sistemasi va Qashqadaryo havzasida ham NDWI tahlili muvaffaqiyatli qo'llanilgan. Tadqiqotlar natijasida O'zbekiston hududidagi 200 dan ortiq suv obyektining mavsumiy va ko'p yillik dinamikasi xaritasi tuzilgan.

3-jadval. O'zbekistondagi asosiy suv obyektlari NDWI tahlili natijalari

Suv objekti	Maydon (2000)	Maydon (2023)	O'zgarish	Tahlil platformasi
Orol dengizi (Janubiy)	17 000 km ²	3 200 km ²	-81,2%	Landsat-7/8
Orol dengizi (Shimoliy)	3 000 km ²	3 150 km ²	+5,0%	Landsat-7/8
Charvak suv ombori	40 km ²	39 km ²	-2,5%	Sentinel-2
To'yatepa ko'li	90 km ²	62 km ²	-31,1%	Sentinel-2
Arnasoy ko'llar sist.	2 500 km ²	3 100 km ²	+24,0%	MODIS
Amudaryo deltasi	12 000 km ²	7 800 km ²	-35,0%	Landsat-8/9

NDWI ning afzalliklari

NDWI ning eng kuchli tomoni — uning sodda matematik tuzilishi va turli sun'iy yo'ldosh platformalari bilan keng muvofiqligidir. Indeksning hisoblash algoritmi avtomatlashtirilishi mumkin, bu esa katta hududlarni tezkor monitoring qilish imkonini beradi. GEE kabi platformalarda yillik yoki o'n yillik suv dinamikasini bir necha daqiqada tahlil qilish mumkin bo'ladi.

Ikkinchi muhim afzallik — arxiv ma'lumotlardan foydalanish imkoniyati. Landsat arxivlari 1972 yildan beri mavjud bo'lib, bu yer yuzasidagi suv obyektlarining 50 yillik dinamikasini o'rganish imkonini beradi. Bunday uzoq muddatli monitoring iqlim o'zgarishlari va inson faoliyatining suv resurslariga ta'sirini baholash uchun beqiyos manbadir.

Cheklovlar va xatolik manbalari

Biroq NDWI bir qator cheklovlarga ham ega. Birinchidan, atmosfera ta'siri (bulutlar, aerazol) tasvirlar sifatini pasaytiradi va O'rta Osiyo cho'l hududlarida chang bo'ronlari davomida olingan ma'lumotlarning ishonchliligini kamaytiradi. Ikkinchidan, suvning sayozligi va loyqaligi (turbidlik) NDWI qiymatini pasaytiradi — Amudaryo kabi cho'kindiga to'la daryolarda bu muammo ayniqsa seziladi.

Uchinchidan, inson qo'li bilan yaratilgan qoplamalar — metallali tomlar, nam beton — ba'zan suv bilan chalkashib ketishi mumkin. Bu muammoni bartaraf etish uchun NDWI ni NDVI (o'simlik indeksi) va NDBI (qurilish indeksi) bilan kombinatsiyalab, qarorlar daraxti algoritmlaridan foydalanish tavsiya etiladi.

To'rtinchidan, erning nozik suv qatlamlari (0–5 sm chuqurlikdagi suv) va muzliklarning erishidan hosil bo'lgan qisqa muddatli suv yuzalari NIR kanali tomonidan suvning infraqizilni yutish xususiyatiga ega bo'lmaganligi sababli to'g'ri tasniflanmasligi mumkin.

XULOSA VA TAVSIYALAR

NDWI indeksining masofadan zondlash sohasidagi o'rnini, uning nazariy-matematik asoslarini va amaliy qo'llanish metodologiyasini to'liq yoritishga harakat qildi. Tadqiqot natijalari asosida quyidagi xulosalar shakllantirildi:

1. NDWI indeksi suv obyektlarini aniqlashning sodda, tezkor va ishonchli usuli bo'lib, Landsat va Sentinel-2 kabi keng tarqalgan sun'iy yo'ldosh platformalari bilan to'liq muvofiqdir. Chegaraviy qiymat (0,1) standart holatda yaxshi natija bersa-da, har bir hudud uchun kalibrlash tavsiya etiladi.
2. O'zbekiston hududida NDWI tahlili Orol dengizining 50 yillik degradatsiyasini, Amudaryo deltasining qisqarishini va ichki suv havzalarining mavsumiy dinamikasini yuqori aniqlikda aks ettirish imkonini bergan. Bu ma'lumotlar suv resurslarini boshqarish va iqlim o'zgarishlari ta'sirini baholash uchun qaror qabul qiluvchi organlar uchun muhim asos yaratadi.
3. Google Earth Engine platformasi NDWI hisoblashni bulutli muhitda tezkor va samarali amalga oshirish imkonini beradi. Millionlab kvadrat kilometr maydonni bir necha daqiqada qayta ishlash qobiliyati ushbu platformani O'rta Osiyo mintaqasi uchun optimal tanlov qiladi.
4. NDWI ni NDVI, MNDWI va EWI (Enhanced Water Index) kabi boshqa spektral indekslar bilan kombinatsiyalab qo'llash, shuningdek mashinaviy o'rganish algoritmlarini integratsiyalash tasniflash aniqligini 92–96% gacha oshirishi ko'rsatilgan.
5. Kelajakda O'zbekistonda suv resurslarini real vaqt rejimida monitoring qilish uchun Sentinel-2 (10 kun qaytuvchanligi) va MODIS (kunlik qaytuvchanligi) ma'lumotlarini avtomatik ravishda qayta ishlaydigan milliy geoportal tizimini joriy etish tavsiya etiladi.

FOYDALANILGAN ADABIYOTLAR:

1. Gao B.C. NDWI A Normalized Difference Water Index for remote sensing of vegetation liquid water from space // Remote Sensing of Environment. 1996. Vol. 58(3). P. 257–266.
2. McFeeters S.K. The use of the Normalized Difference Water Index (NDWI) in the delineation of open water features // International Journal of Remote Sensing. 1996. Vol. 17(7). P. 1425–1432.
3. Xu H. Modification of Normalised Difference Water Index (NDWI) to enhance open water features in remotely sensed imagery // International Journal of Remote Sensing. 2006. Vol. 27(14). P. 3025–3033.
4. Gorelick N. et al. Google Earth Engine: Planetary-scale geospatial analysis for everyone // Remote Sensing of Environment. 2017. Vol. 202. P. 18–27.
5. Feyisa G.L. et al. Automated Water Extraction Index: A new technique for surface water mapping using Landsat imagery // Remote Sensing of Environment. 2014. Vol. 140. P. 23–35.
6. Orolning qurib borisho: kosmik monitoring natijalari. O'zbekosmos hisoboti. — Toshkent, 2022. 89 b.
7. Chander G., Markham B.L., Helder D.L. Summary of current radiometric calibration coefficients for Landsat MSS, TM, ETM+, and EO-1 ALI sensors // Remote Sensing of Environment. 2009. Vol. 113(5). P. 893–903.
8. Drusch M. et al. Sentinel-2: ESA's Optical High-Resolution Mission for GMES Operational Services // Remote Sensing of Environment. 2012. Vol. 120. P. 25–36.
9. Toshmatov E., Nazarov A. Masofadan zondlash texnologiyalari asoslari. TATU nashriyoti, Toshkent. 2021. 210 b.
10. Yusupov R., Mirzayev S. O'rta Osiyo suv resurslarini kosmik monitoring qilish. Fan, Toshkent. 2020. 186 b.

11. Li W. et al. A comparison of land surface water mapping using the normalized difference water index from TM, ETM+ and ALI // Remote Sensing. 2013. Vol. 5(11). P. 5530–5549.



**BAKTERIYALARDA ANTIBIOTIKLARGA REZISTENTLIK RIVOJLANISH
MEXANIZMLARI VA UNING KLINIK AHAMIYATI**

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Annotatsiya: Antibiotiklar bakterial infeksiyalarni davolashda muhim terapevtik vosita hisoblanadi. So'nggi yillarda mikroorganizmlarning antibiotiklarga nisbatan rezistentligi ortib borishi global sog'liqni saqlash tizimida dolzarb muammolardan biriga aylandi. Mazkur maqolada bakteriyalarda antibiotiklarga rezistentlik rivojlanishining molekulyar-biologik mexanizmlari, rezistent shtammlarning shakllanishiga olib keluvchi omillar hamda ularning klinik amaliyotdagi ahamiyati tahlil qilinadi. Shuningdek, antibiotiklardan oqilona foydalanish va antimikrob terapiyani nazorat qilishning ahamiyati ko'rib chiqiladi.

Kalit so'zlar: antibiotiklar, bakteriyalar, rezistentlik, mikroorganizmlar, beta-laktamaza, infeksiya, antimikrob terapiya.

**MECHANISMS OF ANTIBIOTIC RESISTANCE DEVELOPMENT IN BACTERIA AND
ITS CLINICAL SIGNIFICANCE**

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Abstract: Antibiotics are essential therapeutic agents in the treatment of bacterial infections. In recent years, the increasing resistance of microorganisms to antibiotics has become one of the most pressing challenges in global healthcare. This article analyzes the molecular-biological mechanisms of antibiotic resistance development in bacteria, the factors leading to the formation

of resistant strains, and their significance in clinical practice. Furthermore, the importance of the rational use of antibiotics and the oversight of antimicrobial therapy are discussed.

Keywords: *antibiotics, bacteria, resistance, microorganisms, beta-lactamase, infection, antimicrobial therapy.*

Infeksion kasalliklar insoniyat tarixida keng tarqalgan patologiyalardan biri bo'lib, ularni davolashda antibiotik preparatlari muhim o'rin egallaydi. XX asr o'rtalarida antibiotiklarning kashf etilishi tibbiyot sohasida katta burilish yasadi hamda bakterial infeksiyalar tufayli yuzaga keladigan o'lim ko'rsatkichlarini sezilarli darajada kamaytirdi.

Biroq so'nggi o'n yilliklarda bakteriyalarning antibiotiklarga nisbatan rezistentligi keskin ortib bormoqda. Antimikrob preparatlarning keng va ba'zan nazoratsiz qo'llanilishi mikroorganizmlarning moslashuvchanlik xususiyatlarini kuchaytirib, yangi rezistent shtammlarning paydo bo'lishiga olib kelmoqda. World Health Organization ma'lumotlariga ko'ra, antibiotik rezistentligi global sog'liqni saqlash tizimi oldida turgan eng jiddiy muammolardan biri hisoblanadi. Rezistent mikroorganizmlar tufayli infeksiyon kasalliklarni davolash murakkablashadi, davolash muddati uzayadi hamda bemorlar o'limi xavfi ortadi. Antibiotik rezistentligi bakteriyalarning antimikrob preparatlar ta'siriga chidamlilik hosil qilishi bilan tavsiflanadi. Bunday mikroorganizmlar antibiotiklar mavjud bo'lgan muhitda ham yashab qolish va ko'payish qobiliyatiga ega bo'ladi. Rezistentlik tabiiy (intrinsik) yoki orttirilgan (acquired) bo'lishi mumkin. Tabiiy rezistentlik bakteriya turining biologik xususiyatlari bilan bog'liq bo'lsa, orttirilgan rezistentlik genetik mutatsiyalar yoki genetik material almashinuvi natijasida yuzaga keladi. Bakteriyalarda antibiotiklarga chidamlilik rivojlanishining muhim mexanizmlaridan biri antibiotik molekulalarini parchalaydigan fermentlar ishlab chiqarishdir. Masalan, beta-laktamaza fermentlari beta-laktam guruhiga kiruvchi antibiotiklarning strukturasi buzib, ularning bakteritsid ta'sirini yo'qotadi. Ba'zi grammanfiy bakteriyalar hujayra membranasidagi porin oqsillari tuzilishini o'zgartirib, antibiotiklarning hujayra ichiga kirishini cheklaydi. Bu holat ham bakteriyalarning rezistentligini oshiradi. Ayrim bakteriyalar maxsus transport tizimlari — efflyuks nasoslari orqali antibiotik molekulalarini hujayradan tashqariga chiqarib yuboradi. Bu mexanizm antibiotiklarning hujayra ichidagi konsentratsiyasini kamaytiradi va bakteriya yashab qolishiga imkon yaratadi. Antibiotik rezistentligi rivojlanishiga bir qator epidemiologik va ijtimoiy omillar sabab bo'ladi. Ularga antibiotik preparatlarini nazoratsiz qo'llash, o'z-o'zini davolash, davolash kursini to'liq yakunlamaslik, veterinariya va qishloq xo'jaligida antibiotiklardan keng foydalanish kiradi. Shuningdek, kasalxonalarda sanitariya-gigiyena qoidalariga yetarli darajada rioya qilinmasligi ham nosokomial infeksiyalarning tarqalishiga sabab bo'ladi. Bunday infeksiyalar ko'pincha ko'p dorilarga chidamli mikroorganizmlar bilan bog'liq bo'ladi. Antibiotik rezistentligi klinik amaliyotda sezilarli muammolarni yuzaga keltiradi. Rezistent bakteriyalar sababli infeksiyon kasalliklarni davolash murakkablashadi hamda uzoq muddatli terapiyani talab qiladi. Bundan tashqari, kuchli va qimmat antimikrob preparatlardan foydalanish zarurati paydo bo'ladi. Rezistent infeksiyalar bemorlarning kasalxonada yotish muddatini uzaytiradi hamda sog'liqni saqlash tizimi uchun iqtisodiy yukni oshiradi. Ayrim hollarda esa og'ir septik holatlar va o'lim bilan yakunlanishi mumkin.

Bakteriyalarda antibiotiklarga rezistentlik rivojlanishi zamonaviy tibbiyotning eng dolzarb muammolaridan biridir. Mikroorganizmlarning genetik moslashuvchanligi hamda antibiotiklardan noto'g'ri foydalanish rezistent shtammlarning keng tarqalishiga olib kelmoqda. Shu sababli antibiotiklardan oqilona foydalanish, infeksiyon nazorat choralarini kuchaytirish va

aholining tibbiy savodxonligini oshirish antibiotik rezistentligi tarqalishini kamaytirishda muhim ahamiyatga ega.

Xulosa.

Tadqiqot natijalari shuni ko'rsatadiki, bakteriyalarning antibiotiklarga chidamliligi zamonaviy tibbiyotning eng dolzarb muammosidir. Mikroorganizm-larning genetik mutatsiyalar va beta-laktamaza kabi fermentlar orqali himo-yananishi infeksiyalarni davolash samaradorligini pasaytirmoqda. Xulosa qilib aytganda, rezistentlikni jilovlash uchun antibiotiklardan oqilona foydalanish, klinik laboratoriya nazoratini kuchaytirish va o'zboshimchalik bilan davolanishga chek qo'yish strategik ahamiyatga ega. Bu choralar antimikrob terapiya kelajagini ta'minlashning yagona yo'lidir.

Foydalanilgan adabiyotlar:

1. World Health Organization (WHO). Global antimicrobial resistance and use surveillance system (GLASS) report 2022. Geneva: WHO, 2022.
2. Azizov I.S., et al. Antibiotiklarga rezistentlikning molekulyar asoslari. Toshkent: Tibbiyot nashriyoti, 2020.
3. Bush K., Bradford P.A. β -Lactamases and β -Lactamase Inhibitors in Clinical Practice. Expert Review of Anti-infective Therapy, 2016; 14(9): 803-818.
4. Saidov A.B., Jumanazarov Q. Klinik mikrobiologiya va antimikrob terapiya asoslari. Toshkent: Ibn Sino nomidagi nashriyot, 2021.
5. Davies J., Davies D. Origins and Evolution of Antibiotic Resistance. Microbiology and Molecular Biology Reviews, 2010; 74(3): 417-433.
6. O'zbekiston Respublikasi Sog'liqni saqlash vazirligi. Antimikrob preparatlardan oqilona foydalanish bo'yicha milliy qo'llanma. Toshkent, 2023.

ETIOLOGY OF EPILEPSY AND MODERN TREATMENT
APPROACHES

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Abstract: This article provides a scientific analysis of the etiology, pathogenesis, and modern treatment approaches to epilepsy. Epilepsy is one of the most common chronic disorders of the central nervous system, characterized by recurrent seizures resulting from excessive and synchronous electrical activity of brain neurons. The paper examines the genetic, structural, infectious, and metabolic factors that influence the onset of the disease. Furthermore, it highlights modern therapeutic approaches used in the management of epilepsy, including the significance of antiepileptic drugs, surgical methods, and dietary therapy. The findings of the study indicate that early diagnosis and effective treatment are crucial factors in improving the quality of life for patients with epilepsy.

Keywords: epilepsy, etiology, pathogenesis, antiepileptic drugs, neurology, seizure, treatment methods.

Introduction: Epilepsy is considered one of the most prevalent chronic disorders of the central nervous system. This condition is characterized by recurrent seizures arising from the excessive and synchronous electrical activity of cerebral neurons. Epilepsy significantly impacts an individual's physical, psychological, and social well-being, often leading to a diminished quality of life. Consequently, it remains one of the most pressing issues in the field of neurology.

Currently, millions of people worldwide suffer from epilepsy. The disorder occurs across various age groups, with a notably higher incidence among children and the elderly. The development of epilepsy can be attributed to genetic factors, traumatic brain injuries, infectious diseases, metabolic imbalances, and structural alterations in the brain. However, in certain cases, the specific etiological factor remains unidentified.

In recent years, scientific research in medicine and neurology has enabled a deeper understanding of the pathogenesis and clinical progression of epilepsy. The development of advanced diagnostic techniques and new-generation antiepileptic drugs has expanded the possibilities for seizure control. Furthermore, surgical intervention methods are being utilized in complex clinical cases. The objective of this article is to provide a scientific analysis of the etiological factors of epilepsy and modern approaches to its treatment.

Main Body: Epilepsy is a chronic disorder of the central nervous system, manifested by recurrent epileptic seizures resulting from the excessive and synchronous electrical activity of cerebral neurons. In modern neurology, epilepsy is regarded as a multifactorial disease, where genetic, structural, metabolic, infectious, and immunological factors play a critical role in its development.

Recent scientific studies emphasize the significant importance of genetic factors in the etiology of epilepsy. Certain genetic mutations lead to the dysfunction of neuronal ion channels, which increases neuronal excitability. Consequently, pathological electrical impulses are generated within brain cells, triggering epileptic seizures.

Furthermore, epilepsy can be associated with organic structural changes in the brain. Such conditions arise from traumatic brain injuries, brain tumors, strokes, congenital developmental defects, or cerebrovascular disturbances. Structural alterations disrupt the normal connectivity between neurons, leading to the formation of an epileptogenic focus. Infectious diseases are also vital factors; conditions such as meningitis, encephalitis, and neurocysticercosis cause inflammatory processes in brain tissue, which may subsequently induce seizures. In some instances, metabolic imbalances—such as sharp drops in glucose levels, electrolyte imbalances, or the effects of toxic substances—also contribute to the development of the disorder.

The pathogenesis of epilepsy is primarily linked to an imbalance between the excitatory and inhibitory processes of brain neurons. Under normal conditions, a

homeostatic balance exists between excitatory and inhibitory neurotransmitters in the central nervous system. In epilepsy, the activity of excitatory neurotransmitters (e.g., **glutamate**) increases, while the influence of inhibitory neurotransmitters (e.g., **GABA**) decreases. This results in the generation of excessive electrical impulses that rapidly propagate through brain tissues, forming an epileptic focus. If these pathological impulses spread to large areas of the cerebral cortex, a generalized seizure occurs.

Modern research indicates that processes such as neuroinflammation, impaired synaptic plasticity, and the reorganization of neural networks also play a significant role in the pathogenesis of epilepsy. Additionally, the dysfunction of ion channels in brain cells remains one of the primary mechanisms enhancing epileptic activity. In summary, the etiopathogenesis of epilepsy is a complex, multifactorial process involving genetic, structural, and biochemical alterations. A profound understanding of these processes is essential for early diagnosis and the development of effective treatment strategies.

Diagnostic Criteria for Epilepsy The accurate and early diagnosis of epilepsy is of paramount importance in neurology, as it enables effective treatment and seizure control. In modern medicine, the diagnosis of epilepsy is established based on clinical manifestations, instrumental examinations, and laboratory analyses. In recent years, the integration of new technologies and scientific approaches in the field of diagnostics has significantly increased the accuracy of disease detection.

When diagnosing epilepsy, the primary focus is on the patient's clinical presentation and the specific characteristics of the seizures. In international neurological practice, a diagnosis of epilepsy may be established in the following cases:

- **Recurrence of Seizures:** When at least two unprovoked (not related to a temporary cause) epileptic seizures occur more than 24 hours apart.
- **High Risk of Recurrence:** When a single unprovoked seizure occurs, but the probability of further seizures is high (similar to the general recurrence risk after two unprovoked seizures).
- **Epilepsy Syndromes:** When clinical signs characteristic of a specific epilepsy syndrome are identified.

Diagnostic Methods and Therapeutic Approaches

In this context, the duration, type, and onset of the seizure, as well as subsequent neurological symptoms, serve as vital diagnostic criteria.

1. **Electroencephalography (EEG):** EEG remains one of the primary instrumental methods for detecting epilepsy. It records the electrical activity of brain neurons and can identify markers of epileptiform activity. In modern neurology, **Video-EEG monitoring** is widely utilized. This method allows for the simultaneous analysis of clinical seizures through video recording and synchronized EEG data.
2. **Neuroimaging Technologies:** In recent years, the importance of neuroimaging in epilepsy diagnosis has grown significantly. The following methods are especially prevalent:
 - **Magnetic Resonance Imaging (MRI):** To detect structural brain lesions.
 - **Computed Tomography (CT):** For acute cases or identifying calcifications.
 - **Functional MRI (fMRI):** To map critical brain functions during surgical planning. These techniques enable the detection of structural alterations, tumors, traumatic injuries, or other pathological processes within the brain.
3. **Genetic Testing:** Some scientific studies also employ genetic testing to identify specific epilepsy syndromes, particularly in pediatric cases.

Treatment Strategies

Epilepsy is a chronic disorder of the central nervous system, and the primary goal of treatment is to reduce or achieve complete control over epileptic seizures. Recent scientific research in neurology has paved the way for developing new and effective treatment modalities. Modern therapeutic approaches encompass pharmacological treatment, surgical interventions, dietary therapy, and innovative technologies.

- **Pharmacological Treatment:** Antiepileptic drugs (AEDs) hold the primary role in treating epilepsy. These medications prevent seizures by reducing the hyperexcitability of brain neurons. In modern medicine, **new-generation antiepileptic drugs** are widely prescribed. They are generally better tolerated by patients and possess fewer side effects. Medication is selected

individually, considering the patient's age, the specific type of epilepsy, and the characteristics of the seizures.

- **Surgical Interventions:** If pharmacological treatment proves insufficient (drug-resistant epilepsy), surgical methods may be applied. The objective of surgical intervention is to identify and resect the specific area of the brain where the epileptogenic focus is located.

Advanced Treatment Modalities and Lifestyle Management

Modern neurosurgical technologies continue to enhance the safety and efficacy of surgical interventions. In recent years, **neurostimulation technologies** have also gained widespread use in the management of epilepsy. For instance, **Vagus Nerve Stimulation (VNS)** helps reduce the frequency of epileptic seizures by modulating brain activity. Additionally, innovative methods such as **Deep Brain Stimulation (DBS)** are showing effective results in certain severe or refractory cases.

Dietary management also plays a crucial role for patients with epilepsy. The **Ketogenic Diet** — a high-fat, low-carbohydrate regimen — has proven particularly effective in reducing epileptic seizures, especially in pediatric patients.

Furthermore, lifestyle modification is a vital factor in the treatment of epilepsy. Ensuring adequate sleep, reducing stress, abstaining from harmful habits, and strict adherence to medical recommendations significantly enhance the overall effectiveness of the treatment.

Rehabilitation and Psychosocial Support

Epilepsy manifests not only through seizures but also exerts a negative impact on the patient's psychological, social, and physical well-being. Therefore, alongside clinical treatment, patient rehabilitation is of critical importance. The rehabilitation process is aimed at enhancing the quality of life, developing independent living skills, and ensuring social adaptation.

1. **Pharmacological Monitoring:** Regular assessment of medication dosages and therapeutic efficacy.
2. **Restoration of Damaged Functions:** Utilization of neurorehabilitation exercises if epilepsy developed following traumatic brain injury or stroke.
3. **Physiotherapy:** Physical exercises to improve muscle tone and motor coordination.

4. **Stress Reduction:** Addressing the high prevalence of depression and anxiety among patients. Psychological counseling, meditation, and relaxation techniques are highly beneficial.
5. **Cognitive Training:** Exercises focused on improving memory, attention, and executive functions.
6. **Development of Social Skills:** Helping patients gain confidence in social environments and interpersonal interactions.
7. **Special Education Programs:** Individualized educational plans for children and adolescents to ensure learning is not hindered by the disorder.
8. **Public and Family Awareness:** Educating the family and society about the disease to reduce social stigma and enhance support networks.
9. **Sleep Hygiene:** Regulating sleep patterns and ensuring adequate rest.
10. **Stress Management and Physical Activity:** Incorporating regular, safe physical activity to mitigate triggers.
11. **Treatment Adherence:** Ensuring consistent medication intake and strict compliance with medical advice.

Conclusion: Epilepsy is a chronic disorder of the central nervous system, and its development is inherently multifactorial. The etiopathogenesis of the disease is explained by genetic, structural, infectious, metabolic, and immunological factors. The disruption of the balance between excitatory and inhibitory mechanisms among neurons leads to the generation of pathological electrical impulses, resulting in epileptic seizures. In the diagnosis of epilepsy, clinical observations, electroencephalography (EEG), neuroimaging techniques, and, in recent years, genetic research play a pivotal role. Modern diagnostic technologies enable early detection and the selection of individualized treatment strategies. The management of epilepsy involves a combination of antiepileptic drugs, surgical interventions, neurostimulation methods, dietary therapy, and lifestyle modifications. Furthermore, the rehabilitation process is of significant importance in ensuring the psychological, social, and physical adaptation of the patient, thereby enhancing their overall quality of life. In summary, a comprehensive approach to the treatment and rehabilitation of patients with epilepsy allows for effective seizure control, increased social engagement, and a substantial improvement in their quality of life. Modern scientific research and evolving technologies continue to play a crucial role in the effective management of this disorder.

References

1. **Fisher, R.S., et al.** (2014). Epileptic Seizures and Epilepsy: Definitions Proposed by the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE). *Epilepsia*.
2. **Scheffer, I.E., et al.** (2017). ILAE Classification of the Epilepsies: Position Paper of the ILAE Commission for Classification and Terminology. *Epilepsia*.
3. **Shorvon, S.D., & Lowenstein, D.H.** (2015). *Epilepsy: A Comprehensive Textbook*. 3rd Edition. Oxford University Press.
4. **Kwan, P., & Brodie, M.J.** (2000). Early Identification of Refractory Epilepsy. *New England Journal of Medicine*.
5. **Engel, J. Jr., et al.** (2013). *Surgical Treatment of the Epilepsies*. 2nd Edition. Lippincott Williams & Wilkins.

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Annotation:

This paper examines the Kepler problem as a special case of the motion of bodies in a central force field. It presents Kepler's fundamental laws, which describe the motion of planets around the Sun, and discusses their physical meaning and significance for modern science. Particular attention is paid to the analytical solution of the two-body problem and the impossibility of obtaining an exact solution for systems with three or more bodies. In this regard, numerical methods for solving equations of motion are considered, specifically the use of the MATLAB environment for modeling orbital motion. An algorithm is presented for reducing a system of differential equations to first-order form and their subsequent numerical solution. The paper emphasizes the importance of the Kepler problem for the development of astronomy, mechanics, and space exploration.

Keywords:

Kepler problem, Kepler's laws, planetary motion, central field, celestial mechanics, numerical methods, differential equations, MATLAB, orbital motion, two-body model, astronomy.

ЗАДАЧА КЕПЛЕРА

Аннотация:

В данной работе рассматривается задача Кеплера как частный случай движения тел в поле центральных сил. Приводятся основные законы Кеплера, описывающие движение планет вокруг Солнца, и обсуждаются их физический смысл и значение для современной науки. Особое внимание уделяется аналитическому решению задачи двух тел и невозможности получения точного решения для систем с тремя и более телами. В связи с этим рассматриваются численные методы решения уравнений движения, в частности использование среды MATLAB для моделирования орбитального движения. Представлен алгоритм приведения системы дифференциальных уравнений к виду первого порядка и их последующее численное решение. Работа подчеркивает важность задачи Кеплера для развития астрономии, механики и космических исследований.

Ключевые слова:

задача Кеплера, законы Кеплера, движение планет, центральное поле, небесная механика, численные методы, дифференциальные уравнения, MATLAB, орбитальное движение, модель двух тел, астрономия, классическая механика.

Задача о движении планет в поле тяжести небесных светил, являющаяся частным случаем задачи о движении в поле центральных сил, известна на протяжении нескольких тысячелетий истории человечества и в настоящее время рассматривается как в школьных

курсах физики, астрономии, так и в вузовских курсах классической механики и астрономии.

Большую часть наших знаний о движении планет объединили в себе законы Кеплера, полученные на основе анализа данных астрономических наблюдений.

Большую часть наших знаний о движении планет объединили в себе законы Кеплера, полученные на основе анализа данных астрономических наблюдений, которые формулируются следующим образом:

1. Всякая планета движется по эллиптической орбите, в одном из фокусов которой находится Солнце.

2. Скорость планеты возрастает по мере удаления от Солнца таким образом, что прямая, соединяющая Солнце и планету, в равные промежутки времени заметает одинаковую площадь.

3. Для всех планет, вращающихся вокруг Солнца, отношение T^2/R^3 одинаково (T — период обращения планеты вокруг Солнца, R — большая полуось эллипса).

Отметим, что получить аналитическое решение задачи Кеплера удастся только в случае рассмотрения движения двух тел, взаимодействующих по закону обратных квадратов. Это решение рассматривается во всех учебниках по классической механике, только малая часть из которых приведена в списке литературы [1–3]. Задача Кеплера для трех и более тел аналитического решения не имеет, может быть решена только численно, поэтому в этой главе основное внимание мы уделяем численному решению уравнений движения тела в центральном поле.

Предваряя нахождение численного решения системы уравнений

$$\frac{d^2X}{dt^2} = -\frac{4\pi^2}{(X^2+Y^2)^{3/2}}X,$$

$$\frac{d^2Y}{dt^2} = -\frac{4\pi^2}{(X^2+Y^2)^{3/2}}Y,$$

приведем ее к эквивалентной системе уравнений первого порядка, выполнив замену переменных $X \rightarrow z_1, \dot{X} \rightarrow z_2, Y \rightarrow z_3, \dot{Y} \rightarrow z_4$:

$$\frac{dz_1}{dt} = z_2 \quad (1)$$

$$\frac{dz_2}{dt} = -\frac{4\pi^2 \cdot z_1}{(z_1^2+z_3^2)^{3/2}} \quad (2)$$

$$\frac{dz_3}{dt} = z_4 \quad (3)$$

$$\frac{dz_4}{dt} = -\frac{4\pi^2 \cdot z_3}{(z_1^2+z_3^2)^{3/2}} \quad (4)$$

Следуя общим правилам MATLAB решения систем ОДУ первого порядка, создадим m-функцию Orbit.m, возвращающую значения координат вектора-функции, стоящей в левой части системы (1)-(4):

```
function dy=Orbit(t,z)
```

```
dy=zeros(4,1); % задание вектора-столбца
```

```
    % размерности 4x1
```

```
    % задание координат вектора-функции,
```

```
% стоящей в правой части (4.30)-(4.33)
dy(1)=z(2);
dy(2)=-4*pi^2*z(1)/(z(1)^2+z(3)^2)^(3/2);
dy(3)=z(4);
dy(4)=-4*pi^2*z(3)/(z(1)^2+z(3)^2)^(3/2)
```

Далее необходимо выполнить в командном окне следующую последовательность команд, сохраненную нами в файле Glava4_1.m:

```
% задание начальных условий x(0), x'(0), y(0), y'(0)
>> x0=1;
>> y0=0;
>> vx0=0;
>> vy0=2*pi*1.2;
% вычисление численного
% решение системы (1)-(4)
>> [t,Y]=ode45('Orbit',[0:10^-3:2.5],[x0 vx0 y0 vy0]);
>> figure(1); plot(t,Y(:,1)); % построение зависимости x(t)
>> figure(2); plot(t,Y(:,2)); % построение зависимости x'(t)
>> figure(3); plot(t,Y(:,3)); % построение зависимости y(t)
>> figure(4); plot(t,Y(:,4)); % построение зависимости y'(t)
>> figure(5); plot(Y(:,1),Y(:,3)); % построение зависимости
% движение тела
```

Задача Кеплера остается актуальной и важной для понимания и предсказания движения небесных тел. Ее решение представляет собой сложную и многогранную проблему, требующую глубокого знания математики, физики и численных методов. Дальнейшие исследования в этой области будут способствовать развитию космонавтики, астрономии и других наук.

Вывод: В результате проведенного исследования установлено, что задача Кеплера играет фундаментальную роль в изучении движения небесных тел и является основой классической механики и астрономии. Законы Кеплера позволяют описывать орбитальное движение планет и служат важным инструментом для анализа гравитационных систем. Показано, что аналитическое решение возможно лишь для системы двух тел, тогда как более сложные системы требуют применения численных методов. Использование программных средств, таких как MATLAB, значительно упрощает процесс моделирования и позволяет получать наглядные результаты движения тел. Таким образом, численные методы являются эффективным средством исследования сложных динамических систем, а дальнейшее развитие данной области способствует прогрессу в космонавтике и смежных науках.

ЛИТЕРАТУРА

1. С.В. Поршнева Компьютерное моделирование физических процессов в пакете MATLAB 2011.736с.
2. Mechanical vibrations / Singiresu S. Rao. 5th edition
3. И.А. Елизаров, Ю.Ф. Мартемьянов, А.Г. Схиртладзе, А.А. Третьяков Моделирование систем 2011.

**HUDUD IQTISODIYOTI TARKIBIY O‘ZGARISHLARIDA
DIVERSIFIKATSIYA JARAYONLARINING ROLI (SURXONDARYO
VILOYATI MISOLIDA)****Jurayeva Safargul****Termiz iqtisodiyot va servis universiteti o‘qituvchisi**

Annotatsiya. Ushbu maqolada Surxondaryo viloyati iqtisodiyotida 2024–2026 yillarda kuzatilgan tarkibiy siljishlar diversifikatsiya jarayonlari nuqtayi nazaridan tahlil qilinadi. Ish faqat rasmiy statistik manbalarga tayangan: 2024 va 2025 yillardagi yalpi hududiy mahsulot (YAHM) hajmi hamda tarmoq tarkibi, 2024–2025 makroiqtisodiy ko‘rsatkichlar jadvali, 2026 yil yanvar oyining sanoat, bozor xizmatlari, ichki savdo va tashqi savdo press-relizlari, shuningdek 2026 yil fevral holatidagi korxonalar demografiyasi va xorijiy investitsiya ishtirokidagi korxonalar statistikasi. 2024 yilda YAHM 54 354,1 mlrd so‘m bo‘lib 5,9% o‘sgan; tarkibda qishloq xo‘jaligi 39,1%, xizmatlar 41,9%, sanoat 9,6% va qurilish 9,4% ulushni egallagan. 2025 yilda YAHM 66 186,5 mlrd so‘mga yetib, 6,6% o‘sgan; tarkibda xizmatlar 43,4%ga ko‘tarilgan, qishloq xo‘jaligi 37,4%ga pasaygan, sanoat 9,9%ga chiqqan. 2026 yil yanvarda sanoat ishlab chiqarishi 1 059,8 mlrd so‘m (fizik hajm indeksi 108,9%) bo‘lgan va ishlab chiqarishning texnologik profili past texnologiyalilikning yuqoriligi bilan ajralib turgan (quyi texnologiyali segment 80,6%). 2026 yil yanvarda bozor xizmatlari 2 572,9 mlrd so‘m (o‘sish 115,0%) bo‘lib, xizmatlar hajmining 71,5%ini kichik biznes ko‘rsatgan. Natijalar shuni ko‘rsatadiki, Surxondaryoda “sektorlar ulushi” bo‘yicha diversifikatsiya sekin, biroq “sektor ichidagi tarkib”, “korxonalar ekotizimi” va “bozor/hamkorlar portfeli” bo‘yicha diversifikatsiya signallari aniqroq ko‘rinadi.

Kalit so‘zlar: diversifikatsiya, tarkibiy o‘zgarish, YAHM, xizmatlar tarkibi, sanoat texnologik profili, tashqi savdo hamkorlari, kichik biznes, Surxondaryo.

Kirish. Hudud iqtisodiyoti tarkibiy o‘zgarishi deganda faqat tarmoqlar ulushining almashishi emas, balki iqtisodiy faoliyatning “qayerdan qiymat yaratishi” ham o‘zgarishi tushuniladi: ishlab chiqarish murakkablashadi yoki soddalashadi, xizmatlar professional segmentlarga o‘tadi yoki savdo atrofida qoladi, tashqi bozorlarga chiqish kengayadi yoki bir yo‘nalishga qattiq bog‘lanib qoladi. Shuning uchun diversifikatsiyani ikki qavatda ko‘rish zarur: birinchisi, sektorlararo diversifikatsiya (qishloq xo‘jaligi–sanoat–qurilish–xizmatlar ulushi), ikkinchisi, sektor ichidagi diversifikatsiya (masalan, xizmatlarda transport/axborot ulushi, sanoatda texnologik darajalar, eksportda hamkorlar ulushi). Surxondaryo misolida 2024–2025 rasmiy YAHM tuzilmasi sektorlararo siljishning bosqichma-bosqich

ketayotganini, 2026 yil operativ ma'lumotlar esa sektor ichidagi "sifat" masalasini ochib berayotganini ko'rsatadi.

Maqolaning maqsadi – 2024–2026 davrida Surxondaryoda diversifikatsiya jarayonlari tarkibiy o'zgarishlarga qanday kanal orqali ta'sir qilayotganini rasmiy raqamlar bilan asoslash. Tadqiqot savollari quyidagicha: 2024–2025 yillarda sektorlar ulushi qanday siljigan va o'sishga qaysi tarmoqlar ko'proq hissa qo'shgan? 2026 yil boshidagi sanoat va xizmatlar ko'rsatkichlari "chuqur" diversifikatsiya (texnologik daraja va xizmatlar segmentlari) haqida nima deydi? Tashqi savdo va korxonalar tarkibi diversifikatsiyani kuchaytirayaptimi yoki aksincha, konsentratsiya riskini oshirayaptimi?

Metodologiya. Ishda faqat rasmiy manbalardan olingan statistik ko'rsatkichlar ishlatildi va ularning o'zidan kelib chiqadigan hosila hisob-kitoblar (foiz punkt farqi, ulushlar o'zgarishi) bajarildi. Asosiy dalil bazasi: Surxondaryo viloyati statistika boshqarmasining 2024 yil yakuniy YAHM press-relizi; 2025 yil yanvar–dekabr YAHM press-relizi; 2024–2025 makroiqtisodiy ko'rsatkichlar jadvali; 2026 yil yanvar sanoat ishlab chiqarishi press-relizi (hajm, fizik hajm indeksi, ishlab chiqarishning texnologik tarkibi va ayrim tarmoqlar ulushi); 2026 yil yanvar bozor xizmatlari press-relizi; 2026 yil yanvar ichki savdo (chakana va ulgurji) bo'yicha reliz; 2026 yil yanvar tashqi savdo relizi; 2026 yil fevral holatiga korxonalar va tashkilotlar demografiyasi hamda xorijiy investitsiya ishtirokidagi korxonalar tarkibi bo'yicha reliz.

Tahlil uch bosqichda qurildi. Birinchi bosqich: 2024 va 2025 yillarda YAHM hajmi, o'sish sur'ati va tarmoq ulushlari solishtirildi. Ikkinchi bosqich: YAHM o'sishiga tarmoqlar hissasi (foiz punkt) bo'yicha "drayverlar" ajratildi. Uchinchi bosqich: 2026 yil yanvar relizlari asosida sanoatning texnologik profili, xizmatlar hajmi va kichik biznes ulushi, ichki savdo aylanmasi hamda eksport bozorlarining konsentratsiyasi ko'rib chiqildi. Cheklov: rasmiy relizlarda eksport tarkibi HS-kodlar bo'yicha batafsil bo'lmaganligi sababli "mahsulot konsentratsiyasi indeksi" hisoblanmadi; ammo hamkorlar ulushi ko'rsatilgani uchun bozor konsentratsiyasi masalasi dalillar bilan muhokama qilindi.

Natijalar. 1) Sektorlar ulushi bo'yicha tarkibiy siljish: xizmatlar foydasiga sekin burilish. 2024 yilda Surxondaryoda YAHM 54 354,1 mlrd so'm bo'lib, 2023 yilga nisbatan 5,9% o'sgan. Tarkibda qishloq xo'jaligi 39,1%, sanoat 9,6%, qurilish 9,4% va xizmatlar 41,9% bo'lgan. 2025 yilda YAHM 66 186,5 mlrd so'mga yetib, 6,6% o'sgan; tarkibda xizmatlar 43,4%ga ko'tarilgan, qishloq xo'jaligi 37,4%ga tushgan, sanoat 9,9%ga chiqqan, qurilish 9,3% bo'lib qolgan. Demak, bir yil ichida asosiy struktur o'zgarish xizmatlar ulushining +1,5 foiz punktga o'sishi va qishloq xo'jaligi ulushining –1,7 foiz punktga kamayishidir.

2. O'sish drayverlari: xizmatlar yetakchi, ammo qishloq xo'jaligi hissasi ham yuqori. 2024 yilda YAHM o'sishiga xizmatlar 3,0 foiz punkt hissa qo'shgan; qishloq xo'jaligi 1,3 foiz punkt, sanoat 0,7 foiz punkt, qurilish 0,8 foiz punkt, sof soliqlar 0,1 foiz punkt bo'lgan. 2025 yilda xizmatlar hissasi 3,3 foiz punktga chiqqan; qishloq xo'jaligi 1,6 foiz punkt, sanoat 0,8 foiz punkt, qurilish 0,8 foiz punkt, sof soliqlar 0,1 foiz punkt. Bu natija tarkibiy o'zgarishning "yo'nalishi"ni ko'rsatadi: xizmatlar nafaqat ulush, balki o'sish manbai sifatida ham birinchi o'rinda. Shu bilan birga, qishloq xo'jaligi hissasi 2025 yilda kuchaygani diversifikatsiya jarayonlari qishloq xo'jaligidan "uzoqlashish" emas, balki qishloq xo'jaligi bazasini boshqa tarmoqlar bilan bog'lab chuqurlashtirish yo'li bilan ketishi kerakligini anglatadi.

3. Makro ko'rsatkichlar: sanoat, xizmatlar, investitsiya va savdo hajmlarining kengayishi. 2024–2025 makro jadvalida sanoat mahsuloti 2024 yilda 13 819,8 mlrd so'm, 2025 yilda 18 833,2 mlrd so'm; xizmatlar 28 381,8 mlrd so'm va 35 561,3 mlrd so'm; asosiy kapitalga investitsiyalar 16 593,1 mlrd so'm va 22 758,4 mlrd so'm qilib berilgan. Tashqi savdo aylanmasi ham keskin oshgan: 2024 yilda 416,1 mln AQSH dollari, 2025 yilda 790,9 mln dollar; eksport 269,5 mln dollardan 507,5 mln dollarga, import 146,6 mln dollardan 283,4 mln dollarga ko'tarilgan. Bu dinamika diversifikatsiya uchun resurs bazasi borligini ko'rsatadi: investitsiya va savdo oqimlari ko'paygan sari, yangi faoliyat turlarini moliyalashtirish va bozorga chiqarish imkoniyati kengayadi.

4. 2026 yil boshida sanoat: hajm o'smoqda, "sifat" muammosi ochiq. 2026 yil yanvarda sanoat ishlab chiqarishi 1 059,8 mlrd so'm bo'lib, fizik hajm indeksi 108,9% qayd etilgan. Shu relizda ishlab chiqaradigan sanoatning texnologik tarkibi berilgan: yuqori texnologiyali 0,7%, o'rta-yuqori 5,0%, o'rta-quyi 13,7%, quyi texnologiyali 80,6%. Bu ko'rsatkichlar tarkibiy o'zgarishning muhim cheklovini ko'rsatadi: sanoatning ulushi (2025 yilda 9,9%) sekin oshayotgan bo'lsa ham, texnologik murakkablik past bo'lib qolsa, sanoat hududning uzoq muddatli produktivlik o'sishiga yetarli tayanch bo'la olmaydi. Relizda ishlab chiqarish sanoatida ayrim tarmoqlar ulushi ham ko'rsatilgan: to'qimachilik, kiyim-kechak va charm mahsulotlari 39,0%, oziq-ovqat, ichimliklar va tamaki 28,1%. Bu tarkib qishloq xo'jaligi bazasi (xomashyo) bilan bog'lanadigan qayta ishlash yo'nalishlari mavjudligini, biroq yuqori texnologiyali segment juda kichikligini tasdiqlaydi.

5. 2026 yil boshida xizmatlar: o'sish tez, kichik biznes ulushi katta. 2026 yil yanvarida bozor xizmatlari hajmi 2 572,9 mlrd so'm bo'lgan va o'sish 115,0% qayd etilgan. Shu davrda bozor xizmatlarining 71,5%ini kichik tadbirkorlik subyektlari ko'rsatgan (1 839,4 mlrd so'm). Bu natija diversifikatsiyaning "ko'p subyekтли" mexanizmini ko'rsatadi: xizmatlar o'sishi bir necha segment va ko'plab kichik

subyektlar orqali tarqalmoqda. Biroq barqarorlik nuqtayi nazaridan bu ikkiyoqlama signal: kichik biznes ko‘pligi moslashuvchanlik beradi, lekin talab yoki kredit shoklarida tez zararlanish xavfi ham yuqori.

6. Ichki savdo: aylanma o‘sishi va kichik biznes ustunligi. 2026 yil yanvar oyida ulgurji savdo tovar aylanmasi 699,9 mlrd so‘m bo‘lib, 2025 yil yanvariga nisbatan 11,8% o‘sgan; 2026 yil 1-fevral holatiga ulgurji savdo korxonalarini 2 549 ta bo‘lib, shundan 16 tasi yirik, 2 533 tasi kichik korxonalar va mikrofirmalar. Chakana savdoda 2026 yil 1-fevral holatiga tijorat korxonalarini 5 038 ta (72 yirik, 4 966 kichik), chakana savdo tovar aylanmasi 2 144,5 mlrd so‘m bo‘lib, 111,1% o‘shish ko‘rsatilgan. Bu raqamlar xizmatlar va savdo sektorida faoliyatning tarqoq ekanini tasdiqlaydi va struktur o‘zgarishda “savdo xizmatlari”ning katta vaznini ko‘rsatadi.

7. Tashqi savdo: eksport bozorlarida konsentratsiya signali. 2026 yil yanvar oyidagi tashqi savdo press-relizida eksport hamkorlari ulushi ko‘rsatilgan: Afg‘oniston 45,6%, Rossiya 22,5%, Xitoy 12,4%, Pokiston 5,0% va AQSH 2,1%; ushbu besh davlatning umumiy ulushi 87,7%. Bu holat diversifikatsiya jarayonlarining zaif bo‘g‘inini ochadi: eksport bozorlarining tor doiraga jamlanishi shok riskini oshiradi. Tashqi bozor diversifikatsiyasi tarkibiy transformatsiya uchun muhim, chunki bozorlar kengaysa, ishlab chiqarish va xizmatlar ham ko‘proq turga o‘tishi, standartlashuvi va sifat oshishi mumkin.

8. Korxonalar ekotizimi va FDI profili: savdo ustun, ishlab chiqarish ulushi kichik. 2026 yil 15-fevraldagi press-relizda Surxondaryoda faol korxonalar va tashkilotlar soni 25 551 ta ekani ko‘rsatilgan (shundan 21 227 tasi kichik korxonalar va mikrofirmalar). Xorijiy investitsiya ishtirokidagi faoliyat yuritayotgan korxonalar 509 ta bo‘lib, ularning 296 tasi savdo sohasida, 73 tasi sanoatda, 36 tasi qishloq xo‘jaligida, 35 tasi qurilishda, 20 tasi axborot va aloqada qayd etilgan. Bu taqsimot shuni bildiradiki, xorijiy kapital asosan savdoga yo‘naltirilgan; tarkibiy o‘zgarish nuqtayi nazaridan esa ishlab chiqarish, logistika va axborot xizmatlari segmentlarida xorijiy ishtirokni oshirish diversifikatsiyani “sifat” jihatdan kuchaytirishi mumkin.

Muhokama. Yuqoridagi natijalar Surxondaryoda diversifikatsiya jarayonlari tarkibiy o‘zgarishga uchta kanal orqali ta’sir qilayotganini ko‘rsatadi.

Birinchi kanal – sektorlar ulushidagi sekin siljish. 2024–2025 yillarda xizmatlar ulushi oshgan, qishloq xo‘jaligi ulushi kamaygan, sanoat ulushi ozroq ko‘tarilgan. Bu “klassik” struktura o‘zgarishiga o‘xshaydi, ammo tezlik past. Shu sabab, faqat sektor ulushiga qarab “diversifikatsiya kuchayib ketdi” deyish noto‘g‘ri; aksincha, sektorlararo tarkib hali ham ikki yirik blok (xizmatlar va qishloq xo‘jaligi) atrofida jamlangan.

Ikkinchi kanal – sektor ichidagi tarkib (sifat) o‘zgarishi. 2026 yil yanvar sanoat relizi sanoatning texnologik profili pastligini fakt bilan ko‘rsatdi (80,6% quyi texnologiyali). Bu ko‘rsatkichni e‘tiborsiz qoldirib, sanoat o‘shini diversifikatsiya sifatida talqin qilish xato bo‘ladi. Tarkibiy transformatsiya uchun sanoat “miqdor”dan tashqari “murakkablik”ka ham o‘tishi kerak. Xizmatlarda esa o‘sh yuqori, lekin xizmatlar ichida transport/axborot segmentining ulushi YAHM tarkibida 5% atrofida qolayotgani (2024–2025 relizlarida) diversifikatsiya “savdo markazli” bo‘lib qolish xavfini bildiradi. Demak, xizmatlar o‘shini barqaror diversifikatsiyaga aylantiradigan yo‘l – logistika, axborot/aloqa va professional xizmatlarning ulushini oshirishni maqsadli indikatorga aylantirishdir.

Uchinchi kanal – bozor va institutlar portfeli. 2024–2025 yillarda tashqi savdo hajmining ortishi, investitsiyaning ko‘payishi diversifikatsiya uchun imkoniyat yaratadi, lekin 2026 yil yanvardagi eksport hamkorlarining yuqori konsentratsiyasi bu imkoniyatning riskini ham ko‘rsatadi. Boshqa tomondan, FDI korxonalarini tarkibining savdoga og‘ishi ishlab chiqarish va innovatsion xizmatlarga kapital oqimini cheklashi mumkin. Shuning uchun tarkibiy o‘zgarishlar “miqdor o‘shishi” emas, “portfel kengayishi” bilan baholanishi kerak: eksport geografiyasi, investitsiya yo‘nalishlari va xorijiy ishtirokdagi korxonalar tarmoqlar bo‘yicha tarqatilsa, diversifikatsiya barqarorlikka xizmat qiladi.

Amaliy jihatdan, 2024–2026 rasmiy ko‘rsatkichlar Surxondaryo uchun diversifikatsiya siyosatini qanday “o‘lchash” mumkinligini ham ko‘rsatadi. Minimal monitoring to‘plami: (1) YAHM tarkibida sanoat va xizmatlar ulushi hamda ularning o‘shiga hisssasi (foiz punkt), (2) sanoatning texnologik tarkibi (yuqori va o‘rta-yuqori ulush), (3) xizmatlar hajmida kichik biznes ulushi va xizmat turlari bo‘yicha o‘sh, (4) ichki savdo (chakana/ulgurji) o‘shishi va firmalar tarkibi, (5) eksport bozorlarining ulushi (hamkorlar konsentratsiyasi), (6) FDI korxonalarining tarmoqlar bo‘yicha taqsimoti. Ushbu indikatorlarning barchasi 2026 yil relizlarida mavjud va ular tarkibiy o‘zgarishning qaysi yo‘nalishda ketayotganini dalil bilan kuzatish imkonini beradi.

Diversifikatsiyani baholashda narx omili ham alohida ko‘rilishi kerak. 2025 yil YAHM deflyatori 109,8% bo‘lgani ko‘rsatiladi; relizda deflyator ko‘rsatkichlari tarmoqlar kesimida ham berilib, sanoatda 118,4% va xizmatlarda 111,9% kabi yuqori qiymatlar qayd etilgan. Bu fakt YAHM va tarmoq hajmlarining nominal o‘shishi ichida narxlar ta‘siri borligini bildiradi. Shuning uchun tarkibiy o‘zgarishni “nominal ulushlar” bilan cheklab qo‘yish barqaror xulosa bermaydi: sanoat bo‘yicha fizik hajm indeksleri (masalan, 2026 yil yanvarda 108,9%) va xizmatlar bo‘yicha o‘sh sur‘atlari (2026 yil yanvarda 115,0%) kabi ko‘rsatkichlar bilan birga tahlil qilish zarur.

Hududiy diversifikatsiyaning yana bir ko'rsatkichi – korxonalar bazasining kengayishi va uning tarkibi. Milliy statistika qo'mitasining 2026 yil 26-fevraldagi ma'lumotida 2026 yil 1-yanvar holatiga Surxondaryoda 31 225 ta korxonalar va tashkilot faoliyat ko'rsatayotgani qayd etiladi; shu xabarda bozor xizmatlari hajmi 14,1%ga, tashqi savdo aylanmasi 86,2%ga o'sgani ham keltirilgan. Bu raqamlar iqtisodiy faollikning miqyosi oshayotganini ko'rsatadi, biroq diversifikatsiya uchun hal qiluvchi masala korxonalar qaysi faoliyat turlarida ko'payayotganidir: agar o'sish asosan savdo va oddiy xizmatlarda jamlansa, tarkibiy transformatsiya sekinlashadi; agar sanoat va axborot/aloqa kabi segmentlarda ham ulush ortsa, diversifikatsiya chuqurlashadi.

Shu sabab, ko'rsatkichlar paneli har chorak va yillik kesimda yangilanib borishi lozim.

Xulosa. 2024–2026 yillarga oid rasmiy statistika Surxondaryo viloyatida diversifikatsiya jarayonlari tarkibiy o'zgarishlarda real rol o'ynayotganini, biroq bu rol ko'proq “ichki tarkib” va “bozor portfeli” darajasida ko'rinayotganini ko'rsatadi. 2024–2025 yillarda sektorlar ulushi bo'yicha siljish xizmatlar foydasiga bo'lgan, lekin sanoat ulushi hali ham 10% atrofida va o'sishga hissi 1 foiz punktdan past. 2026 yil yanvar ma'lumotlari sanoatning past texnologiyali profili yuqori ekanini, xizmatlar o'sishi esa yuqori tezlikda ketayotganini ko'rsatdi. Shu bilan birga, eksport bozorlarida yuqori konsentratsiya va FDI korxonalarini tarkibida savdoning ustunligi diversifikatsiyaning zaif nuqtalari sifatida namoyon bo'ladi. Demak, Surxondaryoda diversifikatsiyani tarkibiy transformatsiyaga aylantirish uchun asosiy yo'nalishlar rasmiy indikatorlar bilan mos kelishi kerak: sanoatda texnologik murakkablikni oshirish, xizmatlar ichida transport/axborot va professional segmentlarni kengaytirish, eksport geografiasini tarqatish va xorijiy investitsiya ishtirokini ishlab chiqarish hamda zamonaviy xizmatlarga yo'naltirish.

Foydalanilgan adabiyotlar

1. Surxondaryo viloyati statistika boshqarmasi: “Yalpi hududiy mahsulot, 2024” (PDF)
2. “Svod2025: Yalpi hududiy mahsulot, 2025” (PDF)
3. “Makroiqtisodiy ko'rsatkichlar” (PDF)
4. “Sanoat, 2026 yil yanvar” (PDF); “Xizmatlar, 2026 yil yanvar” (PDF)
5. “Ichki savdo, 2026 yil yanvar” (PDF);

OUTLINE
VOLUME-4, ISSUE-3 MARCH

1	REGBI SPORTINI JORIY ETISHNING PEDAGOGIK VA METODIK ASOSLARI Elmanov Muxammadali	5–8
2	COST REDUCTION STRATEGIES THROUGH EFFICIENT ROVING WASTE RECYCLING IN SPINNING MILLS Alikhonov Sharifkhon	9–11
3	MECHANICAL VS. SOLVENT-BASED RECYCLING TECHNOLOGIES FOR ROVING WASTE: A COMPARATIVE REVIEW Alikhonov Sharifkhon, Bobojanov Khusankhon	12–14
4	PREVALENCE OF HODGKIN'S LYMPHOMA IN THE POPULATION OF KHORAZM PROVINCE M.A. Kadamova	15–16
5	MODERN ECHODIAGNOSTICS OF NODULAR FORMATIONS OF THE THYROID GLAND IN PATIENTS Annamurotova Muhayyo	17–18
6	ANALYSIS OF LAND COVER AND LAND USE INDICATORS OF THE SANGZAR RIVER BASIN Kosimov Nurmukhamad, Ismoilova Mukhlisa	19–21
7	SHUKUR XOLMIRZAYEV ASARLARIDA POEZIYANING BADIY TALQINI Qaraqulov Azizbek	22–23
8	ANALYSIS OF ADVERSE PROGNOSTIC FACTORS IN ENDOMETRIAL CANCER Kuryozova Gulasal	25–28
9	HOW AI HAS CHANGED THE ASSESSMENT OF STUDENTS IN MATHEMATICS Malohat Avlotova, Abduqaxxarov Samandar	29–30
10	HOW AI IS INFLUENCING THE ASSESSMENT OF STUDENTS IN PHYSICS Gulshoda Jurayeva, Axrorbek Abdujabborov	31–32
11	MASOFADAN ZONDLASH MA'LUMOTLARI ASOSIDA SUV OBYEKTLARINI ANIQLASH (NDWI indeksi yordamida) Mo'minov Suhrob	33–39
12	BAKTERIYALARDA ANTIBIOTIKLARGA REZISTENTLIK RIVOJLANISH MEXANIZMLARI VA UNING KLINIK AHAMIYATI Jumanova Sarvinoz, Baxridinova Mohina, Valijon Masharipov	40–42
13	THE KEPLER PROBLEM Alieva Jamila, Akbarova Nigora	43–45
14	ETIOLOGY OF EPILEPSY AND MODERN TREATMENT APPROACHES Choriyeva Zulfiya, Keldiyarova Halena, Yo'lichiboyiva Nigora, Tojaliyeva Mashhura	46–52
15	HUDUD IQTISODIYOTI TARKIBIY O'ZGARISHLARIDA DIVERSIFIKATSIYA JARAYONLARINING ROLI (SURXONDARYO VILOYATI MISOLIDA) Jurayeva Safargul	53–58
	MUNDARIJA	59