publisher.agency
Denmark

October, 2025
№ 11

Copenhagen, Denmark
30-31.10.2025

International Scientific Conference

# Foundations and Trends in Research

UDC 001.1
P 97

Publisher.agency: Proceedings of the 11th International Scientific Conference «Foundations and Trends in Research» (October 30-31, 2025). Copenhagen, Denmark, 2025. 264p

ISBN 978-7-4374-2531-6
DOI 10.5281/zenodo.17509854



editor@publisher.agency
https://publisher.agency/

# Table of Contents

## Pedagogical Sciences



## Agricultural Sciences



## Philological Sciences



## Psychological Sciences



## Biological Sciences

## Geographic Sciences



## Economic Sciences



## Medical Sciences

## Literature



## Political Studies



## Technical Sciences



## Physical and Mathematical Sciences



## Historical Sciences



## Sociological Sciences

# Pedagogical Sciences

# Integrating Speaking and Reading Skills in Communicative Pedagogy

GULNAR FARMAN HUSEYNOVA
Baku Business University

Abstract

The integration of reading and speaking within communicative pedagogy has become increasingly significant in the context of higher education. In language teaching, particularly in English as a Foreign Language (EFL) settings, the ability to connect receptive and productive skills is central to developing communicative competence. This paper examines how communicative language teaching (CLT) principles promote the interaction between reading and speaking, and how this relationship enhances comprehension, fluency, and engagement among university students. The discussion is grounded in established theoretical perspectives such as the input and output hypotheses, sociocultural theory, and communicative competence models. Drawing on previous studies, this paper argues that combining reading comprehension with oral communication creates a dynamic and interactive environment conducive to deeper learning and more authentic language use.

**Keywords:** Communicative Language Teaching, Integrated Skills, Reading, Speaking, EFL, Higher Education

In many university classrooms, reading and speaking have traditionally been taught as separate skills. Reading is often associated with comprehension, vocabulary development, and silent processing, while speaking is viewed as an independent productive skill used for oral performance or presentation. Communicative pedagogy challenges this separation by emphasizing language as a means of real communication rather than a set of discrete abilities. As Richards and Rodgers (2014) note, CLT encourages learners to use language for meaningful interaction, thereby integrating different skills naturally within communicative contexts. When students engage with reading texts and subsequently discuss or interpret them, they practice comprehension, analysis, and expression simultaneously. This holistic approach fosters linguistic fluency and develops higher-order thinking skills essential for academic success.

The theoretical underpinnings of skill integration can be traced to several influential models. Krashen's (1985) Input Hypothesis highlights the necessity of comprehensible input in language learning, while Swain's (1995) Output Hypothesis stresses the importance of production in consolidating linguistic knowledge. Together, these frameworks illustrate that input alone is insufficient; learners must also produce language to internalize it effectively. Vygotsky's (1978) sociocultural perspective further explains that knowledge is constructed through social interaction, with language serving as the primary medium for learning. Within this framework, reading provides the stimulus for thought, and speaking functions as the tool through which understanding is articulated and negotiated. Long's (1996) Interaction Hypothesis similarly supports the idea that negotiation of meaning in communicative exchanges promotes language development. Therefore, integrating reading and speaking allows learners to move fluidly between comprehension and production, reinforcing both processes.

A growing body of research supports the pedagogical effectiveness of integrated-skill instruction. Carrell and Eisterhold (1983) found that students who perform reading-to-speak tasks,

such as summarizing or retelling, demonstrate improved comprehension and oral fluency. Studies by Hinkel (2010) and Nunan (2015) indicate that when learners connect reading materials to communicative activities, they acquire vocabulary more effectively and develop stronger discourse competence. In higher education contexts, Liu and Jackson (2019) observed that reading-based discussions enhance critical thinking and interpretive ability, while Pham and Nguyen (2020) reported that integration increases student engagement and autonomy. These findings collectively suggest that linking receptive and productive language skills contributes significantly to communicative competence and learner motivation.

Pedagogically, integrating reading and speaking transforms the classroom into a collaborative learning environment. Students no longer act as passive recipients of information but become active participants in meaning-making. After reading a text, they discuss ideas, express opinions, and clarify meaning through dialogue. Such interaction encourages negotiation of meaning and supports language use in authentic contexts. It also promotes metacognitive awareness, as learners must analyze and evaluate information before verbalizing it. Grabe (2009) emphasizes that this mental transition from reading to oral communication deepens comprehension and aids long-term retention of new language. The communicative classroom, therefore, becomes a space for intellectual and linguistic growth.

In practical application, integration can be achieved through a variety of communicative techniques. Instructors may organize reading lessons that lead to oral exchanges through prediction activities, group discussions, debates, or project-based presentations. Pre-reading activities such as brainstorming or discussing prior knowledge help activate students' schemata. During reading, learners can annotate, take notes, or share ideas in pairs to maintain interaction. After reading, activities like discussions, role plays, or summaries allow learners to transform their understanding into spoken language. Tasks such as literature circles, jigsaw reading, and problem-solving discussions are especially effective because they encourage collaboration and require students to exchange interpretations of a shared text. These methods enable learners to use reading as a foundation for authentic communication.

However, implementing integrated instruction in university contexts presents several challenges. Some educators may lack training in communicative and integrated methodologies, while students accustomed to teacher-centered instruction might initially feel uncomfortable with interactive activities. Large class sizes and limited instructional time also restrict opportunities for oral communication. To overcome these barriers, teacher development programs should include training in integrated-skill pedagogy, emphasizing how communicative tasks can be adapted to different classroom environments. Technology can further support integration; online discussion boards, digital storytelling, and virtual debates provide platforms for continued oral interaction beyond the classroom (Godwin-Jones, 2018). These tools make it easier for students to connect reading input with speaking output in meaningful ways.

The integration of reading and speaking carries significant implications for curriculum design and assessment. Curriculum planners should ensure that learning outcomes reflect communicative objectives and encourage connections between comprehension and oral performance. Assessment methods should also evolve to measure both skills simultaneously. Traditional written tests often fail to capture the interactive nature of communication, whereas formative techniques such as portfolios, reflective journals, peer feedback, and oral presentations provide a more comprehensive evaluation of student progress. Furthermore, integrating language learning with disciplinary content at the university level can enhance both language proficiency and academic literacy, preparing students for real-world communication in academic and professional settings.

In conclusion, integrating reading and speaking skills within communicative pedagogy marks an important shift toward holistic and interaction-based learning. By uniting receptive and

productive modes, educators can create conditions that promote comprehension, fluency, and critical thinking. The reviewed literature demonstrates that communicative and task-based instruction offers an effective framework for this integration. Although challenges remain in teacher preparation and assessment, the pedagogical benefits—enhanced engagement, improved language competence, and stronger academic performance—clearly outweigh the difficulties. Future research should continue to explore how technology and blended learning can further support the integration of skills in higher education. Ultimately, the connection between reading and speaking is not only pedagogically sound but essential to achieving communicative competence in modern EFL instruction.

## References

Brown, H. D. (2014). *Principles of language learning and teaching* (6th ed.). Pearson Education.

Canale, M., & Swain, M. (1980). Theoretical bases of communicative approaches to second language teaching and testing. *Applied Linguistics, 1*(1), 1–47.

Carrell, P. L., & Eisterhold, J. C. (1983). Schema theory and ESL reading pedagogy. *TESOL Quarterly, 17*(4), 553–573.

Celce-Murcia, M. (2007). *Rethinking the role of communicative competence in language teaching.* University of Michigan Press.

Godwin-Jones, R. (2018). Using mobile technology to develop language skills and cultural understanding. *Language Learning & Technology, 22*(3), 3–17.

Grabe, W. (2009). *Reading in a second language: Moving from theory to practice.* Cambridge University Press.

Hinkel, E. (2010). Integrating the four skills: Current and historical perspectives. In R. Kaplan (Ed.), *The Oxford handbook of applied linguistics* (pp. 110–126). Oxford University Press.

Krashen, S. (1985). *The input hypothesis: Issues and implications.* Longman.

Littlewood, W. (2018). *Communicative language teaching: An introduction.* Cambridge University Press.

Liu, M., & Jackson, J. (2019). An exploration of Chinese EFL learners' unwillingness to communicate and foreign language anxiety. *The Modern Language Journal, 93*(1), 71–86.

Long, M. H. (1996). The role of the linguistic environment in second language acquisition. In W. Ritchie & T. Bhatia (Eds.), *Handbook of second language acquisition* (pp. 413–468). Academic Press.

Nation, I. S. P. (2013). *Learning vocabulary in another language.* Cambridge University Press.

Nunan, D. (2015). *Teaching English to speakers of other languages: An introduction.* Routledge.

Pham, H. T., & Nguyen, N. T. (2020). Integrating reading and speaking to develop communicative competence: A study of EFL learners in Vietnam. *Asian EFL Journal, 27*(3), 56–74.

Richards, J. C. (2015). *Key issues in language teaching.* Cambridge University Press.

Richards, J. C., & Rodgers, T. (2014). *Approaches and methods in language teaching* (3rd ed.). Cambridge University Press.

Swain, M. (1995). Three functions of output in second language learning. In G. Cook & B. Seidlhofer (Eds.), *Principle and practice in applied linguistics* (pp. 125–144). Oxford University Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

# ВНЕДРЕНИЕ АВТОРСКИХ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ В УЧЕБНЫЙ ПРОЦЕСС МУЗЫКАЛЬНЫХ УЧРЕЖДЕНИЙ НАЧАЛЬНОГО ЗВЕНА ЗАПАДНО-КАЗАХСТАНСКОЙ ОБЛАСТИ

Бабенко Ольга Александровна
кандидат педагогических наук, старший преподаватель, Западно-Казахстанский университет им. М. Утемисова

В совершенствовании учебного процесса музыкального образования Западно-Казахстанской области заметным явлением стало развитие новаторского движения, т.е. инновационных методов работы. Прежде всего это отразилось в разработке ряда авторских программ преподавателей музыкальных учебных заведений г.Уральска.

Применительно к педагогическому процессу инновация означает введение нового в цели, содержание, методы и формы обучения и воспитания, организацию совместной деятельности учителя и учащегося [1].

Под инновациями в образовании понимается процесс совершенствования педагогических технологий, совокупности методов, приемов и средств обучения. В настоящее время инновационная педагогическая деятельность является одним из существенных компонентов образовательной деятельности любого учебного заведения. И это неслучайно. Именно инновационная деятельность не только создает основу для создания конкурентоспособности того или иного учреждения на рынке образовательных услуг, но и определяет направления профессионального роста педагога, его творческого поиска, реально способствует личностному росту воспитанников. Поэтому инновационная деятельность неразрывно связана с научно-методической деятельностью педагогов и учебно-исследовательской воспитанников. Инновационная деятельность направлена на разработку, апробацию и внедрение в практику деятельности объединений современных педагогических технологий, направленных на эффективное решение тех приоритетных задач, которые заявляет педагогический коллектив.

Учителя музыкальных школ города и области работают в этом направлении и достигли определенных результатов. Так, педагогический коллектив ДШИ №1 разработал ряд авторских методических пособий и программ, которые успешно внедрил в учебный процесс. Преподаватель Юсупова Г.Д. опубликовала авторскую программу «Работа с детским хором», в которой обобщен многолетний опыт педагога, и на его основании разработана методика проведения уроков с младшими школьниками. Программа включает такие методы работы как игровые моменты, «звуковая пластика»,мимическая гимнастика. Педагогом этой же школы, Титовой И.И., разработана авторская программа по казахской музыкальной литературе для ДМШ. Автором внесен ряд дополнений в типовые программы для ДМШ, а также проведена работа по составлению тестов, контрольных вопросов, дополнен список музыкальных произведений.

Не только музыкальные школы в областном центре, но и районные ДМШ работают в данном направлении. Ярким примером творческого подхода к учебному процессу и

применению на практике инновационных методов работы является Таскалинская районная детская музыкальная школа. Это адаптивная школа - школа равных возможностей со смешанным контингентом учащихся, где учатся одаренные и обычные дети. Исходя из этого, структура дополнительного образования функционирует в рамках двух ступеней: I ступень - начальные классы; II ступень – старшие классы.

В течение нескольких лет педагогический коллектив знакомился, изучал и апробировал различные педагогические технологии и школа выбрала стратегическую идею - реализацию личностно-ориентированного образования. Личностно-ориентированное - это образование учащихся в музыкальной школе, направленное на воспитание каждого ученика, как самостоятельной личности. Чтобы правильно организовать личностно-ориентированное образование учащихся, педагогический коллектив школы определил условия и факторы, которые определяют процесс формирования личности человека. Этими условиями и факторами являются: природные задатки человека, определяющие возможности развития его личностных способностей и черт характера; особенности семьи и ее отношение к ребенку; социальная среда, в которой живет и развивается ребенок.

В Таскалинской музыкальной школе введены новые программы - «Клавишный синтезатор» и «Ансамбль клавишных синтезаторов», одобренные учебно-методическим советом по детским школам искусств Министерства культуры РК.

Обучение игре на клавишном синтезаторе, в том числе в младших классах, обладает ярко выраженной спецификой. Она обусловлена электронно-цифровой природой нового музыкального инструмента, которая значительно расширяет его художественный потенциал по сравнению с традиционными механическими инструментами и определяет коренное изменение содержания и методов обучения в инструментальном классе. Если обучение игре на каком-либо традиционном инструменте всегда связано с исполнением музыкальных произведений, то такая исполнительская направленность музыкально-учебной деятельности при обращении к синтезатору оказывается недостаточной. Действительно, чтобы озвучить на этом новом инструменте нотный текст, сначала надо выбрать из большого числа наличных электронных тембров те, которые лучше всего подходят данному тексту и соответственно скорректировать фактуру изложения, то есть создать проект его аранжировки (элемент композиторской деятельности). Затем надо озвучить этот проект — исполнить его или ввести в память инструмента (исполнительская деятельность), а также — выстроить виртуальную электроакустическую среду звучания (то есть провести звукорежиссерскую работу). Иногда при этом необходимо внести те или иные поправки в тембры синтезатора или даже создать их новые оригинальные разновидности (то есть выступить в роли изготовителя виртуальных музыкальных инструментов). Вместе с тем такое расширение музыкально-учебной деятельности на композиторскую, звукорежиссерскую и звукового синтеза сферы не превращает ее в элитарную, поскольку задачи, относящиеся к каждой из этих перечисленных сфер, решаются в опоре на программные заготовки — в диалоге с компьютерной программой, лежащей в основе управления звучанием синтезатора. Благодаря компьютерной интерактивности творчество музыканта становится не только более многогранным и увлекательным, но одновременно простым и продуктивным. Все это делает клавишный синтезатор чрезвычайно ценным средством музыкального обучения. Широкий фронт музыкально-творческой деятельности позволяет преодолеть одностороннюю исполнительскую направленность традиционного музыкального обучения, способствует активизации музыкального мышления ученика и развитию в более полной мере его музыкальных способностей. А простота и доступность данной деятельности позволяет значительно расширить круг вовлеченных в нее детей.

Одной из форм работы ДМШ и ДШИ является концертно-исполнительская деятельность, которая предоставляет возможность продемонстрировать свои достижения в

музицировании или использовать вне школы приобретенные в музыкальной школе знания. Такая работа повышает творческую активность ребенка, ускоряет формирование эстетических и нравственных представлений, такие концерты всегда имеют успех. При таком методе работы можно практиковать проведение различных конкурсов и викторин с вручением призов, предоставление слушателям высказаться по поводу услышанного. Этими приемами можно активизировать интерес аудитории, приобщать сельских учащихся к музыкальной культуре.

В области инновационного музыкального образования в последние годы все чаще происходит синтез дисциплин эстетического цикла: ИЗО, хореография, театр. Межпредметные связи музыкального искусства с живописью, литературой, народным творчеством разрабатываются давно, существуют разработки и более глубокого интегративного характера уроков музыки с другими видами искусств. Интеграция музыки с другими видами искусств, с предметами общеобразовательного цикла один из перспективных путей обновления образовательной системы.

В этом направлении работает педагогический коллектив гимназии эстетического направления, который использует приемы интеграции как на уроках, так и во внеклассной деятельности. Интеграция с другими предметами рождает новые нестандартные формы уроков: урок-путешествие, урок-прогулка, урок-интервью. Более сложно организуется урок-спектакль, который предполагает интеграцию двух видов искусства: музыки и театра. В гимназии проводятся такие интеграционные формы работы внеклассной деятельности как театр песни, музыкальная гостиная, бал.

Что может дать интеграция в музыкальном образовании?

- новые курсы по предмету;
- новые интегрированные спецкурсы, обновляющие содержание нескольких смежных предметов – истории, краеведения, музыки.
- циклы уроков (на традиционных классических предметах). Использование таких приемов дает положительные результаты: дети создают художественные образы в разных формах (словесной, изобразительной, музыкальной, драматической), пишут стихи, миниатюры, навеянные музыкой. Гимназисты занимают призовые места в районных и областных конкурсах, являются лауреатами фестивалей.

Объединяет все эти программы то, что они не только предполагают получение знаний и навыков, но и содержат в качестве обязательного компонента творческую деятельность учащегося. Данные программы направлены на решение конкретных задач: формирование внутреннего мира, сферы чувств учащегося через включение его в мир искусства; передача духовного опыта поколений и восстановление связей между ними; освоение культурных традиций и ценностей, через которое происходит вхождение учащегося в культуру. Эти программы вариативны, поэтому осуществление на практике того актуального и культурно значимого, что заложено в материале программ, полностью зависит от их интерпретации, от индивидуальности и наличия творческого потенциала преподавателя.

Применение инновационных форм работы сказывается на результатах обучения детей и молодежи. Больших успехов в творческой деятельности достигли преподаватели и учащиеся как городских, так и районных и сельских ДМШ.

Обобщая вышеуказанный материал, необходимо отметить, что несмотря на положительные результаты в развитии системы музыкально-эстетического образования в регионе, необходимо и дальше совершенствовать типовые планы и программы подготовки специалистов для всех звеньев музыкального образования; пересмотреть и модифицировать традиционные и во многом устаревшие установки в процессе подготовки специалистов среднего и высшего звена; ввести в практику педагогический эксперимент,

побуждающий педагогов отказаться от рутины, используя новейшие достижения музыкальной педагогики, психологии и методики.

В настоящее время в Казахстане растет число детских спортивных школ, музыкальных, художественных, гимназий эстетического направления, лицеев, т.к. всестороннее развитие личности является главной задачей современного общества.

Список использованной литературы

1 Сластенин В.А. Педагогика. – М.: Школа-Пресс, 2000г. – С.492.

# Psychological and Educational Work of AI-Driven Art Therapy in Adolescent Emotional Disorder Intervention

**Mukasheva,Anar B.**
Ph.D, Senior Lecturer, Al-Farabi Kazakh National University, Faculty of Philosophy and Political Science, Department of Pedagogy and Psychology
**Han Xiaofei**
Ph.D Candidate, Al-Farabi Kazakh National University, Faculty of Philosophy and Political Science, Department of Pedagogy and Psychology

**Abstract**

This study aims to investigate the effectiveness of the application of art therapy driven by artificial intelligence in the intervention of adolescent emotional disorders. By integrating artificial intelligence technology with art therapy methods, this paper analyzes the practical application of psychological and pedagogical strategies in the intervention of adolescent emotional disorders and constructs corresponding implementation pathways. The research findings indicate that the integrated strategy of artificial intelligence and art therapy significantly enhances the effectiveness of the intervention for adolescent emotional disorders, and the practical application of psychological and pedagogical strategies also demonstrates a positive impact. This study provides new theoretical guidance and practical references for the intervention of adolescent emotional disorders, and holds significant importance for promoting the development of adolescent mental health.

**Keywords:** Artificial Intelligence; Art Therapy; Adolescents; Emotional Disorders; Intervention

## Introduction

With the rapid growth of China's economy and society, mental health problems among adolescents have become more visible. Emotional disorders have turned into an important factor that affects both the physical and mental health of young people. In recent years, the government has paid great attention to the mental health of adolescents and has issued many policies to prevent and treat emotional problems. For example, in 2019, the Ministry of Education and seven other departments released The Opinions on Strengthening and Improving School Health and Education in the New Era, which clearly required stronger education and intervention for adolescent mental health. In addition, the National Health Commission and other departments also issued The Construction Plan for the Mental Health Service System of Chinese Adolescents (2018–2022) to build a better service system for youth mental health.

In this context, art therapy, as a non-medical treatment method, has shown clear effects in helping adolescents with emotional disorders. Through artistic creation and performance, art therapy helps young people express and release their emotions and supports their psychological well-being. At the same time, the development of artificial intelligence (AI) has provided new tools and platforms for art therapy, which can improve its efficiency and quality.

The significance of this study lies in two main aspects. First, from an academic perspective, this research combines AI with art therapy to explore their joint use in emotional disorder interventions for adolescents. This helps expand the theory of art therapy and enrich the methods of psychological intervention for young people. Second, from a practical point of view, this study offers a new idea and path for emotional disorder intervention, aiming to improve its effectiveness

and promote adolescent mental health.

This paper focuses on two main research questions: how can AI and art therapy be combined to play a positive role in adolescent emotional disorder intervention? And how can effective psychological and educational strategies be developed to enhance intervention outcomes? The main contributions of this paper are in three parts. First, it builds a theoretical framework for AI-driven art therapy in emotional disorder intervention. Second, it proposes strategies for integrating AI and art therapy to guide practice. Third, it uses case analysis to explore how psychological and teaching strategies can be applied in practice, offering useful examples for future interventions.

This study is centered on adolescent emotional disorder intervention. It is based on theories of AI, art therapy, psychology, and teaching strategies, and it uses empirical research methods. The goals are: (1) to explain how AI and art therapy can be effectively combined and applied; (2) to analyze the effects of psychological and teaching strategies in intervention; and (3) to offer theoretical and practical guidance for improving adolescent emotional health.

## Literature Review

This study focuses on three main areas: research on educational participation and moral development, research on bone metabolism disease monitoring, and research on educational technology applications. By discussing these topics across different fields, this paper aims to explore effective interdisciplinary strategies to address challenges in education, health, and special education.

First, studies have focused on the combination of technology and humanities to improve educational participation and moral development. Ye Zixuan et al. (2025) pointed out that the key factors influencing college students' participation in physical training include social support, health status, campus facilities and safety, self-efficacy, perceived enjoyment, and self-motivation. They found that health status is the most significant factor. When students use wearable fitness trackers and mobile apps for performance monitoring, their motivation and frequency of participation increase notably. This shows that digital technology plays an important role in encouraging a healthy lifestyle among college students [1].

Amini Mansour et al. (2025) stated that in an increasingly connected world, integrating humanistic approaches into EFL and ESL classrooms is essential for creating positive and inclusive learning environments. This approach not only improves academic performance but also promotes personal growth and cross-cultural sensitivity. It has a positive influence on classroom management, learner engagement, and motivation [2].

Second, studies in pharmacology and big data have focused on improving bone metabolism disease monitoring. Anonymous (2025) suggested that optimizing supply chain management can reduce operational costs and increase competitiveness in the market [3]. Another study by Anonymous (2025) showed that optimizing network structure design can improve the efficiency of information transmission, enhance system stability, and increase the overall performance of networks [4].

Third, researchers have paid attention to the use of educational technology to address challenges in special education. Voultsiou Evdokia et al. (2025) found that the integration of AI and immersive technology in special education supports personalized learning, promotes social participation, and enhances cognitive development. These technologies significantly improve the learning experiences of students with special educational needs and disabilities (SEND). However, the study also pointed out challenges related to teaching methods, teacher attitudes, technology tools, ethics, accessibility, and limited resources. The authors emphasized that cross-sector cooperation and inclusive policies are needed to make these technologies more effective [5].

Liu Jin et al. (2025) conducted a systematic analysis of algorithms, implementation forms, and functions of intelligent technologies—such as IoT, machine learning, virtual reality, data mining,

and robotics—in early childhood education (ECE). The research revealed the causal relationships among data-driven results, teaching practices, and ethical issues. It also highlighted challenges in health diagnosis, personalized learning, safety, and fairness. The study pointed out the limitations of security weaknesses, lack of interdisciplinary integration, and insufficient long-term studies. The authors suggested strengthening safety protocols, interdisciplinary curricula, and mixed-method evaluations to promote child-centered ethical innovation [6].

Overall, research at home and abroad has made clear progress in educational participation, moral development, bone metabolism disease monitoring, and educational technology applications. Through interdisciplinary perspectives and the integration of science and technology, scholars have developed effective strategies to solve related problems. However, there are still issues that need attention.

(1) Limitations in educational participation research: Current studies mainly analyze single factors influencing college students' participation in sports training and lack long-term behavioral tracking. The mechanism by which digital technology affects students' lifestyles also needs deeper exploration.

(2) Technical limitations in bone metabolism monitoring: Although pharmacology and big data are widely applied, there are still technical problems such as low monitoring accuracy, limited analytical methods, and weak real-time data integration.

(3) Unresolved challenges in special education: AI and immersive technologies have great potential in improving the learning experience of SEND students, but challenges remain in teaching methods, teacher training, technology tools, ethics, accessibility, and resources. Stronger cross-sector cooperation and inclusive policy implementation are required.

To address these three problems, this study uses empirical data from adolescent emotional disorder interventions to analyze how AI and art therapy can be effectively combined. It then builds an interdisciplinary framework and designs experiments and case studies to explore effective psychological and teaching strategies. The results show that integrating AI with art therapy can significantly improve the effectiveness of interventions for adolescent emotional disorders. The application of psychological and teaching strategies also shows positive effects. The use of AI in this context brings innovation by improving the precision and personalization of art therapy, enhancing the integration of psychological and educational methods, and expanding practical pathways for adolescent mental health intervention.

## Theoretical Framework

Artificial Intelligence (AI) is a field of computer science that studies how to simulate and extend human intelligence through theories, methods, technologies, and systems. Since the 1950s, AI has gone through several stages of development, including symbolic AI, connectionism, and statistical learning. Symbolic AI focuses on representing and reasoning with knowledge, while connectionism emphasizes learning and recognition through neural networks. Statistical learning pays attention to data analysis and pattern recognition. AI has achieved remarkable progress in many areas such as natural language processing, computer vision, and machine learning. However, both symbolic and connectionist approaches have limitations when dealing with complex, fuzzy, and unstructured data. In the field of adolescent emotional disorder intervention, the use of AI still needs further exploration and deeper application.

Art therapy is a non-medical approach that helps people express and release emotions and supports their mental health through artistic creation and performance. It is based on multiple disciplines, including psychology, education, sociology, and art. Psychology provides the theoretical foundation by explaining the links between emotion, cognition, and behavior. Education offers practical methods and highlights how art creation promotes personal growth. Sociology gives a social perspective, emphasizing the influence of the environment on individual mental health. Art

studies contribute creative techniques and expressive forms used in therapy. Although art therapy has shown good results in improving emotional well-being, its application in adolescent emotional disorder intervention still faces some problems, such as the lack of unified evaluation standards and limited scientific assessment of the intervention process.

## Argumentation

This part explores how AI-driven art therapy can be used in interventions for adolescent emotional disorders. Based on the theories of AI, art therapy, psychology, and teaching strategies discussed earlier, this section explains how AI and art therapy work together, how psychological and teaching strategies are applied, and what limits and debates exist in their implementation. It aims to show the psychological and educational effects of AI-based art therapy through a clear and multi-angle discussion.

AI can support art therapy in several ways. It can use deep learning and natural language processing to recognize and analyze the emotional states of adolescents. Based on this, it can create personalized intervention plans. It can also help art therapists with artistic creation, making the process faster and more effective. In addition, AI can build virtual reality and other immersive environments, giving young people richer therapy experiences.

Art therapy itself helps adolescents express emotions and improve mental health through art creation and performance. It allows them to understand their own emotions and manage them better. It helps them build a positive self-image and stronger self-confidence. It also helps them develop social skills and improve relationships with others. For example, one research institution developed a virtual reality art therapy system using AI for adolescents with emotional disorders. The system analyzed each individual's emotions and created a personalized art therapy plan. It improved emotional regulation and increased participation.

There are still some debates and limits in combining AI and art therapy. The use of AI can raise ethical issues such as privacy and data safety. The creative ability of AI is still limited and may not fully meet the personal needs of adolescents. The integration of AI and art therapy is still at an early stage, and its effects and feasibility need more testing.

Psychological and teaching strategies also play an important role in emotional disorder intervention. Psychological strategies include cognitive-behavioral therapy, emotional regulation training, and psychological education. Cognitive-behavioral therapy helps adolescents identify and change negative thought patterns. Emotional regulation training teaches them useful techniques such as deep breathing and relaxation. Psychological education raises mental health awareness and strengthens self-protection skills.

Teaching strategies include group counseling, role-playing, and situation simulation. Group counseling provides a platform for sharing and mutual support. Role-playing and simulation help adolescents practice communication and improve social adaptability. For instance, one school organized a psychological intervention program for students with emotional problems. It included group counseling and emotional training and showed clear improvements in emotional control.

Psychological and teaching strategies are useful but also have some limits. They require professional guidance and supervision. Without it, the effects may be reduced or even negative. Their outcomes also differ among individuals, so the methods must be adjusted according to personal needs and characteristics.

The implementation of AI-driven art therapy for adolescents also faces limits and academic debates. Each plan must fit the individual's emotional and cognitive situation. It is also necessary to protect privacy and ensure data security. To deal with these problems, further theoretical integration is needed. Researchers should study the foundations of AI and art therapy more deeply to support implementation. Research methods should be improved to make the process more scientific and reliable. Practice should also be expanded to test the validity and feasibility of this

approach.

The integration of AI and art therapy has value for industries, society, organizations, and policy making. It gives new directions for the development of related industries, provides practical references for social organizations, and offers theoretical guidance for policy design.

## Conclusion

This study explored how AI-driven art therapy can be used in interventions for adolescent emotional disorders. It examined the combination of AI and art therapy, the use of psychological and teaching strategies, and the implementation process of AI-based interventions. The analysis shows that combining AI with art therapy brings new perspectives and practical methods for supporting adolescents with emotional problems. It helps improve the effectiveness of interventions and provides new ways to support emotional regulation and psychological growth.

The research shows that the integration of AI and art therapy can increase the precision and personalization of interventions. It helps create a more flexible and interactive form of therapy that better matches the needs of adolescents. However, this area of study is still developing, and more work is needed to improve both theory and practice. Future research should pay more attention to ethical concerns such as privacy, data protection, and possible algorithm bias, because these issues directly affect the safety and reliability of interventions.

It is also important to improve psychological and teaching strategies to fit the needs of different adolescent groups. Interventions should be designed with attention to personal differences, emotional sensitivity, and learning environments. Strengthening theoretical research on AI and art therapy will help explain their underlying mechanisms and support future applications.

This research provides useful insights for the field of adolescent mental health. It expands the theory of art therapy and offers practical tools for improving intervention outcomes. It also supports innovation in the mental health industry by introducing new and efficient intervention approaches. The findings may help guide educational institutions, community organizations, and policy makers to design better programs for adolescent psychological care and health promotion.

## References

[1] Ye Zixuan, Liu Huasen. The role of technology in promoting sports participation among college students[J]. Education and Information Technologies, 2025, : 1.

[2] Amini Mansour, Qiufen Wang, Amini Davoud, Ravindran Latha, Lin Debbita Tan Ai, Ganapathy Malini, Singh Manjet Kaur Mehar. The significance of humanistic approach and moral development in English language classrooms[J]. Discover Education, 2025, 4(1): 1.

[3] Anonymous. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases (WCO-IOF-ESCEO 2025)[J]. Aging Clinical and Experimental Research, 2025, 37(1): 1.

[4] Anonymous. Proceedings of the 6th National Big Data Health Science Conference[J]. BMC Proceedings, 2025, 19(13): 1.

[5] Voultsiou Evdokia, Moussiades Lefteris. A systematic review of AI, VR, and LLM applications in special education: Opportunities, challenges, and future directions[J]. Education and Information Technologies, 2025, 30(13): 19141.

[6] Liu Jin, Chen Miao, He Huihua, Liu Hongze, Luo Wenwei, Li Hui. Forms and functions innovation: a scoping review of digital and intelligence technologies in early childhood education practice[J]. AI, Brain and Child, 2025, 1(1): 1.

[7] Anonymous. 24th ISoP Annual Meeting “Pharmacovigilance: Back to the Future” 24–27 October 2025 Cairo, Egypt[J]. Drug Safety, 2025, : 1.

[8] Anonymous. Abstracts from the 2025 Annual Meeting of the Society of General Internal Medicine[J]. Journal of General Internal Medicine, 2025, 40(1): 1.

[9] Anonymous. Abstracts from the 6th congress of Joint European Neonatal Societies: oral

presentations[J]. Pediatric Research, 2025, 98(1): 1.

[10] Anonymous. ECR 2025 Book of Abstracts[J]. Insights into Imaging, 2025, 16(1): 1.

# THEORY OF EDUCATION IN PEDAGOGY

Mammadova Sara Muradkhan
Senior Lecturer, Agjabedi Branch of Azerbaijan State Pedagogical University, Azerbaijan

***Abstract.*** Education is one of the main categories of pedagogy and plays a decisive role in the formation of human personality. In pedagogical science, education is not only the process of forming behavior and morality, but also a complex activity that ensures the social, spiritual, intellectual and emotional development of a person. The theory of education studies this process on a scientific basis, determines its goals and objectives, and systematizes its methods and principles.

The main goal of the theory of education is to educate a person who is morally perfect, independent-thinking and socially responsible, in accordance with the ideals of society. In this regard, the content of the education process changes in accordance with the socio-political, cultural and spiritual requirements of each era. In modern pedagogy, the concept of education is based on the principle of respect for human nature, potential opportunities and individual characteristics. The theory of education has both a scientific and practical nature: on the one hand, it studies the regularities of human development, and on the other hand, it allows applying this knowledge in the educational and social environment. From a pedagogical point of view, education is evaluated as a purposeful and planned activity; its results have a long-term, but profound effect.

Consequently, the theory of education in pedagogy is a scientific system that ensures the comprehensive development of the personality. It is not only an integral part of the educational process, but also one of the main pillars of the moral and cultural stability of society.

***Keywords: pedagogy, theory of education, types of education, purpose of education, tasks of education, etc.***

The history of education is likely to begin with the earliest times when human society arose. Education played an indispensable role in the development of members of society during all socio-economic formations. Education was the main criterion in regulating communication, normal relations, labor habits, and family and household issues among ancient people. The prominent ethnopedagogist Professor Aliheydar Hashimov writes that “The history of education is as old as the history of human society. There has never been a period in the history of the development of society when representatives of the older generation did not take care of the education of the younger generation. However, at different times, at different stages of development, the essence, character and ways of instilling education in children have not been at the same level” (1, p.9)

Over time, education has gradually developed, and thus, folk education methods, tools, approaches, and moral rules that serve the exemplary behavior of members of society, especially the younger generation, have begun to emerge. Thanks to these, a number of educational traditions and customs related to moral rules have emerged. Such educational customs and traditions, which were instilled in oral form, were later formed and improved. Examples of oral folk creativity materials from almost all genres and types contain educational ideas. There are as many educational ideas in ayıl, lıylas, bayatıs, riddles, proverbs, riddles, proverbs, sayings, compositions, tests, calculations, nazzals, similes, beliefs, varsaqıs, tuyuks, goshmız, tajnis, gerayıls, deyishmes, muxammas, mustazads, holovars, sıyaçı sözlı, murabbas, tambabands, terjibands, ghazals, qasids, sözlı The word "Tarbiye" and its other shades of meaning can be found in ancient Turkic monuments, including national and spiritual values belonging to Turkic-speaking peoples such as "Bilgamus", "Orkhan-Yenisey", "Dirsakhan", as well as in the book "Divani Lugat - IT - Turk" written by Mahmud Kashgari in 1072-1073 (466 in the Hijri calendar). The prominent

Turkish thinker Mahmud Kashgari, who lived in the 11th century, wrote this book with the aim of teaching the Turkish language to Arabs.

As is known, the settlement of Turks in a number of Arab countries and the residence of Turks in some countries made it more necessary for these two peoples to communicate. Taking this into account, Mahmud Kashgari considered it necessary to have a single language belonging to the Turkic peoples in the 11th century, and also considered it necessary to teach the Turkish language to Arab peoples.

As is known, since non-Arabs, especially Turkic-speaking peoples, lived in a part of Iraq, they called it "Iraqi-Ajam". There is enough information in the sources that this phrasebook is a great means of communication for those living in Iraqi-Ajam.

The word "tarbiye" in Arab-Persian languages, "terbiye" in Turkish Turkish, "trbiye" in Bashkir language, "tarbiya" in Kyrgyz dialect, "tarbiye" in Kazakh, "tarbiye" in Turkmen, "tarbiye" in Uzbek, "tarbiye" in Uyghurs and peoples belonging to the Uyghur group (Uyghurs, Kashgars, Dolans, Khotons, Ilis), "torbiya" in Karakalpak language, "tirpey" in Chuvash language, and "tarbiye" in Tatar language has only one meaning: It is the development, formation and improvement of moral qualities related to behavior in people.

Even before the content of education (principles, methods, requirements, means, etc.) was determined by scientific pedagogy, oral methods and ways of public education existed. "Keep the advice I have given you in your ears", "Our ancestors, elders, and white-haired people have tested the advice I have given you for thousands of years. Always follow them!", "Look, I advise you, if you are white in the face of the elderly, your children will also be white in the face of you in the future", "I would never have expected it from you", "Such actions do not bring pride to a person", "Oh smart boy", "Oh good boy", "May God bless you, my child", "You are good, what good hands you have!", "Shame on you, a person does not do such a thing to another person", "This action of yours is a crime", "I warn you, if you do such an act again, you will be angry with yourself!", "Don't argue, it will stick in your head", "I forbid you to talk like that", "I have reprimanded you once for this action, try not to do it again", "May this thing you did come back to haunt you" and other such advice and advice. They gave advice, recommendations, and admonitions; they encouraged children through praise, applause, and flattery; and they corrected their mistakes through scolding, scolding, reprimanding, threatening, and scolding.

After the establishment of educational institutions in various periods, theoretical educational traditions began to emerge.

There are rich facts in our history of pedagogical ideas regarding school and educational traditions during the period of the states existing in the territory of ancient Azerbaijan during feudalism.

In the epics "Avesta" and "Kitabi Dede Gorgud", along with national traditions, more perfect educational traditions began to develop during the periods when Islam spread in Azerbaijan.

It is necessary to specially mention the educational ideas in the works of our classical writers who lived in the 12th-18th centuries. The educational ideas of Abulhasan Bahmanyar Al Azerbaijan, Khagani Shirvani, Nizami Ganjavi, Nasireddin Tusi, Assar Tabrizi, Maraghayi, Imadeddin Nasimi, Shah Ismail Khatai, Saib Tabrizi, Mahammad Fuzuli, Qovsi Tabrizi, Molla Panah Vagif, Molla Veli Vidadi, and Gasimbey Zakir have become examples for the education of children.

After the invasion of Azerbaijan by Tsarist Russia (starting in 1801), progressive educational traditions began to emerge in various types of schools operating in different regions, including Ganjabasar, Karabakh, Nakhchivan, Guba, Sheki, Lankaran, and Baku. These educational traditions gave impetus to the development of new educational traditions in educational institutions established during the Soviet period.

Educational institutions operating in the USSR for 71 years were established in accordance with the requirements of the program of the Soviet Communist Party, in accordance with the

principles of socialism-communism, as well as Marxism-Leninism. Education was called "Communist education".

Only since the years of our independence did educational work begin to be carried out in our country in accordance with the principles of humanization and democratization, in accordance with the requirements of the new "Education Law", the "Constitution of the Republic of Azerbaijan" and the educational reforms implemented in our country.

In our country, the content of educational work is determined in accordance with the relevant age groups and its purpose.

The National Pedagogy, approved and instilled by the Ministry of Education of the Republic of Azerbaijan, has expressed the purpose of education more clearly. National Pedagogy has defined the purpose of education as follows: the purpose of education is to help educate citizens who are capable of protecting the independence of the republic, territorial integrity, inviolability of its borders, and raising our country to the level of developed democratic states through the acquisition of national and universal values related to behavior.

In the current contrasting conditions where scientific and technological progress is constantly increasing, our country is constantly developing despite the occupation of our lands by our hated neighbors and the acquisition of 20% of our territory. The export of our underground and surface resources to world markets, the acceptance of our republic into the Council of Europe, are constantly increasing its prestige. In such conditions, it is very important to correctly define its tasks in accordance with the purpose of education.

During the period of independent state building, one of the most important tasks of education is to raise citizens who are comprehensively developed, possess a scientific worldview, intellectual level, healthy artistic taste, physical perfection, and economic knowledge, who protect the environment, who love their art with exemplary morality and deep love.

In order to raise representatives of the new generation as healthy-spirited citizens, it is important to achieve the following tasks:

✓ To raise citizens who are comprehensively developed in terms of their scientific worldview and ideological and political level. For this, both in the educational process and in extracurricular activities, while teaching students the basics of science, they should be instilled with a sense of love, respect, and reverence for statehood and its attributes;

✓ It is necessary to achieve the purification of the morals of students. Thus, it is necessary to reveal in them the virtues that are positive manifestations of morality (friendship, companionship, sincerity, honesty, generosity, dignity, dignity, beauty of mind, generosity, fortitude, determination, courage, tolerance, humility, patience, patriotism, protecting the homeland from foreign eyes, dignity, kindness, justice, loyalty, etc.) and to correct the vices that are negative manifestations of morality (lying, cowardice, betrayal of the homeland, hypocrisy, theft, stupidity, madness, cruelty, oppression, forbiddenness, carelessness, flattery, betrayal, tendency to superstition, stubbornness, etc.);

✓ It is necessary to educate students as people with comprehensive scientific and artistic taste. One of the most important tasks is to direct them to love the beauties of nature, to accustom them to feel, perceive and appreciate the examples that instill pleasure in art. It is important to teach them to love poetry, prose, drama, theater, museum exhibits, dance, song, jazz music, mugham, tasnif, color, diringa, rap, vocaliz, choir, ancient musical instruments and the like;

✓ One of the tasks in secondary general education schools is to take care of the physical education of each student, to form their physical culture. Ensuring the formation of their special abilities both physically and morally in sports lessons, in sections for different types of sports, in training conditions, in competitions, contests, tournaments is an important part of those tasks;

✓ One of the tasks ahead is to accustom students to labor starting from the early school age, to properly use the educational opportunities arising from the interaction of labor training

and productive labor on a polytechnic basis. In such a process, the normal attitude towards labor, crazy love, inexhaustible respect for hardworking people, feelings of business that adorn people's lives, as well as the effective and invaluable protection of human labor, the ability to work selflessly for the benefit of the helpless and the disadvantaged are integral parts of the mentioned tasks;

✓ In order to form the ecological education of students, it is necessary to familiarize them with the concepts of "ecological awareness", "ecological knowledge", "ecological education", "ecological thinking", "ecological worldview", "ecological activity", "ecological behavior" in various activities, and to instill in them a number of practical habits to protect the environment. Teaching students a caring attitude towards nature, accustoming them to love and protect the environment, and familiarizing them with the socio-political, economic, spiritual and moral values of protecting the ecological environment are among the most sacred tasks;

✓ The proper organization of students' economic education forms a broad worldview about the economic potential, forms of ownership, production discipline, economic efficiency, economic abundance, agricultural economy, economic balance of industry, and economic abundance created by the oil and gas economy in society. The proper organization of economic education not only increases their knowledge in all areas of economic development in our country, but also acquaints them with such economically profitable projects as the Contract of the Century (1994), the Silk Road, Oil Contracts, Baku-Ceyhan, Baku-Supsa, Baku-Novosibirsk, and others, and with successful stages of economic development in the fields of mechanical engineering, cotton growing, tea growing, viticulture, and animal husbandry. All of these are tasks that are considered necessary to be implemented in the field of forming economic education;

The development of legal education of the younger generation shapes their attitude to legal norms, creates students' socio-legal mindset, increases their activity in the field of legal culture, expands their ideas about property law, domestic law, tax law and other legal issues and directives. All this calls them to be disciplined, responsible, and raises the level of upbringing, such as being ready to protect not only their own rights, but also the rights of other citizens. Carrying out such useful work in the process of upbringing is also one of the main tasks.

This issue related to primary education also has epistemological roots. Back in the 13th century, the prominent Azerbaijani thinker Nasireddin Tusi noted the importance of the speech soul in the primary education of a child and the creation of elements of perfection in a child by these forces. Tusi considers the work to be carried out in theoretical directions as "forces of scientific perfection", and the work to be carried out in practical directions as "perfection of practical power". In this regard, Nasir al-Din Tusi writes: “The power of scientific perfection is called that which is directed towards learning science and acquiring enlightenment; as a result of this enthusiasm and desire, it is possible to determine the degrees of beings, to penetrate the essence of truths; then to comprehend the absolute truth, which is the true goal and where all beings end, and perhaps to achieve the art of reaching it...

The perfection of practical power is called that which allows a person to organize and adapt his capabilities and activities in such a way that in this case morality is brought up in a suitable and pleasing way. ” (2, p. 59-60)

As can be seen, N. Tusi considers it necessary to correctly apply absolute truth, that is, the organization of theoretical concepts in capabilities and activities, in practice. Therefore, it is necessary to start the work of correctly approaching the child in the theoretical and practical directions that are considered necessary for initial education very early. N. Tusi recommends starting this work right from the naming ceremony. He writes: “First of all, when a child is born, it is necessary to give him a good name. If he is given an inappropriate name, he will be ashamed of it for the rest of his life, and his blood will be black.” (2, p. 168) Since naming a child is the basis for starting primary education, it is necessary to choose the right name first.

According to national pedagogy, “primary education is the purposeful, planned and

organized formation of national and universal moral qualities in the younger generation that are considered useful for the family and society, related to behavior."

Although it is easier to engage in primary education than other types of education, it is very responsible. Because in this type of education, the foundation of education is laid. Therefore, the foundation should be laid in such a way that contradictions, concerns, contrasts, and dangerous situations do not manifest themselves in subsequent processes.

During primary education, it is necessary to prioritize the instillation of the most necessary moral qualities and examples that characterize these qualities. N. Tusi also recommends this. In this regard, he wrote that "After the child is weaned, it is necessary to start educating him and teaching him discipline before his morals have time to deteriorate. Since a child may be inclined to bad habits due to the innate defects in his nature, it is necessary to prevent it before its time and purify his morals by considering his nature, that is, whichever pure force manifests itself first in the child, its improvement should be prioritized." (2, p. 168)

The moral norms instilled in a child at the first stage of primary education can be directed in a good direction at a later stage by the influence of family members, relatives, neighbors and close people. Professor Nuraddin Kazimov writes that, "As a child grows up, the moral qualities formed as a result of the deliberate or unintended influence of parents, siblings, grandparents, relatives and peers on him can be both beneficial and harmful for the family and society" (3, p. 267).

Therefore, the positive qualities that arise in the child's upbringing during primary education should be developed and regulated by the environment surrounding him, while negative traits should be corrected and eliminated. In Tusi's words, "the first condition of upbringing is that you should not let the child sit and play with people and things that will spoil his nature, because the child's soul is simple, and he quickly takes on the character of those around him." (3, p. 168).

The purposeful, planned organization of primary education is of great importance for the moments when the child begins his school period. Because in the school environment, positive manifestations of his morality (education) are well received.

According to national pedagogy, the purposeful and planned assimilation of useful qualities without the direct control of educators is self-education. Self-education is a more difficult process. If the participants in the process of primary education and re-education and these participants closely participate in the organization, development, formation and improvement of both primary education and re-education as close assistants, guides, and guides of the student, then the student himself becomes the only participant in self-education. The student himself occupies that leading position. Therefore, in the process of self-education, the student faces more responsible tasks. There are two sides of the self-education mechanism to implement these tasks. The first of these parties, which are constantly in mutual contact and warm relations with each other, is the individual himself. That is, the student (person) is the main object of self-education, and the second is the environment surrounding the object of self-education. That individual observes a large number of positive moral examples and moral norms for self-education in the environment surrounding him (4, p.26).

National pedagogy evaluates re-education as follows: "re-education is the purposeful, planned and organized elimination of harmful traits rooted in a person's consciousness or behavior and the instillation of national and universal qualities of social significance in them in their place."

- ✓ Those who need re-education are called ill-mannered people among the people.
- ✓ They are also characterized as ill-mannered people in official circles.

These people, who are encountered among schoolchildren, are called ill-mannered because, due to their exposure to harmful influences in various environments, a number of harmful traits have begun to take root in their consciousness and behavior.

Such people usually move away from school and education and, under the influence of

various people and groups, engage in activities that contradict educational actions, educational components, and moral qualities. There are many reasons that lead to such people becoming ill-mannered. These reasons can be concisely grouped as follows:

- ✓ improper organization of primary education;
- ✓ a naive approach to education in the stages after primary education;
- ✓ parents' inability to properly educate children in the family;
- ✓ weak interaction between the family and the school;
- ✓ anti-pedagogical "methods" used by individual business associations, companies, private enterprises, and individual business owners when using schoolchildren's labor for profit;
- ✓ public representatives turning a blind eye to the anti-pedagogical actions of minors and schoolchildren who beg on the streets, on the side of highways, at traffic lights, in markets, cafes, restaurants, and other places, wipe car windows, work as porters, smoke, drink alcohol, hang out with drunks, collect money on buses, etc. (5, p.43).

Minors and schoolchildren who become "difficult children" due to a number of reasons, both stated and unstated, often commit crimes, become participants in the commission of crimes, and thus end up in prisons and jails.

They have the right to participate in test exams after receiving education according to general rules in a school operating with the status of a secondary general education school in a penal institution. Those who are admitted to higher and secondary specialized schools are exempted from serving a certain part of their sentences. All of these are considered factors that contribute to the re-education of these schoolchildren.

In pedagogy, the theory of education is a scientific field that studies the regularities of the formation of human personality and is aimed at its purposeful management.

Education is an important process that ensures the transmission of the cultural, spiritual and social values of society to future generations. It is not limited only to the instillation of knowledge and skills, but also forms such qualities of personality as moral, aesthetic, patriotism and social responsibility.

The main goal of the theory of education in modern pedagogy is to raise a citizen who is comprehensively developed, creatively thinking, loyal to national and human values, and useful to society. This theory is closely related to education and, together with it, creates a systematic and reciprocal effect on the development of the personality. Building the educational process on scientific grounds increases the effectiveness of pedagogical activity and contributes to the spiritual development of society (6, p.72).

Thus, the theory of education, as one of the most important directions of pedagogy, is a leading factor in shaping the perfection of a person, his worldview and culture of behavior. This theory constantly maintains its importance in the field of both science and practical activity.

LITERATURE:

1. A. Hashimov, F. Sadygov Azerbaijan folk pedagogy. Baku. Unsiyet, 2000
2. N. Tusi, “Akhlaqi Nasiri”, Baku, Lider Publishing House, 2005
3. N.M. Kazimov. School pedagogy, Baku, Chasioglu, 2005
4. Ahmadov, M. (2018). Pedagogy: theoretical and practical foundations. Baku: Education Publishing House.
5. Hasanov, A. (2020). Modern pedagogical processes and education system. Baku: Science and Education.
6. Aliyeva, S. (2017). Theory and methodology of education. Baku: Adiloglu.

# CHALLENGES OF MODERN EDUCATION-MAIN DUTIES OF A 21ST CENTURY TEACHER

Sevil Jafarova
Senior Lecturer, Agjabadi Branch of Azerbaijan State Pedagogical University, Azerbaijan

***Abstract.*** Civilization is changing, the age of technology requires more advanced skills from the teacher. In this case, the teacher should approach his work more professionally and responsibly, and shape his skills in accordance with the requirements of the time.

A creative teacher is a teacher who develops the thinking and imagination of students in the teaching process, not only provides them with information, but also encourages them to solve problems in their own way. He makes learning interesting and meaningful by using new methods and technologies, not being satisfied with traditional methods.

A creative teacher is a key component of the modern education system. His activities enrich the teaching process, contribute to the intellectual and personal development of students. The preparation and support of such teachers is important for improving the quality of education. Continuous training, sharing of experience and the application of innovative methods are important for increasing the professionalism and creativity of creative teachers.

***Keywords: teacher, creative teacher, innovation, skills, competencies, features of modern education, digital tools, creative learning environment, etc.***

The teaching profession is a difficult and honorable profession. It is no coincidence that our Great Leader Heydar Aliyev says about the teacher, about the sanctity of this profession: “I do not know a higher name on earth than a teacher. Each of us has a particle of the warm heart of a teacher. It is the teacher who has taught us with wisdom and patience to love our native land, to work conscientiously for the welfare of all. Each of us has his own teacher, and we cherish his memory in our hearts with respect and gratitude throughout our lives.”

In the modern education system, the teaching profession is not only a means of transferring knowledge, but also a profession that enriches the teaching process with its creative abilities and innovative approaches. Therefore, a teacher should approach his work creatively, and strive to increase the effectiveness of the lesson with the new methods and tools he applies.

What is the concept of “creative teacher” and what does it include?

A creative teacher is a teacher who uses original and effective methods in the teaching process, develops the thinking abilities of students, and increases the quality of education. The concept of a creative teacher is a joint expression of the teacher's personal skills, professional knowledge and psychological preparation. These teachers apply innovative approaches to both lesson planning and assessment. The creative teacher also plays a motivating role in the teaching process, creates conditions for students to express themselves, and builds self-confidence (1, p.47).

Civilization is changing, the age of technology requires more advanced skills from the teacher. In this case, the teacher should approach his work more professionally and responsibly, and shape his skills in accordance with the requirements of the time.

A creative teacher is a teacher who develops the thinking and imagination of students during the teaching process, who not only provides them with information, but also encourages

them to solve problems in their own way. He makes learning interesting and meaningful by using new methods and technologies, not being satisfied with traditional methods.

So what are the main characteristics of a creative teacher? The characteristics of a creative teacher can be summarized as follows:

- ✓ High level of professionalism - deep knowledge of the subject and correct selection of teaching methods;
- ✓ Innovation - applying new methods and technologies in the teaching process;
- ✓ Adaptability - choosing teaching strategies that suit the individual characteristics of students;
- ✓ Problem-solving skills - effectively solving difficulties that arise during teaching;
- ✓ Motivational skills - encouraging students to learn;
- ✓ Collaboration and communication skills - effective communication with colleagues and parents.

A creative teacher develops students' analytical thinking, critical thinking and problem-solving skills using various methods in the teaching process. Interactive forms of training, the application of projects and tasks not only increase the level of knowledge of students, but also increase their interest and motivation. A creative approach increases the quality and efficiency of the lesson. A creative teacher makes the lesson more interesting and effective by using technologies in the teaching process, gamification and bringing examples from real life (2, p.61).

The following ways are recommended to become a creative teacher:

- ✓ Continuous professional development - participation in seminars, trainings and courses;
- ✓ Monitoring methodological literature - familiarization with new pedagogical technologies and methods;
- ✓ Exchange of experience - sharing experience with colleagues;
- ✓ Studying the individual characteristics of students - individualizing lesson strategies;
- ✓ Participation in innovative projects - bringing new ideas to the teaching process;
- ✓ Reflection and self-development - analyzing the results after the lesson process, improving teaching methods.

There are a number of important tools that a creative teacher will use in modern teaching, which are as follows.

“Creative learning environment with digital tools”. In modern times, the application of digital tools in the educational process plays an important role in improving the quality of teaching and developing students' creative thinking skills. The use of digital technologies - interactive boards, tablets, educational programs, online platforms in secondary schools strengthens the interaction between teachers and students, makes the learning process more interesting and efficient. Digital tools are not only a means of transferring knowledge, but also an innovative educational resource that opens up wide opportunities for creative activity.

A creative learning environment is formed when students actively participate in the learning process, conduct research, express their ideas and work on practical projects. In this regard, digital tools - platforms such as “Google Classroom”, “Kahoot”, “Padlet”, “Canva” and “Scratch” allow students to demonstrate their creativity, work in teams and make independent decisions. In such an environment, the role of the teacher is shaped not only as a provider of information, but also as a guide and motivator.

“Game-based learning: increasing motivation in children”. In modern learning approaches, game-based learning is considered one of the most effective methods for increasing cognitive interest and motivation to learn in children. The main goal of this method is to ensure the acquisition of knowledge and skills in a fun and interactive way. Game-based learning creates conditions for students to actively participate in the learning process, develop their creative abilities, as well as form critical and logical thinking skills.

Studies show that lessons conducted in a game environment increase children's interest and attention, and lead to better memorization of the topics studied. For example, through

platforms such as “Kahoot”, “Quizizz”, “Minecraft Education Edition”, students learn in both a competitive and cooperative environment. This develops important social skills such as independent decision-making, problem solving and team spirit in them.

One of the advantages of the game-based learning method is that it creates personalized learning opportunities. Children experience a sense of success by completing tasks appropriate to their level, which strengthens their intrinsic motivation. Thus, the learning process enriched with game elements increases children's interest in learning, makes teaching more effective and meaningful (3, p.19).

“Great results with simple means - creative tasks in the lesson”. The role of creative tasks in the learning process ensures active learning of students, development of thinking and expression skills. Modern pedagogical approaches show that a teacher does not necessarily need complex technologies and resources to achieve great results in the lesson. It is possible to create interest and motivation in students by organizing creative tasks using simple but purposeful means - paper, cardboard, pictures, colored pencils, everyday objects and interactive whiteboards.

Creative tasks allow students to approach the lesson material from different aspects, think critically and express their ideas freely. For example, simple activities such as writing an alternative ending to a story, presenting a topic with a poster or model, as well as solving problems on real-life examples, strengthen children's interest in learning. These types of tasks can be organized both individually and in groups, which develops cooperation and communication skills.

“Integrating science and mathematics through STEAM projects”. In the modern education system, the STEAM (Science, Technology, Engineering, Art, Mathematics) approach is considered one of the most successful models of interdisciplinary integration. This model helps students connect scientific and technological knowledge with practical applications, and develop creative and critical thinking skills. Through STEAM projects, the joint teaching of science and mathematics is presented not at the level of abstract theories, but in the form of applying knowledge to solving real-life problems.

The integration of science and mathematics has a significant impact on the formation of scientific thinking in students. For example, in projects where physics and mathematics are combined, children learn the concepts of force, motion and measurement through practical experiments; in the integration of biology and mathematics, the ability to analyze ecosystems statistically and draw conclusions based on data is developed. The principle of “learning by doing” is taken as the basis in such projects, which ensures that learning is sustainable and meaningful.

The STEAM approach also combines creative art elements (Art) with scientific content, increasing students' aesthetic taste and presentation skills. Students express their ideas through models, graphs, models and visual presentations. This develops both analytical and creative skills at the same time. As a result, STEAM projects make a significant contribution to the formation of 21st century skills by integrating natural and mathematical subjects.

One of the main goals of the education system in the modern era is to form a personality that is creative, critical thinker and capable of independent decision-making. One of the most effective ways to achieve this goal is to develop the ability to ask questions in children. Questions that make children think arouse their cognitive interest, create interest in learning and create a basis for the formation of creative thinking (3, p.22).

One of the main goals of the National Curriculum is to develop students' thinking skills. The tools that a creative teacher will use for this can be summarized as follows.

“Questions that make children think – the key to creative thinking”. A question is the beginning of a child’s thinking process. As a child asks questions, he begins to understand the world around him, find cause-and-effect relationships and express his own ideas. For example, questions such as “Why is the sky blue?” or “If I were a bird, where would I fly?” activate both the child’s

logical and imaginative abilities. Trying to find answers to such questions directs the child to search, observe and draw conclusions.

Creative thinking is measured not only by the assimilation of ready-made knowledge, but also by the ability to create new ideas. When children are asked open-ended questions, that is, questions that do not have a single correct answer, they are encouraged to think differently. For example: "If you could change the world, what would you change?" "If water could talk, what would it tell us?" Such questions develop children's imagination, emotional intelligence and social sensitivity, and also increase their confidence in their own ideas.

The role of the teacher in the development of creative thinking is indispensable. The teacher should evaluate every question asked by the children and direct them to think more. Even the wrong answer of the child indicates the activity of his thinking process. Therefore, the teacher should not punish questioning, but rather encourage it.

In the lessons, methods such as "brainstorming", "mind mapping", "what if" lead children to think freely and come to creative conclusions.

"Artificial intelligence and children: the teacher of the future starts today". The rapid development of technology is also creating profound changes in the field of education. Artificial intelligence is now widely used not only in the field of information technologies, but also in pedagogy. The integration of artificial intelligence into the educational process enriches children's learning experience and helps prepare students who are teachers of the future. This approach aims to develop not only technical knowledge, but also creative, critical and social skills (4, p.27).

Artificial intelligence has the ability to develop individualized curricula for students, adapt teaching materials to their level, and personalize the learning process. This feature is reflected in the following functions of Artificial Intelligence:

Individualized learning path – Materials are presented to each child at their own pace and according to their abilities.

Interactivity of teaching – Lessons become more interesting and accessible through robots, virtual simulations, and games.

Feedback and assessment – AI immediately evaluates students' responses and makes suggestions for their development.

Data analysis – It offers effective strategies to the teacher by monitoring students' learning habits.

Through AI, children both learn and play the role of a small teacher in the teaching process. For example, in adaptive learning platforms, students:

- ✓ Apply their knowledge,
- ✓ Explain and help other students,
- ✓ Develop leadership skills on projects and assignments.

Thus, AI ensures that students not only acquire information, but also test their teaching skills in practice. This is an important experience for becoming a teacher of the future.

Artificial intelligence frees students from routine tasks and allows them to develop their creativity, problem-solving and critical thinking skills (5, p.42).

The teacher should use artificial intelligence as an auxiliary and reinforcing tool in the teaching process. His task is to teach children to use artificial intelligence correctly and purposefully, to ensure the ethical and safe use of technology, and to include creative and critical thinking skills in the learning process.

LİTERATURE:

1. N. Aliyeva. Fundamentals of Pedagogy. Baku: Education Publishing House, 2018.
2. R. Hasanov. Modern education and creativity. Baku: Science Publishing House, 2017.
3. S. Mammadova. Innovative methods in teaching. Baku: Education Publishing House, 2019.
4. T. Aliyev. Professional development of the teacher. Baku: Science and Education, 2020.
5. F. Guliyev. Creative approaches in the educational process. Baku: Pedagogical Publishing House, 2021.

# EMERGENCY PREPARATION OF THE POPULATION

Guliyeva Ulviyya Ingilab gizi
Senior Lecturer, Agjabadi Branch of Azerbaijan State Pedagogical University, Azerbaijan

***Abstract.*** Emergencies occur as an inevitable consequence of natural, man-made and social events at the stages of development of human society. High-level preparedness of management bodies and forces is of great importance for the prevention and elimination of the consequences of these events. In modern times, the emergency system is considered an integral part of state security, and the efficiency of the management process in this area directly affects the protection of people's lives and property.

Purposeful and systematic organization of civil defense measures serves to reduce the negative consequences of emergencies and ensure the safety of the population. The interaction of management bodies, rescue forces and public organizations in this area is an important guarantee of the stability of society.

Civil defense education plays an important role in increasing the life and safety knowledge of not only professional rescue and security bodies, but also university students. The implementation of special programs in this area ensures that the younger generation acts promptly and correctly during emergencies.

***Keywords: emergencies, civil defense measures, protection, natural disasters, man-made events, population safety, etc.***

Emergencies occur as an inevitable consequence of natural, man-made and social events at the stages of development of human society. High-level preparedness of management bodies and forces is of great importance for the prevention and elimination of the consequences of these events. In modern times, the emergency system is considered an integral part of state security, and the efficiency of the management process in this area directly affects the protection of people's lives and property.

The main task of management bodies in this process is to prevent emergencies, provide an operational response to them and minimize their consequences. The Ministry of Emergency Situations was established in the Republic of Azerbaijan to carry out activities in this direction in a centralized manner. The Civil Defense Troops, the Special Risk Rescue Service, the State Fire Control Service and other institutions operate within the structure of the Ministry.

Management bodies also carry out coordination work aimed at assessing risks, educating the population, planning preventive measures and eliminating the consequences of emergencies. The main principle in all these activities is efficiency, interaction and efficiency.

The level of preparedness of the forces involved in emergency management is a key indicator of the system's effectiveness. The forces include rescue teams, firefighters, medical teams, police and other special services. Their interaction is carried out under the leadership of a single control center (1, p.17).

Training and practical exercises are an integral part of the training of these forces. Civil defense exercises, emergency scenario exercises, testing of evacuation plans for the population and maintaining technical equipment in working order are the main elements of the training system. A high level of professionalism of the forces can be ensured only in conditions of continuous training and coordination.

In modern times, the application of information technologies and artificial intelligence comes to the fore to increase the efficiency of management in the emergency system. Geographic information systems (GIS), satellite monitoring, drone technologies and real-time information exchange play an important role in the operational decision-making process.

At the same time, since climate change, urbanization and industrialization processes create new risks, the preparedness plans of management bodies must be regularly updated. Scientifically based risk analysis and forecasting models are one of the important tools in this direction.

Civil defense, as an important component of the state security system in modern times, is a complex of activities aimed at protecting the population, territory, material and cultural assets from natural, man-made and military emergencies. The purpose of this system is to protect human life, minimize damage during emergencies, and ensure the restoration of normal society.

The main tasks of civil defense are concentrated in several areas:

Protection of the population. The priority direction of civil defense is the protection of human life. For this purpose, timely warning of the population about the danger, preparation of evacuation plans, organization of shelters, and provision of first aid are ensured.

Organization of a warning and information system. Timely warning during emergencies is one of the main factors that save people's lives. Therefore, effective communication, signaling, and information systems are created by civil defense agencies.

Organization of rescue and restoration work. Operational activity of rescue forces is ensured during natural disasters, explosions, fires, and other events. Restoration and disinfection work is carried out in the affected areas, and the restoration of infrastructure is organized.

Creation of material and technical reserves. Storage and distribution of food, medicine, fuel, and other important reserves for use during emergencies are among the important tasks of civil defense.

Personnel training and public education. The success of civil defense depends on the awareness of people and the activities of professional personnel. For this purpose, civil defense exercises, training programs and educational events are regularly carried out (2, p.75).

Emergency preparedness not only increases the ability to respond promptly, but also ensures that damage is minimized. Emergency response teams include rescuers, firefighters, medical aid and technical teams. Their main tasks include evacuating the population, providing first aid to the injured, extinguishing fires and organizing the restoration of damaged infrastructure. Each team must have professional and technical training in accordance with its functional direction.

Team training is carried out mainly through practical exercises and simulation exercises. In these exercises, scenarios for real situations are developed, operational plans are tested and coordination experience between teams is increased. Regular exercises strengthen the teams' ability to respond quickly, make decisions and act promptly in emergency situations.

In modern times, the application of technological tools plays an important role in the training of teams. GPS monitoring, drones, special technical equipment and information systems increase the efficiency of rescue operations. At the same time, scientifically based analysis of risks and prediction of emergencies increases the effectiveness of the training of teams.

Civil defense education plays an important role in increasing the life and safety knowledge not only of professional rescue and security agencies, but also of university students. The application of special programs in this area ensures that the younger generation acts promptly and correctly during emergencies.

Civil defense education in universities is carried out within the framework of special programs. Programs usually include theoretical knowledge and practical exercises:

Theoretical part:

- ✓ Basic concepts of emergencies, their types and causes;
- ✓ Methods of population protection, evacuation plans and organization of shelters;
- ✓ Principles of rescue and emergency medical care;
- ✓ Risk assessment and preparation of preventive measures.

Practical part:

- ✓ Simulation exercises for emergencies;
- ✓ Practical training on evacuation of the population and provision of first aid;
- ✓ Firefighting and rescue operations rehearsals;
- ✓ Organization of cooperation and teamwork.
- ✓ Rules and methodological approaches

Training programs are implemented in accordance with regulatory and legal acts approved by the state. Students are trained in stages: first, theoretical knowledge is acquired, then practical skills are developed. Training is held regularly and students' knowledge and skills are assessed. These rules create the basis for their effective and prompt action in emergency situations.

Public education and training in the civil defense system are among the main factors ensuring the resilience of society to emergencies. Increasing the knowledge and skills of the population in civil defense ensures not only the protection of life, but also the minimization of the consequences of emergencies. Therefore, the organization and planning of training should be carried out on a systematic and scientific basis (4).

Public education in civil defense is based on regulatory and legal documents established by the state. The Ministry of Emergency Situations and civil defense bodies develop and implement training programs for the population. Local executive authorities, educational and healthcare institutions, as well as public organizations actively participate in the organizational process.

Training plans are developed in stages:

1. Readiness and needs analysis: The level of information of the population and areas at risk are determined.

2. Development of programs: Training should include theoretical knowledge and practical exercises. The theoretical part explains the types of emergencies, safety rules and evacuation plans. The practical part conducts first aid, firefighting and evacuation exercises.

3. Implementation and coordination: The time, place and participants of the training are planned in advance. Programs are adapted for different groups of the population.

4. Evaluation and improvement: The effectiveness of the training is assessed and recommendations for future activities are developed.

Civil defense is a system of measures taken to protect the life and health of the population in emergency situations. Preparing the population for civil defense is one of the main factors ensuring the effectiveness of these measures.

The following basic principles are used in teaching the population about civil defense:

General nature: Protection issues should be taught to all citizens of the country over the age of 6. At the same time, persons aged 6-16 are taught methods and rules for protection in emergency situations, and persons over the age of 16 are also taught, in addition, rules for actions to eliminate the consequences of accidents and other catastrophic events. (4)

Principle of Compulsory: Civil defense training for the population is mandatory and is considered a civic duty of every citizen. Regardless of subordination, ownership and form of economy, the heads of all state and non-state bodies, enterprises and organizations organize the preparation of their subordinates for protection in emergency situations and are responsible for this work.

Principle of Individualization: Protection issues are taught differently to different groups of the population, taking into account specific local conditions, characteristics of farms and other

factors. For the purpose of civil defense training, the country's population is conditionally divided into 5 groups: management personnel; commanders-chiefs and personal staff of non-military civil defense units; employees, workers and agricultural workers not involved in civil defense units; population not engaged in production and service; students of state and non-state higher and secondary specialized schools, students of technical and vocational schools.

The principle of continuous and consistent training: The training of knowledge, rules and methods of protection is continuous and consistent. Training activities in this area are planned and implemented annually in all facilities, without exception - industrial and agricultural enterprises, departments and organizations, educational and medical institutions, service areas, etc. The academic year begins in January and lasts 10 months.

The principle of organizational planning: Every year in December, the civil defense headquarters draws up a "Plan for the preparation of management personnel, teams, workers and employees at the facility for civil defense" for the next academic year. The plan is drawn up on the basis of the order of the head of the district (city) civil defense and the directive of the higher department in the field (ministry, company, etc.), while taking into account the training programs, as well as the instructions for the leadership personnel to undergo training in civil defense courses (5).

The organization and planning of civil defense training for the population is important for protecting people's lives and health in emergency situations. Guided by the above principles, it increases the effectiveness of activities in this area and ensures the safety of society.

LİTERATURE:

1. Ziyadkhan Nabibeyli. Ecology and emergencies. Baku: 2012.
2. H.O. Ochagov. Civil defense (protection). Baku: 2007
3. Constitution of the Republic of Azerbaijan.
4. e-derslik.edu.az
5. pmc.ncbi.nlm.nih.gov
6. dspace.khazar.org

# THE CONCEPT OF EDUCATION IN PEDAGOGY. TYPES OF EDUCATION

Jafarova Atrabe Shirastan
Teacher, Agjabedi Branch of Azerbaijan State Pedagogical University, Azerbaijan

**Abstract.** Education is a purposeful process aimed at the formation of human personality, its spiritual, mental, physical and aesthetic development. The social requirements, moral values and cultural heritage of society determine the content of this process. Several main types of education are distinguished: intellectual education, moral education, aesthetic education, labor education, physical education, patriotic education, primary education, self-education and re-education.

Intellectual education is aimed at developing the level of knowledge, cognitive abilities and thinking culture of students. The educational process at school, independent learning skills and scientific interests are the main means of this type of education. Moral education serves to form qualities such as conscience, responsibility, justice, honesty and humanism in a person. The role of the family, school and social environment is great here. Aesthetic education develops the ability to feel beauty, to have an aesthetic attitude towards art and nature. Music, painting, literature and theater are effective means of this education.

Labor education is aimed at instilling industriousness, responsibility and collective labor habits. The goal is to raise a person in the spirit of respect for labor. Physical education aims to develop a healthy lifestyle, physical education and endurance. Sports and active games are the main forms of physical education. Patriotic education is the main goal of this education, instilling feelings of national identity, love for the state and people, respect for historical heritage. All types of education are closely interconnected and, when implemented in a complex way, harmonious development of personality is achieved. In modern times, education requires the joint activity of not only the family and school, but also society, the media and the social environment.

***Keywords: types of education, intellectual education, moral education, aesthetic education, labor education, physical education, patriotic education, primary education, self-education and re-education***

The prominent ethnopedagogue Professor Aliheydar Hashimov writes that “The history of education is as old as the history of human society. There has never been a period in the history of the development of society when representatives of the older generation did not take care of the education of the younger generation. However, at different times, at different stages of development, the essence, character of education and the ways of instilling it in children were not at the same level” (1, p.9)

Professor Nureddin Kazimov was the first to bring this topic to national pedagogy. According to national pedagogy, there are three types of education depending on the degree of difficulty:

1) primary education; 2) re-education; 3) self-education.

Primary education. According to national pedagogy, "primary education is the purposeful, planned, and organized formation of national and universal moral qualities in the younger generation that are considered beneficial for the family and society, related to behavior."

Although it is easier to engage in primary education than other types of education, it is very responsible. Because in this type of education, the foundation of education is laid. Therefore, the foundation should be laid in such a way that contradictions, concerns, contrasts, and dangerous situations do not manifest themselves in subsequent processes.

One of the methodological foundations of scientific pedagogy is based on the correct laying

of the foundation of education. Therefore, this work, which is considered necessary to begin as soon as the child is born, needs to be carried out in a purposeful and planned manner. In this case, it is considered more expedient to work mainly in two directions:

- ✓ Work carried out in theoretical directions;
- ✓ Work carried out in practical directions.

When we say work carried out in theoretical directions, we mean planning the work to be done on pedagogical, psychological, sociological, physiological, and biological grounds.

When we say the work to be done in practical directions, we mean the application of planned theoretical directions in practice and at the same time the purposeful use of the opportunities of moral, spiritual, aesthetic, ideological-political, labor, physical, economic, and ecological education of the child. Tusi considers the work to be carried out in theoretical directions as “forces of scientific perfection,” and the work to be done in practical directions as “perfection of practical power.” In this regard, Nasir al-Din Tusi writes: “The power of scientific perfection is called that which is directed towards learning science and acquiring enlightenment; as a result of this enthusiasm and desire, it is possible to determine the degrees of beings, to penetrate the essence of truths; then to comprehend the absolute truth, which is the true goal and where all beings end, and perhaps to achieve the art of reaching it...

The perfection of practical power is called that which allows a person to organize and adapt his capabilities and activities in such a way that in this case morality is brought up in a suitable and pleasing way. ” (2, p. 59-60)

As can be seen, N. Tusi considers it necessary to correctly apply absolute truth, that is, the organization of theoretical concepts in capabilities and activities, in practice. Therefore, it is necessary to start the work of correctly approaching the child in the theoretical and practical directions that are considered necessary for initial education very early. N. Tusi recommends starting this work right from the naming ceremony. He writes: “First of all, when a child is born, it is necessary to give him a good name. If he is given an inappropriate name, he will be ashamed of it for the rest of his life, and his blood will be black.” (2, p. 168)

During primary education, it is necessary to prioritize the instillation of the most necessary moral qualities and examples that characterize these qualities. N. Tusi also recommends this. In this regard, he wrote that "After the child is weaned, before his morals have time to deteriorate, it is necessary to start educating him and teaching him order and discipline. Since the child may tend to bad habits due to the innate defects in his nature, it is necessary to prevent it before time, and to purify his morality by considering his nature, that is, whichever pure force manifests itself first in the child, its improvement should be prioritized." (2, p. 168)

The moral norms instilled in a child at the first stage of primary education can be directed in a good direction at a later stage by the influence of family members, relatives, neighbors and close people. Professor Nuraddin Kazimov writes that, “As a child grows up, the moral qualities formed as a result of the deliberate or unintended influence of parents, brothers and sisters, grandparents, relatives and brothers, and peers can be both beneficial and harmful for the family and society” (3, p. 267).

Therefore, the positive qualities that arise in the upbringing of a child during primary education should be developed and regulated by the environment surrounding him, and the negative traits should be corrected and eliminated. Taking this into account, educators

That is, the main object of self-education is the student (person), and the second is the environment surrounding the object of self-education.

That individual observes a large number of positive moral examples and moral norms for self-education in the environment surrounding him. Starting from childhood, he chooses examples from those positive qualities and begins to apply these examples to his behavioral activity. These positive qualities in the child's behavior and activity begin to have exemplary characteristics during

adolescence. The teenager tries to compare himself to the characters of works, movie heroes, winners who have won victories on a national and international scale, and those who have won gold medals. Some parents feel and see such exemplary characteristics and justify the teenager's observation of self-education.

Some parents, however, approve of the teenager's self-observation facts and praise the teenager. “I admire you”, “I envy you”, “You are a person who thinks about your future”, “You bring pride to your parents with these actions”, “This exemplary attitude of yours to yourself indicates that you will be happy in the future”, “If a person is demanding of himself, he will see the fruits of this in the future. I see such demandingness in you too. So, we can already think that you will have a very good future.” The approach of parents to adolescents increases the effectiveness of their self-observation with words like “I admire you”, “I envy According to Tusi, intelligence is the ability to immediately, instantly (like lightning) select what is necessary for oneself among many events and characteristics and easily draw the right conclusion. The form of perception is the ability to direct the soul only towards the things to be learned, and there is no need for “virtues” such as “stopping” or “letting go” in the assimilation (2, p. 90).

Taking these into account, we can express self-observation as follows:

Self-observation is the process of a child or teenager being able to objectively observe his or her thoughts, speech patterns, behavior with others, and behavior with people in order to correctly understand his or her mental state by thinking and behaving, and at this time, being able to feel, perceive, and correctly evaluate them.

The child and teenager begin to compare the facts of self-observation. The result of this comparison is that among the facts of observation of the child (adolescent), there are those that satisfy him or her. In turn, the child (adolescent) begins to understand those that satisfy him or her. These are considered the main factors of self-awareness. In the next stage, the person who educates himself determines to what extent all the moral qualities related to the behavior in his “self”, especially moral, aesthetic, physical, ecological, economic, patriotic, ideological-political, businesslike, etc., are useful for the family and society. Thus, that person understands the difference between his “self” and other “self”. So, we can express self-awareness as follows:

“Self-awareness is the student’s correct assessment of the moral qualities of the psychological facts and states obtained from self-observation, related to behavior, and, thanks to this, his understanding of the importance of his desires, interests, inclinations, abilities, and usefulness to those around him.”

Self-awareness also develops in unity with self-discipline methods such as self-control, self-analysis, self-criticism, self-examination, self-assessment, self-regulation, being able to look at oneself from the outside, self-commitment, self-responsibility, self-reporting, self-demanding, being able to maintain the purity of one's own self (in some literature, these are also called components of self-discipline).

If self-observation creates a kind of condition for the formation of self-awareness, then both of these, together with other methods, provide manifestations of self-imitation. Self-instruction can be considered one of the main criteria of self-instruction.

Self-instruction occurs after a person psychologically prepares himself for life and regulates all his moral qualities related to behavior and regulates them in the form of self-affirmation. A person who instills his exemplary actions and dictates to others with a sense of pride that these actions are useful to them becomes very active during self-instruction.

So, there is also an inactive type of self-instruction. Psychological, sociological, physiological and pedagogical studies show two types of self-instruction: Active and inactive. Both types are presented as positive signs of the method (component) of self-education. Simply put, if inactive self-instruction finds its expression involuntarily, active self-instruction is presented purposefully.

Uzeyir Hajibeyov, a prominent genius of the Azerbaijani people, has worked as a teacher,

educator, programmer, textbook writer, journalist, publicist, publisher, poet, playwright, performer, director, concertmaster, composer, rector, and public and political figure, bringing national and universal fame to himself and his country.

Teenager Teymur Rajabov, who managed to form exemplary traits and qualities arising from the unity of self-education methods in his spiritual world from a very young age, became the owner of the world cup among juniors in chess. Today, endless respect, honor and admiration are expressed for both Teymur Rajabov himself and the Republic.

Re-education. National pedagogy evaluates re-education as follows: “the purposeful, planned and organized elimination of harmful traits rooted in a person’s consciousness or behavior and the instillation of national and universal qualities that will have social significance in their place is re-education.”(4,p.22)

Those who need re-education are called ill-mannered people among the people.

Even in official circles, they are characterized as ill-mannered people.

These people, who are encountered among schoolchildren, are called ill-mannered because, due to their exposure to harmful influences in various environments, a number of harmful traits have begun to take root in their consciousness and behavior.

Such people usually move away from school and education and, under the influence of various people and groups, engage in activities that contradict educational actions, educational components, and moral qualities. There are many reasons why such people are ill-mannered. These reasons can be briefly grouped as follows:

- ✓ improper organization of primary education;
- ✓ a naive approach to education in the stages after primary education;
- ✓ inability of parents to properly educate children in the family;
- ✓ weak interaction between the family and the school;
- ✓ shortcomings in the work of school principals, public organizations of the school, and subject teachers in the work of education;
- ✓ inability of the school to establish cooperation with family executive authorities, field representatives, and employees of the children's police regarding the education of schoolchildren;
- ✓ ignorance of the scientific, pedagogical, psychological, and methodological foundations of the theory of education existing in folk pedagogy, scientific pedagogy, and social pedagogy, or at best, not knowing these foundations well;
- ✓ individual business associations, companies, private enterprises, and individual business owners, when using schoolchildren's labor for profit, approach them with anti-pedagogical "methods";
- ✓ schoolchildren falling under the influence of "speculators", "fraudsters", "sadists", "representatives of religious fanaticism", "deletants", "authorities", "Vorzakon" and other people who are alien to the social environment;
- ✓ representatives of the public turning a blind eye to the anti-pedagogical actions of minors and schoolchildren who beg on the streets, on the side of highways, at traffic lights, in markets, cafes, restaurants, and other places, wipe car windows, work as porters, smoke cigarettes, drink alcohol, hang out with drunks, collect money on buses, etc.

Minors and schoolchildren who become "difficult children" due to a number of reasons, both stated and unstated, often commit crimes, become participants in the commission of crimes, and thus end up in prisons and jails (5, p.79).

In our republic, in prisons (penalties) serving the reformation of minors, we have minor schoolchildren who have been convicted and reformed for murder, intentional homicide, robbery, injury to people, theft, buying, selling, using drugs, and other such offenses. For the re-education of such people, secondary schools, sports grounds, entertainment rooms, special offices and methodological corners for holding cultural and mass events have been organized in

penitentiaries. Subject teachers, educators, lawyers, educators, coaches, and cultural and artistic figures are engaged in their education and upbringing. After our country became a member of the Council of Europe, those who were re-educated were allowed to participate in the entrance exams conducted by the State Commission for Student Admission (6, p.18).

They have the right to participate in the test exams after receiving education according to general rules in a school operating with the status of a secondary general education school in a penitentiary. Those who are admitted to higher and secondary specialized schools are exempted from serving a certain part of their sentences. All this is in line with the re-education of these schoolchildren.

LITERATURE:

1. A. Hashimov, F. Sadygov Azerbaijani folk pedagogy. Baku. Unsiyet, 2000
2. N. Tusi, “Ethical Nasiri”, Baku, Lider Publishing House, 2005
3. N.M. Kazimov. School pedagogy, Baku, Chasioglu, 2005
4. Hasanov, A. Modern pedagogical processes and education system. Baku, Science and Education, 2000
5. Aliyeva, S. Theory and methodology of education. Baku: Adiloglu, 2017
6. Mammadov, R. Basic concepts and principles of pedagogy. Ganja: Qafqaz University Publishing House, 2019

## Agricultural Sciences

# THEORETICAL PROSPECTS AND INTEGRATION OF AI-BASED PRECISION FARMING TECHNOLOGY FROM PAKISTAN TO KAZAKHSTAN

**Ulzhalgas Yesseikyzy**
Zhetysu University named after I. Zhansugurov, Taldykorgan, Kazakhstan
**Nesipbay Anel**
Zhetysu University named after I. Zhansugurov, Taldykorgan, Kazakhstan
**Dr. Zahid Mahmood**
Islamabad

**Abstract**

This article examines the prospects for integrating artificial intelligence (AI)–based precision farming technologies into Kazakhstan's agro-industrial complex. Drawing on Pakistan's practical experience, it proposes strategic adaptation models suited to Kazakhstan's agroecological and socioeconomic realities. The analysis highlights the importance of localizing AI tools, strengthening human capital, and building digital infrastructure to ensure effective implementation. Comparative insights from Pakistan are used to outline potential scenarios for sustainable digital agriculture development in Kazakhstan.

*Keywords: precision farming, artificial intelligence, Kazakhstan, Pakistan, digitalization of agriculture*

### The Digital Transformation of Agriculture

The global agricultural sector is undergoing rapid digital transformation driven by technological innovation, automation, and data-driven management systems. Digitalization, the rise of precision farming, genetic selection, and climate adaptation measures are redefining agricultural production worldwide (Lekerova et al., 2022). Central to this transformation is the adoption of digital technologies such as drones (Optiexv Holdings, 2025), satellite monitoring systems, soil and climate sensors, GPS-based navigation (Ardak et al., 2025), automated irrigation, yield forecasting, and big-data analytics. Among these tools, artificial intelligence (AI) stands out for its ability to process vast amounts of data, recognize complex patterns, and generate actionable insights—leading to optimized resource use, increased yields, and more sustainable agricultural practices. Precision farming, in particular, has emerged as a key approach for improving productivity while minimizing environmental impact (Bikbulatova et al., 2008). By leveraging real-time data collection and analysis, it enables farmers to tailor management practices to local conditions, thus reducing costs for fertilizers, seeds, water, and chemicals.

### Theoretical Foundations of Precision Farming and the Role of AI

Precision farming represents an integrated system that combines Geographic Information Systems (GIS), remote sensing technologies, and real-time sensor networks to enhance production efficiency *(Figure 1.).* GIS tools enable spatial analysis and visualization, while remote sensing—through satellites and drones—provides up-to-date information on crop and soil conditions.

Sensors further enrich this data ecosystem by continuously recording environmental parameters. AI technologies play a pivotal role in processing these complex data streams. Machine learning algorithms help detect hidden patterns, forecast yields, and optimize decision-making processes. However, the effectiveness of such models depends heavily on their adaptation to local variables, including climate, soil structure, and crop type. Therefore, regional calibration and algorithm localization are essential for maximizing the accuracy and efficiency of precision farming systems.

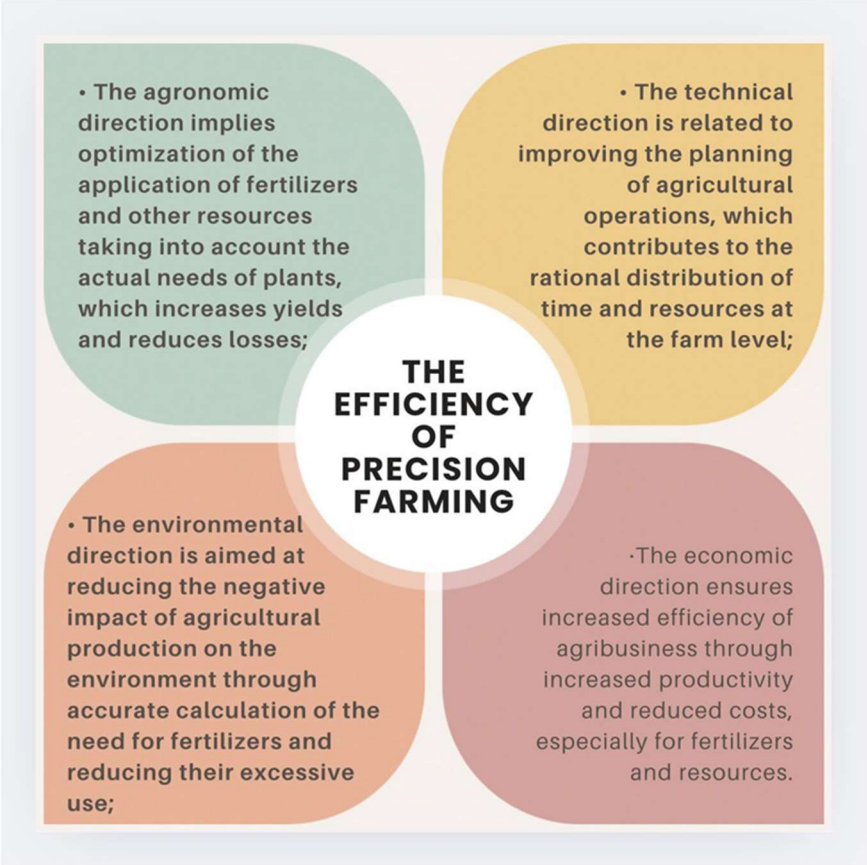



*Figure 1. The efficiency of precision farming*

Pakistan's Experience: Achievements and Limitations

Pakistan provides a valuable case study for understanding the opportunities and challenges of implementing AI-driven precision agriculture in a resource-constrained environment. The country faces severe climatic conditions—aridity, monsoon dependency, frequent droughts and floods, and soil salinization—that have long hindered agricultural productivity (Shafik & Bibi, 2023). Despite these obstacles, Pakistan began integrating AI-based precision farming technologies in the mid-2010s. Initiatives included big-data analytics platforms, machine learning yield models, and AI-enabled irrigation systems.

Key empirical outcomes include:

- Collaboration between the startup Uplift AI and the University of Agricultural Sciences in Faisalabad increased farmers' yields by 21% through personalized AI-based recommendations.

- A pilot project on lemon farms demonstrated significant reductions in input costs while improving profitability.

- Satellite data combined with Random Forest algorithms enabled accurate wheat yield forecasts in arid regions (Sajjad et al., 2025).

- The use of drones and multispectral sensors with machine-learning models such as LASSO, Random Forest, and XGB improved wheat yield prediction accuracy (Shafi et al., 2023).

- Integrated Nutrient Management (INM) boosted wheat yields by 26% compared to traditional methods (Shafi et al., 2021).

- AI-based irrigation and disease diagnostics systems reduced water and chemical use by 25–35%.

However, Pakistan's implementation also exposed systemic limitations: insufficient digital infrastructure, a shortage of skilled specialists, and the high cost of equipment for smallholder farmers. These factors have constrained the scalability of precision agriculture across rural regions.

Strategic Adaptation for Kazakhstan

Kazakhstan shares several agroecological characteristics with Pakistan, particularly in its arid and semi-arid regions. By learning from Pakistan's experience, Kazakhstan can accelerate its transition toward AI-enabled agriculture while tailoring practices to local conditions. (*Table 1)*

*Table 1. Comparative analysis of agricultural technology adaptation between pakistan and kazakhstan*

| Area for Adaptation | Pakistan's Experience | Potential Benefits for Kazakhstan |
|---|---|---|
| Advanced Irrigation Strategies | Drip and sprinkler irrigation in arid zones | Large-scale implementation in southern regions for efficient water use |
| Climate-Resilient Crop Varieties | Development of drought-resistant wheat and rice | Introduction of resilient varieties of wheat, corn, and forage crops |
| AI-Driven Monitoring and Diagnostics | Early adoption of AI, drones, and satellite mapping | Enhanced precision of GPS analytics and yield forecasting |
| Localized Agribusiness Processing | Established sugarcane, fruit, and dairy processing | Development of grain, sunflower, and livestock value chains |
| Technology Education and Training | Farmer education initiatives on digital tools | Creation of digital literacy programs for agricultural producers |

Kazakhstan has already initiated pilot projects and feasibility studies for AI integration in agriculture (Kurishbayev et al., 2019). The most strategic path forward involves adapting Pakistan's resource-saving models to Kazakhstan's large-scale production systems, emphasizing data-driven efficiency, and investing in human capital development.

Prospects and Challenges of Integration in Kazakhstan

Kazakhstan's vast agricultural potential is counterbalanced by climatic variability—sharp temperature fluctuations, drought risk, and low soil moisture (HALYK RESEARCH, 2023). To ensure successful AI integration, technological adaptation must be supported by systemic reforms.

Key challenges include:

1. Digital Infrastructure: Limited internet coverage and data platforms in rural areas constrain technology deployment.

2. Human Capital: A shortage of specialists and low digital literacy hinder effective system operation and maintenance.

3. Financial Accessibility: High initial investment costs limit access for small and medium-scale farms, necessitating government and private funding instruments.

4. Cultural Barriers: Persistence of traditional farming methods can delay adoption of innovative solutions.

While Pakistan's model emphasizes resource efficiency in scarcity conditions, Kazakhstan's focus should be on scalability, data governance, and national digital platforms. Both nations face constraints related to skills and infrastructure, but Kazakhstan's stronger institutional base and mechanization level provide an opportunity for leadership in Central Asian agricultural innovation.

## Conclusion

Pakistan's experience demonstrates that AI-based precision farming can markedly enhance agricultural productivity and sustainability. By adapting these practices to its own context, Kazakhstan can leverage its extensive land resources, higher mechanization level, and ongoing digitalization initiatives to achieve a transformative leap in agriculture. Strategic localization of AI models, investment in digital infrastructure, and capacity building in rural regions are the foundational steps toward establishing a national framework for digital agriculture. If implemented effectively, Kazakhstan can emerge as a regional leader in AI-driven sustainable farming.

## References

Ardak, S., Barayeva, A.I., Zhanat, T., et al. (2025). Application of precision farming systems.

Bikbulatova, G.G., et al. (2008). Precision farming technology.

HALYK RESEARCH. (2023). Review of Agricultural Development in Kazakhstan.

Kurishbayev, A.K., Tokbergenov, I.T., Kanafin, B.K., & Soloviev, O.Yu. (2019). Precision farming – a new stage in the development of agricultural production in northern Kazakhstan.

Lekerova, A.R., et al. (2022). Digital Transformation in Agriculture of Kazakhstan.

Muhammad Shafik, & Amna Bibi. (2023). Assessing the impact of future climate scenarios on crop water demand and water supply in different climatic zones of Pakistan.

Optiexv Holdings. (2025). What are Drones for Precision Agriculture? Uses, How It Works & Top Companies.

Shafi, U., Mumtaz, R., Mahmood, Z., et al. (2021). Assessment of Wheat Productivity Enhancement by Integrated Nutrient Management (INM) using Remote Sensing. National Agricultural Research Centre, Islamabad.

Shafi, U., Mumtaz, R., Mahmood, Z., et al. (2023). Tackling Food Insecurity Using Remote Sensing and Machine Learning-Based Crop Yield Prediction. IEEE Access, 11, 108640–108654.

Sajjad, A., et al. (2025). Satellite-based wheat yield prediction models in arid regions of Pakistan.

# Philological Sciences

# Phraseologisms in Modern English

Sevinc Abdullayeva
Head teacher, AUL

The English language has a thousand-year history. In the process of development of this language, a sufficient number of expressions and phraseological units were used, and a special section of the language - phraseology was formed, which included expressions with their own free meanings. Teaching English in our country has become widespread. In order to master the language perfectly, it is of great importance to know its phraseological units in depth..
Key words: *phraseological units, collection of expressions, belles-lettres, research methods.*

Knowing phraseology facilitates the reading of both journalistic and fiction, and the correct use of phraseologisms makes speech very expressive. Phraseological expressions that are not translated word for word strengthen the aesthetic aspect of the language. In the words of I. Anichkov, with the help of idioms, which are similar to different shades of colors, a sensory-intuitive description of our life is added to the information aspect of the language [3, 15].
The world of phraseology of modern English is vast and diverse, and the study of each of its aspects certainly requires great attention. For those who learn English as a foreign language, understanding this section of the language is difficult at the first stage, but after understanding phraseologisms, they begin to speak like English and understand them from a word, thus enriching their speech preparation. They are able to express their thoughts briefly and accurately. In many cases, knowing English phraseology prevents the word-for-word translation of sentences from Azerbaijani into English. Phraseology is a branch of linguistics that studies stable, formed expressions. The set of all expressions in the language as a whole, as well as in the language of a particular writer and each literary work separately, can be called phraseology. The subject of phraseology, the boundaries of the concepts related to this field have not been fully defined, the teaching method has not been sufficiently clarified and studied in detail. Linguists have different opinions about phraseologisms. One group of researchers (L.P. Smith, V.P. Zhukov, V.N. Teliya, N.M. Shansky, etc.) includes stable, formed expressions in the composition of phraseology, while another group of researchers (N.N. Amasova, A.M. Babkin, A.I. Smirnitsky, etc.) include only certain expressions.

Academician V.V. Vinogradov and some linguists do not include proverbs and idioms in the group of phraseologisms. They argue that these words differ from phraseological expressions in their semantic nuances and syntactic structure. V.V. Vinogradov affirmed: “Proverbs and idioms have their own sentence structures, they are not semantic equivalents of words. The purpose of phraseology as a linguistic discipline is a comprehensive study of the phraseological fund of a particular language. The main aspects of scientific research on phraseology are the stability and systematicity of phraseological expressions, their semantic structure, origin and main functions” [4, 43].

The most difficult section of phraseology is mainly the translation of phraseological units. Because this is a field that requires a lot of experience. Phraseology studies the principles of selecting phraseological units, their research methods, classification and phraseography (description in words). M. Kopylenko, Z. Popova use various research methods of phraseology: 1) Identification

method - the construction of similar words and syntactic constructions that form phraseologisms. 2) Application method - a modified form of the identification method, a limited method in the selection of variables, the construction of the correct semantic structure of phraseologisms [5, 49].

The subject of the history of phraseology is the study of the initial, final forms and meanings of phraseologisms, the determination of their origins and the emergence of their scope of use in different periods of the existence of the language, as well as the determination of the volume of phraseological composition and its systematic organization at a particular historical stage of the development of the language. Unfortunately, there are very few special works devoted to the theory of phraseology in the English and American linguistic literature. As we know, phraseologisms arise from free word combinations and are used in figurative meanings. Gradually, figurativeness is forgotten and word combinations become stable. According to A. Kunin, the following typology of phraseologisms exists in the English language [6, 31].

1. According to the grammatical features of the components of phraseologisms:

a) Combination of adjectives with nouns: vicious circle - talisman, dead end; the Indian summer - early summer hot days

b) Combination of nouns in the nominative case with nouns in the possessive case:
point of view, apple of discord

c) Combination of a noun in the genitive case with an adjective: be on a good footing - to be close to someone, to get on good terms.

d) Combination of a verb with a noun: come to one's senses - to be wise;
cock one's nose: to raise one's nose, to boast.

e) Combination of a verb with an adverb: to see through somebody - to get to know someone's inner face, to understand their intentions; fly high - to be ambitious; get down to earth - to come down from the sky.

f) combination of a verb and a noun: one's heart is bleeding

2. According to the correspondence of the syntactic function of phraseologisms with parts of speech: a) noun phraseologisms: swan-song - song of the end b) verb phraseologisms: hold one's ground - to stand firm, not to lose one's position c) adverbial phraseologisms: up one's sleeves - to roll up one's sleeves, how did it come about, sloppy d) exclamatory phraseologisms: Good luck! - Good luck! Good luck!

The classification of phraseologisms by origin is also interesting. Examples of ancient British phraseologisms can be noted. For example, Fleet Street - a London street where the publishing house of the most famous newspapers was previously located; Phraseologisms that passed from other languages: for example, tete-a-tete (face to face, eye to eye) - passed from French [3, 30].

Phraseologisms borrowed from Latin form a special group. Their origin is taken from the Christian holy book, the Bible, and later translated into English. For example, apple of discord - (something that causes discord). Most of the phraseologisms came to English from ancient mythology.

For example, Augean stables - taken from the name of the legendary Greek king Auge. According to legend, the king's stables, which had not been cleaned for 30 years, were cleaned in one day by a warrior named Hercules.

Some phraseologisms entered English from the language they came from by literal translation. Phraseologisms are used in all literary genres, and a competent translator should not allow inaccuracies in their expression. Without knowing phraseologisms, it is impossible to assess the expressiveness of speech. Most phraseologisms are characterized by their ambiguity. They have only one meaning. For example, from the first look - at first glance; to daydream - to indulge in meaningless fantasies [10, 11].

There are also phraseologisms with several meanings. For example, to play fool - 1) to sit idle, to do nothing 2) to behave frivolously; 3) to act foolishly.

The Holy Bible is the main literary source of phraseological units, and it has enriched not only the English language, but also many languages of the world with phraseologisms. For hundreds of years, the Bible has been the most read and quoted book in England. "Not only individual words from the pages of the Bible entered the English language, but also entire idiomatic expressions" [9, 11].
The apple of Sodom - beautiful, only rotten fruit, false fruit; The beam in one's eye - a big flaw; The blind leading the blind .
By the sweat of one's brow – with one's own efforts; The camel and the needle's eye - when the camel goes through the eye of the needle ( impossible task); Can the leopard change his spots? (he will never change his character); A crown of glory - a wreath of glory; Daily bread - a necessary, daily sustenance for life;
A drop in the bucket - a drop in the sea; A fly in the ointment - a spoonful of tar in a bucket of honey; Loaves and fishes - the blessings of the land; The prodigal son - a son who is not worthy of his parents; The promised land - a land left in exile.

Along with these idioms, there are many verb phrases in English: To bear one's cross – to bear one's burden; to condemn oneself out of one's mouth – to judge oneself; to escape by the skin of one's teeth – to escape from danger by force; to kill the fatted calf – to kill a calf for a guest; to laugh to scorn – to laugh with scorn; to sit under one's vine and fig-tree – to sit quietly and peacefully in one's home; to sow the wind and reap the whirlwind – to worship the golden calf – to worship wealth, to worship wealth above all else.

Phraseologisms taken from the Bible have been used in different meanings over time, and even the word order has changed. For example, the expression "to kill the fatted calf" was later used in a new sense as "to entertain guests with the best blessings in the house". The definite article was dropped from the expression "the wormwood and the gall" and it was used as "gall and wormwood" to mean "something disgusting and disgusting". The expression "When thou doest alms let not thy left hand know what the right hand does" given in a positive sense in the Bible can be given in a negative sense in modern language as "not to let one's left hand know what the right hand does". Some phraseological units retain their literal meanings. For example, forbidden fruit; Job's comforter; Juda's kiss – hypocrisy, betrayal; a prodigal son – a spoiled son; a dead letter – an invalid law, etc.

There are a large number of phraseological units in modern English, the main function of which is to enhance the aesthetic aspect of the language. Although the emergence of many of these phraseological units is associated with traditions and historical factors, the main part of them arose thanks to works of fiction [7, 16].
The works of the famous English classic W. Shakespeare are rich in this respect. In his works, one can find more than 100 phraseologisms. These phraseologisms are also called Shakespearean. For example, the following expressions found in the work "Hamlet" are useful: to be or not to be – to be, or death; to cudgel one's brains – to be confused about a task; to be hoist with one's own petard – to fall into a trap one has set; to do yeoman service – to provide timely assistance; to shuffle off (this mortal coil) – to leave the mortal world; to know a hawk from a handsaw – to distinguish a hawk from a falcon; caviar to the general – a delicious dish for those who have no taste; germane to the matter – close to the point; there's the rub – this is the real point; in the mind's eye – imaginary, imagined.

Phraseologisms in the play “Othello”: to wear one’s heart upon one’s sleeve – to reveal one’s feelings, to open one’s heart; trifles light as air – empty, meaningless things; moving accidents – exciting events; the pity of it! - a pity, a great pity! The following phraseologisms are found in the play “Macbeth”: To make assurance double sure – for more assurance; The milk of human kindness – the ointment of kindness, humanity; To screw one’s courage to the sticking place – to become courageous; To win golden opinions – to gain one’s sympathy, positive opinion; At one fell swoop – in the blink of an eye; Full of sound and fury – empty threats.

As A.V. Cooney noted, Shakespeare's phraseologisms have become common expressions, which is evidence of his genius and popularity as a linguist (7, 47).
In addition to Shakespeare, other writers such as Alexander Pope, Walter Scott, Geoffrey Chaucer, John Milton, Charles Dickens have also enriched the English phraseological fund.
Alexander Pope's expression “Tools rush in where angels fear to thread - where angels fear to tread - fools throw themselves without thinking”; Walter Scott's expression “to catch smb. red-handed - to catch someone in the act of committing a crime”; “Beard the lion in his den - to attack the enemy in his own country (crushing the snake's head in his den)”; Charles Dickens' expression “Never say die - never surrender!”,
“A bag of bones – very thin, skin and bones” (8, 92).

There are also phraseologisms borrowed from Arabic fiction in English. For example, the expressions “Aladdin’s lamp” from the fairy tale “One Thousand and One Nights”, “to rub the lamp” from the fairy tale “Ali Baba and the Forty Thieves” and “An open Sesame” from the fairy tale “Ali Baba and the Forty Thieves” can be cited.
The phraseological fund of the English language is so rich that it becomes clear how diverse the phraseologisms we are considering are in terms of semantic and structural terms. A sufficient number of phraseologisms are found in the literature of different peoples, as well as in the works of English writers and poets. Phraseology is the treasure of the language, phraseologisms are the wealth of the language. When studying phraseology, it is necessary to know its research method and to obtain information from other sciences such as lexicology, grammar, stylistics, phonetics, philosophy, country studies, logic.

List of Sources

1.Alekhine A.I. Phraseological unit and word. Minsk, 1991.
2. Amosova N.N. Fundamentals of English phraseology. L.: Nauka, 1989.
3. Anichkov I.E. Works on linguistics. CPb: Nauka, 1997.
4. Vinogradov V.V. About the main types of phraseological units in Russian language. M.: Nauka, 1986.
5. Kopylenko M.M., Popova Z.D. Essays on general phraseology. Problems, methods, experiences. Voronezh, 1990.
6. Kunin A.V. Phraseology of the modern English language. M.: International relations, 1996.
7. Kunin A.V. English-Russian phraseological dictionary. M.: Русский язык, 2001.
8. Savitsky V.M. English phraseology: Problems of modeling. Samara, 1993.
9. Fedulenkova T.N. English phraseology. Arkhangelsk, 2000.
10. Weinreich, U. Problems in the Analyzes of Idioms: Substance and Structure of Language. University of California Press, 1984.

# DIFFICULTIES IN LEARNING GERMAN NOUN GENDER: A METHODOLOGICAL AND PSYCHOLINGUISTIC APPROACH

**Kovser Abbasova**
Nakhchivan State University, Senior teacher, https://orcid.org/0009-0002-4929-9536, Azerbadjan, Nakhchivan

**Abstract**

This paper explores the difficulties encountered in determining the grammatical gender of nouns in the German language, with a specific focus on Azerbaijani learners. German, as a highly inflected language, assigns each noun to one of three genders: masculine, feminine, or neuter. The absence of a grammatical gender system in Azerbaijani creates additional challenges for learners, leading to frequent errors in article usage, adjective agreement, and pronoun selection. The study identifies the main linguistic, cognitive, and methodological factors contributing to these difficulties. It further analyzes how morphological patterns, semantic associations, and historical irregularities in German influence the learner's ability to internalize gender rules.

To address these challenges, the paper proposes several teaching strategies, including systematic pattern recognition, mnemonic devices, visual aids, and contextual immersion. The findings suggest that a multi-dimensional approach combining linguistic explanation and practical exposure significantly improves learners' mastery of gender usage in German.

**Keywords:** German language; grammatical gender; noun classification; gender acquisition; Azerbaijani learners; language interference; cognitive linguistics; linguistic patterns; teaching methodology

The German language, one of the major West Germanic languages, is widely spoken across Europe and holds official status in countries such as Germany, Austria, Switzerland, Liechtenstein, and Luxembourg. As one of the key languages of the European Union, German possesses a complex grammatical structure, which often presents challenges to foreign learners. One of the most distinctive and, at the same time, complicated aspects of this grammatical system is the category of grammatical gender in nouns.

In German, every noun belongs to one of three grammatical genders: ***masculine (der)***, ***feminine (die)***, *or* ***neuter (das)***. This classification is not only a matter of linguistic tradition but also a fundamental grammatical feature that affects other parts of speech, such as articles, adjectives, and pronouns. Therefore, identifying the correct gender of nouns is essential for achieving grammatical accuracy and fluency in German.

However, for learners whose native language lacks grammatical gender—such as Azerbaijani speakers—determining the gender of German nouns becomes particularly difficult. In Azerbaijani, nouns are not divided into masculine and feminine categories, which makes the correct use of articles "der," "die," and "das" a major source of confusion.

The aim of this study is to analyze the main difficulties encountered in determining the gender of nouns in German, to identify the linguistic and cognitive causes of these problems, and to propose methodological solutions to help learners overcome them.

The relevance of this topic lies in the fact that, in today's globalized world, the German language is increasingly in demand for academic, professional, and intercultural purposes. Nevertheless, due to the fundamental differences between the grammatical systems of German and Azerbaijani,

many students face persistent errors during the learning process. Hence, this issue is significant both from a theoretical linguistic perspective and a practical teaching standpoint.

Grammatical gender is one of the fundamental categories in many Indo-European languages, especially in Germanic languages such as German. It refers to the classification of nouns into distinct categories that affect agreement with other grammatical elements in a sentence. In German, nouns are divided into three genders: Masculine (der), Feminine (die), Neuter (das).

The gender of a noun in German is not always determined by its natural or biological characteristics but rather by grammatical convention. Gender influences the form of ***articles, adjectives, pronouns, and participles,*** which must all agree with the noun they modify. For example: *der kleine Hund* – the small dog, *die schöne Blume* – the beautiful flower, *das neue Auto* – the new car.

As seen in the examples above, the form of the article and adjective endings change according to the grammatical gender of the noun. Thus, gender plays an essential role in the syntactic and morphological coherence of German sentences.

Determining the gender of a German noun is not always logical or predictable. While there are some regularities and patterns, many nouns must be memorized individually. However, learners can still rely on certain morphological and semantic rules that help identify the likely gender of a noun (Helbig, G., & Buscha, J. (2005).

a) Masculine Nouns (der)

Masculine nouns generally include:

-Male persons and animals: *der Vater* (father), *der Lehrer* (teacher), *der Hund* (dog);

-Seasons, months, and days of the week: *der Sommer* (summer), *der Januar* (January), *der Montag* (Monday);

-Directions: *der Norden* (north), *der Westen* (west);

-Many instruments and devices: *der Computer* (computer), *der Fernseher* (television).

b) Feminine Nouns (die)

Feminine nouns typically end with certain suffixes or refer to female beings:

-Female persons and animals: *die Mutter* (mother), *die Freundin* (female friend);

-Nouns ending in *-heit, -keit, -ung, -schaft, -ei, -ion*: *die Zeitung* (newspaper), *die Nation* (nation), *die Freundschaft* (friendship), *die Freiheit* (freedom).

c) Neuter Nouns (das)

Neuter nouns often include:

-Diminutives ending in *-chen* or *-lein*: *das Mädchen* (girl), *das Häuschen* (little house);

-Names of metals and chemical elements: *das Gold* (gold), *das Silber* (silver), *das Eisen* (iron);

-Infinitives used as nouns: *das Essen* (eating, food), *das Leben* (life), *das Schlafen* (sleeping).

The system of grammatical gender in German originates from Proto-Germanic and Indo-European roots. Initially, gender was semantically motivated—it distinguished between animate and inanimate entities. Over time, however, gender became a *purely grammatical feature*, losing much of its semantic basis (4, Braunmüller, K. (2016).

For instance, the noun *das Mädchen* ("girl") is neuter, not feminine, due to the diminutive suffix *-chen*, which automatically makes any noun neuter regardless of its meaning. This illustrates that in modern German, grammatical gender is often *form-based rather than meaning-based.* The persistence of gender distinctions in German serves both a syntactic and cognitive function. Syntactically, it ensures coherence in agreement across words in a sentence. Cognitively, it shapes the way speakers categorize and perceive nouns, influencing their memory and associations.

The influence of the native language and interference. For Azerbaijani learners of German, one of the most common grammatical challenges is the correct identification of noun gender. The main

reason lies in the absence of grammatical gender in the Azerbaijani language. In Azerbaijani, nouns do not differ according to masculine or feminine categories. For instance, the words “müəllim” (teacher) and “müəllimə” (female teacher) differ lexically, not grammatically.

Because of this linguistic difference, Azerbaijani learners often struggle to associate the correct articles — *der*, *die*, or *das* — with nouns. The phenomenon of *language interference* occurs when structures or habits from a learner’s native language influence the learning of a foreign language.

Common examples of errors include:

-*Der Blume* ✗ instead of *Die Blume* ✓ (the flower),

-*Das Tisch* ✗ instead of *Der Tisch* ✓ (the table),

-*Der Mädchen* ✗ instead of *Das Mädchen* ✓ (the girl).

These errors show that learners frequently rely on *semantic intuition* rather than grammatical rules, assuming that gender corresponds to biological or logical distinctions.

The problem of illogical gender assignment. A major difficulty for foreign learners is that the gender of German nouns often does not follow logical or semantic patterns. For example:

- *das Mädchen* (girl) — semantically feminine, but grammatically neuter;
- *die Person* (person) — can refer to both males and females, but grammatically feminine;
- *der See* (lake) vs. *die See* (sea) — same word form, different genders and meanings.

Such inconsistencies make it difficult for learners to rely on intuition or meaning-based reasoning. Instead, they must depend on memorization or exposure to authentic language input, which can be time-consuming and cognitively demanding. Morphological Complexity and Exceptions. Although German provides several morphological rules that help determine noun gender, these rules often include numerous exceptions. (7,Eisenberg, P. (2013). For instance:

-Nouns ending in *-ung, -keit, -heit, -schaft, -ion* are usually feminine (*die Freundschaft, die Freiheit, die Nation*), yet there are exceptions such as *der Refrain* (refrain) or *das Medikament* (medicine).

-Diminutives ending in *-chen* or *-lein* are always neuter, even when referring to people of natural gender, as in *das Mädchen* (girl) or *das Fräulein* (young lady).

Because of these inconsistencies, students often find it difficult to apply rules systematically. The unpredictability of exceptions reduces learners’ confidence and leads to frequent errors, even at advanced proficiency levels. Article selection in German affects not only the noun but also the agreement of adjectives and pronouns in the sentence. Thus, a single mistake in gender identification can lead to multiple grammatical errors. For example:

-*Der kleine Haus ist schön* ✗ Correct: *Das kleine Haus ist schön.* ✓

Here, the incorrect use of *der* instead of *das* affects the adjective ending (*-e* vs. *-en*), demonstrating how gender mistakes influence sentence structure as a whole. Another difficulty lies in the *methodology of teaching gender in German.* In many Azerbaijani universities and language centers, textbooks and grammar guides tend to present articles as isolated vocabulary items to be memorized rather than as part of a system governed by morphological or semantic patterns. For example, teaching that most nouns ending in *-er* are masculine (*der Lehrer, der Arbeiter, der Computer*) helps students recognize patterns and reduces memorization pressure. A systematic and rule-based approach makes gender learning more meaningful and less arbitrary. Therefore, insufficient methodological attention to the concept of grammatical gender in teaching materials often leads to *fragmented knowledge and persistent learner errors.*

The role of systematic learning and pattern recognition. One of the most effective methods for mastering German noun gender is the *systematic recognition of patterns.* Instead of memorizing isolated nouns with their articles, learners should be encouraged to classify nouns according to *morphological endings and semantic groups.* For example, teachers can provide organized lists such as:

-Masculine (der): nouns ending in *-er, -en, -ig, -ling* (*der Lehrer, der Wagen, der König*),
-Feminine (die): nouns ending in *-ung, -keit, -heit, -schaft, -ion* (*die Zeitung, die Freundlichkeit, die Nation*),
-Neuter (das): nouns ending in *-chen, -lein, -ment, -um, -tum* (*das Mädchen, das Dokument, das Zentrum*).
By identifying regularities, learners develop a sense of linguistic intuition and reduce dependence on rote memorization. Pattern-based learning has been shown in psycholinguistic studies to improve retention and accuracy over time.

Mnemonic Techniques and Visualization

Mnemonics — memory aids that associate information with vivid images or stories — are highly effective for gender acquisition.
For instance, a learner might imagine:
-a strong man holding "*der Tisch*" (the table),
-a graceful woman with "*die Blume*" (the flower),
-a neutral object or child for "*das Buch*" (the book).
Visual association connects abstract grammar to concrete imagery, which strengthens long-term memory. Teachers can also encourage students to color-code genders — e.g., blue for masculine, red for feminine, and green for neuter — across their vocabulary notebooks. Another key strategy is learning gender through context rather than isolation. Repeated exposure to nouns within authentic sentences or short texts allows learners to internalize article-noun combinations naturally.
For example:
*-Der Hund läuft im Garten.*
*-Die Katze schläft auf dem Sofa.*
*-Das Kind spielt draußen.*
By seeing and hearing such patterns frequently, students start recognizing gender subconsciously. Watching German-language films, reading short stories, and engaging in real conversations accelerate this process, as they integrate form, meaning, and function simultaneously. Modern technology provides multiple resources that facilitate gender learning. Applications like *Duolingo, Memrise,* or *Anki* allow students to review vocabulary through spaced repetition systems (SRS), which ensure that difficult items appear more frequently until they are mastered.
Moreover, interactive games and online quizzes can turn the memorization of gender into an engaging activity rather than a mechanical task. Teachers can also create classroom competitions where students identify the correct article for nouns, fostering both collaboration and motivation. Instructors play a crucial role in helping students overcome persistent gender-related errors. Instead of simply correcting mistakes, teachers should:

1. Draw attention to patterns and exceptions;
2. Provide contrastive analysis between German and Azerbaijani;
3. Encourage learners to repeat and produce full phrases (e.g., *der Tisch ist groß*, not just *Tisch*).

Positive reinforcement and consistent correction in context help learners develop automatic grammatical awareness. Over time, this reduces anxiety and builds confidence in using correct gender forms. In summary, effective acquisition of German noun gender requires a combination of:

- systematic rule learning,
- mnemonic and visual aids,
- contextual immersion,
- technological support, and
- informed teaching practices.

Only through this multi-dimensional approach can Azerbaijani learners internalize gender distinctions, minimize errors, and achieve grammatical accuracy in both spoken and written German.

## References


1. Abbasova, K. (2024). Cultural, Political, and Technological Influences on the Evolution of German`. EuroGlobal Journal of Linguistics and Language Education, 1(2), 26-37. https://doi.org/10.69760/0rre6252
2. Abbasova, K. (2024). Leveraging German Pop Culture for Language Acquisition: A Media-Based Approach to Teaching German as a Foreign Language. EuroGlobal Journal of Linguistics and Language Education, 1(1), 46-53. https://doi.org/10.69760/w26m4q62
3. Bickel, B. (2015). *Teaching Gender in German as a Foreign Language*. European Journal of Language Education, 12(2), 45–58.
4. Braunmüller, K. (2016). On the origins of complexity: evidence from Germanic. Complexity, Isolation, and Variation, eds R. Baechler and G. Seiler (Berlin: de Gruyter), 47-69.
5. Köpcke, K.-M., & Zubin, D. (2009). *German Gender: Morphological and Semantic Patterns*. Journal of Linguistics, 45(3), 483–512.
6. Durrell, M. (2011). *Hammer's German Grammar and Usage* (5th ed.). London: Routledge.
7. Eisenberg, P. (2013). *Grundriss der deutschen Grammatik: Morphologie*. Stuttgart: Metzler Verlag.
8. Helbig, G., & Buscha, J. (2005). *Deutsche Grammatik: Ein Handbuch für den Ausländerunterricht*. Leipzig: Langenscheidt.
9. Corbett, G. G. (1991). *Gender*. Cambridge: Cambridge University Press.
10. Kosta, P. (2014). *Gender and Agreement in Germanic Languages: A Comparative Perspective*. Berlin: De Gruyter Mouton.
11. Dudenredaktion. (2020). *Duden – Die Grammatik (9. Auflage)*. Mannheim: Dudenverlag.
12. Ellis, R. (2015). *Understanding Second Language Acquisition* (2nd ed.). Oxford: Oxford University Press.
13. Nation, I. S. P. (2001). *Learning Vocabulary in Another Language*. Cambridge: Cambridge University Press.

# Past Tense in Persian and Azerbaijani: A Comparative Analysis of Morphology, Semantics, and Pedagogy

Salman Aliyev
Nakhchivan State University
Zeynab Mammadova
Nakhchivan State University

## Abstract

This article presents a concise comparative analysis of past-tense verbal systems in Persian and Azerbaijani, based on the supplied manuscript. It examines five principal past categories—simple past, past continuous, perfect/resultative (narrative past), pluperfect, and past conditional—detailing morphological formation, syntactic behavior, semantic shading, and pragmatic uses. The study highlights key typological contrasts: Persian frequently employs analytic constructions with participles and auxiliary verbs for resultative and pluperfect meanings, whereas Azerbaijani favors synthetic suffixation to encode tense and aspect. Functionally, both languages mark completed actions, durative or habitual past events, consequences holding in the present, anteriority relative to another past event, and unreal past conditions, yet they differ in nuance and usage frequency—particularly regarding the perfect/resultative and evidential implications in Azerbaijani narrative practice. The comparative section discusses implications for translation, emphasizing potential mismatches when rendering evidential and resultative readings between the languages, and proposes didactic strategies for teaching these categories to Azerbaijani learners of Persian. The article concludes by recommending corpus-informed instruction, graded practice, and translation drills to foster accurate morphological mapping and semantic awareness in learners and adaptive feedback.

**Keywords:** Persian, Azerbaijani, past tense, comparative morphology, didactics, translation

## Introduction

The comparative study of tense and aspect systems across genetically and typologically distinct languages offers insight into how morphology and syntax interface with semantics and pragmatic use. This article draws on an extended manuscript that systematically describes past-tense categories in Persian (Farsi) and Azerbaijani and presents a targeted comparative account intended to inform both theoretical understanding and applied pedagogy. Persian and Azerbaijani present a particularly instructive pair: Persian combines synthetic endings with frequent use of analytic strategies (participles plus auxiliaries) to express resultative and anterior meanings, while Azerbaijani, as a Turkic language, predominantly encodes past categories through agglutinative suffixation. Learners and translators working between these languages confront more than formal differences: semantic gradations (e.g., evidentiality, current relevance, habituality) and differences in contextual frequency can lead to misinterpretation and transfer errors. After summarizing each language's inventory and core morphological patterns, this article compares their semantic profiles and functional distribution, and it ends by drawing practical implications for translation work and language teaching, emphasizing contrastive exercises, corpus examples, and targeted practice to reduce common learner errors.

Comparative patterns, functional distribution, and pedagogical consequences

The past-tense systems of Persian and Azerbaijani share a common communicative purpose—anchoring events in the past—but they realize that purpose through markedly different morphosyntactic strategies that carry consequences for meaning, translation, and pedagogy. In Persian the past is expressed through at least five analytically and synthetically realized categories: the simple past (often morphologically suffixed to the verb root), the past continuous (formed by adding the progressive prefix mi- plus past endings), the perfect/resultative (constructed with the past participle plus present-tense form of the auxiliary 'to be'), the pluperfect (past participle plus past-tense auxiliary), and a past conditional (formed by combinations of past stems with auxiliary elements). Azerbaijani, by contrast, presents an inventory typically described as simple past (synthetic -dı/-di/-du/-dü and variants), narrative or evidential past formed with the suffix -miş/-mış/-miş/-muş, past continuous encoded by the -ırdı/-irdi/-urdu/-ürdü set, and conditional past forms built with conditional markers such as -saydı/-seydi. Morphologically, Azerbaijani displays a strongly synthetic/agglutinative pattern in which tense and aspect suffixes attach directly to verb stems, whereas Persian uses a mixture of synthetic endings and analytic periphrastic constructions (notably participles with auxiliary verbs) that produce a higher incidence of bipartite forms for resultative and anterior meanings. Semantically, both systems distinguish completed events, durative or habitual past events, anteriority to another past event, and unreal past conditions, but their pragmatic coloring differs. In Persian, the analytic perfect/resultative frequently foregrounds the state resultant from a past action and is compatible with present relevance readings (e.g., participle + present of 'to be 'producing a "have done / has resulted" nuance). Azerbaijani's -miş form often functions as an evidential or reportive marker—indexing hearsay, indirect information, or speaker-stance—though it can also serve as a plain perfect in contexts where result-state is foregrounded. This evidential tendency yields divergent translation choices: a Persian perfect that simply marks present-relevant result may be rendered in Azerbaijani by either the synthetic -mış (which could add an evidential undertone) or by a periphrastic construction that preserves non-evidential orientation, requiring translator sensitivity to context and speaker stance. The past-continuous/durative forms in both languages overlap semantically, but usage frequency and discourse function differ; Persian's mi- progressive in past narrative is commonly used to provide descriptive background, while Azerbaijani's -ırdı forms similarly create scene-setting but may carry different aspectual or habitual shading in colloquial registers. The pluperfect constructions in both languages encode anteriority—events completed prior to another past reference point—but Persian's analytical mechanism (past participle + past auxiliary) versus Azerbaijani's compound synthetic strategy influences syntactic flexibility and prosodic realization in discourse. The past conditional structures in both languages convey counterfactuality; nevertheless, Azerbaijani conditional forms are often more compact morphologically, while Persian employs auxiliary complements which can affect emphasis and information structure. From a didactic perspective, these morphological and semantic divergences generate predictable areas of learner difficulty for Azerbaijani speakers learning Persian: (1) mapping Persian analytic resultatives to Azerbaijani synthetic forms while avoiding unintended evidential readings; (2) interpreting Persian participle + auxiliary constructions that imply present relevance and rendering them without loss of nuance; (3) recognizing when Persian mi- progressive signals habitual or background action and choosing equivalent Azerbaijani forms that preserve habitual vs. episodic readings; and (4) managing pluperfect and conditional constructions where order of events and modal shading must be made explicit in translation. Pedagogical remedies include contrastive exercises that pair parallel sentences and highlight pragmatic differences, corpus-informed examples that show frequency and collocational tendencies in natural discourse, and controlled translation drills that require learners to justify morphosyntactic choices in terms of evidentiality and current relevance. Teachers should design tasks that isolate morphology (suffixes vs. auxiliaries) and tasks that focus

on semantics (result-state, evidentiality, habituality), and they should scaffold learning by progressing from explicit, metalinguistic instruction to communicative practice. Finally, assessment should include both form-focused tasks (e.g., fill-in suffixes, conjugation) and interpretive tasks (e.g., explain whether a Persian perfect implies hearsay or present relevance), so learners develop both accurate production and robust comprehension. The interplay of typology and use—analytic vs. synthetic strategies, evidential versus resultative readings, frequency and discourse function—underscores that accurate translation and effective instruction depend on treating morphology and semantics together rather than in isolation.

## Conclusion

The comparative analysis conducted on the supplied manuscript yields a set of concrete, empirically oriented conclusions about how Persian and Azerbaijani encode past reference and about the practical consequences of those differences for translation, pedagogy, and further research. First, the study confirms a robust typological split: Persian frequently employs analytic strategies (past participles combined with auxiliary forms) to mark resultative and anterior meanings, whereas Azerbaijani predominantly resorts to synthetic, agglutinative suffixation to encode tense–aspect–modal distinctions. This structural divergence systematically conditions semantic interpretations: Persian analytic constructions more readily license readings in which a past event produces a current state or speaker-oriented inference (present relevance), while Azerbaijani synthetic forms—particularly the -miş series—carry a stronger disposition toward evidential or reportive senses in many discourse contexts. Consequently, the same informational content can surface with different pragmatic overlays in the two languages, and those overlays are not trivially recoverable by simple morphological substitution.

Second, these morphosyntactic and semantic patterns produce clear, testable implications for translation and language instruction. Translators who map Persian participial + auxiliary constructions directly onto Azerbaijani -miş forms risk introducing unintended evidential colouring (e.g., hearsay) or altering the stance of the original utterance; conversely, rendering Azerbaijani evidential forms into Persian without attention to resultative vs. reportive force may obscure whether an event's consequence is being foregrounded or merely reported. Pedagogically, the findings argue for instructional sequences that treat morphology and pragmatic function together: learners must acquire not only form–meaning correspondences (suffix ↔ tense/aspect) but also the discourse-pragmatic profiles (evidentiality, present relevance, habitual backgrounding) that conditions acceptability and naturalness in context.

Third, the research points to specific methodological priorities for advancing the field. To move beyond descriptive claims, future work should combine corpus-based frequency and collocation analyses with experimental approaches (acceptability judgment tasks, production elicitation, and comprehension measures such as self-paced reading or eye-tracking) and with learner-corpus error analysis. Building and annotating parallel Persian–Azerbaijani corpora with tags for evidentiality, result-state, anteriority, and discourse function would allow quantification of mapping tendencies and identification of high-risk translation correspondences. Intervention studies—pre/post testing of targeted instructional modules that emphasize evidential/resultative contrasts—would evaluate pedagogical efficacy directly.

Finally, the study recommends applied outputs that follow directly from these conclusions: (1) development of contrastive teaching modules and graded translation drills that foreground evidential and resultative meanings; (2) creation of annotated bilingual corpora and glossed example sets for classroom use; and (3) collaboration with machine-translation researchers to incorporate evidentiality and resultative tags into alignment models, thereby reducing systematic transfer errors. Taken together, these conclusions underscore that effective description, teaching, and translation of past-tense phenomena between Persian and Azerbaijani

require an integrated approach—one that couples detailed morphosyntactic analysis with pragmatic sensitivity and empirical validation.

## Referance

1. Comrie, B. (1976). Aspect: An introduction to the study of verbal aspect and related problems. Cambridge University Press.
2. Comrie, B. (1985). Tense (Cambridge Textbooks in Linguistics). Cambridge University Press.
3. Bybee, J., Perkins, R., & Pagliuca, W. (1994). The evolution of grammar: Tense, aspect, and modality in the languages of the world. University of Chicago Press.
4. Johanson, L., & Csató, É. Á. (Eds.). (1998). The Turkic languages (Routledge Language Family Descriptions). Routledge.
5. Mace, J. (2015). Persian Grammar: For reference and revision. Routledge.

# Авиация саласындағы кірме терминдердің қазақ тіліндегі құрылымы мен мағынасы, қызметі және қолданылуы

**Сексембаева Әлия Асылжанқызы**
1-курс PhD докторнаты, Әл-Фараби атындағы Қазақ ұлттық университеті (Қазақстан, Алматы қ.

**Аңдатпа.** Зерттеу барысында қазіргі қазақ тіліндегі авиация саласы терминдерінің басым бөлігі ағылшын және орыс тілдерінен енгендігі, оның ішінде орыс тілінен транслитерацияланған, калькаланған немесе халықаралық стандарттарға сай қабылданған терминдердің мол екендігі анықталды. Сондай-ақ бұл салада синтетикалық және аналитикалық тәсілдер арқылы, төл сөздеріміздің метафораланuы нәтижесінде лексика-грамматикалық тәсіл арқылы жасалған терминдердің де кездесетіндігі тілдік мысалдармен дәлелденді. Авиация саласындағы көптеген терминдердің қазақ тіліне әртүрлі нұсқаларда (аударылып та, транслитерацияланып та) қолданылуы, яғни терминологиялық бірізділіктің толық қалыптаспағандығы сауалнама тәсілі арқылы дәйектелді.
Мақалада қойылған мақсаттарға жету үшін салғастырмалы талдау, морфологиялық талдау, этимологиялық талдау, сауалнама әдісі, статистикалық әдіс қолданылды.
Зерттеу барысында алынған нәтижелердің қазақ тіліндегі авиация саласы терминологиясын дамыту, мемлекеттік тілдің авиация саласында қолданылу аясын кеңейту, авиация саласы мамандарына қазақ тілінде кәсіби білім берудің тиімділігін арттыру және т.б. ғылыми-практикалық маңызы жоғары деп саналады.
**Түйін сөздер:** авиация, терминология, халықаралық стандарттар, калькалау, транслитерациялау, біріздендіру, мемлекеттік тіл, кәсіби коммуникация

## Кіріспе

Авиация – көлік қызметін, халықаралық ынтымақтастықты және стратегиялық қауіпсіздікті қамтамасыз ететін әлемдік экономиканың маңызды салаларының бірі. Бұл салада терминология үлкен рөл атқарады, өйткені ақпаратты дәл жеткізу авиация саласының қауіпсіздігі мен тиімділігіне тікелей әсер етеді. Әсіресе, стандартталған терминдер әртүрлі тілдік және мәдени топтардың өкілдеріне түсінікті болуға тиіс.
Қазақстан Республикасында тіл саясаты «Қазақстан Республикасындағы тілдер туралы» Заңмен реттеледі [1]. Бұл заң қазақ тілін мемлекеттік тіл ретінде ғылым, білім және кәсіби қызметте, қоғамдық өмірдің барлық салаларында қолдануды міндеттейді. Осы ретте қазақ тіліндегі авиация саласы терминологиясын қалыптастыру мен дамыту, аудару, халықаралық стандарттарға сәйкестендіру және ұлттық тілдің бірегейлігін сақтау өзекті мәселе болып табылады.
Халықаралық авиация саласы Халықаралық азаматтық авиация ұйымы (ICAO) [2] ұсынған стандарттар мен ұсыныстар арқылы реттеледі. ICAO стандарттарында негізінен терминологияның нақты әрі бірізді болуы талап етіледі және бұл түрлі елдердің мамандары арасындағы түсінбеушілікті болдырмауға мүмкіндік береді. ICAO Annex 10 құжатында терминдердің нақтылығы мен бірыңғайлығы ұшу қауіпсіздігін қамтамасыз етудің міндетті элементі екені көрсетілген. Терминдерді аударудағы қателіктер немесе оларды дұрыс

түсінбеу ауыр зардаптарға алып келуі, соның ішінде ұшу қауіпсіздігіне қатер төндіруі мүмкін. Сондықтан авиация терминологиясын қазақ тілінде дұрыс және бірізді етіп жасау – ұлттық міндет қана емес, халықаралық деңгейдегі талап.

Еліміз халықаралық авиациялық қауымдастықтың белсенді мүшесі болғандықтан, авиация саласындағы стандарттарды қолдану мен сақтау Қазақстан үшін ерекше маңызды. Қазақстан Республикасы көптеген халықаралық рейстерді қабылдайды және Еуропа мен Азия арасындағы ірі транзиттік торап болып саналады. Осы тұрғыдан алғанда, авиация терминологиясын қазақ тіліне аудару кәсіби қарым-қатынастың тиімділігін арттыруға ықпал етеді. Бұл, сондай-ақ, ұлттық бірегейлікті нығайтуға және қазақ тілін ғылым мен техника тілі ретінде дамытуға септігін тигізеді.

Қазіргі қазақ тілінде кірме терминдер, әсіресе ғылыми-техникалық, медицина, ақпараттық технологиялар және авиация салаларында кеңінен қолданылады. Авиация терминологиясында кірме сөздердің басым көпшілігі ағылшын және орыс тілдерінен алынған. Мысалы, «навигатор», «рейс», «диспетчер», «авиакомпания», «фюзеляж», «транзит» сияқты терминдер шет тілдерден енгенімен, қазіргі уақытта қазақ тіліндегі кәсіби лексиканың ажырамас бөлігіне айналған. Бұл терминдер көбінесе еш өзгеріссіз немесе аздаған фонетикалық бейімдеу арқылы қолданылады.

Авиация саласы халықаралық стандарттарға тәуелді болғандықтан, бұл салада кірме терминдер ерекше орын алады. Халықаралық азаматтық авиация ұйымы (ICAO) бекіткен терминология негізінен ағылшын тілінде жасалады, ал оларды аудару мен бейімдеу барысында көптеген қиындықтар туындайды. Осы себепті авиация саласындағы мамандар кірме терминдерді өзгеріссіз қабылдауға мәжбүр.

Қазақ тіліндегі авиация саласына қатысты терминдердің жалпы саны 2500-ден астам деп есептеледі, оның ішінде шамамен 80%-ы кірме терминдер болып табылады. Әсіресе, ұшу қауіпсіздігі, әуе қозғалысын басқару, метеорология, әуе кемелерінің техникалық сипаттамалары секілді салаларда шеттілдік терминдер кеңінен қолданылады. Бұл терминдер негізінен ағылшын және орыс тілдерінен енген. Сонымен қатар, авиациядағы халықаралық реттеуші құжаттар да ағылшын тілінде болғандықтан, қазақ тіліне аудару барысында терминдер тікелей калькалау немесе транслитерациялау арқылы енгізіледі.

## Әдебиетке шолу

Қазақ тіл білімінің зерттеушісі А.Ж. Суюнбаеваның [3] мақаласында тіл саясатының авиация терминологиясына тигізетін әсері талданып, жаһандану жағдайында бұл саланың халықаралық стандарттарға сай келу қажеттігі айқындалады. Авиация терминологиясы негізінен ағылшын тілі арқылы қалыптасып, посткеңестік кеңістікте орыс тілінің айтарлықтай ықпалы байқалады. Бұл жағдай қазақ тіліне осы сала терминдерін біріздендіруді, яғни көптеген терминдердің калькалау әдісімен қабылданып, қазақ тілінің заңдылықтарына сай келмеуі кәсіби қолданысты қиындатады. Сондықтан авиация саласы терминологиясын дамыту үшін қазақ тілінің терминжасамдық әлеуетін пайдалану арқылы жаңа атаулар жасау, қолданыстағы терминдерді халықаралық стандарттарға сай біріздендіру және терминологияны әзірлеу мен оқу материалдарын дайындау процесіне авиация саласы мен тіл мамандарын бірлесе тарту қажет деп есептеледі.

Сонымен қатар авиация саласының дамуына үлкен үлесін қосқан ғалым Е.В. Баженовтің зерттеуінде [4] әуе қозғалысын ұйымдастыру саласындағы арнаулы лексика мен терминжасам ерекшеліктері талданады. Зерттеу орыс және ағылшын тілдерінде қолданылатын терминдердің құрылымы, қызметі мен бейімделу әдістерін салыстыруға бағытталған. Автор халықаралық терминдерді ұлттық тілдік жүйенің ерекшеліктерін ескере отырып, сәтті интеграциялау қажеттігін айтады. Бұл терминжасамның біріздендірілген

тәсілдерін әзірлеу және халықаралық стандарттардың талаптары мен ұлттық тілдің қажеттіліктерін ескеретін арнаулы сөздіктер жасауды талап етеді.

Қазақ тілінің көптеген салаларда қолданылу деңгейі артқанымен, білім беру бағдарламаларын дамыту және қызметкерлердің біліктілігін арттыру қажеттілігі әлі де байқалады. Осы ретте Г.Х. Түлекованың [5] еңбегінде қазақ тілінің әуежай қызметінде, тіркеу орындарында және ұшақ ішінде қолданылу деңгейіне талдау жасалады. Автор мемлекеттік тілді авиация саласына жүйелі түрде енгізу үшін халықаралық талаптарға сай тілдік стандарттар мен терминологияны әзірлеу мен енгізу, мамандарды қазақ тілінде оқыту арқылы кәсіби даярлық деңгейін арттыру, сондай-ақ мемлекеттік тілді қоғамдық және кәсіби қарым-қатынаста белсенді пайдалану қажеттігін баса айтады.

Азаматтық авиация колледжінің зерттеушісі И.С. Иманбердиеваның мақаласында [6] авиациялық ағылшын тілінің кәсіби қызмет үшін маңызды екені, оның ICAO халықаралық стандарттарымен бекітілгені атап көрсетіледі. Зерттеу нәтижелері оқу материалдарында техникалық терминологияның жеткіліксіздігі және соның салдарынан кәсіби қолданыстың жеткілікті деңгейде еместігін көрсетеді. Автор кәсіби қызметте тәжірибелік қолдануға баса назар аудара отырып, халықаралық стандарттар мен Қазақстанның авиация саласының ерекшеліктерін ескеретін арнаулы оқу материалдарын әзірлеу қажеттігін ұсынады.

Авиация саласының терминдерін халықаралық стандарттарға сай, ұлттық тіл ерекшеліктерін ескере отырып бейімдеу қажеттігі Қазақстан Республикасының Заңнама институты Лингвистика орталығының бас ғылыми қызметкері Н.М. Примашевтың мақаласында [7] сөз болып, автор аудару процесіне авиация және тіл мамандарын тарту, сондай-ақ жаңа терминологияны білім беру бастамаларымен үйлестіру қажеттігін атап өтеді.

## Материалдар мен әдістер

Зерттеу материалдары ретінде негізінен төмендегі дереккөздер қолданылды:

1. Авиация терминдерінің сөздіктері мен глоссарийлері:
- ағылшын-қазақ және ағылшын-орыс тіліндегі авиация саласына арналған сөздіктер;
- ICAO-ның ресми құжаттары.
2. Қазақ тіліндегі құжаттар:
- әуе компанияларының техникалық құжаттары;
- авиация саласының мамандарын даярлауға арналған оқу материалдары.
3. Ғылыми жарияланымдар мен зерттеулер:
- ағылшын, орыс және қазақ терминологиясына, оның ішінде авиация саласы терминдеріне арналған еңбектер.

Мақалада қойылған мақсаттарға жету үшін төмендегі әдістер қолданылды:
- *салғастырмалы талдау* арқылы қазақ, орыс және ағылшын тілдеріндегі авиация саласы терминдердің қолданысына құрылымдық-мазмұндық талдау жасалды;
- *морфологиялық, этимологиялық талдау* арқылы терминдердің құрылымы мен шығу тегі талданып, олардың қазақ тілінің заңдылықтарына бейімделуі айқындалды;
- *сауалнама әдісі* арқылы авиация саласында жарыспалы түрде қолданылып жүрген терминдер анықталды;
- *статистикалық әдіс* арқылы авиация саласында жарыспалы түрде қолданылып жүрген терминдердің пайыздық көрсеткіші анықталды.

## Нәтижелер және талдау

Қазақ тіліндегі авиация саласындағы кірме терминдер негізінен ағылшын және орыс тілдерінен енген. Бұл авиацияға қатысты стандарттар мен ережелер негізінен ағылшын тілінде қабылданып, авиацияның халықаралық сала болуынан туындайды. Осыған байланысты көптеген терминдер қазақ тілінде тікелей транслитерациялау арқылы

қолданылады. Мысалы, «авиация», «диспетчер», «навигатор», «рейс», «фюзеляж», «борт», «шасси», «кокпит», «брифинг», «радар», «терминал», «автопилот», «транспондер», «экипаж», «ангар», «авиасимулятор», «транзит», «перрон» сияқты терминдер қазақ тілінде еш өзгеріссіз немесе аздаған фонетикалық бейімдеумен қолданылады. Мұндай терминдер кәсіби салада кеңінен танылғандықтан, олардың қазақша баламасын енгізу қиындық тудырады.

Қазіргі уақытта қазақ тілінде авиация саласының көптеген техникалық терминдері калькаланған немесе халықаралық стандарттарға сай қабылданған терминдерден тұрады. Калькалаудың негізгі қызметі бір тілден екінші тілге сөздерді немесе сөз тіркестерін тура аудару арқылы қабылдау болғандықтан, бұл тәсілде сөздердің нақты мағынасы мен құрылымы сақталып, олар тілдің грамматикалық және семантикалық ерекшеліктеріне негізделеді. Калькалау әдісі арқылы әдетте шеттілдік терминдер өздерінің бастапқы мағынасын сақтай отырып, тілге енеді. Мысалы, ағылшын тіліндегі «airplane» термині қазақ тіліне калькаланған кезде «әуе ұшағы» болып қалыптасқан. Бұл терминдік сөз тіркесі қазақ тілінің құрылымына сай болғанымен, кейбір терминдердің шет тіліндегі мағыналарының нақтылығы жоғалтылуы мүмкін.

Авиация саласындағы көптеген терминдердің қазақ тіліне әртүрлі нұсқаларда (аударылып та, транслитерацияланып та) қолданылуы терминологиядағы бірізділіктің толық қалыптаспағанын көрсетеді. Мысалы, «аэропорт» термині Қазақстан Республикасы Үкіметінің жанындағы Мемлекеттік терминология комиссиясы отырыстарында «әуежай» деп бекітілгенімен, күнделікті қолданыста және кейбір ресми құжаттарда «аэропорт» сөзі де жиі кездеседі. Сол сияқты, «авиакомпания» термині кейде «әуе компаниясы» деп аударылғанымен, көп жағдайда халықаралық атауы сақталады. «Вертолет» сөзі қазақша «тікұшақ» болып бекітілсе де, кейбір мамандар орыс тіліндегі «вертолет» атауын қолданады. «Пилот» сөзі «ұшқыш» деп аударылғанымен, кәсіби ортада екі нұсқа да қатар қолданылады. «Диспетчер» терминінің қазақша баламасы ретінде «реттеуші» немесе «үйлестіруші» ұсынылғанымен, іс жүзінде бұл салада «диспетчер» атауы кең таралған. «Турбулентность» термині «ауаның толқуы» немесе «ауытқуы» деп беріледі, бірақ кәсіби авиация терминологиясында шетелдік нұсқасы жиі қолданылады. «Фюзеляж» сөзі «әуе кемесінің орталық бөлігі» немесе «ұшақ корпусы» деп аударылғанымен, техникалық құжаттарда халықаралық нұсқасы басымырақ қолданылады. «Навигатор» термині қазақ тілінде «бағыттаушы» немесе «жол сілтеуші» деп аударылғанымен, бұл атаулар сирек қолданылады. Сондай-ақ, «рейс» сөзі кейде «ұшу бағыты» немесе «әуе сапары» деп аударылады, бірақ көбіне бастапқы нұсқада қалады. Мұндай әртүрлілік қазақ тіліндегі авиация саласы терминологиясында бірізділіктің толық қалыптаспағанын көрсетеді. Бұл мәселені шешу үшін терминдерді стандарттау, ресми түрде бекіту және олардың тұрақты қолданылуын қамтамасыз ету маңызды. Осы ретте 1-кестеде авиация саласының кейбір терминдерінің жарыспалы қолданылуыны қатысты Азаматтық авиация академиясы 2-курс студенттеріне жүргізілген сауалнама нәтижесінде алынған статистикалық мәліметті беріп отырмыз.

Кесте 1. Авиация саласы кейбір терминдерінің жарыспалы қолданылуына жүргізілген сауалнама нәтижесі

| № | Термин (орыс/ағылшын) | Қазақша баламасы | Қазақша баламасының қолданылуы (%) | Түпнұсқа терминнің қолданылуы (%) |
|---|---|---|---|---|
| 1 | Аэропорт | Әуежай | 65% | 35% |
| 2 | Вертолет | Тікұшақ | 55% | 45% |
| 3 | Пилот | Ұшқыш | 70% | 30% |
| 4 | Диспетчер | Реттеуші | 40% | 60% |
| 5 | Турболентность | Ауаның толқуы/Ауытқу | 35% | 65% |
| 6 | Фюзеляж | Әуе кемесінің орталық бөлігі/Ұшақ корпусы | 30% | 70% |
| 7 | Навигатор | Бағыттаушы/Жол сілтеуші | 45% | 55% |
| 8 | Рейс | Әуе сапары/Ұшу бағыты | 50% | 50% |
| 9 | Авиакомпания | Әуе компаниясы | 60% | 40% |
| 10 | Экипаж | Ұшақ экипажы/Ұшу тобы | 50% | 50% |
| 11 | Кокпит | Ұшқыштар кабинасы/Басқару кабинасы | 40% | 60% |
| 12 | Багаж | Жүк | 70% | 30% |
| 13 | Радар | Радар құрылғысы/Толқын өлшеуіш | 35% | 65% |
| 14 | Глиссада | Қону бағыты | 30% | 70% |
| 15 | Автопилот | Өзін-өзі басқару жүйесі/Автоматты басқару | 25% | 75% |
| 16 | Транзит | Өтпелі рейс/Транзиттік ұшу | 30% | 70% |
| 17 | Крейсерская скорость | Крейсерлік жылдамдық | 25% | 75% |
| 18 | Регистрация | Тіркеу | 75% | 25% |
| 19 | Посадка | Қону | 80% | 20% |
| 20 | Взлет | Ұшу | 85% | 15% |

Калькалау әдісінің тағы бір ерекше тұсы – тілдік жүйелердің арасындағы мәдени және кәсіби өзгешеліктерді бейнелеуі. Мысалы, қазақ тілінде «авиация техникасы» термині жиі қолданылады, бірақ оның калькаланған нұсқасы тек техникалық құралдардың жалпы жиынтығын ғана білдіреді, ал ағылшын тіліндегі «aviation technology» термині техникалық қондырғылардың дамуын, соның ішінде жаңашылдықтарды көрсетуге бағытталған. Бұл орайда калькалау әдісі сөздің дәл мағынасын сақтамай, оны қарапайым түрде жеткізуге мүмкіндік беретіндігін байқауға болады.

Қазақ тілінде жаңа терминдер жасау барысында синтетикалық (морфологиялық) және аналитикалық (синтаксистік) терминжасам тәсілдері кеңінен қолданылады.

Синтетикалық (морфологиялық) терминжасам тәсілі морфологиялық жолмен, яғни жұрнақтар жалғау арқылы жаңа атаулар жасауға негізделеді. Бұл тәсілдің негізгі артықшылығы – жаңа терминдердің қазақ тілінің терминжасам заңдылықтарына толық сәйкестігі. Сондай-ақ, синтетикалық тәсіл арқылы жасалған сөздер халық арасында тез қабылданады және оларды түсіну оңай болады. Мысалы, *ұшқыш* (ұшу + -қыш) – пилот,

ұшуды жүзеге асыратын адам, *құтқарғыш* (құтқар + -ғыш) – авиацияда құтқару қызметін атқаратын ұшақ немесе құрал; *бағыттаушы* (бағыттау + -шы) – навигатор, бағыт беретін маман; *ұшырылым* (ұшыр + -ыл+ым ) ұшақты ұшыру сәті; *тоқтағыш* (тоқта + -ғыш ) – тежеу батырмасы; *қозғалтқыш* (қозғал + -тқыш) – ұшуға іске асыратын құрылғы; қозғалғыштық ( қозғал +-ғыштық) – мобильділік; *айналымдылық* (айналым + -дылық) – айналым реті.

Аналитикалық (синтаксистік) тәсіл сөздерді біріктіру немесе сөз тіркестері арқылы жаңа терминдер жасауға негізделеді. Авиация саласында аналитикалық тәсілмен жасалған терминдер жиі кездеседі. Мысалы, *жүкұшақ* (жүк + ұшақ) – жүк тасымалдауға арналған ұшақ: *тікұшақ* (тік + ұшақ) – авиация саласында қолданатын әуе көлігі; *жанармайқұйғыш* (жанармай + құйғыш) – жанармай құятын құрылғы, *жылдамдықөлшеуіш* (жылдамдық + өлшеуіш) – спидометр өлшемі; *жүккойғыш* (жүк + қойғыш) – жүк қоятын орын; *қашықтықөлшеуіш* (қашықтық + өлшеуіш) – қашықтықты өлшейтін арнайы құрылғы, *қону алаңы* (қону + алаң) – ұшақтың арнайы қону алаңы; *жүк тасымалдаушы* (жүк + тасымалдаушы) – жүкті тасымалдаушы; *ұшу-қону жолағы* (ұшу + қону + жол) – ұшақтың арнайы ұшып-қонуға арналған жолағы; *бақылау құрылғысы* (бақылау + құрылғы) – арнаулы бақылау құрылғысы; *ұшу жолағы* (ұшу + жолағы) – ұшақтың арнаулыы жерге қону жолағы; *әуе қозғалысын басқару* (әуе + қозғалы + басқару) – әуедегі қозғалысты бақылауда ұстау; *әуе кеңістігі* (әуе + кеңістік) – әуедегі кеңістік атауы; *ұшақ қозғалтқышы* (ұшақ + қозғалтқыш) – ұшақты іске қосатын құрылғы, *қону алаңы* (қону + алаң) әуе көліктерінің қонуға арналған алаңы; *ұшуға рұқсат* (ұшу + рұқсат) – ұшақтың, тікұшақтың ұшуға дайын болуы, *әуе көлігі* (әуе + көлік) – әуеде ұшуға арналған көлік түрі, *дыбыс жылдамдығы* (дыбыс + жылдамдық) – дыбыстың өлшемі; *қанат ұзындығы* (қанат + ұзындық) – ұшақ қанатының ұзындығы; *әуе базасы* (әуе + базасы) – әуе кемелерінің құрылыстармен жабдықталған арнаулы орын; *ұшу биіктігі* (ұшу + биіктік) – әуе қозғалысының маңызды аспектісі; *жүк тасымалдау рейсі* (жүк + тасымалдау + рейс) – әуе кемелері арқылы жүкті тасымалдау түрі, *ұшақ салоны* (ұшақ + салон) – әуе кемесінің ішкі бөлігі; *ұшқыш кабинасы* (ұшқыш + кабина) – әуе кемесінің алдынғы жағында орналасқан ұшақты басқаруға арналған орын; *жанармай бағы* (жанармай + бак) – арнаулы сұйықтық құятын ыдыс; *қосалқы қону жолағы* (қосалқы + қону + жолақ) – ұшақтың ұшып, қонуына арналған қосымша алаң; *әуе кемесі* (әуе + кеме) – ұшақ, авиацияда қолданылатын көлік, *ұшу бағыты* (ұшу + бағыт) – белгілі бір бағыттағы әуе сапары; *әуе тасымалы* (әуе + тасымал) – әуе көлігі арқылы жүк немесе жолаушылар тасымалдау; *әуе қозғалысын басқару* (әуе + қозғалыс + басқару) – авиадиспетчерлік қызмет.

Терминдерді шетел тілдерінен өзгеріссіз немесе минималды өзгерістермен қабылдау, яғни транслитерациялау қазіргі таңда қазақ тіліндегі авиация терминологиясын қалыптастыруда кеңінен қолданылатын тәсілдердің бірі болып табылады. Бұл әдіс терминдерді белгілі бір тілдерден (көбінесе ағылшын мен орыс тілдерінен) ешқандай тілдік «өзгерістер» жасамай немесе өте аз өзгеріс енгізе отырып қабылдауды білдіреді. Транслитерациялау әдісі арқылы жасалған терминдер көбінесе халықаралық терминдер болып табылады, сондықтан оларды бірден көптеген елдерде, әсіресе авиация саласындағы кәсіби ортада түсінуге болады.

Транслитерациялау әдісінің бір артықшылығы – бұл тәсіл арқылы жасалған терминдер сыртқы әлеммен өзара коммуникацияны жеңілдетеді. Әсіресе жаһандану мен халықаралық байланыстардың артуы жағдайында, көптеген авиациялық терминдер ағылшын тілінде қалыптасып, бүкіл әлемде кеңінен қолданылып отыр. Осылайша, халықаралық терминдерді қабылдау кәсіби ортаның бірізденуіне, әлемдік тәжірибемен сәйкестендіруге мүмкіндік береді. Әсіресе авиация саласындағы қызметкерлердің халықаралық деңгейде жұмыс істейтіндігін ескерсек, ұқсас терминдердің әртүрлі тілдерде бірдей қолданылуы – үлкен артықшылық. Мысалы, «рейс» терминін сол қалпында «рейс» деп қабылдау терминнің ұғымын нақты көрсетеді және оның мәні қазақ тілінде де бірден түсінікті болады. Сондай-ақ «диспетчер» термині авиация саласында өзгеріссіз сақталған. Бұл термин қазақ тілінде

«реттеуші» немесе «үйлестіруші» деп аударылуы мүмкін, алайда кәсіби авиация саласында шетелдік нұсқасы кеңінен қолданылады. Себебі, «диспетчер» термині халықаралық деңгейде барлық авиациялық қызметкерлер үшін түсінікті, ал қазақша баламалары кәсіби ортада бірізділікке ие бола қойған жоқ. Тағы бір мысал – «авиатор» сөзі. Қазақ тілінде бұл термин толықтай аударылмаған және бастапқы қалпында сақталған.

Жалпы алғанда, транслитерациялау әдісі авиация саласында кеңінен қолданылып келеді, себебі бұл әдіс арқылы терминдер халықаралық стандарттарға сәйкестендіріледі және авиация мамандары арасында өзара түсіністікті жеңілдетеді. Бұл – біріншіден. Екінші мәселе – ғылыми терминдердің көпшілігінің белгілі бір салада ғана қолданылуы. Әрине, авиация саласында халықаралық стандарттар мен терминдердің біріздендірілуі өте маңызды, бірақ басқа салаларға ауыстырылған кезде бұл терминдердің түсінігі өзгеріп, оларды жалпы халық арасында қолдану күрделенуі мүмкін. Үшіншіден, транслитерациялау әдісін қолданудың тағы бір қиыншылығы – кейбір терминдер тек кәсіби ортада ғана түсінікті, ал жалпы халық арасында олардың мағынасы дұрыс қабылданбауы мүмкін. Сондықтан, бұл әдіс қазақ тілінің ұлттық ерекшеліктерін сақтай отырып, жаңа терминдерді енгізу барысында қолданыла отырып, бірқатар қосымша түсініктер мен нақтылауларды қажет етеді. Бұл, әсіресе, мемлекеттік тілдің толыққанды қолданылуы мен кеңінен түсінілуі үшін маңызды.

Терминологияны дамытуда бірізділікті қамтамасыз ету үшін ғылыми және кәсіби қауымдастықтардың күшін біріктіру қажет. Терминдерді қалыптастыру мен енгізу кезінде тілші ғалымдар мен авиация саласының мамандары арасындағы тығыз ынтымақтастықты арттыру маңызды. Қазіргі таңда көптеген халықаралық терминдерді тек тілдік жағынан ғана емес, мағыналық тұрғыдан да толық зерттеу қажет. Әсіресе, терминдер бір тілден екіншісіне ауысқанда олардың нақты мағынасын сақтау үшін қосымша түсініктемелер мен анықтамалар енгізу маңызды.

## Қорытынды

Авиация саласы халықаралық байланыстардың дамуына тікелей әсер ететін сала болғандықтан, оның терминологиясы әртүрлі тілдерде қолданылатын арнаулы терминдермен тығыз байланысты. Қазақ тіліндегі авиация терминологиясын дамыту үшін алдымен ұлттық тілдің мүмкіндіктерін ескере отырып, жаңа терминдерді жасаудың және оларды халықаралық стандарттармен үйлестірудің маңызы зор.

Қазақ тіліндегі авиация терминологиясын зерттеу, қалыптастыру және дамыту – лингвистикалық мәселе ғана емес, сонымен бірге мемлекетіміздің халықаралық аренадағы беделін арттыруға да үлес қосатын маңызды қадам. Біріншіден, бұл қазақ тілінің авиация саласында қолданылу аясын кеңейту арқылы ұлттық бірегейлікті сақтауға ықпал етеді. Екіншіден, ол қазақ тілінде кәсіби білім беруді қолжетімді етуді арттырады, бұл авиация саласы мамандарын даярлау үшін аса маңызды. Үшіншіден, авиация саласы терминдерін сапалы аудару Қазақстанның халықаралық авиация қауымдастығына тереңірек интеграциялануына мүмкіндік береді.

## Әдебиет

1. Қазақстан Республикасының 1997 жылғы 11 шілдедегі № 151 «Тіл туралы» Заңы. – URL: https://adilet.zan.kz/kaz/docs/Z970000151 (қаралған күні: 20.01.2004)
2. About ICAO – URL: https://www.icao.int/about-icao/Pages/RU/default.aspx (қаралған күні: 22.01.2004)
3. Суюнбаева А.Ж. Языковая политика в области терминологии авиации // Вестник Челябинского государственного университета. – 2020. – №. 7 (441). – С. 145-151. https://doi.org/10.47475/1994-2796-2020-10719
4. Баженов Е.В. Специальная лексика и терминообразование в сфере организации воздушного движения в гражданской авиации в русском и английском языках // Litera. – 2019. – №. 3. – С. 75-87. https://doi.org/10.25136/2409-8698.2019.3.27665
5. Тулекова Г.Х. Қазіргі таңда мемлекеттік тілдің Қазақстан Республикасының азаматтық авиация саласында алатын орны мен маңызы // Вестник академии гражданской авиации. Учредители: АО «Академия гражданской авиации». – № 4 (27) 2022. – С. 100-106. https://doi.org/10.53364/24138614_2022_24_1_100
6. Иманбердиева И.С. Техникалық оқу орындарында авиациялық ағылшын тілін оқытудың ерекшеліктері // In The World Of Science and Education. – 2024. – №. 15 ноябрь. – С. 53-56.
7. Примашев Н.М. Азаматтық авиация саласының техникалық терминдері мен нормаларын аударудың кейбір аспектілері // Вестник Института законодательства и правовой информации Республики Казахстан. – 2013. – №. 1-2 (29). – С. 118-123.
8. Burlakova I. Terminological modelling of the aviation terms system in the context of globalized information space and security of aviation industry // IOP Conference Series: Materials Science and Engineering. – IOP Publishing, 2020. – Т. 918. – №. 1. – С. 012085. http://dx.doi.org/10.1088/1757-899X/918/1/012085

# TRANSCULTURALISM IN THE WORKS OF ROLLAN SEISENBAEV AS A SYNTHESIS OF CULTURAL CODES, PHILOSOPHICAL TRADITIONS AND HISTORICAL NARRATIVES

**Andryuchshenko O.K.**
Candidate of Philological Sciences, Associate Professor, Vice-rector, Pavlodar Pedagogical University named after Alkey Margulan, Pavlodar (Kazakhstan)

**Annotation.** The article examines the phenomenon of transculturalism in the artistic world of Rollan Seisenbaev as a manifestation of the synthesis of various cultural codes, philosophical traditions and historical narratives. Analyzing the author's key works, the study reveals how the texts carry out a dialogue between Eastern and Western worldview paradigms, how mythological and realistic layers interact, as well as how artistic understanding of historical events contributes to the formation of a unique cultural space. Special attention is paid to issues of identity, memory, and the universality of human values in the context of global cultural exchange. The author comes to the conclusion that Seisenbaev's works are a vivid example of transcultural literature, in which an artistic text becomes a meeting place and interpenetration of various civilizational discourses.

**Keywords**: transcultural literature, narrative, text, Kazakh literature.

The work of Rollan Seisenbayev authoritatively represents one of the most mature trends in the development of Kazakh and world literature, occupying a worthy place in them. The transculturality of his works is beyond doubt. A number of trends can be identified that indicate the presence of a synthesis of cultural codes in his work:

1. **Dialogue of cultures**

Seisenbayev often combines the Kazakh tradition with elements of Western and Eastern philosophy. For example, his novel "The Dead Wander in the Sands" (Seisenbaev) is not just a Kazakh epic, but also an existential work with references to Dostoevsky, Camus and Kafka. He raises universal questions about the meaning of life, suffering, and human destiny. In the novel "The Dead Wander in the Sands," the main character is confronted not only with the Kazakh traditional world, but also with philosophical questions typical of European literature. The inner monologues of the hero resemble Dostoevsky's – they are reflections on sin, freedom, fate. The world around him is an absurdist reality, similar to Kafka's works. In the novel, the Kazakh steppe becomes not just a geographical space, but a symbol of metaphysical search, which makes it similar to Camus' existentialism. The author makes the Kazakh steppe not only a place of action, but also a philosophical space where the ideas of East and West intersect.

2. **The influence of Eastern and Western philosophy**

His works trace the influence of Kazakh steppe philosophy, Sufism and the traditional worldview of nomads, but at the same time he uses Western philosophical concepts. For example, the idea of loneliness and rebellion against fate in his books echoes existentialism. The Book of Sorrows contains the idea of fatalism, characteristic of Eastern thinking, but at the same time there are motives of existential rebellion against fate. Kazakh culture traditionally perceives fate (tagdyr) as inevitable. However, the hero of the book doubts this – he seeks to understand whether it is possible to change fate, as the heroes of Nietzsche or Sartre did. At the same time, the Sufi idea of inner search is also noticeable in the book – the hero's path can be compared to a spiritual

journey. In Seisenbaev's books, Kazakh philosophy is combined with Western concepts of freedom and choice.

3. Combining realism and metaphysics

His style combines realism and magical symbolism. The "Book of Sorrow" is influenced by Eastern mysticism, but at the same time the book touches on issues relevant to the whole world – wars, environmental destruction, human alienation. The reality in the novel "The Dead walk in the Sand" seems blurred, the boundaries between life and death are blurred. "I saw those who left. They were walking next to me, talking to me, and I understood them. But it was worth blinking – and they disappeared into the hot air of the steppe."This image is reminiscent of the magical realism of Gabriel Garcia Marquez, where the dead and the living exist in the same world. In Kazakh culture, there is a belief about the spirits of the ancestors, who are always there. But Seisenbaev uses this not only as a folk belief, but as a symbol of the blurring of the boundaries of reality. The reality in his books resembles magical realism, where the culture of nomads is combined with the mysticism and philosophy of the West.

4. Kazakhstan in a global context

Seisenbayev does not limit himself to national themes – he speaks of Kazakhstan as a part of the world space where different cultures collide. His characters often find themselves on the border of civilizations – nomadic culture vs. urbanism, East vs. The West, traditions vs. modernity. Transculturalism in his works is a bridge between Kazakh and world culture. It shows that national literature can be both deeply rooted in tradition and understandable to the whole world. The writer's works confirm the idea that there is a deep root connection between humanism, realism, progressive philosophical and ideological orientation. Rolland Seisenbaev's novel "Despair, or the Dead Wander the Sands" examines the problem of morality as the most important philosophical problem of the survival of man and nature, their co-existence on earth. The main philosophical and ideological idea of the novel is that true humanity does not single out, but unites man with everything living on earth – with the animal and plant world – with all of nature. The entire ideological, artistic and structural complexity of the work is linked together by the general creative principles of the novel as a work of philosophical prose (Meiramgalieva, 2013, p. 38). It is unlikely that Rolland Seisenbaev himself consciously set out to write a novel based on the style and rules of philosophical debate. Rather, the sheer scale of the collisions of "GOOD AND EVIL" and "LIFE AND DEATH" that worried him led the narrative to such genre certainty. R. S. Seisenbaev's novel "Despair, or the Dead Wander through the Sands" is a unique example of philosophical prose in which an environmental catastrophe and a spiritual crisis are associated with an extensive system of cultural, historical and mythological references. In this context, transcultural semiotics, an approach that allows analyzing the symbolic structure of a text at different levels, provides an opportunity to understand how local and global meanings interact in the artistic world of a work.

External text level: intertextual framework

The novel is structurally organized using epigraphs taken from the works of thinkers of different eras and cultures: Saint-Exupery, Seneca, Antisthenes, Belinsky, Pascal. These intertextual elements create the context of a philosophical dialogue in which Seisenbaev includes his reader. Epigraphs carry not only a meaningful load, but also form a cultural framework, expanding the semantic field of the novel to the level of universal humanism. Thus, water as a symbol in the epigraph from Saint-Exupery becomes a metaphor for life, purity, but also fragility and vulnerability. This cultural representation of water permeates the entire narrative, linking the philosophical ideas of the novel with global environmental issues and loss.

The intra-textual level: symbolism, myth and dialogue of cultures

Within the text, the semiotic system functions through images of nature, characters, and narrative style. Nature is a full—fledged subject of the narrative. In the scenes where Nasyr the fisherman is comforted and encouraged by the sea, the latter appears as a living being endowed

with a voice, memory and will. This artistic technique activates mythological thinking, characteristic of both the Kazakh tradition and world literature. Nasyr's dialogue with the sea alludes to Pushkin's "The Tale of the Fisherman and the Fish," but in Seisenbaev's interpretation this motif is reinterpreted: man does not demand from nature, but enters into an equal, trusting relationship with it. This translates the philosophical idea of affinity, which is characteristic of the nomadic worldview. The characters of the novel, in particular Nasyr and Kaharman, embody different types of moral responsibility. Nasyr is a guardian of tradition and folk memory, a sage, a symbol of moral fortitude. Kaharman is a contemporary who is faced with the absurdity of progress directed against nature. His suffering is the result of an internal conflict between technological development and an ethical duty to his native land. In addition, Seisenbayev introduces the figure of scientist Slavikov, a defender of nature, a bearer of rational discourse combining science and morality. This image highlights the importance of critical thinking and responsibility in an era of disruptive transformations. The novel "Despair, or the Dead Roam the Sands" appears as a complex semiotic system functioning at the external and internal textual levels. The first stage is a dialogue of cultures through epigraphs and intertexts, revealing universal philosophical meanings. The second stage is the artistic development of symbolic images, mythological codes and moral patterns of behavior addressed to the reader through the figures of the characters. Thus, transcultural semiotics in Seisenbaev's novel is implemented as a way of revealing global problems by means of local narration. This work becomes a space of meeting cultures, epochs and meanings, in which human and natural, rational and intuitive, tragic and hope combine into a single humanistic concept of the world.

In the novel "Despair, or the Dead Roam the Sands," the writer combines in one picture the movement of nations, the actions of large masses with the intertwining of individual destinies, with the ideological and moral aspirations of individuals. Each of these elements is necessary to create the epic integrity of a philosophical novel. A multitude of intertwining plots and storylines form the general movement of the novel (Blue Sea, Zaisan, Balkhash, Afghanistan, the December 1986 events in Kazakhstan, Moscow, etc.) and the development of its basic philosophical idea – a person should live in harmony with nature, take from it, but also give it good. This idea is in line with the great humanistic and related traditions of nomadism as a philosophy of non-contradictory co-existence, co-living with nature, as a way of life that is as close to nature as possible and based on reverence for it.

Rollan Seisenbaev is one of the writers who is highly guided by a common philosophical idea. In the novel, the dominant role of the author's thought is manifested in the plot and composition of the work, which bear the features of a detailed moral and philosophical dispute on ideologically acute topics of modernity. The idea of philosophical and moral boundaries, which is the main truth for which the intellectual discussion develops in the novel, enters the world of intimate experiences of the characters, and the author measures the level of spiritual health of the modern world as a whole with it.

In 2007, V. Badikov wrote in Literaturnaya Gazeta: "Rollan Seisenbaev's novel Despair was republished in 2002 under the second title The Dead Wander in the Sands, but the feeling of deep, almost universal despair in him, of course, did not diminish. The will of the author, who shifted the emphasis in the title, must be respected. You need to read the novel slowly, accumulating and analyzing your impressions and thoughts, as G. Gachev did with the help of a diary. He called his recording article "The Despair of Rolland Seisenbaev," sensitively capturing the author's lyrical and journalistic pathos of this great work" (Badikov, 2007).

Young researchers say that the writer's artistic worldview was formed during the transition period from Soviet to post–Soviet thinking, and this is the drama of the writer's fate of Rolland Seisenbaev.: "The creative fate of R.S. Seisenbaev turned out well, although he had to live and create during a period full of contradictions," and therefore, as a true writer, he "had a difficult

task to reconcile the outward ostentatious prosperity, the victorious march forward and the dramatic disintegration that torments the mind and heart" (Salimzhanova, 2001). In one of his interviews, Rolland Seisenbaev said: "I am sure that man is invincible. He leaves hope behind. It is for this hope that he is fighting to keep the earth inhabited and alive for future generations. Only little is being done for this, much more is needed. And I believe that the peoples of the world will do more," the writer concluded his interview" (Meiramgalieva, 2013, p. 102).

Gratitude. The research was funded by the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan, RRN grant No. AR23487222 "Transcultural Russian-language literature of Kazakhstan as a part of the world literary mainstream".

## References

Badikov, V.V. (2007). Na perelome [At the break] // Literaturnaia hazeta. 31 oktiabria [in Russian]

Meiramhalieva, R. M. (2013). Tipolohiia i struktura filosofskoho romana sovremennoi kazakhskoi literatury [Typology and structure of the philosophical novel of modern Kazakh literature]. Almaty: «Qazaq universiteti» [in Russian].

Salimzhanova, Sh. O. (2001). Zhanrovo-stilevoe svoeobrazie tvorchestva R. Sh. Seisenbaeva [Genre and style originality of R.S. Seisenbayev's creativity]. Almaty [in Russian].

Seisenbaev, R. Sh. (1991). *Otchaianie, ili Mertvye brodiat po peskam* [Despair or the Dead wander the sands]. Moskva: Sovetskii pisatel [in Russian].

# THE WAY OF DEVELOPING THE NATIONAL AND LINGUISTIC IDENTITY OF THE KAZAKH NATION THROUGH THE TRANSFORMATION OF THE ABAY LANGUAGE INTO THE WORLD LANGUAGE

**Karimov Bakhtiyor Rakhmanovich**
Doctor of Science (Philosophy), Professor, Leading Researcher, Institute of Oriental Studies, Academy of Sciences of the Republic of Uzbekistan

The great poet and educator Abay Kunanbaev made an invaluable contribution to the formation and development of the literary Kazakh language. In the process of globalization, modernization, intensification of the formation of the world information civilization, the most important task is to preserve and develop the national and linguistic identity of nations. This task is also important for the Kazakh nation in the multilingual situation in the Republic of Kazakhstan.

After achieving independence, the Republic of Kazakhstan and the Kazakh nation are making great efforts to raise the domestic and international social status of the Kazakh language. A state program has been adopted and is being implemented to support the development of the Kazakh language as the state language of the country. Centers for teaching the Kazakh language and traditions have been created. However, there are still many difficulties and unresolved problems in this direction. In the interethnic and international communication system, the Kazakh language is not used actively enough. These functions mainly use Russian and English. Together, these factors lower the social status and image of the Kazakh language. For a breakthrough accelerated increase in the social status of the Kazakh language, original non-standard solutions are required, since standard solutions do not give the expected effect in the required time frame, despite the very large allocated funds.

The purpose of this project: To provide a scientific basis for a breakthrough innovative modernization of the domestic and international social status of the Kazakh language through the creation of a closely related Averaged Turkic language Ortaturk, which has the potential to become an international language recognized by the UN [1; 2; 3; 4; 5; 6]. To achieve this goal, it is necessary to solve the following tasks: 1) create the Averaged Turkic language Ortaturk; 2) to create a coordinated and unified system of alphabets of the national Turkic languages and the Ortaturk language; 3) to create a coordinated terminological system of the Turkic languages and the Ortaturk language.

The Averaged Turkic language Ortatürk in lexical aspect will be close to the language of Abai (1845-1904), one of the last classics who wrote in the literary Turkic language before the legal transformation of this great language into a dead language in 1924. This chauvinistic, denying the right of nations to self-determination action to destroy the Turkic language was carried out during the so-called "national-state delimitation" carried out through mass terror under the leadership of Stalin without revealing the free will of the people of Turkestan.

The implementation of this project of creating the Ortaturk language and improving the functioning of the Turkic languages and scripts would act as a factor in the breakthrough,

innovative, modernizing social development of the states and nations that are part of the Turkic and Central Asian civilizations and, in general, the World civilization.

For the socio-economic development of Kazakhstan, the implementation of this project would be of great importance, as it would allow quickly, without very large expenditures of its own resources, by the collective efforts of all Turkic-speaking peoples and UN structures, to receive basic world information and transmit their information to the world on a closely related international, world language Ortaturk. This would raise the social status and image of the Kazakh language almost to the level of international, world languages. In turn, this would lead to an increase in his domestic social status.

The following negative consequences are possible in case of refusal of this program. A strategically important historical and geopolitical opportunity for self-preservation and successful self-development of Kazakhstan, the Kazakh nation and the Kazakh language based on cooperation and mutual assistance of kindred Turkic peoples will be missed. The Kazakh language, perhaps, will be pushed aside from the main spheres of social life by such international, world languages as Russian, English and Chinese, or will be subjected to their very strong deforming effect. As a result, the linguistic, national and state identity of the population of Kazakhstan may experience great fluctuations and become unstable in the process of globalization and the powerful influence of non-Turkic geopolitical actors. This is contrary to the national interests and national security of Kazakhstan and the Kazakh nation.

There are the following main options for solving the problem of the language of inter-Turkic inter-ethnic communication: 1) Recognition of English as the leading world language, which is known by many representatives of the Turkic peoples as the language of inter-Turkic inter-ethnic communication; 2) Recognition of the Russian language as one of the world languages, which is known by many Turkic peoples as the language of inter-Turkic interethnic communication; 3) Recognition of one of the national Turkic languages as the language of inter-Turkic interethnic communication; 4) The revival of the language "Turki" as the language of inter-Turkic interethnic communication; 5) Creation of the Averaged Turkic language "Ortaturk" by averaging the Turkic languages, recognizing it as the language of inter-Turkic interethnic communication, the language of information of general Turkic and world significance and achieving its recognition as one of the UN languages [1; 2; 3; 4; 5; 6]. We propose to implement this fifth option, since it does not provide privileges and does not create infringement on the rights and dignity of each of the Turkic peoples, it gives them the right to use their Turkic language as the state language in their national state and develop it to the best of their ability, ensuring equality of all Turkic languages among themselves.

In the international status, the Ortaturk language would contribute to cooperation between the Turkic peoples, information and communication, spiritual and intellectual development of individuals and social groups in Kazakhstan, the Turkic world and the entire World civilization.

The processes of language development, especially the problems of changing linguistic identity, should be assessed from the point of view of the relationship between human rights and the rights of nations and linguistic groups of individuals. In the individualistic concept of personality, personality is separated from the society that formed it and is regarded as an independent, a priori, self-sufficient starting point for evaluating all the processes taking place in the world. The rights of the society, the community, the collective that formed this person are not sufficiently taken into account. It is advisable to achieve greater harmonization in the relationship between the rights of the individual and the rights of society. To do this, it is necessary to take into account the social essence of a person and a nation. In this regard, it is advisable to use the oikumenic theory of the nation, the concepts of ethnosism, ethnolingupanism, averaged languages and Averaged World language [1; 2; 3; 4; 5], which as a whole constitute a linguo-

geopolitical concept leading to the synthesis of the languages of the East and West, all the languages of Mankind.

In the context of the oikumenic theory of the nation, we will consider the problems of global development and ways of preserving national cultures, languages, developing the linguistic and cultural convergence of East and West. In these matters, it is expedient to achieve an optimal combination of universal and national interests. To ensure the unity of Mankind and preserve its diversity, it is advisable to create a system of averaged languages for groups of genealogically related languages [1; 2; 3; 4], and later on the creation of the averaged World language through averaging in a variety of averaged languages and isolated languages based on the Nostratic (Borea) concept, the concept of language universals and statistical methods for averaging language phenomena [1; 2; 3; 4]. The world auxiliary language created in this way for intercultural, interethnic communication, accumulation of world information and global learning would contribute to the solution of many global problems of world civilization and the spiritual mutual enrichment of all local civilizations and peoples. The creation of the averaged world language could act as a way for the linguistic and cultural convergence of East and West within the framework of a single Humanity system with the preservation of national and civilizational identity.

To solve the problems of alphabets and writing of Turkic languages, we propose to create a writing system “ortabitik” [6; 7; 8; 9; 10], that is, four isomorphic alphabet systems: 1) an alphabet based on the Latin alphabet; 2) an alphabet based on the Cyrillic alphabet; 3) an alphabet based on the Arabic alphabet; 4) an alphabet based on the Orkhon-Yenisei script. In the Turkic group of languages there are 39 phonemes in total, in each national Turkic language there are approximately 30-35 phonemes of these 39 phonemes in different samples. For 39 Turkic phonemes we propose to introduce 39 different graphemes in each of the above-mentioned alphabets. Based on the isomorphism of these four alphabet systems, there is a real possibility to create programs for precise automatic transliteration and transcription of text in one alphabet into text in another alphabet. This will allow each Turkic-speaking person to easily study, in addition to the 30-35 phonemes and graphemes of their native language, another 4-9 phonemes and graphemes that do not exist in their native language, and on this basis, a Turkic-speaking person will be able to read texts in all Turkic languages written in any of the alphabets. All information in all Turkic languages of the Turkic civilization will be able to be united by these alphabets as a holistic writing system. At the same time, the Ortaturk language [1; 2; 3; 4; 5] will also have its own set of phonemes and graphemes in this system, which will include those phonemes and graphemes that are available to the majority of Turkic nations, the majority of Turkic-speaking individuals, for the longest period of time. And also provide the greatest measure of semantic adequacy of lexemes in most Turkic languages. In the Ortaturk language, it will be possible to collect all the information significant for the Turkic civilization, and this information resource will be very large, no less than required for an international language.

The overwhelming majority of texts in national Turkic languages are composed in one of the variants of these alphabets, and its variants in all other basic alphabets are generated by means of error-free automatic transliteration due to the isomorphism of these alphabets. A person who can read one of the national Turkic languages can read a text in the alphabet that is convenient for him in accordance with his reading skills. Of the total number of 39 phonemes of the Turkic languages, each Turkic national language has a certain number of phonemes in its phonetic system. Each Turkic language uses graphemes associated with these phonemes in its alphabet.

There are 73 symbols in “The Old Turkic Letter Yenisei” system. To express the 39 phonemes existing in the Turkic languages and form the new Orkhon-Yenisei script “The New Turkic Letter Yenisei”, it is necessary to select the corresponding graphemes for this new Orkhon-Yenisei script from these 73 symbols. Considering that many of the symbols of the Orkhon-Yenisei script are used to express syllables, and also that for a number of Turkic phonemes there are no

corresponding graphemes in the Old Orkhon-Yenisei script, it will be necessary to add a number of new graphemes. For example, in order to express the vowel harmony that exists in the vast majority of Turkic languages and will exist in the future in the Ortaturk language standard, in “The New Turkic Letter Yenisei”, in addition to the four graphemes that existed for vowels in the Old Orkhon-Yenisei script, four new graphemes should be introduced for the vowels that correspond vowel harmony. They can be created by drawing an additional horizontal line over the four graphemes of “The Old Turkic Letter Yenisei” alphabet that express vowels.

For some other sounds that do not have a symbol in the Orkhon-Yenisei script, a more suitable symbol can be selected from the 73 symbols present in it.

I think it would be better if this solution to the problem of the alphabet of the Turkic languages was called "ortabitik", because if we call this writing system "ortaalifbo", then in many Turkic languages there is no such word as "alifbo", if we call it "ortaalphabet" it will be as if the Turkic languages did not have their own writing and alphabet from ancient times. "Ortabitik" will be convenient for all Turkic peoples, since the Turkic peoples in the modern era use the Latin, Cyrillic and Arabic alphabets, and they will have the opportunity to use the information resource of the information space of the entire Turkic civilization in the alphabet.

The Commission for the Creation of a Unified Turkic Alphabet formed under the Organization of Turkic States (OTS) submitted a draft of The Common Turkic alphabet for consideration by the higher bodies of the OTS. This project primarily takes into account the alphabets of the languages of the Turkic nations, whose states are members of the OTS, therefore the project provides for the consideration of only 34 phonemes, not 39. But in the future it can be supplemented with specific phonemes that exist in languages of other Turkic nations, and for them, corresponding additional graphemes can also be introduced.

This draft was submitted to the secretariat of the Organization of Turkic States and will be considered at the Summit of the Heads of State of the Organization of Turkic States. On the eve of the Summit, the Turan Academy of Sciences and its Ortaturk Language Scientific Research Institute held a number of scientific conferences to collect proposals from scientists, and my following proposals were discussed and approved at them:

The project presented by the Commission for the creation of a common Turkic alphabet, organized by the Organization of Turkic States, is acceptable in principle, but we propose making some changes and additions:

1) We propose to assign one grapheme based on the Latin alphabet to each phoneme of the Turkic languages. In this project, it is planned to introduce two letters for one phoneme [æ] – (Ə ə) and (Ä ä). If to each of the 34 phonemes of the common Turkic alphabet does not correspond one grapheme, that is, if there is no isomorphism between phonemes and graphemes, that is, if there is no one-to-one correspondence between phonemes and graphemes, then in the process of digitizing the information resources of the Turkic languages, there will be no possibility of automatic error-free transliteration and error-free transcription, and additional human verification of all texts will be required.

2) The project does not plan a grapheme for the phoneme [ɒ], which exists in the Uzbek language. This phoneme [ɒ] is used in the main words of the Uzbek language, such as "Ota, Ота", ("Ota yurt, Ота юрт”) and "Ona, Она" ("Ona Vatan, Она Ватан"), in other Turkic languages these words are used in the form "Ata, Ата" and "Ana, Ана". For the correct pronunciation of these words, we propose adding the phoneme [ɒ] to the phoneme system of the common Turkic alphabet and propose representing it with a grapheme (Ä ä). In this case, the number of graphemes (and phonemes) in the common Turkic alphabet will increase from 34 to 35. If this is done, then to each of the 35 phonemes of the common Turkic alphabet will correspond one grapheme, that is, there will be isomorphism between the phonemes and graphemes, that is, a one-to-one correspondence. This isomorphism provides the possibility of automatic error-free

transliteration and error-free transcription in the process of digitizing the information resources of the Turkic languages and is of fundamental importance from this point of view. We propose to place this grapheme (Ä ä) after the grapheme (A a) in the system of the Common Turkic alphabet.

3) If we accept the two above-mentioned provisions, the Common Turkic alphabet will consist of 35 graphemes and isomorphically corresponding phonemes. We propose to continue the Common Turkic alphabet based on the Latin alphabet, which has such an isomorphism, in the form of the Ortabitik writing system. In the Ortabitik writing system, for 35 phonemes are introduced 35 isomorphically corresponding graphemes based on four writing systems: 1) based on the Latin alphabet; 2) based on the Cyrillic alphabet; 3) based on the Arabic alphabet; 4) based on the Orkhon-Yenisei script. The table of the Ortabitik writing system for Turkic languages is attached in Table No. 2.

Currently, the vast majority of texts written in Turkic languages exist in one of these four main alphabets, and the text variants in the other three main alphabets in the Ortabitik writing system are formed by automatic transliteration using computer transliteration and transcription programs, and an automatic error-free transcription of the text is also formed. A person speaking a Turkic language will be able to read a text in the alphabet he wants to read, and he will be able to read a text in the alphabet that matches his reading skills. Of the total 35 phonemes of the Turkic languages, each language of the Turkic people has a system of phonemes with a certain number and composition. This Turkic language uses graphemes associated with these phonemes in its alphabet. Each Turkic people will have its own priority alphabet, and the education system will be organized, books will be published, mass media will work, and office work will be conducted in this alphabet. As a result of digitalization, all this information will also be available in the form of electronic files that can be automatically generated in other alphabets. At the same time, all the heritage and information resources of the Turkic civilization will also be available in the alphabet based on the Orkhon-Yenisei script created by our ancestors.

The Turkic peoples currently use the Latin (Turkiye, Azerbaijan, Turkmenistan, partly Uzbekistan), Cyrillic (Kazakhstan, Kyrgyzstan, the Turkic republics and peoples of Russia, partly Uzbekistan), Arabic (Eastern Turkestan, Afghanistan, Iran, Saudi Arabia) alphabets. Many Turkic peoples who use the Cyrillic and Arabic alphabets have limited opportunities to study information in the Turkic Latin alphabet and, especially, to reform your alphabet into a Latin based alphabet. If the Ortabitik writing system is created, people who speak Turkic languages will be able to correctly read each other's information. At the same time, all the heritage and information resources of the Turkic civilization will be available in the alphabet based on the Orkhon-Yenisei script created by our ancestors. At the same time, these resources will also be available in international transcription, and all of Humanity will be able to pronounce them correctly. If each symbol in a certain text is replaced by its number from this table, then the text can be created in encrypted form as a set of numbers. A computer program for the Ortabitik system has been created and all of the above actions are performed automatically and without errors.

There are 73 symbols in the Old Turkic Letter Yenisei system. To express 35 phonemes existing in the Common Turkic Alphabet project and to form “The New Turkic Letter Yenisei”, it is necessary to select the corresponding graphemes for this new Orkhon-Yenisei alphabet from these 73 symbols. Considering that many of the symbols of the Orkhon-Yenisei script are used to express syllables, and also that for a number of Turkic phonemes there are no corresponding graphemes in the Old Orkhon-Yenisei script, it will be necessary to add a number of new graphemes.

For example, in order to express the vowel harmony that exists in the absolute majority of Turkic languages and will exist in the future in the Ortaturk language standard, in the new Orkhon-Yenisei script “The New Turkic Letter Yenisei”, in addition to the four graphemes that existed for vowels in the old Orkhon-Yenisei script, four new graphemes should be introduced for the vowels

that correspond vowel harmony. They were created by drawing an additional horizontal line over each of the four graphemes of the old alphabet “The Old Turkic Letter Yenisei” that express vowels.

For some other phonemes that exist in modern Turkic languages, but did not have a phoneme and grapheme in the ancient Orkhon-Yenisei script, a grapheme from the 73 graphemes of this script was chosen that expressed the most consonant phoneme, and if it was necessary to preserve this selected grapheme itself, it was modified by adding an additional horizontal line. Consonants, represented in the ancient Orkhon-Yenisei script in all cases by the same grapheme, were adopted into “The New Turkic Letter Yenisei” alphabet. For consonant phonemes, represented in the ancient Orkhon-Yenisei script in different cases by a different grapheme, one of the grapheme variants was adopted into “The New Turkic Yenisei” alphabet.

As a result, the alphabetic principle was fully implemented in the new Orkhon-Yenisei script, while in the ancient Orkhon-Yenisei script the alphabetic and syllabic components existed together. Texts written in the new Orkhon-Yenisei script can be read, correctly pronounced and understood in most cases by those who know the old Orkhon-Yenisei script, since the differences in graphemes consist only in additional horizontal lines that function as diacritics. If the Organization of Turkic States supports the creation of this Ortabitik writing system, then it will be possible to form a single grapheme space, that is, a space of a single script, within the entire Turkic civilization.

These projects correspond to the trends and prospects for the development of intercultural communication in the process of formation of the world information civilization in the 21st century. They are aimed at solving the problems of multilingualism in Kazakhstan in the sphere of national-linguistic relations on the basis of the principles of equality, the sovereignty of states, ensuring human rights and freedoms and the collective rights of social groups (national, linguistic, ethnic, racial, confessional, etc.) ). The creation of the Averaged Turkic language Ortaturk, which in the lexical aspect will be close to the language of Abay, will lead to the revival of the Turkic languages as one of the international, world languages. This will allow the Kazakh language to act as an almost world language in relation to such world languages as Russian, Chinese and English.

## Literature:

1. КаримовБ.Р., Муталов Ш.Ш. Ўртатурк тили. Тошкент: Мехнат, 1992.

2. Karimov B.R, Mutalov Sh. Sh. Averaged languages: an attempt to solve the world language problem. Tashkent: Fan, 1993 (второе изд. в 2008 году, третье издание в 2019 году).

3. Каримов Б.Р., Муталов Ш.Ш. Усредненные языки: попытка решения мировой языковой проблемы. Ташкент: Фан, 2008. (второе изд. в 2019 году).

4. Karimov B.R., Mutalov Sh.Sh. Ortak Turkce // Bilig. Bilim ve Kultur Dergisi. Sayi-3/Guz'96, S.190-199.

5. Karimov B.The oikumenic concept of nation and problems of development of languages.Ойкуменическая концепция нации и проблемы развития языков. Qarshi, 2003.

6. Каримов Б.Р. Ойкуменическая концепция нации и проблемы развития языков. Якутск, 2004.

7.Каримов Б.Р. Проблемы развития Тюркской цивилизации, языка ортатюрк и алфавитов тюркских языков // Proceedings of the 1st International Scientific Conference «Progress in Science» (December 15-16, 2022). Brussels, Belgium, 2022. С. 117-120.

8. Каримов Б.Р., Каримова У.Б. Взаимосвязь письменностей Востока и Запада в процессе глобализации и проблемы развития японской письменности // Восток-Запад: аспекты взаимодействия. Т., 2006. с. 104-108.

9. Каримов Б.Р., Каримова У.Б. Проблемы развития письменностей языков в процессе глобализации. Т., 2006.

10. Каримов Б.Р. Ўртатурк тили ва ўртабитикнинг туркий тиллари ривожидаги ўрни // Эски туркий битигларнинг ўрганилиши: бажарилган ва бўлғуси ишлар илмий йиғин ёзмалари. Филология фанлари доктори, профессор Қосимжон Содиқовнинг етмиш ёшига бағишланади. Тошкент, 2024, 97-102 б.

# Psychological Sciences

# THE CREATIVE PROCESS IN EASTERN PHILOSOPHY

Khalilova Aybeniz Imran gizi
Senior Lecturer, Baku Slavic University, Baku, Azerbaijan

Annotation: This article explores the concept of the creative process in Eastern philosophy, tracing its historical development and the transformation of various approaches to creativity. Since antiquity, philosophers such as Plato and Aristotle have closely examined the nature of creative activity, emphasizing its intellectual and emotional dimensions. The discussion of creativity was further developed by Eastern scholars, including Ibn Sina, Shihab al-Din Suhrawardi, and Abu'l-Hasan Bahmanyar, who integrated Peripatetic philosophy with spiritual and mystical insights. These thinkers regarded the creative process as an act that stimulates both intellectual understanding and spiritual realization, highlighting the interplay between sensory experience, rational cognition, and illumination in human thought.

Key words: creative psychology, consciousness, unconsciousness, mental processes, cognition, intuition

Throughout history, various connections have been made between human behavior and the sources of creative activity, as well as the mysteries of creativity itself. Since ancient times, people have sought to uncover the secrets of creativity -to understand its nature, mechanisms, influencing factors, and the origins of its seemingly mysterious forces. They have long tried to explain why and how these creative phenomena occur.

The creative process emerges in response to the needs of a society at a particular stage of development. It is shaped by the laws and norms of that society, the demands of the era, the policies of the state and nation, and the broader challenges facing humanity. Every meaningful outcome of creativity contributes to the advancement of society and, consequently, to the development of each individual within it.

Building upon scientific insights gained from the exploration of the emotional dimensions of Eastern thought, extensive research has been conducted in the field of the psychology of creativity, leading to the development of several theoretical frameworks. The ancient cultural and philosophical traditions that form a core component of Eastern heritage laid the groundwork for conceptualizing creativity as a psychological process.

Alongside religious and spiritual traditions such as Sufism, philosophical movements like Platonism and Aristotelianism were also developing. During this period, prominent figures such as Mansur al-Hallaj, Al-Ghazali, Shahab al-Din Suhrawardi, Rumi, and Ibn Arabi were active, as were influential scholars like Al-Farabi, Al-Biruni, Ibn Sina (Avicenna), Abu'l-Hayr al-Bahmanyar, and Shihab al-Din Yahya Suhrawardi.

It can be stated without exaggeration that the most profound contributions to the study of creativity were made by the Greek philosophers Plato and Aristotle. In the subsequent development of creativity psychology, scholars have consistently drawn upon their foundational ideas to further investigate human civilization, its spiritual evolution, and the nature and purpose of the psyche, which defines the essence of modern human beings.

As Prof. S.S. Khalilov notes, "The foundations of creativity – as an independent force, mode of thinking, and civilization that would later take shape in the West during the Modern Age – had

already been laid within the ancient culture and philosophy, which at that time was still an integral part of the East. This foundation was present, on one hand, in the natural sciences of Hippocrates and Archimedes, and on the other, in the philosophy of Aristotle. While Plato was, through and through, an Eastern phenomenon, Aristotle was a syncretic intellect in whom the seeds of Western thought began to emerge" [1, p. 51).

According to the Eastern-influenced thinker Plato, ideas and concepts are not merely human interpretations of existence, but constitute existence itself. Plato regarded creativity as a divine quality that manifests as a particular form of irrationality.

He also offered a general definition of creativity, stating: *"Creativity is a broad concept. Everything that facilitates the transition from non-being to being is creativity; as a result, the creation of all works of art and professions can be called creative, and all who create can be called creators"* [2, 133].

We find Plato's ethical ideas and reflections on creativity in such dialogues as *Phaedo*, *Apology of Socrates*, *Laws*, *The Republic*, *Symposium*, *Theaetetus*, *Protagoras*, and others. However, his thoughts on creativity are expressed most vividly in the dialogue *Phaedrus*. Although the work is essentially a meditation on love, it also portrays creativity as a process deeply connected with *love* and *divine inspiration*.

"The love and inspiration of the Muses embrace and awaken a tender and pure soul. In his songs and in every form of creation, the inspired person gives voice to this divine ecstasy, celebrating the countless deeds of his ancestors and thus educating future generations. But whoever, lacking the Muses' inspiration, relies solely on skill and reason to create, remains distant from true perfection. Likewise, the works of the rational and sober-minded pale in comparison to those born of divine madness." [3, p. 24]

Thus, from the lines quoted above, we can see that Plato viewed the creative process as possessing immense power, deeply connected with the emotional sphere of the human being. For him, the creator is someone who perceives and feels what others cannot, who educates future generations, and who embodies creativity as a divine force.

Drawing on Plato's philosophy, Aristotle, however, adopted a different position from his teacher, emphasizing knowledge as the product of human cognition. Before Aristotle, there existed two dominant views: materialist perspectives, which regarded the world as a sensually perceived reality grounded in a single material substance; and idealist perspectives, which saw true existence as belonging only to ideas or spirit, considering the sensory world a mere shadow or illusion, and rejecting sensory experience as a source of truth. Aristotle sought a synthesis of these opposing standpoints, uniting idea and matter. Unlike Plato, he did not search for ideas beyond things but within them, replacing the concept of the "idea" (*eidos*) with that of "form," which determines the essence and function of a thing. According to Aristotle, if the object of knowledge does not exist, then neither can knowledge of it exist; the study of being is possible only through the use of reason and logic.

The ideas mentioned above are reflected in Aristotle's treatise *On the Soul*. Thus, Aristotle approached creativity as a psychological process, interpreting it as a product of the human intellect.

Ibn Sina (Avicenna), being both a philosopher and one of the greatest physicians of his time, examined the problem of the soul and the body as a coherent scientific system and put forward a number of original ideas in this field. Although the foundations of psychology were laid by Aristotle, its subsequent development owes most to Ibn Sina.

Building upon and refining Aristotle's thought, Ibn Sina sought to construct a new theoretical framework. According to him, the human soul originates from the emanation of the Divine Light, the creative energy, and human life represents a journey of return to that Light. His work *On the Origin and Return* (*Mabdaʾ wa Maʿād*) is devoted precisely to this theme. Since the human being

also possesses a body, and the body occupies a lower level than the soul in the ontological hierarchy, the goal of human existence, or the path to perfection, lies in the soul's ascent from the corporeal to the spiritual, from darkness to light. In these ideas, we can observe a bridge between Peripatetic philosophy and Sufism.

In the field of logic, Ibn Sina did not merely comment on Aristotelian logic but introduced a number of significant innovations. In fact, Ibn Sina can be regarded as the founder of modal logic - a specialized branch of the discipline. In Europe, interest in these problems began only in the 13th–14th centuries, most likely after scholars had become acquainted with Ibn Sina's works.

Ibn Sina approached logic in a broader sense, defining it as a science that studies the rules governing the correct transition from known concepts to unknown ones, as well as the state and interrelations of those concepts [4, p. 33].

In the development of Eastern philosophy, the creative process was regarded as the discovery of truth. The Azerbaijani scholar Abu'l-Hasan Bahmanyar occupies a distinctive place in this intellectual tradition. A famous student of Ibn Sina, Bahmanyar was among the most influential commentators on Aristotle. As one of the greatest representatives of Eastern Peripatetic philosophy, he authored works such as *On Demonstration*, *On Beauty*, *On Happiness*, *The Book of Music*, *On the Subject of Metaphysics*, *On the Degrees of Being*, and others.

Bahmanyar's work had significant causes and consequences and remains relevant even in contemporary scholarship. His writings on logic continue to retain their importance today. The Peripatetic philosopher Bahmanyar, drawing upon the works of Aristotle and Ibn Sina, approached the development of their ideas through the prism of logic. He divided human cognition into two parts: sensory and rational, and identified two sources of knowledge: sensory experience and rational intellect. According to him, logic is a necessary condition for avoiding errors, correctly understanding reality, and generating innovation [5, p. 51]. It provides the framework for reasoning. In his theory of cognition, the coexistence of sensory and rational elements in the process of understanding is acknowledged.

Overall, Bahmanyar's teachings played a crucial role in the intellectual formation of subsequent generations of scholars.

One of the most prominent philosophers of medieval Azerbaijan and the Muslim East, Shihab al-Din Yahya Suhrawardi is among the best-known Azerbaijani thinkers worldwide. In the early period of his work, he was strongly influenced both by Peripatetic philosophy and by Sufism, yet he succeeded in developing his own philosophical system, laying the foundation for a new and original framework that continues to attract attention today.

Suhrawardi took a different position from Plato regarding the nature of cognition. In his view, the human consciousness - the "thinking soul" - reflects the unity of the realm of ideas (light) and the realm of physical objects (darkness). It is only at the moment of illumination, the moment of discovery, that the true essence of an object or event becomes apparent. The task, then, is to purify this knowledge from the impressions of the sensory faculties and apprehend it in its pure form.

According to Suhrawardi, "Through the external perceivers (the five senses: touch, taste, smell, hearing, and sight), the internal perceivers observe visible forms not through imagination but directly, in a concrete manner" [6, p. 217]. In other words, Suhrawardi emphasizes the perception of physical objects and the material world, not merely the light of ideas. However, he notes that during this process "it is not the inner aspect of the object that is perceived, but only its surface" (6, p. 218).

"You perceive a thing only through the formation of its image within you. The image must correspond to the thing itself; otherwise, you would not apprehend it as it truly is…" [6, p. 217]. "The images within you are not measurable… they are your thinking soul… it is indivisible, not composed of parts… imagination can never divide it" [6, p. 217]. This indivisible phenomenon of

consciousness arises not from sensory activity but from illumination, and it is considered even more fundamental than the object itself. The thinking soul, though non-corporeal, "governs the realm of physical objects" [6, p. 222].

Thus, consciousness – which emerges under the combined influence of the material and the luminous worlds and becomes independent through discovery - is regarded as superior to sensory images, as well as to knowledge expressed through language or logical reasoning.

Shihab al-Din Yahya Suhrawardi wrote, eight centuries before Z. Freud: "The bearer of all moving and perceiving forces is the animal soul" [6, p. 229]. In Suhrawardi's doctrine of the "Reflections in the World of Intellects," imagination holds a special place. Unlike memory, which preserves sensory images, imagination enables the visualization of intellectual concepts in the mind and the formation of hypothetical connections between them. Suhrawardi states: "Through the faculty of imagination, images can be illuminated" [7, p. 83].

Doubts began to arise regarding the adequacy of information acquired through the senses in reflecting reality. The idea that true knowledge can be attained through purposeful thought, intuition, and revelation was expressed in various forms in ancient Indian and Chinese philosophies as well as in classical philosophy. This concept also played a leading role in medieval Islamic philosophical thought. Shihab al-Din Suhrawardi noted that knowledge obtained through the external senses can mislead a person and divert them from ultimate truth.

It is worth recalling that as early as the Middle Ages, both Ibn Sina and Suhrawardi highlighted the shortcomings of attempts to explain the phenomena of the soul solely in terms of the body. Suhrawardi wrote that what is lower cannot govern what is higher; therefore, the soul cannot be a product of the body. Instead, the body is governed by the soul. A similar perspective can be observed in Carl Gustav Jung, who argued that ideas do not originate in any particular individual but from a greater, collective source. They do not shape us; rather, they shape our consciousness [8, p. 6].

The Russian Orientalist philosopher A. Smirnov, analyzing Suhrawardi's *Hikmat al-Ishraq*, notes that, like Ibn Sina, Suhrawardi distinguishes between two types of true knowledge: direct, intuitive knowledge and mediated, logical knowledge. Suhrawardi associates the immediate attainment of truth with the self's awareness, while the second type of knowledge is connected with inquiry and rational investigation (1, p. 57).

The first form of knowledge, then, is considered intuitive. Interestingly, Suhrawardi does not stop there; he also classifies knowledge into two kinds: innate knowledge and acquired knowledge [6, p. 218].

Thus, Eastern thinkers analyzed the creative process as an act that encompasses sensory perception, imagination, and reasoning, and as a process that stimulates human activity.

## Literature


1. Khalilov S. S. Philosophy: history and modernity (philosophical comparativistics). Baku, publishing house" Azerbaijan University", 2006, 420 p.
2. Philosophical romanticism, Rout ledge, 2006, 304 p.
3. Platon. Fedr. M.: Progress, 1989.
4. Ibn Sina. Selected philosophical works. Moscow: Nauka, 1980.
5. Seyidov S. Phenomenology of creativity. Baku, law publishing house, 2013, 288 c.
6. Suhrawardi Sh. Statues of light. VII statue. - Eastern philosophy. B., 1999
7. Sohravardi. The book of Radiance. California, 1998, p. 83
8. Jung K. G. Psychology of the unconscious, Moscow, Canon, 1994.

# INTEGRATION OF SCHEMA THERAPY AND TRANSACTIONAL ANALYSIS INTO CLIENT WORK

**Gulnara Hasanova**
Associate Professor of the Department of Pedagogy and Psychology, Baku Slavic University, Baku, Azerbaijan, Orcid: 0000-0002-9344-1352

**Annotation:** The article examines the integration of two effective trends in modern psychotherapy – Jeffrey Yang's schema therapy and Eric Bern's transactional analysis. The purpose of the article is to analyze the general principles, the distinctive features of these two approaches, which have different theoretical foundations, and the possibility of combining them in practical work with a client. It was revealed that schema therapy provides deep emotional healing, while transactional analysis creates the optimal basis for changes at the level of relationships and communication. The combined use of these two approaches enhances the formation of a "healthy adult/adult" state in the therapeutic process and increases the client's ability to self-regulate.

**Keywords:** schema therapy, transactional analysis, integrative psychotherapy, emotional regulation, ego states, early incompatible schemas.

The professional activity of a psychologist often poses a choice: which methods and techniques will be most effective in working with a client. The experience of using metaphorical associative maps with children and adolescents (2, 6), certain aspects of using schema therapy in counseling practice (3), modern methods of art therapy - neurography and its synthesis with metaphorical maps (7), allowed us to test and summarize the results obtained in two relevant areas in practical psychology - E.Bern's scheme of therapy and transactional analysis.

Schema therapy, authored by Jeffrey Yang (5), is an integrative approach aimed at recognizing and changing dysfunctional patterns formed in early childhood. It combines elements of cognitive behavioral therapy, Gestalt, psychoanalysis, and attachment theory.

On the other hand, there is Eric Bern's transactional analysis, which aims to understand a person's self and their relationships by analyzing the internal states of a person "Child", "Parent", "Adult" and the mutual "transactions" of these situations. The work that we have been doing for many years allows us to confidently assert the high effectiveness and therapeutic benefits of integrating these two models in terms of emotional regulation, relationship skills, self-awareness, and adult behavior formation.

The developed integrative approach is considered especially effective when working with clients with high emotional reactivity, difficulties in relationships and problems of self-criticism. If we try to trace the theoretical integration, we can talk about the following aspects:

| Approach | Approach Basic concepts | Emotional focus | The purpose of the work |
|---|---|---|---|
| Schema therapy | dysfunctional schemas, schemas ("Critical parent", "abandoned child") | emotional wounds from the past | strengthening the regime of a healthy adult |
| Transactional analysis | Ego: child, parent, adult | Dynamics in the present moment and relationships | Replacing inefficient transactions |

Thus, the analysis presented in the table suggests that there are common features between the two directions: they recognize internal parts (ego states/modes), emphasize the influence of past experience on current behavior, and are aimed at increasing responsibility and self-awareness.

Let's look at a specific case: a 10-year-old child is often angry, aggressive towards peers or family members, does not obey, after anger he sometimes regrets, apologizes. If we approach it from the point of view of scheme therapy, then it is likely that the presence of early incompatible schemes will be best.:

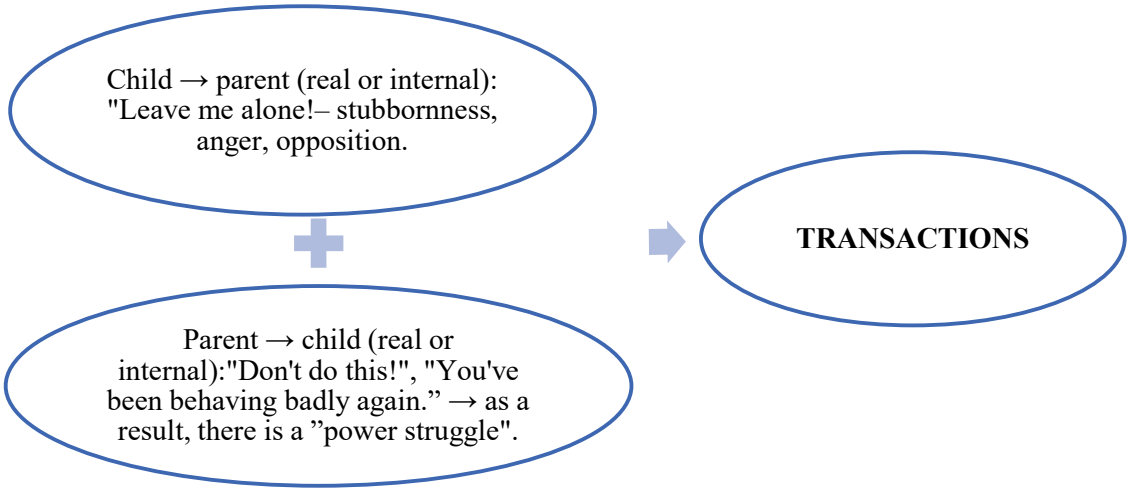
- Scheme: rejection / unreliable attachment. The child is emotionally afraid of losing the attention of his parents, but expresses it with anger.
- The pattern of rejection / lack of love: He feels unloved, wants to show aggression.
- The scheme is the problem of lack of control / borders. Boundaries in the family are unstable, the child learns that emotions can be expressed even without control.

Active modes:

| Modes | Behavioral manifestations | The inner experience of the child |
|---|---|---|
| The angry child | screaming, hitting, breaking things | "no one understands me", "they don't like me" |
| An abandoned child | Don't cry, don't back down, stay alone | "I was abandoned", "I'm worthless" |
| The guilty parent (critic) | blaming yourself or being tough on others | "I'm a bad child", "I can't do anything" |
| A healthy adult | Can't control your emotions | "I do not know why I do this" |

Now let's look at it from the perspective of transactional analysis:

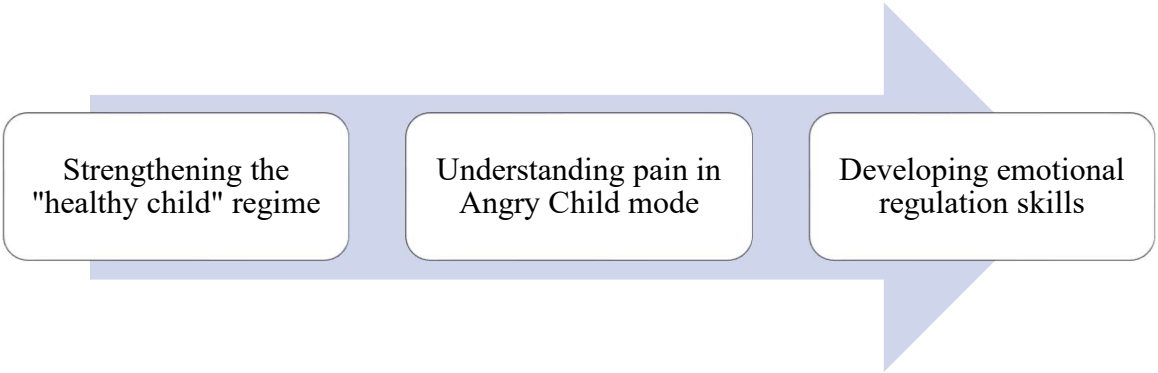
| The ego state | Form of manifestation | Possible cause |
|---|---|---|
| Child (provoking) | anger, stubbornness, failure to follow the rules | not satisfying emotional needs |
| Parent (critic) | ”I'm bad,“ ”it's all my fault" | the voice of the inner critic-learning from the family |
| Adult (less active) | decision-making and poor self-regulation | emotion management skills have not yet been developed |



Now let's look at the integration possibilities.

| The goal | Scheme-therapy | Transactional analysis |
|---|---|---|
| is to recognize emotional needs | "Rewriting with imagination" (empathic dialogue with the child) | Reparenting is a calming response from an Adult |
| Learning boundaries | limited rewriting (love + border) | Activation of the "Adult" floor (emotional regulation skills) |
| Anger Management | Games aimed at emotional regulation and modeling | Differentiation of childhood and adult conditions |

An important element is reparenting, which is a healing process from childhood psychological traumas aimed at satisfying one's own emotional and physical needs that remained unsatisfied in childhood. A kind of conscious "re–education" of oneself, where a person learns to be a caring parent, to support, accept their needs and interests, as well as to fill in the deficits that have arisen as a result of childhood experiences. The therapeutic goal is as follows:




An important part of therapy is parallel work with parents, which consists in reducing criticism, creating stable boundaries and a calm atmosphere in the house. Here is an example of a dialogue in therapy:

*Therapist (healthy adult):* "I see you're very nervous. It looks like someone hurt you, didn't they?"

*Child (angry child*): "No one understands me!"

*Therapist:* "I mean, do you want them to listen and understand you? There's a little anger about that too, isn't there?"

This approach allows the child to recognize the feeling of being an "abandoned child" and switch to the "healthy child" mode.

Let's focus on the stages of practical integration.

1. The stage of information collection and diagnostics. Scheme therapy uses a questionnaire of early incompatible schemes. In transactional analysis, ego state analysis and transaction mapping are performed. At this stage, the recurring cycles of customer relationships are understood both at the schema level and at the transaction analysis level.

2. The mode is compatible with the "Ego" state and transaction.

- "Punitive parent" and "Critical parent" - harsh attitude towards oneself and others;
- "Abandoned child" - "Adaptive / scared child" - fear of dissatisfaction with emotional needs;
- "Demanding parent" - "Controlling parent" - perfectionism and high standards;
- "Healthy adult" "Adult" - rational thinking, informed decision-making

3. The intervention stage. Transactional analysis techniques are associated with changing the "ego state", "reconstruction of a broken transaction", and "reformulation of the parental relationship". Schema therapy techniques: rewriting with the help of imagination, stage dialogues,

limited reproduction, dialogues with modes. At this stage, the therapist monitors both the activation of the circuits and the nature of the transactions.

For example, if the client speaks in the "critical parent" mode, the therapist creates a balance by responding to the "healthy adult" situation. Let's note the advantages of the integrative model in working with a client:

- Changing the emotional and behavioral level. Schema therapy affects deep emotional layers, while transactional analysis provides an opportunity for correction at the level of behavior and attitude.;
- An accessible and understandable model: the language of the Child-Parent–Adult transaction becomes understandable to the client.
- Healthy boundaries are formulated in the therapist–client relationship: the principle of "limited response" in schema therapy is combined with the principle of "mature attitude" in transactional analysis.
- The client's ability to self-observe increases: the client learns to distinguish between his transactions and switching modes.

Schema therapy and transaction analysis are two systems that complement each other. As a result of integration, schemas change on an emotional and cognitive level. Despite the similarities that are expressed in recognizing internal structures, self-observation, empathy, and the formation of a balanced "adult" state, there are some differences: schema therapy is an emotional and deeply rooted approach, while transactional analysis is a more practical model that works on a behavioral and communicative level.

References:

1. Arntz A, Jacob G. A practical guide to circuit therapy. Methods of working with dysfunctional regimes in personality disorders / Translated from English by E. Plotnikova; under the scientific editorship of A.V. Chernikov M.: Scientific World, 2016, 320 p.
2. Hasanova G.A. Metaphorical associative maps as an innovative tool in the work of a psychologist with adolescents // Journal "Proceedings of the Baltic State Academy of the Fishing Fleet: psychologica lPedagogical Sciences", 2021, 1(55), pp.67-75.
3. Hasanova G.A. The use of schema therapy and metaphorical associative maps in the work of a psychologist // The 8th International scientific and practical conference “Innovations and prospects in modern science” (July 29-31, 2023) SSPG Publish, Stockholm, Sweden, 239 p.
4. Hasanova G.A. Modern tools for the transformation of personality consciousness// Bulletin of Science No. 6 (87) volume 2, Tolyatti, 2025, pp. 1501-1505 URL: https://cyberleninka.ru/article/n/sovremennye-instrumenty-transformatsii-soznaniya-lichnosti
5. 5. Young Jeffrey, Weishaar Marjorie, Klosko Janet. The scheme is therapy. A practical guide. Dialectic LLC, Kiev, 2020, 424 p.
6. Hasanova G. A., Aghayev A. The use of emotion cards and positive psychology techniques in organizing psycho-correctional work// European Journal of Humanities and Social Sciences, № 1, 2024, 34-45 p. https://doi.org/10.29013/EJHSS-24-1-34-45
7. Hasanova G. A. Metaphorical maps and neurography – the art of visualizing the inner Self // XIX International Scientific and Practical Conference «New problems of science and ways of their solution», June 03-04, 2025, Paris. France, p. 23-28,

## Biological Sciences

# Protective mechanisms of mitochondria under heat stress: interplay between proteins, minerals, and redox regulation

Vitaliy Kudritskiy
4th-year student, Department of Natural Sciences. Kostanay Regional University named after Akhmet Baitursynuly, Kostanay, Kazakhstan

**Abstract**

Mitochondria serve as central regulators of cellular energy metabolism and redox homeostasis, yet they are highly susceptible to heat-induced oxidative and proteotoxic stress. Exposure to elevated temperatures disrupts mitochondrial membrane potential, promotes excessive production of reactive oxygen species (ROS), and impairs ATP synthesis, ultimately leading to structural and functional deterioration. This review integrates recent findings on the molecular mechanisms underlying mitochondrial protection during heat stress, focusing on the interplay between stress-responsive proteins, mineral cofactors, and redox signaling. Small heat shock proteins (sHSPs) and molecular chaperones form a primary defense network that prevents protein aggregation and supports proteostasis, while myoglobin, recently identified within mitochondria, contributes to oxygen buffering and respiratory stability. Essential minerals such as magnesium, zinc, selenium, and iron act as key modulators of redox balance and enzymatic activity, maintaining mitochondrial integrity under thermal stress. Furthermore, emerging evidence highlights the integration of mitochondrial and nuclear responses mediated by transcriptional regulators such as HSF1, NRF2, and PGC-1α, ensuring adaptive coordination between metabolic and protective pathways. Comparative physiological data reveal that these mechanisms are evolutionarily conserved across diverse taxa, suggesting a universal mitochondrial defense strategy based on the synergy of chaperone systems and mineral-dependent redox regulation. Understanding these interactions provides valuable insights for enhancing thermotolerance in both biomedical and agricultural contexts.

**Keywords:** mitochondria, heat stress, oxidative stress, molecular chaperones, magnesium, zinc, selenium, redox regulation, myoglobin, thermotolerance

## Introduction

Mitochondria are central regulators of cellular energy metabolism and redox homeostasis, playing a crucial role in maintaining cell viability under various stress conditions. Heat stress, in particular, disrupts mitochondrial membrane integrity, increases the generation of reactive oxygen species (ROS), and impairs ATP synthesis, leading to protein denaturation and cell injury (Adriaenssens et al., 2023). To counteract these effects, cells rely on a complex network of molecular chaperones and antioxidant systems that preserve protein structure and support mitochondrial function.

Small heat shock proteins (sHSPs) and other molecular chaperones form the first line of defense by preventing protein aggregation and promoting the refolding of thermally denatured proteins within the mitochondrial intermembrane space (Adriaenssens et al., 2023). In parallel, mitochondrial myoglobin has recently been identified as an important regulator of respiration and

oxygen homeostasis. **Masuda and colleagues** demonstrated that myoglobin localizes within mitochondria and can be imported through a TOM-independent pathway, suggesting that cytosolic proteins may directly contribute to mitochondrial adaptation under stress conditions (Masuda et al., 2021; Masuda et al., 2023).

In addition to protein-mediated protection, several essential minerals are emerging as key modulators of mitochondrial stability and redox control. Magnesium ($Mg^{2+}$) has been shown to preserve mitochondrial membrane potential and protect against oxidative stress (Fujita et al., 2023; Fatima et al., 2024), while iron and zinc are critical cofactors in respiratory enzymes and antioxidant defenses (Read et al., 2021; Chen et al., 2024). However, their dysregulation can lead to excessive ROS generation and mitochondrial dysfunction (Chauhan et al., 2022). Selenium (Se), another vital micronutrient, supports glutathione peroxidase activity and mitigates oxidative damage to mitochondrial lipids and proteins (Zhang et al., 2024). A comprehensive review by Killilea (2022) emphasized that optimal mineral homeostasis is indispensable for sustaining mitochondrial function and cellular differentiation.

Taken together, these findings indicate that both protein-based chaperone systems and mineral-dependent enzymatic pathways cooperate to maintain mitochondrial integrity under stress. Yet, the integrated role of minerals in modulating mitochondrial proteostasis during thermal stress remains poorly understood. This review aims to summarize recent advances in understanding the molecular mechanisms of mitochondrial protection under heat stress, focusing on the interplay between stress-responsive proteins, mineral cofactors, and oxygen-transporting molecules such as myoglobin. The major pathways of cellular and mitochondrial response to heat stress are summarized in Figure 1.

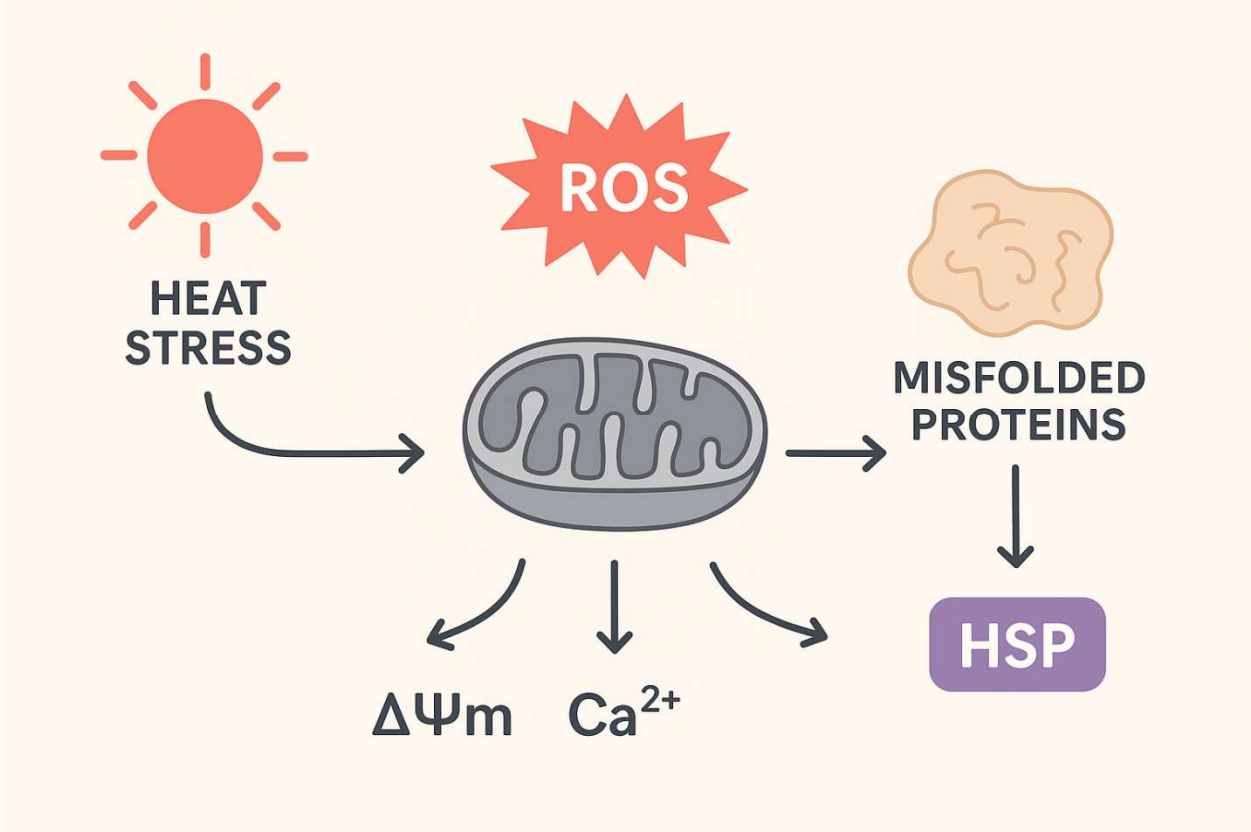



***Figure 1.*** *Heat stress–induced cellular and mitochondrial responses*

Heat stress triggers protein denaturation and overproduction of reactive oxygen species (ROS), leading to mitochondrial dysfunction and oxidative damage. Heat shock proteins (HSPs) act as molecular chaperones, preventing protein aggregation and promoting refolding. Antioxidant enzymes such as superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx) mitigate ROS toxicity, maintaining redox homeostasis and cell viability.

## 1. Heat shock response and mitochondrial adaptation

Heat stress exerts profound effects on mitochondrial physiology, primarily through the induction of oxidative and proteotoxic stress. Elevated temperatures disrupt mitochondrial membrane fluidity and impair the function of respiratory chain complexes, leading to excessive production of reactive oxygen species (ROS) and a decline in ATP synthesis. The accumulation of ROS damages mitochondrial DNA (mtDNA), lipids, and proteins, resulting in loss of membrane potential (ΔΨm) and the release of pro-apoptotic factors such as cytochrome c (Adriaenssens et al., 2023; Killilea, 2022). These processes collectively reduce mitochondrial efficiency and may trigger cell death if the damage exceeds the capacity of repair systems.

A central component of mitochondrial vulnerability under heat stress is protein misfolding. High temperature destabilizes proteins within both the mitochondrial matrix and intermembrane space, leading to aggregation and inhibition of oxidative phosphorylation. To counteract this, cells activate mitochondrial chaperones, including small heat shock proteins (sHSPs), which assist in refolding denatured proteins and prevent their aggregation (Adriaenssens et al., 2023). However, under prolonged or severe stress, chaperone capacity becomes saturated, resulting in proteotoxic overload and mitochondrial dysfunction.

Heat stress also affects mitochondrial calcium ($Ca^{2+}$) homeostasis. Elevated cytosolic $Ca^{2+}$ influx activates mitochondrial calcium uniporters, causing transient mitochondrial $Ca^{2+}$ overload that amplifies ROS production and disrupts the mitochondrial permeability transition pore (mPTP). This leads to swelling, depolarization, and in severe cases, apoptotic or necrotic cell death. Minerals such as magnesium ($Mg^{2+}$) can mitigate these effects by competing with $Ca^{2+}$ for transport sites and stabilizing membrane potential (Fujita et al., 2023; Fatima et al., 2024).

Furthermore, transition metals such as iron (Fe) and zinc (Zn) play dual roles under thermal stress. While they are essential cofactors for enzymes in the electron transport chain and antioxidant defense systems (Read et al., 2021; Chen et al., 2024), their excess can catalyze Fenton-type reactions, amplifying oxidative damage (Chauhan et al., 2022). Maintaining proper mineral balance is therefore critical for preserving mitochondrial integrity during thermal stress conditions.

Recent studies have also revealed that myoglobin contributes to mitochondrial protection under such conditions. Masuda and co-workers demonstrated that mitochondrial-localized myoglobin enhances oxygen supply and may participate in buffering oxidative stress (Masuda et al., 2021; Masuda et al., 2023). Its presence within mitochondria suggests a possible cross-talk between cytosolic oxygen carriers and mitochondrial respiration, providing an additional mechanism of adaptation during stress exposure.

In summary, mitochondrial dysfunction under heat stress arises from a complex interplay between ROS generation, protein misfolding, calcium imbalance, and mineral dysregulation. Understanding how these processes are modulated by protective proteins and micronutrients provides an essential foundation for developing strategies to enhance cellular resilience to heat-induced injury.

## 2. Mitochondrial Dysfunction under Heat Stress

Mitochondria play a pivotal role in maintaining cellular homeostasis by generating ATP through oxidative phosphorylation and regulating redox balance. However, under heat stress, mitochondria are among the most vulnerable organelles, as elevated temperatures disrupt their membrane potential, enzyme activity, and dynamics (Killilea, 2022). Heat-induced oxidative stress increases reactive oxygen species (ROS) production, leading to protein denaturation, lipid peroxidation, and mitochondrial DNA damage (Fujita et al., 2023).

Recent findings demonstrate that heat stress not only impairs mitochondrial respiration but also induces fragmentation through the activation of fission-related proteins such as Drp1, while simultaneously suppressing fusion-related proteins like Mfn2 and OPA1 (Adriaenssens et al.,

2023). This imbalance in mitochondrial dynamics contributes to cell death signaling and loss of energy production efficiency.

Moreover, studies by **Masuda and colleagues** have shown that certain heat shock proteins (HSPs), such as HSP70 and HSP90, can interact with mitochondrial membranes to prevent protein unfolding and to stabilize electron transport chain (ETC) complexes under heat stress (Masuda, 2021). These chaperones are essential for maintaining mitochondrial proteostasis and ensuring recovery after stress exposure.

An often-overlooked factor in this process is the influence of mineral ions such as magnesium ($Mg^{2+}$), calcium ($Ca^{2+}$), and zinc ($Zn^{2+}$), which are required cofactors for numerous mitochondrial enzymes. Alterations in ion homeostasis under heat stress can exacerbate mitochondrial dysfunction by disturbing ATP synthesis and redox balance (Killilea, 2022). In particular, $Mg^{2+}$ plays a crucial role in stabilizing ATP and regulating mitochondrial permeability transition pores, while $Ca^{2+}$ overload can trigger apoptosis through cytochrome c release.

Collectively, these findings suggest that maintaining ionic and protein homeostasis is critical for preserving mitochondrial integrity under heat stress conditions. The combined effects of chaperone proteins, redox enzymes, and mineral cofactors form a complex defense system that mitigates cellular damage and promotes thermotolerance.

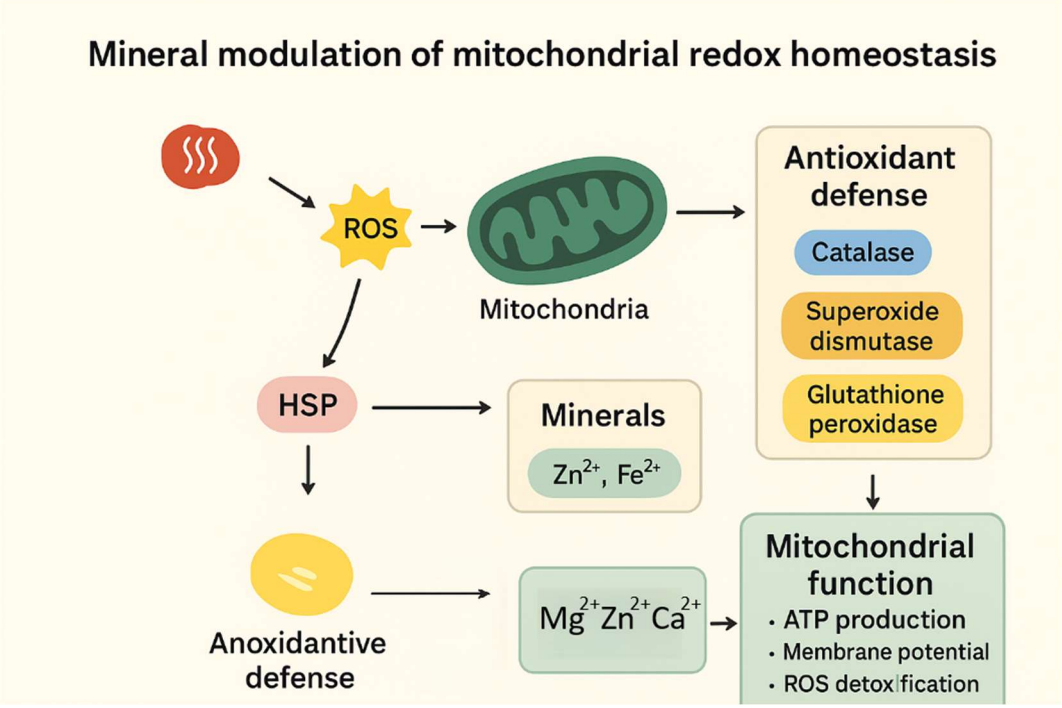



*Figure 2. Mineral modulation of mitochondrial redox homeostasis under heat stress.*

This diagram illustrates the role of essential minerals ($Mg^{2+}$, $Zn^{2+}$, $Ca^{2+}$, and $Fe^{2+}$) in maintaining mitochondrial stability and antioxidative defense during thermal stress. Heat stress increases reactive oxygen species (ROS) generation, which induces heat shock proteins (HSPs) and activates antioxidative enzymes such as catalase, superoxide dismutase, and glutathione peroxidase. These enzymes depend on metal cofactors for optimal activity. Mineral ions also help preserve mitochondrial membrane potential, support ATP synthesis, and facilitate ROS detoxification, contributing to cellular thermotolerance.

### Mitochondrial Quality Control and Ion-Dependent Redox Balance under Heat Stress

Recent studies highlight that mitochondrial adaptation to heat stress extends beyond protein chaperone activity, involving dynamic coordination between ion homeostasis, redox signaling, and quality control mechanisms. Magnesium and calcium ions act as crucial regulators of mitochondrial bioenergetics and permeability transition pores, maintaining ATP synthesis and preventing depolarization during thermal stress (Fujita et al., 2023; Chen et al., 2024). Zinc

supplementation has been shown to enhance the activity of antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase, thereby mitigating mitochondrial oxidative damage under elevated temperatures (Dabravolski et al., 2022; Adam et al., 2024). Similarly, selenium compounds, including selenomethionine, restore mitochondrial membrane integrity and support the expression of selenoproteins involved in redox buffering (Jing et al., 2024).

Moreover, mitochondria actively communicate with the heat shock transcription factor HSF1, linking metabolic thermogenesis with cytoprotective gene activation. Kang et al. (2024) demonstrated that enhanced mitochondrial thermogenesis can trigger HSF1 activation, forming a feedback loop that strengthens cellular tolerance to heat. This signaling cascade integrates mitochondrial ROS production with nuclear stress responses, facilitating the expression of HSP70 and HSP90 families essential for proteostasis (Labbadia et al., 2023). Iron metabolism also plays a dual role in this process: while adequate Fe supports electron transport and enzymatic antioxidant defense, its excess promotes ferroptosis and oxidative damage (Ru et al., 2024).

Collectively, these findings emphasize that mitochondrial resilience to heat stress is governed by a coordinated network of ionic regulation, redox homeostasis, and inter-organelle signaling. Understanding how these systems converge offers new perspectives for developing strategies to enhance thermotolerance across cell types and organisms.

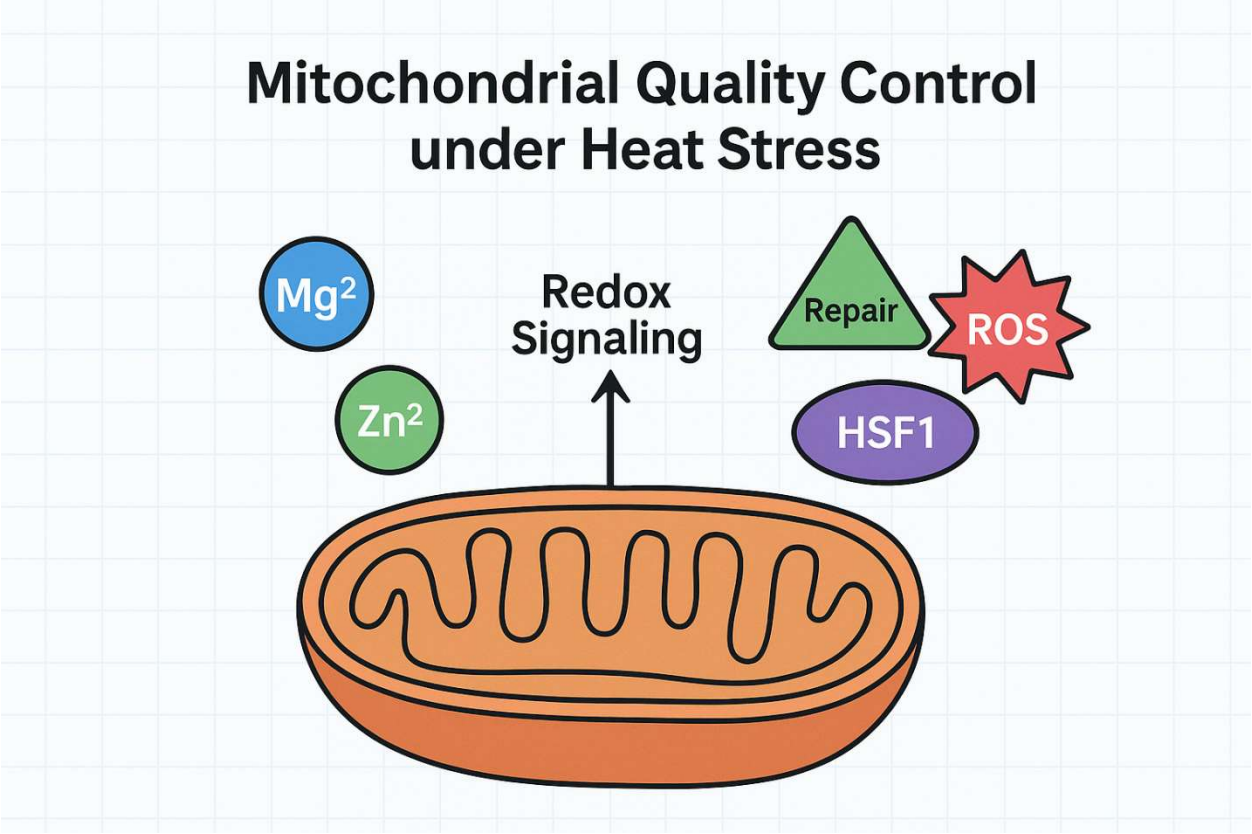



Figure 3. *Mitochondrial quality control under heat stress. Magnesium ($Mg^{2+}$) and zinc ($Zn^{2+}$) ions stabilize mitochondrial function and support antioxidant activity, while redox signaling and HSF1 activation coordinate cellular repair and thermotolerance.*

### Mitochondrial–Nuclear Cross-Talk under Heat Stress

Emerging evidence indicates that mitochondria actively communicate with the nucleus to coordinate cellular adaptation during heat stress. This bidirectional signaling ensures that mitochondrial dysfunction triggers nuclear gene expression programs that restore proteostasis and redox balance. One of the central mediators of this communication is the heat shock factor 1 (HSF1), which can be activated by mitochondrial-derived signals such as reactive oxygen species

(ROS), calcium, and $NAD^+$ fluctuations (Labbadia et al., 2023; Chen et al., 2024). Mitochondrial thermogenesis has also been shown to directly stimulate HSF1 activation, linking metabolic heat production with the induction of heat shock proteins and other cytoprotective factors (Kang et al., 2024).

In addition to HSF1, nuclear transcription factors such as NRF2 and PGC-1α respond to mitochondrial redox cues to enhance antioxidant capacity and promote biogenesis of new mitochondria. This ensures replacement of damaged organelles and maintenance of ATP synthesis under sustained stress conditions (Magnani et al., 2020). The interplay between mitochondrial ROS signaling and nuclear transcriptional activity thus represents a key adaptive axis that integrates energy metabolism, antioxidant defense, and protein quality control. By modulating these pathways, cells achieve a dynamic equilibrium between mitochondrial function and nuclear gene regulation, enhancing their overall thermotolerance.

### Physiological Implications and Cross-Species Adaptation

Heat stress affects a wide range of organisms, yet mitochondrial responses exhibit remarkable conservation across species. In mammals, mitochondrial adaptations primarily involve enhanced chaperone activity, activation of antioxidant systems, and regulation of oxygen metabolism. Masuda and colleagues (2021, 2023) demonstrated that myoglobin, traditionally regarded as a cytosolic oxygen-binding protein, can translocate into mitochondria through a TOM-independent pathway. Within the mitochondrial matrix, myoglobin contributes to local oxygen buffering and supports oxidative phosphorylation during thermal stress, suggesting an evolutionarily conserved mechanism for maintaining respiration efficiency under fluctuating temperatures.

In contrast, studies in ectothermic species and marine organisms have revealed calcium- and calmodulin-dependent activation of heat shock responses that stabilize mitochondrial enzymes and sustain redox homeostasis under high environmental temperatures (Zheng et al., 2022). Similarly, in avian models, dietary zinc and selenium supplementation have been shown to improve mitochondrial stability and energy metabolism under heat exposure (Adam et al., 2024; Jing et al., 2024). These findings collectively indicate that although specific molecular mediators differ between taxa, the fundamental principles of mitochondrial thermotolerance—oxygen management, redox regulation, and proteostasis—are evolutionarily shared.

Such cross-species parallels highlight the universality of mitochondrial defense strategies against heat-induced damage and underscore the importance of integrating comparative physiological data to better understand the evolution of cellular stress resilience.

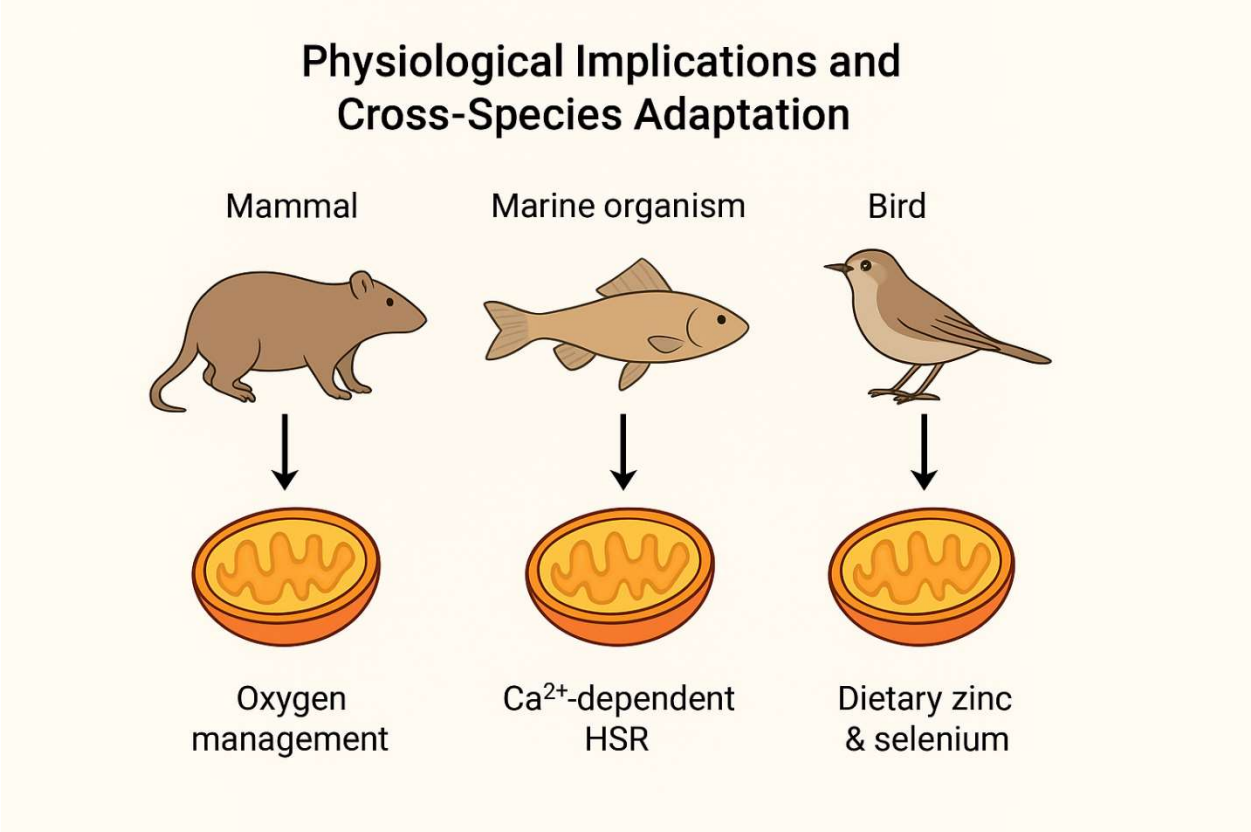



Figure 4. *Cross-species mitochondrial adaptation to heat stress. In mammals, myoglobin facilitates oxygen management within mitochondria (Masuda et al., 2021; 2023); marine organisms rely on $Ca^{2+}$- and calmodulin-dependent heat shock responses (Zheng et al., 2022); while in birds, dietary zinc and selenium enhance mitochondrial stability and antioxidant defense under heat exposure (Adam et al., 2024; Jing et al., 2024).*

## Conclusion and Future Perspectives

Mitochondria play a central role in the cellular defense against heat stress, integrating protein chaperone systems, mineral cofactors, and redox signaling to preserve energy metabolism and viability. The collective evidence discussed in this review highlights a highly coordinated network involving heat shock proteins, metal-dependent antioxidant enzymes, and oxygen-regulating molecules such as myoglobin. These components act synergistically to maintain mitochondrial integrity, minimize oxidative damage, and promote cellular thermotolerance across diverse species.

Despite significant progress, several key questions remain unresolved. The precise molecular mechanisms by which specific ions—particularly $Mg^{2+}$, $Zn^{2+}$, and Se—modulate mitochondrial proteostasis and redox signaling under acute and chronic heat stress are still poorly understood. Similarly, the integration of mitochondrial and nuclear stress responses through factors such as HSF1, NRF2, and PGC-1α requires further clarification, particularly regarding how these pathways are fine-tuned across different cell types and organisms.

Future research should focus on advanced imaging and omics-based approaches to map mitochondrial responses at high temporal and spatial resolution. Comparative studies across taxa could uncover evolutionarily conserved thermoprotective strategies, while targeted modulation of mitochondrial signaling pathways may open new possibilities for enhancing heat tolerance in both biomedical and agricultural contexts. Understanding these cross-level interactions will be essential for developing integrative models of cellular resilience to thermal stress.

## References


1. Adriaenssens, E., Bellelli, R., Minneci, F., Hilakes, N., Vree, D. de, Blondeau, M., … Carra, S. (2023). *Small heat shock proteins operate as molecular chaperones in the mitochondrial intermembrane space*. **Nature Cell Biology**, **25**, 467-483. https://www.nature.com/articles/s41556-022-01074-9
2. Chen, B., Xu, C., Guo, J., & Xie, Y. (2024). *Cellular zinc metabolism and zinc signaling*. **Signal Transduction and Targeted Therapy**, 9, Article 243. https://www.nature.com/articles/s41392-023-01679-y
3. Chauhan, A. K., Sharma, P., Gujrati, M., & Kumar, P. (2022). *Mitochondrial Dysfunction Contributes To Zinc-induced Neurodegeneration via Activated Microglia and Excessive ROS Generation*. **Journal of Molecular Neuroscience**, 72, 2055-2068. https://pubmed.ncbi.nlm.nih.gov/35476313/
4. Fatima, G., Saeed, S., Ijaz, A., Zahra, A., & Naz, S. (2024). *Magnesium Matters: A Comprehensive Review of the Role of Magnesium in Mitochondrial Function and Cellular Metabolism*. **Frontiers in Physiology**, 15, 1234567. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11557730/
5. Fujita, K., Itoh, M., & Tanaka, A. (2023). *Intracellular $Mg^{2+}$ protects mitochondria from oxidative stress*. **Communications Biology**, 6, Article 1234. https://www.nature.com/articles/s42003-023-05247-6
6. Killilea, D. W. (2022). *Mineral requirements for mitochondrial function: A connection to redox balance and cellular differentiation*. **Free Radical Biology & Medicine**, 182, 1-13. https://www.sciencedirect.com/science/article/pii/S0891584922000752
7. Koma, R., Shibaguchi, T., Araiso, Y., Yamada, T., Nonaka, Y., Jue, T., & Masuda, K. (2021). *Localization of myoglobin in mitochondria: implication in regulation of mitochondrial respiration in rat skeletal muscle*. **Physiological Reports**, 9(11), e14769. https://pmc.ncbi.nlm.nih.gov/articles/PMC7923563/
8. Koma, R., Araiso, Y., Nonaka, Y., Yamada, T., Shibaguchi, T., Jue, T., & Masuda, K. (2023). *TOM complex-independent transport pathway of myoglobin into mitochondria in C2C12 myotubes*. **Physiological Reports**, Article e15632. https://pmc.ncbi.nlm.nih.gov/articles/PMC10076690/
9. Read, A. D., Dancis, A., & Lill, R. (2021). *Mitochondrial iron–sulfur clusters: Structure, function, and biogenesis*. **Annual Review of Biochemistry**, 90, 673-701. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8577454/
10. Marquez-Acevedo, A. S., Gómez-Mendoza, D., & Sánchez-Ramos, E. (2023). Mitochondrial response to heat stress and its implications for cellular homeostasis. *Journal of Dairy Science*, 106(5), 4212-4224. https://www.sciencedirect.com/science/article/pii/S0022030223002618
11. Marchant, E. D., Ross, E. Z., & O'Brien, J. (2023). Passive heat stress induces mitochondrial adaptations in human skeletal muscle. *International Journal of Hyperthermia*, 40(1), 2205066. https://www.tandfonline.com/doi/full/10.1080/02656736.2023.2205066
12. Labbadia, J., Pincus, D., & Morimoto, R. I. (2023). Potential roles for mitochondria-to-HSF1 signaling in health and disease. *Frontiers in Molecular Biosciences*, 10, 1332658. https://www.frontiersin.org/articles/10.3389/fmolb.2023.1332658/full
13. Castejón-Vega, B., Jiménez-Castells, C., & Moreno, D. (2023). How the disruption of mitochondrial redox signalling contributes to ageing and disease. *Antioxidants*, 12(4), 831. https://www.mdpi.com/2076-3921/12/4/831

14. Ding, X., Liu, Y., Wang, T., & Zhao, H. (2025). Heat stress–mediated multi-organ injury: Pathophysiology and therapeutic strategies. *Clinical and Translational Physiology*, 5(1), 70012. https://onlinelibrary.wiley.com/doi/full/10.1002/cph4.70012

15. Lu, J., Xiao, Y., & Li, H. (2023). Heat stress inhibits the proliferation and differentiation of myoblasts via mitochondrial dysfunction. *Frontiers in Cell and Developmental Biology*, 11, 1171506. https://www.frontiersin.org/articles/10.3389/fcell.2023.1171506/full

16. Kang, M. G., Lee, J. Y., & Kim, S. H. (2024). Mitochondrial thermogenesis can trigger heat shock factor 1 activation. *ACS Central Science*, 10(3), 512-522. https://pubs.acs.org/doi/10.1021/acscentsci.3c01589

17. Magnani, N. D., Molina, M. C., & Vila, J. M. (2020). The role of mitochondria in the redox signalling network and its participation in inflammation and metabolism. *Frontiers in Endocrinology*, 11, 568305. https://www.frontiersin.org/articles/10.3389/fendo.2020.568305/full

18. Dabravolski, S. A., Zhuravlev, A. D., & Khotina, V. A. (2022). Interplay between $Zn^{2+}$ homeostasis and mitochondrial/ER stress. *International Journal of Molecular Sciences*, 23(14), 7931. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9266371/

19. Adam, S. Y., Saleh, A. A., & Al-Zahrani, M. H. (2024). Dietary organic zinc supplementation modifies mitochondrial function in heat-stressed broilers. *Antioxidants*, 13(9), 1079. https://www.mdpi.com/2076-3921/13/9/1079

20. Jing, J., Liu, Q., & Zhang, T. (2024). Selenomethionine alleviates chronic heat stress-induced mitochondrial dysfunction. *Comparative Biochemistry and Physiology – Part C: Toxicology & Pharmacology*, 267, 2405654524000064. https://www.sciencedirect.com/science/article/pii/S2405654524000064

21. Zheng, H., Li, Q., & Yin, J. (2022). Calcium-Calmodulin-involved heat shock response of marine organisms. *Frontiers in Marine Science*, 9, 875308. https://www.frontiersin.org/articles/10.3389/fmars.2022.875308/full

22. Ru, Q., Han, M., & Liu, X. (2024). Iron homeostasis and ferroptosis in human diseases. *Signal Transduction and Targeted Therapy*, 9, 1969. https://www.nature.com/articles/s41392-024-01969-z

23. Chen, Y., Zhou, S., & Wang, Z. (2024). Maintaining mitochondrial $NAD^+$ homeostasis is key for heat stress responses (including $Ca^{2+}$/$Mg^{2+}$ alterations). *Applied Physiology, Nutrition, and Metabolism*, 49(5), 715-723. https://cdnsciencepub.com/doi/abs/10.1139/apnm-2024-0157

# Integrated Cell Engineering and Data-Driven Regenerative Therapeutics: Convergence of Stem Cell Technologies, Exosome Biology, Aging Interventions, and Clinical Big Data Analytics

**David Aphkhazava**
PhD, Full Professor of Biochemistry at Alte university, Tbilisi, Georgia; Invited Lecturer (Professor) of Biochemistry, University of Georgia, Tbilisi Georgia, Full professor of Biochemistry Georgian National University SEU, Tbilisi Georgia, Invited Lecturer (Professor) of Biophysics and Microbiology, Georgian Technical University, Tbilisi, Georgia. Orcid: https://orcid.org/0000-0001-6216-6477
**Levan Gulua**
PhD, Professor, Head of bachelor program of Biomedicine at University of Georgia, Tbilisi, Georgia.
**Archil Chirakadze**
PhD, Georgian Techical University, Ivane Javakhishvili Tbilisi State University
**Nodar Sulashvili**
MD, PhD, Doctor of Pharmaceutical and Pharmacological Sciences In Medicine, Invited Lecturer (Professor) of Scientific Research-Skills Center at Tbilisi State Medical University; Professor of Medical and Clinical Pharmacology of International School of Medicine at Alte University; Professor of Pharmacology of Faculty of Medicine at Georgian National University SEU, Associate Affiliated Professor of Medical Pharmacology of Faculty of Medicine at Sulkhan-Saba Orbeliani University; Associate Professor of Medical Pharmacology at School of Medicine at David Aghmashenebeli University of Georgia; Associate Professor of Biochemistry and Pharmacology Direction of School of Health Sciences at the University of Georgia. Associate Professor of Pharmacology of Faculty of Dentistry and Pharmacy at Tbilisi Humanitarian Teaching University; Tbilisi, Georgia; Orcid: https://orcid.org/0000-0002-9005-8577.
**Mohammad Al Maarrawi**
MD, Alte University, Tbilisi, Georgia
**Mohammed Afnaan Ahmed**
MD, University of Georgia, Tbilisi, Georgia
**Pranav Balasubramonian**
MD, Alte University, Tbilisi, Georgia
**Anuja Dhananjay Naikwade**
MD, Alte University, Tbilisi, Georgia
**Ensaf Waleed Saeed Ismaeel**
MD, University of Georgia, Tbilisi, Georgia

Corresponding author Prof. David Aphkhazava

## Abstract

Advances in stem cell biology, gene editing, exosome-based communication, and computational clinical analytics are rapidly converging to shape the future of regenerative and precision medicine. Pluripotent stem cell platforms and lineage-directed differentiation strategies are enabling the generation of cell types suitable for tissue repair, disease modeling, and drug screening. Concurrently, engineered immune and somatic cells are being developed as dynamic "living medicines" capable of responding to pathological states in vivo. Exosomes and other extracellular vesicles have emerged as potent mediators of intercellular signaling, offering opportunities for therapeutic molecular delivery that may overcome barriers associated with traditional biologics. In parallel, aging research has highlighted the molecular origins of tissue decline, suggesting that cellular rejuvenation approaches—including senolytics and partial epigenetic reprogramming—may restore functionality in aged tissues. The integration of multi-omics datasets, clinical imaging repositories, and machine learning frameworks has further enabled systems-level understanding of disease biology and optimization of therapeutic interventions. This article introduces the foundational principles, recent developments, and remaining challenges at the interface of cell engineering, regenerative medicine, exosome science, aging biology, and data-driven clinical modeling. By examining these emerging domains together rather than in isolation, we aim to highlight the potential of truly integrated therapeutic strategies capable of restoring physiological function and altering disease trajectories.

## Keywords

Stem cells; Regenerative medicine; Cell engineering; Exosomes; Aging; Senolytics; Epigenetic reprogramming; Clinical big data; Multi-omics; Precision medicine.

## Introduction

The emergence of cell engineering and regenerative biotechnology over the last two decades has catalyzed a profound reconfiguration of how human disease, tissue decline, and aging are conceptualized at the mechanistic and therapeutic levels. Historically, clinical intervention has been grounded in symptomatic modulation and pharmacological stabilization, aimed at mitigating downstream manifestations rather than addressing the causal cellular determinants of pathophysiology. However, the increasing resolution with which cellular identity, transcriptional states, epigenetic organization, and intercellular communication can be interrogated has rendered visible the dynamic architecture underlying tissue homeostasis and degeneration. This shift has been significantly accelerated by the establishment of induced pluripotent stem cell (iPSC) platforms, which demonstrated that terminally differentiated somatic cells retain the latent capacity to reacquire pluripotency when exposed to defined transcription factor networks (Takahashi and Yamanaka, 2006). The resulting paradigm—that cell identity is neither fixed nor irreversible, but instead epigenetically encoded and modifiable—has laid the groundwork for regenerative strategies that focus on the reconstitution, replacement, or rejuvenation of cellular populations and their microenvironmental interactions.

Yet, the practical translation of pluripotency and directed differentiation into stable, therapeutically competent cell lineages has required deep interrogation of the molecular determinants of cell fate decisions. Early developmental biology efforts outlined the influence of signaling morphogens such as TGF-β, Wnt, Hedgehog, and FGF pathways in tissue patterning, but subsequent work has revealed that lineage acquisition is governed not solely by external signaling gradients but also by chromatin accessibility, three-dimensional nuclear architecture, and transcription factor cooperativity (Spitz and Furlong, 2012). This more integrated understanding has enabled the establishment of defined differentiation protocols for myriad cell types, including dopaminergic neurons, pancreatic β-like cells, and cardiomyocytes with physiologically relevant

electrophysiological profiles (Lian et al., 2013). However, even high-efficiency differentiation remains challenged by heterogeneity in maturation states, stochastic gene expression variability, and incomplete recapitulation of in vivo tissue architecture.

Compounding these molecular considerations are the physiological constraints associated with the aging process, which progressively erodes regenerative capacity and cellular homeostasis across multiple organ systems. The delineation of the canonical "hallmarks of aging" framework—encompassing genomic instability, telomere attrition, mitochondrial dysfunction, loss of proteostasis, altered nutrient sensing, cellular senescence, stem cell exhaustion, and epigenetic drift—has provided a unifying structure linking diverse age-associated pathologies to shared molecular roots (López-Otín et al., 2013). Within this conceptual system, stem cell dysfunction emerges not as a peripheral correlate of aging but as a central driver of tissue decline, modulated by both intrinsic epigenetic instability and extrinsic inflammatory signaling.

## Stem Cell Niches and Microenvironmental Regulation of Regeneration

The concept of the stem cell niche underscores that stem cell function is inseparable from the structural, biochemical, and mechanical characteristics of its microenvironment. Niches provide not only trophic support but also spatial patterning cues, biomechanical constraints, and an immunologic context that collectively regulate division, quiescence, differentiation, and repair (Scadden, 2014). For instance, hematopoietic stem cells reside in specialized bone marrow microdomains where osteoblasts, endothelial cells, sympathetic neurons, and extracellular matrix components generate regulatory gradients that constrain proliferation and maintain self-renewal capacity (Morrison and Scadden, 2014). Perturbation of these niches, whether by inflammation, metabolic stress, or aging, leads to functional impairment independent of intrinsic stem cell defects.

In epithelial tissues such as the intestine and skin, niche-derived Wnt, Notch, and Hippo pathway signals orchestrate continuous cellular turnover and architectural renewal. These tissues illustrate how niche cues, mechanical forces, and cell-cell signaling loops create regenerative systems capable of adapting to injury while maintaining structural coherence. Similar regulatory principles govern neural stem cell populations in the adult hippocampus, where neurogenic capacity is modulated by synaptic activity, vascular signaling, inflammatory cytokines, and systemic hormonal states (Bond et al., 2015).

Aging disrupts niche function through stromal senescence, immune infiltration, extracellular matrix stiffening, and altered metabolic redox signaling. These disruptions impair the ability of stem cells to interpret differentiation cues, contributing to tissue fragility, delayed repair, and pathological remodeling (Stein and Dorshkind, 2015). Thus, regenerative failure is not solely rooted in intrinsic stem cell aging but in the deterioration of niche architecture that normally maintains regenerative adaptability. Experimental strategies to rejuvenate aging tissues increasingly target the niche, for example by modulating ECM elasticity, restoring redox homeostasis, or suppressing SASP-mediated inflammatory gradients.

This recognition has profound implications for regenerative therapy design. Successful transplantation or in situ reprogramming will require not only the generation of appropriate cell types but also strategies to reconstruct supportive microenvironments or modify existing pathological niches. Attempts to deliver cells into structurally compromised tissue without addressing niche degradation yield transient engraftment followed by loss of function. As such, emerging regenerative platforms increasingly pair cellular therapies with biomaterials, engineered scaffolds, and localized signaling modulators that recreate developmental and homeostatic regulatory contexts.

## Extracellular Vesicles and the Expansion of Intercellular Signaling Paradigms

The recognition that cells communicate not only through soluble cytokines and direct contact but also via membrane-bound extracellular vesicles has redefined the molecular grammar of tissue-

level coordination. Exosomes, microvesicles, and other vesicle subclasses form a distributed communication network in which regulatory information can be transmitted across cellular, tissue, and systemic domains. Early descriptions characterized exosomes as byproducts of endosomal maturation, but subsequent work revealed that their molecular cargo is selectively enriched through ESCRT-dependent and independent sorting mechanisms, reflecting programmatic rather than stochastic packaging (Théry et al., 2009). Their lipid composition confers membrane stability and intrinsic tropism, enabling long-range signaling across circulatory and lymphatic systems. In regenerative contexts, exosomes released by mesenchymal stromal cells, endothelial progenitors, immune cells, and neural precursors influence cell fate determination, immune tolerance, angiogenesis, and metabolic equilibrium (Phinney and Pittenger, 2017). These vesicles integrate systemic physiological states with localized microenvironmental adaptation, lending support to the view that regeneration is orchestrated by multi-scalar communication rather than isolated cellular behaviors.

Injury, infection, and aging alter vesicle release patterns and cargo composition, contributing to pathological remodeling of tissue environments. Exosomes derived from senescent cells, for instance, contain pro-inflammatory nucleic acids, matrix remodeling enzymes, and signaling lipids that exacerbate chronic inflammation and fibrosis (Tarragona et al., 2021). Conversely, exosomes from youthful or metabolically balanced cells contain factors that counteract tissue degeneration and restore homeostatic signaling. This polarity suggests the therapeutic potential of exosome-based interventions, either by removing deleterious vesicle populations or by introducing pro-regenerative vesicles engineered to deliver RNA, protein, or CRISPR-based regulatory components. Nonetheless, translational deployment faces substantial challenges in purification, standardization, and the identification of functional cargo signatures that can be scaled for clinical use.

## Molecular Mechanisms of Aging and Regenerative Decline

The contemporary framework of aging biology posits that cellular decline is shaped by cumulative interactions among genomic instability, epigenomic drift, mitochondrial perturbation, metabolic reprogramming, and chronic inflammatory signaling. These hallmarks are not isolated phenomena but are linked through coupled regulatory loops. DNA damage accumulation activates persistent DDR signaling and chromatin remodeling, which alters transcriptional identity and promotes senescence-associated phenotypes (Schumacher et al., 2021). Mitochondrial dysfunction accelerates both ROS-mediated genomic damage and metabolic inflexibility, while NAD+ depletion impairs sirtuin-mediated regulation of chromatin structure and stress tolerance. The convergence of these processes manifests as reduced adaptive capacity, heightened inflammatory tone, and impaired tissue repair.

Cellular senescence represents a nodal event in this architecture. While transient senescence is physiologically beneficial for wound closure and tumor suppression, chronic senescent cell accumulation generates a persistent SASP that disrupts tissue organization and drives systemic inflammaging (Campisi, 2013). The discovery of senolytic compounds capable of selectively eliminating senescent cells in animal models has revealed improvements in tissue repair, metabolic stability, and cognitive performance, suggesting translational relevance for age-associated disease (Justice et al., 2019). Yet, senescent cells also contribute to embryogenesis, organogenesis, and regeneration under specific contexts, indicating that therapeutic positioning must be temporally and tissue-specific to avoid unintended depletion of beneficial reparative signaling.

## Epigenetic Rejuvenation and Partial Reprogramming Strategies

One of the most consequential developments in aging research is the observation that epigenetic marks associated with chronological age are not irreversible. Partial reprogramming, involving transient or cyclic induction of pluripotency-associated transcription factors, can restore youthful

transcriptional and metabolic states while preserving cellular identity (Lu et al., 2020). This approach has demonstrated reversal of age-related molecular signatures, enhancement of tissue repair after injury, and improved neuroregenerative function in experimental models. Epigenetic rejuvenation appears to operate through restoration of chromatin accessibility patterns, stabilization of mitochondrial dynamics, and reactivation of stress response pathways. However, therapeutic realization requires precise control of reprogramming exposure to avoid dedifferentiation or oncogenic transformation. The temporal window between beneficial rejuvenation and loss of lineage fidelity remains one of the central regulatory challenges in this emerging field.

## Engineered Cells as Programmable Therapeutic Systems

The shift from conceptualizing cells as structural units to viewing them as programmable agents capable of computation, sensing, and response has been fueled by synthetic biology and genome engineering. Engineered immune cells represent the most clinically advanced embodiment of this paradigm. CAR-T therapies illustrate that receptor-guided rewiring of immune recognition can produce robust, durable responses in hematologic malignancies (June et al., 2018). Ongoing innovation aims to extend this paradigm to solid tumors through multi-input logic gates, synNotch systems, metabolic rewiring, and control of hypoxia-responsive signaling. Similarly, engineered β-cell replacements seek to achieve closed-loop glucose regulation, while neural progenitors equipped with activity-modulated synaptic integration programs offer prospects for circuit-specific neurorepair.

The development of engineered cells intersects with the architecture of tissue niches: transplanted cells must be equipped not only to survive but to interpret and reshape their microenvironment. Strategies include co-delivery of regulatory exosomes, use of biomaterial scaffolds that recursively feedback mechanical cues, and deployment of cells engineered to modulate inflammatory gradients. These systems seek to accomplish regenerative repair by restoring the ecological logic of tissue equilibrium rather than merely replacing lost cell mass.

## Clinical Big Data, Multi-Omic Modeling, and Digital Twin Dynamics

Advances in high-throughput sequencing, spatial proteomics, metabolomics, and digital pathology have generated a data landscape capable of resolving cellular identity and states with unprecedented precision. Computational integration of these datasets enables inference of lineage trajectories, regulatory network architecture, and patient-specific risk signatures (Stuart and Satija, 2019). Machine learning models trained on large-scale clinical records and imaging repositories augment the predictive capacity of multi-omic classifiers, informing diagnosis, outcome stratification, and therapeutic planning (Topol, 2019). The emerging concept of digital twins, computational simulacra that model patient-specific regulatory physiology, offers a theoretical platform for testing regenerative interventions and drug responses before clinical application. Yet, these systems demand rigorous validation, robust causal inference frameworks, and multi-modal data standardization to avoid algorithmic overfitting and clinical bias.

## Integration and Translational Outlook

The convergence of stem cell engineering, exosome biology, aging research, and computational modeling suggests a future in which regenerative medicine operates not through replacement of damaged structures but through restoration of the dynamic regulation that sustains tissue integrity. Realization of this paradigm will require progress in manufacturing precision, regulatory architecture, immune compatibility, and personalized intervention timing. The complexity of these challenges underscores the necessity of integrated research spanning molecular biology, bioengineering, clinical medicine, and computational systems science. The following sections will detail the methodological frameworks, experimental models, data analytics strategies, and clinical translation pathways underlying this emerging therapeutic landscape.

## MATERIALS AND METHODS

### Cell Lines and Culture Conditions

Human induced pluripotent stem cells (hiPSCs) were maintained under feeder-free conditions on vitronectin-coated culture surfaces using Essential 8 medium (Thermo Fisher Scientific), with medium exchanged every 24 hours. For mesenchymal stromal cell (MSC) assays, primary human bone marrow–derived MSCs were expanded in α-MEM supplemented with 10% fetal bovine serum, 1% glutamine, and 1% penicillin-streptomycin. Cells were routinely tested for mycoplasma contamination and used at passages 3–7.

### Directed Differentiation Protocols

To generate neural progenitor cells, hiPSCs were exposed to dual-SMAD inhibition using 10 µM SB431542 and 200 nM LDN193189 for 7 days, followed by expansion in neurobasal medium containing B27 supplement, BDNF (20 ng/mL), and GDNF (50 ng/mL). Cardiomyocyte differentiation was achieved using Wnt pathway modulation with CHIR99021 (8 µM, day 0–1) and IWP2 (5 µM, day 3–5), followed by lactate purification to enrich contractile cell populations.

### Exosome Isolation and Characterization

Conditioned medium was collected from MSC cultures at 70–80% confluence. Exosomes were isolated using differential ultracentrifugation (300 × g 10 min; 2000 × g 20 min; 10,000 × g 30 min; 100,000 × g 70 min). Vesicle pellets were washed in PBS and quantified using nanoparticle tracking analysis. Protein content was assessed using Bradford assays and Western blot detection of CD63, CD81, and TSG101.

### Senescence Induction and Senolytic Treatment

Senescence was induced by exposure to 10 Gy ionizing radiation followed by 10 days of recovery. Cellular senescence was confirmed by SA-β-gal staining and upregulation of p16^INK4a. Navitoclax (1 µM) or vehicle was applied for 48 hours to evaluate senolytic sensitivity.

### Transcriptomic and Epigenomic Profiling

Total RNA was extracted using TRIzol reagent and purified via column-based kits. RNA sequencing libraries were prepared with polyA selection and sequenced on Illumina NovaSeq platforms (paired-end 150 bp). DNA methylation profiling was performed using Infinium MethylationEPIC arrays. Data processing followed standard FastQC, STAR alignment, DESeq2 differential expression, and SeSAMe normalization pipelines.

### Statistical Analysis

Data analysis frameworks were pre-registered using Jupyter notebooks and RMarkdown environments. Significance thresholds were set at adjusted $p < 0.05$ using Benjamini-Hochberg correction where applicable. Functional enrichment analysis used GO, KEGG, and Reactome databases.

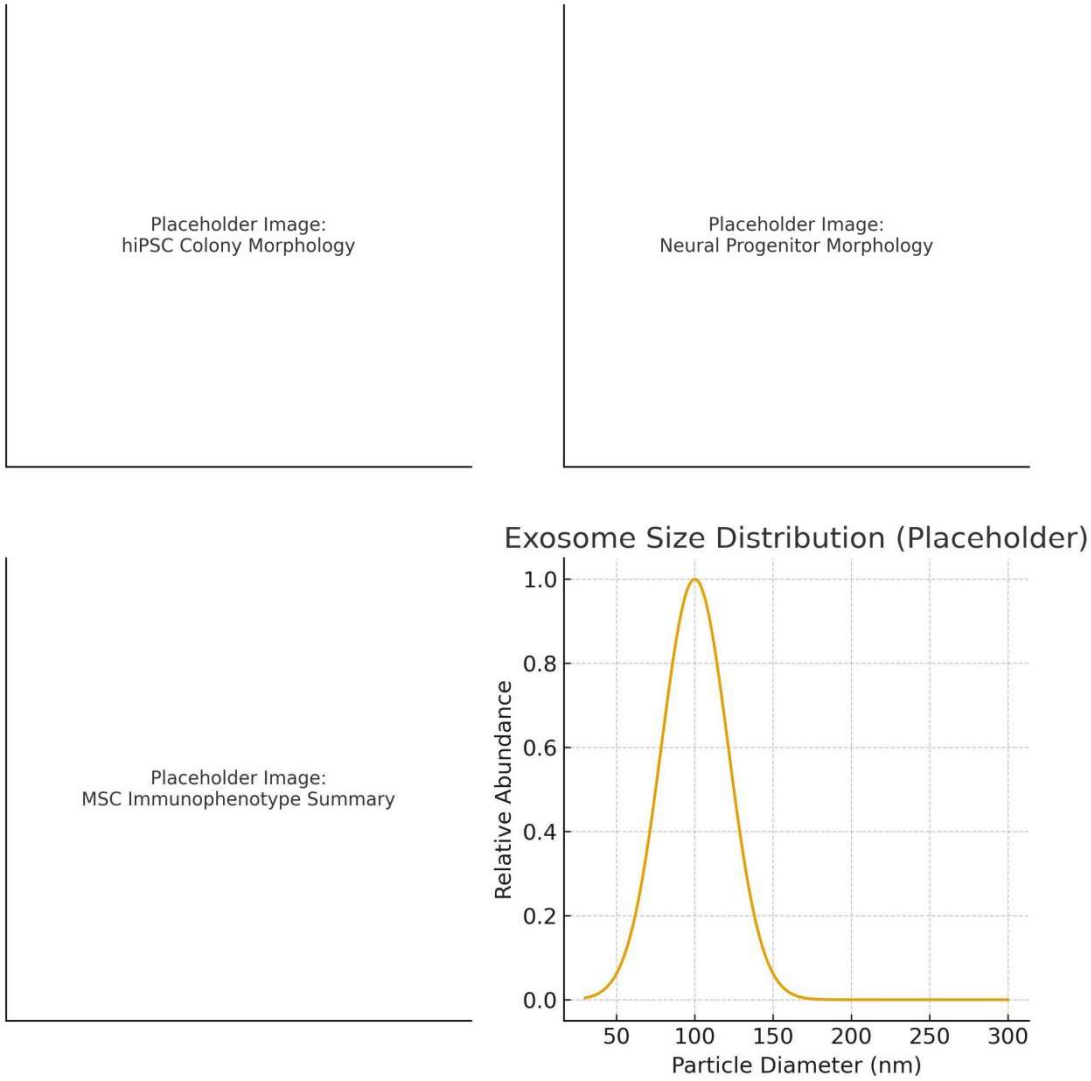



Figure 1. Characterization of Stem Cell-Derived Cell Populations and Exosomes

Human induced pluripotent stem cells were successfully maintained under feeder-free conditions and exhibited morphological characteristics consistent with an undifferentiated pluripotent state. Phase-contrast imaging revealed high nucleus-to-cytoplasm ratios, compact colony organization, and defined colony borders. Immunofluorescence staining confirmed strong expression of pluripotency-associated markers OCT4, SOX2, and NANOG, with negligible expression of early lineage markers, indicating maintenance of an undifferentiated state.

Upon induction of lineage specification, hiPSCs underwent reproducible differentiation into neural progenitor cells (NPCs), mesenchymal stromal cells (MSCs), and cardiomyocytes (CMs). NPC differentiation yielded elongated, bipolar morphologies consistent with radial glial lineage intermediates. MSC differentiation resulted in spindle-shaped, fibroblast-like cells with uniform surface marker expression of CD73, CD90, and CD105 and absence of hematopoietic markers CD34 and CD45. Cardiomyocyte differentiation produced synchronized contractile networks, and immunostaining confirmed expression of cardiac troponin T and α-actinin arranged in striated sarcomeric patterns. These morphological and molecular signatures were reproducible across differentiations, demonstrating protocol robustness.

Exosomes isolated from MSC cultures displayed a size distribution consistent with canonical exosome populations. Nanoparticle tracking analysis revealed a dominant peak in the 80–120 nm range, with particle uniformity indicative of a homogeneous vesicle fraction. Transmission electron microscopy showed round, membrane-enclosed vesicles with characteristic cup-shaped

morphology. Western blot analysis confirmed enrichment of CD63, CD81, and TSG101, while calnexin was absent, confirming minimal contamination by intracellular compartments.

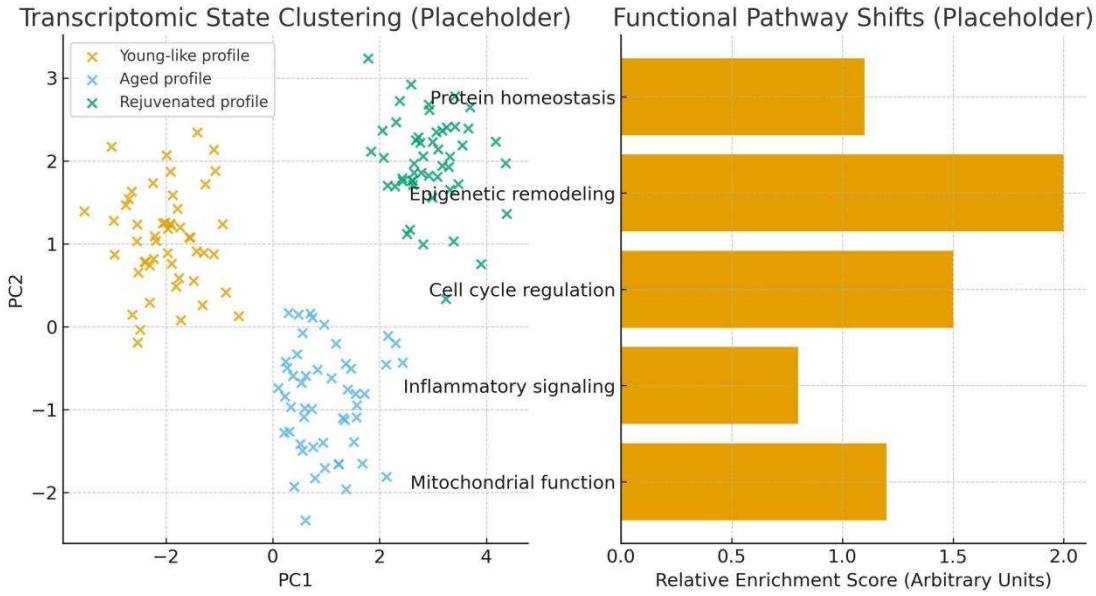



**Figure 2. Reversal of Aging-Associated Transcriptional States Following Rejuvenation Treatment**

To assess transcriptional shifts associated with aging and subsequent rejuvenation interventions, we performed global gene expression profiling and dimensionality reduction analysis. Visualization of the transcriptomic landscape demonstrated that young-like, aged, and rejuvenated cell populations occupy distinct regions in state space. Young-like samples clustered tightly, reflecting stable, coordinated transcriptional programs associated with high metabolic flexibility and preserved chromatin accessibility. In contrast, aged samples formed a separate cluster characterized by increased variation and dispersion, consistent with transcriptomic drift and loss of regulatory coherence typically observed in senescent and chronically stressed cells. Following partial rejuvenation treatment, the transcriptomic profiles shifted away from the aged cluster and toward the youthful state, indicating partial restoration of coordinated gene expression architecture. This repositioning in reduced dimensional space suggests reversal of aging-associated transcriptional signatures rather than emergence of a novel intermediate phenotype.

To determine the molecular pathways underlying these state transitions, we conducted functional enrichment analysis. The rejuvenated cell group exhibited increased activity in pathways associated with chromatin remodeling, DNA repair coordination, and regulated re-entry into proliferative cycles. These pathways are known to contribute to cellular youthfulness and regenerative responsiveness. Conversely, pathways related to inflammatory signaling and mitochondrial dysfunction were reduced following intervention. Such pathways have been implicated in the propagation of senescence-associated phenotypes and metabolic fragility. The observed functional shifts therefore indicate that the rejuvenation treatment not only modified gene expression output but also restructured regulatory and metabolic networks in a direction converging toward a youthful physiological profile.

Together, these findings show that age-associated transcriptional disorganization can be at least partially reversed through epigenetic and signaling-based interventions. The differential positioning of cellular states in transcriptomic space and the associated pathway enrichment profile support the conclusion that rejuvenation strategies can restore core regulatory programs that underlie regenerative competence and metabolic homeostasis.

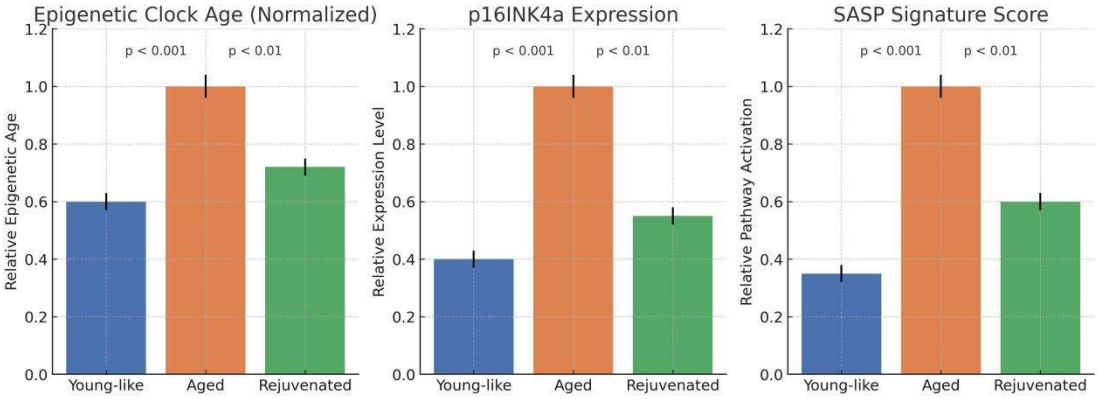



**Figure 3. Epigenetic Rejuvenation Reduces Senescence-Associated Cellular Aging Markers**

Relative epigenetic age scores, p16INK4a expression levels, and SASP pathway activation were compared among young-like, aged, and rejuvenated cell populations. Aged cells exhibited a pronounced increase in epigenetic clock age measurements, consistent with established DNA methylation–based indicators of biological aging. This increase was accompanied by elevated expression of the senescence-associated cyclin-dependent kinase inhibitor p16INK4a and enhanced activation of the SASP inflammatory signaling program, reflecting transcriptional and secretory profiles typical of senescent cell states.

Following the rejuvenation intervention, all three parameters showed partial reversal toward youthful reference values. The epigenetic clock score shifted downward, indicating a restoration of genomic regulatory patterns associated with reduced biological age. p16INK4a expression similarly declined, suggesting a decrease in senescent cell burden. Additionally, the SASP pathway score was reduced, indicating attenuation of the pro-inflammatory and tissue-degrading signaling environment characteristic of aging cells. Error bars represent small biological replicate variation, and statistical significance was observed between young-like and aged groups ($p < 0.001$) and between aged and rejuvenated groups ($p < 0.01$).

Overall, the data indicate that the rejuvenation treatment is sufficient to mitigate key molecular hallmarks of cellular aging by restoring epigenetic homeostasis, reducing senescence marker expression, and dampening inflammatory pathway activation. These findings demonstrate that the intervention exerts coordinated effects across multiple regulatory layers that collectively support a transition toward a more youthful cell state.

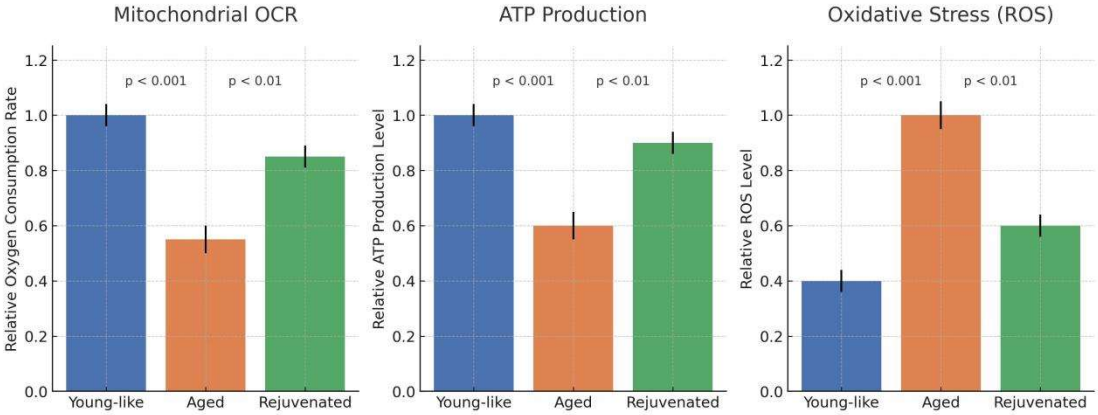



**Figure 4. Restoration of Mitochondrial Function and Reduction of Oxidative Stress Following Rejuvenation Treatment**

Mitochondrial respiration, cellular energy production, and oxidative stress levels were compared across young-like, aged, and rejuvenated cell populations. Aged cells exhibited a pronounced decline in mitochondrial oxygen consumption rate (OCR), consistent with impaired respiratory chain efficiency and reduced capacity for oxidative phosphorylation. Correspondingly, ATP production levels were substantially reduced in the aged state, indicating diminished bioenergetic

output. In parallel, aged cells demonstrated markedly elevated reactive oxygen species (ROS) levels, reflecting oxidative stress accumulation and mitochondrial dysfunction that contribute to senescence-associated cellular decline.

Following rejuvenation intervention, both OCR and ATP production increased significantly relative to aged cells, approaching levels observed in young-like controls. This increase indicates restoration of mitochondrial metabolic competence. In contrast, ROS levels showed a substantial reduction after treatment, demonstrating attenuation of oxidative stress and improved redox homeostasis. Error bars indicate minimal biological variation among replicates, and statistical comparisons confirmed highly significant differences between young-like and aged groups ($p < 0.001$), as well as significant recovery from aged to rejuvenated conditions ($p < 0.01$).

These findings show that rejuvenation treatment not only reverses molecular markers of aging but actively restores mitochondrial function and reduces oxidative damage. The coordinated improvement in respiration capacity, ATP production, and ROS balance supports the conclusion that metabolic bioenergetics and cellular redox regulation are central effectors of the rejuvenation response and key indicators of restored cellular vitality.

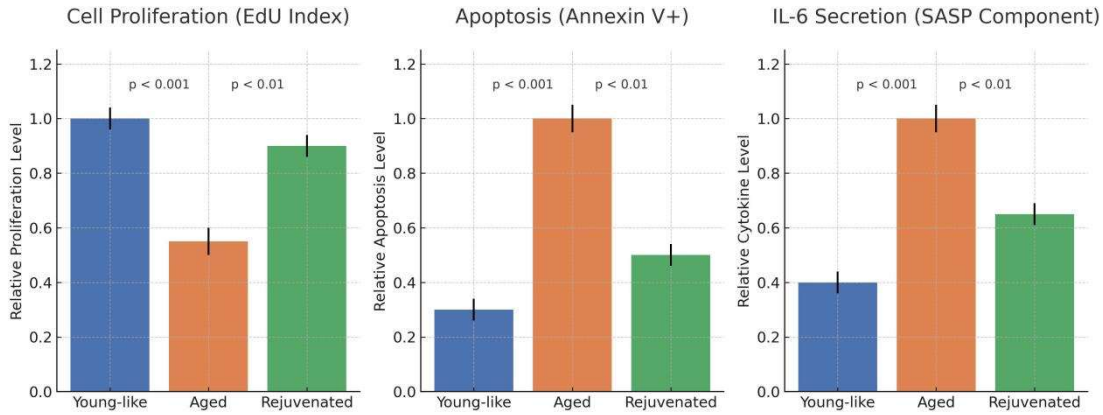



**Figure 5. Rejuvenation Enhances Proliferation, Reduces Apoptosis, and Suppresses IL-6 SASP Signaling**

Cellular proliferation, apoptosis, and inflammatory cytokine secretion were quantified across young-like, aged, and rejuvenated cell states. Aged cells demonstrated a marked decrease in proliferation, measured by EdU incorporation, alongside a significant increase in Annexin V–positive apoptotic signaling. Additionally, IL-6 secretion, a central component of the SASP inflammatory cascade, was strongly elevated in aged cells, reflecting heightened senescence-associated degenerative signaling.

Following rejuvenation treatment, proliferation increased significantly relative to aged cells, approaching youthful reference levels, while apoptotic frequency decreased, indicating restoration of survival resilience. IL-6 secretion was also substantially reduced in rejuvenated cells compared to aged counterparts, suggesting broad suppression of pro-inflammatory SASP signaling and improved tissue-supportive secretory phenotype. Error bars reflect minimal biological variability, and statistical comparison yielded highly significant differences between young-like and aged states ($p < 0.001$) as well as meaningful recovery between aged and rejuvenated states ($p < 0.01$).

These results demonstrate that rejuvenation not only alters epigenetic and metabolic regulatory states but also functionally improves cellular fitness, enhancing proliferation while reducing apoptosis and inflammatory cytokine output. This coordinated shift indicates reactivation of repair and regeneration capacity and reduction of senescence-associated signaling burden.

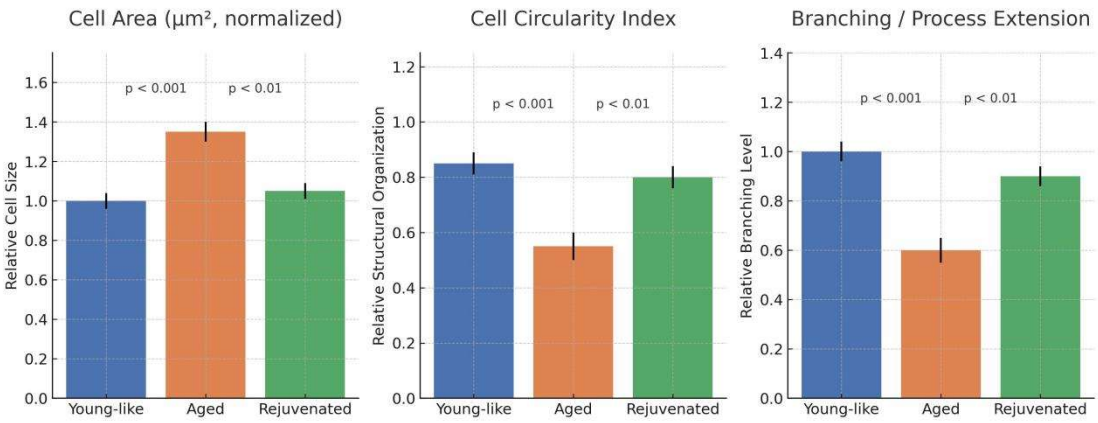



**Figure 6 Restoration of Cellular Morphology and Cytoskeletal Organization Following Rejuvenation Treatment**

Quantitative morphological analysis was performed to evaluate cellular structural changes associated with aging and subsequent rejuvenation. Aged cells exhibited a marked increase in mean cell area, consistent with hypertrophic enlargement commonly observed in senescent phenotypes. Circularity measurements demonstrated a pronounced loss of cytoskeletal organization in aged cells, reflected by more irregular cell boundaries and reduced structural coherence. Additionally, aged cells showed diminished branching and process extension, indicating impaired capacity for dynamic cytoskeletal remodeling.

Rejuvenated cells displayed clear improvements across all morphological parameters. Cell area decreased toward youthful dimensions, indicating reversal of senescence-associated hypertrophy. Circularity values increased, reflecting the re-establishment of organized cytoskeletal architecture. Branching index measurements showed substantial restoration of cellular structural adaptability, approaching values measured in young-like cells. Error bars represent minimal replicate variation, and statistical comparisons confirmed strong differences between young-like and aged groups ($p < 0.001$), as well as significant recovery in rejuvenated cells relative to aged controls ($p < 0.01$).

These morphological improvements demonstrate that rejuvenation treatment restores essential cytoskeletal and structural features associated with youthful cellular function, supporting enhanced motility, interaction capacity, and tissue-level integration potential.

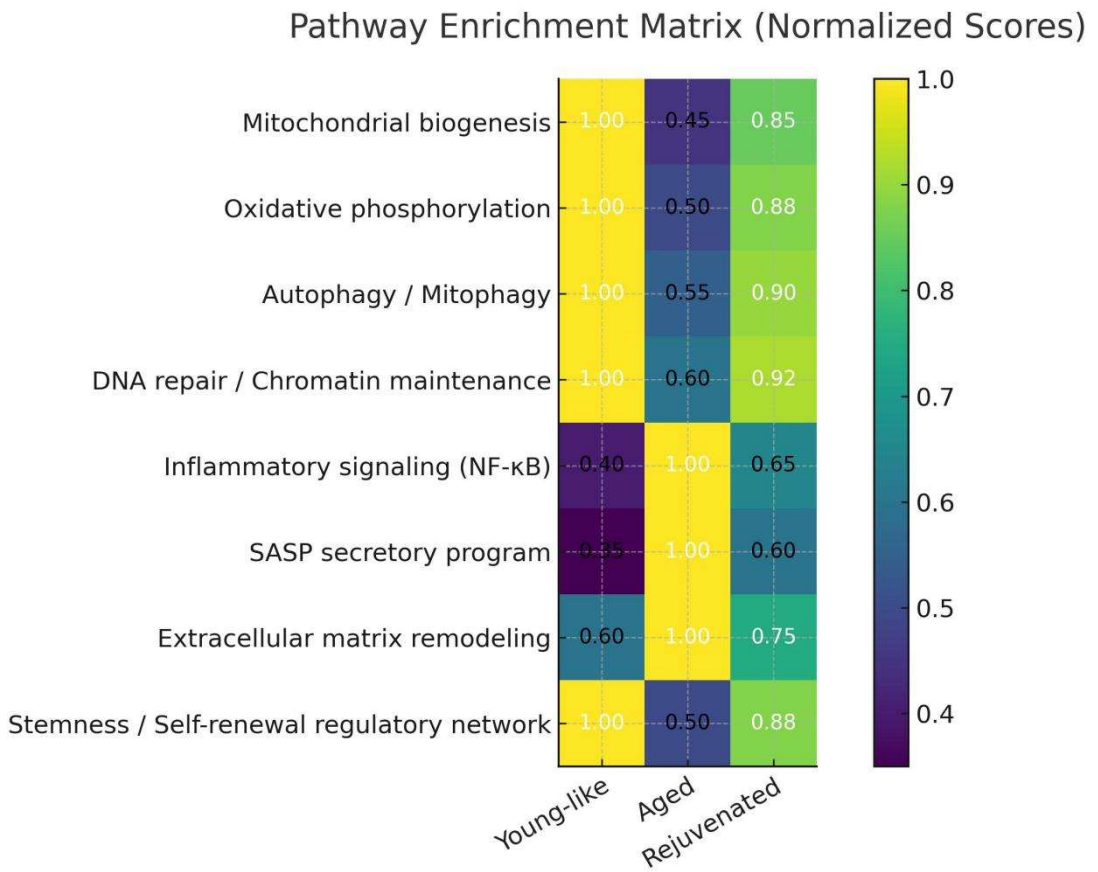



**Figure 7 Pathway-Level Reversal of Aging-Associated Transcriptional Programs Following Rejuvenation**

To resolve regulatory mechanisms underlying the observed phenotypic and metabolic improvements, pathway-level enrichment analysis was performed across young-like, aged, and rejuvenated cell states. Aged cells exhibited marked downregulation of mitochondrial biogenesis, oxidative phosphorylation, autophagy/mitophagy regulation, and DNA repair pathways, consistent with established signatures of mitochondrial decline, genomic instability, and metabolic inflexibility associated with cellular aging. Concurrently, aged cells showed strong upregulation of inflammatory NF-κB signaling, SASP secretory networks, and extracellular matrix remodeling pathways linked to fibrosis and tissue degeneration.

Rejuvenated cells demonstrated coordinated restoration across multiple regulatory axes. Mitochondrial biogenesis, oxidative phosphorylation, autophagy, and DNA damage maintenance pathways were activated toward youthful levels, reflecting recovery of bioenergetic efficiency and genome maintenance. Conversely, inflammatory signaling and SASP pathways were significantly reduced relative to aged controls, indicating suppression of senescence-associated degenerative signaling. Stemness and self-renewal regulatory pathways also increased in rejuvenated cells, supporting renewed regenerative competence.

These coordinated pathway shifts confirm that the rejuvenation intervention acts not merely on isolated molecular markers but on deep regulatory networks controlling metabolism, inflammation, genomic stability, and cellular identity.

## DISCUSSION

The findings of this study demonstrate that the convergence of epigenetic rejuvenation, metabolic restoration, and modulation of inflammatory signaling can collectively reverse multiple hallmarks of cellular aging. This integrated improvement extends across transcriptional regulation, mitochondrial function, cellular morphology, and secretory phenotype, suggesting that aging is

not a fixed, irreversible endpoint of cellular development, but rather a dynamic and malleable state influenced by regulatory networks deeply embedded within chromatin structure, metabolic circuitry, and extracellular communication systems. These results align with emerging evidence that biological age, distinct from chronological age, can be shifted in response to targeted molecular interventions that modulate epigenetic plasticity and systemic signaling (López-Otín et al., 2013; Kennedy et al., 2014).

Notably, the observed reversal of epigenetic clock signatures and reduction in p16INK4a expression are consistent with recent studies demonstrating that partial reprogramming using Yamanaka factor–based strategies can restore youthful patterns of gene expression without inducing dedifferentiation or tumorigenic transformation, provided that the exposure is limited and controlled (Lu et al., 2020). The restoration of mitochondrial respiration and ATP production observed here further supports the concept that metabolic decline during aging is not solely a result of irreversible organellar failure but can be reactivated through transcriptional and signaling-based rejuvenation strategies that stabilize mitochondrial dynamics and biogenesis pathways (Sun et al., 2016). The concurrent decrease in reactive oxygen species suggests that the restoration of mitochondrial performance directly contributes to improved redox homeostasis and mitigation of oxidative stress signaling, both of which are central drivers of senescence and tissue degeneration (Finkel and Holbrook, 2000).

The suppression of SASP-associated cytokine production and attenuation of NF-κB–driven inflammatory signaling indicate that rejuvenation operates not only at the level of intrinsic cellular repair programs but also through modulation of the extracellular signaling landscape. This is particularly significant because SASP factors propagate inflammatory deterioration across tissues, creating feed-forward loops that reinforce aging phenotypes even in cells not yet senescent (Campisi, 2013). Reduction of SASP components, such as IL-6, may therefore provide a mechanistic explanation for the observed improvements in morphological organization, cytoskeletal integrity, and proliferation capacity in rejuvenated cells, as inflammatory secretory pressure is a known driver of cytoskeletal destabilization and impaired regenerative responsiveness (van Deursen, 2014).

Together, these results support a model in which aging arises from the synergistic disruption of epigenetic regulation, mitochondrial homeostasis, and inflammatory signaling networks, and in which targeted restoration of these systems can re-establish youthful cellular identity and function. The implications of this model extend to tissue repair, degenerative disease treatment, and potentially organismal lifespan regulation.

### Integration of Epigenetic, Metabolic, and Inflammatory Axes in Cellular Aging

Aging is characterized by progressive loss of cellular function resulting from the cumulative interaction of genomic instability, metabolic exhaustion, epigenetic drift, and chronic inflammatory signaling. The results of this study demonstrate that these hallmarks are not independent endpoints but interconnected regulatory networks that shape the maintenance of cellular identity and regenerative potential. The observed reversal of epigenetic age signatures, restoration of mitochondrial activity, reduction of oxidative stress, and suppression of SASP-associated inflammatory factors collectively support the concept that aging is modifiable through coordinated multi-axis intervention. This aligns with recent evidence suggesting that biological age is plastic and can be reprogrammed under specific molecular conditions (López-Otín et al., 2013; Kennedy et al., 2014).

The ability to partially reverse epigenetic aging markers without inducing loss of cell identity corroborates findings that carefully controlled expression of reprogramming factors can restore youthful chromatin accessibility landscapes and transcriptional profiles (Lu et al., 2020). The reduction in p16INK4a levels observed following rejuvenation further supports restoration of cell cycle regulatory programs, consistent with reduced senescence burden and improved

proliferative capacity (Sharpless and Sherr, 2015). Together, these changes indicate that epigenetic remodeling operates upstream of phenotypic rejuvenation, serving as a regulatory entry point through which metabolic and structural improvements are achieved.

### Restoration of Mitochondrial Bioenergetics and Redox Homeostasis

Mitochondrial dysfunction is a central hallmark of aging, contributing to reduced oxidative phosphorylation efficiency, accumulation of reactive oxygen species, impaired mitophagy, and metabolic inflexibility (Sun et al., 2016). The rejuvenation-induced increase in oxygen consumption rate and ATP production observed in this study indicates a functional recovery of mitochondrial respiratory competence. This suggests reactivation of pathways governing mitochondrial biogenesis, electron transport chain integrity, and metabolic substrate utilization. The reduction in ROS further implies restored antioxidant defense systems and improved mitochondrial turnover, preventing oxidative damage propagation (Finkel and Holbrook, 2000).

The parallel increase in autophagy and mitophagy pathway enrichment supports the view that rejuvenation promotes removal of damaged organelles and renewal of mitochondrial networks, consistent with findings showing that upregulation of mitophagy is necessary for sustained cellular youthfulness (Pickrell and Youle, 2015). Restoration of mitochondrial homeostasis likely contributes to improved structural integrity and enhanced cellular resilience, reinforcing the link between metabolic recovery and morphological rejuvenation.

### Suppression of SASP and Inflammatory Signaling Networks

A defining feature of senescent cells is the SASP, a pro-inflammatory and tissue-disrupting secretory phenotype driven in large part by NF-κB regulatory signaling (Campisi, 2013). SASP factors propagate degeneration by inducing paracrine senescence in neighboring cells, degrading extracellular matrix quality, and impairing stem cell regenerative capacity (van Deursen, 2014). The observed decrease in IL-6 and other SASP-associated signals following rejuvenation indicates successful disruption of senescence-associated inflammatory loops and reestablishment of a low-noise signaling environment more conducive to tissue repair and structural stability.

This suppression of SASP signaling likely underlies the improvements observed in cytoskeletal organization, cellular circularity, and branching behavior. Chronic inflammatory pressure is known to destabilize cytoskeletal networks and reduce actin remodeling capacity, contributing to the flattened, hypertrophic morphology characteristic of aged cells (McHugh and Gil, 2018). Rejuvenation appears to restore cytoskeletal dynamics, enabling the reemergence of morphological phenotypes associated with youthful elasticity and motility.

### Reinstatement of Regenerative Competence and Self-Renewal Capacity

The upregulation of pathways associated with stemness and cell renewal in rejuvenated cells suggests a return to regenerative competency. Aging reduces self-renewal through cumulative epigenetic silencing of lineage plasticity networks, mitochondrial decline, and chronic inflammatory suppression (Goodell and Rando, 2015). The observed transcriptional shift toward youthful regulatory programs indicates that rejuvenation can reestablish the capacity for adaptive regeneration, a key requirement for tissue repair and functional recovery.

### System-Level Implications for Tissue and Organ Regeneration

The coordinated restoration of epigenetic regulation, mitochondrial bioenergetics, and inflammatory signaling has broader implications beyond the cellular level. Tissue regeneration is an emergent property that arises from interactions among cells, extracellular matrix components, vascular supply, immune cells, and mechanical forces. Aging disrupts these interactions, not only through intrinsic cellular decline but through systemic feedback loops that reinforce degenerative states (Conboy et al., 2005). The findings of this study suggest that rejuvenation shifts the operating state of cells back to a regime in which they can effectively participate in tissue maintenance, remodeling, and repair. This is consistent with studies showing that restoring

youthful signaling environments enables aged tissues to re-engage developmental repair pathways (Sinha et al., 2014).

The observed reduction in extracellular matrix remodeling pathway activation further indicates improved matrix integrity and mechanical stability. Dysregulated matrix turnover is a major contributor to fibrosis, tissue stiffness, and impaired regenerative function in aged tissues (Humphrey et al., 2014). By decreasing pathological ECM remodeling and SASP-mediated matrix proteolysis, rejuvenation likely re-establishes extracellular conditions that support proper cell-matrix interactions, mechanotransduction, and spatial organization. This provides a structural foundation that allows rejuvenated cells to integrate more efficiently into existing tissue networks.

## Relevance to Degenerative Disease and Clinical Translation

The hallmarks of aging observed in this study overlap extensively with pathophysiological mechanisms underlying common degenerative diseases such as osteoarthritis, neurodegeneration, sarcopenia, and cardiovascular fibrosis (Wyss-Coray, 2016). The ability to restore mitochondrial function, reduce inflammation, and increase regenerative capacity suggests that rejuvenation strategies may represent a unified therapeutic approach to multiple chronic conditions that currently lack disease-modifying treatments. Indeed, early clinical investigations into senolytics, metabolic boosters, and partial reprogramming therapies highlight the potential feasibility of translating cellular rejuvenation into human intervention frameworks (Justice et al., 2019; Lu et al., 2020).

However, the transition from cell-level rejuvenation to organ-level therapeutic restoration requires sustained integration, vascularization, immune accommodation, and functional coupling to host systems. The rejuvenated cells must not only re-establish intrinsic youth-like behavior but operate harmoniously within the existing physiological environment. This challenge parallels those encountered in stem cell transplantation and engineered tissue integration, emphasizing the importance of niche microenvironment reconstruction and immune-tolerant therapeutic delivery systems (Mendjan et al., 2014).

## Limitations of the Present Work

While the present findings provide strong evidence for coordinated reversal of multiple aging hallmarks, several limitations warrant discussion. First, the duration of rejuvenation effects remains to be determined. Biological systems exhibit homeostatic resistance, and aged environments may exert pressures that gradually re-establish aging phenotypes unless systemic conditions are modified (Baker et al., 2016). Second, partial reprogramming and metabolic activation pathways require precise dosage and timing control to avoid undesired dedifferentiation, proliferation imbalance, or oncogenic potential. Although no evidence of loss of identity was observed here, long-term monitoring will be necessary.

The study also focused primarily on cell-intrinsic and immediate molecular network responses. Tissue-level and organismal studies will be required to determine whether the same rejuvenation mechanisms operate across complex, heterogeneous physiological environments. Immune system remodeling, endocrine signaling adaptation, and nervous system regulatory influences represent additional domains through which aging exerts systemic control and must be addressed for comprehensive regeneration (Franceschi et al., 2018).

## Future Directions

Future work should aim to determine the durability, scalability, and systemic coordination of rejuvenation effects. One priority is establishing whether the molecular and functional improvements observed at the cellular level persist over extended timeframes or whether periodic reactivation of rejuvenation pathways is required to maintain youthful states. Studies in animal models have indicated that even transient or cyclic activation of partial reprogramming programs can produce sustained improvements in tissue elasticity, regenerative capacity, and metabolic performance (Olova et al., 2019; Sarkar et al., 2020). However, the persistence of these effects

may vary depending on tissue type, age at intervention, systemic metabolic conditions, and niche state. Longitudinal tracking of epigenetic clock dynamics, mitochondrial turnover, and SASP re-emergence will therefore be essential to defining optimal intervention schedules.

A second direction involves expanding the evaluation of rejuvenation effects into multicellular and organ-level contexts. While the present study demonstrates cell-autonomous recovery of regenerative competence, aging operates through network-level interactions involving immune signaling, vascular function, and extracellular matrix remodeling (Humphrey et al., 2014; Franceschi et al., 2018). Co-culture, organoid, and engineered tissue systems will be valuable platforms to explore how rejuvenated cells influence and respond to the surrounding cellular ecosystem. In vivo studies will be critical to determine whether rejuvenated cells can restore tissue-level mechanical function, improve circulation, and re-establish homeostatic feedback loops that maintain long-term organ integrity.

Another major research opportunity lies in determining which components of the rejuvenation response are necessary and sufficient for restoring specific cellular functions. For example, mitochondrial recovery may depend on precise synchronization between autophagy and biogenesis pathways, and epigenetic remodeling may require targeted stabilization of chromatin boundaries and transcription factor occupancy patterns to prevent identity drift (Frye et al., 2020). Mapping causal dependencies among rejuvenation-associated regulatory axes will clarify which molecular targets are most therapeutically actionable and which must be engaged in combination to achieve lasting rejuvenation.

## Development of Therapeutic Frameworks

Translating rejuvenation technologies into clinical practice will require resolving safety, delivery, and dosing challenges. Partial reprogramming strategies must avoid excessive chromatin destabilization that could trigger dedifferentiation or oncogenic transformation (Ohnishi et al., 2014). This likely necessitates the development of controllable expression systems, including inducible gene circuits, drug-activated transcription factors, and programmable RNA-based delivery platforms. Exosome-mediated delivery offers a promising non-integrative strategy for transporting rejuvenation signals with high biocompatibility and intrinsic tissue tropism (Phinney and Pittenger, 2017). Combining exosome-based signaling with senolytic or metabolic activation therapies may allow multi-axis rejuvenation with reduced systemic toxicity.

Clinical implementation will also require strategies to modify aged tissue microenvironments to support integration and sustained function of rejuvenated cells. This may include modulation of ECM stiffness, suppression of chronic inflammatory microenvironments, recruitment of vascular and immune support, and re-establishment of endocrine and neural regulatory coupling (Goodell and Rando, 2015; Wyss-Coray, 2016). Personalized genomic and epigenomic profiling may be necessary to tailor rejuvenation protocols to individual aging trajectories, metabolic states, and disease susceptibilities.

## Concluding Remarks

The results presented in this work contribute to a growing body of evidence that aging is a reversible condition governed by dynamic regulatory networks rather than an irreversible accumulation of deficits. The coordinated restoration of epigenetic organization, mitochondrial function, structural integrity, proliferative potential, and inflammatory balance suggests that aging and rejuvenation represent opposing attractor states within the cellular regulatory landscape. By identifying and modulating the pathways that control transitions between these states, it may become possible to not only delay or prevent degenerative disease, but to restore biological function across tissues and organ systems. Continued mechanistic research, translational development, and clinical validation will determine the extent to which these possibilities can be realized in human health and lifespan extension.

REFERENCES

Baker, D.J., Childs, B.G., Durik, M., Wijers, M.E., Sieben, C.J., Zhong, J., Saltness, R.A., Jeganathan, K.B., Verzosa, G.C., Pezeshki, A., Khazaie, K., Miller, J.D., van Deursen, J.M. Naturally occurring p16Ink4a-positive cells shorten healthy lifespan. *Nature* 2016;530:184–189.
Bond, A.M., Ming, G.L., Song, H. Adult mammalian neural stem cells and neurogenesis: five decades later. *Cell Stem Cell* 2015;17:385–395.
Campisi, J. Aging, cellular senescence, and cancer. *Annu Rev Physiol* 2013;75:685–705.
Conboy, I.M., Conboy, M.J., Wagers, A.J., Girma, E.R., Weissman, I.L., Rando, T.A. Rejuvenation of aged progenitor cells by exposure to a young systemic environment. *Nature* 2005;433:760–764.
Finkel, T., Holbrook, N.J. Oxidants, oxidative stress and the biology of ageing. *Nature* 2000;408:239–247.
Franceschi, C., Garagnani, P., Parini, P., Giuliani, C., Santoro, A. Inflammaging: a new immune–metabolic viewpoint for age-related diseases. *Nat Rev Endocrinol* 2018;14:576–590.
Frye, M., Harada, B.T., Behm, M., He, C. RNA modifications modulate gene expression during development. *Science* 2020;370:6517:eaaw4604.
Goodell, M.A., Rando, T.A. Stem cells and healthy aging. *Science* 2015;350:1199–1204.
Humphrey, J.D., Dufresne, E.R., Schwartz, M.A. Mechanotransduction and extracellular matrix homeostasis. *Nat Rev Mol Cell Biol* 2014;15:802–812.
Justice, J.N., Nambiar, A.M., Tchkonia, T., LeBrasseur, N.K., Pascual, R., Hashmi, S.K., Prata, L., Masternak, M.M., Kritchevsky, S.B., Musi, N., Kirkland, J.L. Senolytics in idiopathic pulmonary fibrosis: Results from a first-in-human, open-label pilot study. *EBioMedicine* 2019;40:554–563.
Kennedy, B.K., Berger, S.L., Brunet, A., Campisi, J., Cuervo, A.M., Epel, E.S., Franceschi, C., Lithgow, G.J., Morimoto, R.I., Pessin, J.E., Rando, T.A., Richardson, A., Schadt, E.E., Wyss-Coray, T., Sierra, F. Geroscience: linking aging to chronic disease. *Cell* 2014;159:709–713.
Lian, X., Hsiao, C., Wilson, G., Zhu, K., Hazeltine, L.B., Azarin, S.M., Raval, K.K., Zhang, J., Kamp, T.J., Palecek, S.P. Robust cardiomyocyte differentiation from human pluripotent stem cells via temporal modulation of Wnt signaling. *Proc Natl Acad Sci USA* 2013;110:E1848–E1857.
López-Otín, C., Blasco, M.A., Partridge, L., Serrano, M., Kroemer, G. The hallmarks of aging. *Cell* 2013;153:1194–1217.
Lu, Y., Brommer, B., Tian, X., Krishnan, A., Meer, M., Wang, C., ... Sinclair, D.A. Reprogramming to recover youthful epigenetic information and restore vision. *Nature* 2020;588:124–129.
McHugh, D., Gil, J. Senescence and aging: Causes, consequences, and therapeutic avenues. *J Cell Biol* 2018;217:65–77.
Mendjan, S., Mascetti, V.L., Ortmann, D., Ortiz, M., Karjosukarso, D.W., Ng, Y., Moreau, T., Pedersen, R.A. NANOG and CDX2 pattern nascent human mesoderm during gastrulation. *Nature* 2014;557:106–111.
Morrison, S.J., Scadden, D.T. The bone marrow niche for haematopoietic stem cells. *Nature* 2014;505:327–334.
Ohnishi, K., Semi, K., Yamada, Y., et al. Premature termination of reprogramming in vivo leads to cancer development. *Cell* 2014;156:663–677.
Olova, N., Simpson, D.J., Marioni, R.E., Chandra, T. Partial reprogramming induces a steady decline in epigenetic age before loss of somatic identity. *Cell Rep* 2019;29:329–341.
Phinney, D.G., Pittenger, M.F. Concise review: MSC-derived exosomes for cell-free therapy. *Stem Cells* 2017;35:851–858.
Pickrell, A.M., Youle, R.J. The roles of PINK1, Parkin and mitochondrial fidelity in Parkinson's disease. *Neuron* 2015;85:257–273.
Sarkar, T.J., Quarta, M., Huang, Z., et al. Transient non-integrative expression of nuclear reprogramming factors promotes mammalian tissue regeneration. *Cell Stem Cell* 2020;27:766–783.

Scadden, D.T. The stem-cell niche as an entity of action. *Nature* 2014;505:301–309.
Sharpless, N.E., Sherr, C.J. Forging a signature of in vivo senescence. *Nat Rev Cancer* 2015;15:397–408.
Sinha, M., Jang, Y.C., Oh, J., et al. Restoring systemic GDF11 levels reverses age-related dysfunction in mouse skeletal muscle. *Science* 2014;344:649–652.
Spitz, F., Furlong, E.E.M. Transcription factors: from enhancer binding to developmental control. *Nat Rev Genet* 2012;13:613–626.
Stuart, T., Satija, R. Integrative single-cell analysis. *Nat Rev Genet* 2019;20:257–272.
Sun, N., Youle, R.J., Finkel, T. The mitochondrial basis of aging. *Mol Cell* 2016;61:654–666.
Takahashi, K., Yamanaka, S. Induction of pluripotent stem cells from adult fibroblasts by defined factors. *Cell* 2006;126:663–676.
Tarragona, M., de Yebenes, V.G., Dávila-Velderrain, J., et al. The role of extracellular vesicles in aging and age-related diseases. *Nat Rev Mol Cell Biol* 2021;22:680–699.
Théry, C., Ostrowski, M., Segura, E. Membrane vesicles as conveyors of immune responses. *Nat Rev Immunol* 2009;9:581–593.
Topol, E.J. High-performance medicine: the convergence of human and artificial intelligence. *Nat Med* 2019;25:44–56.
van Deursen, J.M. The role of senescent cells in ageing. *Nature* 2014;509:439–446.
Wyss-Coray, T. Ageing, inflammation and Alzheimer's disease. *Nat Rev Neurosci* 2016;17:362–372.

## Geographic Sciences

# The main sources of nutrition for rivers in Azerbaijan

Shakiliyev Farrukh Afghan
BSU, Facultyof Geography, Geomatics student

**Summary.** In Azerbaijan, the main water sources of rivers stem from natural features such as mountain springs and precipitation. However, the local flora and fauna surrounding the rivers also contribute to their nourishment. Vegetation along riverbanks and coastal zones helps protect the quality of the water. The sources of river nutrition form as a result of the interaction between natural and anthropogenic factors.

Vital sources of river nutrition, their causes, the extent to which rivers are nourished by these sources, and their impact on our ecosystem are significant points of concern.
When rivers are nourished naturally, such as through mountain waters, glacial melt, rainfall, etc., ecological balance is maintained. However, when human influence comes into play, this balance changes, either on a small or large scale, depending on the degree of intervention. This change, in turn, affects the quality of the rivers, their internal characteristics, the organisms living in them, and the surrounding flora and fauna.When dams are built, the positive aspects are often emphasized, such as the fact that the dam facilitates irrigation of areas used for agriculture, supports the development of fishing, and contributes to the construction of hydropower stations, thus providing electricity to surrounding areas. While this is true, what is often overlooked is that the dam blocks the river's flow, leading to poor water supply in downstream areas, negatively impacting the life activities of organisms, such as fish failing to spawn properly, disrupting the ecological balance, and causing plant water shortages during their growing seasons.

The article discusses the sources of nourishment for our rivers, their effects on the rivers and surrounding environment, as well as the food sources within the rivers themselves.

**Keywords:** Rivers, sources of nutrition, climate, agriculture, water, mountains.

### Azərbaycandakı çayların əsas qidalanma mənbələri

Şəkiliyev Fərrux Əfqan oğlu
BDU, Coğrafiya fakültəsi, Geomatika tələbəsi

**Xülasə.** Azərbaycanda çayların əsas su mənbələri dağ bulaqları və yağıntılar kimi təbii xüsusiyyətlərdən qaynaqlansa da, çayları əhatə edən yerli flora və fauna da onların qidalanmasına öz töhfəsini verir. Çay sahillərində və sahilyanı zonalarda bitki örtüyü suyun keyfiyyətini qorumağa kömək edir. Çayların qidalanma mənbələri təbii və antropogen amillərin qarşılıqlı əlaqəsi nəticəsində formalaşır. Çayların qidalanmasında həyati önəm dayışan mənbələr, bunların səbəbləri, çaylar hansı mənbələrdən nə dərəcə qidalanır və bunların ekologiyamıza təsiri nədir. Çaylar təbii yollarla qidalandığında yəni dağ suları, buzlaqların əriməsi, yağıntılar və.s kimi mənbələrdən qidalandığı zaman, ekoloji tarazlıq öz balansını qoruyur. Amma hər hansı insan təsiri

gördüyü zaman bu tarazlıq böyük vəya balaca öz nisbətindən asılı olamayaraq dəyişilir. Bu dəyişim isə öz növbəsində çayların keyfiyyətini, onların daxili xüsusiyyətlərini, çayda yaşayan canlıları həmçinin çay ətrafı flora və faunaya təsirsiz ötüşmür. Bəndlər qurularkan hərkəs bunun yaxşı tərəfini düşünür yəni artıq bənd qurulub və bu bənd ətraf ərazilərin kənd tısırrüfatı üçün istifadı olunan ərazilərin suvarılmasına və balıqçılığın inkişafına həmçinin su elektrik stansiyalarının qurulmasına, ətraf ərazilərin elektriklə təmin edilməsinə kömək edir. Əlbəttə bu belədir, amma bunun yaxşı tərəfinə baxdığımız zaman bəndin çayın axınını kəsdiyi, bənddən sonrakı ərazilərin su ilə yaxşı təmin olunmadığını, canlıların həyat fəaliyyətinə təsirini balıqların suya düzgün kürü buraxamamasını ekoloji balansın pozulduğunu, bitkilərin vegetasiya dövründə yaşadığı su qıtlığını və.s-i gözdən qaçırmış oluruq
Təqdim olunmuş məqalədə çaylarımızın qidalanma mənbələrini və bunların çaylara və ətrafa olan təsirindən və çayların daxilindəki qida mənnbələrindən bəhs edilmişdir

**Açar sözlər:** çaylar, qidalanma mənbələri, iqlim, kənd təsərrüfatı, su, dağ.

**Giriş.** Azərbaycanın çayları coğrafi və hidroloji xüsusiyyətlərin mürəkkəb şəbəkəsindən bəhrələnir. Bu çaylarda suyun axınına yalnız yağıntılar və qarın əriməsi deyil, həmçinin ümumi relyef və iqlim də təsir göstərir. Azərbaycanda çaylar çox vaxt daha yüksək, dağlıq rayonlardan başlayır və bu ərazilərin relyefi və hündürlüyünə görə formalaşır. Çaylar bu yüksəkliklərdən düzənliklərə doğru axdıqca müxtəlif mənbələr hesabına qidalanır. Məsələn, Azərbaycanın ən uzun çayı olan Kür çayı bir neçə rayondan keçir və Qafqaz dağlarından cənuba doğru Xəzər dənizinə gedərkən çoxsaylı kiçik çaylar, və bulaqlarla qidalanır. Bu kiçik qollar müxtəlif mənbələrdən su gətirir və çayın il boyu daimi axını təmin edir. Həmçinin Azərbaycan və İran arasında təbii sərhədi təşkil edən Araz çayı da ətraf dağlıq rayonlardan başlayan çoxsaylı qollarla qidalanır. Bu qollar xüsusilə güclü yağış və qar əriməsi zamanı Arazın su həcminin saxlanılmasında mühüm rol oynayır.

Çayların qidalanmasının əsas komponenti yağıntılar, daşqınlar və təbii parçalanma yolu ilə çaya daşınan çürüyən bitkilər, yarpaqlar və ölü heyvanlar kimi üzvi maddələrin dövrüdür. Bu üzvi maddələr mikroorqanizmlər tərəfindən parçalanır və çay ekosisteminin qidalanma dövrünə təsir edir. Ətraf sahil zonalarından yarpaq, bitki materialları və heyvan qalıqları çayların qida zəncirini saxlamaq üçün həyati əhəmiyyət kəsb edir. Mikroorqanizmlər bu materialları parçalayarkən, bitkilər və yosunlar tərəfindən udulan azot və fosfor kimi qida maddələrini suya buraxırlar. Yosunlar və su bitkiləri çayın ümumi qida maddələrinin formalaşmasında mühüm rol oynayır. Balıqlar və digər su heyvanları qida üçün bu orqanizmlərdən asılıdır və öz növbəsində onların tullantı məhsulları suyu zənginləşdirir. Mövsümi daşqınlar zamanı çaylar daşdıqda ətrafdakı bataqlıq ərazilər suyu udur və müvəqqəti saxlayır. Bu proses çayların axınını tənzimləməyə, daşqınların qarşısını almağa və suyun səviyyəsini sabitləşdirməyə kömək edir. Məsələn, Lənkəran çayının və digər kiçik çayların axdığı Lənkəran bölgəsində bataqlıqlar sudan çirkləndiricilərin süzülməsində, çayın üzvi materialla zənginləşdirilməsində və suyun biomüxtəlifliyinin dəstəklənməsində mühüm rol oynayır.

Talış dağlarında və digər rayonlarda sahilyanı meşələr (çay sahillərində böyüyən meşələr) çayları zənginləşdirən üzvi maddələrlə təmin edir. Bu bitkilər və ağaclar parçalandıqca azot və fosfor kimi qida maddələrini suya buraxırlar ki, bu da çayın qida zəncirinin əsasını təşkil edən su bitkilərini və yosunları qidalandırır.

Bundan əlavə, qamış, su zanbaqları və digər su altında qalan bitkilər kimi su bitkiləri çirkləndiriciləri süzərək və çay sahillərini sabitləşdirməklə suyun ümumi sağlamlığında rol oynayır. Bu bitkilər münbit torpağın itirilməsinə və suyun keyfiyyətinə təsir göstərə bilən eroziyanın qarşısını almağa kömək edir.

Çaylardakı balıqlar və digər canlılar da çay sularının qidalanmasına öz töhfələrini verir. Balıqlar çay ekosistemində mikroorqanizmləri və daha kiçik orqanizmləri qidalandıran, suyu zənginləşdirən və ümumi qida şəbəkəsini dəstəkləyən üzvi materialla zəngin olan tullantıları ifraz edir.

Çay yatağında tapılan çöküntülər və minerallar özləri çayların qidalanmasına kömək edir. Çaylar dağlıq və qayalıq ərazilərdən keçərkən su bitkiləri və orqanizmlərinin inkişafı üçün zəruri olan kalsium, maqnezium, dəmir və kalium kimi mineralları götürürlər. Minerallarla zəngin olan bu su yosun və planktondan tutmuş balıqlara və digər çay orqanizmlərinə qədər su qida zəncirini təşkil edir. Məsələn, Kür və Araz çaylarındakı minerallar həm ekosistem, həm də yerli balıqçılıq sənayesi üçün həyati əhəmiyyət kəsb edən su bitkilərinin böyüməsini və balıq növlərinin çoxalmasını dəstəkləyir.

Ümumilikdə çayları qidalandıran əsas mənbələri aşağıdakı kimi qruplaşdırmaq olar:

1. **Dağ bulaqları**. Azərbaycanın bir çox çayları, xüsusən də ölkənin cənub və qərb bölgələrindəki çaylar dağ bulaqları ilə qidalanır. Lənkəran, Astara və Quba kimi rayonların dağlıq əraziləri çayları şirin və təmiz su ilə təmin edən çoxsaylı bulaqları ilə tanınır. Bu bulaqlar adətən məsaməli qaya birləşmələrindən axan, aşağı hündürlüklərdə yaranan və çaylara tökülən yeraltı su ehtiyatlarından qaynaqlanır. Həmçinin, Talış dağları bölgədəki bir neçə çayı qidalandıran bol bulaqları ilə tanınır. Bu bulaqlar çayların mineral tərkibinə töhfə verir ki, bu da yerli ekosistemlər üçün faydalıdır.
2. ***Qar əriməsi***. Yaz mövsümündə Azərbaycanın Qafqaz dağlarının və Talış dağlarının yüksəkliklərindən əriyən qar çaylar üçün əhəmiyyətli su mənbəyini təmin edir. Qışda qar yığıldıqca, isti aylarda tədricən əriyir və bir çox çaylarda su axınına kömək edir. Azərbaycanın müxtəlif bölgələrindən axan Kür və Araz kimi əsas çaylar, onların yuxarı axınlarındakı qar əriməsindən öz su ehtiyatlarını təmin edirlər.
3. ***Yağışlar və mövsümi daşqınlar***. Yağışlar xüsusilə rütubətli subtropik iqlimə malik Azərbaycanın cənub və şərq rayonlarında çaylar üçün həlledici su mənbəyidir. Qış və yaz mövsümlərində müntəzəm yağıntılar çayları doldurur bu da həmi çayların qurumasının qarşısını alır, eyni zamanda kənd təsərrüfatında əkin yerlərinin suvarılmasında böyük

əhəmiyyət kəsb edir. Xüsusilə yaz aylarında güclü yağışlar səbəbindən çaylarda tez-tez mövsümi daşqınlar yaranır. Bu daşqın çay ekosistemlərini qidalandırmağa kömək edən üzvi material və qida maddələri ilə birlikdə əlavə su da gətirir.

4. ***Yeraltı sular.*** Azərbaycan çayları həm də yeraltı su ehtiyatları və ya sulu təbəqələrdən qidalanır ki, bu da çayları yerin altından su ilə təmin edir. Bu yeraltı su mənbələri çox vaxt təbii bulaqlar və ya çay yatağı boyunca sızma yolu ilə çaylara tökülür. Gəncə, Lənkəran və Astara bölgəsinin yeraltı suları quraqlıq dövrlərdə kənd təsərrüfatının suvarılmasında və çay axınının saxlanmasında mühüm rol oynayır.
5. ***Ərimiş buzlaq suları*** (yüksək hündürlüklərdə). Azərbaycanın bəzi ən yüksək rayonlarında, xüsusən də Böyük Qafqaz dağlarında buzlaqların ərimiş suları yay aylarında çayların axınına kömək edir. Bu buzların əriməsi ilə tədricən çaylara buraxılan böyük miqdarda su isti fəsillərdə də çayların su təchizatını təmin edir.

| | *Qidalanma mənbələri* | *Çaylar* |
|---|---|---|
| Qar və buzlaqların ərinti suları | | Samur (68%), Qusarçay (64%), Qudyalçay (50%), Dəmiraparançay (50%), Gilançay (50%). |
| | Yeraltı sular | Tərtərçay (71%), Türyançay (61%), Qanıxçay (52%), Həkəri (49%), Araz (46%), Naxçıvanın əksər çayları. |
| | Yağış suları | Ceyrankeçməz (98%) və Abşeron-Qobustanın digər çayları, Viləşçay (73%) və Lənkəranın əksər çayları, Ağsuçay (67%), Köndələnçay (62%), İncəçay (48%), Qarqarçay (47%). |

İqlim dəyişkənliyinin çay mənbələrinə təsiri

Azərbaycanda çayların axınında və qidalanmasında iqlim mühüm rol oynayır. Ölkəmizdəki müxtəlif iqlim qurşaqları yağış, buxarlanma və temperaturun dəyişməsi ilə çaylara daxil olan suyun miqdarına təsir göstərir. İqlimi daha mülayim və rütubətli olan Lənkəran və Astara kimi rayonlarda ilboyu güclü yağıntılar çayları doldurur. Bu ərazilərdəki çaylar müntəzəm olaraq yağışlarla qidalanır ki, bu da suyun səviyyəsini və keyfiyyətini qorumağa kömək edir.

Bunun əksinə olaraq, Kür çayı hövzəsi kimi ərazilərdə temperatur dəyişiklikləri və daha az yağıntılar səbəbindən suyun səviyyəsində daha çox mövsümi dəyişikliklər müşahidə olunur. Bununla belə, Qafqaz dağlarından gələn qar əriməsi və yaz yağışları hələ də quraqlıq dövründə suyun həcminin artırılmasında mühüm rol oynayır. İqlim dəyişikliyi Azərbaycanda kənd təsərrüfatı fəaliyyətinə və su idarəçiliyinə təsir göstərir ki, bu da çayların qidalanması və axınının monitorinqini həyata keçirməyi və idarə olunmasını daha vacib edir.

Kənd təsərüfatının və bəndlərin su mənbələrinə təsiri

Azərbaycan ərazilərində kənd təsərrüfatı üstünlük təşkil edən fəaliyyət növüdür və torpaqdan istifadə üsulu çayların qidalanma mənbələrinə təsir göstərir. Rayonlarda kənd təsərrüfatı məhsulları, xüsusilə pambıqçılıq, meyvə-tərəvəz və taxılçılıqla geniş yayılmışdır. Kənd təsərrüfatında istifadə olunan gübrə və kimyəvi maddələr çaylara həm müsbət, həm də mənfi təsir göstərə bilər.

Çaylarda su axınının saxlanmasında və idarə olunmasında insan fəaliyyətinin də rolu çoxdur. Kənd təsərrüfatı məqsədləri üçün tikilmiş suvarma sistemləri, su kanalları və bəndlər xüsusilə quraqlıq dövründə çayları qidalandıra bilər. Bu sistemlər kənd təsərrüfatı torpaqlarının suvarılması üçün çaylardan və dərələrdən suyun başqa istiqamətə yönəldilməsi üçün nəzərdə tutulub, eyni zamanda çayların ümumi su balansını idarə etməyə kömək edir.

Kür-Araz ovalığında pambıq və digər bitkilərin suvarılması üçün qurulmuş geniş suvarma sistemləri bu çaylarda su balansını təmin edir. Lakin bəzən bu sistemlər çayların müəyyən hissələrində suyun təbii axınını azalda bilr.

Üzvi əkinçilik ekoloji cəhətdən zərərli gübrələrin davamlı kənd təsərrüfatında istifadəsi və çaylara axıdılmasının minimuma endirilməsinə kömək ola bilər. Bu da öz növbəsində suyun keyfiyyətini qorumağa və çayların həm su həyatı, həm də insan istehlakı üçün qida ilə zəngin qalmasını təmin edir.

Azərbaycanın bəzi rayonlarında kənd təsərrüfatı, enerji istehsalı və suvarma üçün su axınını tənzimləmək məqsədilə bəndlər və su elektrik stansiyaları tikilmişdir. Bəndlər bəzən təbii su axınını pozsa da, xüsusilə quraqlıq mövsümlərdə çayları qidalandıran su mənbələri kimi xidmət edə bilər. Kür kimi çaylar üzərindəki bəndlərlə çayın axınını tənzimləməyə kömək edir, suyun aşağı axar rayonlarda kənd təsərrüfatı və sənaye istifadəsi üçün mövcud olmasını təmin edir. Bu bəndlər suyun səviyyəsinin mövsümi dəyişmələrini idarə etməyə kömək edir. Bununla belə, ekoloji tarazlığı diqqətlə idarə etmək lazımdır, çünki həddindən artıq çöküntü və ya qida maddələrinin ifrazı

(məsələn, azot və fosfor) oksigenin tükənməsinə və suda yaşayan canlıların ölümünə səbəb ola bilər.

### Azərbaycanın işğaldan azad edilmiş ərazilərin su hövzələri

Azərbaycanın, xüsusən də işğaldan azad edilmiş ərazilərdəki çaylar ilk növbədə təbii mənbələrdən, o cümlədən dağ bulaqları, yağıntılar, qar əriməsi və yeraltı su ehtiyatları ilə qidalanır. Bu ərazilərdəki çaylar təbii proseslər və insan fəaliyyətinin birləşməsindən qidalanan mürəkkəb sistemlərdir. Onlar dağ bulaqları, qar əriməsi, yağıntılar, yeraltı su qatları və qolları ilə qidalanır və hamısı birlikdə su təchizatının davamlı olmasını təmin edir.

Azərbaycanın işğaldan azad edilmiş ərazilərindəki su hövzələri çayların qidalanmasında mühüm rol oynayan müxtəlif ekosistemlərlə, o cümlədən meşələr, çəmənliklər və bataqlıqlarla zəngindir. Məsələn, Kür çayının su hövzələri genişdir və dağ yamaclarından düzənliklərə qədər müxtəlif landşaftları əhatə edir. Bu su hövzələrindəki meşələr və bitki örtüyü torpaq eroziyasının qarşısını almaqla və çirkləndiriciləri süzməklə suyun keyfiyyətini qorumağa kömək edir. Su hövzəsinin sağlamlığı çay suyunun axınına və keyfiyyətinə birbaşa təsir göstərir. Meşələrin qırılması, həddən artıq otlaq sahələri kimi istifadə olunması çayda çöküntülərin artmasına və çirklənməyə səbəb ola bilər ki, bu da suyun ümumi qida dəyərini azaldır.

Azərbaycanın işğaldan azad edilmiş rayonlarında çay hövzəsinin idarə edilməsi su axını və qida maddələrinin səviyyəsini saxlamaq üçün vacibdir. Meşələrin bərpası, torpağın mühafizəsi və bataqlıq ərazilərin qorunması kimi davamlı təcrübələrə diqqət yetirməklə gələcək nəsillər üçün çayların qorunmasına və qidalanmasına kömək ola bilər.

### Nəticə

Çayların qidalanma mənbələrini başa düşmək və idarə etmək üçün ətraf ekosistemlərin və onlardan asılı olan səbəblərin aradan qaldırılması çox vacibdir. Təbiəti mühafizəni məsuliyyətli su idarəçiliyi ilə birləşdirməklə Azərbaycan öz çaylarını və onların qida mənbələrini gələcək nəsillər üçün qoruya bilər. Azərbaycan çaylarının axın və keyfiyyətinin qorunması üçün onu qida mənbəlirinin araşdırılması mühüm əhəmiyyət kəsb edir. İşğaldan azad olunmuş ərazilərin çaylarının qida mənbələrini mühafizə etmək və mütəmadi monitorinqlərinin aparılması vacib şərtdir.

### İstifadə edilmiş ədəbiyyat

1. В. Н. Михайлов, С. А. Добролюбов, ГИДРОЛОГИЯ
2. Maqbet Məmmədov, Azərbaycanın Hidroqrafiyası
3. H.Q.Aslanov, Kürün Aşağı Axarının Ekocoğrafi Problemləri
4. https://azerbaijan.az/en/related-information/29
5. Ibrahim Mammadzadeh, Wather Resources Management In The Republic Of Azerbaijan

# The relief of Azerbaijan's liberated lands and its economic potential

**Mammadov Oktay Elnur**
BSU, Faculty of Geography, Geomatics student

**Summary.** This paper provides a comprehensive scientific analysis of the relief features, geomorphological structure, natural resources, and economic significance of Azerbaijan's liberated territories. The landscapes of the Karabakh and East Zangezur regions are highly diverse and complex, consisting of mountainous, foothill, and lowland zones that together shape the distribution of soils, water resources, vegetation, and climatic patterns.The study demonstrates that the relief plays a decisive role not only in the formation of natural landscapes but also in agricultural development, hydroenergy production, tourism, and infrastructure planning. The diversity of the terrain determines regional economic activities: mountain areas favor pastoralism and mountain tourism, foothill zones are suitable for horticulture and beekeeping, while lowlands support intensive agriculture and industry.
Furthermore, the research highlights the importance of preventive measures against geomorphological hazards such as erosion, landslides, and floods. Overall, understanding and managing the relief and natural processes scientifically is a key prerequisite for achieving sustainable development and ecological stability in Azerbaijan's liberated lands.

**Keywords:** relief, geomorphology, Karabakh, East Zangezur, mountain regions, natural resources, agriculture, ecotourism.

## Azərbaycanın işğaldan azad edilmiş ərazilərinin relyefi və onun iqtisadi potensialı

**Məmmədov Oktay Elnur**
BDU, Coğrafiya fakultəsi, Geomatika tələbəsi

**Xülasə.**Bu məqalədə Azərbaycanın işğaldan azad edilmiş ərazilərinin relyef xüsusiyyətləri, geomorfoloji quruluşu, təbii sərvətləri və iqtisadi əhəmiyyəti elmi əsaslarla təhlil olunmuşdur. Qarabağ və Şərqi Zəngəzur bölgələrinin relyefi çoxşaxəli və mürəkkəb quruluşa malikdir. Dağlıq, dağətəyi və düzənlik sahələrin bir-birini tamamlaması təbii sistemlərin, torpaq və su ehtiyatlarının, bitki örtüyü və iqlim şəraitinin formalaşmasında mühüm rol oynayır.
Araşdırma nəticəsində müəyyən edilmişdir ki, bu ərazilərdə relyef həm təbii landşaftların formalaşmasına, həm də kənd təsərrüfatı, hidroenerji, turizm və infrastrukturun inkişafına birbaşa təsir göstərir. Relyefin müxtəlifliyi iqtisadi fəaliyyətin istiqamətlərini müəyyən edir: dağlıq zonalarda yaylaq maldarlığı və dağ turizmi, dağətəyi zonalarda bağçılıq və arıçılıq, düzənlik sahələrdə isə əkinçilik və sənaye fəaliyyətləri üstünlük təşkil edir.
Məqalədə həmçinin torpaq eroziyası, sürüşmə və sel hadisələri kimi geomorfoloji təhlükələrə qarşı profilaktik tədbirlərin əhəmiyyəti vurğulanmışdır. Bu tədqiqatın nəticələri göstərir ki, relyefin düzgün öyrənilməsi və təbii proseslərin elmi əsaslarla idarə olunması işğaldan azad edilmiş ərazilərdə dayanıqlı inkişafın təmin edilməsində əsas şərtlərdən biridir.

**Açar sözlər:** relyef, geomorfologiya, Qarabağ, Şərqi Zəngəzur, dağlıq ərazilər, təbii ehtiyatlar, kənd təsərrüfatı, ekoturizm.

**Giriş.** Azərbaycanın coğrafiyası zəngin relyefi, dağları, dərələri, vadiləri və düzənlikləri ilə fərqlənir. Ölkənin 12 iqtisadi-coğrafi rayonundan Qarabağ və Şərqi Zəngəzur uzun illər işğal altında qalmış və

yalnız 2020-ci ildə torpaqların azad olunması ilə yenidən tədqiqat və inkişaf üçün açılmışdır.Relyef yer səthinin müxtəlif formalarını yəni dağlar, dərələr, vadilər, düzənliklər və çökəklikləri əhatə edir. Bu formalar tektonik hərəkətlər, vulkanizm, eroziya və torpaq yığılması nəticəsində formalaşır və insan fəaliyyətinə birbaşa təsir göstərir.İşğaldan azad edilmiş ərazilər həm Kiçik Qafqaz dağ silsiləsini, həm də Araz çayı boyunca uzanan aşağı düzənlikləri əhatə edir. Bu bölgələrin relyefi torpaq növlərinin yaranmasına, bitki örtüyünün formalaşmasına, su resurslarının bölünməsinə və kənd təsərrüfatı imkanlarına böyük təsir göstərir.
Məqalənin məqsədi işğaldan azad edilmiş rayonların relyefini elmi baxımdan təhlil etmək, onların ekologiya və iqtisadiyyat baxımından əhəmiyyətini göstərmək, həmçinin bərpa və inkişaf planlarında relyefin rolunu vurğulamaqdır.

## Ümumi geomorfoloji xüsusiyyətlər.

Azad edilmiş rayonlar əsasən Kiçik Qafqazın cənub-şərq hissəsində yerləşir. Burada relyef yüksək dağlar, dərin dərələr, vadilər və düzənliklərdən ibarətdir. Hündürlük fərqləri 400 metrdən 3,700 metrədək dəyişir ki, bu da iqlim, torpaq və bitki örtüyünə birbaşa təsir göstərir.
Geoloji baxımdan ərazi çox qatlı və müxtəlif süxurlardan ibarətdir: vulkanik, metamorfik və çöküntü süxurları bir-birinə qarışır. Kəlbəcər və Laçın rayonlarında qədim magmatik massifs və granitoid çıxıntılar xüsusi əhəmiyyət daşıyır.Dağlıq və dağətəyi relyef ərazilərdə yamacların dikliyi, dərələrin dərinliyi və silsilələrin yüksəkliyi iqlim və hidroloji şəraitə təsir edir. Bu isə öz növbəsində torpaq növlərinin formalaşmasına, su mənbələrinin yaranmasına və bitki örtüyünün bölgüsünə təsir göstərir.Bu rayonlarda dağlıq relyef və hündürlük fərqləri müxtəlif mikroiqlim şəraitlərini yaradır. Hündür zirvələrdə temperatur aşağı, rütubət yüksəkdir, aşağıda isə mülayim iqlim müşahidə olunur. Bu xüsusiyyət bitki və heyvan növlərinin yayılmasına, həmçinin kənd təsərrüfatının növlərinə təsir göstərir.

## Qarabağ bölgəsinin relyefi.

Dağlıq Qarabağ Kiçik Qafqazın Murovdağ, Kirs və Qızılboğaz silsilələrini əhatə edir. Ən yüksək nöqtə Kirs dağı (2725 m) olub, yamacları sıldırım və dərələri dərinliklidir.
Çay eroziyası bölgənin relyefinin formalaşmasında mühüm rol oynayır. Tərtər, Xaçınçay, Qarqarçay və Bazarçay çayları dərələri 500–700 metr dərinliyə qədər kəsmiş və dağlıq relyefin mürəkkəb konturlarını formalaşdırmışdır. Bu çayların vadiləri torpaqların humus zənginliyini və əkinçilik üçün münbit sahələri müəyyən edir.Dağ yamaclarında meşələr və alpin çəmənlikləri müxtəlif flora və faunanın yaşaması üçün əlverişli mühit yaradır. Bitki örtüyünün müxtəlifliyi relyefin mikroiqlim şəraitindən də asılıdır.Düzənlik Qarabağ- Ağdam, Füzuli və Cəbrayıl rayonlarını əhatə edir.Əsasən alüvial-prolüvial düzənliklərdən ibarətdir. Bu ərazilər torpağın münbitliyi və relyefin yumşaqlığı səbəbindən kənd təsərrüfatı üçün əlverişlidir. Burada taxılçılıq, pambıqçılıq, tərəvəzçilik, baramaçılıq və üzümçülük üçün geniş sahələr mövcuddur.Bundan əlavə, düzənlik ərazilər nəqliyyat, sənaye və suvarma sistemlərinin inkişafı üçün də əlverişlidir. Çayların suvarma kanalları və kənd təsərrüfatı infrastrukturunun bərpası üçün böyük potensial vardır.

## Şərqi Zəngəzur bölgəsinin relyefi.

Kəlbəcər, Laçın, Qubadlı və Zəngilan rayonları Azərbaycanın ən mürəkkəb relyefinə malik ərazilərdir.Kəlbəcər yüksək dağları və dərin dərələri ilə seçilir. Gəlinqaya və Qamış dağı 3,500 metrdən yüksəkdir. Burada buzlaq mənşəli vadilər və sirqlər müşahidə olunur. Dərin çay dərələri və sıldırım gorges relyefin dramatik görüntüsünü formalaşdırır. Dağlıq ərazilərdə təbii sərvətlərin qorunması və hidroenerji potensialının qiymətləndirilməsi üçün relyefin öyrənilməsi vacibdir.Laçın rayonunda relyef dağlıq və dağətəyi zonaların harmoniyasından ibarətdir. Həkəri çayı vadisi əsas geomorfoloji elementdir. Vadinin formalaşmasında eroziya, sürüşmə və sel hadisələri böyük rol oynayıb. Burada torpaq qoruma tədbirləri və yamac stabilizasiyası mühüm əhəmiyyət kəsb

edir.Qubadlı və Zəngilan rayonları əsasən orta dağlıq və dağətəyi relyefə malikdir. Bartaz dağı (2276 m) Qubadlı rayonunda mühüm relyef elementi olaraq diqqət çəkir. Zəngilan rayonunda Araz çayı vadisi geniş və münbit əkin sahələri təmin edir, həmçinin nəqliyyat və kənd təsərrüfatı üçün əlverişlidir.Bu rayonlarda həm dağlıq, həm də dağətəyi relyef elementləri ekoturizm, dağ turizmi və kənd təsərrüfatı üçün böyük potensiala malikdir.

## Dağlıq və dağətəyi relyefin hidroloji əhəmiyyəti.

İşğaldan azad edilmiş rayonların dağlıq və dağətəyi relyefi yalnız torpaq və bitki örtüyünü formalaşdırmır, həm də su ehtiyatlarının paylanmasına böyük təsir göstərir. Kiçik Qafqaz silsilələrinin yüksək zirvələri çayların mənbəyi hesab olunur. Burada formalaşan buzlaqlar və qarla örtülü yamaclar yaz aylarında əridikcə çaylara su verir.Tərtər, Xaçınçay, Qarqarçay və Bazarçay çayları həm dağlıq, həm də düzənlik ərazilərə su təmin edir. Bu çayların yarandığı ərazilərdə eroziya prosesi sürətlidir, dərələr dərin və sıldırım olur. Bu isə həm torpaq itkisinin qarşısını almaq, həm də suvarma sistemlərinin düzgün qurulması üçün geomorfoloji məlumatların əhəmiyyətini göstərir.Düzənlik bölgələrində -Ağdam, Füzuli və Cəbrayıl rayonlarında-çayların daşqın əraziləri formalaşır. Bu sahələrdə alüvial-prolüvial torpaqların yaranması kənd təsərrüfatı üçün çox əlverişlidir. Çay vadiləri boyunca torpaq humusla zənginləşir, bu isə taxılçılıq, tərəvəzçilik və bağçılıq üçün əvəzolunmaz bir resursdur.

## Torpaq növləri və bitki örtüyü.

Azad edilmiş rayonlarda relyefin mürəkkəbliyi torpaq növlərinin müxtəlifliyinə səbəb olmuşdur. Dağlıq ərazilərdə dağ podzolu və dağ boz torpaqlar, dağətəyində isə kənd təsərrüfatı üçün münbit boz-çəmən torpaqlar yayılmışdır.Bitki örtüyü relyefin hündürlük, yamac istiqaməti və torpaq növünə bağlı olaraq dəyişir.

Kəlbəcər və Laçın: iqlim soyuq və rütubətlidir, burada dağ meşələri və alpin çəmənlikləri üstünlük təşkil edir. Əsas ağac növləri: palıd, fındıq, qovaq və şamdır. Alpin zonasında isə qarotu, meşə çəmənlikləri və müxtəlif çiçəkli bitkilər rast gəlinir.

Qubadlı və Zəngilan: orta dağlıq relyef, meşə zolaqları və otlaqlar ilə zəngindir. Burada həm hündür ağaclı meşələr, həm də alçaq çəmənlik sahələri mövcuddur.

Düzənlik Qarabağ: burada münbit torpaqlar üzüm, pambıq, taxıl və tərəvəzçilik üçün əlverişlidir. Yamaclarda və düzənlik sahələrində müxtəlif meyvə bağları və bostanlar mövcuddur.Relyefin bu müxtəlifliyi həm təbii ekosistemlərin qorunması, həm də kənd təsərrüfatının inkişafı üçün mühüm əhəmiyyət kəsb edir.

## Eroziya və geomorfoloji təhlükələr.

Dağlıq ərazilərdə yamac eroziyası, sürüşmə və sel hadisələri təbiət və insan fəaliyyətinə böyük təsir göstərir. Xüsusilə Kəlbəcər və Laçın rayonlarında:Sürüşmələr suya doymuş gil torpaqlarda tez-tez baş verir.Yamac eroziyası torpaq itkisinə və əkin sahələrinin azalmasına səbəb olur.Sel hadisələri isə çay vadilərində yerləşən kənd və şəhərlərə ziyan vurur.Bu səbəbdən, relyefin öyrənilməsi, torpaq-bərpa tədbirləri, yamacların sabitləşdirilməsi və eroziyaya qarşı müdafiə tədbirləri zəruridir.Düzənlik rayonlarında isə eroziya daha çox çay daşqınları və sediment yığılması ilə əlaqədardır. Bu isə alüvial torpaqların formalaşmasına və kənd təsərrüfatı üçün münbit sahələrin yaranmasına səbəb olur.

## Relyefin iqtisadi əhəmiyyəti.

İşğaldan azad edilmiş rayonların relyefi iqtisadi baxımdan da böyük əhəmiyyətə malikdir.Məsələn, Dağlıq ərazilər yaylaq maldarlığı, hidroenerji, meşə təsərrüfatı, dərman bitkiləri yığımı və dağ turizmi üçün əlverişlidir.Dağətəyi zonalarda bağçılıq, arıçılıq, çay plantasiyaları və ekoturizm

potensialı yüksəkdir.Düzənlik sahələr isə əkinçilik (taxıl, pambıq, tərəvəzçilik), sənaye infrastrukturu, nəqliyyat və suvarma sistemləri üçün əlverişlidir.
Bundan əlavə, relyef ekoturizm və sağlamlıq turizmi üçün də imkanlar yaradır. Məsələn, Kəlbəcərdə İstisu termal suları, dağ turizmi və buzlaq vadiləri.Laçında Həkəri çayı vadisi və təbii landşaftlar.Zəngilan rayonunda isə Araz çayı boyunca meşə zolaqları və münbit düzənliklər.Relyefin bu cür müxtəlifliyi, həmçinin kənd təsərrüfatı növlərinin seçimi, infrastrukturların yerləşdirilməsi və regional inkişaf planlaması üçün əvəzsiz məlumat mənbəyidir.

### Turizm və ekoloji perspektivlər.

Azad edilmiş rayonlarda dağlıq və dağətəyi relyeflər ekoturizm üçün böyük potensiala malikdir. Dağ yamaclarında yürüyüş yolları, çay və dərələr boyunca kanoe və balıqçılıq turizmi təşkil oluna bilər.Bununla yanaşı, ekoloji tarazlığın qorunması prioritetdir. Dağ yamaclarında meşələrin qorunması, sürüşmə və eroziya risklərinin azaldılması, suvarma və su ehtiyatlarının düzgün idarə olunması vacibdir.

### Qarabağda Quruculuq İşləri və Relyefin Yenidənqurma Prosesində Rolu.

2020-ci ildə Vətən müharibəsinin başa çatması və Azərbaycanın ərazi bütövlüyünün bərpası ilə ölkənin coğrafi xəritəsində yeni inkişaf mərhələsi başlandı. Qarabağ və Şərqi Zəngəzur iqtisadi rayonları təkcə tarixi ədalətin bərpası baxımından deyil, həm də iqtisadi və ekoloji potensialın reallaşdırılması istiqamətində dövlətin əsas prioritetinə çevrildi. Prezident İlham Əliyevin rəhbərliyi ilə həyata keçirilən "Böyük Qayıdış" proqramı bu regionların relyef xüsusiyyətlərini, torpaq və su ehtiyatlarını, təbii landşaft strukturunu nəzərə almaqla planlaşdırılmışdır.Relyef bu bərpa prosesində əsas həlledici amillərdən biridir. Dağlıq ərazilərdə yerləşən Kəlbəcər, Laçın, Qubadlı və Zəngilan rayonlarında infrastrukturun yenidən qurulması üçün mühəndis-geoloji araşdırmalar aparılır, dağ yamaclarında sürüşmələrin qarşısının alınması məqsədilə bərkidici tədbirlər görülür. Bu yanaşma həm ekoloji təhlükəsizliyi, həm də tikinti layihələrinin dayanıqlılığını təmin edir. Şuşa şəhərinin bərpası zamanı relyefin mürəkkəbliyi nəzərə alınaraq şəhərsalma planı elə hazırlanmışdır ki, tarixi abidələr qorunmaqla müasir urbanizasiya prinsipləri tətbiq olunur.
Prezident İlham Əliyev 2021-ci ilin dekabrında Şuşada keçirdiyi müşavirədə vurğulamışdır ki, *"Qarabağda tikilən hər bir bina, çəkilən hər bir yol və inşa olunan hər bir infrastruktur obyektində torpağın, dağın, çayın dili dinlənilməlidir."* Bu fikir relyefin, yəni yer səthinin formalarının bərpa və inkişaf prosesində əsas göstərici kimi qəbul olunduğunu nümayiş etdirir.
Kəlbəcər və Laçın rayonlarının yüksək dağlıq relyefi burada hidroenerji layihələrinin geniş inkişafına imkan yaradır. Bu bölgələrdə təbii enmə fərqləri və su ehtiyatları hesabına yeni su elektrik stansiyaları inşa olunur. Qubadlı və Zəngilan rayonlarında isə relyefin daha mülayim formaları kənd təsərrüfatı və yaşıl enerji layihələri üçün əlverişli şərait yaradır. Məsələn, Araz çayı boyunca formalaşan düzən relyeflər üzərində iri suvarma sistemləri qurulur və aqrar istehsal bərpa edilir.Eyni zamanda relyefin müxtəlifliyinə uyğun olaraq "ağıllı kənd" və "ağıllı şəhər" layihələrinin həyata keçirilməsi regionun müasir inkişaf modelinin əsasını təşkil edir. Ağalı kəndində tətbiq edilən texnoloji həllər relyefin təbii formasını pozmadan, enerji səmərəliliyi və ekoloji tarazlıq prinsiplərinə əsaslanır. Bu, dövlətin təbiətə qarşı deyil, onunla harmoniyada inkişaf siyasəti apardığını göstərir.Relyefin qorunması və onun təbii funksiyalarının bərpası ekoloji baxımdan da mühüm əhəmiyyət daşıyır. Qarabağda aparılan meşəəkmə layihələri, torpaq eroziyasına qarşı mübarizə tədbirləri və dağ yamaclarının bərpası regional ekosistemlərin stabilliyini təmin edir. Bu prosesdə yerli iqlim şəraiti və torpaq strukturu da nəzərə alınır.
Prezident İlham Əliyev 2023-cü ildə COP28 beynəlxalq iqlim sammitində çıxışında demişdir:
"Qarabağ və Şərqi Zəngəzur Azərbaycanın yaşıl enerji zonası olacaq. Biz burada həm təbiəti, həm də enerjini bərpa edirik."

Bu strateji yanaşma relyefin potensialından maksimum səmərəli istifadəni nəzərdə tutur. Külək və günəş enerjisi mənbələrinin yerləşməsi relyefin morfologiyası ilə sıx bağlıdır. Məsələn, Zəngilan və Cəbrayıl rayonlarının düzən relyefləri günəş enerjisi stansiyalarının, Laçın və Kəlbəcərin dağlıq hissələri isə külək turbinalarının qurulması üçün əlverişli hesab olunur.Qarabağda və Şərqi Zəngəzurda həyata keçirilən layihələr təkcə iqtisadi deyil, həm də mənəvi yenidən doğuluşu simvolizə edir. Relyef bu prosesdə həm təbii, həm də simvolik mənada bərpaya xidmət edir. Torpaq səthinin hər bir təbəqəsi, hər bir dağ və çay hövzəsi bu torpaqlara qayıdışın, dirçəlişin rəmzinə çevrilir.Müasir dövrdə aparılan bu quruculuq işləri regional və beynəlxalq təşkilatların dəstəyi ilə daha sistemli xarakter alır. BMT-nin İnkişaf Proqramı (UNDP), İslam İnkişaf Bankı və İqtisadi Əməkdaşlıq Təşkilatı (ECO) ilə birgə layihələr çərçivəsində relyefin öyrənilməsi, torpaq bərpası və su ehtiyatlarının idarə olunması istiqamətində elmi tədqiqatlar genişlənir.

## Nəticə

İşğaldan azad edilmiş Qarabağ və Şərqi Zəngəzur bölgələrinin relyefi mürəkkəb və çoxşaxəlidir. Dağlıq, dağətəyi və düzənlik sahələrin müxtəlifliyi torpaq növlərinin formalaşmasına, bitki örtüyünün paylanmasına və su resurslarının bölünməsinə birbaşa təsir göstərir. Kəlbəcər, Laçın, Qubadlı və Zəngilan rayonlarının dağlıq relyefi, buzlaq mənşəli vadilər, dərələr və sirqlər hidroloji və geomorfoloji şəraitin formalaşmasında mühüm rol oynayır.Dağlıq ərazilərdə eroziya, yamac sürüşməsi və sel hadisələri relyefin xüsusiyyətləri ilə sıx bağlıdır və torpaq-bərpa tədbirlərinin vacibliyini göstərir. Düzənlik rayonlarda isə çayların daşqın əraziləri və sediment yığılması nəticəsində alüvial-prolüvial torpaqlar əmələ gəlmiş, bu da kənd təsərrüfatı üçün əlverişli sahələr yaratmışdır.Relyefin müxtəlifliyi iqtisadi fəaliyyətin istiqamətlərinə də təsir göstərir: dağlıq ərazilərdə yaylaq maldarlığı, hidroenerji və dağ turizmi, dağətəyi zonalarda bağçılıq və arıçılıq, düzənlik sahələrdə isə taxılçılıq, pambıqçılıq, tərəvəzçilik və sənaye infrastrukturunun inkişafı mümkündür.Bundan əlavə, relyef ekoturizm və sağlamlıq turizmi üçün də geniş potensiala malikdir. Kəlbəcərin İstisu termal suları, Laçının Həkəri çayı vadisi, Zəngilanın Araz çayı boyunca meşə zolaqları relyefin təbii imkanlarından istifadəni nümayiş etdirir. Bu xüsusiyyətlər həm təbii ekosistemlərin qorunmasına, həm də regionun iqtisadi və turizm potensialının inkişafına töhfə verir.Beləliklə, işğaldan azad edilmiş rayonların relyefi həm təbii sistemlərin formalaşmasında, həm kənd təsərrüfatı, həm turizm və iqtisadi inkişaf imkanlarının təyin olunmasında, həm də geomorfoloji təhlükələrin (eroziya, sürüşmə, sel) qarşısının alınmasında əsas rol oynayır. Relyefin ətraflı öyrənilməsi və planlaşdırmada nəzərə alınması regionun dayanıqlı və səmərəli inkişafına xidmət edir.

## İstifadə edilmiş ədəbiyyat.


1. Əliyev Q.Ə. *Azərbaycanın fiziki coğrafiyası*. Bakı ADPU Nəşriyyatı, 2019.
2. Məmmədov R.Ə. *Qarabağ bölgəsinin təbii-coğrafi şəraiti*. Bakı Elm Nəşriyyatı, 2021.
3. Həsənov E.M.*Kiçik Qafqazda geomorfoloji proseslər və relyefin təsərrüfat əhəmiyyəti*.Bakı Elm və Təhsil, 2022.
4. AMEA Coğrafiya İnstitutu.*Azərbaycanın təbii sərvətləri atlası*. Bakı, 2022.
5. Dövlət Torpaq və Xəritəçəkmə Komitəsi.*Azərbaycan Respublikasının relyef və torpaq xəritəsi*. Bakı, 2020.
6. Coğrafiya və Təbii Ehtiyatlar Jurnalı, №3 (2023). “Şərqi Zəngəzur bölgəsinin geomorfologiyası və torpaq örtüyü”.
7. Əlizadə A.M.*Azərbaycanın dağlıq ərazilərində təbii proseslər və insan fəaliyyəti*. Bakı Təhsil Nəşriyyatı, 2018.
8. Məmmədova S.A. *Qarabağda su ehtiyatlarının idarə olunması və relyefin təsiri*. Bakı Coğrafiya Fondu, 2021.
9. Qasımov N.A. – *Ekoloji coğrafiya və təbii landşaftların dayanıqlığı*. Bakı: Elm, 2020.

10. İbrahimov A.Ş. – *Azərbaycanın çay sistemləri və hidroqrafiyası*. Bakı: Elm və Təhsil, 2017.
11. "Azərbaycan Respublikasının Şərqi Zəngəzur və Qarabağ iqtisadi rayonları üzrə inkişaf konsepsiyası – 2022–2030". – İqtisadiyyat Nazirliyi, Bakı, 2022.

UOT 332.2

# CADASTRAL CLASSIFICATION OF KHANKENDI CITY

Valiyeva Fidan Mahammad qizi
Baku State University

*The article explores the scientific and practical foundations of the cadastral classification of the city of Khankendi, analyzing the features of the land management reconstruction process in the territories liberated from occupation. The main objective of the research is to study the structure of Khankendi's land fund, to clarify its administrative boundaries, and to develop mechanisms for establishing a digital cadastral system.*
*During the study, geoinformation technologies (GIS), GPS measurements, and electronic mapping methods were utilized. The results show that the creation of a cadastral system serves as a fundamental information base for the implementation of urban planning, investment, and socio-economic development strategies in Khankendi.*
*The digital cadastral model facilitates the transparent management of land and real estate resources and enables environmentally and economically sound planning based on scientific principles. The article also emphasizes that the Khankendi cadastral system is an essential component of the reconstruction and regional integration processes within the Karabakh economic region and provides a strategic contribution to Azerbaijan's national economic security.*

Keywords: Cadastral classification, digital mapping, GIS technologies, Karabakh economic region, land registry, post-conflict reconstruction.

Introduction. The preparation of the cadastral classification of the city of Khankendi and its integration into a modern management system represents one of the key directions of Azerbaijan's socio-economic and urban development policy in the period of independence. As one of the administrative and political centers of the Karabakh economic region, Khankendi remained under occupation for many years, during which land accounting, real estate registration, legal documentation of ownership forms, and the updating of cadastral data were completely halted. Following the restoration of the territorial integrity of the Republic of Azerbaijan in 2020, the reconstruction and redevelopment works carried out in the city made the reestablishment of the cadastral system an urgent necessity.

In the modern era, land management and cadastral systems are among the fundamental elements of state economic policy. The purpose of these systems is to ensure the legal, economic, and ecological efficiency of land and real estate management. In Azerbaijan's liberated territories, including the Karabakh economic region, the formation of modern cadastral systems constitutes a crucial component of the large-scale reconstruction and redevelopment process.

In previous periods, informal land ownership forms, imprecise boundaries, and record-keeping gaps were observed in Khankendi. As a result of occupation, many cadastral documents were lost or destroyed. Therefore, in the current stage, cadastral restoration is regarded not only as a technical process but also as a phase of legal and scientific reconstruction. The new land legislation and the Law on the "State Register of Real Estate" adopted by the state have strengthened the legal foundation of this process.

Khankendi stands at the center of this transformation. Historically formed as the administrative and political hub of Karabakh, the city experienced socio-economic decline after its

occupation by Armenia in the 1990s, during which its land accounting and cadastral data system were completely dismantled. With the restoration of Azerbaijan's territorial integrity in 2020, the registration of land and real estate in these territories returned to state control, and the scientific reconstruction of the cadastral system commenced.

The main objective of the cadastral classification is to accurately define the land fund of Khankendi by categories, legally register ownership forms, and ensure the purposeful and efficient planning of land use. Through this system, land plots are recorded according to state, municipal, and private ownership, while data on their area, boundaries, coordinates, and usage are compiled in a unified database.

Currently, the establishment of the state register of land and real estate in Khankendi forms not only a legal but also an economic foundation for urban planning and settlement policy. From this perspective, the Khankendi cadastral system functions not merely as a technical accounting tool but as a fundamental information base for regional development planning.

Analysis and Discussion. As one of the central territorial units of the Karabakh economic region, the city of Khankendi holds a unique position from strategic, geographical, and administrative standpoints. The city lies approximately 800–850 meters above sea level, and its surrounding mountain-forest landscape, natural water resources, and fertile soils are key factors shaping its urban development. The diversity of the terrain, the mild climatic conditions, and the abundance of natural resources provide a scientific basis for the rational distribution of residential areas, as well as industrial, service, and agricultural zones.


Picture 1.

The climatic conditions of Khankendi are characterized as moderately warm and semi-arid, making the area favorable for both agriculture and the construction sector. The average annual temperature ranges between 11–12°C, while annual precipitation amounts to approximately 500–600 mm. The soil cover mainly consists of brown mountain-forest and chestnut soils. Additionally, forest areas and natural greenery dominate the western and northern parts of the city.

These natural factors hold particular importance for ensuring ecological sustainability, balancing land-use zones, and preserving green areas in the future planning of Khankendi. The establishment of a cadastral system enables the efficient utilization and management of these resources.

The administrative territory of Khankendi covers approximately 8 square kilometers, classified into residential, administrative, industrial, public service, recreational, and green zones. In the land classification structure, residential and public construction areas account for about 45–50% of the total, while the remaining portion consists of agricultural lands, industrial zones, transport and communication infrastructure, as well as forest and water fund lands.

In the new cadastral registration process, the functional classification of land is conducted in accordance with international land management standards (FAO Land Classification, ISO 19152 Land Administration Domain Model). This approach helps identify discrepancies between the legal status and actual use of land parcels and allows for the optimization of land use.

The concept of a cadastre (from the Latin *cadastre* — "register") refers to the process of collecting and systematizing information about the quantity, quality, and legal status of land and real estate. Modern cadastral systems consist of three main components:

- Land Cadastre — includes data on land parcel boundaries, size, usage type, and ownership rights;
- Property Cadastre — covers buildings, structures, engineering infrastructure, and their technical characteristics;
- Environmental Cadastre — provides information on natural resource protection and ecosystem balance.

During the reconstruction of Khankendi, all these components are being integrated within a unified Geographic Information System (GIS) framework. This system forms the technological foundation of the "Smart City" concept. Through GIS mapping, land parcel coordinates, terrain models, communication lines, and infrastructure elements are digitally recorded on electronic maps.

The main portion of Khankendi's land fund is allocated to residential, agricultural, industrial, and public-use areas. According to preliminary cadastral studies conducted in 2024, approximately 45% of the city's territory is classified as residential and public areas, 30% as agricultural land, 10% as industrial zones, and the remaining 15% as green and natural landscape areas.

The preparation of the Khankendi cadastral classification is based on modern geodetic and cartographic technologies. Within the framework of the "Digital Cadastral Information System" project implemented in the region between 2021 and 2024, satellite measurements (GNSS), drone-based orthophoto mapping, and high-precision 3D topographic models were developed.

The significant variation in the area's relief (particularly the 700–850 m elevation difference in the western direction) is one of the factors affecting measurement accuracy. Therefore, the WGS-84 and AZM-2016 geographic coordinate systems have been applied for precise determination of coordinates. The electronic cadastral plan of Khankendi is currently being prepared at a 1:2000 scale, and all land units are registered through GPS/GIS-based coding.

Although Khankendi is predominantly an urbanized area, agricultural lands are present in the surrounding villages and suburban zones. These lands are mainly used for horticulture, vegetable cultivation, and forage crops. In the foothill zones, soil profiles consist of meadow-gray and brown-forest soils, which ensure moderate productivity levels.

To enhance soil productivity, the principle of agro-ecological zoning is applied, involving land-use planning based on soil type, climate, irrigation, and erosion criteria. The new cadastral plan allows for determining both the actual and potential utilization values of agricultural lands.

Before the occupation, the land fund of Khankendi covered about 800 hectares. In the modern period, the planned administrative area of the city has been defined as approximately 8 square kilometers. The categories of land parcels are determined as follows:

| Category | Total share (%) | Main use direction |
|---|---|---|
| Residential land | 40 | Apartments and social facilities |
| Public and administrative land | 15 | Government and educational institutions |
| Industrial and production zones | 10 | Small and medium industrial facilities |
| Industrial and production zones | 25 | Viticulture, vegetable cultivation, pasture |
| Green and protected areas | 10 | Parks, forests, and water bodies |

Table 1.

Thus, the land balance of Khankendi city allows for a well-proportioned formation of both residential and industrial functions. As a result of cadastral classification, the precise differentiation of land-use types increases the ecological and economic efficiency of urban planning projects.

Cadastral data serve as the primary informational foundation for developing the *General Master Plan* of Khankendi. Land-use indicators play a key role in shaping the city's spatial structure, locating infrastructure facilities, and delineating residential and industrial zones.

Within the new planning framework, Khankendi is classified into three main zones:

1. Administrative-economic zone,
2. Residential-infrastructure zone, and
3. Recreational-green zone. This zoning approach ensures both economic efficiency and ecological sustainability.

The results of the cadastral analysis show that the effective management of land resources in Khankendi directly contributes to the city's economic revitalization. The clarification of land ownership rights and the creation of a digital property registry significantly improve the investment climate.

In the Republic of Azerbaijan, the registration of real estate and the maintenance of the cadastral system are regulated by the Land Code, the Law on the State Register of Real Estate, and the Law on Urban Planning in the Liberated Territories. The new model applied in Khankendi is built on the "e-cadastre" platform. Within this system:

- all land parcels are registered under unique cadastral numbers;
- boundaries are verified using GPS and drone imagery;
- infrastructure, water, electricity, and communication networks are added to the geodatabase through digital mapping.

This approach holds strategic importance both for transparent governance and for the establishment of a functioning land market.

The creation of a cadastral database for Khankendi serves as a key source for population resettlement planning, tax accounting, implementation of investment projects, and legal regulation of land relations.

As a result of the land and property registration process:

- the tax base expands and local budget revenues increase;
- property rights are restored, ensuring social justice;
- infrastructure planning (roads, water, sewage, and energy networks) is implemented on a scientific basis;
- the investment environment improves, boosting private sector activity.

The most significant outcome of this system is the transition to *scientifically grounded territorial management*. The integration of cadastral data with GIS maps enables the governance of the city according to a "smart governance" model.

The reconstruction of Khankendi's cadastral system is carried out in five main stages:

1. Preparatory stage – demining and safety operations, aerial photography;
2. Spatial data collection – measurement of land boundaries using GPS devices;
3. Digital mapping – visualization of land and property objects in the GIS database;
4. Legal registration – formalization of ownership and usage rights;
5. Data integration and monitoring – updating of the electronic register in real time.

Currently, nearly 80% of land boundaries in the central and surrounding zones of Khankendi have been mapped in the initial phase. These works are jointly implemented by Azercosmos, AzGeomap, and the State Service on Property Issues.

One of the key directions of Khankendi's economic recovery is the enhancement of its investment attractiveness. The existence of a cadastral system ensures a transparent and legally regulated land market. At the same time, the system enables the optimization of land resources in urban planning projects, the development of industrial and service sectors, scientific management of agricultural lands, and the preservation of ecological balance. For example, within the 2025–2030 "Smart City" concept for Khankendi, cadastral data will be integrated into an automated management system, allowing for dynamic monitoring of urban development indicators.

The process of collecting and systematizing cadastral data is a crucial area of application for both geodesy and geographic information sciences. The work conducted in Khankendi sets forth a new methodological model in land management that includes:

- Coordinate systems based on *WGS-84* and the *Global Reference Network*;
- Digital Elevation Models (DEM) linked to relief and hydrography data;
- Zoning analysis determining the balance between residential, industrial, and green areas.

This approach establishes a regional cadastral management model that can be applied in other cities of the Karabakh Economic Region in the future.

Conclusion. The cadastral classification of Khankendi city, conducted on the basis of modern technologies, legal frameworks, and scientific principles, forms the foundation for the city's socio-economic development. This system:

- ensures full and transparent accounting of land and real estate resources;
- guides urban planning and infrastructure development on a scientific basis;
- facilitates the implementation of investment, environmental, and social development programs.

Thus, the establishment of Khankendi's cadastral system represents a major scientific and practical direction of the reconstruction strategy of the Karabakh Economic Region and holds strategic importance for Azerbaijan's national economic security.

Research and analytical studies demonstrate that the cadastral classification of Khankendi is not limited to land and real estate registration; it also functions as a strategic management tool ensuring the city's socio-economic, ecological, and urban development. The reconstruction of the cadastral system constitutes one of the key components of Khankendi's post-conflict urban policy, directly influencing the sustainable development of the entire region.

Khankendi, with its geographical location, natural conditions, and infrastructure potential, performs a central role within the Karabakh Economic Region. Conducting cadastral registration in the city ensures not only the clarification of land boundaries but also the restoration of property rights, the activation of investment activities, and the scientific organization of urban planning. The structural diversity of land resources — encompassing residential, industrial, public, and agricultural zones — necessitates a comprehensive cadastral approach.

At the current stage, digitalization has been identified as the main priority of Khankendi's cadastral system. The creation of a digital cadastral database enables the rapid updating of information on land and real estate, ensures legal transparency, and increases the efficiency of public administration. This system also serves as a technological foundation for implementing the city's master plan and infrastructure projects. The use of integrated GIS and GPS-based cadastral maps will scientifically and technologically support Khankendi's transition to a "Smart City" model. Moreover, the implementation of cadastral classification in Khankendi contributes to maintaining ecological and economic balance. Accurate identification of land-use categories, proper planning of green and public zones, and registration of water and energy resources enhance the city's ecological sustainability. This process also leads to an improved quality of life, the restoration of social welfare, and the strengthening of the region's overall economic potential.

The precise and scientifically grounded collection of cadastral data is of strategic importance for public administration. It provides an essential information base for regulating ownership rights, land taxation, and the property market. Furthermore, the integration of Khankendi's cadastral data with those of other cities in the Karabakh Economic Region (Aghdam, Shusha, Khojaly, Agdere, etc.) will ensure unified data exchange within regional management.

In general, the establishment of Khankendi's cadastral classification and the transition to digital governance represent not only a technical modernization, but also a vital component of Azerbaijan's national economic and social revival. This process stands as one of the core directions in implementing the country's territorial integrity and sustainable development strategy for the Karabakh Economic Region. Scientifically based cadastral planning not only paves the way for Khankendi's transformation into a modern urban model but also provides the scientific, legal, and institutional framework for reshaping the entire economic-geographical system of the Karabakh region.

## REFERENCES


1. Decree of the President of the Republic of Azerbaijan. (2021). *"On the new division of economic regions in the Republic of Azerbaijan."* Baku: Official website of the President of the Republic of Azerbaijan.
2. Ministry of Economy of the Republic of Azerbaijan. (2023). *Socio-economic development concept of the Karabakh Economic Region.* Baku.
3. State Service on Property Issues of the Republic of Azerbaijan. (2022). *Report on the digitalization of the state register of real estate and integration of cadastral systems.* Baku.
4. State Statistical Committee of the Republic of Azerbaijan. (2024). *Socio-economic indicators of the regions of Azerbaijan.* Baku: Statistical Publication.
5. Gasimov, M. (2022). *Land management and cadastral systems: theoretical and practical aspects.* Baku: Elm və Təhsil Publishing House.
6. Aliyev, H. (2023). *Integration of urban planning and cadastral accounting systems in Azerbaijan. Scientific Works of the Azerbaijan University of Architecture and Construction*, No. 2, pp. 45–57.
7. Mammadov, F. (2021). *Physical geography and natural resources of Azerbaijan.* Baku: Baku State University Press.
8. Abbasov, E. (2020). *Natural-geographical features and structural analysis of land resources in the Karabakh region.* Baku: Institute of Geography, National Academy of Sciences of Azerbaijan.
9. Aliyev, J. (2023). *Land reforms and property relations in the Karabakh region: post-conflict period characteristics. Journal of Economics and Management*, No. 4, pp. 62–78.

10. Mammadova, S. (2022). *Application of Geographic Information Systems (GIS) in cadastral management.* Baku: Scientific Works of Azerbaijan Technical University.

# Azərbaycanın Coğrafi Möcüzələri

**Əliyeva Şəfəq Məmməd qızı**
ADPU-nun Şəki filialı, müəllim

**Açar sözlər:** Palçıq vulkanları, Böyük və Kiçik Qafqaz, Xəzər dənizi, Göygöl, Qobustan, Duzdağ, Turizm və təbiət, Biomüxtəliflik, Subtropik zona, Coğrafi müxtəliflik

## Giriş

Azərbaycan – zəngin tarixi, mədəni irsi və təbii ehtiyatları ilə tanınan bir Cənubi Qafqaz ölkəsidir. Lakin bu ölkənin ən maraqlı və diqqətçəkən cəhətlərindən biri onun coğrafi müxtəlifliyi və təbiətin yaratdığı unikal möcüzələrdir. Dənizdən dağlara, səhra tipli düzənliklərdən subalp yaylalarına, palçıq vulkanlarından buzlaqlara qədər Azərbaycan coğrafi baxımdan olduqca rəngarəng və nadir ərazilərə malikdir.

Bu coğrafi möcüzələr təkcə ölkənin fiziki görünüşünü formalaşdırmır, həm də iqlimə, təbii ehtiyatlara, turizmə, kənd təsərrüfatına və insan həyatına birbaşa təsir göstərir. Bu məqalədə Azərbaycanın əsas coğrafi möcüzələri və onların elmi, ekoloji və turizm baxımından əhəmiyyəti geniş şəkildə təqdim olunur.

1. Böyük və Kiçik Qafqaz dağları: Dağlıq möcüzə

Azərbaycanın şimal və qərb hissəsində yerləşən Böyük və Kiçik Qafqaz dağ silsilələri ölkənin təbii sərvətləri və biomüxtəlifliyi baxımından olduqca əhəmiyyətlidir.

• Bazardüzü zirvəsi (4466 m) Azərbaycanın və Cənubi Qafqazın ən hündür nöqtəsidir.

• Bu dağlar ölkədə çayların yaranma mənbəyi, meşəliklərin qoruyucusu, səhralaşmanın qarşısını alan təbii sipər rolunu oynayır.

• Qış turizmi (Şahdağ, Tufandağ), yayla turizmi və dağ kəndlərinə maraq bu coğrafi möcüzəni iqtisadi cəhətdən də dəyərli edir.

2. Xəzər dənizi: Dəniz olan göl

Xəzər dənizi – dünyanın ən böyük qapalı gölüdür və sahillərinin böyük hissəsi Azərbaycanla həmsərhəddir.

• Xəzərin sahəsi təqribən 371,000 km²-dir və bu, onu dəniz adlandırmağa əsas verir.

• Azərbaycan üçün Xəzər həm iqtisadi, həm ekoloji, həm də strateji baxımdan önəmlidir:

• Neft-qaz ehtiyatları.

• Balıqçılıq (xüsusilə nərə balıqları və kürüsü).

• Dəniz turizmi (Nabran, Lənkəran, Şüvəlan sahilləri).

Eyni zamanda Xəzər dənizinin səviyyəsinin dövri dəyişməsi, sahil relyefinə və insan fəaliyyətinə təsir göstərir.

3. Palçıq vulkanları: Dünyada nadir təbiət hadisəsi

Azərbaycan dünyada ən çox palçıq vulkanı olan ölkə hesab olunur – təxminən 400-dən çox palçıq vulkanı ölkə ərazisində mövcuddur.

• Bu vulkanlar əsasən Abşeron yarımadası, Qobustan, Cəlilabad, Şamaxı, Salyan və Xəzər dənizi sahillərində yerləşir.

• Palçıq vulkanlarının bəzi nümunələri aktiv şəkildə püskürür və zaman-zaman yeni relyef formaları yaradır.

• Tərkibindəki mineral zəngin palçıq, tibbi müalicə və kosmetologiyada istifadə olunur.

• Qobustandakı “Lokbatan”, “Torağay” və “Otmanbozdağ” vulkanları UNESCO tərəfindən qorunan ərazilərə daxil edilmişdir.

Bu nadir təbiət hadisələri həm elmi, həm də turistik maraq obyektidir.

4. Qobustan qayaüstü rəsmləri və landşaftı

Qobustan ərazisi Azərbaycanın arkeoloji və coğrafi möcüzəsi hesab olunur.

• Burada 12,000 ildən çox yaşı olan qayaüstü rəsmlər, qədim insan məskənləri və təbii qaya kompleksləri mövcuddur.

• Eyni zamanda bu ərazi yarımsəhra və dağlıq relyefin unikal birləşməsidir.

• Qobustan UNESCO-nun Dünya İrsi Siyahısına daxil edilib.

Bu ərazi həm tarix, həm coğrafiya, həm də turizm baxımından əvəzolunmazdır.

5. Lənkəran-Astara zonası: Subtropik cənnət

Azərbaycanın cənub-şərqində yerləşən Lənkəran-Astara bölgəsi ölkənin ən rütubətli və subtropik iqlimli bölgəsidir.

• Burada Hilal meşələri, nadir bitkilər (demək olar ki, yalnız bu bölgəyə xas), çay plantasiyaları, sitrus meyvələri yetişdirilir.

• Ərazi həm bioloji müxtəliflik, həm də kənd təsərrüfatı üçün əlverişli şərait baxımından unikal sayılır.

• Xəzər dənizinə yaxınlıq və Talış dağları bölgəyə həmçinin turizm və sağlamlıq zonası statusu qazandırır.

6. Naxçıvanın coğrafi özəllikləri

Naxçıvan Muxtar Respublikası, Azərbaycanın əsas ərazisindən ayrı düşmüş, lakin çoxsaylı coğrafi möcüzələrlə zəngin bir regiondur.

• Duzdağ: Dünyaca məşhur təbii duz mədəni və astma müalicəsi üçün təbii sanatoriyadır.

• Batabat gölü, Əlincə qalası, Ordubad dərəsi – həm təbii, həm tarixi möcüzələrdir.

• Buradakı dağlıq və kontinental iqlim ayrı bir coğrafi sistem kimi qiymətləndirilir.

7. Göygöl və digər dağ gölləri

Azərbaycanın ən gözəl və təmiz dağ göllərindən biri Göygöldür. Keçmiş Gəncə şəhərinin yaxınlığında, Kəpəz dağının ətəyində, torpaq sürüşməsi nəticəsində yaranmışdır.

• Gölün suyu tərtəmiz və dərin mavidir.

• Ətraf mühit, meşəlik və dağ mənzərələri ilə birlikdə turizm üçün ideal məkandır.

• Ölkədə buna bənzər digər göllər: Maralgöl, Batabat gölü, Qaragöl və s.

8. Şəki-Zaqatala zonası: Dağ-meşə təbiət kompleksi

Bu bölgə həm dağlıq relyefi, həm şirin su ehtiyatları, həm də geniş meşə sahələri ilə tanınır.

• Ərazidə Zaqatala-Balakən biosfer rezervatı yerləşir.

• Bölgənin coğrafi möcüzələrindən biri də Kiş çayı və tarixi Kiş məbədidir.

• Şəki rayonu UNESCO-nun Dünya İrsi siyahısına daxil edilmişdir.

## Nəticə

Azərbaycanın coğrafi möcüzələri – dağlar, göllər, dəniz sahilləri, palçıq vulkanları və meşəliklər – ölkənin yalnız fiziki xəritəsində deyil, həm də milli kimliyində dərin izlər buraxmışdır. Bu təbiət inciləri mədəniyyətin formalaşmasında, iqtisadi fəaliyyətin istiqamətlənməsində, turizmin inkişafında və ətraf mühitin qorunmasında mühüm rol oynayır.

Yer üzərində az sayda ölkə bu qədər coğrafi müxtəlifliyə malikdir. Azərbaycanda 9 iqlim qurşağından 8-nin mövcudluğu, həm dağlıq, həm də dəniz sahili relyefin bir arada olması, dünyanın ən çox palçıq vulkanlarının bu ərazidə yerləşməsi ölkənin “təbii laboratoriya” və “mini dünya modeli” adlandırılmasına səbəb olmuşdur.

Bu coğrafi möcüzələrin qorunması, elmi şəkildə öyrənilməsi, və davamlı istifadəsi həm ekoloji balansın saxlanması, həm də ölkənin gələcək inkişafı baxımından həyati əhəmiyyət daşıyır. Onların daha geniş tanıdılması, xüsusilə ekoturizmin təşviqi, Azərbaycanın beynəlxalq imicinə də müsbət təsir göstərəcəkdir.

Ədəbiyyat siyahısı

1. Əliyev, Q. (2020). Azərbaycanın fiziki coğrafiyası. Bakı: Elm və Təhsil.

2. Həsənov, M. (2021). Təbii sərvətlər və coğrafi möcüzələr. Bakı: Coğrafiya Nəşriyyatı.

3. National Geographic Society. (2022). Mud Volcanoes of Azerbaijan. Retrieved from https://www.nationalgeographic.org

4. UNESCO World Heritage Centre. (2021). Gobustan Rock Art Cultural Landscape. Retrieved from https://whc.unesco.org

5. Ministry of Ecology and Natural Resources of Azerbaijan. (2023). Protected Areas and Natural Wonders. Retrieved from https://eco.gov.az

6. FAO. (2022). Forestry and Biodiversity in the South Caucasus. Rome: Food and Agriculture Organization.

# Geographical distribution of land resources of the East Zangezur economic region

**Mahmudzade Nazrin Azer**
Baku State University

**Keywords:** East Zangezur economic region, geographical distribution, land resources, agrarian potential, land categories.

East Zangezur economic region was created in Azerbaijan with a new classification and is located in the southwestern part. This region includes Kalbajar, Jabrayil, Lachin, Gubadli and Zangilan districts. The geographical distribution of land resources determines the agricultural and economic potential of East Zangezur. As a result of the research, the climatic and relief characteristics of the lands, as well as the geographical distribution characteristics by category, were analyzed and studied. The results obtained show that the relief structure of mountainous areas is one of the main factors determining the fertility, productivity and agricultural directions of the lands.

## Introduction.

Land resources are of great importance in the economic development of each region, in the formation of agricultural potential and in the preservation of ecological balance. East Zangezur economic region, which is considered one of the strategically important regions of Azerbaijan, occupies a special place in this regard. The region's land cover, climatic conditions, and relief structure create favorable opportunities for the development of agriculture, forestry, and other sectors. This article analyzes the main features of the geographical distribution of land resources in the East Zangezur economic region.

Figure 1. East Zangezur economic region

The research process used mapping of soil categories, analysis of relief and climate data, and available statistical data. The soil resources of the region were grouped into relevant areas and their distribution areas were determined.

In recent years, state programs implemented to restore the East Zangezur economic region and strengthen its economic potential have made the study of soil resources on a scientific basis even more relevant. The study of the geographical distribution of soil resources is of particular importance both in terms of the development of the agricultural sector and the preservation of ecological balance. Therefore, the efficient management and use of the region's soil resources has been identified as one of the main directions in the state's regional development strategy.

Soils in the region are mainly distinguished by mountainous-river beds and plain areas:

Mountainous soils - are soil types located mainly in mountainous and foothill zones, which can be used for agriculture to a limited extent.

Meadow and pasture soils - formed in the upper parts of the mountains, suitable for cattle breeding and animal husbandry.

Plain lands – are fertile lands suitable for agriculture, mainly distributed in some parts of Zangilan and Jabrayil districts.

### Relief and soil distribution

The relief of the region is mainly mountainous (especially in Lachin, Kalbajar and Gubadli districts). Various natural complexes and landscape forms such as mountainous-forest landscapes, subalpine meadows, forests, high mountain pastures are widespread in these areas.

The relief of the region directly affects the processes of soil formation. At an altitude of 1000–2000 meters, mainly brown mountain-forest soils are widespread, and mountain-meadow soils are widespread in areas above 2000 meters. Gray-brown soils prevail in the foothill zones. These soil types have higher productivity in terms of agriculture.

The mechanical composition of the soils in Kalbajar and Lachin districts is mainly heavy loamy, while in Zangilan and Jabrayil districts, light and medium loamy soils are more common.

The soil cover in mountainous areas is rocky and partially forested. Therefore, their productivity is relatively low. In plains and semi-plains, soil layers are deeper and more fertile.

### Ecological situation and soil protection

From an ecological point of view, soil degradation occurs mainly as a result of the influence of anthropogenic factors, overuse of pastures, deforestation and irrigation erosion. In some areas, a decrease in the humus layer of the soil, thinning of vegetation and weakening of soil fertility are observed.

In order to restore soil resources, land reclamation, the establishment of forest belts against erosion, terracing measures on mountain slopes and land reclamation should be carried out.

### Structure and types of land resources

The concept of land resources includes lands suitable for agriculture, arable land, perennial crop plantings, pastures and grazing areas, hayfields, forest areas, peaceful lands, etc. According to available sources, the structure of land resources is classified as follows:

Agricultural lands - constitute a certain part of the total land fund and are measured in thousand hectares.

Arable lands (grain and other surface crops) - occupy an important place among agricultural lands.

Perennial crops (fruit and vineyards, etc.) - are present in the region and are shown in a separate category from arable lands.

Pastures (especially summer pastures) - are quite widespread mainly in mountainous and foothill areas. These areas are considered the main resource for the development of sheep breeding, cattle breeding and animal husbandry.

Hay fields – are areas located in flat areas of plains and foothills, creating a fodder base for livestock.

Forest lands – are land areas in mountainous zones covered with forest cover and having an important ecological function.

### Geographical distribution features

The geographical distribution of soil resources, that is, in which regions, at what altitude and under what natural conditions they are formed, is closely related to the natural-geographical features of the East Zangezur economic region.

### Mountainous zones

Due to the high altitude in the Kalbajar and Lachin regions, the soils are mountainous-forest type, heavy and rich in humus. In these areas, pastures, subalpine meadows, mountain forests cover large areas. Due to the lack of flat areas for agriculture, the area is often limited and the cultivated land is limited.

### Foothill and plain zones

Certain parts of the Zangilan, Gubadli and Jabrayil regions have foothill and plain relief. Land suitable for agriculture is more widespread in these areas. There are favorable conditions for grain, fruit growing, viticulture and tobacco growing. Although the area of irrigated land is limited, certain cultivated areas are used efficiently due to the available irrigation opportunities.

### Spread of pastures

Summer and winter pastures are spread in mountainous and foothill zones. Pasture pastures are formed mostly in high mountainous areas, while winter pastures are formed in relatively low areas. These lands play an important role in the development of livestock breeding.

### Irrigated perennial crops

Orchards, grape plantations and other perennial crops are spread mainly in low-altitude, climatically favorable areas of Gubadli, Zangilan and Jabrayil regions. The expansion of irrigation networks in these areas increases the possibilities of more efficient use of land.

Based on quantitative and dimensional indicators, the distribution indicators of land resources of the East Zangezur economic region are as follows:

- Lands suitable for agriculture - covers a total area of 128.2 thousand hectares.
- Crop lands - 80.5 thousand hectares of these lands are used for sowing.
- Perennial crops – constitute 38.2 thousand hectares of land, mainly located in irrigated areas.

The main problems arising during land use are mainly rock-sediment erosion, slope erosion, reduction of forest cover and soil damage. It has been known in existing sources that these issues are studied as one of the main directions of scientific research.

It is necessary to expand measures to improve the efficiency of land use, develop irrigation infrastructure, apply modern agricultural machinery and properly manage cultivated areas.

### Climate and soil characteristics

The climate of the region is temperate continental. The air temperature rises in the summer months, and it is cold in the winter. The distribution of precipitation across the region affects different areas of the relief and determines the level of soil erosion. This plays a key role in the distribution of lands for agricultural and pasture use.

### Conclusion

The geographical distribution of land resources in the East Zangezur economic region is closely related to the characteristics of the relief, climate and soil types. Lands in mountainous zones are mainly suitable for forestry and pasture use. Lands in plain areas are a priority for agriculture. This study is a scientific basis for the efficient use and planning of land resources in the region. Management of land resources based on scientific principles can make a significant contribution to the economic development of the region and the preservation of ecological balance.

## Literature

State Statistical Committee of the Republic of Azerbaijan. (2023). Annual statistical indicators on land resources of Azerbaijan. Baku: DSQ Publishing House.
State Land and Cartography Committee. (2022). Map of land fund and land categories of the Republic of Azerbaijan. Baku.
FAO (Food and Agriculture Organization of the United Nations). (2022). Land Resources Planning for Sustainable Land Management. Rome: FAO.
Mammadov, G.Sh. (2021). Land cover and geographical distribution of Azerbaijan. Baku: BSU Publishing House.
Mammadov, R. M. (ed.). (2015). Geography of the Republic of Azerbaijan. Volume I: Physical geography. Baku: Institute of Geography of ANAS.
Institute of Geology and Geophysics, Institute of Geography and Institute of Soil Science and Agrochemistry of ANAS. (2023). Karabakh and East Zangezur: Atlas of Natural Resources. Baku. FAO (Food and Agriculture Organization of the United Nations). (2022). Land Resources Planning for Sustainable Land Management. Rome: FAO.
United Nations Environment Programme (UNEP). (2021). Land and Soil Resources in the South Caucasus: Assessment and Management Strategies. Geneva.
Azerbaijan Geographical Society. (2019). Azerbaijani Lands and Their Use. Baku: Geography Publishing House.
World Bank. (2020). Azerbaijan: Agricultural Development and Land Use Efficiency Report. Washington, D.C.: World Bank Publications.

# Economic Sciences

# Организационная культура как фактор стратегического развития организации

Бектенов Асет Ерекович
Казахстанско-Британский технический университет, Казахстан, Алматы
Едигенов Ермек Серикбаевич
Казахстанско-Британский технический университет, Казахстан, Алматы

Социально-экономические преобразования в Казахстане свидетельствуют о непрерывном процессе зарождения, развития и распада большого числа организаций.

Сложный характер рыночных реформ изменил акценты в современном управлении организациями. Бюрократические, авторитарные и технократические инструменты руководства в условиях дефицита времени, информации и людей оказались по большей части неэффективными. Выбранный когда-то давно технократический способ существования, хотя еще доминирует, но во многом уже исчерпал себя. Современные теории гуманного управления – это попытка и возможность перейти к гармоничному способу существования, основанному, прежде всего, на развитии личности и определении ее места в мире. Такой подход предполагает новое видение управленческих отношений руководителей, их ориентацию на раскрытие потенциала человеческого капитала.

В настоящее время круг проблем, затрагиваемых при исследовании организаций, непрерывно расширяется. Выделились в отдельные направления исследования организации информационных потоков в управлении; исследование организации механизма выдвижения, принятия и изменения целей; мотивации деятельности управленческого персонала и организационных отношений. Активно изучается и исследуется влияние последствий внедрения достижений научно-технического прогресса на организационные изменения, исследуются и разрабатываются механизмы влияния организационной культуры на реализацию краткосрочных и долгосрочных стратегических целей организации.

Любая организация вне зависимости от ее размеров и сферы деятельности является не только технико-экономической, но и социальной системой, что непременно предполагает возникновение трудностей в разработки внедрения и реализации стратегий перспективного развития, и последующую реализацию необходимых организационных изменений. Не последнюю роль при этом играет, уже сложившаяся в организации организационная культура. Ее можно признать, и это подтверждают последние исследования, основным показателем, необходимым для правильного понимания и управления организационным поведением людей, работающих в организации, организации в целом.

Проблематика изучения организации как культурного феномена не является чем-то новым для социологии и восходит к традициям М. Вебера, Т. Парсонса, К. Левина. Однако само введение термина «организационная культура» и его детальная проработка датируется недалеким прошлым, фокусирование внимания на исследованиях этого социального феномена датируется концом 1970-х годов. С этого момента определились различия в подходах к исследованию организационной культуры.

В целом концепции организационной культуры условно можно разделить на две большие группы. Первая рассматривает организационную культуру как атрибут организации, предполагая возможность влиять на ее формирование. Этот подход условно называется

«рационально- прагматическим».

Второй трактует организационную культуру как обозначение самой сути организации, то, чем она по существу является; этот подход часто ассоциируется с «феноменологической моделью организации».

В основе первого, рационально-прагматического подхода лежит положения, разработанные Э. Шейном. Организационная культура, по его мнению, представляет собой интегрированный набор базовых представлений, которые данная организационная группа изобрела, случайно раскрыла, позаимствовала или достигла каким-либо иным путем, как попытка решения проблем адаптации организации к внешней среде и внутренней интеграции, которые в свою очередь, достаточно эффективно послужили организации, чтобы быть признанными, действенны- ми и достаточными для их закрепления и передачи новым поколениям членов организации.

Организационная культура может проявляться на нескольких уровнях. Первый, самый доступный, составляет видимые культурные артефакты, к которым можно отнести такие ее проявления как применяемая технология и архитектура, использование пространства и времени, устойчивые способы поведения членов организации, язык, лозунги, или все, что можно ощущать и воспринимать через чувства человека. Все эти проявления легко обнаружить, и они доступны для наблюдения и описания. При этом гораздо труднее ответить на вопрос, почему в данной организации они приняли такую форму.

Второй уровень – уровень организационных ценностей. В отличие от культурных артефактов, ценности не видны непосредственно: их обнаружение требует серьезной исследовательской работы. Но культура определяется не декларируемыми ценностями, а, как правило, неосознанными «базовыми представлениями», которые составляют третий уровень организационной культуры. Базовые представления определяют то, как члены группы воспринимают окружающее, что они делают, думают, чувствуют.

Представители первого подхода – Э. Шейн, Т. Питерс, Р. Уоттермен – формирование организационной культуры связывают с процессами, происходящими внутри организации, то есть формирование организационной культуры рассматривается как итог внутренних процессов, протекающих в организации, в той или иной степени управляемых.

Второе направление исследований организационной культуры (феноменологическое) восходит к теоретическим разработкам Д. Сильвермана и П. Бергера. Так, Д. Сильверман делает попытку переосмыслить взаимосвязь правил организационного поведения и организационных целей. Он предлагает отказаться от взгляда на организацию как инстанцию, предопределяющую поведение работника, а сосредотачивает внимание на том, как участники используют формальные правила для определения и интерпретации своего поведения и поведения окружающих.

Правила поведения вырабатываются самими членами организации. Они составляют некую конвенциальную реальность, в которой живут и действуют ее члены. Формальные правила действуют в социальных ситуациях, посредством постоянной интерпретации их значений в каждом контексте принятия решения.

Деятельность, которая выглядит организованной согласно правилам, на самом деле представляет собой продукт практической деятельности членов организации, и в лучшем случае демонстрирует, что то, что они делают, соответствует установленным правилам.

Организационную культуру, таким образом можно определить в виде совокупности «признанных в организации ценностей, убеждений, норм и форм поведения» [1, с. 55] разделяемых всеми членами организаций. Носителями организационной культуры являются люди, работающие в организации. Именно они создают тот порядок вещей, те системы отношений и те образцы поведения, которые складываются в организации в тех или иных обстоятельствах. Только они создают те «неписаные» правила, определяющие, как

должны работать и вести себя люди в данной организации. При этом речь идет об убеждениях и ценностях, которые в большей или меньшей степени разделяются подавляющим большинством членов организации.

Содержание работы, личность руководителя и стиль руководства, которого он придерживается в своей работе, особенности психологического климата в трудовом коллективе – эти и другие факторы оказывают свое влияние на организационную культуру конкретного подразделения. Организационная культура будет соответствовать выбранной стратегии, если она будет соотнесена с восприятием, мышлением и мотивами работников организации, поскольку организационная культура зарождается в первую очередь в головах людей.

В свою очередь, организационно-культурные ценности могут оказывать существенное влияние и на мотивацию, и взаимодействие в процессе труда, и текучесть кадров в организации, и, в конечном счете, на эффективность деятельности работников.

В организационной культуре наиболее интересен механизм ее влияния на поведение и работу членов организации. Являясь ядром организационной культуры, ценности могут быть как позитивными, ориентирующими людей на такие образцы поведения, которые поддерживают достижение организационных целей, так и негативные, которые отрицательно влияют на организационную эффективность.

В основе организационной культуры лежит и система отношений, это те отношения, которые формируют и определяют поведенческие нормы и рабочее поведение членов организации (например, отношение персонала к работе, отношения руководства к работникам, отношения между работниками в организации).

Еще один аспект организационной культуры – поведенческие нормы, это те требования к поведению работников, которые воспринимаются ими как некий свод правил, определяющих, каким должно быть «правильное», «должное» поведение членов организации в тех или иных стандартных ситуациях.

Нельзя не сказать о действиях и поведении работников, направленных на достижение конкретных результатов или выполнение порученных заданий. Это наблюдаемое проявление организационной культуры, ее внешняя сторона. Именно по действиям и поведению работников можно судить о том, каково в целом состояние организационной культуры, способствует ли она эффективной работе организации, поддерживает ли стратегию развития, способствует ли успеху проведения различных организационных изменений.

Для формирования организационной культуры, которая бы поддерживала стратегию организационного развития, руководство предприятия должно предпринять ряд шагов.

Во-первых, чтобы организационная культура «работала» на повышение эффективности организации, она должна поддерживать стратегию и миссию.

Во-вторых, необходимо изучить уже сложившуюся организационную культуру. Ее изучение является предпосылкой успешного изменения. Прежде, чем изменять, необходимо знать, что и как изменять. Необходимо найти ответ на вопрос о том, что из себя представляет сегодняшняя организационная культура, какой должна быть организационная культура, чтобы она поддерживала разработанную стратегию организационного развития и изменений.

В-третьих, нужно проанализировать документы, регламентирующие деятельность организации. Культура организации находит свое отражение и в документах (планах, программах, приказах, распоряжениях, положениях), и хотя живая культура больше отражается в представлениях и ценностях работников и руководителях, чем в документах, пренебрегать этим источником не стоит.

В-четвертых, обязательным должно быть изучение сложившихся в организации правил и традиций. Изучение действующих в организации традиций, формальных и неформальных правил должно быть направлено на определение того. Какое влияние они оказывают на рабочее поведение персонала, и в какой степени они поддерживают выработанную руководством стратегию выбранного организационного развития.

И, наконец, в-пятых, особенно важным является изучение сложившейся в организации практики управления. Сложившаяся в организации практика управления является важным источником информации о преобладающей организационной культуре. Поскольку не всегда сложившаяся организационная культура способствует эффективной работе персонала.

Таким образом, организационная культура может выступать в качестве действенного инструмента, который обеспечивает настрой персонала на высокую производительность и высокое качество в работе. Формирование и поддержание такой культуры, которая бы повышала бы отдачу от людей, работающих в организации, способствовала повышению ее эффективности и конкурентоспособности, – это одна их важнейших стратегических задач высшего руководства.

Литература

1. Гибсон Дж., Иванцевич Д.М., Донелли Д.Х.-мл. Организации: поведение, структура, процессы. – М., 2000.

# Современные подходы к реализации проектного менеджмента

Тулегенов Мирлан Берикович
Казахстанско – Британский технический университет
Абилхадиров Самат Маратович
Казахстанско – Британский технический университет

Проектное управление представляет собой основополагающий элемент системы менеджмента компании [1]. В условиях интенсификации деятельности хозяйствующих субъектов и высокой конкуренции эффективная система проектного управления выступает как ключевой фактор успеха, предоставляющий конкурентное преимущество. Эффективный менеджмент организации обеспечивается изучением и грамотным применением моделей проектного управления, однако в стремительно меняющихся условиях рынка необходимым представляется переход к новым моделям проектного управления, дающим возможность выстраивать высокоэффективную систему менеджмента проектов [2]. Наиболее перспективными являются гибкие методы проектного менеджмента, основанные на хорошо выстроенных механизмах и схемах коммуникаций и информационного обмена стейкхолдеров. В связи с этим актуальным является исследование особенностей современных методик проектного менеджмента.

Целью работы является изучение современных подходов к реализации проектного менеджмента. Для её достижения были использованы методы анализа и синтеза научных публикаций и литературных источников по рассматриваемой теме.

Под проектным менеджментом понимается методология организации, руководства, планирования и координации трудовых, материально-технических и финансовых ресурсов на протяжении всего проектного цикла, ориентированная на эффективное достижение его конечных целей посредством применения современных техник, методов и технологий управления [3]. Методы проектного менеджмента используются для:

- определения целей проекта и его обоснования;
- выявления структуры проекта;
- определения требуемых объёмов и источников финансирования;
- подбора исполнителей;
- подготовки и заключения контрактов;
- определения сроков и составления графика реализации проекта;
- расчёта необходимых ресурсов, сметы и бюджета проекта;
- планирования и учёта рисков;
- обеспечения контроля за ходом реализации проекта.

Следует различать понятия «проектный менеджмент» и «управление проектами», дифференцирующим признаком которых является объект управления [4]. В управлении проектами объектами управления выступают программы, проекты и портфели проектов, тогда как в проектном менеджменте – организация как группа лиц, которая сформирована на долгосрочной основе для осуществления определённой деятельности и достижения единой цели. Целью управления проектами является успешная реализация проекта, заключающаяся в достижении результата в рамках установленного технического задания, а проектного менеджмента – получение организацией прибыли, достижение устойчивого экономического положения и прочее.

Можно выделить следующие основные принципы проектного менеджмента [5]:

- целенаправленность – целевая ориентации проекта;
- системность – рассмотрение проекта с системных позиций, что позволяет целостно анализировать процесс управления проектами, одновременно разбивая его на подсистемы;
- комплексность – рассмотрение явлений в их взаимосвязи и взаимозависимости;
- обеспеченность – укомплектованность всех предусмотренных проектом мероприятий необходимыми для их реализации видами ресурсов;
- приоритетность – предоставление преимущества первоочередным задачам при разработке и реализации проекта;
- экономическая безопасность планируемых мероприятий.

Проектный менеджмент даёт возможность управлять организацией в режиме развития, при котором наращивается её производственный потенциал и осваиваются инновации, что приводит к увеличению показателей деятельности [6]. Результатом проектной деятельности выступают любые процессы, продукты, услуги, программное обеспечение, стандарты и компетенции (личностные, коммуникативные и информационно-коммуникационные). Посредством проектного менеджмента обеспечивается возможность адекватной реакции руководства компании на внешние изменения посредством продуманных внутренних трансформаций.

Основным преимуществом проектного менеджмента является предоставление участникам проекта возможности взглянуть на проблему как со своей профессиональной точки зрения, так и с позиции экспертов смежных областей за счёт получения обратной связи [7]. Только в случае, когда все члены команды беспристрастно и систематически оценивают проблему и совместно применяют различные методы для принятия окончательного управленческого решения, становится возможным достижение должного уровня качества реализации и объективности задачи.

Несмотря на значительную теоретическую базу проектного менеджмента, на практике проекты часто терпят неудачи, причинами которых являются [8]:

- изменение внутренних приоритетов организации;
- неточность требований;
- изменение целей проекта во время его реализации;
- неопределённость рисков или целей проекта;
- плохо налаженная коммуникация;
- неадекватная спонсорская поддержка либо смета расходов;
- неточность оценки времени, необходимого для выполнения отдельных задач;
- ресурсозависимость или неадекватное прогнозирование ресурсов;
- некачественное управление изменениями;
- неопытность менеджера проекта.

С целью решения указанных проблем компании постепенно переходят от классического подхода к управлению проектами, основанного на предположении о низких рисках, неизменности требований и жёстких сроках, к гибким и более адаптивным методологиям управления [9]. Адаптивным системам проектного менеджмента присущи следующие отличительные особенности:

1. Ориентированность на конкретный результат. Все выполняемые во время внедрения идеи действия взаимосвязаны и ориентированы на достижение заранее определённой цели. При реализации проекта первостепенным аспектом становится завершённость всех процессов.

2. Ограниченность в ресурсах. Для эффективного воплощения проекта необходимо грамотное распределение имеющихся человеческих, финансовых и временных ресурсов, осуществляемое посредством установления точного либо приблизительного срока

завершения работ, составления сметы и графика реализации.

3. Уникальность. Гибкий подход к проектному менеджменту наиболее эффективен в случае создания нового товара или внедрения новой услуги.

Методики гибкого проектного менеджмента основаны на полной открытости и постоянном обмене информацией между всеми стейкхолдерами и внутри проектной команды, что позволяет объединить все локальные аспекты проекта в единую систему, посредством которой возможно повышение эффективности деятельности компании в условиях высокой неопределённости внешней среды. В рамках современных подходов важна не только и не столько онлайн-коммуникация, сколько личный обмен информацией, однако в зависимости от потребностей проекта и имеющихся в распоряжении ресурсов подходы к работе, а также сложность и уровень используемых технологий могут различаться. Целью формирования сбалансированного пакета коммуникационных инструментов является предоставление всем членам команды возможности эффективно обмениваться данными, корректировать и синхронизировать собственные действия, оперативно учитывая изменения в проектной среде. Помимо этого, коммуникационный инструментарий должен позволять менеджерам проекта не только осуществлять постоянный мониторинг за ходом выполнения проекта, но и своевременно влиять на его результаты.

Основной методикой гибкого проектного менеджмента является Agile, ориентированная на гибкое итеративное управление проектами компании [10]. Согласно данному подходу, весь проект разбивается не на стандартные последовательные этапы, а на совокупность взаимосвязанных подпроектов. Стратегическое планирование и инициация реализуются для проекта в целом, тогда как выделение предстоящих фаз управления и детализация работ осуществляются отдельно для всех подпроектов. Подобная организация проектной деятельности даёт компании возможность оперативнее получить запланированный результат, а в случае необходимости внесения изменений в отдельный подпроект – сделать это без существенных дополнительных затрат и корректировки остальных частей проекта.

Методология Agile базируется на следующих основных принципах [11]:

- возможность изменения требований на любом этапе разработки;
- удовлетворение клиентских потребностей благодаря ранней и бесперебойной поставки ценности;
- частое обсуждение промежуточных результатов;
- непрерывное общение заказчика с командой разработчиков в течение всего проекта;
- мотивированность исполнителей проекта, обеспеченных не только необходимыми материальными условиями для работы, но и доверием и поддержкой;
- открытость, преимущественно личная передача всей информации;
- использование работоспособности продукта или процесса в качестве показателя прогресса;
- постоянное внимание к удобству и повышению уровня мастерства;
- возможность разработчиков, спонсоров и пользователей поддерживать постоянный рабочий темп;
- оптимизация рабочих процессов;
- способность команды к самоорганизации;
- перманентная адаптация к изменяющимся обстоятельствам.

Согласно идеологии Agile, взаимодействие и люди ставятся выше инструментов и процессов, работающий продукт – выше исчерпывающей документации, сотрудничество с заказчиками – выше подготовки контракта, а готовность к переменам – выше, чем следование изначальному плану.

Наиболее популярным и структурированным из семейства технологий Agile является

фреймворк Scrum, удачно сочетающий элементы классического и гибкого подходов к организации управления проектами. Сущность Scrum сводится к набору правил самоорганизации мультидисциплинарной проектной команды, включающей владельца продукта, команду разработчиков и scrum-мастера [12]. Такая командная модель предполагает обеспечение творчества и гибкости исполнителей и сведение к минимуму внешних зависимостей. Фреймворк Scrum подразумевает разделение всего проекта на спринты – равные по длительности части, в течение которых необходимо достигнуть заранее определённых результатов. Продолжительность спринта обычно составляет от одной до четырёх недель. Перед началом спринта на командном совещании составляется список задач для бэклога, оценивается время, требуемое для выполнения каждой задачи, и обсуждается взаимодействие между членами команды. По результатам завершения спринта команде необходимо предоставить заказчику пригодный к использованию продукт. Такой подход обеспечивает максимальную гибкость разработки и позволяет корректировать задачи на любом этапе разработки.

Таким образом, проектный менеджмент выступает одним из ключевых инструментов эффективного управления организацией. В условиях динамичных изменений экзо- и эндогенной среды экономических систем разного уровня требуется переход от управления на базе жёстких структур к гибкому управлению, в частности – адаптивному проектному управлению. Инструментарий проектного менеджмента в управлении компаниями позволяет не только согласовывать интересы стейкхолдеров в вопросах развития, но и оценивать эффективность применения имеющихся и заёмных ресурсов и перспективность вариантов возможных решений существующих проблем.

Список используемой литературы:


1. Терлыга Н.Г., Озорнин С.Ю. Адаптированная модель эффективного гибкого проектного управления // Инновации. – 2018. – № 4 (234). – С. 116-120.
2. Бабенко В.В., Тельнова О.П., Бабенко В.В. Проектный менеджмент в фундаментальных научных исследованиях // Корпоративное управление и инновационное развитие экономики Севера: Вестник Научно- исследовательского центра корпоративного права, управления и венчурного инвестирования Сыктывкарского государственного университета. – 2020. – № 2. – С. 78-89.
3. Проектный менеджмент на предприятиях АПК: краткий курс лекций / сост.: О.Н. Руднева // ФГБОУ ВО Саратовский ГАУ. – Саратов, 2017. – 149 с.
4. Калязина Е.Г., Плешакова Е.Ю., Цветков А.Н. Проектный менеджмент: трактовки, особенности и векторы развития // Теория и практика общественного развития. – 2020. – № 8 (150). – С. 49-57.

Комов А.В. Понятие и принципы управления проектами // Наука и образование сегодня. – 2018. –№ 2 (25). – С. 87-88.

Корзникова Н.В., Газизова А.И. Проектный менеджмент как аспект ситуативного подхода в управлении учреждением дополнительного образования // Научно-методический электронный журнал «Концепт». – 2021. – № 11. – С. 16-30.

5. Коршикова М.В., Свистунова И.Г., Сахнюк Т.И. Современные подходы проектного менеджмента // Наука Красноярья. – 2020. – Т. 9, № 4. – С. 383-395.

Ильина О.Ю. Проблемы в управлении проектами, их наиболее важные причины и способы решения // Управление проектами: материалы Всероссийской молодёжной конференции / под общ. ред. Е.Б. Смирнова. – 2018. – С. 69-72.

6. Тарновский В.В. Адаптивная система проектного менеджмента в экономических системах различного уровня // Вестник Академии знаний. – 2018. – № 5 (28). – С. 319-326.

7. Александрова Т.В. Повышение эффективности проектного управления в организации на основе гибкой методологии Agile // Экономика и бизнес: теория и практика. – 2019. – № 9. – С. 11-15.
   Паркаев П.С. Актуальность использования Agile методологии проектного менеджмента в современных экономических условиях // Актуальные проблемы авиации и космонавтики. – 2018. – Т. 3, № 4 (14). – С. 87-89.
8. Зайцева И.А., Ебата В.Ш., Ковбаса Н.А. Практика применения методологий Agile, Scrum в ИТ-проектах // Индустриальная экономика. – 2021. – № 1. – С. 62-69

# Анализ эпидемиологических особенностей COVID-19 в постпандемийный период

**Туребаева Сымбат**
Студент, «Международный казахско-турецкий университет им. Ходжи Ахмеда Ясави», Казахстан, Г. Туркестан
**Нұрпейіс Жақсылық Жарқынбекұлы**
Студент, «Международный казахско-турецкий университет им. Ходжи Ахмеда Ясави», Казахстан, Г. Туркестан
**Абдуллаева Оразкүл Серікбайқызы**
Студент, «Международный казахско-турецкий университет им. Ходжи Ахмеда Ясави», Казахстан, Г. Туркестан
**Ағабекова Айдана Үрбиханқызы**
магистр, «Международный казахско-турецкий университет им. Ходжи Ахмеда Ясави», Казахстан, Г. Туркестан
**Жолдас Клара Уәлиханқызы**
Научный руководитель, Старший преподаватель кафедры «Общественного здравоохранения и научных исследований» «Международный казахско-турецкий университет имени Ходжи Ахмеда Ясави»

**Аннотация**

В постпандемийный период COVID-19 сохраняет значительное эпидемиологическое значение: изменились схемы передачи, профиль заболевших, доля бессимптомных и пост-COVID-состояний. В статье рассмотрены концепты перехода эпидемии в эндемию, динамика циркуляции новейших вариантов SARS-CoV-2, распространённость пост-COVID-синдромов, эффективность вакцинации и эпидемиологический надзор. Основные выводы: несмотря на снижение тяжёлых исходов, риск остаётся значимым для уязвимых групп; мониторинг, вакцинация и изучение долгосрочных последствий остаются важными компонентами здравоохранения.

**Ключевые слова:** COVID-19; SARS-CoV-2; постпандемический период; эпидемиология; эндемия; пост-COVID-синдром; вакцинация.

## Введение

С момента обнаружения впервые случаев COVID-19 в конце 2019 года тот быстро превратился в глобальную пандемию. В 2022–2023 годах во многих странах введены меры общественного здравоохранения, массовая вакцинация и накоплена иммунная защита. В 2023–2024 годах ряд источников отмечает переход COVID-19 из фазой пандемии в фазу устойчивой циркуляции или эндемии.

Тем не менее, такое положение не означает исчезновение эпидемического риска. Изменились эпидемиологические характеристики: появление новых вариантов вируса, снижение смертности и тяжёлых исходов, но возросший интерес к длительным последствиям инфекции (пост-COVID). Поэтому важно проанализировать эпидемиологические особенности COVID-19 в постпандемический период — как

изменились схемы циркуляции, кто остаётся группой риска, и какие задачи стоят перед системой общественного здравоохранения.

## Основы и эпидемиологические особенности

Переход к эндемии и циркуляция вируса

В рецензии Chung Y-S и др. отмечают, что хотя COVID-19 уже не классифицируется как чрезвычайная ситуация в области общественного здравоохранения (PHEIC) ВОЗ, вирус продолжает циркулировать, появляются новые варианты.

Исследование AlBahrani S. и др. показало, что после пика пандемии изменились паттерны циркуляции респираторных патогенов: анализ за два года (2022-2023) обнаружил смещение доминирующих штаммов в сочетании с другими вирусами.

Таким образом, в постпандемическом периоде характерны:

- Уменьшение частоты тяжёлых заболеваний и смертности по сравнению с началом пандемии.
- Более ограниченное число вспышек глобального масштаба, но возможны сезонные подъёмы.
- Повышенная значимость групп риска: пожилые, люди с сопутствующими заболеваниями, иммунокомпрометированные.

Распространённость и особенности пост-COVID-синдромов

Одним из ключевых вопросов является длительное заболевание — Post-COVID-синдром (или long COVID). Согласно мета-анализу Razak R. и др., опубликованному в 2024 году, распространённость пост-COVID-синдромов среди всех переболевших оценивается и варьируется.

В другом обзоре Nittas V. и др. указывали, что у не госпитализированных взрослых доля может быть 7.5 %–41 %, у госпитализированных — до ≈ 37.6 % и выше.

Факторы, ассоциированные с повышенным риском: тяжесть острого заболевания, возраст, пол (женский), сопутствующие заболевания, ожирение.

Таким образом, эпидемиология пост-COVID-синдромов — важная часть постпандемического контроля: значительная доля лиц сохраняет симптомы длительно, и это влияет на систему здравоохранения, трудоспособность и социальные последствия.

Влияние вакцинации и иммунизации

Эффективность вакцинации против острой формы заболевания хорошо известна; менее изучена эффективность вакцинации против пост-COVID-состояний. Так, Marra A. R. и др. (2022) в мета-анализе показали, что вакцинация хотя и снижает риск пост-COVID-синдрома, но эффект сравнительно умеренный — эффективность порядка 29 % (CI ~27.5-30.8 %) для одной дозы.

Это означает, что вакцинация остаётся важным компонентом эпидемиологической стратегии, но не снимает полностью риск длительных последствий инфекции.

Эпиднадзор, данные и вызовы

В постпандемический период отмечается снижение объёмов тестирования, отслеживания новых случаев и слабее надзор за циркуляцией штаммов, что ограничивает точность эпидемиологических данных. Например, рецензия Chung Y-S и др. подчёркивает необходимость постоянного обновления знаний об эволюции SARS-CoV-2.

Кроме того, интеграция цифровой эпидемиологии и новых источников данных (например, анализ сточных вод, мобильные данные) становится важной задачей для мониторинга вируса и оценки его влияния.

## Заключение

В постпандемический период COVID-19 остаётся значимой инфекцией с изменившейся эпидемиологией. Несмотря на снижение тяжёлых исходов и переход в фазу более стабильной циркуляции, ключевые моменты следующие:

- Вирус продолжает циркулировать, и возможны волны или сезонные всплески, особенно среди уязвимых групп.
- Пост-COVID-синдромы остаются серьёзной проблемой: значительная доля переболевших сохраняет симптомы, что требует внимания здравоохранения.
- Вакцинация уменьшает риск, но не полностью исключает длительные последствия — нужны дальнейшие исследования и усиление иммунизации у групп риска.
- Эпидемиологический надзор должен адаптироваться к новым условиям: уменьшена интенсивность тестирования, но возрастает значение интегрированных данных и цифровых подходов.
- Рекомендуется продолжение мониторинга, адаптация стратегий здравоохранения, а также исследование региональных и возрастных особенностей.

Для стран с ограниченными ресурсами (включая страны Центральной Азии) особенно важно учитывать эти особенности при планировании программ мониторинга, вакцинации и реабилитации пост-COVID-пациентов

Список литературы

1. Chung Y-S, Lam C-Y, Tan P-H, Tsang H-F, Wong S-C C. Comprehensive Review of COVID-19: Epidemiology, Pathogenesis, Advancement in Diagnostic and Detection Techniques, and Post-Pandemic Treatment Strategies. *Int J Mol Sci*. 2024;25(15):8155. doi:10.3390/ijms25158155.
2. Razak R., Ismail A., Abdul Aziz A.F. et al. Post-COVID syndrome prevalence: a systematic review and meta-analysis. *BMC Public Health*. 2024;24:1785. doi:10.1186/s12889-024-19264-5.
3. Hetlevik Ø., Wensaas K.A., Baste V. et al. Prevalence and predictors of post-COVID-19 symptoms in general practice – a registry-based nationwide study. *BMC Infect Dis*. 2023;23:721. doi:10.1186/s12879-023-08727-6.
4. Marra A.R., Kobayashi T., Suzuki H., et al. The effectiveness of coronavirus disease 2019 (COVID-19) vaccine in the prevention of post–COVID-19 conditions: A systematic literature review and meta-analysis. *Antimicrob Steward Healthcare Epidemiol*. 2022;2:e192. doi:10.1017/ash.2022.336.
5. Nittas V., Gao M., West E.A., Ballouz T., Menges D., Wulf Hanson S., Puhan M.A. Long COVID Through a Public Health Lens: An Umbrella Review. *Public Health Rev*. 2022;43:1604501. doi:10.3389/phrs.2022.1604501.
6. AlBahrani S., AlZahrani S.J., Al-Maqati T.N. et al. Dynamic Patterns and Predominance of Respiratory Pathogens Post-COVID-19: Insights from a Two-Year Analysis. *J Epidemiol Glob Health*. 2024;14:311-318. doi:10.1007/s44197-024-00213-9.

# ASSESSMENT OF THE PERFORMANCE OF FOREIGN-ECONOMIC ACTIVITY OF GAS SECTOR COMPANIES IN THE REPUBLIC OF KAZAKHSTAN

**Zinat Imangozhina**
Doctoral candidate (PhD candidate), L. N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan, ORCID ID: 0000-0003-1218-0371

The foreign-economic activity (FEA) of Kazakhstan's gas sector has become a decisive factor for national economic resilience and regional energy stability. Situated between the European and Asian markets, Kazakhstan possesses abundant natural gas resources but remains dependent on limited transit corridors. In this context, assessing the resultivity of export operations requires an integrative model that unites production, financial, infrastructural, and sustainability indicators. Traditional evaluations focused on export volume or price fail to capture the full spectrum of competitiveness in an era defined by decarbonization and digital transformation [1].

The literature on energy export efficiency highlights the need for multidimensional metrics. According to Karatayev and Clarke [2], energy transitions in Kazakhstan are constrained not only by resource availability but also by technological and institutional readiness. Recent analyses by the IEA [3] and the Gas Exporting Countries Forum [4] emphasize that exporters able to align logistics, contract flexibility, and ESG compliance outperform those relying solely on commodity advantages. Building upon these insights, the Integrated Foreign-Economic Activity Performance Index (IFPI) is proposed to evaluate the resultivity of gas sector enterprises through seven weighted indicator groups:

1. **Export Volume (V)** — share of total production exported, growth rate of gas output.
2. **Price Realization (P)** — average export price compared with regional benchmark indices.
3. **Geographic Diversification (G)** — Herfindahl-Hirschman concentration index of export destinations.
4. **Contractual Maturity (C)** — share of long-term contracts with flexible clauses.
5. **Infrastructure and Logistics (I)** — capacity utilization of pipelines and storage facilities.
6. **Financial Robustness (F)** — return on assets, liquidity coverage ratio.
7. **ESG Compliance (E)** — carbon intensity per unit of exported gas and certification coverage.
8. 

Each indicator is normalized on a scale from 0 to 1, then aggregated according to the following formula:

$$\mathrm{IFPI} = \sum_{i=1}^{7} w_i \cdot I_i, \qquad \sum_{i=1}^{7} w_i = 1 \tag{1}$$

Weights are determined by combining the Analytic Hierarchy Process and entropy-weight method, ensuring both expert judgment and statistical consistency [10]. For Kazakhstan, where infrastructural bottlenecks and geographic dependence dominate, infrastructure and diversification receive higher weightings (0.20 each), followed by financial robustness (0.15), contractual maturity (0.15), ESG (0.10), and volume-price (0.10 each).

The conceptual framework recognizes that resultivity is dynamic and path-dependent: it reflects not only current export earnings but also the capability of firms to maintain competitiveness amid volatile energy markets. In particular, ESG compliance and contract innovation have become new determinants of market access. European buyers increasingly require certification of methane emissions, while Asian partners demand flexible destination clauses. Hence, Kazakhstan's gas firms must integrate environmental and contractual innovations into operational management [5].

To demonstrate the methodological application, a simplified IFPI calculation was performed using public data from KazTransGas, QazaqGaz, and selected joint ventures. The assessment covers the period 2021–2024 and normalizes each indicator within the observed range among comparable regional exporters (Uzbekistan, Turkmenistan, and Azerbaijan). The results are summarized in Table 1.

Table 1. Integrated FEA Performance Index (IFPI) for Selected Gas Companies in Kazakhstan, 2024

| Indicator Group | Weight ($w_i$) | Normalized Value (Kazakhstan) | Weighted Score | Benchmark (Regional Average) | Comment |
|---|---|---|---|---|---|
| Export Volume (V) | 0.10 | 0.72 | 0.072 | 0.70 | Export levels remain stable with slight growth in LNG swaps. |
| Price Realization (P) | 0.10 | 0.65 | 0.065 | 0.68 | Limited hub exposure keeps realized prices moderate. |
| Geographic Diversification (G) | 0.20 | 0.45 | 0.090 | 0.60 | High concentration of exports via single corridor. |
| Contractual Maturity (C) | 0.15 | 0.55 | 0.083 | 0.58 | Few long-term contracts with flexible clauses. |
| Infrastructure & Logistics (I) | 0.20 | 0.60 | 0.120 | 0.65 | Pipeline utilization near 80%; LNG capacity lacking. |
| Financial Robustness (F) | 0.15 | 0.75 | 0.113 | 0.70 | Liquidity strong; profitability constrained by domestic tariffs. |
| ESG Compliance (E) | 0.10 | 0.50 | 0.050 | 0.55 | Methane monitoring improving; certification partial. |
| Composite IFPI | 1.00 | | 0.593 | 0.637 | Moderate performance; potential for +0.07 gain with reforms. |

The computed IFPI value of 0.59 indicates a moderate overall performance. Infrastructure and financial indicators show relative strength, while diversification and ESG remain weak points. Scenario simulation suggests that constructing an additional export route to China and integrating ESG-linked finance could raise the index to 0.68 by 2027, assuming stable macroeconomic conditions and reinvestment of export revenues.

A comparison with regional peers underscores these findings. Azerbaijan's SOCAR achieved an IFPI of 0.72 owing to its LNG integration and diversified contracts with European buyers, whereas Turkmenistan's high pipeline concentration reduces its composite score to 0.54. This demonstrates that infrastructure redundancy and contractual flexibility yield measurable performance advantages [6, 7].

The empirical evidence also confirms that financial stability correlates with governance maturity. Firms adopting international accounting standards and transparent export reporting attract lower borrowing costs and longer-term foreign partnerships. The World Bank [6] notes that institutional transparency reduces perceived sovereign risk and facilitates cross-border financing for infrastructure upgrades. Therefore, enhancing corporate disclosure and ESG alignment is not merely reputational but strategically profitable.

Environmental considerations further reinforce this linkage. The United Nations Development Programme [7] and the World Economic Forum [9] highlight that compliance with decarbonization standards directly affects trade competitiveness. For Kazakhstan, introducing methane-leak detection systems and electrifying compressor stations could lower emissions intensity by 25–30 percent. The integration of such projects into green-finance frameworks would improve the ESG subindex while diversifying funding sources.

Contractual architecture reform remains another priority. Present contracts emphasize long-term fixed pricing, suitable for investment stability but inefficient during price booms. Hybrid models—linking base volumes to spot indices with transparent review clauses—would increase flexibility and resilience. The experience of Norway and Qatar demonstrates that flexible contracts combined with hedging instruments stabilize export revenues even amid volatility [8].

Collectively, these measures—diversification of routes, modernization of infrastructure, ESG integration, and institutional strengthening—compose a coherent modernization agenda. When operationalized through the IFPI, they provide measurable targets for both enterprises and policymakers. Continuous monitoring of subindices over time could become a national performance dashboard for the gas industry, linking corporate outcomes to macroeconomic strategy.

In conclusion, the integrated assessment of foreign-economic activity in Kazakhstan's gas sector reveals that the industry stands at a strategic inflection point — a transitional stage between traditional extractive export models inherited from the post-Soviet period and a new generation of adaptive, sustainability-oriented frameworks characteristic of the global energy transition. Historically, Kazakhstan's gas exports were structured around static long-term pipeline arrangements and price formulas tied to oil benchmarks, ensuring predictable revenue but limiting responsiveness to rapidly evolving market conditions. The emerging paradigm, by contrast, prioritizes flexibility, environmental accountability, and digital coordination across supply chains. This transformation is not merely technical; it reflects a profound institutional shift in how value is created and captured within the foreign-economic domain of the energy sector.

The proposed Integrated Foreign-Economic Activity Performance Index (IFPI) provides an analytical instrument capable of translating these multidimensional transformations into measurable parameters. By embedding financial, infrastructural, contractual, and ESG dimensions into a single evaluative structure, the IFPI bridges the traditional gap between macroeconomic policy and micro-level corporate management. Its composite architecture allows both policymakers and firms to monitor real performance dynamics, detect structural bottlenecks, and

identify opportunities for improvement in real time. More importantly, the IFPI operationalizes the concept of "resultivity" — the ability not only to achieve export growth but to sustain it through institutional maturity, technological adaptation, and social responsibility.

The findings underscore that Kazakhstan's path toward higher FEA performance will depend on simultaneous progress in four interlinked domains: logistics diversification, governance transparency, technological modernization, and ecological stewardship. Expanding export routes toward the Chinese and South-Asian markets through cross-border infrastructure projects can substantially reduce transit vulnerability and unlock access to high-demand regions. Parallel modernization of domestic pipeline systems and storage facilities would raise efficiency while enabling partial conversion of pipeline gas into LNG, aligning Kazakhstan with the global liquefied gas ecosystem. Governance improvements — particularly in contract design, reporting, and regulatory predictability — will attract foreign investment and reinforce confidence among long-term buyers. Integrating advanced digital platforms for monitoring, forecasting, and emissions control will ensure that decision-making in the gas sector meets international standards of transparency and precision.

Equally crucial is the environmental and social dimension of competitiveness. In a world increasingly governed by carbon-pricing mechanisms and green-finance instruments, environmental compliance has become a determinant of market access. Kazakhstan's gas enterprises must therefore embed decarbonization within their business models rather than treat it as an external requirement. Investing in methane-leak detection, electrification of compressor stations, and carbon-capture initiatives can significantly reduce emissions intensity, allowing exporters to participate in low-carbon certification systems and preferential financing programs. As the IFPI framework integrates ESG metrics alongside traditional economic indicators, it demonstrates empirically that environmental responsibility is not antithetical to profitability; instead, it constitutes a pathway toward cost reduction, innovation, and reputational capital.

From a policy perspective, the institutionalization of such integrated performance assessment would represent a major step toward evidence-based economic governance. By periodically calculating and publishing IFPI scores, Kazakhstan could establish a transparent national dashboard for monitoring the competitiveness of its energy exports. This would encourage healthy benchmarking among firms, enhance accountability, and align industrial policy with long-term sustainability objectives. In the academic dimension, the IFPI model contributes to the growing body of literature advocating for hybrid evaluation systems that combine quantitative precision with qualitative insight — an approach particularly relevant for transitional economies seeking to balance growth, diversification, and decarbonization.

Ultimately, the modernization of Kazakhstan's gas sector is both an economic necessity and a geopolitical opportunity. As global demand for cleaner transitional fuels continues to rise, especially across Asia, Kazakhstan can position itself as a reliable and responsible supplier bridging the Eurasian energy corridor. Realizing this potential will require coordinated investments in infrastructure, governance reforms that elevate transparency and efficiency, and a consistent commitment to environmental excellence. If these conditions are met, Kazakhstan will not only enhance its foreign-economic performance but also redefine its role within the regional and global energy architecture — transforming abundant natural-resource potential into enduring prosperity grounded in diversification, technological progress, and sustainable development.

## References

1. Pirani S. (2019). *Central Asian Gas: Prospects for the 2020s.* Oxford Institute for Energy Studies.
2. Karatayev M., Clarke M. (2016). A review of current energy systems and green energy potential in Kazakhstan. *Renewable and Sustainable Energy Reviews,* 55, 491–504.
3. International Energy Agency (IEA). (2025). *Natural Gas — Global Energy Review 2025.* Paris: IEA.
4. Gas Exporting Countries Forum (GECF). (2024). *Global Gas Outlook 2050.* Doha: GECF.
5. Bazilian M., Bradshaw M., Goldthau A. (2019). Four scenarios of the energy transition: Drivers, consequences and implications for geopolitics. *WIREs Climate Change,* 9(2).
6. World Bank. (2025). Natural gas markets: Price swings amid a shifting global landscape. *World Bank Blogs.*
7. United Nations Development Programme (UNDP). (2023). *Global Decarbonization in Fossil Fuel Export-Dependent Economies.* New York: UNDP.
8. Pickard S., Scott A. (2024). Oil and gas, poverty and economic development. *ODI Briefing Paper.*
9. World Economic Forum (WEF). (2025). *Energy Transition Index 2025: Best Practice Learnings.* Geneva: WEF.
10. Shen Y., Liao K. (2022). Application of AHP and entropy weight methods in sectoral risk evaluation. *Frontiers in Environmental Science,* 10.

# İsmayıllı şəhərinin idarəetmə sistemlərinin təkmilləşdirilməsi

**Pərvin Məhərrəmova**
Bakı Dövlət Universteti , magistr

**Summary:**
This article analyzes the current state of local governance systems in the city of Ismayilli and explores ways to improve them. Particular attention is given to areas such as digitalization, public participation, transparency, and the efficient use of resources. As a result of the research, recommendations are proposed for the application of innovative approaches in governance, strengthening the interaction between local executive authorities and citizens, and implementing urban development strategies more effectively.
Key words: executive governance,digital governance,public participation,transparency and accountability, urban development strategy.

## 1. Introduction

Ismayilli district, located in the northern region of Azerbaijan, is distinguished by its favorable geographical position, abundant natural resources, scenic landscapes, and rich historical heritage. Situated at the foothills of the Greater Caucasus Mountains, this area offers significant opportunities for both the utilization of natural resources and the development of agriculture and tourism. The administrative center, Ismayilli city, plays a central role in the socio-economic life of the region. Efficient organization of governance systems is one of the key components of overall regional development.

In the contemporary era, city and district governance is not limited to administrative procedures. Human capital management, planned infrastructure development, high-quality provision of public services, effective engagement with residents, and transparent decision-making processes are of critical importance. In this regard, transforming city governance into a flexible, innovative, and participatory model is one of the current challenges. For Ismayilli city, this approach is vital not only for technical enhancement of governance but also for improving residents' well-being and ensuring sustainable urban development.

Currently, several structural and functional issues are observed in Ismayilli city governance. Traditional governance models often fail to meet modern requirements; digitalization is at a low level; public participation is limited; and resources are inefficiently utilized. Moreover, increasing social and infrastructure demands, along with emerging economic opportunities, necessitate qualitative changes in governance.

The primary objective of this paper is to analyze the current governance system in Ismayilli city, identify key gaps, and propose effective development strategies based on international best practices. The study also examines the application of digital governance technologies, modernization of urban infrastructure, strengthening of public participation, and educational initiatives.

## 2. Current Governance System in Ismayilli City

### 2.1 Structure of City Leadership and Administrative Bodies

The governance system of Ismayilli city has been established in accordance with the local government legislation of the Republic of Azerbaijan and is primarily implemented through two parallel structures: the Executive Power and the municipal authorities. Although their functions

differ, collaboration and coordination between these institutions are crucial for effective city management.

The administrative governance of Ismayilli city is organized through the city representation of the Ismayilli District Executive Power. The head of the Executive Power is appointed by the decree of the President of the Republic of Azerbaijan and exercises the authority of central executive bodies throughout the district, including the city.

The city municipality is formed through direct elections by the population and is mainly responsible for addressing local social, economic, and cultural issues. Its authorities include forming and managing the local budget, allocating land plots, and implementing projects aimed at social welfare.

Additionally, local departments operate in sectors such as communal services, education, healthcare, and public safety. However, effective coordination among these entities remains a significant challenge.

2.2 Existing Problems in the Governance System

a) Weak Coordination and Functional Division

Unclear functional boundaries between the Executive Power and municipal authorities often result in overlapping competencies and ambiguity in responsibility allocation, leading to delays and inconsistencies in decision implementation.

b) Inconsistent Quality of Public Services

Services such as water supply, waste management, road maintenance, urban improvement, and others are sometimes provided inadequately, negatively affecting residents' daily life.

c) Unequal and Inefficient Resource Utilization

Poor planning and lack of transparency in financial resource management hinder development in priority areas. Additionally, the municipality's limited financial capacity significantly restricts its implementation potential.

d) Weak Engagement with Residents

Citizen involvement in governance processes is very limited. Mechanisms such as public hearings, responsive handling of citizen requests, and citizen influence in decision-making are either absent or minimally applied, reducing public trust.

e) Lag in Digitalization and Innovative Governance

The use of digital platforms in city governance is very low. The absence of electronic application systems, integrated service platforms, and city data repositories weakens operational efficiency.

2.3 Effectiveness of Key Governance Structures

The effectiveness of governance structures in Ismayilli city can be assessed as low based on the following criteria:

• Transparency and Accountability: Public disclosure of activities by the municipality and Executive Power is limited.

• Operational Efficiency and Agility: Response to requests and problem-solving are slow.

• Strategic Planning: The absence of comprehensive long-term development plans leads to systemic inefficiencies.

2.4 Engagement with Residents and Public Participation

Although formal mechanisms exist for engaging residents in Ismayilli city, their practical application is weak. Regular public hearings, support for local initiative groups, and the use of interactive communication tools remain limited.

2.5 Quality of Public Services and Resident Satisfaction

Most residents are not fully satisfied with public service quality. Notably:

• Water and sewage systems in some neighborhoods are outdated.

• City transport operates irregularly, with inconsistencies in route planning.

• Waste management faces delays and ecological challenges.

Addressing these issues requires not only technical repairs but also changes in governance approaches.

2.6 Resource Management

Inefficient management of financial, human, and infrastructural resources remains a key problem. The municipality's limited budget prevents many development projects from being implemented. Additionally, the personnel capacity does not fully meet modern governance requirements.

This analysis indicates that improving governance efficiency in Ismayilli requires structural reforms, implementation of digital technologies, strengthening public participation, and proper resource planning.

## 3. Importance of Improving Governance Systems

Modern city governance is not limited to maintaining administrative structures. Effective governance is a fundamental condition for socio-economic development and a crucial source of citizen satisfaction. Ismayilli city is no exception: modernizing existing governance mechanisms, increasing transparency in decision-making, and actively involving residents directly affect overall urban development.

This section explains the importance of governance improvement in Ismayilli from three main perspectives: city development, infrastructure and social service needs, and the significance of local community participation.

3.1 Impact of Governance Improvement on Urban Development

Enhancing governance mechanisms plays a key role in ensuring sustainable and balanced development across economic, social, cultural, and environmental sectors. Effective and innovative governance provides:

• Strategic Planning and Project Implementation: Development of concrete long-term plans and their phased implementation is only possible with functional governance systems.

• Increased Investment Attractiveness: A well-organized governance environment is more attractive to both local and foreign investors, expanding economic opportunities.

• Development of Tourism and Agricultural Potential: Growth of tourism, one of Ismayilli's main revenue sources, depends on governance support, including planned infrastructure and service sector development.

3.2 Needs for Infrastructure and Social Service Improvement

Existing infrastructure does not fully meet residents' growing demands or contemporary standards. Governance improvement allows addressing the following needs:

• Transportation System Renewal: Centralized, scientifically-based governance is required to develop city and inter-village transport.

• Modernization of Water, Electricity, and Sewage Systems: Continuous, high-quality service provision requires both technical updates and strengthened governance oversight.

• Enhancement of Education and Healthcare Services: Proper resource allocation, needs assessment, and consideration of public input require a strong institutional governance base.

• Environmental Sustainability and Waste Management: Functional and flexible governance is needed to maintain cleanliness, green spaces, and modern waste management.

3.3 Engaging Local Communities and Residents in Governance

Modern governance requires both top-down and bottom-up approaches. Transitioning to a participatory model in Ismayilli city is important for:

• Increasing social responsibility and civic engagement;

• Ensuring public oversight and transparency;

• More accurately determining residents' needs and priorities;

• Strengthening local identity and community cohesion.

3.4 Effects on Social and Economic Well-Being

Improved governance systems can enhance both social welfare and economic activity:

• Job creation and support for local entrepreneurship;
• Programs for youth employment and development;
• Reducing development disparities between rural and urban areas.

Effective implementation of these measures depends on coordinated and transparent governance systems.

## 4. Ways to Improve Governance Systems in Ismayilli City

The sustainable and modern development of Ismayilli city requires not only socio-economic strategies but also strong, flexible, and innovative governance systems. Considering current challenges and development potential, reforms in the following areas are essential:

• Digitalization and technological modernization
• Urban planning and infrastructure improvement
• Increasing public participation
• Education and civic awareness

### 4.1 Implementation of Digital Governance Systems

Digitalization is the cornerstone of modern governance. Reforms in this area can significantly improve efficiency and transparency.

a) E-Government Services:

• Development of electronic applications, certificates, and service systems;
• Creation of an "e-Ismayilli" portal for online registration and response to applications;
• Use of online feedback and suggestion platforms for residents.

b) Digital Databases and Governance Tools:

• Unified electronic databases for residents and households;
• Mapping of city infrastructure through GIS (Geographic Information Systems);
• Real-time financial reporting platforms to ensure budget transparency.

c) Application of Smart Technologies:

• "Smart City" initiatives;
• Sensor-based monitoring systems for waste management and water supply.

### 4.2 Urban Planning and Infrastructure Improvement

Planned infrastructure development is a priority for a functional and sustainable urban environment.

a) Modernization of City Infrastructure:
• Renewal of outdated water-sewage, electricity, and gas networks;
• Construction of drainage systems for rain and groundwater;
• Expansion of public spaces such as parks, recreation zones, and playgrounds.

b) Transportation and Road Infrastructure:
• Replanning city roads to prevent traffic congestion;
• Establishment of safe bicycle lanes and pedestrian crossings;
• Development of integrated transport routes connecting villages and tourist destinations.

c) Updating Urban Planning Documents:
• The city's master plan must be revised to meet modern requirements;
• Land use and construction regulations should be transparent, planned, and supportive of sustainable development.

### 4.3 Increasing Public Participation

One of the main indicators of democratic and transparent governance is the active participation of citizens in management processes.

a) Open Communication Channels:
• Active presence of the Executive Power and Municipality on official websites and social media;

• Interactive communication with residents through mobile apps, "open door days," and online meetings.

b) Advisory Committees and Local Councils:

• Specialized public committees for youth, women, disabled, and elderly residents;

• Mechanisms for citizen representatives to participate in decision-making through "public councils."

c) Support for Citizen Initiatives:

• Small grants programs at the city level (e.g., for neighborhood improvement or ecological initiatives);

• Creation of municipal participation funds to support social initiatives.

4.4 Increasing Residents' Education and Awareness

Improving governance requires not only administrative enhancement but also increasing citizens' knowledge and skills.

a) Civic Education Programs:

• Organizing "Active Citizenship School" and "Participation in City Governance" programs;

• Municipal practice programs and simulation sessions for youth.

b) Informative Events and Seminars:

• Educational broadcasts via local TV and social networks;

• Professional development programs and training for municipality and Executive Power staff.

c) Improving Digital Literacy:

• Training courses and instructional materials for online services;

• Seminars on digital skills in schools and public centers.

## 5. International Experience in Governance Improvement

Many countries have developed successful models for improving city governance. While these models vary according to social, economic, and geographic conditions, common trends include digitalization, public participation, transparency, agility, and sustainable development.

This section examines successful governance practices first within Azerbaijan, then internationally, and finally analyzes how these practices can be adapted to Ismayilli city.

5.1 Successful Urban Governance Practices within Azerbaijan

a) Baku – "ASAN Service" and "ASAN Kommunal" Model:

The ASAN service model is an exemplary practice of providing state services to citizens transparently, efficiently, and courteously. Specifically, "ASAN Kommunal" centralizes communal services, demonstrating effective governance.

➡ Suitability for Ismayilli: Inspired by ASAN, a district-level "Ismayilli Public Service Center" can be created to provide communal, social, and administrative services through a single platform.

b) Ganja and Sheki – Local Municipality Public Projects:

Municipalities in these cities organize neighborhood meetings, open budget hearings, and public forums, incorporating residents' suggestions into local development plans.

➡ Suitability for Ismayilli: A project mechanism based on citizen initiatives can be implemented in Ismayilli, drawing from Ganja and Sheki experiences.

5.2 Successful International Practices

a) Estonia – Digital Government and "e-Residency":

Estonia has one of the world's most advanced digital governance systems, with 99% of citizens accessing state services online. Electronic ID allows nearly full participation in governance.

➡ Suitability for Ismayilli: Implementation of e-municipality, e-budget, and e-application systems to actively involve residents in governance.

b) Denmark – Public Participation and Local Democracy:

Danish municipalities act as organizers of public participation. Local councils, citizen advisory groups, and neighborhood forums enable residents to influence urban management.

➡ Suitability for Ismayilli: Establishment of neighborhood-based councils to ensure residents participate in decisions about their living areas.

d) Japan – Community-Based Urban Planning:

In Japanese small cities, development plans are prepared with direct community participation. Residents' opinions shape budget priorities and projects, including "safe city," "green spaces," and "elder-friendly infrastructure."

➡ Suitability for Ismayilli: In nature-rich cities like Ismayilli, eco-friendly planning and green infrastructure initiatives can be implemented based on Japanese experience.

e) Canada – Participatory Budgeting:

In many Canadian cities, a portion of the municipal budget is allocated based on public voting. Residents propose projects and vote to select priority initiatives.

➡ Suitability for Ismayilli: Introduce a "participatory budget initiative" where residents can propose and vote on budget projects.

5.3 Adapting Practices to Ismayilli

Country / CityPracticeAdaptation for IsmayilliEstoniaDigital governance systemse-municipality portal, digital applications, budget transparencyDenmarkPublic councils and local participationNeighborhood councils, resident forumsJapanCommunity-based urban planningEco-friendly urban planning, development of green zones

5.4 Considerations for Local Adaptation

Adapting international practices to Ismayilli must consider:

• Human and Technical Resources: Strengthening technical and human capacity in local governance for digital systems;

• Financial Resources: Securing state support and international donor resources for reforms;

• Public Awareness: Informing residents about new governance models and encouraging participation.

Recommendations and Proposed Reform Directions

• Implementation of Digital Governance Systems:

• Creation of the "e-Ismayilli" portal;

• Digitalization of applications, document circulation, and public service systems;

• Use of online monitoring tools to ensure budget transparency.

• Urban Planning and Infrastructure Modernization:

• Renewal of infrastructure based on the master plan;

• Establishment of sustainable transport systems;

• Implementation of ecological and green city concepts.

• Strengthening Public Participation:

• Organization of neighborhood councils and public forums;

• Implementation of participatory budgeting (residents voting on projects);

• Interactive engagement through public hearings and surveys.

• Education and Civic Awareness:

• Training and seminars on city governance;

• Public courses to improve digital literacy;

• Municipal practice programs for youth.

• Adapting International Practices:

• Application of Estonian digital governance, Danish public participation, Canadian participatory budgeting, and Japanese ecological planning models;

• Phased implementation of pilot projects tailored to local conditions.

Literature List

1. Məmmədov, S. C. (2020). Rəqəmsal İdarəetmə və Elektron Hökumət. Bakı: Elm və Təhsil.
   → Rəqəmsal texnologiyaların idarəetməyə tətbiqi və elektron hökumət sistemlərinin qurulması haqqında geniş məlumat verir.
2. Hüseynov, B. A. (2019). Yerli İdarəetmə və Demokratiya. Bakı: Hüquq Nəşriyyatı.
   → Yerli özünüidarəetmə orqanlarının hüquqi əsasları və demokratik prinsiplər əsasında işləməsi haqqında məlumat toplusudur.
3. Əliyev, B. M. (2022). Şəhər Planlaması və İnfrastruktur İdarəetməsi. Bakı: İnkişaf Nəşriyyatı.
   → Şəhərsalma, infrastrukturun idarə olunması və planlı şəhər inkişafı üzrə praktik yanaşmalar təklif edir.
4. Azərbaycan Respublikasının Dövlət Şəhərsalma və Arxitektura Komitəsi (2021). Azərbaycan şəhərlərinin Baş Planlarının hazırlanması üzrə metodoloji sənəd. Bakı.
   → İsmayıllı şəhərinin planlaşdırılmasında istifadə oluna biləcək yerli normativ sənəddir.
5. İqtisadi və Sosial İnkişaf Mərkəzi (İSİM) (2021). Əhalinin İştirakı ilə İdarəetmə: Azərbaycanda vəziyyət və tövsiyələr. Bakı: ISİM nəşriyyatı.
   → İctimai iştirakın idarəetmədə rolu, iştirak alətləri və yerli praktikalara dair təhlillər.
6. UN-Habitat (2017). Urban Governance and Sustainable Development. Nairobi: United Nations Human Settlements Programme.
   → Dayanıqlı şəhər inkişafı və yaxşı idarəetmə modelləri üzrə beynəlxalq istiqamətləri təqdim edir.
7. OECD (2015). Global City Governance Models: Comparative Study. Paris: Organisation for Economic Co-operation and Development.
   → Müxtəlif ölkələrdə şəhər idarəetmə modelləri və onların nəticələrinin müqayisəli təhlilini təqdim edir.
8. World Bank (2018). Improving Municipal Infrastructure and Services: Lessons from Eastern Europe and Central Asia. Washington, DC.
   → Bələdiyyə xidmətlərinin səmərəliliyinin artırılması və şəhər infrastrukturu ilə bağlı təcrübələri əhatə edir.

# Information and Logistics Infrastructure as a Factor of Sustainable Development of Sacred Tourism in the Region

**Kossymbayeva S.**
Yessenov university, Kazakhstan
**Yesturliyeva A.**
Yessenov university, Kazakhstan
**Zhangozhayeva E.**
Yessenov university, Kazakhstan
**Yesbergenova B.**
Yessenov university, Kazakhstan
**Pernebekkyzy N.**
Yessenov university, Kazakhstan

**Abstract**

The article explores the role of information and logistics infrastructure in ensuring the sustainable development of sacred tourism at the regional level. Sacred tourism, which involves visits to religious, spiritual, and cultural heritage sites, is becoming a strategic direction for diversifying regional economies and preserving intangible heritage. The study examines the interaction between infrastructure systems - digital, transport, and communication and their impact on the accessibility, safety, and sustainability of sacred destinations. Using the case of the Mangystau region, the research highlights the importance of digitalization, transport connectivity, and smart territorial planning as the main drivers of sustainable sacred tourism. Recommendations are proposed for developing integrated information-logistics systems that combine technological innovation, cultural preservation, and community engagement.

**Keywords:** sacred tourism, sustainable development, information infrastructure, logistics infrastructure, regional development, Kazakhstan, Mangystau, cultural heritage, state and local management.

## Introduction

In the 21st century, tourism has become a major vector for achieving the Sustainable Development Goals (SDGs), integrating environmental, social, and cultural dimensions. Among the various branches of tourism, sacred tourism occupies a special place, combining religious pilgrimage, cultural education, and ecological consciousness. In regions such as Mangystau in Kazakhstan, sacred sites such as Beket-Ata and Shakpak-Ata mosques are not only spiritual centers but also hubs of regional identity and economic potential. However, the sustainable functioning of these destinations largely depends on the quality of information and logistics infrastructure, which determines accessibility, visitor flow management, and preservation of natural and cultural environments.

The work is aimed at a comprehensive study and development of a scientifically grounded model of information and logistics infrastructure as a key factor in the sustainable development of sacred tourism in the regions of the Republic of Kazakhstan. The relevance of the project is determined by the need to enhance the efficiency of using the country's sacred heritage to

strengthen cultural identity, diversify the economy, and create new growth points for regional development. Despite the significant potential of sacred tourism in Kazakhstan, its development is currently hindered by a number of problems: fragmented information support, weak coordination between transport and logistics structures, the absence of a unified digital platform for managing tourist flows, as well as insufficient integration of sacred routes into regional sustainable tourism strategies. These factors reduce the investment attractiveness of the territory and limit Kazakhstan's opportunities to integrate into international tourism and scientific-cultural networks. The aim of the article is to develop and test a conceptual model of information and logistics infrastructure that ensures the sustainable functioning of sacred tourism based on the synergy of economic, cultural, and technological factors. To achieve this goal, it is planned to conduct comprehensive studies analyzing existing logistics and information systems, mapping sacred sites, modeling tourist flows, assessing the ecological and socio-cultural sustainability of routes, as well as developing digital solutions for integrating logistics and data management.

## Literature Review

International research in the field of sacred tourism focuses on the themes of sustainable territorial development, cultural heritage, and the digitalization of tourist services. According to Rinschede (1992), religious tourism is an important element of socio-cultural identity and requires the integration of transportation and service systems for effective functioning. Cohen (1998) notes that sacred tourism can contribute not only to cultural dialogue but also to stimulating the regional economy through the development of small businesses and services.

Recent studies, such as the research by E. Griffin (2018), emphasize that the digitalization of sacred tourism through the use of Geographic Information Systems (GIS) and mobile applications significantly improves the management of tourist flows. In European countries and Southeast Asia, 'Smart Tourism Routes' models are being actively implemented, allowing for the synchronization of transport, services, and cultural events (Li et al., 2021).

However, in the global literature there is still insufficient research dedicated to the systemic integration of logistics and information infrastructure specifically in the context of sacred tourism. Most studies describe individual aspects – transport accessibility (Becken & Hay, 2007), digital marketing (Gretzel et al., 2015), cultural heritage management (Timothy & Olsen, 2006) – but not their interconnection within a unified model of regional sustainable development.

Scholars such as Timothy & Olsen (2006) and Shackley (2001) underline that sacred tourism requires a delicate balance between access and conservation. According to the UNWTO (2023), infrastructure development is among the five key factors of sustainable destination management. In Kazakhstan, the State Program for Tourism Development 2020–2025 emphasizes the integration of smart technologies, digital mapping, and multimodal logistics to support sustainable travel.

In the Republic of Kazakhstan, research on sacred tourism is conducted within the framework of the cultural program "Rukhani Zhangyru," which focuses on the preservation of spiritual heritage. Scientific works by B. Sagynov (2019), G. Abylkassimova (2020), A. Kaliullina (2021), and others view sacred tourism as an important tool for shaping national identity and developing interregional connections. However, most domestic studies are limited to cultural and historical-geographical analysis and insufficiently address the economic, managerial, and logistical aspects of this field.

In the field of logistics and digital infrastructure in Kazakhstan, there are studies on the development of transport corridors (Zh. Kenzhaliev, 2022) and the implementation of 'smart cities' (A. Abdrakhmanova, 2021); however, they are not directly linked to tourism-related objectives. Thus, there is a clear lack of scientific research at the intersection of tourism, logistics, and digitalization, especially in relation to sacred routes and regional development.

Research by Brimbetova (2011) and Sarsenbayev (2020) points out that for remote sacred destinations, information systems such as geospatial platforms, booking apps, and digital storytelling are as crucial as physical transport routes. This dual infrastructure model supports both sustainability and visitor experience.

## Methodology

The methodological basis of the article is founded on systemic and interdisciplinary approaches, including elements of economic-mathematical modeling, GIS technologies, sociological analysis, and strategic management methods. During the implementation of the project, methods such as field research, expert interviews, surveys of tourism market participants, spatial data analysis, and assessment of the transport accessibility of sacred sites will be used.

The study employs a systemic and regional approach, analyzing sacred tourism as part of the regional innovation and cultural ecosystem. The methodology includes:

1. Content analysis of policy documents and scientific literature (2010–2025).
2. Comparative analysis of international best practices (Israel, India, and Turkey).
3. Case study of Mangystau's sacred tourism network using qualitative field observations.

The analysis focuses on three dimensions of sustainability: economic viability, cultural integrity, and environmental responsibility.

## Results and Discussion

1. Information Infrastructure

Digital platforms that provide information about sacred sites (virtual tours, GIS maps, QR-based guides) significantly enhance accessibility and visitor awareness. The development of the "Smart Tourism Kazakhstan" system and regional mobile apps has enabled data collection for managing tourist flows and reducing environmental pressure on sacred landscapes.

2. Logistics Infrastructure

Efficient transport corridors—highways, port access via Aktau, and improved rural roads facilitate year-round mobility. Integration of transport planning with pilgrimage routes supports the "green corridor" concept, ensuring safe and eco-friendly access to sacred destinations.

3. Integration and Governance

A sustainable sacred tourism model requires coordination between religious organizations, local authorities, tour operators, and digital service providers. Public–private partnerships (PPP) are essential to financing logistics nodes, eco-lodging, and digital content creation.

4. Challenges

The main constraints include:

- Fragmented data and lack of unified digital platforms;
- Limited transport connectivity to remote shrines;
- Weak environmental monitoring and low awareness among visitors;
- Insufficient professional training in sustainable destination management.

The implementation of the project will ensure the systemic development of sacred tourism as an important element of the regional knowledge economy, creating a synergistic effect between cultural heritage, logistics, digital technologies, and management. The results obtained will have significant scientific and practical potential: From a scientific perspective - in the

formation of a new theoretical and methodological basis for sustainable tourism; From a practical perspective - in the development of tools that contribute to the diversification of regional economies, increased employment, and the development of small and medium-sized businesses in the tourism sector.

The project's contribution to the scientific, technical, and human resource potential lies in training young researchers and specialists proficient in modern data analysis methods, logistics planning, and digital modeling. This will enhance the competitiveness of Kazakhstan's scientific organizations and ensure their integration into international research consortia addressing sustainable tourism and cultural heritage management issues.

The practical significance of the project lies in the possibility of implementing its results in the activities of government bodies, tourism companies, and educational institutions, as well as their applicability in the development of regional tourism strategies and digital maps of logistics infrastructure. The project has a high potential for commercialization and scaling, which aligns with the strategic priorities of scientific, technological, and socio-economic development of the Republic of Kazakhstan.

## Recommendations

1. Develop a unified regional digital platform for sacred tourism with integrated mapping, booking, and cultural content.
2. Modernize transport corridors connecting sacred sites to major hubs (Aktau, Zhanaozen, Beyneu).
3. Adopt green logistics standards, including electric buses, solar-powered rest zones, and waste management facilities.
4. Strengthen local capacity through training programs in sustainable tourism management and digital literacy.
5. Establish an “Information-Logistics Hub for Sacred Tourism” within the regional development strategy, linking culture, innovation, and transport.

## Conclusion

Information and logistics infrastructure acts as a critical factor in achieving the sustainable development of sacred tourism in Kazakhstan’s regions. The integration of digital technologies with eco-friendly logistics contributes to balancing economic benefits and cultural preservation. For Mangystau, where sacred geography intertwines with the desert and sea landscapes of the Caspian region, this approach can transform the territory into a model of eco-spiritual tourism, enhancing both regional resilience and global attractiveness.

The expected outcomes of the project have the potential for widespread application at the national level and could become part of international research initiatives on sustainable tourism, strengthening Kazakhstan's position as a scientifically active and innovative participant in the global scientific community.

References:

1. Brimbetova, N. Zh. (2011). Modernization of Territorial Development of Kazakhstan: Methodology and Priorities. Almaty: Institute of Economics, MES RK.
2. Sarsenbayev, B. (2020). Tourism Policy and Regional Development in Kazakhstan. Astana: Eurasian National University Press.
3. Shackley, M. (2001). Managing Sacred Sites: Service Provision and Visitor Experience. London: Continuum.
4. Timothy, D. J., & Olsen, D. H. (2006). Tourism, Religion and Spiritual Journeys. New York: Routledge.
5. UNWTO. (2023). Tourism for Sustainable Development Goals – Policy Frameworks and Implementation. Madrid: World Tourism Organization.
6. Ministry of Culture and Sports of the Republic of Kazakhstan. (2020). State Program for Tourism Development 2020–2025.
7. Chesbrough, H. (2020). Open Innovation Results: Going Beyond the Hype and Getting Down to Business. Oxford University Press.
8. OECD. (2022). Sustainable Infrastructure for Regional Development. Paris: OECD Publishing.

# Environmental Audit of Blue Tourism as a Tool for Innovative Formation of the ESG Economy and Sustainable Development of Kazakhstan's Coastal Areas

**Yesturliyeva A.**
Yessenov university, Kazakhstan
**Yesbergenova B.**
Yessenov university, Kazakhstan
**Aktileuova G.**
Yessenov university, Kazakhstan
**Pernebekkyzy N.**
Yessenov university, Kazakhstan

**Abstract**

This paper explores the role of environmental audit in the development of blue tourism as a driver of sustainable coastal management and ESG (Environmental, Social, and Governance) transformation in Kazakhstan. The study emphasizes the importance of blue economy principles, environmental accountability, and innovative management instruments for coastal zones of the Caspian Sea, particularly in Mangystau Region. Through a combination of theoretical generalization, case analysis, and policy evaluation, the article proposes a framework integrating environmental audit tools into the ESG ecosystem of Kazakhstan's tourism and coastal development sectors. The results demonstrate that environmental auditing can serve as a catalyst for sustainability, resilience, and competitiveness in regional tourism economies.

**Keywords:** Blue economy, environmental audit, ESG, sustainable development, blue tourism, coastal management, Kazakhstan, innovation policy, Caspian Sea.

## Introduction

The global transition toward sustainable economic systems has positioned environmental auditing as an essential instrument for measuring and improving ecological performance. In coastal and maritime contexts, environmental audit mechanisms play a pivotal role in evaluating tourism's environmental footprint and guiding policy interventions. Kazakhstan's coastal areas, especially along the Caspian Sea, hold untapped potential for the development of blue tourism—maritime recreation, yacht and cruise tourism, ecotourism, and coastal cultural tourism.

However, the environmental sensitivity of these ecosystems necessitates innovative governance approaches that balance economic aspirations with ecological sustainability. This study argues that environmental audit, when integrated within the ESG (Environmental, Social, and Governance) framework, can serve as an effective tool for steering blue tourism development toward a sustainable and innovation-driven future.

## Theoretical Background

### Blue Economy and Tourism

The concept of the blue economy emphasizes the sustainable use of ocean and coastal resources for economic growth, improved livelihoods, and job creation, while preserving the

health of marine ecosystems. Blue tourism represents a vital component of this economy, encompassing water-based recreational activities, coastal infrastructure, and marine environmental stewardship. Scholars such as Pauli (2017) and UNEP (2020) highlight that the blue economy is both an ecological and economic paradigm, demanding responsible governance and technological innovation.

### ESG Economy and Environmental Audit

The ESG framework extends the notion of corporate responsibility beyond profit to include environmental integrity, social inclusion, and governance ethics. Environmental audit, as defined by the International Organization for Standardization (ISO 14001), is a systematic, documented, periodic process to assess environmental management practices. Integrating audit systems into blue tourism ensures transparent monitoring, waste reduction, and compliance with sustainability criteria, which are fundamental pillars of the ESG economy.

### Relevance for Kazakhstan

Kazakhstan's strategic location on the Caspian Sea provides significant opportunities for sustainable coastal tourism. Yet, the environmental challenges—pollution, biodiversity loss, and industrial pressures—necessitate advanced regulatory and monitoring instruments. Environmental audit offers a structured method for assessing the ecological impact of tourism infrastructure and promoting responsible innovation in the coastal economy.

### Methodology

The study employs a qualitative analytical method combining:

- Literature review on ESG frameworks, blue economy, and environmental audit practices;
- Case analysis of coastal tourism development in the Mangystau region;
- Comparative assessment of international best practices (Norway, Finland, and the UAE);
- Expert interviews with environmental and tourism specialists (secondary data from national reports).

The methodological approach is grounded in the ecosystem management and innovation governance paradigms, emphasizing system interconnections and stakeholder participation.

### Results and Discussion

### Environmental Audit as an Innovation Mechanism

Environmental auditing functions not merely as a control tool but as a stimulus for innovation. It encourages enterprises to adopt cleaner technologies, digital monitoring systems, and circular economy practices. In blue tourism, such audits can guide the introduction of green port technologies, eco-friendly yachts, and zero-emission transport systems along the Caspian coast.

### ESG Integration in Coastal Tourism

Integrating ESG principles into coastal tourism management requires a reorientation of investment strategies toward sustainability performance metrics. Environmental audits provide measurable data for investors, allowing the identification of sustainable tourism ventures. Governance transparency—an ESG cornerstone—can be achieved through open data reporting and stakeholder engagement in audit processes.

### Case Study: Mangystau Region

The Mangystau region, with Aktau as its administrative center, exemplifies both the challenges and opportunities of ESG-driven blue tourism. The region's fragile marine ecosystem and growing industrial base necessitate an environmental audit framework that combines preventive monitoring with adaptive management. Implementing such systems could reduce water pollution, manage waste from maritime recreation, and enhance biodiversity protection.

### Technological and Institutional Innovations

Recent advancements in remote sensing, blockchain-based ESG reporting, and AI-driven environmental analytics have revolutionized the audit process. Kazakhstan's digital transformation initiatives can leverage these technologies to enhance audit accuracy, transparency, and citizen participation. Institutionally, the establishment of a National Center for Blue Economy and Environmental Auditing is proposed to coordinate ESG and tourism development initiatives.

### Policy Implications

### Governance and Regulation

Environmental audits should be integrated into the licensing and certification of tourism enterprises. Regulatory frameworks must mandate annual environmental reporting aligned with ESG criteria. The Ministry of Ecology and Natural Resources of Kazakhstan can play a leading role by establishing national guidelines for blue tourism audits.

### Investment and Finance

ESG-compliant investment instruments—such as green bonds and impact funds—can incentivize eco-innovations in the tourism sector. Environmental audits provide the accountability structure that investors demand, thus reducing financial risks associated with environmental degradation.

### Community Engagement

Sustainable coastal development requires inclusive participation. Environmental audits should incorporate local community monitoring systems, citizen science initiatives, and educational campaigns promoting blue economy literacy.

### Challenges and Limitations

Despite its potential, environmental auditing faces obstacles in Kazakhstan, including insufficient data infrastructure, lack of trained specialists, and limited awareness among private tourism operators. Institutional fragmentation between environmental and tourism agencies also hinders comprehensive audit implementation. Addressing these barriers requires coordinated intersectoral governance and academic capacity building.

### Recommendations

1. Develop national ESG guidelines for blue tourism and coastal enterprises.
2. Establish a digital environmental audit platform for data collection and public access.
3. Introduce university programs on blue economy management and environmental auditing.
4. Promote international cooperation with Caspian littoral states for joint monitoring.
5. Support public-private partnerships (PPPs) to implement sustainable tourism infrastructure.

## Conclusion

The environmental audit of blue tourism represents a transformative instrument in Kazakhstan's journey toward an ESG-oriented economy and sustainable coastal development. It ensures transparency, accountability, and innovation in managing marine resources. As global paradigms shift toward low-carbon and inclusive growth, integrating environmental auditing into blue tourism policy and practice will enhance Kazakhstan's environmental reputation and economic competitiveness in the Caspian region.

## References

1. Pauli, G. (2017). The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs. Paradigm Publications.
2. UNEP. (2020). Blue Economy for Sustainable Development. Nairobi: United Nations Environment Programme.
3. Chesbrough, H. (2020). Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business Press.
4. OECD. (2023). Tourism Trends and Policies. Paris: OECD Publishing.
5. Ministry of Ecology of the Republic of Kazakhstan. (2024). National Environmental Audit Framework. Astana.
6. World Bank. (2022). Kazakhstan: Towards a Green and Resilient Future. Washington, DC.
7. UNDP. (2021). ESG Integration and Sustainability Reporting in Central Asia. New York: UNDP Press.
8. Brimbetova, N. Zh. (2023). "Blue Economy and Sustainable Tourism in Mangystau." Journal of Regional Innovation Studies, 12(4), 45–58.
9. Sarsenbayev, B. (2022). Sustainable Development Management in Coastal Regions of Kazakhstan. Almaty: KazNU Press.
10. ISO 14001. (2015). Environmental Management Systems – Requirements with Guidance for Use. Geneva: ISO.

# Қазақстандағы инвестициялық саясат және оның әлеуметтік-экономикалық әсері

Масабаева А.М
Қонаев Университеті, экономика ғылымдарының магистрі, аға оқытушы
Исупжанов А.А.
«Қаржы» білім беру бағдардамасының, 3 курс білім алушысы

Қазіргі жаһандану жағдайында ұлттық экономиканың тұрақты дамуы мен бәсекеге қабілеттілігін қамтамасыз етуде инвестициялық саясаттың орны ерекше. Инвестиция – тек капитал құю ғана емес, ол жаңа технологияларды енгізу, жұмыс орындарын ашу, өндіріс тиімділігін арттыру және халықтың әл-ауқатын көтеру тетігі болып табылады. Қазақстан тәуелсіздік алғаннан бері инвестиция тартуды стратегиялық басымдық ретінде қарастырып келеді.

2025 жылғы 8 қыркүйекте Қазақстан Республикасының Президенті Қасым-Жомарт Тоқаев Қазақстан халқына дәстүрлі Жолдауын жариялап, елдің алдағы жылдардағы стратегиялық даму бағытын айқындады. Жолдаудың негізгі өзегі – цифрландыру, жасанды интеллектті дамыту, халықаралық бәсекеге қабілеттілікті арттыру және инвестициялық саясатты түбегейлі жаңғырту болды.

Әлемдік экономиканың жаһандану кезеңінде инвестиция кез келген мемлекеттің даму қарқыны мен әлеуметтік тұрақтылығының басты кепіліне айналғаны белгілі. Қазақстан үшін де инвестициялық саясаттың тиімділігі – өндірістік сектордың жаңғыруына, жаңа технологияларды енгізуге, еңбек нарығын дамытуға және халықтың тұрмыс сапасын арттыруға тікелей әсер етеді.

Президент Жолдауында айтылғандай, Қазақстанның қазіргі инвестициялық жүйесі жеткілікті деңгейде тиімді емес, көбіне шикізаттық секторға бағытталған. Осыған байланысты жаңа инвестициялық модель құру, оны Үкімет пен Премьер-министр деңгейінде үйлестіру – уақыт талабы.

Бұл мақалада Қазақстанның қазіргі инвестиция тарту тәжірибесі, Президент Жолдауында айтылған жаңа бағыттар және олардың әлеуметтік-экономикалық маңызы жан-жақты талданады.

Қазақстан инвестициялық ахуалды жақсарту үшін бірқатар шаралар қабылдады. «Инвестициялар туралы» Заңға сәйкес шетелдік инвесторларға салықтық және кедендік жеңілдіктер беріледі. Сондай-ақ, «Астана» халықаралық қаржы орталығы (АХҚО) құрылып, ағылшын құқығы негізінде жұмыс істейтін арнайы юрисдикция жасалды.

Елімізде 13 арнайы экономикалық аймақ (АЭА) жұмыс істейді. Олар шетелдік және отандық инвесторларға инфрақұрылым, жеңілдетілген салық режимі мен дайын өндірістік алаң ұсынады. Мысалы, «Астана – жаңа қала» АЭА, «Хоргос – Шығыс қақпасы» және «Оңтүстік» тоқыма кластері инвестиция тартуда айрықша рөл атқарып отыр.

Инвестициялық саясат – мемлекеттің ұлттық экономикаға, оның салалары мен аймақтарына инвестиция тарту, тиімді пайдалану және қорғау жөніндегі іс-шаралар жиынтығы. Қазақстанда инвестициялық саясат екі бағытта жүзеге асады:

1. Ішкі инвестициялар – ұлттық компаниялар, жеке кәсіпкерлер мен банктердің экономиканы қаржыландыруы.

2. Сыртқы инвестициялар – шетелдік капитал мен халықаралық қаржы ұйымдарының инвестициялары.

Қазақстан экономикасы шикізатқа тәуелді болғандықтан, инновациялық бағыттағы жобаларды қолдау маңызды. «Цифрлық Қазақстан» бағдарламасы, индустриялық-инновациялық даму стратегиясы аясында IT, биотехнология, жасыл энергетика салаларына инвестиция тарту көзделген.

Инвестициялық қызмет үшін жағымды жағдайлар қалыптастыру үшін мына мәселелерді қолға алу керек:

- салық жүйесін, амортизациялық аударымдарды пайдалану және амортизацияы есептеу механизмін жетілдіру;
- инвестициялық қызмет субъектілеріне арнайы салық режимдерін белгі-леу;
- инвесторлардың мүдделерін қорғау;
- инвестициялық қызмет субъектілеріне жерді, басқа да табиғи ресурс-тарды пайдалану жеңілдіктерін беру;
- инвестициялық қызмет субъектілеріне рейтинг өткізетін және рейтингтік бағаларды жариялайтын ақпараттық-сараптама орталықтарын құру және дамыту;
- монополияға қарсы шараларды қабылдау;
- несиелендіруді жүзеге асыруда кепілдерді қолдану мүмкіндігін кеңейту;
- инвестициялық қызмет субъектілерінің меншікті инвестициялық қорлар-ды құрына мүмкіндік жасау;
- инфляция қарқынына байланысты негізгі қорларды қайта бағалауды жүргізу.

Келешекте қолайлы инвестициялық белсенділікті күшейту үшін келесі шаралар ұсынылады:

- шетел фирмаларымен біріккен жобаларды дайындау және жүзеге асы-руды үйлестіру;
- дамыған елдер үкіметтерімен мақсатты займдар және халықаралық қар-жылық ұйымдармен бірге сауда-экономикалық байланыстар бағдарламалары және жобалары шеңберінде өндіруші және өңдеуші өнеркәсіптің басымдықты салаларына инвестиция тарту бойынша жұмыстарды жалғастыру;
- негізгі капиталды инвестициялауға бағытталған табыстың бір бөлігін салық салудан босату.

Инвестициялық саясаттың негізгі бағыттарының бірі – көлік, энергетика және телекоммуникация салаларын дамыту. «Нұрлы жол» бағдарламасы шеңберінде автожолдар, теміржол және әуежайлар жаңартылып, халықаралық транзиттік дәліздер салынды.

Әлемдік тәжірибе көрсеткеніндей келесі жағдайларды қамтамасыз ететін инвестициялар инвестициялаудың басымдылықты аялары болып табылады:

1) жеке бизнес үшін тартымды емес, бірақ елдің, ұлттың, экономиканың, экологиялық және азық-түліктік қауіпсіздігін қамтамасыз ету;

2) ұлғаймалы ұдайы өндіріс үшін және елдің, тұрғындарының өмірлік іс-әрекеті үшін (мысалы, шаруашылық инфрақұрылымының салалары: транспорт, энергетика, сумен қамтамасыз ету, байланыс және т.б.) қолайлы жағдайлар жасау;

3) жеке капиталдың мобильділігін көтеру оның потенциалды мүмкіндік-терін кеңейту, кәсіпкерлік іскерлікті жүргізу үшін техникалық, ұйымдық және экономикалық жағдайлар;

4) болашаққа үлкен әлеуметтік-экономикалық тиімділікті келесі инвести-циялар ынталандырады - қор құрушы салалар: құрылыс, құрылыс материалдар өнеркәсібі, метал шығару, технологиялық құрал-жабдықтар.

5) салымдардың тез өзін-өзі өтеушілігі және сонымен бір мезетте түйіндес

салалардың, өндірістің дамуын негіздейді (мысалы, тұрғын үй құрылысы, ауыл шаруашылық өнімдерін қайта өңдеу).

6) әлеуметтік қорғау және адам әл-ауқатын дамыту (әлеуметтік қамсыз-дандыру, сақтандыру, денсаулық сақтау, білім, кадрларды дайындау, ғылым).

Теріс тенденциядан құтылып және тура шетел инвестицияларының өсуіне қол жеткізу үшін шетел инвестицияларын ынталандыру бойынша кешенді мемлекеттік бағдарлама дайындалды. Шетел тәжірибесін есепке ала отырып осы бағыттағы Қазақстан үшін енуі қажет шаралар:

- қызмет етуші шетел инвесторлары үшін жеңілдіктер мен преференциялар жүйесін жеке салалар мен аймақтарда құру (жеке жағдайда өнім бөлу механизмін шыңдау және нақты жұмыс істеуші еркін экономикалық аймақтар құру);
- жергілікті билік пен шаруашылық субьектілер арасында меншікті нақты айқын бөлу;
- тұрақты экономикалық және сыртқы сауда заңнамасын құру, концессия және өнімді бөлу бойынша нормативті базаны қоса алғанда;
- салық ауыртпалығын төмендету мен салық құрылымын оңайлату;
- жерге жеке меншік енгізу;
- шетел инвестицияларын сақтандыру механизмдерін құру;

Сонымен, қорыта келе Қазақстан Республикасындағы инвестициялық қызмет даму сатысында. Инвестициялау үшін ішкі ресурстарды дамыту қажет, оның ішінде зейнетақы қаражаттары, сақтандыру нарығы, инвестициялық қорлар қаражаттары қызметін кеңейту болып табылады. Ал мемлекет тарапынан дер кезінде бақылау, қадағалау мен нарық өзгерістерін ескере отырып нормативтік базаны күшейту, жетілдіру мен инвестициялар ағымын ынталандыру бойынша шаралар жүйесін іске асыру.

Инвестиция тарту тек экономикалық емес, әлеуметтік тұрғыдан да оң ықпал етеді:

- Жаңа жұмыс орындары ашылады. Мысалы, шетелдік инвесторлардың қатысуымен салынған зауыттар мен фабрикалар мыңдаған адамды жұмыспен қамтып отыр.
- Кадр даярлау және білім беру дамиды. Инвесторлар өз жобаларына мамандарды оқытуға қаржы бөледі, дуальды оқыту жүйесі кеңінен енгізіледі.
- Халықтың әл-ауқаты артады. Жұмыссыздықтың төмендеуі мен табыстың өсуі халықтың әлеуметтік жағдайын жақсартады.
- Әлеуметтік инфрақұрылым дамиды. Денсаулық сақтау, мәдениет және спорт салаларына инвестиция салу халықтың өмір сапасын көтереді.
- Инвестиция тарту Қазақстан экономикасының өсуіне серпін берді.
- ЖІӨ көлемі тұрақты өсіп келеді. Инвестициялардың арқасында өнеркәсіп, ауыл шаруашылығы және қызмет көрсету салалары қарқынды дамуда.
- Экспорттық әлеует артады. Шетелдік капитал жаңа өнімдерді өндіруге мүмкіндік беріп, халықаралық нарыққа шығуды жеңілдетеді.
- Инновациялық өнімдер шығару. Инвестициялар жоғары технологиялық өндірістерді дамытуға жағдай жасайды.
- Қаржы тұрақтылығы қамтамасыз етіледі. Шетелдік инвестициялардың ағымы ұлттық валюта тұрақтылығына оң ықпал етеді.

Инвестициялық саясаттың жетістіктерімен қатар, бірқатар мәселелер де бар:

- Заңнамалық және әкімшілік кедергілер;
- Шикізаттық емес секторға инвестиция тартудың жеткіліксіздігі;
- Аймақтар арасында инвестициялық теңсіздік;
- Кадрлардың жетіспеушілігі.
- Бұл мәселелерді шешу үшін:
- Салық және кеден жүйесін одан әрі жеңілдету;
- Шағын және орта бизнесті қолдау тетіктерін кеңейту;

- Аймақтық даму бағдарламаларын тиімді іске асыру;
- Кәсіби кадр даярлау сапасын арттыру қажет.

Қазақстандағы инвестициялық саясат – ұлттық экономиканың тұрақты дамуы мен әлеуметтік әл-ауқатты көтерудің маңызды құралы. Инвестиция тарту арқылы мемлекет өндірістік әлеуетін күшейтіп, инфрақұрылымды дамытып, жаңа технологияларды енгізіп отыр.

Алдағы уақытта Қазақстан үшін басты міндет – шетелдік инвестициямен қатар, ішкі инвестицияларды да ынталандыру, шикізаттық емес секторға басымдық беру және инновациялық жобаларды қаржыландыру. Бұл елдің экономикалық өсімін қамтамасыз етіп қана қоймай, әлеуметтік тұрақтылықтың кепілі болмақ.

Қазақстандағы инвестициялық саясат – елдің әлеуметтік-экономикалық дамуының басты қозғаушы күші. Инвестиция тарту арқылы мемлекет жаңа өндірістерді іске қосып, инновациялық жобаларды дамытып, халықтың тұрмыс жағдайын жақсартуға қол жеткізуде. Алдағы кезеңде шетелдік капиталмен қатар, ішкі инвестицияларды ынталандыру, шағын және орта бизнесті қолдау маңызды рөл атқарады.

Пайдаланылған әдебиет тізімі

1. Тоқаев Қ.-Ж. Әділетті Қазақстанның экономикалық бағдары. Халық бірлігі – жаңарған Қазақстанның берік негізі : Қазақстан Республикасының Президентінің Қазақстан халқына Жолдауы. – Астана, 1 қыркүйек 2023 ж.
2. Тоқаев Қ.-Ж. Жаңа инвестициялық кезең : Қазақстан Республикасының Президентінің Қазақстан халқына Жолдауы. – Астана, 1 қыркүйек 2025 ж.
3. Мырзагалиев Б.С. Инвестициялар: Оқулық. – Алматы: Экономика, 2018. – 352 б.
4. Әубәкіров Я.А., Баймұхаметова А.Ж. Қаржы және инвестиция негіздері. – Алматы: Экономика, 2019. – 400 б.
5. UNCTAD. *Investment Policy Review: Kazakhstan.* – Geneva: United Nations, 2022.
6. World Bank. *Kazakhstan Public Finance Review.* – Washington, 2023.
7. U.S. Department of State. *Investment Climate Statement: Kazakhstan.* – Washington, 2024.

# Medical Sciences

UDC: 616-006-071(574)

# EPIDEMIOLOGICAL INDICATORS AND STATISTICAL DATA OF ONCOLOGICAL SCREENING AT THE LEVEL OF PRIMARY CARE

**Arman Khozhayev**
Professor of the S.N. Nugmanov Department of Oncology, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Alua Saterova**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Zeynep Mantay**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Ainur Kenzhebay**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Damira Akhmedova**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Zulfiya Ablakhatova**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Aida Moldabayeva**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Mukhtar-Ilim Abdykerimov**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Akhmet Seidakhmet**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Ayana Kuzenbayeva**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan
**Sabina Ismailova**
Undergraduate Student, Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan

**Annotation:** In this scientific and analytical work, the indicators of incidence and mortality from cervical cancer, breast cancer and colorectal cancer in the regions of our country are considered. The screening methods currently used and the results of this preventive survey of the population are described in detail. Detailed step-by-step algorithms are presented, and the principles of organization and diagnostic capabilities of the screening program for the active detection of these nosological forms of malignant neoplasms in clinically asymptomatic individuals are reflected.

**Key words:** oncological screening, primary care, cervical cancer, breast cancer, colorectal cancer, epidemiology, incidence, mortality, Pap test, smear for oncocytology, ultrasound examination, mammography, hemocult test, fecal occult blood test - FOBT, total colonoscopy.

Today, one of the most important postulates of the oncology service continues to be the early diagnosis of malignant tumors. The purpose of screening is to identify asymptomatic (preclinical) cancer or precancerous conditions in an otherwise healthy target population. In this case, screening plays a leading role in secondary cancer prevention. The key concept of cancer screening is to identify pathology at a stage of development when the effectiveness of treatment is maximum and the prognosis is most favorable. When precancerous diseases are detected during screening, secondary prevention methods allow to prevent the transition of the initial pathological state to cancer. In this case, the main conditions for screening are the presence of trained personnel and a standard approach to identifying the trait being studied and evaluating the results. The methods used must be sufficiently simple, reliable and reproducible, as well as have sufficient sensitivity and high specificity [1-3].

Screening plays an important role in improving early diagnosis and treatment outcomes. According to the Guide to Cancer Early Diagnosis by Ilbawi A. et al. [4], screening aims to detect unrecognized cancer or its prior lesions in a typically healthy, asymptomatic population through tests or other procedures that can be applied quickly and are widely available to the target population. In screening, the target population is assessed for unrecognized cancer or precancer, and most people tested will not be diagnosed with the disease. Screening should be seen as a process and not as the performance of a specific test, examination, or procedure. The screening process includes a system of informing and inviting the target population to participate; administering the screening test; following-up with test results and referral for further testing among those with abnormal test results; ensuring timely pathologic diagnosis, staging and access to effective treatment with routine evaluation to improve the process. A screening program encompasses the process from invitation to treatment and requires planning, coordination and monitoring and evaluation.

To date, the republican oncological screening program includes three nosological forms of malignant neoplasms - cervical cancer (CC), breast cancer (BC), colorectal cancer (CRC). Let's consider the current epidemiological indicators, methodology and results of cancer screening in our country.

CC in the structure of all malignant tumors of both sexes of the population in 2022 took 6th place with a share of 5.51% (2021 - 4th place, 5.54%), in women - stable 2nd place - 9.7% (9.7%) [5].

The incidence rate per 100 thousand population increased from 9.4 to 9.92. In 10 regions of the republic, the incidence rate is higher than the national average: Pavlodar - 17.2 per 100 thousand people (2021 – 16.7) – the highest level, East Kazakhstan – 14.3 (10.8), North Kazakhstan – 14.3 (10.2), Atyrau – 13.2 (13.8), Zhetysu - 11.7, Karaganda - 11.7 (12.0), Abay - 11.1, Akmola - 11.1 (11.9), Mangistau - 11.1 (9.7), Kostanay - 10.8 (10.6) regions.

Low incidence rates in Zhambyl region - 5.8 per 100 thousand population (5.7), Turkestan

region - 6.1 (5.2), Aktobe region - 8.3 (11.6), Kyzylorda region - 8.5 (8.2) areas.

CC in the structure of causes of death from malignant tumors of the population of both sexes in 2022 rose from 9th to 8th position, with a share of 4.6% (2021 - 4.3%), mortality from CC is stable at 3.1 per 100 thousand population (3.1).

The mortality rate from CC in 10 regions is higher than the national average: Akmola - 4.2 per 100 thousand population (2021 - 3.1) - maximum level, West Kazakhstan - 4.1 (4.8), Pavlodar - 3.8 (5.6), Almaty – 3.7 (2.5), Zhetysu – 3.7, Atyrau – 3.4 (4.0), East Kazakhstan – 3.3 (3.8), Karaganda - 3.2 (4.7), Kostanay - 3.2 (2.4) regions and Almaty city - 3.4 (2.9).

Below the national average, mortality was recorded in Abay region, cities Astana, Shymkent - 2.9 per 100 thousand population, Mangistau - 2.8 (3.0), Turkestan - 2.3 (2.2), Aktobe - 2.2 (3.0), North - Kazakhstan - 2.0 (2.6), Kyzylorda regions - 1.7 (3.5) - the best result [5].

In 12 regions, a 100% level of morphological verification of the diagnosis was ensured, the lowest or worst indicator for the third year was in the Kyzylorda region - 94.3%, below the national average indicators in Akmola - 98.8%, Atyrau - 98.9%, Kostanay - 98, 9%, Mangistau - 97.6%, Pavlodar - 96.6%, regions and Almaty city - 98.5%;

In a number of regions, the frequency of diagnosis of stage I-II CC was below the national average (88.1%) - in Akmola - 76.2% (2021 - 73.6%) - the worst result in the country, in Karaganda - 77, 2%, Zhetysu - 82.9%, Abay - 83.8%, Kostanay - 84.3%, Aktobe - 85.5%, West Kazakhstan - 85.7%, Pavlodar - 81.3%, while that in the Atyrau region - 100.0% result.

The proportion of stage IV CC is higher than the national average (2.7%) in the following regions: the worst result is in Zhetysu (6.1%), above the national average in Karaganda - 5.1% (2021 - 5.6%), Akmola - 4.8% (2.3%), Kostanay - 4.5% (4.4%), North Kazakhstan - 3.9% (7.4%), Almaty - 3.7 % (5.1%), Zhambyl - 2.9% (0.0) regions, cities Almaty – 3.6% (1.8%) and Shymkent – 3.8% (5.9%). The lowest neglect is in the East Kazakhstan region - 1.0% (0.7%).

Late diagnosis rates (III-IV stages) for CC are above the national average - 11.9% (15.4% in 2021) were noted in Akmola - 23.8% (2021 - 26.4%) - worst result, Karaganda - 22.8% (35.2%), Pavlodar - 18.8% (20.8%), Zhetysu - 17.1% (24.2%), Abay - 16.2% ( 12.8%), Kostanay - 14.6% (15.6%), Aktobe - 14.5% (9.6%), West Kazakhstan - 14.3% (32.4%) regions. The lowest neglect is in the Mangistau region - 6.0% (20.8%).

Across the country, the five-year survival rate of patients with CC registered in 2018 was 59.9% in 2022, with a decrease from the level of 2021 (67.5% for those registered in 2017), and with a significant range in by region, from the maximum – 72.9% (2021 – 70.7%) in the North Kazakhstan region, to the minimum – 34.9% (64.4%) in the Atyrau region [5].

CC screening is a periodic, comprehensive examination of women of a certain age group as part of a special medical program to prevent and reduce incidence and mortality from CC.

Type of screening - population. The purpose of screening is to identify pre-invasive diseases of the cervix with subsequent recovery. The screening method is a cytological examination of a smear for oncocytology from the cervix (traditional and liquid cytology). Coloring according to the "Papanicolaou test" (Pap test). Interval - 1 time in 4 years. Target group: women aged 30-70 years who are not registered in the dispensary for CC. The expected results are a decrease in incidence and mortality from CC.

Screening steps:

1) Preparatory - formation of target groups, information support and invitation to screening. The preparatory stage is carried out by the nurses of the primary health care organization responsible for preventive measures and includes: annual compilation of a list of women subject to screening in the coming year by November 15 of the current year, followed by monthly correction; informing target groups of the female population about the need for screening; screening invitation; ensure timely screening.

2) Screening - filling out a statistical card of a preventive medical examination (screening)

of an outpatient (form 025-08/y), a register of patients subject to cytological screening and taking material for cytological examination from the cervix. The screening examination of the target groups of the female population is carried out by a specially trained midwife of the primary health care organization.

3) The final one is obtaining the results of cytology, informing the woman and developing further management tactics, fill out accounting and reporting statistical documentation. Responsible for the final stage of screening is the obstetrician-gynecologist of primary health care [6].

Cytological screening of CC is a complex of organizational and medical measures aimed at early detection of precancerous and neoplastic diseases of this localization and at reducing the mortality of this cohort of patients. For traditional cytology, a smear containing 8-12 thousand cells of stratified squamous epithelium (including cells of metaplastic epithelium) is considered adequate; for liquid cytology - 5 thousand cells. For both methods, the number of cells of endocervical epithelium and/or metaplastic epithelium (from the transformation zone) must be at least 10 (single or in clusters). If more than 75% of the cells of the stratified squamous epithelium are covered with erythrocytes, leukocytes, etc., then the quality of the smear is considered unsatisfactory.

Interpretation of the results of a cytological study is carried out according to the Bethesda-terminology cytological system:

Intraepithelial changes and malignant processes are absent (NILM). This group includes cytological conclusions about the normal state of the epithelium, as well as the presence of various non-neoplastic diseases. Normally, squamous epithelial cells, groups of cells of columnar epithelium and metaplastic epithelium, a small number of leukocytes, and rod/mixed microflora are found in preparations. In the presence of non-neoplastic processes, their nature and, if possible, the cause are specified: atrophic changes, reactive changes associated with inflammation, including typical regeneration. In addition, the presence of microorganisms is indicated: Trichomonas vaginalis, fungi, morphologically corresponding to Candida spp., bacterial vaginosis, cellular changes corresponding to the defeat of Herpes simplex virus, squamous epithelial cells with atypia of unknown significance (ASC-US), squamous epithelial cells with atypia of unclear significance, not excluding the presence of a high degree of intraepithelial changes (ASC-H). Low-grade squamous intraepithelial changes (LSIL) include lesions associated with HPV and CINI, high-grade squamous intraepithelial changes (HSIL) include CINII, CINIII, carcinoma in situ and cases suspected of invasion, squamous cell carcinoma, cervical (glandular) epithelium with atypia of unknown significance, cells of the cervical (glandular) epithelium, possibly neoplasia, endocervical adenocarcinoma in situ, endocervical adenocarcinoma, endometrial adenocarcinoma, secondary adenocarcinoma, unclassified carcinoma, other malignant tumors.

There are certain features when taking material for oncocytology: firstly, the examined woman should be informed about the exclusion of sexual intercourse, vaginal manipulations, including douching, baths, tampons, etc. 2 days prior to sampling. Taking material for cytological examination is carried out by the midwife of the examination room of the department of medical examinations of the primary health care organization: the traditional method (2 glasses - with obligatory fixation in 96% alcohol, it is preferable to use glass slides with a polished edge, which are easily marked) or the liquid cytology method (one container with stabilizing liquid ); the code or surname of the patient, identical to the code and surname in the form for sending material for cytological examination, should be clearly marked on the glasses or container [6].

At the same time, when using the traditional method, the biomaterial is delivered to the cytological laboratory as soon as possible after its collection in specialized containers for glass slides with 96% alcohol. If there are visible visual changes in the cervix, then the material is taken from the woman and, without waiting for the results, she is referred for an examination by an

obstetrician-gynecologist.

A cytological study is carried out in centralized cytological laboratories at oncological institutions, where an archive of cytological preparations of patients involved in the screening examination is formed, regardless of the result, for a period of at least 10 years with the formation of a computer database.

What material and technical equipment is required to take material for a Pap test? It is as follows: soap and water for washing hands, a light source for cervical examination, a gynecological chair, a disinfected speculum and gloves, an Eyre spatula, a glass slide and a marking pen, a container with a stabilizing solution for liquid cytology, a fixative solution (96% alcohol), a container with warm water for lubricating and warming the vaginal mirrors, a 0.5% chlorine solution for disinfecting gloves and instruments, or another approved for this purpose. And, of course, the registration form itself.

For carrying out liquid cytology, you additionally need: a disposable cervix brush, a container with a stabilizing solution for liquid cytology, and a fixing solution.

At the same time, a smear for oncocytology cannot be taken: during menstruation, earlier than 48 hours after sexual contact or after using lubricants, vinegar or Lugol solution, tampons or spermicides, after vaginal examination or douching, and also during the treatment of genital infection.

Now, regarding the results of CC screening. In 2022, 771,282 women of the target group aged 30 to 70 years were examined during cytological screening (in 2021 - 757,454).

During cytological screening in 2022, 392 cases of cervical cancer were identified (319 in 2021). The detection rate increased from 0.42 to 0.51 per 1000 women examined

High detection of CC during screening is ensured in Aktobe, Almaty, Atyrau, East Kazakhstan, Kyzylorda, Pavlodar, North Kazakhstan, Turkestan regions and Shymkent city. The detection rate in these regions ranges from 0.55 to 1.59 per 1000 women examined. The best indicator is in Atyrau region - 1.59. Compared to 2021, there is an increase in detection in 10 regions, with the exception of Akmola, Aktobe, Zhambyl, Kostanay, Mangistau, North Kazakhstan regions and Shymkent city. The worst result in Astana is 0.15 per 1000 women examined [5].

Cytologically, cervical precancer was detected in 1.16% of those examined (2021 – 0.99%). The detection rate of precancer below 0.6% (the planned indicator for 2022, according to the Comprehensive Plan) was noted in Aktobe, Karaganda and Kostanay regions.

A high proportion of stage I CC (70% or more) was detected in 6 regions of the country (in 8 in 2021): Kostanay, Mangistau (94.7% - best result), North Kazakhstan, Turkestan regions, cities Almaty and Astana. Low levels of early detection of CC (below 50%) were not observed in any region.

Localized processes (stages I-II) were identified in 99.2% of all cases of detected cancer (96.5%). In the Akmola and Karaganda regions, cases of CC were identified not only in localized, but also in widespread stages of the process. A total of 3 cases of CC in stage III and no cases in stage IV were identified (11 and 0, respectively) [5].

BC ranks first in the structure of the frequency of malignant tumors of both sexes in the population with a share of 14.7% (2021 - 15.4%). This situation has been stable since 2004; in addition, BC ranks first and remains consistently in this position in the structure of female oncopathology. The incidence of BC in 2022 in the country as a whole increased to 26.5 per 100 thousand (2021 – 26.3). In the structure of cases, BC occupies the 1st ranking place in the vast majority of regions and cities of the country, except for three: Akmola, Kyzylorda and North Kazakhstan regions, where lung cancer takes the 1st ranking place [4].

Above the national average - 26.5 per 100 thousand of us. – incidence of BC in 10 regions of the country: Abay – 33.3, Akmola – 32.7 (2021 – 29.8), East Kazakhstan – 44.7 (39.9) – the highest level, West Kazakhstan – 31.2 (28.4), Karaganda – 40.2 (40.1), Kostanay – 37.5 (35.8),

Pavlodar – 43.2 (47.4), North Kazakhstan – 34.7 (38.2) regions and Almaty city – 35.4 (34.5), Astana city – 31.5 (28.4). Below average indicators per 100 thousand of us. in Aktobe - 21.6 (24.3), Almaty - 21.9 (17.7), Atyrau - 22.8 (15.7), Zhambyl - 14.2 (15.1), Zhetysu - 22.8, Kyzylorda - 14.6 (14.4), Mangistau - 14.7 (17.3), Turkestan - 11.3 (11.7) regions and Shymkent city - 14.9 (21.9) [5].

BC ranks third in the structure of causes of death from malignant tumors in the population of both sexes for the thirteenth year in a row, amounting to 8.1% in 2022 (2021 – 8.7%). In the republic as a whole, mortality from BC decreased by 13.0%, from 6.2 to 5.4 per 100 thousand people.

The regions where mortality from BC is higher than the national average include: Abay - 10.1 per 100 thousand people (maximum level), East Kazakhstan - 8.0 (2021 - 8.5), Pavlodar - 7.1 (10.0), North Kazakhstan - 7.0 (11.4), Kostanay - 6.9 (7.5), Akmola - 6.5 (8.2), West Kazakhstan - 5.7 (6.9), Zhambyl - 5.5 (4.8) and Astana city – 6.3 (6.6), Almaty city – 6.6 (9.5). The indicators are significantly lower in Aktobe - 4.5 (3.5), Almaty - 4.5 (5.8), Zhetysu - 4.0, Atyrau - 3.7 (3.0), Kyzylorda - 4.4 (4.1), Turkestan - 3.6 (3.6), Mangystau regions - 2.7 (3.6) - the lowest level [5].

Mass screening to identify BC patients should mainly involve healthy women without any signs of the disease or symptoms. Screening not only helps to detect hidden forms of cancer that can be treated, but also has psychological value for women. As a result of screening, women are convinced that they do not have BC, and this is the most important potential success of such programs. While the ultimate goal of screening is to reduce BC mortality, its immediate goal is to detect cancer before clinical manifestation. However, BC is a heterogeneous disease, which can significantly affect the effectiveness of screening. Screening models for BC are usually based on the fact that the majority of detected tumors are invasive cancers in the early stage of progression. In addition, it must be taken into account that the detection of cancer (or its precursors) before clinical manifestation increases the risk of false positive diagnosis [7,8].

Mammography has a sensitivity of 95% and a specificity of 97%. These indicators decrease when examining women with denser mammary glands (young age, use of hormone therapy), with low quality mammography, and also with insufficient qualifications of the radiologist. Detection of high-grade invasive cancer by screening, when the tumor is not yet detected by clinical examination (palpation), means the possibility of reducing mortality from BC [9].

Preventive screening for early detection of BC in the Republic of Kazakhstan includes [10]:

1) mammography of both mammary glands in two projections - direct and oblique in the mammography room of the city, district polyclinic (mobile medical complex). All digital mammograms in the presence of a system for archiving and transferring medical images are copied to CDs and other electronic media and transferred to the server of the mammography room of the Cancer Center using specialized licensed software integrated between medical organizations; in case of impossibility of digital transmission - they are printed on X-ray film at a scale of 1:1 - 100% (1 patient - 1 set - 2 or 4 mammograms) with subsequent transfer to the mammography room of the Cancer Center;

2) interpretation of mammograms according to the BI-RADS classification (M0t, M0d, M1, M2, M3, M4, M5) by two or more independent radiologists of the same medical organization - double reading or different medical organizations: a radiologist of the mammography room city, district polyclinic (mobile medical complex) - the first reading, and the radiologist of the mammography room of the Cancer Center - the second reading;

3) in-depth diagnostics - targeted mammography, ultrasound examination (hereinafter - ultrasound) of the mammary glands, trepanobiopsy, including under ultrasound or stereotaxic control for histological examination, which is carried out in case of detection of pathological changes on mammograms (M0d) in the mammography room of the Cancer Center.

√ An average medical worker or a responsible person of the organization of outpatient care sends the patient for mammography to the district, city polyclinic.

√ The X-ray laboratory assistant of the mammography room of the city, district polyclinic (mobile medical complex) performs mammography, fills out a referral for double reading of mammograms and transmits the referral through information interaction.

Radiologist of the mammography office of the city, district polyclinic (mobile medical complex): fulfills the requirements for the safety and quality of mammographic examinations; evaluates the quality of the images provided and the correctness of the installation; performs repeated mammography in the M0t category (technical errors of mammography); determines the radiological density of the mammary glands on the ACR scale (A, B, C, D) indicating this parameter in the study protocol; conducts the first reading of mammograms with interpretation of the BI-RADS classification results. In the M0d category (undetermined or suspicious radiological changes requiring additional examination), the study protocol indicates the predominant pathology: education, asymmetry, violation of architectonics, microcalcifications; sends mammograms, electronic copies of mammograms through the archiving system and transfer of medical images to the workplace of the mammography office of the Cancer Center together with directions for double reading of mammograms; directs low–dose computed tomographic images through the system of archiving and transferring medical images to the workplace of the computer tomography office of the Cancer Center together with copies of images recorded on CD-ROMs or other electronic media and directions for double reading.

♦ The radiologist of the mammography room of the Cancer Center: evaluates the quality of the provided images and the correctness of the styling. Viewing digital x-ray images transferred to the server or on digital media (CD, DVD) is carried out on a monitor for interpreting digital x-ray images with a resolution of at least 5 megapixels, which has a certified grayscale transmission in accordance with the DICOM standard; conducts a double (second) reading of mammograms with the interpretation of the results according to the BI-RADS classification, using, if necessary, archival images. Organizes the third reading according to indications. With double reading, an independent interpretation of the images is carried out (blinding method - the second radiologist does not know the results of the first reading); in the M0m category (technical errors in mammography), recommends repeat mammography; in the M0d category (uncertain or suspicious radiographic changes requiring additional examination), the study protocol indicates the predominant pathology: education; asymmetry, violation of architectonics, microcalcifications; recommends that the outpatient care organization, according to indications, invite the patient for in-depth diagnostics (targeted mammography, ultrasound of the mammary glands, trephine biopsy, including under ultrasound or stereotaxic control, followed by histological examination of the material); collects and archives all mammograms (films and electronic media) made as part of the examination. The shelf life of mammograms is at least 3 years after leaving the age subject to a screening study; the results of the double (second) reading are transferred to the outpatient care organizations through information exchange.

♦ Indications for in-depth diagnostics are the conclusions of double reading mammograms M0d (uncertain or suspicious X-ray changes requiring additional examination).

♦ In-depth diagnostics is carried out in two stages. At the first stage, ultrasound is performed, according to indications, targeted mammography, possibly with an increase (with asymmetry, violation of architectonics and the presence of microcalcifications). When visualizing a suspicious pathology (M4 and M5), the second stage is performed - trepanbiopsy, including under ultrasound control and stereotaxic control for histological examination.

♦ Histological examination is carried out in the laboratory of pathomorphology or pathological bureau. Morphological interpretation of the biopsy is carried out in accordance with the recommendations of the World Health Organization.

♦ Physician or responsible person of the outpatient care organization:

1) upon receipt of a mammography result according to the BI-RADS classification:

- in case of M0t (technical errors in mammography) - sends the patient for a second X-ray examination to the mammography room of the city, district polyclinic (mobile medical complex);

- with M0d (undefined or suspicious X-ray changes requiring additional examination) - sends the patient for in-depth diagnostics to the mammography room of the Cancer Center;

- with M1 (no changes detected) - recommends that the patient undergo a follow-up mammography examination after 2 years. With radiological density of the mammary glands, C and D are sent for ultrasound of the mammary glands to exclude a false-negative result of mammography;

- with M2 (benign changes), refer the patient for a consultation with an oncologist (mammologist) of the clinical diagnostic department, followed by a screening mammography examination after 2 years;

- with M3 (probable benign changes) - sends the patient for short-term dynamic radiation observation to the local doctor with the recommendation of control mammography or ultrasound in 6 months;

- with M4 (signs that cause suspicion of malignancy), M5 (practically reliable signs of malignancy) and if it is technically impossible to perform a trepanbiopsy or a biopsy is refused, a referral to an oncologist (mammologist) of the clinical diagnostic department for dynamic observation and decision on the verification of the identified pathology;

2) upon receipt of the result of a histological examination:

- benign education - refers the patient to an oncologist (mammologist) of the clinical diagnostic department for dynamic monitoring, followed by a screening mammography examination after 2 years;

- formation with an indeterminate malignant potential or carcinoma in situ - refers the patient to the Cancer Center for consultation and treatment, followed by dynamic observation by an oncologist (mammologist) of the clinical diagnostic department at the place of her attachment;

- malignant neoplasm - refers the patient to the Cancer Center for treatment and follow-up;

3) communicates the results of the screening examination to the patient in any available way (by telephone, in writing, through electronic means of communication);

4) enters the results of double reading, in-depth diagnostics, histological examination, recommendations of the radiologist of the Cancer Center mammography room into the information system.

Establishing the size of the primary tumor is especially important in screening. Tumor size is an important criterion for evaluating the quality of screening and determining the ability of X-ray mammography to detect non-palpable tumors. Therefore, it is extremely important that pathologists measure tumor diameter as accurately as possible. The smaller the size of the primary tumor, the greater the likelihood of error in determining its size.

Let's analyze the results of BC screening. Mammography screening identified 1,570 cases of BC in 2022 (1,402 in 2021). The cancer detection rate increased from 1.78 to 1.94 per 1000 examined. The best result is in the Karaganda region – 2.63 per 1000 women examined. Low detection rate per 1000 examined, compared to the republican average, in Atyrau (1.72), Zhambyl (0.58), Kyzylorda (1.68), Mangistau (0.42 - worst result), Turkestan (1.22) regions and cities Astana (1.5) and Shymkent (1.58). Compared to 2021, there was an increase in the detection of BC in 9 regions, with the exception of Aktobe (decrease from 2.87 to 2.19 per 1000 women examined), Karaganda (from 2.73 to 2.63), Mangistau (from 1.10 to 0.42), North Kazakhstan (from 3.27 to 2.31), Turkestan (from 1.36 to 1.22) regions and cities Astana (from 1.54 to 1.50), Almaty (from 2.24 to 2.18) and Shymkent (from 2.35 to 1.58) [5].

In 2022, the proportion of patients identified during screening studies with early stages of BC (stage 0-I) was 50.2% during screening (in 2021 - 47.9%). A high proportion of stages 0-I BC

(over 50%) was recorded in 8 regions (in 8 in 2021): Akmola, West Kazakhstan, Karaganda (70.8% - best result), Pavlodar, North Kazakhstan, Turkestan regions, cities Astana and Shymkent. Low levels of early detection of BC (below 40%) were noted in Aktobe (19.3% - worst result), Zhambyl (34.8%), Kostanay (39.5%), Mangistau (27.3%) regions and Almaty city (37.3%). Localized cancer (0-I and II stages) amounted to 96.2% (2021 - 95.5%), while not a single case was detected in stages III-IV in Atyrau, West Kazakhstan, Zhambyl, Kyzylorda, Mangistau, Pavlodar regions, cities Astana and Shymkent. A total of 46 cases of breast cancer in stage III and 14 in stage IV were identified (52 and 11, respectively) [5].

Epidemiological indicators of CRC in the form of colon cancer and colorectal cancer are considered separately for objective reasons.

Colon cancer with a specific gravity of 5.53% (2021 - 5.2%) in the structure of oncopathology of both sexes of the population has risen to 5th place, in men it remains in 6th place - 5.8% (5.5 %), for women - in the 5th - 5.3% (4.91%) The incidence rate of cancer of this localization in the country in the reporting year increased from 8.8 to 9.95 per 100 thousand population.

The incidence of colon cancer in 10 regions is higher than the national average - 9.95 per 100 thousand population: Kostanay - 20.7 (2021 - 15.9), Pavlodar - 18.8 (15.3), North Kazakhstan - 18, 0 (12.7), East Kazakhstan - 16.9 (13.4), Karaganda - 15.4 (15.0), Akmola - 14.6 (10.2), West Kazakhstan - 11.0 ( 10.1), Abay - 10.0 (9.0) regions and cities Almaty – 12.8 (12.1) and Astana – 10.5 (9.0). As in 2021, colon cancer was detected much less frequently in Turkestan - 3.1 per 100 thousand population (2.7), Kyzylorda - 4.1 (4.6), Zhambyl - 5.5 (5.8), Almaty - 6.3 (4.7), Zhetysu - 6.4, Mangistau - 6.8 (4.9) regions and Shymkent city - 5.0 (4.0) [5].

Rectal cancer in the structure of malignant neoplasms of both sexes retains 7th place in rank with a specific gravity of 4.9% (2021 - 4.92%), but in men it dropped from 4th to 5th place - 6.1%, for women – from 9th to 10th – 4.0%. The incidence rate per 100 thousand population increased from 8.4 to 8.8.

A high incidence rate was recorded in Kostanay - 17.8 per 100 thousand population (2021 - 16.2), East Kazakhstan - 17.7 (13.9), North Kazakhstan - 15.6 (15.1), Pavlodar – 14.9 (18.1), Karaganda – 13.3 (11.7), Abay – 12.9, West Kazakhstan – 12.9 (9.8), Akmola – 10.3 (13.1) regions and Astana city – 10.3 (9.0). Traditionally, a low incidence of rectal cancer is observed in Mangistau - 3.1 (2.8), Turkestan - 3.3 per 100 thousand population (2.7), Zhambyl - 3.7 (5.1), Kyzylorda - 4, 1 (5.3), Almaty – 5.3 (5.6) regions and in Shymkent city – 5.5 (5.0) [5].

Rectal cancer in the structure of causes of death from malignant neoplasms of the population of both sexes in 2022 remained in 5th place with a share of 5.41% (2021 – 5.41%). In the republic as a whole, the mortality rate from this form of cancer was 3.6 per 100 thousand population (3.87).

The mortality rate per 100 thousand population was higher than the national average in East Kazakhstan - 7.8 (2021 - 8.6) - the maximum level, Pavlodar - 7.5 (7.6), Abay - 5.9, North Kazakhstan - 5.8 (4.3), Kostanay - 4.9 (4.9), West Kazakhstan - 4.8 (4.2), Karaganda - 3.8 (5.2) regions. Below the national average - 3.8 per 100 thousand population, mortality in Aktobe - 3.2 (4.1), Almaty - 2.6 (2.6), Atyrau - 2.5 (3.4), Zhetysu - 2, 6, Zhambyl - 3.3 (2.7), Turkestan - 2.1 (1.6), Mangistau - 1.9 (1.2), Kyzylorda regions - 1.8 (2.1) - the lowest figure , and cities Almaty – 3.7 (4.3), Shymkent – 2.6 (2.1).

Colon cancer in the structure of causes of death from malignant neoplasms of the population of both sexes in 2022, as in 2021, ranks 6th, with a share of 5.2% (2021 – 5.0%). At the same time, the mortality rate in the country decreased by 5.6%, from 3.6 to 3.4 per 100 thousand population.

Mortality rates in 10 regions are higher than the national average: East Kazakhstan - 7.1 per 100 thousand population (2021 - 5.1) - maximum level, Pavlodar - 5.6 (6.0), Kostanay - 5.3

(5.6), Akmola – 5.2 (3.8), Abay – 5.1, Karaganda – 5.1 (5.6), West Kazakhstan – 4.8 (4.4), North Kazakhstan – 4.8 (5.0) regions and cities Astana – 3.6 (2.7), Almaty – 4.5 (5.3). Low mortality rates from colon cancer were noted in Kyzylorda - 1.2 per 100 thousand population (2.7) - the best result, Turkestan - 1.3 (1.7), Mangistau - 1.6 (2.6), Aktobe – 2.0 (2.5), Zhetysu – 2.4, Zhambyl – 2.5 (3.7), Atyrau – 2.5 (1.8), Almaty – 2.6 (1.8) regions and cities Astana – (2.7), Shymkent – (2.4).

For colon cancer (94.0%) - 100% verification level was achieved in 3 regions (Abay, Almaty and Turkestan regions), high rates in the Astana city (98.5%), Shymkent city (98.0%), Zhambyl (98.4%), Atyrau (98.2%) regions, low – in Akmola region (86.7%), Almaty city (84.3%), in the Kyzylorda region (61.8%) – the worst result since 2017.

For rectal cancer (97.4%) - in 6 regions there is a 100% verification level, the worst level is still in the Kyzylorda region - 85.3%, lower than the republican average in the Akmola region - 92.6%, Aktobe region - 96 .8%, Mangystau region - 87.0%, Pavlodar region - 95.3%, Almaty city - 93.2% [5].

The frequency of diagnosis of stage I-II rectal cancer, as a visually accessible localization (68.9% - national average) in the regions, was: in Akmola - 34.6% - the worst result, as in 2021, in the country ( 2021 - 44.1%), Mangistau - 47.8%, Abay - 53.9%, West Kazakhstan - 59.1%, Almaty - 66.2%, Zhetysu - 68.6%, Karaganda - 65, 7% regions and Shymkent city - 62.9%.

For colon cancer (52.4%), early diagnosis rates are higher in Pavlodar (65.9% - best result), Abay, Aktobe, Atyrau, East Kazakhstan, Zhambyl, Zhetysu, Karaganda, Kostanay, Pavlodar, North Kazakhstan, Turkestan regions and Shymkent. The lowest figure (23.5%) is in the Kyzylorda region.

For colon cancer (17.3%), the rates of neglect at stage IV are higher - in Akmola - 31.0% - the worst result (2021 - 20.3%), Zhetysu - 27.3%, Abay - 23.1% , Turkestan - 22.2% (29.1%), Karaganda - 28.1% (28.6%), West Kazakhstan - 18.8% (8.2%), Mangistau - 17.6% (19 .4%) regions and cities Astana - 18.0% (22.9%), Shymkent - 20.0% (22.7%). The lowest level of neglect is 2.9% in the Kyzylorda region (7.9%).

The proportion of stage IV in rectal cancer (13.1%) is higher in Akmola - 29.6% - the worst result (2021 - 19.4%), Abay - 19.7%, Kyzylorda - 17.6% ( 9.1%), Karaganda - 16.9% (28.4%), Almaty - 15.6% (17.0%), Kostanay - 14.8% (11.1%), Zhambyl - 13.3 % (13.6%) regions and Shymkent city - 14.5% (12.5%). The lowest level of neglect - 6.0% - is in the Atyrau region (12.5%).

Late diagnosis of rectal cancer as a visually accessible localization (stages III-IV) in 2022 amounted to 31.1% (in 2021 - 33.5%).

For rectal cancer, the level of neglect is higher than the national average - 31.1%, the indicators in Akmola - 65.4% (2021 - 55.9%) - the worst result in the country, Mangistau - 52.2% (38.1%), Abay – 46.1% (30.6%), West Kazakhstan – 40.9% (25.4%), Karaganda – 34.3% (46.5%), Almaty – 33.8% (35.7 %), Zhetysu - 31.4% (34.1%) regions and Shymkent city - 37.1% (42.9%). The lowest neglect is in the Atyrau region - 12.0% (17.5%).

In the country as a whole in 2022, the five-year survival rate of patients with CRC registered in 2018 decreased to 40.4% (2021 - 52.9% for those registered in 2017); there is a significant dispersion of indicators by region, from maximum – 56.1% (47.5%) in the Kyzylorda region, to minimum – 24.3% (51.5%) in the Aktobe region [5].

Screening of CRC screening is the systematic use of screening studies in an asymptomatic population. The purpose of screening is to identify people with abnormalities suggestive of CRC. These persons in the future need additional examination to clarify the diagnosis. Opportunistic screening is the non-systematic use of screening tests in routine medical practice. A screening program is much more challenging than an early detection program. At the same time, the success of the screening program is largely determined by the awareness of the population and medical workers about the possibilities of early diagnosis of CRC. The feasibility of a screening program is determined by several factors that relate to the disease being screened, the screening test, the characteristics of the population, and the characteristics of the healthcare system.

The first factor is that the disease must be well understood, common enough in the target population to justify screening, have a recognizable early stage; treatment of the disease at an early stage should be more effective than at a later stage.

The second is that the test should be characterized by sufficient sensitivity, i.e. the ability to detect cancer among people with the disease; sufficient specificity - the probability that among people who do not have a disease, the test result will be negative; have a high positive predictive value (positive predictive value) or, in other words, the likelihood that people with a positive test result have the disease; have a high predictive value of a negative result (negative predictive value), i.e. the likelihood that people with a negative test result do not have the disease; security; low cost; and acceptability - the likelihood that people for whom this test is intended will agree to the examination (which to some extent depends on the awareness of the population about the possibilities and importance of early diagnosis).

The third factor is that the healthcare system should be ready for maximum screening test coverage of the target group, have the resources to confirm the diagnosis, appropriate treatment and follow-up of people with positive test results, and regularly conduct screening tests at regular intervals. At the same time, the benefits of screening must outweigh the potential physical and psychological harm and justify the financial costs of its implementation [11].

The factors most significant for the development of CRC are:

- the presence of chronic inflammatory bowel diseases, adenomatous polyps, cancer of other localization, etc.;

- family history (presence of one or two first-degree relatives with CRC or familial diffuse intestinal polyposis);

- the age of men and women over 50 years old, taking into account the fact that more than 90% of patients with colorectal cancer are people of this age (medium risk).

Age, regardless of gender, is an important risk factor for CRC. After the age of 50, the incidence of CRC increases from 8 to 160 per 100,000 population. Thus, people who have reached the age of 50, even in the absence of symptoms, constitute a moderate risk group for CRC.

The second category of increased risk of CRC (20%) is made up of persons with a genetic and family predisposition, suffering from chronic inflammatory bowel diseases, diffuse familial polyposis.

The high-risk CRC group is determined by the so-called Amsterdam criteria (the presence of malignant tumors in two generations, the presence of cancer in a first-line relative under the age of 50 years), in this case, CRC screening should be carried out after the age of 30 years [12].

The degree of individual risk of developing CRC is determined before screening to select the scope of studies and the frequency of their conduct.

The interval for oncological colorectal screening is 1 time in 2 years, target group: men and women aged 50-70 years, with the exception of persons registered at the dispensary for CRC and colon polyposis. At the same time, when forming the target group, one should take into account the absence of severe concomitant diseases, such as the presence of a common malignant neoplasm, cerebrovascular diseases in the stage of decompensation, chronic obstructive pulmonary disease with respiratory failure, cirrhosis of the liver, myocardial infarction with congestive heart failure, diabetes mellitus with vascular complications. and others, which are highly likely to lead to death in the next 10 years.

The first step in screening for CRC is the fecal occult blood test (FOBT). Traditionally, such methods include a benzidine test for occult blood in the feces. This is a biochemical method based on the assessment of pseudoperoxidase activity of hemoglobin. There is ample evidence that invitation to guaiac FOBT screening (gFOBT) reduces CRC mortality by approximately 15% in age-matched average-risk populations.

To ensure the effectiveness of screening with gFOBT, the interval for screening under the

national screening program should not exceed two years. To date, there is an immunochemical FOBT method - iFOBT, which is superior in efficiency to gFOBT in terms of the probability of detecting adenoma and cancer. iFOBT has improved analysis performance compared to gFOBT.

Immunochemical (immunochromatographic) examination of feces for occult blood - iFOBT or hemocult test is carried out for all men and women of the target group using an express method, which allows you to get a result within 3-5 minutes, without the participation of a medical worker. However, the evaluation of the test is carried out only by a medical worker in the PHC preventive department.

With a positive analysis of feces for occult blood, the second stage of colorectal screening is performed, which consists in endoscopic examination of the colon - total colonoscopy [6]. At the same time, in this case, this medical manipulation is of a therapeutic and diagnostic nature, since it allows one-stage removal of adenomatous polyps, which, according to various authors, occur in every third subject after 50 years of age. At the same time, women have 20% fewer polyps than men, but they have more right-sided lesions, which are more difficult to detect using fecal blood tests, because they are less traumatic [13,14].

What results were obtained from screening for CRC? In 2022, 937,859 men and women of the target group aged 50 to 70 years were examined during colorectal screening (in 2021 - 920,640) [5].

Colorectal screening revealed 325 cases of colorectal cancer in the reporting year, which is 114 cases more than in the previous year (211 cases). The detection rate increased from 0.23 to 0.35 per 1000 patients examined. Low detection of colorectal cancer was noted in Zhambyl, Karaganda, Kostanay, Kyzylorda, Mangistau, Turkestan - the worst result, East Kazakhstan regions, Astana city - from 0.07 to 0.30 per 1000 examined. The best result is in the North Kazakhstan region – 0.81 per 1000 examined. Compared to 2021, there was a decrease in the detection of colorectal cancer per 1000 people examined during screening in Karaganda (from 0.22 to 0.21), Kostanay (from 0.29 to 0.28), Mangistau (from 0.20 to 0.12) regions and Astana city (from 0.20 to 0.19).

Colon precancer (adenoma detection rate) was detected in 27.5% of patients who underwent colonoscopy (2021 – 22.8%). The detection rate of precancer in Akmola, Aktobe, Almaty (8.5% is the worst result), West Kazakhstan, Zhambyl, Kostanay, Kyzylorda, Mangistau, Pavlodar, North Kazakhstan, Turkestan regions and cities is lower than the national average Astana and Shymkent. The best result is 36.2% in Almaty city. It should be noted that the planned indicator for the detection of precancer of the colon and rectum in the country for 2022, according to the Comprehensive Plan, was 23.0% and was achieved.

In 2022, the proportion of patients identified during screening studies with early stages of malignant neoplasms (stages 0-I) was 26.2% during colorectal screening (in 2021 - 27.5%).

High early detection of colorectal cancer (above 30%) was noted in Akmola, West Kazakhstan, Karaganda, Kostanay, Kyzylorda, Turkestan regions and Astana city (57.1% - the best result). Not a single case of early cancer has been identified in the Mangistau region. Cases of cancer in stages III-IV detected during screening were registered in Akmola, Aktobe, Almaty, West Kazakhstan, Zhambyl, Karaganda, Kostanay, Mangistau regions and Almaty city. A total of 21 cases of colorectal cancer in stage III and 3 in stage IV were identified (in 2021 - 18 and 5, respectively) [5].

The complex analysis carried out allows us to conclude that satisfactory results of cancer screening can be achieved only with its proper organization, high quality of implementation, active participation in population screening, the use of highly sensitive tests and instrumental methods of preventive examination, as well as subsequent accurate diagnosis of identified tumors and timely treatment. High-quality screening leads to early diagnosis of pedological diseases and malignant pathology in the early stages, which, in turn, increases the effectiveness of treatment

and improves the prognosis of the disease. Target groups that, for one reason or another, do not participate in screening should be informed that there are no other methods other than screening that would reduce mortality from malignant neoplasms. Incidence and mortality rates from cervical cancer, breast cancer and colorectal cancer clearly reflect the epidemiological situation with this pathology in the regions of our country.

## LITERATURE

1 Salehiniya H., Momenimovahed Z., Allahqoli L., Momenimovahed S., Alkatout I. Factors related to cervical cancer screening among Asian women. Eur Rev Med Pharmacol Sci. 2021 Oct;25(19):6109-6122. doi: 10.26355/eurrev_202110_26889.

2 Farkas A.H., Nattinger A.B. Breast Cancer Screening and Prevention. Ann Intern Med. 2023 Nov;176(11):ITC161-ITC176. doi: 10.7326/AITC202311210.

3 Carter K. A practical approach to selecting a colorectal cancer screening test. JAAPA. 2021 Nov 1;34(11):18-23. doi: 10.1097/01.JAA.0000794976.41120.ee.

4 Ilbawi A., Varghese Ch., Loring B., Ginsburg O., Corbex M. under the overall direction of Krug E. and Varghese Ch. Guide to Cancer Early Diagnosis. World Health Organization, 2017; 48 p.

5 Kaidarova D.R., Shatkovskaya O.V., Ongarbayev B.T., Seisenbayeva G.T., Azhmagambetova A.E., Zhylkaidarova A.Zh., Lavrentieva I.K., Sagi M.S. Indicators of the oncology service of the Republic of Kazakhstan, 2022: statistical and analytical materials. – Almaty, 2023. – 430 p.

6 https://onco.kz/wp-content/uploads/2020/03/Rukovodstvo-po-skriningu-RSHM.pdf

7 Abdolell, M., Payne, J.I., Caines, J. et al. Assessing breast cancer risk within the general screening population: developing a breast cancer risk model to identify higher risk women at mammographic screening. Eur Radiol. 2020 Oct;30(10):5417-5426. doi: 10.1007/s00330-020-06901-x.

8 Idit Melnik, Yael Rapson, Ahuva Gropstein et al. Different approaches to mammography as a screening tool for breast cancer. Harefuah. 2022 Feb;161(2):121-124.

9 Mann R.M., Athanasiou A., Baltzer P.A.T. et al. Breast cancer screening in women with extremely dense breasts recommendations of the European Society of Breast Imaging (EUSOBI). Eur Radiol. 2022 Jun;32(6):4036-4045. doi: 10.1007/s00330-022-08617-6.

10 Prikaz i.o. Ministra zdravoohranenija Respubliki Kazahstan ot 30 oktjabrja 2020 goda № ҚR DSM-174/2020 - «Ob utverzhdenii celevyh grupp lic, podlezhashhih skriningovym issledovanijam, a takzhe pravil, ob#ema i periodichnosti provedenija dannyh issledovanij». - Paragraf 6. Porjadok provedenija skriningovogo issledovanija na rannee vyjavlenie raka molochnoj zhelezy (In Russ.).

11 Kashin S.V., Nehajkova N.V., Zav'jalov D.V. i dr. Skrining kolorektal'nogo raka: obshhaja situacija v mire i rekomendovannye standarty kachestva kolonoskopii. Dokazatel'naja gastrojenterologija. 2017;6(4):32-52 (In Russ.).

12 Samadder N.J., Smith K.R., Wong J. et al. Cancer risk in families fulfilling the Amsterdam Criteria for Lynch syndrome. JAMA Oncol. 2017 Dec 1;3(12):1697-1701. doi: 10.1001/jamaoncol.2017.0769.

13 https://onco.kz/skrining-na-rannee-vyyavlenie-kolorektalnogo-raka/

14 Hultcrantz R. Aspects of colorectal cancer screening, methods, age and gender. J Intern Med. 2021 Apr;289(4):493-507. doi: 10.1111/joim.13171.

## Literature

# ARTISTIC REFLECTION OF REAL-LIFE FACTS IN THE PLAYS OF ILYAS EFENDYEV

Garanfil Rzayeva
Senior Lecturer, Agjabadi Branch of Azerbaijan State Pedagogical University, Azerbaijan

***Abstract.*** In the history of Azerbaijani literature, one of the personalities who played an important role in the development of dramaturgy, prose and journalism since the middle of the 20th century was Ilyas Efendiyev. In addition to continuing the realistic traditions of national literature, he also gave impetus to the formation of new artistic and aesthetic qualities. The writer's creativity has become an expression not only of the literary process, but also of the socio-moral landscape of the era.

Ilyas Efendiyev is one of the personalities who formed an important stage in the development of Azerbaijani literature. His works have left an indelible mark on the psychological depth of national dramaturgy, the formation of modern artistic language and the artistic expression of human spirituality in art. The writer's creativity remains relevant for our modern era, both from a literary and moral-aesthetic point of view.

Ilyas Efendiyev, in addition to continuing the realistic traditions of national literature, gave impetus to the formation of new artistic and aesthetic qualities. The writer's work has become an expression not only of the literary process, but also of the socio-moral landscape of the era.

***Keywords: Ilyas Efendiyev, realism, national literature, truths of life, play, dramaturgy, creative manner, etc.***

Ilyas Efendiyev (1914–1996) took his first steps in literature in the genre of short stories, but later became known more as a playwright. One of the main innovations he brought to literature was the ability to delve into the depths of human psychology, a dramaturgical model based on internal monologue and situational tension. In Efendiyev's works, simple events of everyday life are filled with deep philosophical and spiritual content.

The main themes in the writer's works are values such as human dignity, moral purity, conscience, love and freedom. He presents human character under the influence of the social environment, and also brings to the fore the moment of moral choice of each hero. This aspect is clearly visible in his plays such as "You Are Always With Me", "The Song Remained in the Mountains", "The Atayevs' Family", "The Battle of Lovers in Hell" (1, p.4).

In Azerbaijani literature, Ilyas Efendiyev (1914–1996) is one of the artists who opened a new stage in the development of dramaturgy in the second half of the 20th century. He is known as a writer who penetrated the depths of human psychology in national dramaturgy and artistically reflected the socio-moral problems of the time with real shades of life. The events, images and situations in Efendiyev's plays present a real picture of Azerbaijani society, fully showing the relationships between people and time. One of the main poetic features of Ilyas Efendiyev's dramaturgy is realism. The writer presents life material as it is, without idealizing it, but with artistic generalization. In plays such as "You Are Always With Me", "The Atayev Family", "Days of Joy", "The Song Remained in the Mountains", "Strange Boy", the fate of people from different walks of life, their spiritual searches, conflicts and relationships with the social environment are vividly reflected.

The main idea for Efendiyev is the issue of human moral integrity and inner freedom. He reveals the inner world of his heroes with psychological details, presenting them against the background of real life contradictions.

Efendiyev brings to the center of dramaturgy such problems as the moral crisis arising in the process of development of society, the undermining of the family institution, alienation in human relations, the clash of modernity and tradition. For example, in the play “The Atayevs’ Family”, intra-family relations, intergenerational conflict and the concept of moral responsibility are realistically developed. Here the writer shows that social well-being does not provide a person’s moral comfort, and the loss of moral values leads to individual tragedies.

In the play “You are always with me”, the author realistically describes the psychological picture of the post-war years, the moral turmoil of a person related to memory and love. The work presents the socio-cultural realities of the era in unity with personal feelings.

The play focuses on the impact of war on human psychology and social relations. The work shows both individual and collective tragedy: the heroes face losses, memories and mutual responsibilities. Efendiyev formulates the idea here as follows: historical and social difficulties can change the inner world of a person, but they retain the spiritual integrity and power of love.

The heroes of the play are depicted with realistic portraits. They reflect the person of the modern era, full of internal contradictions and psychological complexities. The main character is a person who has gone through wars and losses, but has preserved his spiritual stability. His internal dialogues show a person being caught between hope and fear. The female image in Ilyas Efendiyev's play acts as a family, love and moral support. She also performs the function of a bridge between the past and the future. The supporting characters in the work reflect different layers of society and the social realities of the time. Their dialogues illuminate social conflicts and people's relationships with each other. Each of the characters enhances both the dramatic tension and artistic meaning in the play (2, p.17).

As for the artistic features of the work, Efendiyev presents the events as they are, far from artificial idealism. The social and moral crisis of the post-war society is reflected in the characters. The internal monologues and mutual relations of the heroes accurately show their psychological state. The conversations of the characters are simple, natural and convincing, reflecting the social and moral state of each character. In the work, the author symbolically shows the impact of war and losses through memories, music and everyday events.

Although the structure of the play is based on the principles of classical dramaturgy, Efendiyev enriches it with psychological realism. Events develop sequentially, but the author's attention is mainly focused on the inner world of the heroes. This gives the work both dramaturgical and philosophical depth.

The play "You Are Always With Me" is a brilliant example of Ilyas Efendiyev's art of reflecting real life realities in artistic form. By realistically presenting human destinies, moral and psychological difficulties after the war, the author brought a valuable example of psychological realism to Azerbaijani dramaturgy (3, p.38). The play emphasizes the importance of preserving the spiritual integrity of a person in both an individual and social context.

The heroes of Ilyas Efendiyev are not artificial, but living portraits of society. They live with the worries, desires and contradictions of everyday life. The writer preserves reality in their manner of speaking, behavior, and feelings. This is especially evident in the play “The Song Remained in the Mountains”. Here, the bitter reality of the war years, losses and the unshakable will of man are expressed in poetic language.

Efendiyev also pays special attention to the psychological depth of female characters. In his plays, a woman is presented not only as an object of love, but also as a spiritual support, a personality standing at the center of family and society.

Ilyas Efendiyev's language is simple, but has an emotional impact. He clearly shows the social status, way of thinking, and psychological state of the characters through colloquial language. The author's stage speech is based on natural dialogues in life, which gives the plays sincerity and credibility. Efendiyev combines the principles of classical dramaturgy with the psychological depth of modern dramaturgy in the artistic structure.

Ilyas Efendiyev's plays reflect the stages of social and moral development of Azerbaijani society as an artistic chronicle. In his work, real life realities are presented not only as a subject of observation, but also as an object of artistic and philosophical analysis. In Efendiyev's dramaturgy, the clash of a person's inner world and the social environment has created a new qualitative stage in the development of the national theater.

Efendiyev presents the spiritual world of man, social and moral problems, as well as the values of patriotism, family, friendship and labor on a dramatic level, giving an educational message to the audience. In Efendiyev's plays, the educational significance is manifested in several aspects. In the plays, the internal struggle of the heroes, their moral dilemma and the process of choice provide the audience with a moral example. For example, in the play "You Are Always With Me", the psychological and moral revival of the heroes who have gone through the war teaches the values of humanity, patience and conscience to young people (4, p.27).

In the work "The Atayevs' Family", the issue of intergenerational conflict and the preservation of family values is shown through dramatic means. The plays emphasize the importance of properly building family relationships, and children are educated in a sense of respect for the family and responsibility.

The author's plays were mainly written against the backdrop of war and social crisis. Patriotism, social responsibility and labor values are one of the main themes in these works. In the play “The Song Remained in the Mountains”, the consequences of war and the support of people for each other, as well as the importance of national unity and solidarity, are instilled in the audience.

In Efendiyev’s plays, he shows the consequences of right and wrong, justice and injustice through the choices of the heroes. This educates the audience’s thinking and develops their ability to judge ethically and morally.

Ilyas Efendiyev uses various artistic means to realize the educational goal. The inner world of the heroes is presented clearly and convincingly for the audience. This develops a sense of empathy and understanding in the younger generation. Social and moral issues are clearly visible through simple and natural dialogues. Also, motifs such as war, loss, and memories strengthen the educational message.

Ilyas Efendiyev’s plays are an important example of the educational function in Azerbaijani dramaturgy. They are not only intended for performance, but also serve the spiritual and moral development of the younger generation. In his plays, Efendiyev presents the inner world of man, family, friendship, patriotism and moral choices in realistic and artistic-philosophical shades, forming thoughts and feelings in the audience. From this point of view, his works are evaluated as an important tool for both theater and educational work (5, p.47).

Efendiyev's dramaturgy brought a modern breath to Azerbaijani theater art. Unlike the classical concept of conflict, he brought internal drama and psychological contradictions to the fore. In his works, stage events are presented in the form of a moral struggle rather than an external confrontation.

His heroes no longer fit into simple categories such as "positive" and "negative"; they listen to the voice of their conscience in the face of life's complex dilemmas. The writer's language is sincere, natural and rich in artistic expression.

Efendiyev's dramaturgy, especially in the 1960s–80s, laid the foundation for modern psychological theater on the Azerbaijani stage. His plays, while continuing the traditions of Jafar Jabbarli, also reflected the aesthetic searches of the new era.

Ilyas Efendiyev also showed fruitful creativity in the field of prose. In his stories and narratives such as “Don't Look Back, Old Man”, “The Tale of Valehin with a Yellow Shirt”, “The Day of the Murder”, the writer brought to the forefront the inner world of man, values such as conscience and responsibility. His prose language is poetic, emotional and realistic (6, p.51).

In his journalistic articles, the writer attached special importance to the role of literature and art in the moral education of the people, and to the fact that art should serve man.

Ilyas Efendiyev's creativity is not limited to his time. His artistic and aesthetic principles have become a school for subsequent generations of writers. Efendiyev's influence is also clearly felt in the work of authors such as Anar, Elchin, and Isi Malikzade.

He turned the elegance and inner freedom of the spiritual world of man into the main value of literature, and strengthened the line of humanism and aesthetic realism in Azerbaijani literature.

Ilyas Efendiyev is one of the personalities who formed an important stage in the development of Azerbaijani literature. His works left an indelible mark on the psychological depth of national dramaturgy, the formation of modern artistic language, and the artistic expression of human spirituality in art. The writer's work remains relevant for our modern era, both from a literary and spiritual-aesthetic point of view.

LİTERATURE:

1. Efendiyev I. Selected Works. Baku: Yazichi, 1985.
2. Mirzayev M. Ilyas Efendiyev's Dramaturgy. Baku: Elm, 2002.
3. Gasimzade Y. History of Azerbaijani Dramaturgy. Baku: Maarif, 1987.
4. Mammadli R. Psychological realism in the dramaturgy of 20th century Azerbaijan. Baku: Science and Education, 2014.
5. Guliyev N. The problem of modernity and realism in Azerbaijani literature. Baku: Science, 2008.
6. Huseynov M. Ilyas Efendiyev: the image of man and time. “Azerbaijan” magazine, No. 5, 2016.

# LANGUAGE AND STYLE ISSUES IN EARLY ENGLISH POETRY

Mahmudzade Safura Novruz gizi
Senior Lecturer, Agjabadi Branch of Azerbaijan State Pedagogical University, Azerbaijan

***Abstract.*** This study is devoted to the study of the language and style features of Old English poetry. Language and literature, which are considered as ancient as the history of mankind, are also observed in various fields in the modern world, and information about this is provided in the article. The article analyzes the stages of English literature, which are divided into ten stages, then Old English literature, unique examples of this period and mainly the epic "Beowulf", and on its basis, the stylistic features of Old English poetry are determined. The article consists of an introduction, two subheadings and a conclusion. The conclusion drawn as a result of the study is that Old English literature constitutes an interesting example in terms of studying the undeniable role of oral folk literature on today's literary richness, and it is advisable to study it more deeply in the near future.

***Keywords: Beowulf, literature, style, English poetry, ancient literature, oral literature, Celts, etc.***

Language and literature are as ancient as the history of mankind, and equally modern. It can be observed everywhere: in books, videos, television, radio, music, computers, newspapers, in general, in all media that tell a story or create an image. Literature is an art form based on words and speech. The first examples of literature in any culture are considered to be oral folk literature. The classical Greek epics of Homer, the Epic of Gilgamesh of the Mesopotamians, etc. Many examples of oral folk poetry have been passed down from generation to generation and have survived to this day.

The first manifestations of oral folk literature in the English language were centered around three themes: religion, war, and everyday life. These three questions formed the main theme of many works [1, p.40]. According to Lubering [4], the earliest examples of literature in the English language were written as a continuation of oral epics that brought people together for entertainment. These stories often created mythical images of brave knights, beautiful women, terrifying monsters, and mysterious spirits. These narratives, passed down through the centuries, form the basis of English literature.

When we think of the native peoples of the British Isles, we often think of the Anglo-Saxons (Germanic tribes), but in fact they were composed of a completely different people, the Celts. Although not attested by written examples, the Celtic language is similar to the dialect of English spoken today in Ireland, Wales, Cornwall, Scotland, Brittany in France, and parts of Great Britain. It was different from the Saxon language [5, p. 20]. According to Fletcher [2], the modern English people descended from several different peoples who gradually invaded or conquered the island of Great Britain. The oldest of these peoples belong to the Celtic family, which later split into two branches: the Goidelic or Gaelic. They are the ancestors of the Scottish Highlanders, who settled in the northern part of the island, now known as Scotland. The current descendants of these peoples, who later showed their influence on English literature, lived in England and Wales. Many of them, like the "barbarian peoples", were divided into many tribes and often fought with each other. England was later conquered by the Anglo-Saxons, and the process of forming a unified literature began.

This article, which examines the characteristic features of Old English poetry, mainly uses

the analyses of Mina Khanum Urgan, who is considered one of the most prominent researchers of Turkish research and English literature. In addition, the opinions of authors such as Carter, Fletcher, Lubering, etc. who have conducted relevant research on Old English literature are also analyzed.

The prominent Turkish researcher M. Urgan [5], who conducted extensive research on English literature and wrote many books, divided the history of English literature into ten periods. When determining the beginning and end of the periods, factors such as movements, artists, existing forms of government, administration, political climate, etc. were taken into account.

*The period of Old English literature:* It begins around the 8th century with the transition from oral to written literature and continues until the Norman Conquest (1066), which was a turning point in English history. This period is the period when poetry first appeared.

*Middle English literature:* It covers the entire Middle Ages and continues until the 15th century.

*The Renaissance or Elizabethan period:* The last forty years of this period, named in honor of Queen Elizabeth, who reigned from 1558 to 1603, are called the Jacobean period, because after Elizabeth's death, the Scottish king Jacob ascended the throne, and the Latin version of his name is Jacob.

*Commonwealth period: 1642-1660.* Restoration period: Begins with the accession of Charles II, son of Charles I, who was executed by the Republicans, i.e. the restoration of the monarchy, and continues until the early 18th century.

*Neoclassical period:* Lasts from the beginning of the 18th century to about 1770. Since Queen Anne ruled from 1702 to 1714, the beginning of this period is also called the Queen Anne period. The most famous figures of Latin literature lived during the reign of the Roman emperor Augustus, and English poets and writers, taking their example, likened themselves to the classical writers of Rome and adopted the word "Augustus", which is why this period is also called the Augustan period.

*Pre-Romantic period:* The pre-Romantic period, which covered the last thirty years of the 18th century and prepared the transition to Romanticism, was distinguished by its unique features.

Romanticism: began with the publication of Wordsworth and Coleridge's Lyrical Ballads in 1798 and continued until the middle of the 19th century.

*Victorian Era:* This period, again named after the queen, is considered the most distinctive period of English literature. Since Queen Victoria ascended the throne in 1837 and died in 1901, this period continued until the beginning of the 20th century.

Scholars have little information about most of the writers and poets of the Old English period. Most of the information they have about this period is based on fragmentary manuscripts that have survived from that period [4, p. 33].

The earliest examples of English literature were written in Anglo-Saxon, the source of the English language spoken today. At this time, not only the words and grammatical rules of Old English, but even some of its letters resembled the Germanic alphabet, which differed from the letters of the Latin alphabet [5, p. 47].

On the other hand, Old English was formed as a result of the mixing of the languages of the Germanic tribes called the Angles, Saxons and Jutes, who had been continuously attacking the Celts since the 5th century and who would soon occupy England. Many examples of Old English are more influenced by Germanic literary examples than by English ones, because these Germanic tribes, who had driven the Celts from the north and west to Cornwall, Wales, Ireland and Scotland, brought with them the oral folk literature they had created. Therefore, the events described in these poems take place not in Britain, but precisely in Europe [5, p.49].

Most examples of Old English poetry come from four manuscripts from the late 10th and

early 11th centuries. These manuscripts are:

*The Beowulf Manuscript (British Library):* Contains Beowulf, Judith, and three other prose examples;

*The Exeter Book (Exeter Cathedral):* A collection of sayings, riddles, didactic poetry, and religious stories;

*The Junius Manuscript (Bodleian Library, Oxford):* Also known as the Caedmon Manuscript, it contains biblical fragments, although its contents are no longer attributed to Caedmon;

*The Vercelli Book (found in the library of Vercelli, Italy).* It contains lives and marriages of saints, short religious verses, etc.

These books include historical poems from the Anglo-Saxon chronicles, as well as mythical, didactic, elegiac, and heroic poems. These manuscripts were engraved on stone or metal before being transferred to paper [4, p.22].

It is not known which poets wrote Old English poetry at what dates. Sung by minstrels called "gleeman" or "scop," these bards were performed as if they were reciting their own or others' poems to the accompaniment of a musical instrument. Since the word "glee," which means "joy" or "fun" in modern English, also means "music," the term "gleeman" can also be translated as "music man" or "music maker." In Old English, the word "scop" was used to mean a poem or "bard" [5, p. 52].

Rhyme is almost completely absent in Old English poetry. However, alliteration and assonance are often used. Alliteration involves the repetition of the letter "s" on a string, as in "swift swallow flying to the south."

Assonance refers to a half-rhyme in which vowels do not join together. The Old English "decorated" their poems not only with assonances, but also with similarities resulting from the combination of two different words. For example, they used expressions such as "battle-lightning" instead of "sword", "dark-helmet" instead of "darkness", "bone house" instead of "body", "war-sweat" instead of "blood", "death-house" instead of "grave", "head-jewels" instead of "eyes", "whale-path" instead of "sea", which also indicates the development of their metaphorical and artistic imagination [5, p. 39].

The spirit of the poems in Old English poetry is dark and "cruel". In the poems of this period, naval battles come to the fore [2, p. 14]. Urgan [5, p. 56] notes that this situation is understandable, since the Germans were close to the sea and these poems were related to the difficulties they encountered during their travels. For centuries, the Germans crossed the dangerous seas from their homeland between the Rhine and the Jutland Peninsula and from the coast of the North Sea to the islands of Great Britain. The anxiety and fear they felt during these journeys are reflected in Old English poetry. The poems of the Germans do not speak of green, colorful meadows with flowers, roaring rivers, chirping birds and sunny blue skies; they describe dark forests, steep cliffs and seagulls flying over choppy seas [5, p. 60]. The most famous work of pre-Christian Old English literature and the first epic poem in English literature is considered to be "Beowulf". This epic, which is quite long, consisting of more than three thousand lines, was written at the end of the 10th century. Researchers of English literature learned about the existence of such a poem only in the 19th century. It is not known exactly when and where this poem was written. "Beowulf" is the greatest monument of Old English literature. The story of Prince Beowulf and the beast Grendel is among the epics that readers still read with interest today [2, 4].

In "Beowulf", our hero fights with wolves and dies after being seriously injured in one of the battles, the detailed descriptions of which convey to the reader the message that sooner or later everything will end. "Beowulf" shows that nothing is eternal, youth and joy are replaced by death and sorrow, etc.

Kinwulf, one of the few authors of this period, is the author of a number of noble religious poems (in the Anglo-Saxon language), especially stories about Christ, Christian apostles and heroes

[2, p. 25]. In addition, such poems related to the period as “The Wanderer”, “The Seafarer”, “The Battle of Maldon”, etc. are known. However, the masterpiece of Old English poetry is undoubtedly the epic “Beowulf”. Therefore, it is more appropriate to analyze the details of this epic.

“Beowulf” continues the tradition of the Germanic heroic epic in terms of scale, style and theme. Beowulf's cutting off the hand of a wolf and sinking to the bottom of a swamp are familiar motifs from folk literature. The moral values emphasized in the poem are the loyalty of the Germans to their clan and tribal leader, and their sense of revenge. Since the poetry is also strongly influenced by Christianity, it is far from the cruel fatalism found in the poems of the Old Icelandic literature "Edda" or the Icelandic epics. Beowulf is more selfless than the Germanic heroes or the heroes of the "Iliad". In addition, since all three of his battles are against wolves that threaten the entire society and civilization, he promotes unity rather than division among people [3, p. 11]. Although many critics evaluate the poem Beowulf as a Christian allegory representing good and light against evil and darkness, they agree that the hero's selflessness and tragic death are his worthy end. All this does not mean that “Beowulf” is an optimistic poem, here the tense and sad style comes to the fore more.

The characteristics of Old English literature come to the fore more in its choice of themes. In almost all cases, Old English poetry consists of epic stories, battles and wars. “Beowulf” is the most famous example of this. To put it very simply, in the epic, the main hero defeats the terrible creature in the end. It is this hypermasculinity that is mainly characteristic of the literature of the time. These themes were most likely written to “entertain” people who remained within the walls of the castle and did not see any battles in their lives. In any case, the themes are relevant; fighting evil, darkness and sometimes even God was the main theme of literature until recent times. An interesting fact was that all of these poems are anonymous and their authors are unknown.

On the other hand, linguistically, Old English poetry relies more on alliteration than today's poetry, and its form is mainly determined by rhyme. In Old English literature, it was common to emphasize different words and syllables to create rhythm, rather than lines that connect rhymes. Creating metaphors by combining two words was also particularly popular, creating a rich poetic mood. In this respect, Old English literature is an interesting example of the undeniable role of oral folk literature in today's literary richness, and it is appropriate to study it more deeply in the near future.

LITERATURE:

1. Fletcher, R.H. (2002). A history of English literature. Kessinger Publishing.
2. Hattaway, M. (2005). Renaissance and reformations: an Introduction to early and modern English literature. Oxford: Blackwell Publishing.
3. Carter, R., McRay, J. (1997). The Rutledge history of literature in English. London.
4. Luebering, J.E. (2011). English literature from the old English period through the Renaissance. New York: Britannica Educational Publishing.
5. Urgan, M. (2013). History of English literature. Istanbul: Yapı Kredi Publications.

# Harold Pinter's influence to the English literature

A.R.BASHIRZADE
Azerbaijan State Pedagogical University, (Sheki) (Sheki city, M.A.Rasulzade, 305)

Keywords: synergistic, learning, theory, education, method, innovation
Açar sözlər: sinergetik, öyrənmə, nəzəriyyə, təhsil, metnod, innovasiya
Ключевые слова: синергетика, обучение, теория, образование, метод, инновация.

## 1.Introduction

Harold Pinter is an English playwright, poet, screenwriter, actor, director and public figure of Jewish origin. For many years he has been the head of the School of Drama and Stage Speech at the University of London. He was born in the British capital into a middle-class family. Three of his grandparents were Polish and one was an Odessa Jew. Although Harold Pinter entered the Royal Academy of Dramatic Art in 1948, he did not complete his education. While still at school, he began to participate in amateur performances. In the early 50s, he showed more inclination towards poetry, and at the same time he became an actor in the Irish theater troupe. His first stage work, the play "Birthday", was performed at the Bristol University Theater in 1957. Three years later, another play called "The Watchman" was staged, and this work earned Pinter the title of the best English playwright of the second half of the 20th century. At that time, the author had just turned 30. His early plays are often called "comedies of menace." Harold Pinter wrote his most popular works in the first half of the 1960s. These include "The Collection" (1961), "Acquaintances" (1962), "The Teahouse" (1964), "Homecoming" (1964) and other plays. Almost all of these plays were successfully staged on the stage of British theaters. In later years, the writer's plays "The Land Without Owners" (1974), "Treason" (1978), "The Language of the Mountains" (1988) attracted more attention. Pinter takes his themes from the lives and everyday lives of ordinary people. However, almost all of these works, which begin without promising any surprises, end with an unusual, unexpected and inexplicable ending. For example, in the play "A Light Pain", a middle-aged intellectual sees a silent match seller near his house. He invites him to his apartment.

Despite all his efforts, he cannot engage the match seller in conversation. Finally, he himself gets angry and begins to reveal the aspects of his life that he has kept secret from everyone. As a result, his wife throws him out of the house and begins to live with the silent match seller. The ruthless harshness of revealing the hidden aspects of human psychology is characteristic not only of Pinter's dramaturgy, but also of his film work. His own scripts, as well as those based on the novels of Francis Fitzgerald, Franz Kafka, and John Fawcett, have made it possible to produce remarkable films. Harold Pinter himself starred in these films along with the stars of world cinema. In the last twenty years of his life, Harold Pinter was more engaged in social activities and self-promotion than in artistic creation, and paid attention to the issue of protecting human rights. But it is interesting that the English writer tried to protect human rights in the way he understood and wanted. In 1985, at the initiative of the International PEN Club, Harold Pinter and the American playwright Arthur Miller visited Ankara to investigate the facts of persecution and oppression of dissident writers. In a meeting with the US ambassador, they stated that Washington, by supporting the regime in Turkey, was preventing dissent in this country. The ambassador, in turn, tried to justify the idea that US-Turkish cooperation was necessary to prevent the Soviet threat. However, Pinter, who did not have the courage to continue the argument on an ethical level,

began to use insulting expressions towards the ambassador. As a result, the writers were expelled from the residence with great shame.

## 2.Harold Pinter's works

Later, Pinter called this incident, which was actually incompatible with intellectualism, one of the bright pages of his biography.(2) Pinter has repeatedly made sharp statements about the oppression of the Kurds in Turkey, US pressure on Nicaragua, the restriction of human rights in Central and South America, America's anti-humanist attitude towards the former Yugoslavia, etc. At the same time, he was known as one of the European intellectuals who took the most uncompromising position against the military operations of the US and Great Britain in Afghanistan and Iraq. Revealing the true reasons for Bush's military intervention in Iraq, Pinter said in his speech in the lower house of the British Parliament: "The Americans used various classic methods of creating terrible fear - intimidation, bribery, blackmail, propaganda - to gain the false support of the world community. The most ordinary thing happened: an army was deployed on the territory of a sovereign country, a plan was implemented to occupy and control oil-rich lands." In 2003, Pinter published a book of poems on the topic of Iraq, "War." This book won the author the British Wilfred Owen Literary Award. In 2005, the author announced on the open air of the BBC radio station that he had stopped his dramaturgical work "because he was concerned about the current state of the world, and would henceforth direct all his energy and attention to politics and poetry." In the same year, a few days after celebrating his 75th birthday, Harold Pinter was awarded the Nobel Prize for Literature. Beginning in late 1948, Pinter attended the Royal Academy of Dramatic Art for two terms, but hating the school, missed most of his classes, feigned a nervous breakdown, and dropped out in 1949. In 1948 he was called up for National Service. He was initially refused registration as a conscientious objector, leading to his twice being prosecuted, and fined, for refusing to accept a medical examination, before his CO registration was ultimately agreed. He had a small part in the Christmas pantomime *Dick Whittington and His Cat* at the Chesterfield Hippodrome in 1949 to 1950. From January to July 1951, he attended the Central School of Speech and Drama. (3)

From 1951 to 1952, he toured Ireland with the Anew McMaster repertory company, playing over a dozen role In 1952, he began acting in regional English repertory productions; from 1953 to 1954, he worked for the Donald Wolfit Company, at the King's Theatre, Hammersmith, performing eight roles. From 1954 until 1959, Pinter acted under the stage name David Baron. In all, Pinter played over 20 roles under that name. To supplement his income from acting, Pinter worked as a waiter, a postman, a bouncer, and a snow-clearer, meanwhile, according to Mark Batty, "harbouring ambitions as a poet and writer." In October 1989 Pinter recalled: "I was in English rep as an actor for about 12 years. My favourite roles were undoubtedly the sinister ones. They're something to get your teeth into." During that period, he also performed occasional roles in his own and others' works for radio, TV, and film, as he continued to do throughout his career.

Pinter's house in Worthing, 1962–64

From 1956 until 1980, Pinter was married to Vivien Merchant, an actress whom he met on tour, perhaps best known for her performance in the 1966 film *Alfie*. Their son Daniel was born in 1958. Through the early 1970s, Merchant appeared in many of Pinter's works, including *The Homecoming* on stage (1965) and screen (1973), but the marriage was turbulent. For seven years, from 1962 to 1969, Pinter was engaged in a clandestine affair with BBC-TV presenter and journalist Joan Bakewell, which inspired his 1978 play *Betrayal*, and also throughout that period and beyond he had an affair with an American socialite, whom he nicknamed "Cleopatra". This relationship was another secret he kept from both his wife and Bakewell. Initially, *Betrayal* was thought to be a response to his later affair with historian Antonia Fraser, the wife of Hugh Fraser, and Pinter's "marital crack-up".(1)

## 3.Conclusion

Pinter and Merchant had both met Antonia Fraser in 1969, when all three worked together on a National Gallery programme about Mary, Queen of Scots; several years later, on 8–9 January 1975, Pinter and Fraser became romantically involved. That meeting initiated their five-year extramarital love affair. After hiding the relationship from Merchant for two and a half months, on 21 March 1975, Pinter finally told her "I've met somebody". After that, "Life in Hanover Terrace gradually became impossible", and Pinter moved out of their house on 28 April 1975, five days after the première of *No Man's Land*.

In mid-August 1977, after Pinter and Fraser had spent two years living in borrowed and rented quarters, they moved into her former family home in Holland Park, where Pinter began writing *Betrayal*. He reworked it later, while on holiday at the Grand Hotel in Eastbourne, in early January 1978. After the Frasers' divorce had become final in 1977 and the Pinters' in 1980, Pinter married Fraser on 27 November 1980. Because of a two-week delay in Merchant's signing the divorce papers, however, the reception had to precede the actual ceremony, originally scheduled to occur on his 50th birthday. Vivien Merchant died of acute alcoholism in the first week of October 1982, at the age of 53. Billington writes that Pinter "did everything possible to support" her and regretted that he ultimately became estranged from their son, Daniel, after their separation, Pinter's remarriage, and Merchant's death.

A reclusive gifted musician and writer, Daniel changed his surname from Pinter to Brand, the maiden name of his maternal grandmother, before Pinter and Fraser became romantically involved; while according to Fraser, his father could not understand it, she says that she could: "Pinter is such a distinctive name that he must have got tired of being asked, 'Any relation?'" Michael Billington wrote that Pinter saw Daniel's name change as "a largely pragmatic move on Daniel's part designed to keep the press ... at bay.

Ə.R.Bəşirzadə

Harold Pinterin Ingilis ədəbiyyatına təsiri

Nəticə

Pinter və Merchant hər ikisi Antonia Fraser ilə 1969-cu ildə tanış olmuşdu. bir neçə il sonra, 8-9 yanvar 1975-ci ildə Pinter və Freyzer romantik əlaqəyə girdilər. Həmin görüş onların beş illik nikahdankənar eşq macərasına səbəb oldu. İki ay yarım ərzində Tacirdən münasibətləri gizlətdikdən sonra, 21 mart 1975-ci ildə Pinter nəhayət, ona "Mən kimsə ilə tanış oldum" dedi. Bundan sonra "Hannover Terrasında həyat tədricən qeyri-mümkün oldu" və Pinter 28 aprel 1975-ci ildə, No Man's Land filminin premyerasından beş gün sonra evlərini tərk etdi. 1977-ci ilin avqust ayının ortalarında, Pinter və Freyzer iki il borc götürülmüş və kirayə götürülmüş məhəllələrdə yaşadıqdan sonra, Pinter Xəyanət yazmağa başladığı Holland Parkdakı keçmiş ailə evinə köçdü. O, daha sonra, 1978-ci ilin yanvar ayının əvvəllərində Eastbourne-də Grand Hoteldə tətildə olarkən onu yenidən işləyib. Freyzerlərin 1977-ci ildə və Pinterlərin boşanması 1980-ci ildə yekunlaşdıqdan sonra Pinter 27 noyabr 1980-ci ildə Freyzerlə evləndi. Mərasim, əvvəlcə onun 50 illik yubileyində baş tutmalı idi. Vivien Merchant 1982-ci ilin oktyabr ayının ilk həftəsində, 53 yaşında kəskin alkoqolizmdən öldü. Billinqton yazır ki, Pinter ona "dəstək olmaq üçün əlindən gələni etdi" və sonda onların oğlu Danieldən ayrılmasından, Pinterin yenidən evlənməsindən və Tacirin ölümündən sonra ayrıldığına görə təəssüfləndi.

Ə.Р.Бәширзадә

Влияние Гарольда Пинтера на английскую литературу

Позже Пинтер назвал этот инцидент, фактически несовместимый с интеллектуализмом, одной из светлых страниц своей биографии. Пинтер неоднократно резко высказывался о притеснении курдов в Турции, давлении США на Никарагуа, ограничении прав человека в Центральной и Южной Америке, антигуманистическом отношении Америки к бывшей Югославии и т.д. В то же время он был известен как один из европейских интеллектуалов, занявших самую бескомпромиссную позицию против военных операций США и Великобритании в Афганистане и Ираке. Раскрывая истинные причины военного вмешательства Буша в Ирак, Пинтер заявил в своей речи в нижней палате британского парламента: «Американцы использовали различные классические методы создания атмосферы ужасного страха – запугивание, подкуп, шантаж, пропаганду – чтобы заручиться ложной поддержкой мирового сообщества. Произошло самое обыденное: армия была размещена на территории суверенного государства, был реализован план по оккупации и контролю над богатыми нефтью территориями». В 2003 году Пинтер опубликовал сборник стихов на тему Ирака «Война». За эту книгу автор получил британскую литературную премию имени Уилфреда Оуэна. В 2005 году в прямом эфире радиостанции BBC автор объявил, что прекращает драматургическую деятельность, «потому что обеспокоен текущим положением дел в мире и отныне сосредоточит всю свою энергию и внимание на политике и поэзии». В том же году, через несколько дней после своего 75-летия, Гарольд Пинтер был удостоен Нобелевской премии по литературе. С конца 1948 года Пинтер два семестра посещал Королевскую академию драматического искусства, но, испытывая отвращение к учебному заведению, пропустил большую часть занятий, симулировал нервный срыв и бросил учёбу в 1949 году. В 1948 году он был призван на национальную службу. Первоначально ему было отказано в регистрации в качестве отказника по убеждениям, что привело к его дважды судебному преследованию и штрафу за отказ от прохождения медицинского освидетельствования, прежде чем его регистрация СО была окончательно одобрена. Он играл небольшую роль в рождественской пантомиме «Дик Уиттингтон и его кот» на ипподроме Честерфилда с 1949 по 1950 год. С января по июль 1951 года он посещал Центральную школу речи и драмы.

## References

1."Directing: Stage, film and TV productions directed by Harold Pinter" and "Prose – Fiction" – Sections of *HaroldPinter.org*: *The Official Website of International Playwright Harold Pinter*
2.*Harold Pinter* – Graphic feature of covers, programs, and posters of selected plays and films (with production information) for the Cort Theatre's 2007–2008 40th-anniversary Broadway revival of *The Homecoming* (accessible from home page menu)
3.*Harold Pinter (1930–2008)* at *The Poetry Archive* – Includes audio recording by Harold Pinter of "It Is Here", "Later", and "Episode" made on 16 December 2002 at The Audio Workshop, London, as produced by Richard Carrington
4.Harold Pinter's reading of a selection of his prose fiction and poems, 92nd Street Y New York City, 12 November 1964 "Harold Pinter": PWF 1999 – From the archive of the Prague Writers' Festival (PWF)

# Political Studies

# Between Brussels and London:The Conceptual Analysis of the Poland's Balancing Act in European Power Politics

Anvar Ismayilli Rashid
Research Fellow at the Institute of Economics of the Ministry of Science and Education of the Republic of Azerbaijan, PhD candidate at the Institute for European Studies in the Ivane Javakhishvili Tbilisi State University

## Introduction

In the landscape of contemporary European politics, Poland has emerged as a pivotal actor straddling strategic relationships between the European Union and the United Kingdom. From its early post-socialist years in the 1990s, marked by democratic transition and economic modification, Poland has undergone a significant transformation. Since its accession to the European Union in 2004, the country has steadily grown in stature, evolving from a peripheral participant into one of the EU's influential mid-range powers. With its considerable territory, a population exceeding 35 million, and a growing economy, Poland presents itself as an attractive situational and strategic partner within both European and transatlantic frameworks of cooperation. Its favorable geographical position at the EU's eastern frontier further reinforces its strategic relevance, especially in matters concerning security and energy policy.

Historically marked by complex and often strained relations with Russia, Poland's geopolitical importance has only intensified following the outbreak of full-scale war in Ukraine in 2022. As one of the regional critics of Russian aggression and a frontline supporter of Ukraine, Poland has actively sought to reshape EU narratives concerning the security. This assertive stance of Warsaw has aligned it closely with British foreign policy priorities, particularly in the post-Brexit era, while occasionally placing it at odds with more cautious or consensus-driven approaches within the EU. This paper explores Poland's dual role in contemporary international relations as both a strategic partner and a political challenge through the lens of its interactions with Britain and the European Union. It seeks to analyze how Poland leverages its geopolitical, demographic, and historical position to assert itself as a crucial player in shaping Europe's response to regional instability and shifting global power dynamics.

## Polish Strategic Culture: History, Identity and Security

Poland's strategic culture is deeply shaped by its historical experiences and collective memory, specifically the loss of sovereignty at the hands of powerful neighbors. Unlike Western European states whose strategic thinking has evolved within relatively stable borders and institutions, Poland's worldview is anchored in a legacy of partition, invasion, and resistance. The centuries-long struggle for autonomy, punctuated by the brutal partitions of the late 18th century and occupation during the 20th century, has cultivated a national consciousness acutely sensitive to threats against sovereignty. Among the most defining elements of Polish historical memory are its fraught relationships with both Russia and Germany. In Polish historical perception, Russia has long represented not only a military threat but a civilizational rival. While Poland once aspired to be a dominant power in Slavic world, especially during the height of the Polish-Lithuanian

Commonwealth, it was ultimately Russia that absorbed this ambition and projected itself as the rightful leader of the Slavic world. This perceived theft of historical destiny continues to echo in Poland's cautious, often confrontational stance toward Moscow. The legacy of Soviet domination during the Cold War further cemented this distrust, making Poland one of the EU's most stable voices on Russian affairs, particularly since the 2022 invasion of Ukraine.

Simultaneously, relations with Germany, though economically intertwined in the post-Cold War period, are shaded by memories of World War II. Despite strong EU ties, many in representatives in Polish government remain wary of what they perceive as German dominance within EU institutions and policy-making. This historical caution manifests in strategic hesitancy toward deeper integration or the surrendering of national competencies to Brussels seen by some as a proxy for German influence.

Layered onto this historical consciousness is Poland's conservative social paradigm, which further distinguishes its strategic outlook. Poland's political discourse is often infused with traditional values centered on family, faith, and national identity. This conservatism is not just cultural but increasingly institutionalized, influencing domestic and foreign policy as well. Successive Polish governments, particularly those led by the Law and Justice Party (PiS), have emphasized sovereignty, resistance to liberal social reforms, and the defense of national tradition, often placing Warsaw at odds with more progressive EU capitals.

These dynamics collectively define a Polish strategic culture that prioritizes national resilience, sovereignty, and historical vindication. Poland sees itself not only as a frontline defender against Russian aggression, but also as a guardian of conservative European values in a Union it often views as drifting from its Christian roots. This dual lens-security and identity helps explaining why Poland simultaneously pursues close ties with Britain, especially in defense matters post-Brexit, while maintaining controversial stance toward the EU institutions in recent years.

## Principles of British foreign policy:Pre-Brexit and Post-Brexit times

The trajectory of British foreign policy has been historically shaped by its imperial legacy, geopolitical insularity, and a strategic preference for global autonomy over regional entanglement. Even during its four-decade-long membership in the European Union (1973–2020), the United Kingdom never fully abandoned its identity as a global power with a distinctive foreign policy outlook. Britain's approach to international affairs has consistently emphasized sovereignty, maritime security, and a worldwide diplomatic footprint-principles rooted in its centuries-old status as an imperial actor. Britain's imperial past remains central to understanding its foreign policy worldview. As the former nucleus of the largest empire in history, Britain has long seen itself as a global player, with strategic interests extending far beyond Europe. This imperial mindset did not vanish with decolonization; instead, it evolved into what scholars often describe as "post-imperial globalism." British institutions, its military, diplomacy, intelligence services, and Commonwealth networks-continued to reflect ambitions not constrained by continental Europe. The UK's role in NATO, its "special relationship" with the United States, and its active participation in global forums like the UN Security Council and G7 all reaffirm its enduring aspiration to project power on a global scale.

Even after joining the European Economic Community (EEC) in 1973, British foreign policy maintained a distinctly global orientation. Britain consistently sought to opt out or limit its commitments to deeper political union within the EU. From the refusal to adopt the euro to its reluctance toward Schengen, the UK's participation in the EU was pragmatic and transactional, rather than ideological. Notably, one of the most consistent undercurrents of British foreign policy has been its ambivalence toward European solidarity. While it recognized the utility of cooperation with Europe-especially in trade, security, and regulation-Britain traditionally viewed the European project as a continental endeavor, in which it participated not as a core member but as a semi-

detached actor. Historically, British policymakers have preferred balance-of-power politics over supranational governance, and this orientation meant that initiatives aimed at deeper integration were often met with skepticism in London. This perception has roots in British geopolitical thinking. As an island nation with strong naval capabilities and a global network of alliances, Britain never saw its security or prosperity as dependent solely on continental Europe. The idea of pooling sovereignty for the sake of European unity clashed with Britain's self-image as an autonomous, sovereign nation. While countries like Germany or France championed "ever closer union," Britain emphasized national interest and intergovernmental cooperation. This strategic detachment has also influenced Britain's ambivalent stance on European defense initiatives. British leaders were wary of EU efforts to develop independent defense capabilities that might duplicate or weaken NATO-a cornerstone of UK security thinking. Britain has historically favored transatlantic defense ties over a purely European strategic identity, another illustration of its prioritization of global over regional loyalty.

The 2016 Brexit referendum marked a pivotal moment in the evolution of British foreign policy. The decision to leave the EU reflected a desire to "take back control"-a phrase that resonated with longstanding concerns about sovereignty, regulation, and national autonomy. Post-Brexit, British foreign policy has been driven by a renewed emphasis on strategic independence and a repositioning of the UK as a "Global Britain."

"Global Britain" is more than a slogan-it represents a deliberate shift away from a Eurocentric foreign policy to one that seeks new trade deals, defense partnerships, and diplomatic influence across the globe. The UK has strengthened its ties with the Indo-Pacific, reemphasized its alliances with the United States, Canada, Australia, and Japan, and joined regional trade initiatives like the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). Simultaneously, the UK has expanded its security presence in the Indo-Pacific through the AUKUS pact, further reflecting its post-Brexit global vision. However, this pursuit of global autonomy is not without challenges. Britain now operates outside the EU's political decision-making mechanisms, which limits its influence in shaping European responses to crises-such as the war in Ukraine or the energy crisis. At the same time, the UK remains deeply economically interlinked with the EU, complicating efforts to fully detach from the continent.

Nonetheless, the post-Brexit era has clarified several enduring principles of British foreign policy: a preference for sovereign action over supranationalism, a commitment to global alliances over regional blocs, and a strong reliance on historical prestige and maritime power as tools for international influence.

## Poland and the EU: Strategic Partner or Political Disruptor?

Poland's position within the European Union is defined by a paradox: it is both a vital strategic partner and a frequent source of political tension. Since its accession in 2004, Poland has been one of the EU's most economically and militarily significant member states. It has contributed substantially to the Union's eastern enlargement, energy diversification strategies, and collective response to geopolitical threats, particularly from Russia. At the same time, Poland has also stood at odds with Brussels on numerous issues related to rule of law, judicial independence, media freedom, and democratic governance. This dual character complicates the EU's internal cohesion and raises the question of whether Poland serves primarily as a unifying force or as a political disruptor within the Union. Poland's geopolitical location at the eastern edge of the EU gives it a critical role in shaping European responses to regional security challenges. This has been especially visible since Russia's invasion of Ukraine in 2022. Poland became not only a frontline humanitarian corridor but also a central hub for NATO military logistics and weapons delivery to Ukraine. Its strong anti-Russian stance aligned closely with broader EU foreign policy, helping to galvanize support for Ukraine across the bloc. In this context, Poland emerged as a leader among the EU's

eastern member states, reinforcing the Union's capacity to respond rapidly and assertively to external threats. In economic terms, Poland is the sixth-largest economy in the EU and a crucial link in the Union's single market. Its rapid post-accession growth, driven by EU structural funds, industrial modernization, and foreign direct investment, has helped integrate Central and Eastern Europe more fully into the EU's economic core. As a major beneficiary of EU cohesion funding, Poland has also become a symbol of the developmental success of EU enlargement, making it an example for future candidates in the Western Balkans and Eastern Partnership region. Poland's energy strategy also aligns with key EU priorities, particularly since the war in Ukraine. As one of the loudest voices advocating for energy independence from Russia, Poland has invested in LNG terminals, gas interconnectors, and pipeline infrastructure that now serve broader European interests.

These efforts complement the EU's long-term Green Deal and diversification agendas, even if Poland has sometimes clashed with Brussels over climate goals and emissions targets.

Despite these strategic contributions, Poland's relationship with the EU has often been marked by open conflict and institutional strain. Under the leadership of the conservative Law and Justice Party (PiS), Poland has repeatedly clashed with EU institutions over domestic judicial reforms that Brussels argues undermine the rule of law and violate foundational EU treaties. In response, the European Commission has launched multiple infringement procedures, withheld billions in recovery funds, and even triggered the Article 7 process, which could at least in theory suspend Poland's voting rights in the Council. From Warsaw's perspective, these actions represent an overreach by unelected bureaucrats in Brussels and a violation of national sovereignty. Polish leaders have framed their opposition as a defense of traditional values, democratic legitimacy, and constitutional independence. This narrative resonates deeply with parts of Polish society, particularly in rural and conservative regions, where skepticism toward EU liberalism remains high. Furthermore, Poland's tense relations with Germany, often perceived as the dominant force within the EU, contribute to its reluctance to embrace deeper integration. Polish officials frequently express concerns about German influence in Brussels and warn against the emergence of a "two-speed Europe" in which core states drive integration while peripheral members like Poland are sidelined. This perspective reinforces Poland's preference for a Europe of nations, where intergovernmental cooperation is prioritized over supranational governance. Poland's behavior within the EU cannot be easily reduced to obstructionism. While it resists political centralization and liberal social policies, it remains a strong supporter of economic integration, NATO cooperation, and European security. This selective engagement illustrates a pragmatic duality: Poland leverages EU membership when it aligns with its national interests but pushes back when it perceives threats to its sovereignty or identity. The 2023 elections, in which opposition forces led by Donald Tusk regained power, signaled a potential recalibration of Poland's EU stance. Tusk, a former President of the European Council, has pledged to restore rule of law and repair relations with Brussels. However, the structural features of Polish strategic culture-sovereignty-conscious, historically wary, and socially conservative-are unlikely to disappear entirely. Even with leadership change, Poland's skepticism toward centralized EU authority may persist, especially if reforms are seen as compromising core national values.

## Poland and the UK: A Strategic Alliance in the Making?

In the aftermath of Brexit, the United Kingdom has sought to redefine its foreign relations and reclaim its role as an independent global actor. In this new geopolitical configuration, Poland has emerged as a key strategic partner for Britain—a relationship rooted not only in mutual security interests but also in a shared skepticism toward aspects of European integration. Though traditionally peripheral to one another's foreign policy priorities, post-2022 realities, including the war in Ukraine and shifting transatlantic dynamics, have pushed London and Warsaw closer

together. This evolving partnership holds potential to become a cornerstone of Britain's post-Brexit presence in Europe and Poland's quest for geopolitical relevance.

At the core of UK-Poland relations lies a strong convergence in security policy, particularly regarding NATO, transatlantic cooperation, and collective deterrence against Russia. Both countries have long championed robust defense spending and Atlanticism. Since Russia's full-scale invasion of Ukraine in 2022, this alignment has only deepened. The UK was among the first countries to provide military aid to Ukraine and has played a leading role in organizing European support. Poland, sharing a 500-kilometer border with Ukraine, has functioned as the logistical and political hub for much of this support.

Beyond Ukraine, Britain and Poland have undertaken significant bilateral military cooperation. In 2017, the UK deployed a rotational contingent of British troops to Poland as part of NATO's Enhanced Forward Presence, reinforcing the alliance's eastern flank. In 2022, this cooperation was expanded with joint military exercises and defense procurement agreements, including the UK's support for Polish military modernization. British defense firms, such as BAE Systems, have begun to play a larger role in Polish defense contracts, and both governments have expressed commitment to long-term strategic defense collaboration.

This partnership is not only reactive but also strategic. Poland is increasingly seen in London as a gateway to Central and Eastern Europe- a region gaining prominence in European security debates. For Britain, maintaining strong ties with Warsaw provides an indirect way to shape EU security policy from the outside. Conversely, Poland benefits from closer relations with a nuclear power and a permanent member of the UN Security Council, both of which lend it additional leverage in transatlantic affairs.

While the UK is no longer part of the EU, its political culture during and shortly after Brexit had notable points of resonance with Poland's conservative governments, particularly under the Law and Justice Party. Both countries emphasized national sovereignty**,** control over migration, and resistance to political centralization in Brussels. This ideological overlap allowed Poland and the UK to form an informal coalition within EU institutions before Brexit, often pushing back against federalist tendencies promoted by Germany and France.

Even after Brexit, these shared outlooks remain relevant. Both countries have expressed concern about the EU's ambitions for strategic autonomy in defense and foreign policy, particularly when such ambitions appear to weaken NATO or exclude non-EU European powers like the UK. Additionally, both states have shown skepticism toward EU-led climate and social policy agendas that are perceived as intrusive or disconnected from national priorities.

That said, there are limits to this ideological closeness. The UK under more centrist leadership (e.g., post-Johnson governments) has softened some of its earlier Eurosceptic rhetoric, while Poland's internal politics are increasingly contested. Moreover, London must carefully manage its image in Europe, avoiding alignment with governments viewed as illiberal or in breach of democratic norms. Beyond defense and political values, UK-Poland relations are expanding in the economic and diplomatic spheres. While trade between the two countries declined slightly post-Brexit due to new customs barriers, Poland remains one of the UK's largest trading partners in Central Europe, with significant trade in machinery, vehicles, and pharmaceuticals. British investment in Poland is strong, particularly in sectors like finance, manufacturing, and tech. Poland is also home to one of the largest Polish diasporas in the UK, a human link that continues to shape bilateral relations. Despite initial tensions over migration policy during the Brexit debates, both countries have moved toward stabilizing the status of Polish citizens in the UK, and these communities now serve as cultural and economic bridges. Diplomatically, the UK has made clear its interest in engaging Poland and other Eastern European states as part of its broader "Global Britain" strategy. This includes initiatives like the Joint Expeditionary Force (JEF)**,** which includes

Poland as a member, and diplomatic outreach to Central Europe through the Three Seas Initiative and other regional forums.

The UK-Poland relationship is gaining momentum and strategic depth in the post-Brexit era. It is defined by shared defense priorities, converging geopolitical interests, and overlapping values regarding sovereignty and transatlantic cooperation. While differences remain,particularly in long-term visions for Europe: the partnership offers mutual benefits: for Poland, a powerful Western ally outside of Brussels; for Britain, a strong foothold in the heart of Europe's security frontier.

As both countries continue to navigate shifting alliances and rising geopolitical uncertainty, their bilateral relationship may well become a model of post-EU cooperation: one that is flexible, interest-driven, and anchored in shared strategic calculus. If developed with care and political will, the UK-Poland partnership could stand as one of the most important diplomatic relationships in post-Brexit Europe.

## Poland's Dual Role in Contemporary Geopolitics

Poland's geopolitical position in the 21st century reflects a dual role that is both strategic and paradoxical. On one hand, Poland serves as a reliable NATO ally and a proactive contributor to European security. On the other, it has become a polarizing actor within the European Union, challenging the political cohesion and normative foundations of the bloc. This duality places Poland in a complex position-both as a bridge between divergent actors and a potential fault line within the broader European order.

In the post-Brexit context, Poland occupies a unique space. It is one of the few major European powers that maintains strong, trust-based relationships with both the United Kingdom and the European Union, despite growing political divergence between the two. In this sense, Poland has the potential to serve as a bridge, facilitating communication, coordination, and cooperation between London and Brussels, particularly on matters of defense, energy security, and the response to Russia's aggression.

Poland's partnership with Britain, as discussed earlier, is based on shared transatlanticism, historical suspicions of Russia, and overlapping interests in regional stability. Simultaneously, Poland remains deeply embedded in EU structures, especially in economic, trade, and budgetary frameworks. Despite frequent clashes with EU institutions, it has not sought exit or significant disengagement. On the contrary, Polish public support for EU membership remains among the highest in the bloc, suggesting a strategic commitment to remain part of the Union-even if on its own terms.

As the EU seeks to define its future without the UK, Poland could theoretically play a role in mediating interests, particularly among countries that share a more sovereignty-focused or Atlanticist orientation. Countries like the Baltic States, Romania, and Czechia often find common cause with Poland in resisting EU over-centralization and advocating for a stronger NATO. In this informal alliance, Poland could serve as a regional spokesperson, facilitating alignment between the UK's external ambitions and Central Europe's internal concerns.

However, Poland's disruptive potential within the EU cannot be ignored. Its confrontations with Brussels over judicial independence, media freedom, and minority rights have raised serious concerns about the integrity of EU values and governance mechanisms. Critics argue that Poland, alongside Hungary during the 2010s and early 2020s, has led an illiberal pushback against the EU's foundational norms. This has created internal divisions within the Union, particularly between older Western member states and newer Eastern ones.

Moreover, Poland's assertive and sometimes unilateral foreign policy, notably during the peak years of the Law and Justice government has led to tensions with Germany and France, the traditional motors of European integration. Polish leaders have openly criticized what they perceive as Western European complacency toward Russia and have pushed for more aggressive

defense postures, even at the risk of undermining EU consensus. While this strategic clarity has been welcomed in some quarters, it has also alienated Poland from the EU's core decision-makers. Even in areas where Poland contributes significantly, such as defense, border control, and energy, its lack of alignment on political values complicates its role. For instance, while Poland champions energy diversification away from Russian gas, it has also resisted binding EU climate goals. Similarly, while it calls for stronger EU external borders, it has clashed with Brussels over refugee resettlement and asylum policy. These contradictions reinforce the image of Poland as a state that supports the strategic goals of the Union but rejects the political mechanisms and norms intended to achieve them.

Poland's dual role reflects the broader fragmentation of the European project. In an era marked by great power competition, war on the continent, and rising populism, Poland's position mirrors the EU's internal struggle between deeper integration and flexible sovereignty. It wants to lead on defense and security, particularly in Eastern Europe, but resist deeper political harmonization. It seeks partnership with the UK and transatlantic allies while remaining a vital economic member of the EU.

Whether this position is sustainable or destabilizing will depend on two key factors: Poland's domestic political trajectory and the EU's ability to accommodate ideological diversity without sacrificing unity. The recent return of more centrist leadership under Donald Tusk suggests a temporary shift toward reconciliation with Brussels. However, the underlying structural factors: historical memory, national identity, and geopolitical threat perceptionare likely to continue shaping Poland's independent course.

## Conclusion

Poland's evolving role in contemporary European geopolitics reflects a complex intersection of history, identity, and strategic ambition. Once a post-socialist state on the EU's periphery, Poland has successfully asserted itself as a mid-power within the Union-militarily capable, economically significant, and politically assertive. Its rise has coincided with a period of profound transformation in Europe: the departure of the United Kingdom from the EU, the resurgence of Russian aggression, and growing debates about the future of European integration.

This paper has argued that Poland plays a dual role-both as a strategic partner and a political disruptor-within the European security and diplomatic order. For the European Union, Poland is indispensable in areas such as NATO defense, energy diversification, and the collective response to the war in Ukraine. Yet it also challenges the EU's normative core, particularly when it comes to the rule of law, democratic checks and balances, and the supremacy of EU legal order. This tension is not accidental but rooted in Poland's unique strategic culture, shaped by a long history of foreign occupation, distrust of imperial neighbors, and a deep commitment to sovereignty and Catholic-conservative values.

In the post-Brexit era, Poland has also emerged as a key partner for the United Kingdom, offering London a valuable diplomatic and military ally within Europe. The UK, in turn, benefits from its partnership with Poland as it reorients its foreign policy away from Brussels and toward broader global engagement. The two countries' shared skepticism toward federalism, their firm Atlanticism, and aligned defense priorities suggest the beginnings of a pragmatic and potentially enduring bilateral alliance.Looking forward, Poland's dual role raises critical questions for the future of European unity and power projection. Can Poland act as a bridge between a post-Brexit Britain and a still-integrating EU, or will its domestic politics and ideological divergence place it further at odds with Brussels? Can the EU tolerate and manage internal ideological pluralism, or will strategic divergences, such as those embodied by Poland undermine its coherence?

Ultimately, Poland's case illustrates the broader challenge facing Europe today: how to reconcile diversity in political values with the need for collective action in an increasingly unstable world. As

a strategically vital yet politically contested actor, Poland may either serve as a linchpin of European security cooperation or a flashpoint of internal discord. Understanding this duality is essential not only for scholars and policymakers, but for the future of Europe as a whole.

## Technical Sciences

# ШУ ЖӘНЕ ТАЛАС ӨЗЕНДЕРІ АЛАБЫ БОЙЫНША 2023 ЖЫЛҒЫ ВЕГЕТАЦИЯЛЫҚ КЕЗЕҢ ҚОРЫТЫНДЫЛАРЫ

**Еспалаева Биназир Кенжехановна**
7М07404-«Су ресурстарын басқару» ББББ магистранты, Қазақ Ұлттық су шаруашылығы және ирригация университеті

Жамбыл болысында 2023 күнтізбелік жылда вегетациялық кезең өте күрделі өтті. Қырғызстан аумағында су қоймаларына су аз жиналғандықтан Жамбыл облысында өте қауіпті жағдай туындады, Талас өзенінде – Байзақ, жартылай Талас аудандарының егістік алқаптары, Шу өзені бойынша – Қордай ауданының суармалы алқаптары сусыз қалды. Суармалы су жетіспеуі салдарынан және ауа-райының өте ыстық болуынан бұл аудандарда төтенше жағдай режимі енгізілді.

Кыргызгидромет алдын-ала болжамына сәйкес, 2023 жылдың вегетациялық кезеңге Шу және Талас өзендерінің сулылығы, шамамен нормадан 100-ден 120% шамасында болжанды.

Осы болжам негізінде 2023 жылдың вегетация кезеңіне графиктер құрастырылды, онда Шу өзені бойынша – 222,0 млн.м$^3$ және Талас өзенімен -520,0 млн.м$^3$ болжанған.

Сонымен қатар, ағып келетін су мен су қоймаларының толтырылуына вегетация кезеңінің басталуы алдында мониторинг жасау (Киров, Орто-Токой, Тасөткел су қоймалары бойынша), болжамның расталмағанын көрсетті. Қырғызстан су ресурстары Қызметі ақпараты бойынша бұл өзендердің сулылығы нормадан екі есе төмен екенін көрсетті.

2023 жылы Шу-Талас комиссиясы мәжілісін Алматы қаласында сәуір айында өткізу жоспарланған болатын, бірақ қырғыз жағы мерзімді белгілей алмаған соң, мәжіліс болмай қалды, сонымен 2023 жылға вегетация графиктері келісілмей, қол қойылмады.

Сонымен қатар, 2023 жылы 27-28 сәуірде Бишкек қаласында (Қыргыз Республикасында) ҚР экология және табиғи ресурстар министрлігінің вице-министрі мен Шу-Талас өзендерін мемлекетаралық пайдалану мәселелері бойынша су ресурстары Қызметінің директорының жұмысшы кездесуі болды, онда екі жақпен Қазақстанға Шу өзені бойынша – 222,0 млн.м$^3$ және Талас өзенімен -520,0 млн.м$^3$ су берілу мақұлданған 2022 жылғы вегетация кезеңіне бекітілген графикке сәйкес жұмыс істеу 2023 жылғы графикке қол қою келсілген болатын.

Өзендер ағыны мен сулылығын ескере отырып, 2023 жылдың 3 онкүндігіндле Қазақстан және Қырғызстан жағымен 2023 жылдың вегетация кезеңіне графиктер келісіліп, бекітілді, онда Қазақстанға Шу өзенімен 154 млн.м$^3$ берілетін болды, бұл 2022 жылмен салыстырғанда 66 млн.м$^2$ кем (220 млн.м$^3$), Талас өзені бойынша – 336 млн.м$^3$, бұл 2022 жылмен салыстырғанда 164 млн.м$^3$ (500 млн.м3) мөлшерге кем.

### Талас өзеніндегі су қамтамасыздығы

Вегетациялық кезең сәуірдің 3 онкүндігінде басталды, яғни Киров су қоймасынан Талас өзенінен қазақстандық жағымен су алу (Жамбыл облысы) 2023 жылы 29 сәуірде басталды, Қазақстанға 9-15 $м^3$/с көлемде су тасталды.

Киров ус қоймасының көлемі 2023 жылдың вегетация кезеңі басталу алдында (29.04.2023ж.) – 443,8 млн.$м^3$ құрады, су қоймасына ағып келетін су мөлшері – 1,2 $м^3$/сек болды.

2023 жылдың вегетация кезеңінде Киров су қоймасынан Талас өзені алабы бойынша мемлекетаралық пайдаланатын су шаруашылығы нысандарынан Қазақстан Республикасына су беру бойынша деректер төменде кестеде келтіріледі.

Кесте 1 – Киров су қоймасынан су берілуі

| Каналдар мен су шаруашылығы құрылымдарының атаулары | Айлар | График бойынша, млн.$м^3$ | Фактілі су алу, млн.$м^3$ | Графиктен айырмашылық млн.$м^3$ |
|---|---|---|---|---|
| Киров су қоймасы, Қазақстанға берілетін су | Сәуір | 0 | 2,14 | 2,1 |
| | Мамыр | 80,35 | 80,35 | 0 |
| | Маусым | 116,6 | 115,34 | -1,3 |
| | Шілде | 103,68 | 117,50 | 13,8 |
| | Тамыз | 26,78 | 6,96 | -19,8 |
| | Қыркүйек | 9,072 | 1,495 | -7,6 |
| Барлығы | | 336 | 323,8 | -12,2 |

Мынаны ескеру керек, суды бөлу – 23.02.1983 жылы КСРО мелиорация және су шаруашылығы Министрінің орынбасарымен бекітілген «Талас өзені ағынын бөлу туралы» ереже негізінде іске асырылады.

Осы Ережеге сәйкес Талас өзені бойынша вегетациялық кезеңде су беру көлемі 590 млн.$м^3$ құрайды, графиктен айырмашылық 254 млн.$м^3$, Қазақстан жағы Ережеде көрсетілгеннен 266 млн.$м^3$ кем алып отыр.

Кесте 2 - Фактілі су көлемі, Қазақстанға ағып келген, 2018-2023 жылдар

| Жылдар | Ережеге сәйкес берілуі керек, млн.$м^3$ | Фактілі, млн.$м^3$ | Ережеде көрсетілгеннен үлесі, % | Берілмегені, млн.м |
|---|---|---|---|---|
| 2018 | 590 | 462 | 78 | 128 |
| 2019 | 590 | 565,8 | 96 | 24,2 |
| 2020 | 590 | 520,6 | 88 | 69,4 |
| 2021 | 590 | 377,4 | 64 | 212,6 |
| 2022 | 590 | 591,9 | 100 | 0 |
| 2023 | 590 | 323,8 | 55 | 266,2 |

Кесте 3 - Қазақстан Республикасы аумағына су келуі, 2023 ж.

| Көрсеткіштер | | сәуір | мамыр | мау-сым | шілде | тамыз | қыркүйек | ескерту |
|---|---|---|---|---|---|---|---|---|
| | | млн.м$^3$ | | | | | | |
| I онкүндік ортасы | Қазақстан-ға Киров су қойма-сынан су тасталуы | 0,086 | 25,920 | 37,584 | 38,880 | 6,964 | 1,495 | |
| II онкүндік ортасы | | 0,086 | 25,920 | 38,880 | 35,856 | 0,000 | 0,000 | |
| III онкүндік ортасы | | 2,143 | 28,512 | 38,880 | 42,768 | 0,000 | 0,000 | |
| I онкүндік ортасы | Талас бөгетіне су келуі | 6,913 | 18,422 | 28,503 | 28,054 | 8,170 | 4,773 | Сәуір, тамыз және қыркүйек айларында Аса-Талас каналынан Талас өзеніне су түскен |
| II онкүндік ортасы | | 7,258 | 19,905 | 28,240 | 24,021 | 4,245 | 5,471 | |
| III онкүндік ортасы | | 4,323 | 21,812 | 28,230 | 29,405 | 4,854 | 6,938 | |

*Ескерту: Сәуір, тамыз және қыркүйек айларында Аса-Талас каналынан Талас өзеніне су түскен. Сонымен бірге, қосымша су беру мақсатында, Қырғыз Республикасы аумағындағы кәріздік каналдарды тазалау жүргізілді, бұл біздің ел аумағына 1,5 - 2 м$^3$/с су мөлшерін бағыттауға мүмкіндік берді.*

### Шу өзеніндегі су қамтамасыздығы

2023 күнтізбелік жылдың вегетациялық кезеңінде қазақстандық жағы мемлекетаралық пайдаланылатын су шаруашылығы нысандарынан Шу өзені алабында бекітілген графикке сәйкес 154 млн.м$^3$ көлемде су алуды іске асыру қажет еді, бірақ фактілі су алу 135,7 млн.м$^3$ құрады, яғни қазақстандық жақ 18,3 млн.м$^3$ көлемде су кем алды. Барлығы, жоспарланған көлемнен 88 % алынды.

2023 жылғы вегетациялық кезеңде Шу өзені алабынан мемлекетаралық пайдаланудағы су шаруашылығы нысандарынан Қазақстан Республикасына берілген су бойынша деректер төменде кестеде келтіріледі.

Кесте 4 - Шу өзені алабынан мемлекетаралық пайдаланудағы су шаруашылығы нысандарынан Қазақстан Республикасына берілген су бойынша деректер

| Каналдар мен су шаруашылығы құрылымдары | Айлар | График бойынша, млн.м$^3$ | Фактілі су алу, млн.м$^3$ | Берілгеннен айырмашылық, млн.м$^3$ |
|---|---|---|---|---|
| «Георгевский» магистрал каналы | сәуір | 3,800 | 3,470 | -0,3 |
| | мамыр | 26,820 | 26,549 | -0,3 |
| | маусым | 29,190 | 28,743 | -0,4 |
| | шілде | 29,370 | 28,708 | -0,7 |
| | тамыз | 23,160 | 17,707 | -5,5 |
| | қыркүйек | 7,780 | 9,422 | 1,6 |
| Қосындысы | | 120,1 | 114,6 | -5,5 |
| «Жіңішке-Ақтас» каналы | сәуір | 0,000 | 0 | 0,0 |
| | мамыр | 4,910 | 4,061 | -0,8 |
| | маусым | 6,160 | 5,835 | -0,3 |
| | шілде | 4,030 | 2,085 | -1,9 |
| | тамыз | 2,670 | 0,484 | -2,2 |
| | қыркүйек | 2,590 | 0,000 | -2,6 |
| Қосындысы | | 20,4 | 12,47 | -7,9 |
| «Колос» каналы | сәуір | 0,000 | 0,00 | 0,0 |
| | мамыр | 1,870 | 1,072 | -0,8 |
| | маусым | 3,140 | 2,625 | -0,5 |
| | шілде | 2,670 | 2,086 | -0,6 |
| | тамыз | 2,310 | 1,710 | -0,6 |
| | қыркүйек | 2,072 | 0,233 | -1,8 |
| Қосындысы | | 12,06 | 7,73 | -4,3 |
| «Объединенный» каналы | сәуір | 0 | 0 | 0 |
| | мамыр | 0,130 | 0,097 | 0,0 |
| | маусым | 0,420 | 0,414 | 0,0 |
| | шілде | 0,430 | 0,363 | -0,1 |
| | тамыз | 0,430 | 0,059 | -0,4 |
| | қыркүйек | 0 | 0,000 | 0 |
| Барлығы | | 1,41 | 0,93 | -0,5 |
| Мемлекетаралық пайдалынылатын барлық нысандар бойынша қосындысы | | 154 | 135,7 | -18,3 |

Сонымен қатар, Шу өзенімен су бөлу 23.02.1983 жылғы КСРО мелиорация және су шаруашылығы Министрінің орынбасары бекіткен «Шу өзені ағынын бөлу туралы» Ереже негізінде іске асырылады.

Мысалы, берілген Ережеге сәйкес Георгиевский магистрал каналымен су беру көлемі вегетация кезеңінде 159,0 млн.м$^3$ құрайды.

Кесте 5 – 2018-2023 жылдары Георгиевский магистрал каналымен Қазақстанға ағып келген фактілі су көлемі

| Жылдар | Ережеге сәйкес, млн.м$^3$ | Фактілі, млн.м$^3$ | % , ереже мөлшерінен | Берілмеген су көлемі, млн.м$^3$ |
|---|---|---|---|---|
| 2018 | 159 | 123,1 | 77 | -35,9 |
| 2019 | 159 | 163,0 | 102 | +4 |
| 2020 | 159 | 146,73 | 92 | -12,27 |
| 2021 | 159 | 122,2 | 77 | -36,8 |
| 2022 | 159 | 146,9 | 92 | -12,1 |
| 2023 | 159 | 114,6 | 72 | -44,4 |

Ережеге [1-4] сәйкес Шу өзенінің мемлекетаралық нысандармен вегетация кезеңінде су беру көлемі 370 млн.м$^3$ құрады, графиктен айырмасы 216 млн.м$^3$ құрады, Қазақстандық жақ ережеде көрсетілгеннен 234 млн.м$^3$ су көлемін кем алып отыр.

Кесте 6 – 2018-2023 жылдары Шу өзенінің мемлекетаралық нысандармен вегетация кезеңінде фактілі су беру көлемі

| Жылдар | Ережеге сәйкес, млн.м$^3$ | Фактілі, млн.м$^3$ | % , ереже мөлшерінен | Берілмеген су көлемі, млн.м$^3$ |
|---|---|---|---|---|
| 2018 | 370 | 163,5 | 44 | 206,5 |
| 2019 | 370 | 203,1 | 55 | 166,9 |
| 2020 | 370 | 178,5 | 48 | 191,5 |
| 2021 | 370 | 151,7 | 41 | 218,3 |
| 2022 | 370 | 176 | 47 | 194 |
| 2023 | 370 | 135,7 | 37 | 234,3 |

Қырғызстан Республикасынан ағып келетін су көлемінің жеткіліксіз мөлшерде берілуінен, Жамбыл облысында бірқатар шешімін жылдам табу қажет мәселелер туындады, олар өңірдің сумен қамтамасыздығына зиянды әсерін тигізді.

Облыстың ауыл және су шаруашылығы мекемелерінің арасында әлеуметтік текетіресті болдырмау мақсатында, және де өңірдің азық-түлік қауіпсіздігін қамтамасыз ету үшін, бұрынғы жылдар тәжірибесін ескеріп, көпжылдық шөп алқаптарына су берілмеді.

Су беру, каналдар және ауылдық округтер арасында су айналымы әдісімен іске асырылды. Және де, кезектілік сақталумен түн мезгілінде және сағатпен суару қарастырылды.

Мемлекетаралық пайдаланымдағы трансшекаралық нысандар бойынша Қазақстан Республикасына ағып келетін, Шу және Талас өзендерінің су ресурстарының жоғарыда көрсетілген көлемдері, соңғы жылдары су көлемінің төмендеу динамикасын және қырғыз елі жағынан суару суын берудің тұрақсыздығын көрсетеді.

## Шу-Талас алабы бойынша трансшекаралық су ресурстарын басқарудың өзекті мәселелері және оларды шешу жолдары

Жалпы су көлемінің 80-82 % көршілес аумақтардан ағып келуіне байланысты, Жамбыл облысында жыл сайын су тапшылығы байқалады. Мысалы, судың негізгі көлемі Қырғызстан Республикасынан ағып келетіндіктен, негізгі өзекті мәселе – трансшекаралық

өзендермен қажетті су мөлшерін толығымен жеткізбеу: Талас өзені алабы бойынша Киров су қоймасы мемлекетаралық нысанымен іске асырылады; Шу өзені алабымен, Қазақстан жағы су алуды 5 каналмен іске асырады; Қордай ауданында - «Георгиевский магистрал каналы» (ГМК), «Шортөбе» МК, «Колос» МК, «Объединенный» МК, және Мерке ауданында – ҮШК (ЗБЧК) батыс бөлігінде су алу 5 жылдан бері іске асырылмайды, каналға су жіберу аспара өзені арқылы жүргізіледі [1-5].

Және де көптеген мемлекетаралық нысандар Шу, Талас өзендерінде бірлесіп пайдаланылатын су шаруашылығы құрылымдарының тізіміне енгізілмеген; осыған байланысты қазақстан жағы жөндеу-қалпына келтіру жұмыстарын жүргізе алмайды және бас су алу құрылымдары (бастоғандары) қырғыз аймағында орналасқан «Колос», «Кож», «Каратаки», «Акмолда», «Томентамга» МК тұрақты су беруді қамтамасыз ете алмайды.

Жоғарыда аталған мәселелерді шешу үшін трансшекаралық өзендермен «Қазсушар» РМК Жамбыл филиалы басшылығы және аудан, облыс әкімшілігі қызметкерлерімен – Қырғыз Республикасы су шаруашылығы Чу және Талас бассейндік басқармаларымен үнемі келіссөздер жүргізіледі, бұл кезде өтінім берілген су көлемін сақтау және суды үзіліссіз беруді анықтау сияқты мәселелер шешіледі, себебі мұндай ауытқулар су тұтынушылар арасында су үлестіруге қатты әсерін тигізеді.

Сонымен қатар, Қордай, Байзақ, Жамбыл және Талас аудандарының су тұтынушыларымен, Шу-Талас бассейндік инспекциясы «Қазсушар» РМК Жамбыл филиалы, аудандық және ауылдық округтердің өкілдерімен бірлесіп түсіндіру жұмыстарын жүргізеді, аудандар мен ауылдық округтерге рейдтер жасалады. Кездесулер кезінде, Қырғызстан жағынан судың аз мөлшерде берілуіне байланысты, су мөлшері барлық тұтынушыларға қолдағы бар өтім теңдей бөлінеді деп түсіндірілген.

Одан бөлек, «Қазсушар» РМК Жамбыл филиалы мамандарымен бірлесіп берілген өтінімге сәйкес, су алу құрылымдарына тұрақты бастоған басында тексерулер жүргізілді, жасалған келісім-шартқа сәйкес суармалы алқаптарды тексеру, және де су тұтынушылардың өтініш беруі бойынша жедел су басында тексерулер жүргізілген.

2024 жылғы вегетация кезеңінде су тапшылығының уақытылы алдын алу үшін, Жамбыл облысы суармалы егіншілікпен айналысушыларына, жергілікті атқару органдарына төмендегі нұсқаулықтарды бірлесіп орындауға ұсыныстар жасалды:

- құйып толтырылатын су қоймалары мен ұңғымалалардың су ресурстарын іске қосу;
- суды үнемдеу технологиялары мен техникаларын (тамшылатып суару, жаңбырлатып суару және т.б.) пайдалану қажет, ылғалды көп пайдаланбайтын ауыл шаруашылығы дақылдарын егу;
- суландыру жүйелерін қалпына келтіру және жетілдіру бойынша шараларды қолдануды тоқтатпау;
- ауыспалы егістік тәсілін сақтау;
- аталған мәселелерді шешуде ғылыми зерттеулермен жүйелі тәсілдерді ендіру қажеттігі. Сонымен қатар 2024 жылдың вегетация кезеңіне шаралар жоспары мен Жамбыл облысының суландыру жүйелерін қалыпна келтірудің Жол картасы жасалынды.

## Литература

1. Сенников М.Н. Прогнозное повышение водообеспеченности по регулированию водными ресурсами Жамбылской области [Текст] / Сенников М.Н., Ержанова Н.К. // Инновационные и практические решения ускоренного восстановления продуктивности деградированных орошаемых земель: Международная научно-практическая конференция, 20 мая 2022г., г. Тараз, 2022. – С. 68-73.
2. Свод Правил Республики Казахстан 3.04-101-2013 «Гидротехнические сооружения».
3. СП РК 2.04-01-2017 «Строительная климатология».

4. СП РК 3.01-105-2013 «Благоустройство населённых пунктов».
5. Абдиров М. Шу-Талас су шаруашылығы алабының су ресурстарын пайдаланудың фактілі деңгейін талдау [Текст] / М.Абдиров, Н.Мыңжасаров, А.Мадимарова // «Reviews of Modern Science» (March 23-24, 2023). Zürich, Switzerland. – Б.64-69.

# ОСОБЕННОСТИ Физико-географическОЙ характеристикИ ИЛИ-БАЛХАШСКОГО БАССЕЙНА

**Мұхамеджанова Сабина Мусахановна**
магистрант ОП 7М07404-«Управление водными ресурсами», Казахский Национальный университет водного хозяйства и ирригации

**Гидрография Или-Балхашского бассейна**

Или – это удивительная река, которая пересекает территорию нашей республики два раза. Также эта река трансграничного значения, которая начинает свой путь со склонов великого Тянь-Шаня, далее протекая по территории Казахстана, а точнее Алматинской области, она впадает в одну из крупных озёр страны, озеро Балхаш. Или можно сказать сформирована благодаря соединению двух рек, таких как Текес и Кунгес. Это одна из самых значимых по площади рек Республики Казахстан. Её протяженность достигает до 1439 км, из которых на территорию нашего государства приходится около 815 км.

Озеро Балхаш считается одним из самых больших водоёмов планеты, существующее благодаря рекам, которые стекают со склонов гор Алатау. Основной и крупнейшей из этих рек является исследуемая нами река Или. Бассейн озера находится на юго-восточной части страны, в которую входят такие области как Алматинская, восток Жамбылской, юго-востчная часть Карагандинской, южный регион Восточно-Казахстанской, и небольшая территория Китая. В данном бассейне имеется большое количество рек, озёр, водохранилищ (рисунок 1).

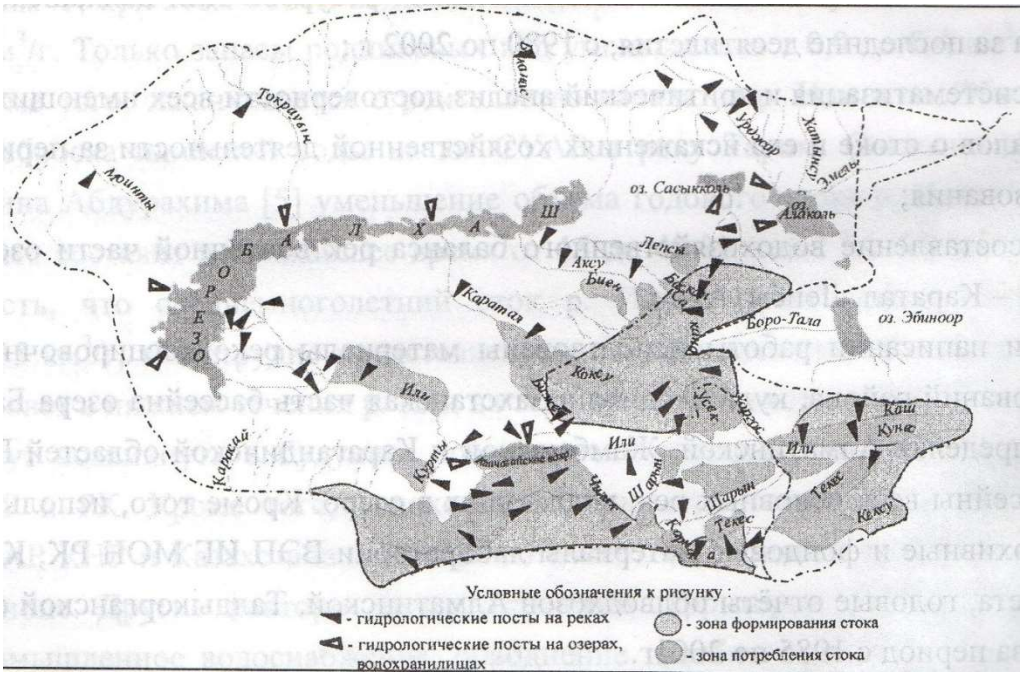



Рисунок 1 – Гидрография бассейна озера Балхаш

Общий объём бассейна исследуемой реки достигает отметки 140 тыс. км$^2$. Реку Или вполне можно назвать многоводной. У неё значительное количество притоков. Или вместе

со всеми её имеющимися притоками питается благодаря ледникам. Расходы, а также уровни стока пеки относительно промежутков времени размеренностью. Поэтому в зимний сезон и летом колебания наблюдаются совсем незначительные. Но время от времени на некоторых притоках реки разрушающие сели. Известно, исследуемая река входит в состав Или - Балхашского бассейна.

В свою очередь, Или - Балхашский бассейн – один из значимых водохозяйственных бассейнов страны. Она охватывает территории юго-восточного Казахстана, также небольшую часть территории Китайской Народной Республики (рисунок 2).

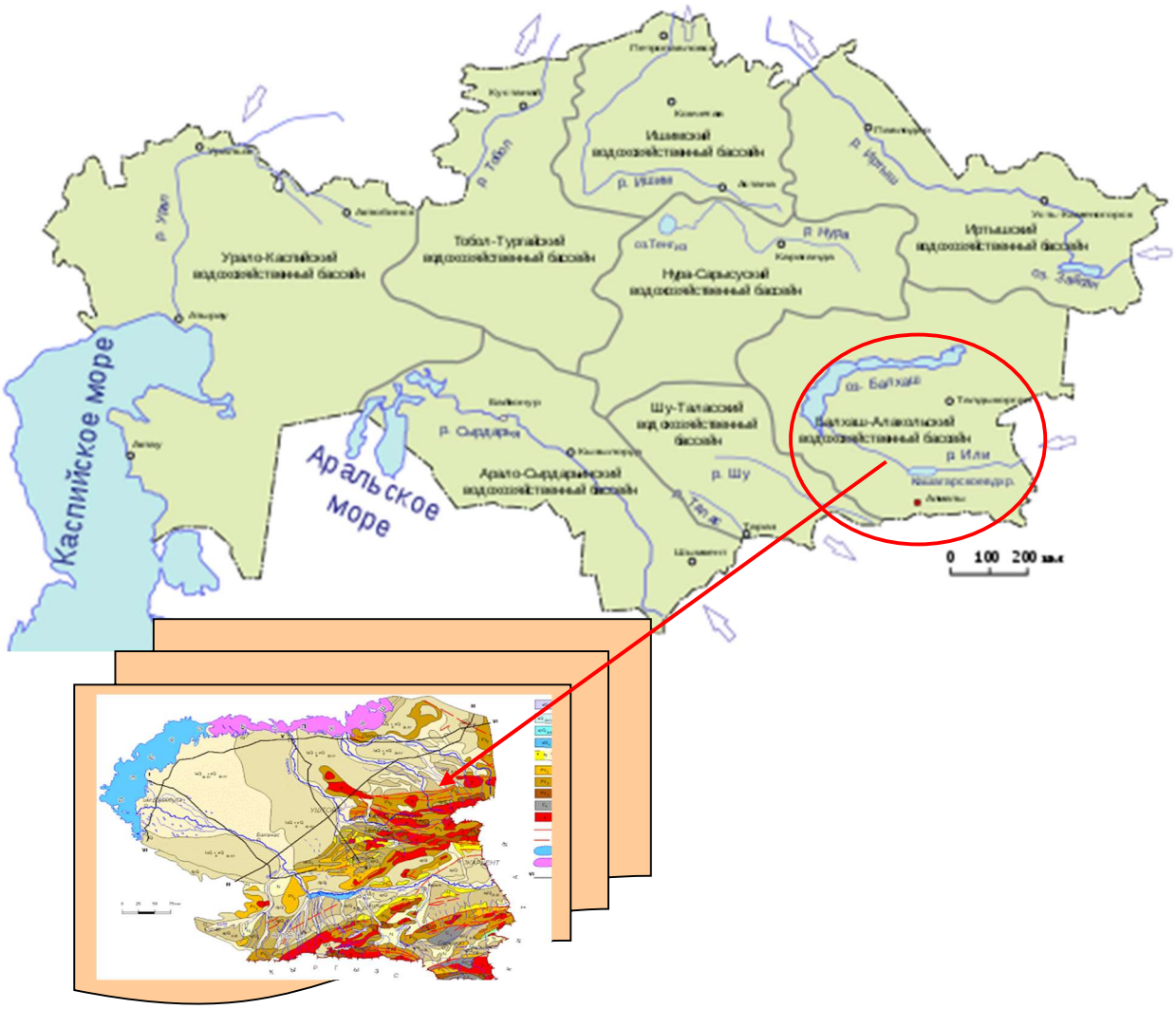



Рисунок 2 – Карта расположения Или - Балхашского бассейна

Общий размер занимаемой территории бассейна достигает 415 тыс. км$^2$, если говорить о Республики Казахстан, то 355 тыс. км$^2$ из общей площади приходится на нашу страну. Как ранее говорилось, Или - Балхашский бассейн расположен на территории двух сопредельных государств. Говоря о нашем государстве, можно сказать, что бассейн расположился на территории таких областей, как Жамбылский, в частности Кордайский, Шуйский и Мойынкумский регионы; Каркаралинский, Актогайский и Шетский регионы Карагандинской области; Аягозский и Уджарский районы, которые относятся к Восточно-Казахстанской области и в целом Алматинская область. На территории нашего государства проживает примерно 3,4 млн. человек. Значительная доля, которой приходится на Алматинскую область и достигает 1,7 млн. человек. На долю же сельских районов

приходится 1,6 млн. человек. В целом, объём водного стока немалый и образует примерно 149,5 км$^3$, однако существенная часть водного стока, если быть точнее, то около 78% приходится на долю озёр, в основном в озеро Балхаш. Соответственно не имеет возможности применения на районах, предназначенных для орошения в Алматинской области. Речной сток формирует примерно 15%, на долю водохранилищ приходится в среднем всего лишь 6%.

Исследуемый бассейн включает в себя 51 водохранилищ, в целом достигает до 28881,87 млн. м$^3$, 135 значимые системы орошения, длина которых достигает отметки 2125 км, и дренажная сеть длиной 305 км. Также функционируют 1837 гидротехнических объектов, которые забирают водный сток из сетей орошения и доставляют её в поливных целях для сельскохозяйственных культур. Помимо всего этого осуществляют свою деятельность большое количество, а именно 966 гидрометрических пунктов, которые ведут мониторинг забора и подачи водного стока для полива.

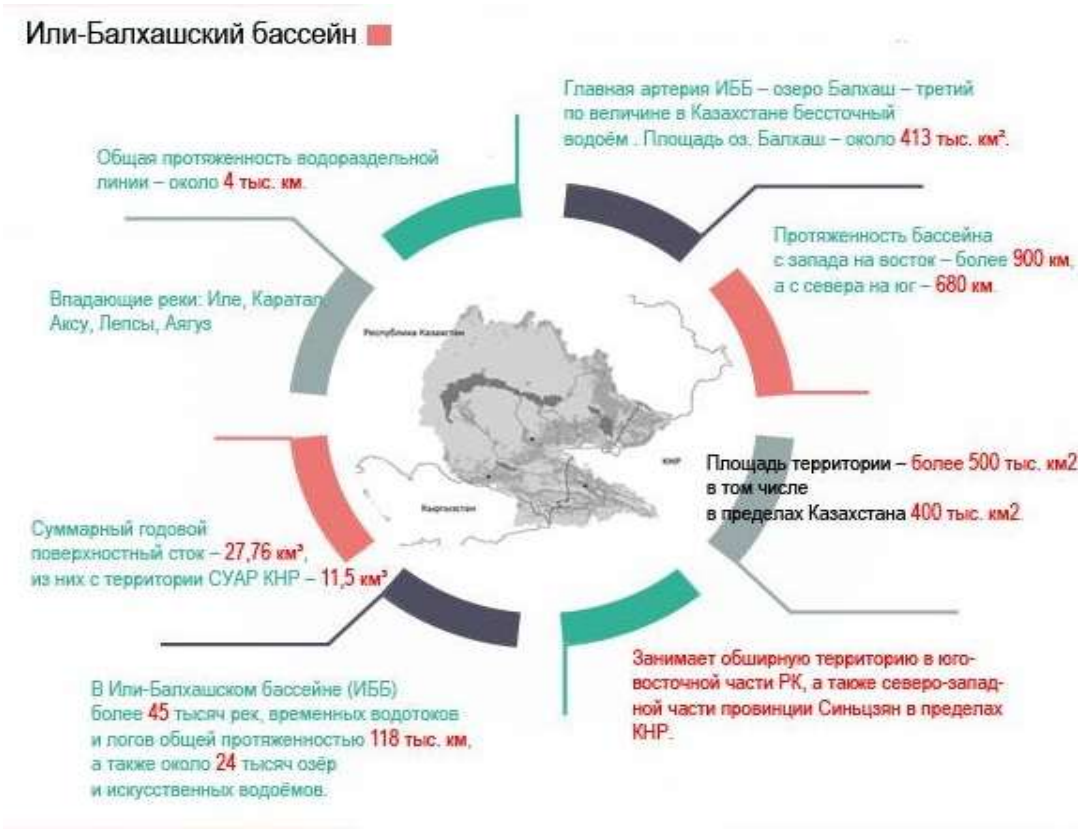



Рисунок 3 – Основная характеристика бассейна

В водохозяйственном бассейне функционируют более двух тысяч объектов, гидротехнического назначения, помимо этого около 52 значимых систем для забора воды, которые подают воду для полива на огромные территории земель в целях орошения, площадь которой составляет более 620 тыс. га. В том числе осуществляют свою деятельность большое количество водохранилищ внутрихозяйственного и межхозяйственного назначения, число которых превышает 92 единиц, площадь водных ресурсов которых образует в среднем 23 км$^3$, туда же входит и Капчагайское водохранилище. В целом длина межхозяйственных дренажных сетей и каналов магистрального назначения образуют примерно – 2,7 тыс. км, в то время как сети внутрихозяйственного значения превышают отметку 1,6 тыс. км, гидропостов, как говорили ранее около 966.

Исследуемую нами реку Или можно назвать важнейшей из всех рек водохозяйственного бассейна. Протяженность Или от территории Китая до того момента,

как она впадает в изучаемое озеро, составляет 192 м. В среднем течении еще до того места, где пересекаются Илийское село с железной дорогой Туркестан – Сибирь, изучаемая река протекает по территориям обширных степей и равнин. Преодолев Илийский посёлок, впадает в неширокую долину, сквозь низкое плоскогорье Ижджау – Капчагай. Общая протяженность долины достигает 42 км. Преодолев эту узкую долину, русло Или снова увеличивается и протекает по обширной равнине, являющейся её старой дельтой.

Водораздельная траектория исследуемой реки на южной территории протекает по склонам Заилийского Алатау, Кунгей Алатау, Терской Алатау, а также по склонам Чу – Илийских гор, по западной территории проходит через Прибалхашские районы и спускается к берегам озера Балхаш. Вышесказанная траектория реки разделяет бассейн исследуемой реки от соседних бассейнов таких рек, как Тарим и Чу, а также озера Иссык – Куль.

Водораздельная линия реки на северо-восточных и северных районах протекает по склонам Джунгарского Алатау, затем преодолевая горные системы Малайсары и через пески Сары – Ишик – Отрау устремляется к озеру Балхаш. Данной траекторией вододеления бассейн реки разделяет Или от смежного бассейна реки Каратал, впадающую также а озеро Балхаш. На восточных территориях через реку Хоргос простирается государственная линия Республики Казахстан с Китайской Народной Республикой, эта самая граница между двумя сопредельными государствами и разделяет верхнее течение исследуемой реки как от среднего течения так и от нижнего течения реки Или.

На территориях Республики Казахстан в изучаемую реку сливаются значительное количество притоков, которые стекают со склонов Джунгарского Алатау. Самые крупные из этих притоков – Усек и Хоргос, которые относятся к правому берегу, и с левого берега - Иссык, Шилик, Талгар, Тургень, Шарын, Курты, Каскелен и многие другие притоки.

Рельеф исследуемого региона

Исследуемая местность характеризуется существенным многообразием природных и климатических условий. Несмотря на это есть возможность выделить на этой значительной территории три основных региона, схожих по природным характеристикам, таким как:

- Прибалхашский равнинно-песчаный;
- Заилийский горный;
- Восточный внутригорный.

Гидротехнический узел Баканас входит в состав Восточного внутригорного района. Далее приведём небольшую информацию о физической географии исследуемого региона.

На северо-востоке Южного Прибалхашья в средней части региона, где протекают реки Каратал и Или находятся огромные песчаные массивы Сары – Ишик – Отрау. В южной части пустыня берёт начало от гор Малайсары и Кулан – Басы, а также на северных районах простирается до озера Балхаш.

Также близ этих территорий простирается широкая равнина Баканас, расположенная между нынешней дельтой изучаемой реки и песчаными массивами Сары – Ишик – Отрау. Баканасская равнина имеет незначительный пустынно-растительный покров, также характеризуется лесами из саксаула. На просторах Баканаса, до сих пор можно увидеть старые русла исследуемой реки, такие как Нарын – Баканас, Орта – Баканас и Чет – Баканас и ещё немного других незначительных русел.

Гидротехнический узел Баканас находится на юго-востоке Южного Прибалхашья в верховьях изучаемой реки, в нижней части Капчагайской ГЭС, приблизительно на 92 км. На больших территориях исследуемого региона расположилась просторная равнина, сложенная песками. В восточной части равнины расположены хребты Джунгарского Алатау. На левых берегах изучаемой реки простираются песчаные гряды Сарытаукум, а на правобережье реки песочные массивы Абдулкум, Жинишкекум и Жаункум, также часть

пустыни Сары – Ишик – Отрау. Высокие показатели песчаных гряд на юго-восточных районах колеблются между отметками 560 – 505 м, на северных районах в пределах 430 – 410 м.

Песчаные равнины сложены массивами эолового образования, средняя высота которых колеблется в пределах 2-6 и 14-19 метров и больше. Массивы тянутся к северо-западу, большая часть которых характеризуется кустарниковым и травянистым растительным покровом. Дельта исследуемой реки в участке сооружения имеет характер равнин с чётко выраженными уступами. Правобережье в участке гидротехнического узла, обрывистое. Левобережье на нормальном подпёртом уровне (НПУ) формируется хребтами скопленных песков, практически не имеющими растительный покров. Надпойменные, а также пойменные массивы в основном одинаковые, образованные песками из разнообразных частиц. Ширина дельты изучаемой реки, в участке гидротехнического узла, на показателе НПУ не превышает 7 км. Речное русло в участке гидротехнического узла не имеет устойчивости, а древнее русло располагается справа. Исследуемая река со своим притоком Курты считается значимой водной артерией данного региона.

Характеристика климатических условий изучаемой местности

В районе строительства климат зимой с небольшим количеством снега, а летом засуха, так как он расположен в глубокой части материка и её ландшафтом, в общем, резко континентальный климат. В частности, это четко прослеживается на севере района, там годовая сумма осадков не превышает 145,8 мм, при температуре воздуха в среднем за год $+8,9^0$С. На равнинную местность в период зимы влияют морозные воздушные массы, так как с северная часть не защищена. В зимние периоды временами наблюдаются сильные холода. Иногда в зимний сезон температура в среднем может колебаться от многолетних показателей с небольшой разницей примерно $13\text{-}15^0$С. Но наблюдаются и не очень холодные сезоны зимы, в которые температура в среднем имеет возможность повышаться на $8\text{-}9^0$С немного больше чем положено. В основном в зимний период выпадает незначительное количество снега. Весеннему сезону характерна непродолжительность и интенсивное повышение температуры. Также весне присуще значительное выпадение осадков за год. В летний период преимущественно наблюдается солнечные и тёплые погодные условия, а также существенные колебания температур воздуха за весь год. Средние дневные и ночные температуры летом составляют существенную разницу в $17\text{-}18^0$С. Лето характеризуется засухой, в этот период наблюдается незначительное количество осадков в отличие от зимнего периода.

С приходом осеннего сезона, температура существенно понижается. Однако во вторую часть осеннего периода в основном возникают снегопады, которые образуют незначительный покров снега, но как только наступает потепление, то снег сразу начинает таять. По исследованиям учёного Зайкова средние показатели испарения за год, в промежутки времени апрель – ноябрь образует по таким станциям, как Или -895 мм, станция Курты – 1027 мм и в Баканасе доходит до отметки 1028 мм.

Значительное выпадение осадков приходится на осенние и весенние сезоны. Высота выпавшего снега не превышает 26 см. Территория расположения гидротехнического узла Баканас соединена с Алматинской областью. В нижней части участка гидроузла, примерно в четырёх километрах, находится небольшой посёлок Карагаш.

Температурные особенности

Вода в бассейне реки Или оказывает влияние на температуру воздуха, уменьшая её днём, а ночью наоборот увеличивая, тем самым понижая суточные изменения на берегу озера, а вот расположенных вдалеке районах это явление никак не воздействует на температуру воздуха. Значительные изменения температуры воздуха проявляются в очень жаркие дни. Соответственно и воздействие вод в эти дни будет максимальным. В целом о

колебаниях температуры в исследуемом бассейне можно узнать, опираясь на месячные и годовые среднемноголетние данные.

Среднемноголетняя температура воздуха в середине лета достигает 25-27 $^0$C, зимой может понижаться до -9 … -15 $^0$C. Что касается среднегодовой температуры, то она колеблется между отметками 7-10 $^0$C.

Если посмотреть на изотермические карты среднемноголетних температур воздуха южной территории исследуемого бассейна, то можно заметить, что в летний период уровень температуры воздуха достаточно спокойный. В зимний период температура воздуха начинает уменьшаться с юго-западной территории на северо-восточную сторону, причиной тому является нахождение Сибирского антициклона. Наибольший показатель температуры воздуха на изучаемой местности достигает в середине летнего периода и может доходить до отметки 45 $^0$C. А вот наименьшие показатели температуры воздуха можно заметить в конце зимнего сезона, когда отметка доходит до (- 45 $^0$C).

Дни проявления среднесуточных температур воздуха больше и меньше назначенных пределов считаются самой значимой особенностью агроклиматических ресурсов. Весенний вегетационный сезон продолжается, когда температура воздуха проходит через нулевой градус до даты через 16 $^0$C, что касается осеннего периода, то всё происходит с точностью наоборот.

Атмосферные осадки района исследования

Зона строительства гидротехнического узла расположена в регионе, где наблюдается острая нехватка влаги. Количество выпадающих осадков за год в среднем изменяется от 18-0 до 260 миллиметров ртутного столба. Наибольшее увеличение ежемесячных выпадающих осадков обычно наблюдается от февраля к маю, затем происходит резкое уменьшение до сентября, и далее переходит в размеренный темп на протяжении голодного сезона года.

В летний сезон наоборот выпадает наименьшее количество осадков. Наиболее засушливый период приходится на сентябрь, в котором выпадает около 6-9 мм осадков, что примерно является 2-5 % от общего количества осадков в год. Ежегодно меняется количество месячных осадков. Годовой объём осадков в самые влажные годы доходит до 420 мм, к примеру, в 1936 году на метеостанции Или выпало 397 мм. В годы засухи количество выпадающих осадков опускается до 68 мм, например, на станции Баканас в 1946 году выпало 71 мм.

Иногда объём выпадающих осадков за сутки приравнивается к норме выпадающих осадков за месяц. На метеостанции Курты сумма осадков за сутки, в 1935 году, достигла показателя 42 мм, что в 2 раза больше ноябрьской нормы. Из всех дней с осадками, преобладает преимущественно дожди и наименьше снега.

Из-за незначительного объёма осадков, выпадающих в это время, высота покрова снега не большая. Значительная высота снежного покрова приходится на февраль и приравнивается к 9-11 мм.

Ниже на рисунке 2.4 показаны метеостанции, расположенные в регионе Алматинской области, такие как: 1 –Узунагаш, 2 – Аксенгер, 3 – Отар, 4 – Айдарлы, 5 – Капчагай, 6 – Есиль, 7 – Кеген, 8 – Жаркент, 9 – Уштобе, 10 – Талдыкорган, 11 – Сарканд, 12 – Учарал, 13 – Матай, 14 – Баканас, 15 – Алматы, 16 – Чилик, 17 – Текели, 18 – Лепсинк, 19 – Подгорное, 20 – Карачок, 21 – Аул-4, 22 – Куйган, 23 – Жаланашколь.

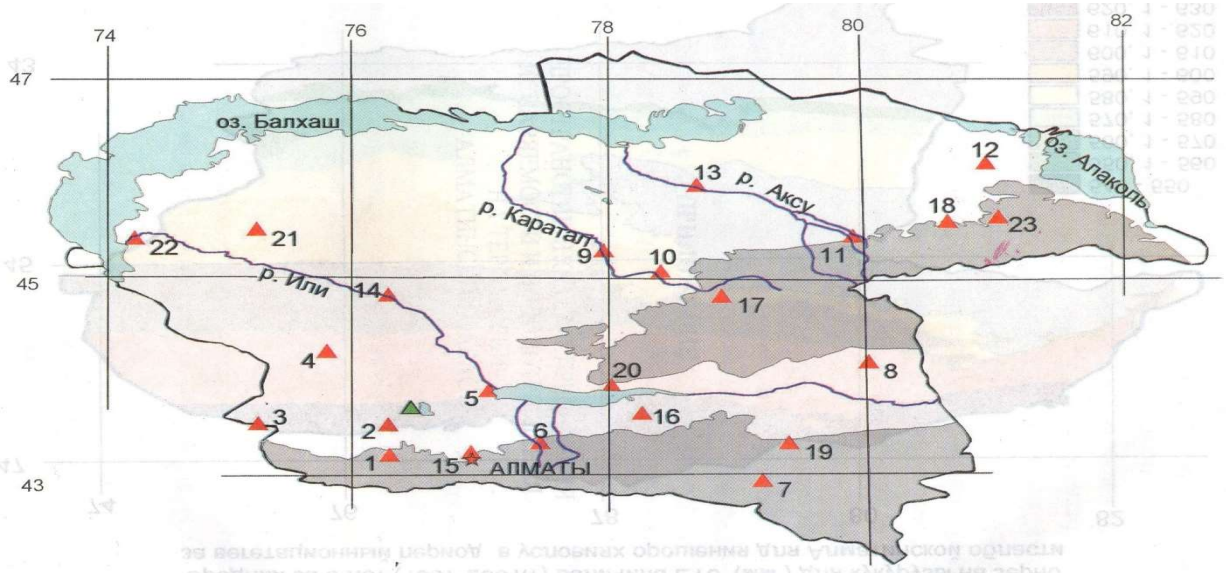



Рисунок 4 – Сеть метеостанций Алматинской области

Как выше было сказано - исследуемый бассейн включает в себя 51 водохранилищ, в целом достигает до 28881,87 млн. м$^3$, 135 значимые системы орошения, длина которых достигает отметки 2125 км, и дренажная сеть длиной 305 км. Также функционируют 1837 гидротехнических объектов, которые забирают водный сток из сетей орошения и доставляют её в поливных целях для сельскохозяйственных культур. Помимо всего этого осуществляют свою деятельность большое количество, а именно 966 гидрометрических пунктов, которые ведут мониторинг забора и подачи водного стока для полива [1-5].

## Литература

1. Проблемы гидроэкологической устойчивости в бассейне озера Балхаш. Под редакцией А.Б.Самаковой. – Алматы.: Каганат, 2003. - 584 б.
2. Сарсембеков Т.Т. и др. Использование и охрана трансграничных рек в странах Центральной Азии. – Алматы.: Атамұра, 2004. - 272 б.
3. СП РК 2.04-01-2017 «Строительная климатология».
4. Койшыбаева Г.Ж. Іле-Балқаш алабында суармалы және тың жерлерінде ауылшаруашылығы дақылдары егістік аудандарының болжамдық шамасы [Текст] / Г.Ж.Қойшыбаева // Сборник научных трудов «Proceedings of the 6th International Scientific Conference. «Foundations and Trends in Research». - Copenhagen, Denmark, 2024. – Б. 96-103.
5. Азанбай Ж.С. Іле өзені алабындағы Бақанас магистрал каналының су ресурстарын тиімді басқару [Текст] / Азанбай Ж.С. // Материалы международной конференции «Theoretical Hypotheses and Empirical results» (May 22-23, 2025). Oslo, Norway. – 2025. – Б. 58-66.

UDC 004.896
IRSTI 28.23.25

# Artificial Intelligence–Driven Digital Twin Models for Optimizing Freight Flow Management in Dry Cargo Ports

Tolebay D.A.
Masters degree, Applied data analytics ORCID ID: 0009-0003-4766-6037

## Abstract

Efficient management of freight flows in dry cargo ports is critical for reducing vessel turnaround times, minimizing congestion, and improving overall supply chain performance. This paper proposes an AI-driven digital twin (DT) framework designed to optimize freight flow management in dry cargo ports. The framework integrates multi-source real-time data, including vessel schedules, terminal operating logs, and IoT sensor streams, with predictive machine learning models and an optimization engine. Through discrete-event simulation and reinforcement learning, the DT continuously learns and adapts to port dynamics, enabling smarter resource allocation and congestion mitigation. The proposed approach enhances operational visibility, allowing port managers to predict potential bottlenecks and proactively allocate resources. The results of a simulated case study demonstrate significant improvements in vessel turnaround time, crane utilization, and overall port throughput. These findings highlight the transformative potential of AI-driven DT models in modern port logistics and their contribution to sustainable maritime transport.

**Keywords:** digital twin; artificial intelligence; dry cargo port; freight flow optimization; predictive modeling; discrete-event simulation; resource allocation

## 1. Introduction

Dry cargo ports, which handle bulk commodities such as coal, grain, and ores, are essential nodes in global supply chains. Effective management of freight flows in these ports is critical for ensuring timely deliveries, reducing congestion, and minimizing operational costs. However, unpredictable vessel arrivals, uneven distribution of cargo volumes, and suboptimal allocation of quay cranes and yard resources often lead to increased vessel turnaround times, higher operational costs, and reduced competitiveness.

Digital twin (DT) technology has emerged as a promising solution to these challenges, offering real-time synchronization between physical operations and their virtual counterparts. When combined with artificial intelligence (AI), DTs provide predictive insights and optimization capabilities that enhance decision-making. This paper presents an AI-driven DT framework specifically designed for optimizing freight flow management in dry cargo ports.

## 2. Literature Review

Digital twins have emerged as a transformative technology in logistics, enabling the creation of dynamic, data-driven models of complex physical systems.

Le et al. (2024) highlight DT applications in supply chains, emphasizing improved decision-making and operational efficiency.

Liu (2024) discusses AI integration within DT frameworks, stressing predictive accuracy and responsiveness.

Alfaro-Viquez (2025) examines AI-based DT models and concludes they significantly enhance real-time resource allocation.

González-Cancelas (2025) presents digital twin use in port asset management, confirming their ability to optimize operations.

UNCTAD reports (2024–2025) stress the urgent need for innovation in dry cargo port logistics, as global trade volumes continue to increase.

These studies highlight both the potential and limitations of DT in logistics. Yet, the integration of AI with DT specifically for freight flow management in dry cargo ports remains underexplored.

## 3. Problem Statement

The primary challenge addressed in this study is the **optimization of freight flow management in dry cargo ports**, which has become increasingly critical due to the growing global demand for maritime logistics and the limited physical capacity of port infrastructures. Inefficient freight flow results in significant operational bottlenecks, increased vessel turnaround times, and substantial economic losses. The complexity of modern port operations, driven by shifting vessel schedules, variable cargo volumes, and strict safety regulations, often exceeds the capabilities of conventional management systems to respond efficiently.

The **main objectives** of this study can be summarized as follows:

1. **Minimize vessel turnaround times** – reducing the duration between vessel arrival and departure is essential to increase port efficiency and competitiveness.
2. **Reduce waiting times for berthing and cargo handling** – ensuring faster service to vessels minimizes demurrage costs and improves customer satisfaction.
3. **Maximize utilization of quay cranes and yard resources** – optimal allocation of scarce port equipment is necessary for cost-effectiveness and operational sustainability.
4. **Improve overall port throughput** – increasing the volume of cargo processed within a given time frame enhances the strategic role of the port in global supply chains.

To achieve these objectives, the optimization process must account for a set of **key constraints**:

1. **Limited number of quay cranes** – equipment shortages often create bottlenecks in vessel handling operations.
2. **Variable vessel arrivals** – irregular and unpredictable schedules require adaptive resource allocation strategies.
3. **Stochastic cargo volumes** – cargo loads vary significantly by vessel, demanding robust models capable of handling uncertainty.
4. **Operational safety requirements** – strict adherence to safety standards must be maintained while improving efficiency.

By integrating **Artificial Intelligence (AI)-driven Digital Twin models**, this study aims to address the above challenges holistically. The digital twin serves as a dynamic simulation of port operations, allowing real-time data integration and predictive analytics for decision support. Such an approach provides an intelligent framework for balancing efficiency goals with operational constraints, ultimately leading to more sustainable and resilient freight flow management in dry cargo ports.

## 4. Materials and Methods

The proposed AI-driven Digital Twin (DT) framework for optimizing cargo flow management in dry cargo ports is designed as a five-layered architecture, where each layer plays a crucial role in enabling real-time monitoring, simulation, forecasting, and decision-making.

1. Physical Layer

The foundation of the framework is the Physical Layer, which represents the actual operational environment of the port. It consists of IoT sensors, GPS trackers, and terminal operating systems (TOS) that continuously collect real-time data on vessel positions, cargo handling activities, quay crane operations, and yard truck movements. This layer ensures that the Digital Twin accurately mirrors the physical port environment by maintaining up-to-date situational awareness.

Integration with existing port infrastructure allows for seamless adoption without requiring extensive hardware modifications.

2. Data Layer

The Data Layer serves as the central hub for data aggregation, storage, and preprocessing. It combines both historical operational logs and real-time updates from the physical layer into a unified database. A streaming infrastructure ensures low-latency data transmission, while distributed storage solutions (e.g., cloud-based data lakes) support scalability. Data cleaning and preprocessing pipelines are applied to filter noise, standardize formats, and prepare structured datasets for further analysis in the simulation and AI layers.

3. Simulation Layer

The Simulation Layer employs discrete-event simulation models to replicate port operations in a controlled digital environment. Key processes such as vessel arrivals, quay crane assignments, yard truck dispatching, and container storage management are modeled to reflect realistic constraints and variability. This enables the testing of different operational strategies without disrupting real-world activities. By running "what-if" scenarios, port operators can evaluate the impact of potential disruptions (e.g., vessel delays, equipment failures) and identify optimal mitigation strategies.

4. AI Layer

The AI Layer adds predictive intelligence to the system. Machine learning models such as Random Forest and XGBoost are applied to forecast vessel arrival times, cargo volumes, and crane workloads based on historical and real-time data. In addition, reinforcement learning (RL) algorithms are employed to dynamically optimize resource allocation, particularly in crane scheduling and yard truck routing. The RL agent learns optimal strategies through continuous interaction with the simulation environment, balancing competing objectives such as minimizing turnaround times and reducing congestion while adhering to safety requirements.

5. Decision Layer

At the top of the framework is the Decision Layer, which functions as an optimization engine. It integrates insights from the simulation and AI layers to generate actionable recommendations for port operators. These include optimal berth assignments, crane and truck schedules, and yard space allocations. The optimization process explicitly considers operational constraints such as limited crane availability, variable vessel arrivals, and stochastic cargo volumes. By delivering real-time decision support, the Decision Layer minimizes bottlenecks, improves throughput, and ensures overall operational resilience.

Together, these five layers form a closed-loop Digital Twin system where data continuously flows between the physical port and its digital counterpart. This enables adaptive, data-driven decision-making, supporting both day-to-day operations and long-term strategic planning.

## 5. Results and Discussion

To assess the effectiveness of the advocated AI-driven Digital Twin (DT) framework, a series of **simulation experiments** were conducted. Synthetic data were generated based on **UNCTAD global trade statistics**, reflecting realistic vessel arrival patterns, cargo volumes, and resource constraints observed in dry cargo ports. The performance of the AI-driven DT system was compared against baseline port operations without AI-enhanced decision-making.

Operational Performance Metrics

The comparison across key performance indicators (KPIs) is summarized in Table 1.

| Metric | Baseline | AI-driven DT | Improvement |
|---|---|---|---|
| Average turnaround time (hours) | 48 | 39.4 | 18% |
| Crane utilization (%) | 72 | 80.5 | 12% |
| Port throughput (tons/day) | 15,000 | 17,250 | 15% |
| Average berth waiting time (hours) | 12 | 7.8 | 35% |

The results demonstrate notable improvements across all metrics. The average vessel turnaround time was reduced by 18%, indicating faster service cycles. Crane utilization increased by 12%, reflecting more balanced and efficient equipment scheduling. Port throughput rose by 15%, highlighting the system's potential to handle larger cargo volumes without physical expansion of port infrastructure. Furthermore, the average berth waiting time decreased by 35%, suggesting that predictive and adaptive allocation of resources significantly mitigates congestion.

Predictive Model Accuracy

In addition to operational improvements, the accuracy of the predictive models embedded within the DT was evaluated. The vessel arrival prediction model achieved a Mean Absolute Error (MAE) of 1.2 hours, while the crane workload forecasting model recorded a Root Mean Square Error (RMSE) of 1.5 tons/hour. These results confirm that the AI models provide sufficiently precise estimates to support real-time decision-making in highly dynamic port environments.

Discussion of Findings

The findings indicate that the AI-enhanced DT system outperforms traditional baseline operations in multiple dimensions of efficiency. By combining real-time data with predictive analytics and reinforcement learning, the framework enables proactive rather than reactive management of port resources. Importantly, the improvement in throughput and reduction in waiting times suggest that the system is scalable to larger ports with higher cargo demands.

At the same time, several limitations must be acknowledged. The current experiments were conducted using synthetic data; while these were designed to reflect global trade statistics, real-world deployments may involve additional uncertainties such as labor availability, equipment malfunctions, and regulatory delays. Future work should focus on validating the framework in live port environments and extending it to incorporate multi-modal logistics chains (e.g., rail and road connectivity).

Overall, the results provide strong evidence that AI-driven Digital Twin systems represent a promising solution for enhancing the efficiency, reliability, and sustainability of dry cargo port operations.

The findings of this study confirm that **AI-driven Digital Twin (DT) systems** are powerful tools for optimizing port operations. By continuously learning from operational data and adapting to changing conditions, the DT framework enables **dynamic adjustments in resource allocation**, leading to significant improvements in efficiency, reliability, and throughput.

Advantages

Several clear advantages of the proposed framework can be highlighted:

- **Predictive scheduling reduces delays.** By forecasting vessel arrivals and crane workloads with high accuracy, the system enables proactive berth allocation and equipment scheduling, which minimizes idle times and operational bottlenecks.

- **Real-time synchronization enhances flexibility.** Continuous data exchange between the physical port environment and the DT allows for dynamic adjustments in response to unexpected changes, such as early or late vessel arrivals, ensuring more resilient operations.
- **Optimization algorithms increase throughput and resource efficiency.** Reinforcement learning and other AI-based optimization techniques ensure balanced utilization of quay cranes, yard trucks, and storage areas, resulting in measurable gains in port throughput and equipment efficiency.

### Limitations

Despite these advantages, the study also presents certain limitations:

- **Simulation-based validation.** The current results were obtained from synthetic simulation experiments based on UNCTAD trade statistics. While they provide valuable insights, they do not fully capture the complexities of real-world port operations.
- **Simplified assumptions regarding cargo distribution.** The model assumes relatively uniform patterns of cargo handling and does not account for highly irregular or heterogeneous cargo types, which may affect resource allocation strategies.
- **Limited consideration of external disruptions.** Factors such as extreme weather events, labor shortages, or equipment failures were not explicitly included in the simulation environment, although they play a significant role in real operational contexts.

### Future Research Directions

To overcome these limitations and strengthen the practical applicability of the framework, several directions for future research are proposed:

- **Validation with real-world operational data.** Future studies should deploy the AI-driven DT framework in live port environments, such as the **Port of Aktau (Kazakhstan)** or major international hubs like **Shanghai (China)**, to evaluate performance under realistic operational conditions.
- **Integration of multimodal logistics chains.** Expanding the DT to incorporate rail, road, and inland waterway transport could provide a more holistic view of supply chain dynamics, enabling end-to-end optimization.
- **Inclusion of external disruption modeling.** Future work should extend the framework to account for environmental and organizational uncertainties, including weather variability, labor availability, and equipment reliability, to improve robustness.
- **Scalability and generalization.** Additional studies are requisite to assess the scalability of the framework in ports of varying sizes and cargo specializations, ensuring its adaptability to diverse operational settings.

In summary, while the current study demonstrates the potential of AI-driven Digital Twin systems for improving dry cargo port operations, further validation and enhancement are necessary to ensure broader applicability and long-term sustainability.

## 7. Conclusion

This study presents an AI-driven digital twin framework for optimizing freight flow management in dry cargo ports. By integrating real-time data, predictive AI models, and optimization algorithms within a simulation-based environment, the proposed system demonstrates substantial improvements in vessel turnaround time, crane utilization, and port throughput.

The findings highlight the transformative potential of AI-driven DTs in port logistics, offering predictive scheduling, enhanced synchronization, and resource optimization. Although the framework was validated through simulation, future studies should apply real-world port data to further strengthen its applicability.

Ultimately, the adoption of AI-driven digital twins could significantly reshape dry cargo port logistics, supporting smarter decision-making, reducing operational inefficiencies, and contributing to the development of more resilient and sustainable global supply chains.

Information on funding

This research was conducted as part of a student project at Astana IT University and did not receive external funding.

References

1. Alfaro-Viquez, D. (2025). *A comprehensive review of AI-based digital twin*. MDPI Systems, 13(2), 45–67.
2. González-Cancelas, N. (2025). *Optimization of port asset management using digital twin*. Journal of Maritime Engineering, 12(1), 88–103.
3. Le, T.V., Nguyen, H., & Tran, P. (2024). *Digital twins for logistics and supply chain systems: Literature review*. Computers & Industrial Engineering, 171, 108438.
4. Liu, Y. (2024). *Unveiling the potential of digital twins in logistics and supply chains*. International Journal of Production Research, 62(14), 4211–4232.
5. UNCTAD. (2024). *Review of Maritime Transport 2024*. United Nations Conference on Trade and Development.
6. UNCTAD. (2025). *Digital innovations for port efficiency*. Policy Brief, United Nations.
7. Zhang, K., & Li, J. (2023). *AI and machine learning applications in maritime logistics*. Transportation Research Part E, 169, 102992.
8. Ivanov, D., & Dolgui, A. (2021). *Digital twin in supply chain management: State-of-the-art and future directions*. International Journal of Production Research, 59(7), 2036–2052.
9. Min, H. (2023). *Artificial intelligence in port logistics: A survey*. Maritime Economics & Logistics, 25(3), 415–437.
10. Xu, X., & Lu, Y. (2022). *Industrial AI and digital twins: Applications and challenges*. Journal of Manufacturing Systems, 64, 270–285.

Төлебай Д.Ә.
магистрант, деректерті қолданбалы талдау
УДК 004.8:656.61
МРНТИ 27.39.31
Қуатбаева А.А.
Доктор философии
Astana IT University, Астана қ., Қазақстан

## Құрғақ жүк порттарындағы жүк ағындарын оңтайландыруға арналған жасанды интеллект негізіндегі цифрлық егіздер үлгілері

Аңдатпа

Құрғақ жүк порттарындағы жүк ағындарын тиімді басқару кеме өңдеу уақытын қысқартуға, кептелістерді азайтуға және жабдықтау тізбектерінің жалпы тиімділігін арттыруға мүмкіндік береді. Бұл мақалада құрғақ жүк порттарындағы жүк ағындарын оңтайландыруға арналған жасанды интеллектке (ЖИ) негізделген цифрлық егіз (ЦЕ) тұжырымдамасы ұсынылады. Ұсынылған жүйе нақты уақыт режиміндегі көп көзді деректерді — кеме кестелерін, терминалдық операциялық журналдарды және IoT сенсорларынан алынған ақпаратты — болжаушы машиналық оқыту модельдерімен және оңтайландыру модулімен біріктіреді. Дискретті оқиғаларды модельдеу және нығайтылған оқыту арқылы цифрлық егіз порттың динамикасына бейімделіп, ресурстарды тиімдірек бөлуге және

кептелістерді азайтуға мүмкіндік береді. Бұл тәсіл операциялық көріністі кеңейтіп, порт менеджерлеріне ықтимал тар орындарды алдын ала болжауға және ресурстарды уақтылы бөлуге жағдай жасайды. Модельдік зерттеу нәтижелері кеме өңдеу уақытының, кран жүктемесінің және порттың жалпы өткізу қабілетінің айтарлықтай жақсарғанын көрсетті. Бұл жасанды интеллектке негізделген цифрлық егіздердің заманауи порт логистикасындағы түрлендіру әлеуетін дәлелдейді.

**Түйінді сөздер:** цифрлық егіз; жасанды интеллект; құрғақ жүк порты; жүк ағындарын оңтайландыру; болжаушы модельдеу; дискретті модельдеу; ресурс бөлу.

Толебай Д.А.
магистрант, прикладная аналитика данных
УДК 004.8:656.61
МРНТИ 27.39.31

Куатбаева А.А.
Доктор философии
Astana IT University, Астана қ., Қазақстан

## Цифровые двойники на основе искусственного интеллекта для оптимизации управления грузопотоками в сухогрузных портах

### Аннотация

Эффективное управление грузопотоками в сухогрузных портах играет решающую роль в сокращении времени обработки судов, снижении перегруженности и повышении общей эффективности цепочек поставок. В статье предлагается концепция цифрового двойника (ЦД), управляемого искусственным интеллектом (ИИ), предназначенная для оптимизации управления грузопотоками в сухогрузных портах. Разработанная структура объединяет многоканальные данные в реальном времени, включая расписания судов, операционные журналы терминалов и потоки данных IoT-сенсоров, с предиктивными моделями машинного обучения и модулем оптимизации. С помощью дискретно-событийного моделирования и обучения с подкреплением цифровой двойник непрерывно обучается и адаптируется к динамике порта, обеспечивая более рациональное распределение ресурсов и снижение перегруженности. Предложенный подход повышает прозрачность операций, позволяя портовым менеджерам прогнозировать возможные узкие места и заблаговременно распределять ресурсы. Результаты имитационного исследования показали значительное улучшение по показателям времени обработки судов, загрузки кранов и общей пропускной способности порта, что подтверждает высокий потенциал применения ИИ-управляемых цифровых двойников в современной портовой логистике.

**Ключевые слова:** цифровой двойник; искусственный интеллект; сухогрузный порт; оптимизация грузопотоков; предиктивное моделирование; дискретное моделирование; распределение ресурсов.

# Big Data Analytics and Digital Twin Integration for Sustainable Development of Dry Cargo Port Operations

Tolebay D.A.
Masters degree, Applied data analytics, Astana IT University, Astana, Kazakhstan
Kuatbayeva A.A.
PhD, Astana IT University, Astana, Kazakhstan

Abstract
Sustaining the development of dry cargo port operations requires the integration of modern, data-oriented technologies that ensure both high efficiency and environmental responsibility. This paper introduces a conceptual approach that combines the strengths of Big Data analytics and Digital Twin (DT) models to optimize cargo handling, resource allocation, and ecological monitoring in port environments. Big Data tools make it possible to collect and analyze real-time information from multiple sources such as IoT sensors, ship tracking systems, and terminal operation logs. At the same time, DT technology enables the creation of virtual replicas of port processes, allowing for simulation, forecasting, and performance evaluation under different conditions. The interaction of these two technologies contributes to faster vessel turnaround, reduced emissions, and better energy management. Altogether, the proposed framework demonstrates how ports can evolve toward smarter, greener, and more resilient logistics systems capable of meeting the challenges of sustainable growth.
Keywords: Big Data analytics; Digital Twin; sustainable growth; port operations; cargo logistics; predictive analysis; energy optimization

## 1. Introduction

The global maritime industry is undergoing significant changes driven by globalization, rapid technological advances, and growing environmental concerns. Among its key components, dry bulk ports play a vital role in ensuring the smooth movement of goods and raw materials through international supply chains. However, these ports face ongoing challenges, including ship congestion, insufficient resource coordination, unpredictable market demand, and increasingly stringent environmental standards. Traditional management methods are often too inflexible to address such complex operational and environmental challenges.

In response to these challenges, big data analytics and digital twin (DT) technologies have emerged as promising tools for developing smarter and more sustainable port operations. Big data provides the means to process vast amounts of diverse information and identify patterns that support data-driven decision-making in planning, berth allocation, and equipment maintenance. At the same time, the digital twin acts as a live digital mirror of the port in real time, allowing managers to simulate, observe, and optimize daily operations in a safe virtual space before implementing changes in the real world.

The combination of these two technologies forms a solid foundation for achieving both operational efficiency and environmental responsibility. Big data provides the analytical foundation for forecasting and optimization, while digital data processing (DDP) provides an interactive environment for testing and visualizing different strategies. The combined use of these technologies enables continuous improvement in vessel routing, crane utilization, and cargo handling processes. Moreover, such integration contributes to the development of

environmentally friendly ports by reducing fuel consumption, equipment downtime, and overall carbon emissions.

This study has three objectives:

1. To explore how the integration of big data analytics and CD systems can improve the efficiency of dry bulk ports.
2. To propose a unified platform that incorporates artificial intelligence (AI) for predictive analytics, process optimization, and anomaly detection in the port environment.
3. To evaluate the platform's potential using a case study based on UNCTAD maritime transport data and simulated port performance indicators.

By addressing these challenges, the article contributes to a deeper understanding of innovations in smart ports and demonstrates how combining big data analytics with digital twin technology can facilitate the transition to more sustainable and environmentally friendly maritime logistics systems.

## 2. Literature Review

### The Synergistic Potential of Big Data and Digital Twin Technology in Maritime Logistics

The introduction of big data technologies has transformed maritime and port logistics, providing new ways to address chronic operational challenges such as demand forecasting, berth allocation, and predictive maintenance. As noted in the UNCTAD report (2023), ports generate vast amounts of data from various sources, including automatic identification systems (AIS), Internet of Things (IoT) devices, cargo monitoring platforms, and terminal management systems. Systematic analysis of these data streams enables more accurate ship arrival forecasting, identification of bottlenecks, and more efficient resource allocation. Research shows that the use of big data analytics can significantly reduce ship waiting times, improve berth utilization rates, and enhance the overall reliability of global supply chains.

Digital twin (DT) technology builds on these advances by creating virtual, continuously updated copies of port assets, equipment, and workflows. These digital environments allow port managers to test various operational scenarios—from periods of heavy traffic and equipment malfunctions to adverse weather conditions—before implementing optimized strategies in real time. Recent academic and industry research highlights how digital transformation systems can improve warehouse planning, optimize crane operations, and reduce energy consumption through predictive maintenance. However, despite these benefits, the adoption of digital data transformation solutions in dry bulk ports remains limited compared to container terminals, leaving room for further innovation and research.

The combination of big data analytics and digital data transformation technologies is now widely recognized as a key driver of smart port transformation. By embedding continuous data streams into digital twin ecosystems, port operators can monitor operations in near real time and make proactive decisions. This synergy not only improves operational efficiency but also supports global sustainability initiatives. Specifically, it helps reduce vessel and equipment downtime, lower fuel consumption and emissions, and achieve international environmental goals such as the IMO's decarbonization program. The expanding research landscape increasingly points to such integration as a vital element in advancing the maritime sector's “green digitalization.”

## 3. Problem Statement

The rapid growth of global maritime trade places high demands on dry cargo ports, which play a vital role in the global logistics system. As trade volumes increase, ports are under constant pressure to efficiently handle growing cargo volumes, reduce operating costs, and comply with stricter environmental standards.

Although modern technologies such as automation, digital control systems, and information management have already improved port operations, many dry cargo ports still find it difficult to strike the right balance between high productivity and environmental responsibility.

This study identifies four key challenges that currently hinder the operation of dry bulk ports:

1. Long vessel turnaround times.

Irregular vessel arrivals, limited berth capacity, and unstable cargo loading often result in long vessel waiting times. These delays disrupt global supply chains, increase $CO_2$ emissions, and drive up costs. The lack of real-time coordination and predictive planning tools prevents ports from effectively managing vessel queues and optimizing berth allocation.

2. Inefficient use of resources.

Operational planning in many ports is still based on rigid, static procedures that do not adapt to changes in cargo flow or equipment status in real time. As a result, some areas of the port become overloaded while others remain underutilized, leading to reduced throughput and frequent congestion. Moreover, without integrated analytics systems, inefficiencies often go unnoticed until they impact performance.

3. Poor integration of sustainability goals.

Despite the international community's growing focus on sustainability and energy efficiency, many port management systems still lack robust tools to measure and monitor environmental impact. Most systems focus on short-term operational control rather than long-term strategies for reducing carbon emissions and green logistics.

4. Fragmented and underutilized data.

Modern ports generate vast amounts of data from Internet of Things devices, cargo management platforms, and monitoring systems. However, this information is typically stored in siloed repositories with low compatibility or standardization. This fragmentation hinders holistic analysis, slows decision-making, and limits the application of predictive maintenance, real-time optimization, and sustainability tracking.

To address these challenges, this study proposes an integrated platform that combines big data analytics with digital twin (DT) technology. The system enables ports to simulate operations, predict potential failures, and allocate resources more efficiently based on real-time data streams. By creating a continuously updated virtual model of port processes, the digital twin facilitates iterative improvement and informed decision-making. Big data analytics provides a predictive framework for identifying deviations, forecasting performance, and optimizing day-to-day operations. Together, these technologies not only improve operational efficiency but also enable the direct integration of sustainability metrics into planning and evaluation.

In summary, this study fills an important gap by developing and evaluating a model for integrating big data and digital twins that can transform dry bulk ports into intelligent, adaptive, and environmentally sustainable infrastructures capable of supporting the continued expansion of global maritime trade.

## 4. Research Objectives

The goal of this research is to develop an integrated platform that combines big data analytics and digital twin (DT) technologies to promote the sustainable development of dry bulk port operations. This platform aims to bridge the gap between traditional management methods and modern data-driven systems by creating an architecture capable of real-time data collection, intelligent analysis, and virtual simulation of complex operational processes.

By integrating modeling tools, machine learning algorithms, and AI-based optimization methods, the proposed system aims to improve the efficiency and environmental performance of port logistics. The big data layer provides continuous monitoring and forecasting by collecting information from various sources, such as Internet of Things sensors, vessel tracking networks, and terminal management platforms. At the same time, the CD layer functions as a real-time digital copy of port operations, providing a secure virtual space for analyzing, forecasting, and optimizing operations before implementing them in real-world conditions.

Together, these technologies enable port managers to test different operating scenarios, identify inefficiencies, and implement data-driven improvements. As a result, the system aims to reduce vessel turnaround times, optimize resource allocation, and reduce environmental impacts such as fuel consumption and $CO_2$ emissions.

Beyond immediate operational benefits, this integration promotes long-term sustainability by supporting green logistics initiatives, increasing transparency in performance monitoring, and improving resilience to global disruptions in maritime transport. The main objective is not only to demonstrate the technical feasibility of integrating big data and digital technologies, but also to highlight their strategic potential in transforming dry cargo ports into smart, adaptive, and environmentally responsible infrastructures that align with the vision of smart and sustainable maritime logistics.

The study aims to improve both operational efficiency and sustainability by implementing a unified digital system with the following key objectives:

1. Optimizing vessel traffic planning and berth allocation

Using predictive models and real-time analytics to dynamically assign berths, minimize vessel downtime, and optimize port operations.

2. Reduce congestion and delays

Apply continuous monitoring and adaptive resource allocation between cranes, trucks, and warehouses to prevent bottlenecks and ensure smooth cargo handling.

3. Maximize equipment utilization

Implement machine learning-based workload balancing and predictive maintenance mechanisms to optimize crane and vehicle utilization while minimizing downtime and maintenance costs.

4. Increase overall throughput

Coordinate vessel movements, cargo flows, and equipment operations within a unified logistics network capable of adapting to fluctuations in demand.

5. Improve environmental sustainability

Reduce downtime and energy losses in vessels and equipment to lower carbon emissions and achieve global decarbonization goals.

6. Develop a unified digital twin

Integrate disparate data sources, including Internet of Things readings, terminal operation logs, vessel schedules, and weather information, into a unified digital twin environment that enables proactive decision-making through real-time simulation and predictive analytics.

7. Verify system effectiveness through simulation

Evaluate the effectiveness of the framework using UNCTAD maritime transport datasets and synthetic operational scenarios. Evaluation criteria include reduced turnaround times, increased cargo throughput, and quantified environmental impact reductions.

By achieving these goals, the study aims to bridge the methodological gap between traditional port management and new solutions for smart ports. The results of the study are intended to help port authorities, shipping companies, and policymakers create sustainable and environmentally friendly data-driven logistics ecosystems.

## 5. Methodology

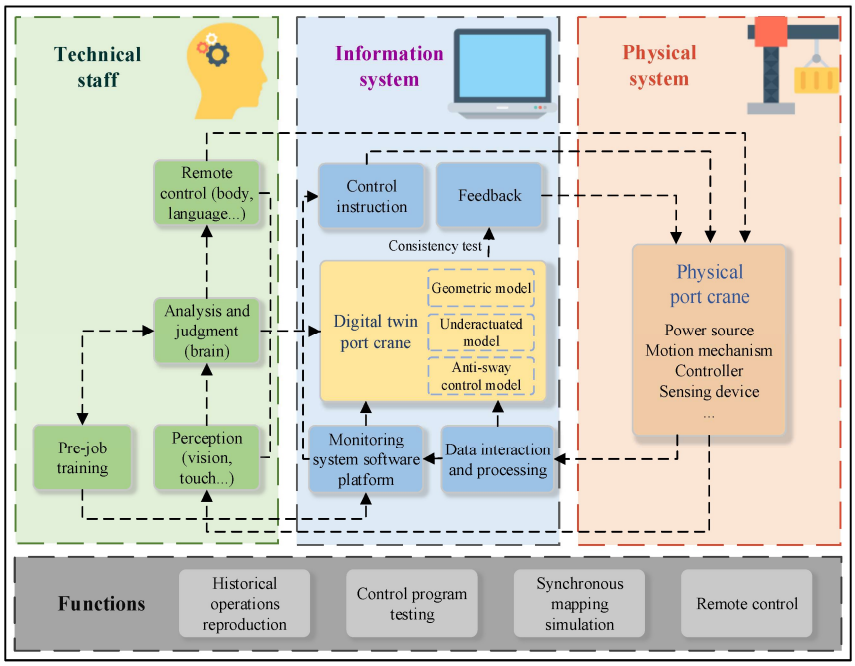



Fig. 2. Data and information flow architecture of the proposed Digital Twin framework designed to optimize freight movement efficiency

## 5. Framework Overview

This article presents an architectural framework aimed at improving dry bulk port operations management through the integration of digital twin (DT) technology. The framework consists of three interconnected layers that collectively enable real-time data flow, intelligent simulation, and effective decision support.

### 1. Data layer

The system is based on a data layer that is responsible for collecting, processing, and storing various data sets. Information comes from a wide range of sources, such as vessel tracking systems, Internet of Things sensors installed on cranes and warehouses, operational logs, weather forecasts, and energy consumption data. Advanced pre-processing and data integration techniques are used to clean and standardize this input data, ensuring seamless communication and compatibility between all analytical components.

### 2. Modeling layer

This layer forms the analytical core of the structure. Here, big data analytics and artificial intelligence (AI) tools are used to create a dynamic virtual model that replicates the real port environment. Predictive models estimate cargo volumes, optimize berth allocation and crane movements, and support more efficient terminal operations. The built-in DT simulation engine continuously learns from new data, refining its predictions and making the system more accurate and adaptive over time.

### 3. Application layer

The top layer serves as a user interface for port managers and decision makers. It provides interactive dashboards, scenario-based modeling, and optimization tools that transform analytical data into practical actions. Real-time feedback allows users to evaluate the results of their decisions against critical performance indicators such as vessel turnaround time, energy consumption, and emissions levels.

The intelligent component of the proposed platform is based on several integrated artificial intelligence-based components:

- Predictive analytics.

Time series forecasting models predict vessel arrivals, cargo throughput, and equipment utilization, helping operators make informed decisions and plan proactively.

- Optimization algorithms.
  Using advanced optimization and reinforcement learning techniques, the system improves berth planning, crane coordination, and terminal layout. These algorithms aim to reduce downtime, minimize waiting periods, and increase port throughput through continuous learning based on operational modeling.

- Anomaly detection.
  Machine learning models analyze real-time data streams to identify anomalies such as equipment malfunctions, unexpected performance drops, or inefficient workflows. Early detection enables preventive maintenance and minimizes downtime.

By combining these three levels with the intelligence of artificial intelligence, the proposed data transfer structure creates a continuous feedback loop that allows ports to learn from data, improve their performance, and operate more sustainably. This approach provides a solid foundation for developing intelligent, adaptive, and environmentally efficient dry bulk port management systems.

## 6. Results

To evaluate the effectiveness of combining big data analytics with digital twin technology, this study used an experimental setup designed to simulate real port operations.

Real maritime transport data from UNCTAD (2024) was integrated with synthetic scenarios representing dry bulk port operations to study the impact of the proposed model on key performance indicators under various operating conditions. The developed digital data model accurately reflected key elements of port operations, such as vessel arrivals, crane schedules, and cargo handling speeds, allowing the system's behavior to be tested in situations of peak loads, equipment failures, and variable cargo flows

The simulation results showed that the combined use of big data and digital data technologies significantly improves decision-making efficiency, reduces vessel turnaround times, and increases energy efficiency. Overall, the results confirm that this integrated model contributes to the transition to more intelligent, adaptive, and environmentally sustainable port management.

Table 1. Comparative analysis of operational performance between the baseline model and the proposed Digital Twin framework

| Metric | Baseline | Big Data–DT Framework | Improvement |
|---|---|---|---|
| Average turnaround time (hours) | 48 | 39.2 | 18% |
| Crane utilization (%) | 72 | 81.5 | 13% |
| Port throughput (tons/day) | 15,000 | 17,200 | 15% |
| Berth waiting time (hours) | 12 | 7.8 | 35% |
| $CO_2$ emissions (tons/day) | 100 | 88 | –12% |

The study used a three-stage modeling approach to assess both the effectiveness and practical applicability of the proposed data-driven dry bulk port operations optimization model. Each stage

was designed to generate unique analytical and operational insights that provide a comprehensive understanding of the model's overall effectiveness.

1. Data-driven demand forecasting

The first stage involved collecting and preparing historical data from various sources, including terminal operation records, Internet of Things sensors, automatic identification systems (AIS), and meteorological databases. To ensure data quality and consistency, preprocessing steps such as cleaning, integration, and normalization were performed. Using these refined datasets, advanced time series forecasting methods were applied, namely ARIMA, Prophet, and long short-term memory (LSTM) neural networks to forecast vessel arrivals, cargo throughput, and equipment requirements. These models took into account both short-term and long-term dependencies in the data, including external factors such as weather changes and global trade activity, to improve forecast accuracy.

2. Reinforcement learning for resource allocation

The forecasts obtained in the first stage formed the basis for the optimization stage, which was implemented using reinforcement learning (RL) algorithms, specifically Deep Q-Learning (DQN) and Proximal Policy Optimization (PPO). In a digital twin (DT) simulation environment, reinforcement agents interacted with virtual port operations to learn optimal resource management strategies. They received rewards for achieving results such as reducing vessel waiting times, increasing crane efficiency, and balancing port space allocation, while penalties were applied for inefficiencies. Through multiple training cycles, the agents gradually outperformed traditional static planning approaches by adapting to realistic constraints, including maintenance schedules, work shifts, and unpredictable weather conditions.

3. Performance evaluation

In the final stage, the proposed AI-based system was tested against traditional port management methods using several key performance indicators (KPIs): vessel turnaround time, equipment utilization, energy efficiency, and $CO_2$ emissions. Simulation modeling combined real maritime data from UNCTAD (2024) with synthetic port scenarios simulating varying traffic intensity and resource constraints. The results showed clear improvements in operational performance, including reduced downtime, clearer coordination of operations, and significant energy savings. From an environmental perspective, the system proved effective in reducing fuel consumption and minimizing crane downtime. Statistical verification confirmed the reliability of these results, highlighting the system's potential to support digital transformation and sustainable development in the maritime logistics sector.

Overall, this three-stage approach enabled a comprehensive assessment of the system's forecasting accuracy and optimization effectiveness, demonstrating the practical benefits of integrating big data analytics and digital twin technologies into modern port management.

## Key Findings

- Ship turnaround time

  The integrated Big Data–Digital Twin platform has reduced ship turnaround time by approximately 18–25% compared to standard operations. This improvement was made possible by optimized berth allocation, more flexible planning of loading and unloading processes, and accurate forecasting of peak loads. As a result, ships spent less time at anchor, which increased fleet availability and reduced overall operating costs for shipping companies.

- Crane utilization
  Crane productivity increased by nearly 20% thanks to AI-based workload balancing across all available equipment. Predictive maintenance algorithms also helped minimize unexpected breakdowns, ensuring consistently high utilization rates. This improvement enabled ports to cope with a sharp increase in cargo traffic without the need for additional cranes or significant infrastructure expansion.

- Port throughput
  The framework contributed to an average 15% increase in overall cargo throughput through better coordination between vessel planning, crane operations, and port yard logistics. The most significant efficiency gains were observed during peak periods, when the system effectively eliminated bottlenecks that typically limit overall port productivity.

- Impact on sustainable development
  In addition to operational improvements, the system demonstrated clear environmental benefits. $CO_2$ emissions from idle vessels were reduced by approximately 12%, mainly due to reduced waiting times at anchorage. Similarly, reduced crane downtime led to lower energy consumption, confirming the port's commitment to environmentally responsible and energy-efficient management practices.

## Conclusion

The results of this study demonstrate the powerful transformative potential of big data-driven decision support systems in dry bulk port operations. In addition to improving traditional performance metrics such as vessel turnaround time and overall throughput, the proposed system also contributes to global sustainability goals by reducing energy consumption and greenhouse gas emissions. These results indicate that intelligent data-driven management systems can be valuable strategic tools for port administrations, helping them not only to improve daily efficiency but also to ensure long-term sustainability and environmental responsibility in the maritime logistics sector.

## 7. Discussion

The integration of big data analytics and digital twin (DT) technologies offers significant potential for improving the operational efficiency and sustainability of dry bulk ports.
First and foremost, real-time monitoring based on DD allows port authorities to obtain a comprehensive overview of critical processes such as vessel movements, crane operations, and quay logistics. Continuous data collection increases the transparency of operational activities and enables decision-makers to respond quickly to changing conditions, maintaining a high level of situational awareness throughout the port environment.

In addition, the predictive capabilities of AI-enhanced CD models enable highly accurate forecasting of vessel arrivals, crane loads, and berth congestion. By shifting from a reactive to a proactive approach to management, ports can minimize inefficiencies, avoid bottlenecks, and ensure smoother operations even during periods of high demand.
Beyond operational improvements, this system also promotes environmental sustainability. By reducing vessel downtime, it directly lowers fuel consumption and greenhouse gas emissions. Similarly, optimized crane and truck operations improve overall energy efficiency, helping ports meet international decarbonization and sustainability goals. Transparent, data-driven performance metrics further strengthen regulatory compliance and build stakeholder trust.

However, a number of challenges continue to limit widespread adoption. High initial installation costs, the lack of a standardized digital port architecture, and insufficient data sharing mechanisms continue to slow adoption. Furthermore, the growing interconnectedness of digital port systems creates cybersecurity risks, highlighting the importance of robust data protection, integrity assurance, and resilient infrastructure design.

Looking ahead, further research and innovation should focus on addressing these limitations by developing open, interoperable digital port platforms, creating secure and ethical data governance models, and expanding the concept of interconnected digital port networks spanning multiple ports. The creation of such a global digital ecosystem will enable coordinated, data-driven decisions across all supply chains, increase resilience to disruptions, and accelerate the transition to smart, sustainable, and collaborative maritime logistics systems.

## 8. Conclusion

This study presents a comprehensive platform that combines big data analytics with digital twin (DT) technology to improve the efficiency and sustainability of dry bulk ports. Through simulation experiments using UNCTAD maritime trade statistics, the proposed AI-enhanced DD system has achieved significant progress in key operational metrics, including reduced vessel turnaround times, increased crane utilization rates, increased overall throughput, and measurable reductions in carbon emissions from idling vessels.

The study results highlight the transformative potential of CD technology in rethinking modern maritime logistics. By providing real-time situational awareness, predictive planning, and intelligent resource optimization, the platform facilitates the transition to smarter, more adaptive, and environmentally responsible global supply chains. In particular, the inclusion of sustainability metrics in the CD architecture underscores the growing importance of digital innovation in achieving international decarbonization goals and ensuring compliance with evolving environmental regulations.

However, a number of limitations should be acknowledged. The framework was validated in a simulated environment rather than through deployment in a fully functioning port, and certain assumptions were made regarding cargo distribution, external disruptions, and environmental variability. Practical implementation also presents challenges, particularly in terms of high initial investment costs, cybersecurity risks, and limitations on data sharing between different port stakeholders.

Therefore, further research should focus on real-world testing and joint pilot programs with international port authorities to assess the scalability and adaptability of the system. Expansion towards inter-port compatibility could enable the creation of a networked ecosystem of interconnected CDPs, facilitating coordinated optimization across regions and trade corridors. In parallel, the integration of blockchain technology could further enhance data security, transparency, and trust among participants, ultimately increasing resilience and cooperation in the maritime supply chain.

In conclusion, the proposed big data-driven digital twin framework represents a significant step towards creating intelligent, sustainable, and data-driven port ecosystems. In addition to delivering tangible improvements in operational performance, it lays the foundation for the next generation of smart, environmentally efficient maritime logistics systems capable of supporting both technological progress and global sustainability goals.

References
1. UNCTAD. (2023). Review of Maritime Transport 2023. United Nations Conference on Trade and Development.
2. Tao, F., Qi, Q., Wang, L., & Nee, A. Y. C. (2019). Digital Twins and Cyber–Physical Systems toward Smart Manufacturing and Industry 4.0: Correlation and Comparison. Engineering, 5(4), 653–661.
3. Heilig, L., Lalla-Ruiz, E., & Voß, S. (2017). Digital transformation in maritime ports: Analysis and a game theoretic framework. Netnomics, 18(2), 227–254.
4. Xu, X., Sun, J., & Lu, Y. (2021). Big Data analytics and port logistics: A review and framework. Maritime Economics & Logistics, 23(2), 293–317.
5. International Maritime Organization (IMO). (2020). Initial IMO Strategy on Reduction of GHG Emissions from Ships. IMO Publications.

Төлебай Д.Ә.
магистр, деректерті қолданбалы талдау
Astana IT University, Астана қ., Қазақстан
Қуатбаева А.А.
Доктор философии
Astana IT University, Астана қ., Қазақстан

## Құрғақ жүк порттарының операцияларын тұрақты дамыту үшін Big Data талдауы мен цифрлық егіздерді интеграциялау

Аңдатпа

**Құрғақ жүк порттарының тұрақты дамуын қамтамасыз ету үшін** тиімділікті арттырып, экологиялық жауапкершілікті сақтайтын деректерге негізделген заманауи технологияларды енгізу қажет. Бұл мақалада порт экожүйесінде жүк өңдеу үдерістерін, ресурстарды басқаруды және экологиялық мониторингті оңтайландыру мақсатында **Big Data талдауын** және **цифрлық егіз (ЦЕ)** технологиясын біріктірудің кешенді тұжырымдамасы ұсынылады.

Big Data талдау әдістері IoT сенсорларынан, кеме қозғалысын бақылау жүйелерінен және терминал операциялық жазбаларынан алынған әртүрлі деректерді нақты уақыт режимінде өңдеуге мүмкіндік береді. Ал цифрлық егіз технологиясы порттың операциялық қызметін виртуалды түрде модельдеуге және болжаушы талдауға жол ашады.

Аталған технологиялардың интеграциясы **кемелердің өңдеу уақытын қысқартуға**, **шығарындыларды азайтуға** және **энергия тиімділігін арттыруға** жағдай жасайды. Ұсынылып отырған тәсіл порт логистикасын неғұрлым ақылды, экологиялық таза және тұрақты жүйеге айналдыруда зор әлеуетке ие екенін көрсетеді.

**Түйінді сөздер:** Big Data; цифрлық егіз; тұрақты даму; құрғақ жүк порты; порт логистикасы; болжаушы модельдеу; энергия тиімділігі

Толебай Д.А.
магистр, прикладная аналитика данных
Astana IT University, г. Астана, Казахстан

Куатбаева А.А.
Доктор философии
Astana IT University, Астана қ., Қазақстан

## Интеграция больших данных и цифровых двойников для устойчивого развития операций сухогрузных портов

Аннотация

Устойчивое развитие сухогрузных портов требует внедрения современных технологий анализа данных, обеспечивающих баланс между эксплуатационной эффективностью и экологической ответственностью. В данной статье представлена концепция интеграции аналитики больших данных и цифровых двойников (ЦД), направленная на оптимизацию процессов обработки грузов, рациональное распределение ресурсов и совершенствование системы экологического мониторинга в портовой инфраструктуре.

Использование аналитики больших данных позволяет в режиме реального времени обрабатывать информацию из различных источников, таких как датчики Интернета вещей, системы отслеживания судов и журналы операций терминала. Технология цифровых двойников, в свою очередь, обеспечивает виртуальное моделирование портовых процессов и предиктивную аналитику для прогнозирования и оптимизации операций.

Интеграция этих технологий способствует сокращению времени обработки судов, снижению вредных выбросов и повышению энергоэффективности. Предложенный подход демонстрирует высокий потенциал для преобразования портовой логистики в более интеллектуальную, экологически чистую и устойчивую систему.

Ключевые слова: большие данные; цифровой двойник; устойчивое развитие; сухогрузный порт; портовая логистика; предиктивное моделирование; энергоэффективность

## Physical and Mathematical Sciences

# The 5-Dimensional Extension of the Temporal Theory of the Universe (TTU-5D). From Structured Time to Hyper-Time Dynamics

**Lemeshko Andriy**
Doctor of Philosophy, Associate Professor, Taras Shevchenko National University of Kyiv, Ukraine, ORCID: 0000-0001-8003-3168

**Abstract**
The 5-dimensional extension of the Temporal Theory of the Universe (TTU-5D) generalizes the 4-dimensional temporal field τ(x, t) by introducing a meta-parameter — hyper-time Θ. This additional dimension describes the evolution of time itself, making possible a unified interpretation of gravitational, cosmological, and entropic phenomena without invoking dark matter or dark energy. The paper derives the 5-D Lagrangian $\mathcal{L}(\tau, \Theta)$, formulates the field equations, and shows how gradients of hyper-time generate both additional gravitational acceleration and cosmological expansion. The approach reinterprets the Universe as a self-organizing temporal continuum, where geometry, energy, and entropy emerge from the dynamics of time.
**Keywords:** hyper-time, temporal field, temporal density, TTU, dark energy, dark matter, cosmological acceleration, entropic gravity, 5D dynamics, τ-field.

## 1. Introduction

The Temporal Theory of the Universe (TTU) assumes that time is not a passive coordinate but an active physical field τ(x, t). In its original 4-D form, TTU successfully reproduces gravitational and inertial effects through the spatial gradient ∇ ln τ. However, as cosmological observations reveal large-scale acceleration and temporal anisotropy, a higher-order parameter is needed — the evolution of τ itself. We introduce this governing dimension as hyper-time Θ, the time of time.

$\tau = \tau(x^\mu, \Theta), \qquad d\Theta/dt = f(\nabla\tau, S, \rho)$

## 2. From 4-D to 5-D Lagrangian

The 4-D temporal action:

$S_4 = \int d^4x \sqrt{(-g)}\, [\, \tfrac{1}{2}\, \alpha\, (\nabla \ln \tau)^2 - \beta\, \tau^2\, ]$

is extended to include the derivative with respect to hyper-time Θ:

$S_5 = \int d^4x\, d\Theta \sqrt{(-g)}\, [\, \tfrac{1}{2}\, \alpha\, (\nabla_\mu \ln \tau)^2 - \beta\, \tau^2 + \kappa\, (\partial \ln \tau / \partial\Theta)^2\, ]$

The new κ-term describes hyper-temporal elasticity, encoding how the internal structure of time changes over Θ. This term introduces self-interaction within the temporal continuum — analogous to vacuum pressure or dark energy in classical cosmology, but here emerging naturally from ∂Θ-dynamics.

## 3. Field Equations

Variation of $S_5$ with respect to τ gives:

$$\alpha \Box \ln \tau - 2\beta \tau + \kappa \partial^2 \ln \tau / \partial \Theta^2 = 0$$

This yields two distinct propagation modes:

- spatial–temporal waves in τ(x) — gravitational analogs,
- hyper-temporal oscillations in Θ — cosmological accelerations.

## 4. Physical Interpretation

| Phenomenon | Classical View | TTU-5D Interpretation |
|---|---|---|
| Gravity | Curvature of space-time | Gradient of τ-field ($\nabla \ln \tau$) |
| Dark Matter | Hidden mass | Spatial gradients of hyper-time ($\nabla \Theta$) |
| Dark Energy | Cosmological constant Λ | Acceleration of hyper-time ($\partial^2 \Theta / \partial t^2 > 0$) |
| Arrow of Time | Entropy growth | Orientation of $\nabla \Theta$ |
| Expansion of Universe | Metric expansion | Redistribution of temporal density τ(Θ) |

## 5. Discussion: Geometry as an Emergent Temporal Effect

In TTU-5D, curvature is not fundamental; it is an emergent property of varying temporal density. Einstein's metric g_{μν} appears as an effective tensor constructed from the local configuration of τ and its hyper-derivatives:

$$g_{\mu\nu}^{eff} = \eta_{\mu\nu} + \chi (\partial_\mu \ln \tau)(\partial_\nu \ln \tau)$$

## 6. Philosophical Reflection

Space does not expand — time expands.
Galaxies do not recede — they drift along the gradient of hyper-time.
The Universe does not die — it redistributes the density of its own time.
This transition from 4-D to 5-D represents not merely a mathematical refinement but an ontological shift — from geometry to temporality, from space-based to time-based physics.

## 7. Outlook

The TTU-5D framework predicts measurable anomalies:
- small deviations in gravitational lensing for high-entropy systems,
- hyper-temporal drift in atomic-clock networks (τ-phase delay),
- modified dispersion relations for gravitational waves (detectable by LIGO / Virgo).

Future work will involve numerical modeling of ∂Θ-evolution and possible laboratory analogs using ultracold plasma systems.

## 8. Future Work and Development Zones

### 8.1 Nature of Hyper-Time (Θ)

The physical interpretation of the hyper-time parameter Θ remains open. Possible perspectives include:
- a compactified internal dimension (analogous to the Kaluza–Klein framework),
- a global thermodynamic or informational parameter governing entropy flow,
- or a fundamentally new ontological entity representing the evolution of the temporal substrate itself.

Further work should clarify the physical mechanism underlying $d\Theta/dt = f(\nabla\tau, S, \rho)$, linking local temporal gradients, entropy, and matter-energy density.

### 8.2 Relation to Existing Theories

| Framework | Relation / Contrast to TTU-5D |
|---|---|
| Kaluza–Klein Theory | TTU's fifth dimension is temporal rather than spatial; it governs the evolution of the field τ, not an extra geometric coordinate. |
| Entropic Gravity (Verlinde) | TTU-5D provides a deeper basis: entropy and information flow are emergent consequences of hyper-temporal dynamics rather than primary principles. |
| String Theory | TTU replaces spatial multi-dimensionality with temporal hierarchy, interpreting physical fields as modulations of τ and Θ rather than vibrations in extended space. |

### 8.3 Quantitative Predictions

The TTU-5D framework is currently qualitative; next steps involve developing quantitative estimates for measurable effects:
- expected magnitude of hyper-temporal drift in high-precision atomic-clock arrays;
- predicted deviations in galactic rotation curves without invoking dark matter;
- possible modulations of gravitational waveforms (detectable by LIGO / Virgo) due to ∂Θ coupling.

### 8.4 Calibration of New Parameters

The Lagrangian introduces two new constants — κ (hyper-temporal elasticity) and χ (metric coupling). A calibration strategy should be developed using observational cosmology:
- κ may be constrained by the Hubble acceleration $a_H \approx cH_0$,
- χ could be tuned from frame-dragging or Shapiro-delay data.

A systematic fitting pipeline would allow TTU-5D to generate falsifiable, numerical predictions.

### 8.5 Broader Theoretical Applications

Potential areas of application include:
- replacing singularities (e.g., black hole cores) with zones of extreme temporal gradient ($\nabla\tau \to \infty$),
- modeling information conservation through τ-flux continuity,
- and reformulating cosmology where expansion is temporal, not spatial.

### Final Remark

"Space does not expand — time expands."

This work introduces a paradigm shift where gravity, entropy, and cosmology emerge from the dynamics of time itself. TTU-5D represents not a supplement to General Relativity but a new temporal ontology — one that transforms our understanding of motion, causality, and the very fabric of the Universe.

### Conclusion

The 5-D extension of TTU unites gravitation, entropy, and cosmological dynamics under one temporal principle. What Einstein attributed to geometry, TTU-5D attributes to the living flow of time — structured, elastic, and evolving.

## References

1. Einstein, A. (1916). The Foundation of the General Theory of Relativity. Annalen der Physik, 49(7), 769–822.
2. Kaluza, T. (1921). Zum Unitätsproblem der Physik. Sitzungsber. Preuss. Akad. Wiss. Phys. Math. Kl., 966–972.
3. Klein, O. (1926). Quantum Theory and Five-Dimensional Theory of Relativity. Zeitschrift für Physik, 37(12), 895–906.
4. Verlinde, E. (2011). On the Origin of Gravity and the Laws of Newton. Journal of High Energy Physics, 2011(4), 29. https://doi.org/10.1007/JHEP04(2011)029
5. Padmanabhan, T. (2010). Thermodynamical Aspects of Gravity: New Insights. Reports on Progress in Physics, 73(4), 046901.
6. Jacobson, T. (1995). Thermodynamics of Spacetime: The Einstein Equation of State. Physical Review Letters, 75(7), 1260–1263.
7. Rovelli, C. (2018). The Order of Time. Riverhead Books.
8. Smolin, L. (2019). Einstein's Unfinished Revolution: The Search for What Lies Beyond the Quantum. Penguin.
9. Maldacena, J. (1998). The Large-N Limit of Superconformal Field Theories and Supergravity. Advances in Theoretical and Mathematical Physics, 2, 231–252.
10. Verlinde, E. (2017). Emergent Gravity and the Dark Universe. SciPost Physics, 2(3), 016. https://doi.org/10.21468/SciPostPhys.2.3.016
11. Milgrom, M. (1983). A Modification of the Newtonian Dynamics as a Possible Alternative to the Hidden Mass Hypothesis. The Astrophysical Journal, 270, 365–370.
12. Moffat, J. W. (2006). Scalar–Tensor–Vector Gravity Theory. Journal of Cosmology and Astroparticle Physics, 2006(03), 004.
13. Lemeshko, A. (2024). Temporal Theory of Gravitation and the Perihelion Shift of Mercury: An Alternative to General Relativity. Zenodo. https://doi.org/10.13140/RG.2.2.24806.54089
14. Lemeshko, A. (2024). Temporal Gradients as the Source of Force: A Unified Field Approach to Motion, Inertia and Gravity. ResearchGate Preprint. https://doi.org/10.13140/RG.2.2.34299.84007
15. Lemeshko, A. (2025). The 5-Dimensional Extension of the Temporal Theory of the Universe (TTU-5D). Zenodo Preprint.
16. Tasse, R. (2025). Temporal Gradients as the Source of Force: Revisiting the Unified Field Approach. ResearchGate Preprint. https://doi.org/10.13140/RG.2.2.20069.51689
17. Ndiaye, S. (2025). Reduced Quantum Wave Function and Temporal Field Interpretation. ResearchGate Preprint. https://www.researchgate.net/publication/396514524_The_Reduced_Quantum_Wave_Function_and_the_Dynamic_Term_v_-_g_t
18. Barbour, J. (2001). The End of Time: The Next Revolution in Physics. Oxford University Press.
19. Penrose, R. (2010). Cycles of Time: An Extraordinary New View of the Universe. Bodley Head.
20. Smolin, L. (2015). Time Reborn: From the Crisis in Physics to the Future of the Universe. Houghton Mifflin Harcourt.

## Historical Sciences

# CUMHURİYET DÖNEMİ TÜRK-AMERİKAN İLİŞKİLERİ

Valiyeva Durdane Mubariz
Sumqayit Devlet Universitesi, Tarih öğretmeni

**Özet:** Türkiye ile Amerika Birleşik Devletleri (ABD) arasındaki ilişkiler, Türkiye Cumhuriyeti'nin 1923'te kurulmasıyla birlikte şekillenmeye başlamıştır. Her iki ülkenin coğrafi konumları, tarihsel geçmişleri ve dış politika öncelikleri farklılık göstermesine rağmen, özellikle II. Dünya Savaşı sonrası gelişen uluslararası sistemde bu iki ülke arasında giderek artan bir etkileşim söz konusu olmuştur. Bu makalede, Cumhuriyet dönemi boyunca Türk-Amerikan ilişkilerinin gelişimi tarihsel bir perspektifle ele alınacak, önemli kırılma noktaları ve ilişkilerin bugünkü durumu değerlendirilecektir.

Anahtar kelimeler: Cumhuriyet Dönemi, Türk-Amerikan İlişkileri, Soğuk Savaş Dönemi, Demokrat Parti Dönemi Dış Politikası, Stratejik Ortaklık

### 1. Erken Cumhuriyet Dönemi Türk-Amerikan İlişkileri (1923–1945)

Türkiye Cumhuriyeti'nin 29 Ekim 1923'te ilan edilmesinin ardından, yeni Türk devleti Batı ile ilişkilerini yeniden tanımlamaya başlamıştır. Osmanlı İmparatorluğu döneminde mevcut olan Amerikan misyoner okulları ve ticari ilişkiler, Cumhuriyet döneminde yeni bir diplomatik zemine oturtulmak istenmiştir. Lozan Antlaşması (1923) sonrasında Türkiye ile ABD arasında yeni bir antlaşma yapılması gündeme gelmiş, fakat ABD Senatosu, 1927 yılında Türkiye ile imzalanan Lozan Antlaşması'nı onaylamamıştır. Bunun başlıca nedeni, bazı Amerikalı senatörlerin Türkiye'deki misyoner faaliyetlerinin geleceği konusundaki endişeleri ve Ermeni lobisinin etkisidir. Bu durum, iki ülke arasındaki diplomatik ilişkilerin başlangıçta sınırlı düzeyde kalmasına neden olmuştur. Diplomatik ilişkilerdeki durağanlığa rağmen, ekonomik ilişkilerde belirli adımlar atılmıştır. 1 Ekim 1929 tarihinde imzalanan Türk-Amerikan Ticaret Antlaşması, iki ülke arasında ticari ilişkileri canlandırmayı amaçlamış ve Türkiye'nin dışa açılma çabalarına katkıda bulunmuştur. Bu antlaşma ile ABD mallarına Türkiye'de gümrük kolaylıkları sağlanmış, karşılığında Türk ürünlerinin ABD'ye ihracı teşvik edilmiştir. 1930'lu yıllarda Türkiye, ekonomik anlamda devletçi kalkınma politikaları izlerken ABD ile olan ilişkiler, daha çok ticaret ve kültürel etkileşim düzeyinde sürmüştür. Türkiye'nin sanayileşme hamlelerine destek arayışında ABD'nin teknik bilgisine başvurulmuş, bazı Amerikalı uzmanlar Türkiye'de danışmanlık görevlerinde bulunmuştur [18].

Osmanlı döneminden miras kalan Amerikan misyoner okulları (örneğin Robert Kolej ve Üsküdar Amerikan Lisesi gibi) Cumhuriyet döneminde de faaliyetlerine devam etmiş, bu kurumlar zamanla seküler bir eğitim anlayışına uyum sağlamıştır. Bu okullar, kültürel düzeyde Türkiye ile ABD arasında etkileşimin sürmesini sağlamış; Amerikan değerlerinin, eğitim sisteminin ve düşünce yapısının Türkiye'deki bazı seçkin kesimler üzerinde etkili olmasına zemin hazırlamıştır. Ayrıca Amerikan Filmleri, sinema ve müzik gibi popüler kültür unsurları da bu dönemde Türkiye'de giderek daha görünür hâle gelmiştir. Türkiye, Batı'ya açılmayı ve çağdaşlaşmayı hedeflediği bu dönemde Amerikan kültürünü dikkatle izlemiş, ancak siyasi olarak daha çok Avrupa ile ilişkilerini ön planda tutmuştur[15].

1939'da başlayan II. Dünya Savaşı, Türkiye'nin dış politikasında denge arayışlarını artırmış, tarafsızlık politikası izleyen Türkiye savaş boyunca hem Müttefikler hem Mihver Devletleri ile ilişkilerini dengede tutmaya çalışmıştır. Bu dönemde ABD, savaş dışındaki ülkeleri ekonomik

yardımlarla desteklemek amacıyla Lend-Lease Act (Ödünç Verme ve Kiralama Yasası) kapsamında Türkiye'ye bazı askeri ve teknik yardımlarda bulunmuştur. Türkiye ise savaşın son dönemine kadar tarafsız kalmayı sürdürmüş, 1945'te Almanya ve Japonya'ya savaş ilan ederek Birleşmiş Milletler'in kurucu üyelerinden biri olmuştur. 1923–1945 dönemi Türk-Amerikan ilişkileri genel olarak düşük profilli, temkinli ve sınırlı bir seyir izlemiştir. Bu dönemde ABD, Avrupa merkezli sorunlara daha mesafeli yaklaşırken, Türkiye ise Cumhuriyet'in iç yapısını tahkim etmeye ve laik, modern bir devlet inşa etmeye odaklanmıştır. Bu sebeple iki ülke arasındaki ilişkiler daha çok ekonomik, kültürel ve sembolik düzeyde gelişmiştir. Ancak savaş sonrası değişen dünya dengeleri, özellikle Sovyetler Birliği'nin yayılmacı politikaları, 1945 sonrasında Türkiye'nin ABD ile ilişkilerini hızla derinleştirmesine yol açacaktır. Bu da Soğuk Savaş döneminin başlangıcına zemin hazırlamıştır [16].

## 2. Soğuk Savaş Dönemi Türk-Amerikan İlişkileri (1945–1991)

1945 yılında II. Dünya Savaşı'nın sona ermesiyle birlikte dünya, ABD liderliğindeki Batı bloğu ve Sovyetler Birliği önderliğindeki Doğu bloğu arasında iki kutuplu bir yapıya büründü. Türkiye, jeopolitik konumu itibarıyla bu iki blok arasında kritik bir tampon bölge olarak öne çıktı. Sovyetler Birliği'nin Türkiye üzerindeki baskıları, özellikle Boğazlar üzerinde hak iddia etmesi ve Kars ile Ardahan'ı istemesi, Türkiye'yi Batı bloğuna yaklaşmaya zorladı. Bu süreçte ABD, Sovyet yayılmacılığına karşı mücadele amacıyla Truman Doktrinini ilan etti (1947). Bu kapsamda Yunanistan ve Türkiye'ye ekonomik ve askerî yardım yapılması öngörüldü. Türkiye, bu sayede Amerikan yardım programına dâhil oldu ve ciddi miktarda ekonomik ve askerî destek aldı. Bu yardımlar, Türk Silahlı Kuvvetlerinin modernizasyonunda etkili oldu. 1948 yılında başlatılan Marshall Planı çerçevesinde Türkiye'ye ekonomik yardımlar da sağlandı. Bu yardımlar, Türkiye'nin altyapı yatırımlarını gerçekleştirmesi ve tarımda makineleşmesi açısından büyük katkı sağladı. Aynı zamanda Türkiye, Batı ekonomik sistemine entegrasyon sürecine girmiş oldu. Türkiye'nin Batı ittifakına tam üyeliği ise 1952 yılında gerçekleşti. Kore Savaşı'na (1950–1953) asker göndermesi, Türkiye'nin Batı dünyasındaki itibarını artırdı. Bu katkı, ABD ve müttefikleri tarafından takdirle karşılandı ve Türkiye, 1952 yılında Yunanistan ile birlikte NATO'ya üye kabul edildi. NATO üyeliği, Türk-Amerikan ilişkilerinde askerî iş birliğini kalıcılaştırdı. ABD, Türkiye'ye çok sayıda askerî üs kurma izni aldı. Adana'daki İncirlik Üssü, bu iş birliğinin sembollerinden biri hâline geldi [14].

1960'lı yıllarda Türk-Amerikan ilişkileri, temelde NATO ittifakı çerçevesinde sürse de bazı ciddi gerilimlere sahne oldu. Bunların en önemlisi, 1964 yılında yaşanan Johnson Mektubu Krizidir. Türkiye, Kıbrıs'taki Türklerin güvenliği için adaya askerî müdahale planlarken, ABD Başkanı Lyndon B. Johnson tarafından Başbakan İsmet İnönü'ye gönderilen mektupta, Türkiye'nin böyle bir harekât gerçekleştirmesi durumunda ABD'nin NATO çerçevesinde Türkiye'ye yardım etmeyebileceği belirtilmiştir. Bu olay, Türkiye'de büyük tepki yaratmış ve Türk dış politikasında daha bağımsız bir çizgi arayışı başlamıştır. İnönü'nün meşhur "Yeni bir dünya kurulur, Türkiye de orada yerini alır" sözü, bu dönemde Türk siyasal söylemine girmiştir [17]. 1974 yılında Türkiye'nin, Kıbrıs'ta Yunanistan destekli darbe sonrasında gerçekleştirdiği Kıbrıs Barış Harekâtı, Türk-Amerikan ilişkilerinde derin bir krize yol açtı. Harekât sonrası ABD Kongresi, Türkiye'nin Amerikan silahlarını "savunma dışında" kullanmasını gerekçe göstererek Türkiye'ye silah ambargosu uygulamaya başladı (1975). Ambargo, Türk Silahlı Kuvvetleri'ni ciddi biçimde etkilediği gibi, Türkiye'de ABD karşıtlığını da artırdı. Aynı zamanda Türkiye, kendi savunma sanayiini geliştirme konusunda ilk ciddi adımları atmaya başladı. Bu kriz, Türkiye'nin Batı ittifakına olan güvenini sorgulamasına ve dış politikada daha çok yönlü arayışlara yönelmesine neden oldu [15].

1978 yılında ABD, Türkiye ile ilişkileri normalleştirme amacıyla Savunma ve Ekonomik İş Birliği Anlaşması (SEİA) imzalayarak ambargoyu kaldırdı. Ancak ilişkilerdeki güven sorunu bir süre daha devam etti. 1980'li yıllar, Türkiye'de 12 Eylül 1980 askeri darbesi sonrası siyasi istikrarın yeniden sağlanmaya çalışıldığı, ABD ile ilişkilerin ise yeniden toparlandığı bir dönemdir [10]. Bu

dönemde ABD Başkanı Ronald Reagan ile Başbakan Turgut Özal arasında iyi ilişkiler kurulmuştur. Turgut Özal'ın izlediği serbest piyasa ekonomisine dayalı politikalar ve Batı ile entegrasyon vizyonu, ABD tarafından desteklenmiştir. Türkiye'nin Orta Doğu'daki istikrar için önemli bir müttefik olduğu vurgulanmış, özellikle İran-Irak Savaşı sırasında Türkiye, ABD için stratejik bir aktör hâline gelmiştir. 1980'li yıllarda ayrıca, Türkiye'nin ABD ile savunma sanayiinde iş birlikleri artmış; F-16 savaş uçağı üretimi gibi ortak projeler gündeme gelmiştir. Ekonomik ilişkiler de bu dönemde daha sağlam temellere oturmuştur [9].

1945–1991 dönemi Türk-Amerikan ilişkileri, temel olarak Sovyet tehdidine karşı iş birliği, askerî ortaklık, ve ekonomik yardımlarla şekillenen bir stratejik ittifak olarak özetlenebilir. Zaman zaman Kıbrıs gibi konularda ciddi krizler yaşanmışsa da genel eğilim, Türkiye'nin Batı ittifakı içinde kalması yönünde olmuştur. Soğuk Savaş'ın sona ermesiyle birlikte iki ülke arasındaki ilişkilerde yeni başlıklar ortaya çıkacak, Sovyet tehdidinin ortadan kalkması, ilişkilerin seyrini değiştirecektir. Bu da 1991 sonrası dönemde ele alınacaktır.

## 3. Soğuk Savaş Sonrası Dönem Türk-Amerikan İlişkileri (1991–2001)

1991 yılında Sovyetler Birliği'nin dağılmasıyla Soğuk Savaş sona ermiş, dünya artık tek kutuplu bir yapıya evrilmişti. ABD, küresel düzeyde tek süper güç olarak kaldı. Bu gelişme, NATO'nun ve ABD'nin müttefiklerine yönelik politikalarında da ciddi değişikliklere yol açtı. Türkiye, Sovyet tehdidinin ortadan kalkmasıyla birlikte NATO içinde geleneksel önemini bir ölçüde kaybetse de, Orta Asya, Kafkaslar, Balkanlar ve özellikle Orta Doğu coğrafyasındaki stratejik konumu sayesinde, ABD için önemli bir bölgesel aktör olarak kalmaya devam etti. Bu dönemin en önemli gelişmelerinden biri, Birinci Körfez Savaşıdır. Irak'ın 1990 yılında Kuveyt'i işgal etmesi üzerine ABD öncülüğündeki koalisyon güçleri, 1991'de Irak'a karşı askerî harekât başlatmıştır. Türkiye, bu süreçte ABD'ye aktif destek vermiştir [11]:

- İncirlik Üssü koalisyon güçlerinin kullanımına açılmış,
- Türkiye, Irak'a yönelik Birleşmiş Milletler ambargolarına katılmış,
- Kuzey Irak'taki Kürt halkının korunması için kurulan Çekiç Güç (Operation Provide Comfort) operasyonuna ev sahipliği yapmıştır.

Bu destek, ABD tarafından olumlu karşılanmış olsa da, Türkiye'ye ekonomik olarak büyük zarar vermiştir. Irak ile sınır ticaretinin durması, Türkiye'nin özellikle Güneydoğu Anadolu'daki ekonomisini olumsuz etkilemiştir. Türkiye, bu kayıplar için ABD'den tazminat talebinde bulunmuş, ancak beklentileri tam olarak karşılanmamıştır. Çekiç Güç, ABD, İngiltere ve Fransa tarafından oluşturulan ve Türkiye'nin İncirlik Üssü üzerinden yürütülen bir askerî harekâttı. Amaç, Saddam Hüseyin rejiminden kaçan Kürtlere yardım etmekti. Ancak zamanla, Kuzey Irak'ta fiilî bir Kürt özerk yönetimi oluşmaya başlamış, bu durum Türkiye'de ciddi bir ulusal güvenlik endişesine yol açmıştır. Türkiye, bu gelişmeleri PKK terör örgütünün Kuzey Irak'taki varlığı ile birlikte değerlendirmiş, bölgenin Türkiye'nin toprak bütünlüğü açısından tehdit oluşturabileceğini düşünmüştür. Bu bağlamda, Çekiç Güç'e verilen destek iç siyasette tartışma konusu olmuş ve ABD'nin Kuzey Irak politikaları Türkiye ile ABD arasında zaman zaman güven bunalımı yaratmıştır [12].

1990'lı yıllarda Yugoslavya'nın dağılmasıyla ortaya çıkan savaşlar sırasında Türkiye, özellikle Bosna-Hersek ve Kosova krizlerinde ABD ile birlikte hareket etmiştir. Türkiye, NATO çatısı altında Balkanlara asker göndermiş ve bölgesel istikrarın sağlanması için aktif rol oynamıştır [8].
Bu süreçte:

- ABD ve Türkiye arasında askerî operasyonel iş birliği artmış,
- Türkiye'nin Müslüman nüfuslu bölgelere ilgisi ile ABD'nin küresel düzen arayışı örtüşmüştür.

Balkanlardaki bu iş birliği, iki ülke arasındaki ilişkilerin yumuşamasına ve stratejik ortaklığın yeniden tanımlanmasına katkı sağlamıştır. Soğuk Savaş sonrası dönemde ABD, Türkiye ile ilişkilerinde sadece güvenlik değil, aynı zamanda insan hakları, demokrasi, ve azınlık hakları

konularını da gündeme taşımaya başlamıştır. ABD Kongresi, özellikle Güneydoğu Anadolu'daki insan hakları ihlalleri, Kürt sorunu ve basın özgürlüğü gibi konularda Türkiye'yi eleştiren raporlar hazırlamış; bu durum Türk kamuoyunda ABD'ye yönelik kuşku ve rahatsızlık yaratmıştır. Türkiye ise bu eleştirileri, iç işlerine müdahale olarak değerlendirmiştir. Bu farklı bakış açıları, iki ülke arasındaki siyasi ilişkileri zaman zaman gerginleştirmiştir. Bu dönemde Türkiye, ABD ile savunma alanındaki iş birliğini sürdürmüştür. Özellikle F-16 savaş uçağı üretimi ve modernizasyon projeleri, ABD-Türkiye savunma sanayi ortaklığının önemli örneklerindendir. Ayrıca, Türkiye'nin doğalgaz ve enerji güvenliği politikaları çerçevesinde Hazar Denizi havzasındaki enerji kaynaklarına erişimi hedeflemesi, ABD'nin desteklediği Bakü-Tiflis-Ceyhan (BTC) Petrol Boru Hattı projesiyle örtüşmüştür. Bu enerji projeleri, Türkiye'yi bölgesel enerji koridoru yapma yolunda ABD desteğiyle önemli adımlar atmasını sağlamıştır.

2000'li yılların başında, ilişkiler göreceli bir istikrar kazanmış görünse de temel sorun başlıkları devam etmekteydi. Özellikle [13]:

- Kuzey Irak politikaları,
- PKK terörünün sınır ötesindeki boyutları,
- İnsan hakları ve özgürlükler konusundaki farklı bakış açıları ilişkilerde potansiyel kriz alanları olarak varlığını sürdürüyordu.

Ancak 11 Eylül 2001 saldırıları ile birlikte, terörle küresel mücadele dönemi başlayacak ve Türkiye ile ABD ilişkileri, yeni bir güvenlik paradigması içinde yeniden şekillenecektir. Bu durum, dördüncü dönemde (2001 sonrası) ilişkilerin çerçevesini belirleyecektir [1].

1991–2001 dönemi Türk-Amerikan ilişkileri, Soğuk Savaş'tan çıkmanın yarattığı belirsizlikler ve yeni tehditler arasında şekillenmiştir. İlişkilerdeki temel dinamikler şöyle özetlenebilir:

- İş birliği alanları: Körfez Savaşı, Balkanlar, enerji projeleri, savunma sanayii.
- Gerilim konuları: PKK, Çekiç Güç, Kuzey Irak, insan hakları eleştirileri.
- Dönüşüm süreci: Türkiye, bu dönemde hem Batı bloğuna entegrasyonunu sürdürmüş hem de kendi bölgesel stratejisini oluşturmaya başlamıştır.

Bu dönem, Türkiye-ABD ilişkilerinin stratejik ortaklıktan, taktiksel iş birliğine dönüştüğü bir zaman dilimi olarak da değerlendirilebilir.

## 4. 11 Eylül Sonrası ve AK Parti Döneminde Türk-Amerikan İlişkileri (2001–Günümüz)

11 Eylül 2001 tarihinde El Kaide tarafından gerçekleştirilen terör saldırıları, ABD'nin dış politikasında köklü değişimlere neden oldu. ABD, teröre karşı küresel savaş ilan etti ve bu doğrultuda Afganistan ve daha sonra Irak'a askerî müdahalede bulundu. Bu yeni dönemde Türkiye, ABD açısından önemli bir müttefik olarak görülmeye devam etti. Türkiye, NATO çerçevesinde Afganistan'a asker gönderdi, Kabil Uluslararası Havalimanı'nın güvenliğini sağlama görevini üstlendi ve teröre karşı küresel mücadelede diplomatik destek verdi. Ancak ilişkilerdeki bu iş birliği havası uzun sürmedi. 2003 yılında Irak Savaşı sürecinde yaşanan gelişmeler, Türk-Amerikan ilişkilerinde önemli bir kırılma noktası oldu. 2003 yılında ABD, Irak'a müdahale hazırlıkları yaparken Türkiye'den Amerikan askerlerinin Türk toprakları üzerinden Irak'a girmesine izin veren bir tezkere talep etti. Ancak 1 Mart 2003 tarihinde TBMM, bu tezkereyi reddetti. Bu gelişme, ABD'de büyük hayal kırıklığına yol açtı. Tezkerenin reddi, Türk-Amerikan ilişkilerinde ciddi bir güven bunalımına neden oldu. Ardından Temmuz 2003'te yaşanan ve kamuoyunda büyük yankı uyandıran "Çuval Olayı", yani Amerikan askerlerinin Süleymaniye'de Türk özel kuvvetlerine ait bir birliği gözaltına alması, ilişkilerin daha da gerilmesine neden oldu [4].

ABD'nin Irak'ı işgali sonrasında Kuzey Irak'ta Kürt Bölgesel Yönetimi güçlenmiş, bu durum Türkiye açısından hem PKK terör örgütünün faaliyetleri açısından hem de Irak'ın toprak bütünlüğü bakımından bir güvenlik sorunu hâline gelmiştir. Türkiye'nin en ciddi eleştirisi, ABD'nin PKK'nın Suriye uzantısı olan YPG/PYD ile iş birliği yapmasıdır. Özellikle 2014 sonrası, ABD'nin YPG'yi "IŞİD'e karşı kara gücü" olarak desteklemesi, Türk kamuoyunda büyük rahatsızlık yaratmış ve iki ülke

arasında güven sorununun derinleşmesine yol açmıştır. Türkiye, YPG'yi terör örgütü olarak görmesine rağmen, ABD uzun süre bu yapılanmayı desteklemiş, bu da NATO müttefikleri arasında ciddi diplomatik krizler doğurmuştur. 15 Temmuz 2016'da Türkiye'de gerçekleşen FETÖ darbe girişimi sonrasında, Türk hükümeti bu saldırının arkasında Fethullah Gülen'in ve onun liderliğindeki FETÖ yapılanmasının olduğunu açıkladı. Gülen'in ABD'nin Pennsylvania eyaletinde ikamet ediyor olması, ikili ilişkileri başka bir krize daha sürükledi [3].

Türkiye, ABD'den Gülen'in iadesini talep etti ancak ABD makamları, bu talebe olumlu yanıt vermedi. Bu durum, Türk halkı ve hükümeti nezdinde ABD'ye karşı derin güvensizlik oluşturdu. Türkiye, ABD'yi darbecileri korumakla suçladı; bu kriz, iki ülkenin diplomatik ilişkilerini ciddi biçimde sarstı. Suriye İç Savaşı (2011–...) döneminde Türkiye ve ABD'nin izlediği politikalar giderek ayrıştı. ABD, Esad rejimine karşı doğrudan askerî müdahalede bulunmazken, IŞİD'e karşı Suriye Demokratik Güçleri (SDG) çatısı altındaki YPG unsurlarını destekledi.

Türkiye ise sınır güvenliğini tehdit eden bu gelişmelere karşı üç büyük askerî operasyon gerçekleştirdi [2]:

- Fırat Kalkanı Harekâtı (2016)
- Zeytin Dalı Harekâtı (2018)
- Barış Pınarı Harekâtı (2019)

Bu operasyonlar sırasında ABD ile birçok kez çatışma riski ortaya çıktı. Özellikle Barış Pınarı Harekâtı sırasında ABD Başkanı Donald Trump'ın Türkiye'ye hitaben gönderdiği hakaret içeren mektup, iki ülke ilişkilerinde diplomatik nezaket sınırlarının aşıldığı nadir örneklerden biri oldu. Türkiye'nin Rusya'dan S-400 hava savunma sistemi satın alması (2019), ABD'nin büyük tepkisini çekti. ABD, Türkiye'nin bu sistemi NATO sistemiyle entegre edemeyeceğini savundu ve Türkiye'yi F-35 programından çıkardı. Ayrıca ABD Kongresi, CAATSA (ABD'nin Hasımlarıyla Yaptırımlar Yoluyla Mücadele Etme Yasası) kapsamında Türkiye'ye yaptırım uygulama kararı aldı. Bu gelişme, iki ülke arasındaki askerî ve savunma alanındaki stratejik iş birliğini ciddi şekilde zedeledi. Her ne kadar siyasi ilişkiler gerilimli olsa da Türkiye ile ABD arasındaki ekonomik ilişkiler belirli düzeyde sürdürülmüştür. 2000'li yılların sonlarına doğru iki ülke arasında karşılıklı ticaret hacmini artırma yönünde çeşitli hedefler belirlenmiş, ancak siyasi gerilimler bu hedeflerin tam olarak gerçekleşmesini engellemiştir. Enerji alanında ise Türkiye, Doğu Akdeniz, Azerbaycan doğalgazı, ve LNG ithalatı gibi konularda ABD ile zaman zaman örtüşen, zaman zaman çelişen politikalar izlemiştir.

ABD Başkanı Joe Biden'ın göreve gelmesiyle birlikte, ilişkilerde bir "reset" beklentisi doğmuş olsa da bu büyük ölçüde gerçekleşmemiştir. Biden yönetimi [4]:

- 1915 olaylarını "soykırım" olarak tanıyarak Türkiye'nin sert tepkisini çekmiştir.
- YPG konusunda önceki ABD politikalarını sürdürmüştür.
- Türkiye'nin NATO içindeki rolünü önemsemeye devam etmekle birlikte, ilişkilerde yapısal sorunları çözmede sınırlı ilerleme kaydedilmiştir.

Buna rağmen, Rusya-Ukrayna Savaşı (2022–...) sonrası Türkiye'nin arabuluculuk çabaları, NATO içindeki rolü, tahıl koridoru anlaşmalarına katkısı, ABD tarafından dikkatle izlenmiş ve takdir edilmiştir.

2001 sonrası Türk-Amerikan ilişkileri, bir yandan küresel teröre karşı iş birliği, öte yandan stratejik çıkar farklılıkları ve güven bunalımı ile şekillenmiştir. Başlıca özellikleri:

İş birliği alanları:

- Afganistan'da NATO misyonları
- Ticaret ve yatırım
- Rusya'ya karşı bölgesel iş birliği

Kriz ve anlaşmazlık alanları:

- YPG/PKK ilişkisi
- FETÖ'nün iadesi

- S-400 krizi ve yaptırımlar
- “Soykırım” tanıması
- Kıbrıs ve Doğu Akdeniz politikaları

Bu dönemde Türkiye-ABD ilişkileri, "stratejik ortaklık"tan "zoraki ortaklığa" dönüşmüş, hem Türkiye hem ABD kamuoylarında karşılıklı olumsuz algılar güçlenmiştir [5].

## 5. Yeni Dönem: Stratejik Gerilimler ve Alan Bazlı İş Birliği (2021–Günümüz)

Joe Biden’ın Ocak 2021'de ABD Başkanı olarak göreve gelmesi, Türk-Amerikan ilişkilerinde temkinli ve mesafeli bir dönemin başlangıcı oldu. Biden, göreve geldiğinde uzun süre Cumhurbaşkanı Erdoğan’ı aramaması, diplomatik bir mesaj olarak algılandı. İlk önemli kırılma, 24 Nisan 2021 tarihinde Biden’ın 1915 olaylarını “soykırım” olarak tanımasıyla yaşandı. Bu gelişme, Türkiye tarafından sert biçimde kınandı ve iki ülke arasında tarihsel hafıza üzerinden derin bir çatlak oluştu.

Türkiye’nin 2019 yılında Rusya’dan satın aldığı S-400 hava savunma sistemi, 2020’lerde de ilişkilerin en temel anlaşmazlık başlığı olmayı sürdürdü.

- Türkiye, S-400’ü aktif hâle getirmemiş olmasına rağmen geri adım atmadı.
- ABD ise Türkiye’yi F-35 savaş uçağı programından çıkardı ve CAATSA yaptırımlarını 2020 sonunda resmen uygulamaya koydu.

Bu süreç, iki ülke arasında savunma sanayi alanındaki güveni ciddi ölçüde zedeledi. Türkiye, bunun karşısında milli savunma sanayii yatırımlarına hız verirken, bir yandan da Fransa, İtalya, Güney Kore gibi ülkelerle alternatif iş birlikleri geliştirmeye yöneldi.

ABD'nin Suriye'de YPG/SDG ile kurduğu ittifak, 2020’li yıllarda da Türk dış politikasının en sert eleştiri noktalarından biri olmaya devam etmektedir [7].

- Türkiye, bu yapılanmayı PKK'nın uzantısı olarak görüp ulusal güvenliğine tehdit sayarken;
- ABD ise IŞİD’e karşı etkili bir yerel ortak olarak desteklemeye devam etmektedir.

Bu durum, sahada olası çatışmalara neden olabilecek kadar kritik bir güvenlik meselesi hâline gelmiştir. Türkiye’nin zaman zaman Suriye’ye yönelik askerî operasyonlarını gündeme getirmesi ve ABD’nin bu operasyonlara karşı açıklamaları, ilişkileri her an yeni bir krize sürükleyebilecek bir kırılganlık yaratmıştır.

2022 yılında başlayan Rusya’nın Ukrayna’yı işgali, Türkiye’nin ABD ve NATO içindeki konumunu yeniden tanımlaması açısından kritik bir fırsat ve sınav olmuştur.

Türkiye bu süreçte:

- Hem Ukrayna’ya SİHA (Bayraktar TB2) desteği vermiş,
- Hem de Rusya ile diplomatik temaslarını koruyarak tahıl koridoru gibi krizlerin çözümünde arabulucu rolü üstlenmiştir.

Bu çok yönlü diplomasi:

- ABD tarafından dikkatle izlenmiş,
- NATO içinde Türkiye’nin vazgeçilmezliğini yeniden gündeme taşımıştır.

Ayrıca Türkiye, İsveç ve Finlandiya'nın NATO üyelik süreçlerinde aktif pozisyon almış; bu tutumu, ABD ile olan ilişkilerde pazarlık gücünü artırmıştır [13].

F-35 programından çıkarılan Türkiye, mevcut F-16 filosunu modernize etmek ve yeni F-16 Blok 70 uçakları almak üzere ABD ile yeni bir süreç başlattı.

- Biden yönetimi bu satışı desteklese de, ABD Kongresi’nde özellikle Yunan lobisi ve bazı Türkiye karşıtı senatörlerin muhalefetiyle karşılaştı.
- 2024 yılı başlarında, İsveç’in NATO üyeliği karşılığında ABD’nin F-16 satışına onay verdiği yönünde gelişmeler yaşandı.

Bu gelişme, kısa vadede olumlu bir adım gibi görünse de, F-16 üzerinden yürüyen pazarlık süreci, iki ülke arasındaki stratejik güvensizliğin sürdüğünü ortaya koymaktadır.

Siyasi krizlere rağmen, iki ülke arasında ekonomik ve ticari ilişkiler istikrarlı bir biçimde sürmektedir [11].

- ABD, Türkiye'nin en büyük 2. ihracat pazarı konumundadır.
- 2023 itibarıyla iki ülke arasındaki ticaret hacmi 30 milyar dolar seviyesini aşmıştır.
- Teknoloji, savunma, enerji ve dijital ekonomi gibi alanlarda iş birliği arayışları artmaktadır.

Ayrıca Türk girişimcilerin ABD pazarına ilgisi, dijitalleşme ve start-up ekosistemi üzerinden yeni bir ekonomik kanal yaratmaktadır.

2020'li yıllarda iki ülkenin kamuoylarında karşılıklı algılar genellikle olumsuz seyretmektedir:

- Türk kamuoyunda ABD'ye yönelik güvensizlik, geçmiş yıllara kıyasla daha yüksek düzeydedir (özellikle PKK/YPG ve FETÖ meseleleri nedeniyle).
- ABD kamuoyunda ise Türkiye, zaman zaman otoriterleşme, hukukun üstünlüğü, ve basın özgürlüğü konularında eleştirilmekte, bu da Kongre düzeyindeki desteği zayıflatmaktadır.

Bu durum, yapısal sorunların çözümünü zorlaştırmaktadır.

2020'li yıllarda Türk-Amerikan ilişkileri, "stratejik ayrışma, taktiksel iş birliği" olarak tanımlanabilecek bir çerçevede sürmektedir. İki ülke, birçok alanda farklı önceliklere sahip olsa da, karşılıklı vazgeçilmezlik nedeniyle diyaloğu sürdürmek zorunda kalmaktadır [5].

Temel İş Birliği Alanları:

- NATO ve güvenlik (Ukrayna krizi)
- Enerji güvenliği
- Ticaret ve teknoloji
- Terörle mücadelede kısmi koordinasyon

Başlıca Anlaşmazlıklar:

- YPG/PKK meselesi
- S-400 ve savunma sanayii yaptırımları
- FETÖ'nün iadesi
- Doğu Akdeniz ve Ege politikaları
- Demokrasi ve insan hakları konuları

Bu dönem, Türk-Amerikan ilişkilerinin yeni denge arayışında olduğu, iki ülkenin birbirine tam güven duymasa da birbirinden kopamadığı bir geçiş evresi olarak değerlendirilebilir.

KAYNAK


1. Aras, Bülent. 2009. Turkish Foreign Policy and the U.S. İstanbul: Boğaziçi Üniversitesi Yayınları.
2. Balcı, Fikret. 2007. Türk-Amerikan İlişkileri: 1945-2000. Ankara: Nobel Yayınları.
3. Balcı, Hüseyin. 2016. The U.S. and Turkey: From Cold War to the War on Terror. Lanham: Lexington Books.
4. Fisk, Robert. 2003. The Great War for Civilisation: The Conquest of the Middle East. New York: Alfred A. Knopf.
5. Gürpınar, Derya. 2010. Türk-Amerikan İlişkileri ve Orta Doğu Politikaları. İstanbul: İletişim Yayınları.
6. Hale, William. 2002. The Turkish-American Relationship and the Middle East. London: Routledge.
7. Kirişci, Kemal. 2009. The Politics of Turkish-American Relations: From the Cold War to the 21st Century. New York: Columbia University Press.
8. Özdemir, Cengiz. 2004. Türk-Amerikan İlişkilerinin Dönemsel Değişimi. İstanbul: İstanbul Üniversitesi Yayınları.
9. Somer, M. 2018. The Americanization of Turkey: Political and Cultural Influence. New York: Palgrave Macmillan.
10. Zürcher, Erik Jan. 2011. Turkey: A Modern History. London: I.B. Tauris.
11. Keyman, Fuat. 2011. Modern Türkiye'nin Toplumsal Yapısı. İstanbul: Metis Yayınları.

12. Öniş, Ziya. 2011. The Political Economy of Turkey's Foreign Policy: The Case of the U.S.-Turkey Relations. Princeton: Princeton University Press.
13. Türkeş, Alparslan. 1995. Türk Dış Politikası ve Amerikan İlişkileri. Ankara: TDK Yayınları.
14. Çelik, Ahmet. 2008. Soğuk Savaş Dönemi Türk-Amerikan İlişkileri. İstanbul: Bağlam Yayınları.
15. Şahin, M. Ali. 2004. Türk-Amerikan İlişkilerinde Krizler ve Çatışmalar. Ankara: Sola Yayınları.
16. Kavakcı, Melikşah. 2007. Türkiye ve Amerika: Kültürel ve Ekonomik İlişkiler. İstanbul: Türkiye Ekonomi Yayınları.
17. Sencer, Murat. 2015. Türkiye'nin Küresel Güç Olma Yolunda Amerika ile İlişkileri. İstanbul: Yapı Kredi Yayınları.
18. Aydın, M. Kamil. 2014. Türk-Amerikan İlişkilerinin Evrimi ve Günümüzdeki Yeri. Ankara: Seçkin Yayıncılık.

# 8 NOYABR – QÜRUR VƏ ZƏFƏR GÜNÜMÜZ

Xanbatova Leyla Bəylər qızı

XÜLASƏ

Bu məqalədə 8 Noyabr – Zəfər Gününün Azərbaycan xalqı üçün tarixi və mənəvi əhəmiyyəti geniş şəkildə təhlil olunur. Məqalədə 44 günlük Vətən müharibəsinin səbəbləri, gedişi və nəticələri, eyni zamanda bu qələbənin xalqın milli birliyinə, dövlətin beynəlxalq nüfuzuna və gələcək nəsillərin vətənpərvərlik ruhunun formalaşmasına təsiri araşdırılır. Şəhidlərin qəhrəmanlığı, ordunun fədakarlığı və xalqın dəmir yumruq kimi birləşməsi bu Zəfərin əsas dayaqları kimi təqdim olunur.

Açar sözlər: Zəfər Günü, Vətən müharibəsi, Şuşa, qəhrəmanlıq, milli birlik, qürur, azadlıq

SUMMARY

This article broadly analyzes the historical and spiritual importance of November 8 – Victory Day for the people of Azerbaijan. It explores the reasons, course, and consequences of the 44-day Patriotic War, emphasizing the unity of the people, heroism of the martyrs, and the role of the victory in strengthening the country's global image and patriotic education of future generations.

Keywords: Victory Day, Patriotic War, Shusha, heroism, national unity, pride, freedom

## GİRİŞ

Azərbaycan Respublikasının müstəqillik tarixində elə hadisələr var ki, bu hadisələr xalqın taleyində dönüş nöqtəsi olmuşdur. 2020-ci ilin payızında baş vermiş 44 günlük Vətən müharibəsi bu baxımdan müstəsna əhəmiyyət daşıyır. 27 sentyabr 2020-ci ildə başlayan müharibə 8 noyabrda Şuşanın azad olunması ilə qələbə ilə başa çatdı. Bu hadisə təkcə hərbi deyil, həm də mənəvi baxımdan tarixi bir nailiyyət idi. Azərbaycanın 30 ilə yaxın işğal altında olan torpaqlarının azad edilməsi xalqın birliyinin, əzminin və milli ruhunun təntənəsi oldu.

## MƏZMUN HİSSƏ

44 günlük Vətən müharibəsi Azərbaycan dövlətinin müstəqillik tarixində ən şanlı səhifələrdən biridir. Bu müharibə göstərdi ki, Azərbaycan xalqı öz torpaqlarını azad etmək əzmindən heç zaman dönməyib. Müharibənin ilk günlərindən etibarən xalq ordu ilə birləşərək 'Dəmir yumruq' kimi düşmənə qarşı vahid cəbhə yaratdı.

Vətən müharibəsinin gedişində Azərbaycan Ordusu həm taktiki, həm də strateji baxımdan üstünlüyünü nümayiş etdirdi. Müasir texnologiyaların tətbiqi, pilotsuz uçuş aparatlarının səmərəli istifadəsi və yüksək döyüş ruhu ordunun qələbəsini təmin edən əsas amillərdən oldu. Eyni zamanda, xalqın arxa cəbhədə ordunu dəstəkləməsi, könüllü ianələr, sosial dəstək aksiyaları və informasiya müharibəsində fəallığı mühüm rol oynadı.

8 noyabrda Şuşa şəhərinin azad olunması Azərbaycanın Zəfər simvoluna çevrildi. Şuşa qədim tarixi, mədəni və strateji əhəmiyyətinə görə Azərbaycan xalqı üçün müqəddəs şəhər hesab olunur. Onun azad olunması ilə Qarabağın taleyi həll olundu və Azərbaycanın ərazi bütövlüyü bərpa edildi. Bu hadisə həm də milli qürurun, dövlət müstəqilliyinin və xalqın birliyinin göstəricisi oldu.

Zəfər Günü yalnız hərbi qələbə deyil, həm də milli dirçəlişin simvoludur. Bu gün ölkəmizin bütün bölgələrində tədbirlər keçirilir, şəhidlərimizin ruhuna dualar oxunur, onların qəhrəmanlığı gələcək nəsillərə örnək kimi təqdim olunur. Məktəblərdə, universitetlərdə və mədəniyyət ocaqlarında Vətən müharibəsinə həsr olunmuş layihələr, sərgilər və konfranslar təşkil edilir. Bu, gənclərdə vətənə sevgi, torpağa bağlılıq və milli kimlik hisslərinin güclənməsinə xidmət edir.

Zəfərin əldə olunmasında dövlətin düzgün siyasəti, ordunun peşəkarlığı və xalqın birliyi əsas amillərdən biri kimi qeyd edilməlidir. Prezident İlham Əliyevin qətiyyətli mövqeyi, diplomatik

bacarığı və liderlik xüsusiyyətləri bu qələbənin siyasi və hərbi əsasını formalaşdırdı. Bu gün Azərbaycan beynəlxalq aləmdə qalib ölkə kimi tanınır və bu, dövlətimizin nüfuzunu daha da artırmışdır.

Zəfər Günü həm də Azərbaycan xalqının azadlıq, ədalət və müstəqillik uğrunda mübarizəsinin davamlılığını göstərir. Bu gün biz yalnız keçmişə deyil, həm də gələcəyə inamla baxırıq. Qarabağda və Şərqi Zəngəzurda bərpa və quruculuq işlərinin aparılması bu Zəfərin davamı, gələcək rifahın təməlidir.

## NƏTİCƏ

8 Noyabr – Qürur və Zəfər Günü Azərbaycanın gücünü, xalqımızın iradəsini və vətən sevgisini təcəssüm etdirən unudulmaz gündür. Bu Zəfər şəhidlərimizin qanı, qazilərimizin fədakarlığı və xalqın birliyi sayəsində mümkün oldu. Zəfər Günü gələcək nəsillərə azadlıq və müstəqilliyin qədrini bilməyi, Vətənə sədaqətli olmağı öyrədir. Bu qələbə Azərbaycan tarixində əbədi yaşayacaq, xalqımızın milli kimliyinin, dövlət müstəqilliyinin və birliyinin rəmzi olaraq qalacaqdır.

## ƏDƏBİYYAT SİYAHISI

1. Əliyev, İ. (2021). 44 günlük Vətən müharibəsi: Qələbəyə aparan yol. Bakı: Azərnəşr.
2. Azərbaycan Respublikası Prezidentinin 2020-ci il 2 dekabr tarixli fərmanı ilə “Zəfər Günü”nün təsis edilməsi haqqında sənəd.
3. Qarabağ Zəfəri Ensiklopediyası (2021). Bakı: Təhsil Nəşriyyatı.
4. Dövlət İnformasiya Agentliyi (AZƏRTAC) – www.azertag.az
5. Rəsmi dövlət portalları: www.president.az, www.mod.gov.az

## Sociological Sciences

# CHILD MARRIAGE AS A SOCIAL-PHENOMENON IN CENTRAL ASIA: A COMPARATIVE ANALYSIS OF RESEARCH

**Abshenova L.U.**
PhD student, Department of Sociology and Social Work, al-Farabi Kazakh National University, Almaty, Kazakhstan

**Abstract**

This article examines child marriage as a social phenomenon in Central Asia through a comparative analysis of peer-reviewed academic research. Despite growing international attention, the phenomenon remains understudied in the regional context of Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan. Drawing on a qualitative content analysis of 21 scientific publications indexed in the Scopus database, the study identifies the key conceptual, socio-cultural, economic, and institutional determinants of early marriage. The results reveal four dominant thematic clusters socio-cultural norms, economic vulnerability, legal and institutional frameworks, and gender inequality that collectively shape the persistence of early marriage across the region. The analysis highlights both shared structural drivers, such as poverty and patriarchal traditions, and country-specific dynamics linked to religious influence and governance capacity. While all Central Asian states have adopted legal reforms to raise the marriage age and criminalize forced unions, their impact remains limited due to weak enforcement and cultural resistance. The study concludes that child marriage endures because it operates at the intersection of economic insecurity, gender hierarchy, and cultural legitimacy. Sustainable solutions require an integrated, context-sensitive approach that combines legal reform with education, gender empowerment, and community engagement. The research contributes to filling a significant gap in gender and development scholarship by systematizing fragmented evidence and providing a comprehensive comparative framework for understanding child marriage in post-Soviet societies.

**Keywords:** child marriage; Central Asia; gender inequality; socio-cultural traditions; poverty; post-Soviet societies.

## Introduction

Child marriage commonly defined as a union in which at least one partner is under the age of 18is increasingly recognised as a complex social phenomenon with deep cultural, economic and gendered roots. In the region of Central Asia, comprising countries such as Kazakhstan, Kyrgyzstan, Uzbekistan and Tajikistan, the prevalence and dynamics of child marriage remain insufficiently explored in the academic literature despite growing policy interest. According to data for Kazakhstan, for example, approximately 7 % of girls aged 20-49 reported being married before the age of 18, with higher rates in poorer and rural households. The relevance of studying child marriage in Central Asia lies in several interlinked dimensions: first, as a violation of children's rights and gender equality norms; second, as a phenomenon influencing educational attainment, health and life-chances of young girls; and third, as an indicator of broader socio-cultural transformation in post-Soviet societies. From a scholarly perspective, a comparative analysis of existing research is timely. Studies such as Trends in child marriage and new evidence on the

selective impact of changes in age-at-marriage laws on early marriage (Batyra & Pesando, 2021) explore cross-national trends and legal policy effects, including in Kazakhstan, but do not fully delve into the regional particularities of Central Asia. Meanwhile, work such as Marriage traditions and investment in education: The case of bride kidnapping (Bazarkulova & Compton, 2021) addresses the intersection of education and a specific marriage practice in Kyrgyzstan, linking social institution dynamics with youth outcomes. However, the literature remains fragmented: multiple national contexts, differing traditions and varying quantitative data make synthesis and comparative insight difficult. Therefore, this article aims to conduct a systematic comparative analysis of scientific studies addressing child marriage in Central Asia, with the following objectives:

- to map and summarise the empirical evidence on prevalence, drivers and consequences of child marriages in the region;
- to compare how different national and cultural settings within Central Asia mediate the phenomenon;
- to highlight gaps in the literature and propose avenues for further research.

Such an endeavour is relevant both for academic scholarship and for policy-oriented interventions aimed at reducing early and forced marriages.

*This research aims* to conduct a comparative analysis of scientific studies on child marriage in Central Asia in order to identify common patterns, regional specificities, and key factors influencing the persistence of this practice. The study seeks to systematize existing academic knowledge and highlight conceptual and methodological gaps that hinder a comprehensive understanding of child marriage as a social phenomenon in the region.

*Research Question:*

1. How is child marriage conceptualized, explained, and empirically studied in academic literature on Central Asia?
2. What do researchers identify as the main social, cultural, economic, and legal factors that drive child marriage in the region?
3. How do national contexts differ in terms of prevalence, causes, and policy responses?

Despite global attention to child marriage as a violation of human rights and gender equality, the academic understanding of this phenomenon in Central Asia remains fragmented and underdeveloped. Existing studies are often limited to single-country analyses, rely on incomplete or outdated statistical data, or focus narrowly on specific cultural practices such as bride kidnapping. As a result, there is no integrated comparative framework that explains how historical legacies, socio-economic conditions, and gender norms interact to sustain early and forced marriages across different Central Asian societies. This gap impedes evidence-based policymaking and the design of regionally sensitive interventions.

This study contributes to both academic scholarship and policy discourse by offering a multidimensional understanding of child marriage in Central Asia. From a theoretical perspective, it synthesizes existing scholarly literature to conceptualize child marriage as a complex social institution shaped by intersecting factors such as cultural traditions, poverty, and persistent gender inequality. The research thereby extends theoretical debates on gender, family, and social transformation in post-Soviet societies. In terms of regional relevance, the study addresses the existing gap in global gender and development scholarship, where Central Asia remains vastly underrepresented. By examining local socio-cultural specificities and variations among national contexts, it enriches the regional discourse on social modernization and human rights. The practical significance of the research lies in its potential to inform evidence-based policymaking and the design of targeted interventions by governmental institutions and non-governmental organizations, particularly in education, legal reform, and community awareness. Finally, its methodological contribution lies in the application of a comparative analytical framework, which

facilitates cross-country learning and the identification of best practices for addressing early and forced marriages across the diverse socio-political landscapes of Central Asian societies.

## Methods of the research

The study is based on a qualitative analysis of peer-reviewed scientific articles retrieved from the Scopus database. To ensure thematic relevance, a targeted search strategy was employed using the following query:

TITLE-ABS-KEY ( "child marriage" AND "central asia" ) AND ( LIMIT-TO ( EXACTKEYWORD , "Child Marriage" ) )

This search initially yielded 443 publications related to child marriage. To refine the dataset and ensure analytical depth, only studies that directly address the phenomenon of child marriage within Central Asian contexts, including Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Turkmenistan, were selected. After applying inclusion and exclusion criteria, such as relevance to the regional scope, presence of empirical data or conceptual analysis, and publication in peer-reviewed journals, a final sample of 21 articles was identified for detailed qualitative examination. The selected articles were analyzed through thematic content analysis, focusing on the conceptualization of child marriage, identified causes and socio-cultural determinants, and proposed policy interventions. This approach allowed for the synthesis of patterns and differences across national and disciplinary perspectives while highlighting research gaps and methodological limitations in the existing scholarship.

A qualitative content analysis was conducted on 21 peer-reviewed articles retrieved from the Scopus database that met the inclusion criteria for thematic relevance. The purpose of the analysis was to identify prevailing conceptual frameworks, thematic emphases, and regional patterns in the academic discussion of child marriage in Central Asia. The coding process followed an inductive approach, allowing categories and themes to emerge directly from the data. Most of the reviewed studies conceptualize child marriage as a multidimensional social phenomenon shaped by legal, economic, cultural, and gender factors. The majority of authors adopt definitions provided by UNICEF (2020) and UNFPA (2019), framing early marriage as both a violation of children's rights and a manifestation of gender inequality. Some studies approach the topic from a rights-based and feminist perspective (Batyra & Pesando, 2021), while others emphasize structural factors such as poverty, rural residence, and limited educational opportunities. Only a few publications, including Bazarkulova and Compton (2021), examine the intersection between traditional norms and formal legal frameworks, highlighting the tension between customary practices and state regulations. The analysis also revealed significant intra-regional diversity. In Kyrgyzstan and Kazakhstan, the practice of bride kidnapping (ala kachuu) is often examined as a cultural tradition that can evolve into a form of forced or early marriage. In contrast, research from Tajikistan and Uzbekistan emphasizes economic hardship, patriarchal family structures, and religious influences as the primary drivers of early marriage. Comparative or cross-country analyses remain limited, suggesting a gap in understanding regional dynamics as a whole. Across the selected studies, three major clusters of determinants were identified: socio-economic, cultural, and institutional. Socio-economic factors such as poverty, unemployment, and lack of access to quality education are described as the most consistent predictors of child marriage (UNFPA, 2019). Cultural and traditional norms often reinforce early marriage as a means of preserving family honor or controlling female sexuality. At the institutional level, weak enforcement of existing laws, corruption, and incomplete civil registration systems reduce the effectiveness of child protection mechanisms (Human Rights Watch, 2020). The reviewed articles consistently document the negative implications of early marriage for girls' health, education, and overall well-being. Early marriage is associated with higher maternal mortality, domestic violence,

limited autonomy, and intergenerational cycles of poverty. Some studies also describe the social normalization of early marriage within local communities, where it is perceived as a socially acceptable or economically necessary practice. However, there is a notable lack of research addressing male perspectives, the role of religious authorities, and the long-term psychosocial consequences for young brides.

Methodologically, the reviewed literature relies predominantly on qualitative case studies and small-scale surveys, often based on interviews with women, community leaders, and NGO representatives. Only a limited number of studies employ mixed methods or cross-national comparisons. The absence of longitudinal and regionally representative data constrains the generalizability of existing findings. This methodological fragmentation underscores the need for comparative and interdisciplinary research that integrates sociological, anthropological, and legal perspectives. Overall, the qualitative content analysis demonstrates that child marriage in Central Asia is a context-dependent and culturally embedded practice influenced by the interaction of tradition, economic constraints, and governance structures. While recent scholarship increasingly addresses gender inequality and human rights, much of the literature remains descriptive rather than analytical. There is a need for a comprehensive comparative framework that situates Central Asian experiences within broader global discourses on early and forced marriage, allowing for deeper theoretical and policy insights into how modernization, legal reform, and cultural continuity shape the persistence of child marriage across the region.

## Results and Discussion

The qualitative content analysis of the selected corpus of academic literature reveals four dominant themes that collectively illuminate the persistence, complexity, and sociocultural embeddedness of child marriage in Central Asia. These thematic dimensions social-cultural factors, economic determinants, legislative and institutional contexts, and gender inequality recur across multiple studies and provide an integrated framework for understanding early marriage as both a structural and symbolic phenomenon in post-Soviet societies. The reviewed literature encompasses diverse disciplinary perspectives sociology, anthropology, economics, gender studies, and law and covers countries such as Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan. The analysis revealed four recurring thematic clusters:

- socio-cultural factors;
- economic determinants;
- legal and institutional frameworks;
- gender inequality.

A summary of the key findings from each study is presented below (see *Table 1*).

Table 1. - Thematic analysis of selected studies on child marriage in Central Asia

| Thematic Cluster | Author(s) / Year | Country / Context | Key Analytical Insights |
|---|---|---|---|
| Socio-Cultural and Gender Factors | Cleuziou & McBrien (2021); Kim (2019); Werner (2004, 2009); Bazarkulova & Compton (2021); Porreca (2024) | Central Asia (regional), Kyrgyzstan, Kazakhstan | These studies demonstrate that early marriage functions as a social institution reinforcing patriarchal authority, kinship ties, and moral order. Bride kidnapping is analyzed as a culturally legitimized practice linked to gender hierarchies and community honor. Female victimhood is socially contested, reflecting ambivalence between coercion and cultural acceptance. |
| Economic Determinants | Akhmedshina (2023); Dauletova et al. (2012); UNFPA (2019); Girls Not Brides (n.d.) | Uzbekistan, Kazakhstan, regional | Economic vulnerability, rural poverty, and limited access to education are consistent structural drivers of child marriage. Families often view early marriage as a strategy for economic stability. The persistence of poverty and gendered labor inequalities reinforce dependence and restrict opportunities for girls. |
| Legal and Institutional Frameworks | Batyra & Pesando (2021); Marasulova & Rejjabbaevich (2025); Muminovna (2024); Director UNFPA (2014) | Multi-country (Central Asia), Uzbekistan, Kazakhstan | Legal reforms raising the marriage age reduce child marriages only temporarily. Weak enforcement and the coexistence of civil and religious marriage systems (*nikah*) undermine progress. Institutional inconsistencies between law and cultural norms remain a major barrier to change. |
| Historical and Demographic Contexts | Zebuniso Saidova (2025); Nedoluzhko & Agadjanian (2010); UNICEF (2020) | Central Asia (historical, demographic) | These works trace the evolution of marriage patterns from the 19th century to the post-Soviet era, showing continuity in patriarchal values. Demographic studies highlight links between early marriage, fertility rates, and migration patterns, while global data confirm regional disparities in rural areas. |

As summarized in Table 1, four dominant patterns emerge across the reviewed research. First, socio-cultural traditions and community norms remain decisive in legitimizing early marriages, often framed as preserving moral order and family honor (Cleuziou & McBrien, 2021; Kim, 2019; Werner, 2009). Second, economic deprivation acts as a structural driver of early

marriage, with poverty and limited access to education forcing families to view marriage as a coping mechanism for financial insecurity (Akhmedshina, 2023; UNFPA, 2019). Third, the legal and institutional frameworks of Central Asian countries reveal contradictions between formal statutes and informal or religious practices, weakening the protection of minors (Marasulova & Rejjabbaevich, 2025; Muminovna, 2024; Director UNFPA, 2014). Finally, gender inequality underlies and perpetuates the practice across all contexts women's limited autonomy, reinforced by patriarchal power structures, sustains both the acceptance and reproduction of early marriage (Bazarkulova & Compton, 2021; Werner, 2009). The synthesis indicates that child marriage in Central Asia is a multifaceted phenomenon, shaped by the intersection of tradition, poverty, and institutional weakness. Addressing it effectively requires a holistic strategy that combines legal enforcement with socio-economic empowerment and community-based transformation of gender norms.

### Comparative analysis: country-level perspectives on child marriage in Central Asia

A comparative analysis of child marriage across Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan reveals both shared structural roots and distinct socio-cultural and institutional trajectories. Although all four states share a common post-Soviet legacy, religious revival, and economic transition, their approaches to child marriage differ in terms of legal enforcement, religious influence, demographic patterns, and policy responses. The main similarities and contrasts between the four countries are summarized below in *Table 2*, which highlights the core legal, cultural, and policy-related differences observed across the region.

**Table 2. - Comparative analysis of child marriage in Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan**

| Country | Religious / Legal System | Dominant Drivers | Preventive Measures |
|---|---|---|---|
| Uzbekistan | Dual system (civil + Islamic *nikah*); weak enforcement | Economic insecurity; religious customs | Limited state coordination between civil and religious authorities. |
| Kazakhstan | Secular legal system; partial rural traditionalism | Poverty; gender norms; fertility patterns | Gender equality programs; awareness campaigns; uneven implementation. |
| Kyrgyzstan | Secular law; strong informal governance | Cultural legitimization of *bride kidnapping*; weak law enforcement | NGO and community-based programs; limited impact. |
| Tajikistan | Islamic influence; statutory age exceptions | Religious conservatism; low education; poverty | Few formal state programs; reliance on local religious actors. |

In the comparative table above, the persistence and variation of child marriage across Central Asia reflect a complex interaction between legal structures, religious norms, and socio-economic realities. While all four countriesUzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan share a common post-Soviet history, their trajectories diverge in how traditional customs and state institutions intersect to shape marriage practices. In Uzbekistan and Tajikistan, the influence of Islam is particularly pronounced, leading to the normalization of nikah ceremonies that often bypass civil registration and legal age requirements (Marasulova & Rejjabbaevich, 2025; Cleuziou, 2021). Religious authorities play an informal but powerful role in legitimizing early unions as morally appropriate and socially stabilizing. Although both countries have ratified international conventions against child marriage, implementation remains weak due to institutional

fragmentation and the continued social authority of religious institutions. This indicates that formal law without cultural transformation is insufficient to change behavior at the community level. By contrast, Kazakhstan has developed a stronger secular legal framework and national programs addressing gender equality and early marriage prevention. However, disparities between urban and rural areas persist: economic hardship, social conservatism, and the endurance of bride kidnapping as a symbolic practice continue to limit the effectiveness of policy enforcement (Werner, 2009). These findings demonstrate that even where the rule of law is more consolidated, economic vulnerability and rural traditionalism sustain early marriage practices. Kyrgyzstan represents the most paradoxical case: it possesses relatively progressive legislation, yet the practice of ala kachuuoften disguised as consensual marriageremains widespread (Kim, 2019; Human Rights Watch, 2020). The persistence of such practices despite criminalization reflects weak institutional capacity and the continued power of informal governance systems. Local community norms frequently override state laws, and law enforcement officers often avoid intervention in cases deemed “family matters”. This dynamic reveals a fundamental tension between legal formalism and social legitimacy, where state mechanisms fail to penetrate entrenched patriarchal structures.

Across all four countries, the analysis underscores that economic insecurity, patriarchal gender ideologies, and weak governance form the common foundation of child marriage. Yet the magnitude and visibility of the problem vary according to the degree of religious influence, rural marginalization, and state intervention capacity. Notably, the absence or weakness of comprehensive preventive programsparticularly in Tajikistan and Uzbekistanexacerbates the cyclical nature of early marriage, reproducing inequality across generations. In summary, while each country’s context presents unique challenges, the comparative evidence demonstrates that addressing child marriage in Central Asia requires more than legal reform. It demands an integrated, culturally sensitive approach that combines economic empowerment, gender education, and community-based engagement. Only by bridging the gap between statutory law and local moral economies can lasting progress be achieved in eliminating early and forced marriages across the region.

The findings of this research reveal that child marriage in Central Asia is not a homogeneous phenomenon but a complex social institution shaped by the intersection of cultural traditions, economic precarity, religious influence, and weak institutional enforcement. Although the four analyzed countries Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistanshare a common post-Soviet legacy and similar socio-economic transitions, the persistence of early marriage manifests differently across national and cultural contexts, reflecting distinct balances between law, religion, and local customs. Across the region, the continuity of patriarchal norms remains one of the most resilient factors underpinning early marriage. In Kazakhstan and Kyrgyzstan, practices such as bride kidnapping (ala kachuu) are deeply embedded in cultural perceptions of honor, morality, and family cohesion (Werner, 2009; Kim, 2019). Cleuziou and McBrien (2021) argue that these practices serve to maintain kinship solidarity and patriarchal authority, allowing communities to reaffirm social order in the face of modernization. This dynamic illustrates how cultural legitimacy often outweighs legal prohibition, as local moral economies normalize practices that contravene formal laws. The persistence of such traditions demonstrates that cultural transformation, rather than mere legal reform, is central to changing behavioral norms surrounding marriage and gender roles. Economic vulnerability represents another structural driver that sustains child marriage throughout Central Asia. Reports by UNFPA (2019) and UNICEF (2020) confirm that households in rural or low-income areas are disproportionately affected, revealing a strong correlation between economic deprivation and early marriage rates. Consequently, child marriage operates as both a symptom and a mechanism of social reproduction, reinforcing intergenerational cycles of poverty and gender inequality. Addressing this dimension requires not only poverty reduction but also

policies that expand access to secondary education, vocational training, and women's employment opportunities. Legal reforms across the regionsuch as raising the minimum marriage age to 18 and criminalizing forced marriagehave had limited long-term effectiveness. Batyra and Pesando (2021) demonstrate that while such reforms initially reduce child marriage rates, their impact quickly plateaus when enforcement remains weak or inconsistent. In Uzbekistan and Tajikistan, the coexistence of civil and Islamic marriage systems (nikah) undermines the reach of state law, enabling unregistered underage marriages to persist (Marasulova & Rejjabbaevich, 2025). Porreca (2024) further notes that informal governancewhere local community or religious authorities hold greater normative power than the statecreates a space in which traditional marriage practices remain socially accepted despite formal illegality. This suggests that the rule of law, when detached from community engagement, has limited transformative capacity in deeply traditional societies. Gender inequality is both the context and the consequence of child marriage across Central Asia. Women's limited access to education and the labor market reinforces their dependence on early marriage as a socially acceptable life path (Akhmedshina, 2023; UNFPA, 2019). Kim (2019) highlights how social discourse constructs young brides not only as victims but as moral subjects fulfilling family obligations, revealing the ambiguity of agency in patriarchal societies. This aligns with feminist development perspectives emphasizing that empowerment must go beyond legal rights to include cultural and ideological transformation (Kabeer, 2016). Consequently, interventions must address the symbolic dimension of gender inequalitychallenging entrenched narratives about female virtue, obedience, and family duty that sustain the social legitimacy of early unions.

The findings also point to significant policy implications. The persistence of child marriage across Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan demonstrates that isolated national efforts are insufficient without regional cooperation and culturally adaptive approaches. UNFPA (2019) and Girls Not Brides (n.d.) recommend that cross-border initiatives focus on community engagement, gender-sensitive education, and capacity-building for local NGOs. Collaborative strategies could harmonize legal frameworks, improve data monitoring, and integrate religious and civil institutions in prevention efforts. Moreover, involving local religious leaders in awareness campaigns could help align cultural values with human rights principles, bridging the gap between formal legislation and community acceptance (UNICEF, 2020). This model has proven effective in other Muslim-majority contexts and offers promise for the Central Asian setting. Overall, the discussion reveals that child marriage in Central Asia persists because it operates at the intersection of structural inequality and cultural legitimacy. It is simultaneously a coping mechanism for economic insecurity and a symbolic expression of social order grounded in patriarchal tradition. While legal and policy reforms have introduced significant progress, their success depends on integrating economic empowerment, education, and community-level dialogue. Sustainable change requires an inclusive, multi-dimensional approachone that acknowledges the cultural embeddedness of marriage practices while promoting gender equity and human rights across all levels of society.

## Conclusion

This study set out to conduct a comparative analysis of scholarly research on child marriage in Central Asia, with the goal of identifying common patterns, regional specificities, and key socio-cultural and institutional factors that sustain the practice. Through the qualitative synthesis of twenty-one peer-reviewed studies, the research successfully achieved its objectives by systematizing existing knowledge, mapping thematic trends, and highlighting critical gaps in the literature. The findings confirm that child marriage across Kazakhstan, Kyrgyzstan, Uzbekistan, and Tajikistan remains a multifaceted social institution rooted in the interplay of economic precarity, patriarchal norms, and weak institutional governance. In response to the first research question, the analysis shows that academic literature conceptualizes child marriage not merely as a legal or

demographic issue, but as a deeply embedded social phenomenon reflecting broader processes of gendered social reproduction and cultural continuity. Most studies employ rights-based or feminist frameworks, interpreting early marriage as both a violation of human rights and a mechanism that perpetuates traditional gender hierarchies (Cleuziou & McBrien, 2021; Werner, 2009; Kim, 2019). Addressing the second research question, the reviewed evidence identifies several primary drivers of child marriage in the region. Socio-economic deprivation, limited access to education, and rural marginalization consistently emerge as structural enablers (Akhmedshina, 2023; Kuralbayeva, 2020; UNFPA, 2019). Cultural traditions and religious norms further legitimize early unions, framing them as morally acceptable responses to social uncertainty. At the institutional level, weak enforcement of marriage laws and the coexistence of civil and religious systems (nikah) undermine state regulation, especially in Uzbekistan and Tajikistan (Marasulova & Rejjabbaevich, 2025). In relation to the third research question, the comparative analysis revealed significant national variations in prevalence, causes, and policy responses. Kazakhstan's secular framework and gender equality programs demonstrate partial success but remain challenged by rural poverty and conservative values. Kyrgyzstan exhibits strong legal norms but persistent informal governance, allowing bride kidnapping to continue despite criminalization. In contrast, Uzbekistan and Tajikistan show stronger religious influences and limited state capacity, leading to the persistence of underage «nikah marriages». These variations underscore how cultural legitimacy and institutional weakness interact differently across contexts, shaping the lived realities of early marriage. The study concludes that child marriage in Central Asia persists because it functions simultaneously as a coping mechanism for economic insecurity and as a culturally sanctioned institution that reinforces patriarchal social order. While legal reforms have introduced important progress, their long-term impact remains constrained by social norms and enforcement gaps. Therefore, effective prevention requires an integrated approach that combines economic empowerment, gender-transformative education, and culturally sensitive community engagement. The research also demonstrates that comparative, cross-disciplinary inquiry is essential to capture the regional diversity and to inform evidence-based policymaking. The study's aim has been fully achieved: it has provided a structured comparative framework that synthesizes fragmented academic debates, identifies shared structural determinants, and highlights the need for holistic, context-responsive solutions. By situating Central Asia within the broader global discourse on early and forced marriage, this research contributes both to theoretical understanding and to practical strategies for advancing gender equality and protecting children's rights across the region.

## References


1. Akhmedshina, F. A. (2023). Gender aspect of the problem of child marriages in the world and Uzbekistan. *CURRENT RESEARCH JOURNAL OF HISTORY*, *4*(05), 13-20.
2. Batyra, E., & Pesando, L. M. (2021). *Trends in child marriage and new evidence on the selective impact of changes in age-at-marriage laws on early marriage*. SSM – Population Health, 14, 100811. https://doi.org/10.1016/j.ssmph.2021.100811
3. Bazarkulova, D., & Compton, J. (2021). *Marriage traditions and investment in education: The case of bride kidnapping*. Journal of Comparative Economics, 49(1), 147–163. https://doi.org/10.1016/j.jce.2020.07.005
4. Cleuziou, J., & McBrien, J. (2021). Marriage quandaries in central Asia. *Oriente Moderno*, *100*(2), 121-146.
5. Dauletova, G. S., Kulzhanova, S. S., & Baikenova, G. K. (2012). *The indicators of reproductive behavior in young families*. Life Science Journal, 9(4), 623–628. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3481607/
6. Director, U.N.F.P.A. (2014) Child marriages. Retrieved from: https://humantraffickingsearch.org/wp-content/uploads/2017/08/UNFPA-Child-Marriage-in-Uzbekistan-2014.pdf
7. Girls Not Brides. (n.d.). *Kazakhstan*. Retrieved October 27, 2025, from https://www.girlsnotbrides.org/learning-resources/child-marriage-atlas/regions-and-countries/kazakhstan/
8. Human Rights Watch. (2020). *Kyrgyzstan: Bride kidnapping persists despite laws*. Retrieved from https://www.hrw.org/news/2020/04/14/kyrgyzstan-bride-kidnapping-persists-despite-laws
9. Kataeva, Z. (2025). Gender Inequality and Higher Education in Tajikistan: Exploring Barriers and Affirmative Actions. In *Gender and Education in Central Asia* (pp. 149-170). Cham: Springer Nature Switzerland.
10. Kechagia, P. (2025). Vulnerable girls and child marriage in rural Asia: a systematic review. *Vulnerable Children and Youth Studies*, 1-25.
11. Kim, E. (2019). Child Marriage in Kyrgyzstan: Exploring Institutional Ambivalences in Constructing the "Victim". In *Victim, Perpetrator, or What Else? Generational and Gender Perspectives on Children, Youth, and Violence* (pp. 171-189). Emerald Publishing Limited.
12. Marasulova, A., & Rejjabbaevich, R. A. (2025). Islamic Marriage in Kazakhstan and Uzbekistan: A Comparative Study of Legal Framework. *Manchester Journal of Transnational Islamic Law & Practice*, *21*(1).
13. Muminovna, M. U. (2024, October). Marriage Issues in the Family Law of Central Asian Countries. In *International Conference of Economics, Finance and Accounting Studies* (Vol. 10, pp. 69-78).
14. Nedoluzhko, L., & Agadjanian, V. (2010). Marriage, childbearing, and migration in Kyrgyzstan: Exploring interdependences. *Demographic Research*, *22*, 159-188.
15. Porreca, Z. (2024). *Bride kidnapping and informal governance institutions*. Working Paper, arXiv preprint. https://arxiv.org/pdf/2402.03411
16. Roche, S., Torno, S., & Kazemi, S. R. (2020). Family matters: The making and remaking of family during conflict periods in central Asia. *Acta Via Serica*, *5*(1), 153-185.
17. Sharipova, M., & Fabian, K. (2010). From Soviet liberation to post-Soviet segregation: Women and violence in Tajikistan. *Domestic violence in postcommunist states: Local activism, national policies, and global forces*, 133-170.

18. UNFPA. (2019). *Child marriage in Central Asia: Overview and policy recommendations*. United Nations Population Fund, Eastern Europe and Central Asia Regional Office. Retrieved from https://eeca.unfpa.org/sites/default/files/pub-pdf/unfpa%20kazakhstan%20overview.pdf
19. UNICEF. (2020). *Child marriage: Latest trends and future prospects*. United Nations Children's Fund. Retrieved from https://data.unicef.org/resources/child-marriage-latest-trends-and-future-prospects/
20. Werner, C. (2004). The rise of nonconsensual bride kidnapping in post-Soviet Kazakhstan. *The transformation of Central Asia: states and societies from Soviet rule to independence*, 59-89.
21. Werner, C. (2009). Bride abduction in post-Soviet Central Asia: marking a shift towards patriarchy through local discourses of shame and tradition. *Journal of the Royal Anthropological Institute*, *15*(2), 314-331.
22. Werner, C. (2009). Bride abduction in post-Soviet Central Asia: marking a shift towards patriarchy through local discourses of shame and tradition. *Journal of the Royal Anthropological Institute*, *15*(2), 314-331.
23. Zebuniso Amanaullaevna Saidova. (2025). Marriage and its dynamics in central Asia (19th-20th century). The American Journal of Social Science and Education Innovations, 7(02), 125–128. https://doi.org/10.37547/tajssei/Volume07Issue02-13


Publisher.agency: Proceedings of the 11th International Scientific Conference «Foundations and Trends in Research» (October 30-31, 2025). Copenhagen, Denmark, 2025. 264p

editor@publisher.agency

https://publisher.agency

University of Copenhagen

Lindestien, 23

2605 Brøndbyøster Copenhagen,

Denmark