

ISSN: 1991-3494 (Print)
ISSN: 2518-1467 (Online)

**SCIENTIFIC JOURNAL OF
PEDAGOGY AND ECONOMICS**

**№2
2026**

ISSN 2518-1467 (Online),
ISSN 1991-3494 (Print)



CENTRAL ASIAN ACADEMIC
RESEARCH CENTER



SCIENTIFIC JOURNAL OF PEDAGOGY AND ECONOMICS

PUBLISHED SINCE 1944

2 (420)

March – April 2026

ALMATY, 2026

EDITOR-IN-CHIEF:

ABYLKASSIMOVA Alma Yesimbekovna, Doctor of Pedagogical Sciences, Professor, Academician of Central Asian Academic Research Center, Director of the Center for the Development of Pedagogical Education, Head of the Department of Methods of Teaching Mathematics, Physics and Computer Science at Abai KazNPU (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=57191275199>, <https://www.webofscience.com/wos/author/record/2076124>.

DEPUTY EDITOR-IN-CHIEF:

SEMBIEVA Lyazzat Myktybekovna, Doctor of Economics, Professor of the Eurasian National University (Astana, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=57194226348>, <https://www.webofscience.com/wos/author/record/38875302>.

EDITORIAL BOARD:

RICHELLE Marynowski, PhD in Education, Professor, Faculty of Education, University of Lethbridge, (Alberta, Canada), <https://www.scopus.com/authid/detail.uri?authorId=57070452800>, <https://www.webofscience.com/wos/author/record/16130920>.

SHISHOV Sergey Evgenievich, Doctor of Pedagogical Sciences, Professor, Head of the Department of Pedagogy and Psychology of Professional Education, Moscow State University of Technology and Management named after K. Razumovsky (Moscow, Russia), <https://www.scopus.com/authid/detail.uri?authorId=57191518233>, <https://www.webofscience.com/wos/author/record/2443966>.

ABILDINA Saltanat Kuatovna, Doctor of Pedagogical Sciences, Professor, Head of the Department of Pedagogy, Karaganda University named after E.A. Buketov (Karaganda, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=56128026400>, <https://www.webofscience.com/wos/author/record/4131549>.

RYZHAKOV Mikhail Viktorovich, Doctor of Pedagogical Sciences, Professor, Academician of the Russian Academy of Education, Editor-in-Chief of the journal "Standards and Monitoring in Education" (Moscow, Russia), <https://www.scopus.com/authid/detail.uri?authorId=6602245542>, <https://www.webofscience.com/wos/author/record/13675462>.

BULATBAEVA Kulzhanat Nurymzhanovna, Doctor of Pedagogical Sciences, Professor, Chief Researcher of the National Academy of Education named after Y. Altynsarin (Astana, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=57202195074>, <https://www.webofscience.com/wos/author/record/40173122>.

PETR Hájek, PhD, Unicorn University, Associate Professor, Department of Finance, (Prague, Czech Republic), <https://www.scopus.com/authid/detail.uri?authorId=35726855800>, <https://www.webofscience.com/wos/author/record/672404>.

JUMAN Jappar, Doctor of Economics, Professor, Honorary Academician of Central Asian Academic Research Center, Honored Worker of Kazakhstan, Director of the Center for International Applied Research Al-Farabi Kazakh National University (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=59238481900>; <https://www.scopus.com/authid/detail.uri?authorId=56658765400>, <https://www.webofscience.com/wos/author/record/60977874>.

LUKYANENKO Irina Grigorievna, Doctor of Economics, Professor, Head of Department of the National University of Kyiv-Mohyla Academy (Kyiv, Ukraine), <https://www.scopus.com/authid/detail.uri?authorId=57189348551>, <https://www.webofscience.com/wos/author/record/939510>.

YESIMZHANOVA Saira Rafihevna, Doctor of Economics, Professor of the University of International Business (Almaty, Kazakhstan), <https://www.scopus.com/authid/detail.uri?authorId=56499485500>, <https://www.webofscience.com/wos/author/record/45951098>.

Scientific Journal of Pedagogy and Economics

ISSN 2518-1467 (Online),

ISSN 1991-3494 (Print).

Owner: «Central Asian Academic Research Center» LLP (Almaty).

The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Communications of the Republic of Kazakhstan

№ KZ50VPY00121155, issued on 05.06.2025

Thematic focus: «*publication of the results of new achievements in the field of fundamental sciences*»

Periodicity: 6 times a year.

<http://www.bulletin-science.kz/index.php/en/>

© «Central Asian Academic Research CenterB» LLP, 2026



БАС РЕДАКТОР:

ӘБІЛҚАСЫМОВА Алма Есімбекқызы, педагогика ғылымдарының докторы, профессор, ҚР ҰҒА академигі, Педагогикалық білім беруді дамыту орталығының директоры, Абай атындағы ҚазҰПУ математика, физика және информатиканы оқыту әдістемесі кафедрасының меңгерушісі (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=57191275199>, <https://www.webofscience.com/wos/author/record/2076124>.

БАС РЕДАКТОРДЫҢ ОРЫНБАСАРЫ:

СЕМБИЕВА Ләззат Мықтыбекқызы, экономика ғылымдарының докторы, Л.Н. Гумилев атындағы Еуразия ұлттық университетінің профессоры (Астана, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=57194226348>, <https://www.webofscience.com/wos/author/record/38875302>.

РЕДАКЦИЯ АЛҚАСЫ:

РИШЕЛЬ Мариновски, білім беру саласындағы PhD, Летбридж университеті педагогика факультетінің профессоры, (Альберта, Канада), <https://www.scopus.com/authid/detail.uri?authorId=57070452800>, <https://www.webofscience.com/wos/author/record/16130920>.

ШИШОВ Сергей Евгеньевич, педагогика ғылымдарының докторы, профессор, К. Разумовский атындағы Мәскеу мемлекеттік технологиялар және басқару университетінің кәсіби білім беру педагогикасы және психологиясы кафедрасының меңгерушісі (Мәскеу, Ресей), <https://www.scopus.com/authid/detail.uri?authorId=57191518233>, <https://www.webofscience.com/wos/author/record/2443966>.

ӘБІЛДИНА Салтанат Қуатқызы, педагогика ғылымдарының докторы, профессор, Е.А. Бөкетов атындағы Қарағанды университетінің педагогика кафедрасының меңгерушісі (Қарағанды, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=56128026400>, <https://www.webofscience.com/wos/author/record/4131549>.

РЫЖАКОВ Михаил Викторович, педагогика ғылымдарының докторы, профессор, Ресей білім академиясының академигі, «Білім берудегі стандарттар мен мониторинг» журналының бас редакторы (Мәскеу, Ресей), <https://www.scopus.com/authid/detail.uri?authorId=6602245542>, <https://www.webofscience.com/wos/author/record/13675462>.

БОЛАТБАЕВА Күлжанат Нұрымжанқызы, педагогика ғылымдарының докторы, профессор, Ы.Алтынсарин атындағы Ұлттық білім академиясының бас ғылыми қызметкері (Астана, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=57202195074>, <https://www.webofscience.com/wos/author/record/40173122>.

ПЕТР Хайек, PhD, Юникорн университеті, Қаржы департаментінің қауымдастырылған профессоры (Прага, Чехия), <https://www.scopus.com/authid/detail.uri?authorId=35726855800>, <https://www.webofscience.com/wos/author/record/672404>.

ЖҰМАН Жаппар, экономика ғылымдарының докторы, профессор, Қазақстанның Еңбек сіңірген қайраткері, ҚР ҰҒА құрметті академигі, әл-Фараби атындағы Қазақ ұлттық университетінің Халықаралық қолданбалы зерттеулер орталығының директоры (Алматы, Қазақстан). <https://www.scopus.com/authid/detail.uri?authorId=59238481900>; <https://www.scopus.com/authid/detail.uri?authorId=56658765400>, <https://www.webofscience.com/wos/author/record/60977874>.

ЛУКЪЯНЕНКО Ирина Григорьевна, экономика ғылымдарының докторы, профессор, «Киево-Могилянская академия» ұлттық университеті кафедрасының меңгерушісі (Киев, Украина), <https://www.scopus.com/authid/detail.uri?authorId=57189348551>, <https://www.webofscience.com/wos/author/record/939510>.

ЕСІМЖАНОВА Сайра Рафиққызы, экономика ғылымдарының докторы, Халықаралық бизнес университетінің профессоры (Алматы, Қазақстан), <https://www.scopus.com/authid/detail.uri?authorId=56499485500>, <https://www.webofscience.com/wos/author/record/45951098>.

Scientific Journal of Pedagogy and Economics

ISSN 2518-1467 (Online),

ISSN 1991-3494 (Print).

Меншіктенуші: «Орталық Азия академиялық ғылыми орталығы» ЖШС (Алматы қ.).

Қазақстан Республикасының Ақпарат және коммуникациялар министрлігінің Ақпарат комитетінде 05.06.2025 ж. берілген № KZ50VPY00121155 мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: *«іргелі ғылым салалары бойынша жаңа жетістіктердің нәтижелерін жариялау»*

Мерзімділігі: жылына 6 рет.

<http://www.bulletin-science.kz/index.php/en/>

© «Орталық Азия академиялық ғылыми орталығы» ЖШС, 2026

ГЛАВНЫЙ РЕДАКТОР:

АБЫЛКАСЫМОВА Алма Есимбековна, доктор педагогических наук, профессор, академик НАН РК, директор Центра развития педагогического образования, заведующая кафедрой методики преподавания математики, физики и информатики КазНПУ им. Абая (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=57191275199>, <https://www.webofscience.com/wos/author/record/2076124>.

ЗАМЕСТИТЕЛЬ ГЛАВНОГО РЕДАКТОРА:

СЕМБИЕВА Лязат Мыктыбековна, доктор экономических наук, профессор Евразийского национального университета им. Л.Н. Гумилева (Астана, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=57194226348>, <https://www.webofscience.com/wos/author/record/38875302>.

РЕДАКЦИОННАЯ КОЛЛЕГИЯ:

РИШЕЛЬ Мариновски, PhD в области образования, профессор факультета педагогики Летбриджского университета, (Альберта, Канада), <https://www.scopus.com/authid/detail.uri?authorId=57070452800>, <https://www.webofscience.com/wos/author/record/16130920>.

ШИШОВ Сергей Евгеньевич, доктор педагогических наук, профессор, заведующий кафедрой педагогики и психологии профессионального образования Московского государственного университета технологий и управления имени К. Разумовского (Москва, Россия), <https://www.scopus.com/authid/detail.uri?authorId=57191518233>, <https://www.webofscience.com/wos/author/record/2443966>.

АБИЛЬДИНА Салтанат Куатовна, доктор педагогических наук, профессор, заведующая кафедрой педагогики Карагандинского университета имени Е.А. Букетова (Караганда, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=56128026400>, <https://www.webofscience.com/wos/author/record/4131549>.

РЫЖАКОВ Михаил Викторович, доктор педагогических наук, профессор, академик Российской академии образования, главный редактор журнала «Стандарты и мониторинг в образовании» (Москва, Россия), <https://www.scopus.com/authid/detail.uri?authorId=6602245542>, <https://www.webofscience.com/wos/author/record/13675462>.

БУЛАТБАЕВА Кулжанат Нурымжановна, доктор педагогических наук, профессор, главный научный сотрудник Национальной академии образования имени Ы. Алтынсарина (Астана, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=57202195074>, <https://www.webofscience.com/wos/author/record/40173122>.

ПЕТР Хайек, PhD, университет Юникорн, ассоциированный профессор Департамента финансов, (Прага, Чехия), <https://www.scopus.com/authid/detail.uri?authorId=35726855800>, <https://www.webofscience.com/wos/author/record/672404>.

ЖУМАН Жаппар, доктор экономических наук, профессор, заслуженный деятель Казахстана, почетный академик НАН РК, директор Центра Международных прикладных исследований Казахского национального университета им. аль-Фараби (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=59238481900>; <https://www.scopus.com/authid/detail.uri?authorId=56658765400>, <https://www.webofscience.com/wos/author/record/60977874>.

ЛУКЪЯНЕНКО Ирина Григорьевна, доктор экономических наук, профессор, заведующая кафедрой Национального университета «Киево-Могилянская академия» (Киев, Украина), <https://www.scopus.com/authid/detail.uri?authorId=57189348551>, <https://www.webofscience.com/wos/author/record/939510>.

ЕСИМЖАНОВА Сайра Рафихевна, доктор экономических наук, профессор Университета международного бизнеса (Алматы, Казахстан), <https://www.scopus.com/authid/detail.uri?authorId=56499485500>, <https://www.webofscience.com/wos/author/record/45951098>.

Scientific Journal of Pedagogy and Economics

ISSN 2518-1467 (Online),

ISSN 1991-3494 (Print).

Собственник: ТОО «Центрально-азиатский академический научный центр» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и коммуникаций и Республики Казахстан

№ KZ50VPY00121155 выданное 05.06.2025 г.

Тематическая направленность: «публикация результатов новых достижений области фундаментальных наук».

Периодичность: 6 раз в год.

<http://www.bulletin-science.kz/index.php/en/>

© ТОО «Центрально-азиатский академический научный центр», 2026



CONTENTS

PEDAGOGY

Aitimbaev A., Issayev M., Apendiyev T. Scientific and methodological opportunities for using archival materials in teaching the history of Kazakhstan in higher education institutions.....	19
Akhmetova G., Kabdusheva A., Mussina A. A quantitative study on university students' academic writing challenges and learning needs.....	40
Akhmetova Zh.A., Nurgali S., Nurmetova D. Pedagogical foundations of using digital resources in teaching academic writing.....	57
Bekbolat Zh., Zholmakhanova A., Yildirim S. Theoretical foundations of teaching M. Shokai's letters through a research-based approach.....	72
Berdenkulova A.Zh., Zhandavletova R.B., Nazarova G.A. A pedagogical model for improving educational quality through the "comfortable school - society - university" partnership.....	88
Duisenova G., Shyndaliyev N., Shadiyev R. Comparative analysis of traditional and virtualized programming education.....	104
Yeskendiroya A., Kassenova N., Nogoyev Y. Comparative analysis of texts created by AI and texts developed using quantization technology.....	121
Zhanysbekova Sh., Nurmakhanova Zh., Akasheva A. Actual problems of the formation of pragmatic competence: research based on the results of content analysis.....	136
Zulpykhar Zh.E., Kapanova D.E., Zhilmagambetova R.Z. Modern resources and technologies as a foundation for the development of teachers' professional competencies.....	153
Isaeva A., Ananyeva S. Axiological interpretation of the Kazakhstan theme in the works of K. Paustovsky: methodological approaches to teaching at the university.....	172
Kabzhalelov K.R., Korganbayeva Zh.K., Nurakhmetova A.R. Developing critical thinking through modern chatbots in chemistry education.....	190
Kazhenova Zh.S., Kydyralina L.M., Rakhmatullina Z.T. Problems of developing students' engineering skills.....	208

Kaldarova A., Vasquez M., Kulgildinova T. Developing students' profession-oriented speaking skills through ChatGPT.....	229
Kapbarova G.Sh., Gundogdu A., Baidalieva E.A. History teaching methodology: theoretical and practical foundations of the competency-based approach.....	243
Kozhakhanova L., Amirova A. Prospects for developing media literacy among primary school students.....	260
Kuzhagulova G., Sydykova R., Smailova M Features of education of national values in visually impaired students through Kazakh lyric songs.....	278
Markhmadova Zh.K., Kassymova G.K., Okenova B. Pedagogical aspects of developing and assessing the digital competence of pedagogy-psychologists.....	297
Mateyeva M., Yeralin K., Burkitbaev T. Training future teachers of artistic work for art-historical regional studies.....	318
Makhanov N., Nishanova K. Development of students' cognitive competencies through museum-based education: evidence from South Kazakhstan.....	333
Myrzagereikyzy G., Yermekova Zh.K., Aldzhambekova G.T. The use of action research in preparing future physics teachers for the development of functional literacy of students.....	348
Reginbayeva N., Nametkulova F. Methodological foundations of professionally-oriented physics education based on STEM education for future air transport specialists.....	365
Serikbayeva N., Orynbekova A., Tuyakova U. Methodology for developing digital competence of educational psychologists in modern education.....	385
Toiganbekova M.E., Kazhigalieva G.A. Aspects of creation and specification of educational texts for increasing the effectiveness of training.....	409
Shegebayeva G., Zhumasheva T., Nurbekova S. Prerequisites for the preparation of future educators for the creation of a health-educational environment based on nutriscology.....	422
Shishov S.E., Iovbak A.S., Verko Y.A. Integrated modular physics experiment as a means of organizing students' experimental activities in secondary school.....	443

ECONOMICS

Abdimoldayeva A., Madysheva A., Zhunussova G. Transformation of logistics cost accounting in the agro-industrial complex under digitalization.....	461
Abuova Zh., Duiskenova R., Kadyrbekova D. The concept of sustainable development of the hotel business based on digital transformation and environmental management.....	479
Amantay Mukhit, Kanabekova M., Oralbayeva Zh. Digitalization as a driver of Kazakhstan’s economic growth: econometric analysis and structural effects.....	494
Ashim N., Dzhrauova K., Kushenova M. Improving the management of agricultural subsidies: Kyzylorda region.....	511
Assemova R., Abdibekov S., Aitbayeva D. Energy efficiency and innovation in agriculture: empirical evidence from Southern Kazakhstan.....	535
Assanova Zh., Baimukhanova S., Konysbaeva G. Environmental accounting, ESG reporting and digitalization: impact on cost reduction and sustainable development.....	554
Baigelova A., Sadykova Zh., Epanchintseva S. Industrial economy transformation in Kazakhstan: structural shifts, digitalization and productivity growth.....	571
Beisekova Zh., Mutaliyeva A., Kunshigarova L. Transformation of entrepreneurial activity in Kazakhstan in 2000–2025.....	590
Beisenbayeva A., Kambarov B., Samenova N. Development of small and medium-sized enterprises in Almaty: ecosystem factors and structural dynamics.....	611
Bekisheva A., Beketova K., Dorohova N. Human resource management practices and employee perceptions in Kazakhstan’s civil service.....	629
Bissenbayeva S., Kireyeva A., Zhumaxanova K. Digitalization, government support and innovation activity: evidence from regional analysis in Kazakhstan.....	646
Em O.L., Kim D. Features of risk management in collective investment.....	665

Ibrayeva A., Kenesheva G., Arynova Zh. Qualification mismatch in the labour market of an industrial region: a conceptual model and measurement mechanism.....	684
Juman J., Mukhtarova K.S., Liao Z. The modern model of China's economic cooperation with Central Asian countries.....	701
Karakulova A., Bakirbekova A., Zhangirova R. Improving the efficiency of digital transformation of agricultural enterprises: an empirical analysis of Kostanay region.....	718
Kuralbayeva A.Sh., Issayeva G.K., Zhussipova E.E. Energy-saving technologies in irrigated agriculture of Southern Kazakhstan: economic and environmental effects.....	734
Naimanova Zh., Bakirbekova A., Kuralbayeva R. Digital inequality and agricultural productivity: evidence from Southern Kazakhstan....	749
Nartbayeva A., Dadabayeva D., Altuntas G. Economic resilience of single-industry towns in Kazakhstan: a dynamic analysis of socio-economic indicators.....	767
Nurlanuly A., Petrovčíková K., Shalbolova U.Zh. Comparative analysis of aviation market development models in Kazakhstan and Slovakia.....	785
Nyshanbayeva U., Moldashbayeva L., Urazbayeva Z. Accounting and valuation of investment projects in digital tourism: an integrated approach.....	801
Shegir G., Kerimova U., Kabi Sh. The transition of the agro-industrial complex of the Almaty region to the production of value-added products.....	819
Shiganbayeva N., Razakova D., Orlowska R. Trade turnover between China and Kazakhstan in the context of contemporary analytical studies: factors, challenges, and risks.....	840
Tuzubekova M., Zhunusova A., Kadirova N. Analysis of SME support incentives in the manufacturing industry of the Republic of Kazakhstan.....	857
Yeraliyeva Ya., Ruziyeva E., Alimbekova B. Trend and structure of research on digital financial literacy: bibliometric approach.....	877
Zhassan G., Taibek Zh., Imanova G. Climate risk management in the banking sector: ESG-based global and Kazakhstani experience.....	891

МАЗМҰНЫ

ПЕДАГОГИКА

Айтимбаев А.Т., Исаев М.С., Апендиев Т.А. Қазақстан тарихын жоғары оқу орындарында оқытуда архив материалдарын пайдаланудың ғылыми-әдістемелік мүмкіндіктері (1920–1950 жж. Оңтүстік Қазақстандағы саяси қуғын-сүргін құрбандары тағдырлары негізінде).....	19
Ахметова Г.С., Кабдушева А.Б., Мусина А.Б. Университет студенттерінің академиялық жазылымдағы қиындықтары мен оқу қажеттіліктеріне арналған сандық зерттеу.....	40
Ахметова Ж.А., Нұрғали С., Нурметова Д. Академиялық жазуды оқытуда сандық ресурстарды пайдаланудың педагогикалық негіздері.....	57
Бекболат Ж.Н., Жолмаханова А.Б., Сейфуллах Йылдырым Мұстафа Шоқай хаттарын зерттеушілік әдіс арқылы оқытудың теориялық негіздері.....	72
Берденкулова А.Ж., Жандавлетова Р.Б., Назарова Г.А. «Жайлы мектеп – қоғам – университет» серіктестігі негізінде білім сапасын арттырудың педагогикалық моделі.....	88
Ескендірова А.А., Касенова Н.Б., Ногоев Ю.Я. ЖИ арқылы жасалған мәтіндер мен кванттау технологиясы арқылы әзірленген мәтіндердің салыстырмалы талдауы.....	104
Жанысбекова Ш., Нурмаханова Ж., Акашева Ә. Прагматикалық құзіреттілікті қалыптастырудың өзекті мәселелері: контент-анализ нәтижелері бойынша зерттеу.....	121
Дүйсенова Г.А., Шындалиев Н.Т., Шадиев Р.Н. Дәстүрлі және виртуалды бағдарламалау білімінің салыстырмалы талдауы.....	136
Зулпыхар Ж.Е., Капанова Д.Е., Жилмагамбетова Р.З. Педагогтердің кәсіби құзыреттілігін дамытудың негізі ретінде қазіргі заманғы ресурстар мен технологиялар.....	153
Исаева А.А., Ананьева С.В. К. Паустовский шығармашылығындағы Қазақстан тақырыбының аксиологиялық интерпретациясы: жоғары оқу орнында оқытудың әдіснамалық тәсілдері.....	172
Кабжалелов К.Р., Қорғанбаева Ж.Қ., Нурахметова А.Р. Химияны оқыту барысында заманауи чат-боттар арқылы сыни ойлауды дамыту.....	190

Каженова Ж.С., Қыдыралина Л.М., Рахматулина З.Т. Оқушылардың инженерлік дағдыларын дамыту мәселелері.....	208
Калдарова А.К., Васкес М.А., Кульгильдинова Т.А. Студенттердің кәсіби-бағдарланған айтылым дағдыларын ChatGPT арқылы дамыту.....	229
Капбарова Г.Ш., Гюндогду А., Байдалиева Э.А. Тарихты оқыту әдістемесі: құзыреттілікке негізделген тәсілді қолданудың теориялық және практикалық негіздері.....	243
Кожыханова Л., Амирова А. Бастауыш сынып оқушыларының медиасауаттылығын дамыту перспективалары.....	260
Кужагулова Г.Е., Сыдыкова Р.Ш., Смаилова М.С. Көру қабілеті бұзылған білім алушыларды қазақтың лирикалық әндері арқылы ұлттық құндылықтарға тәрбиелеудің ерекшеліктері.....	278
Мархмадова Ж.Қ., Касымова Г.К., Өкенова Б. Педагог-психологтың цифрлық құзыреттілігін қалыптастыру және бағалаудың педагогикалық аспектілері.....	297
Матеева М.А., Ералин Қ., Буркитбаев Т. Болашақ көркем еңбек мұғалімдерін өнертанымдық өлкетануға даярлау.....	318
Маханов Н., Нишанова К. Музейлік білім беру негізінде оқушылардың танымдық құзыреттіліктерін дамыту (Оңтүстік Қазақстан мысалында).....	333
Мырзагерейқызы Г., Еркемова Ж.К., Алджамбекова Г.Т. Болашақ физика мұғалімдерін оқушылардың функционалдық сауаттылығын дамытуға даярлауда action research пайдалану.....	348
Регинбаева Н.А., Наметкулова Ф.Д. Болашақ әуе транспорты мамандарына физиканы STEM білім беру негізінде кәсіби-бағдарлы оқытудың әдістемелік негіздері.....	365
Серикбаева Н.Б., Орынбекова А.С., Туякова У.Ж. Қазіргі білім беруде педагог-психологтардың цифрлық құзыреттілігін дамыту әдістемесі.....	385
Тойғанбекова М.Е., Қажығалиева Г.А. Оқытудың тиімділігін арттыру үшін оқу мәтіндерін құру және нақтылау аспектілері.....	409

Шегебаева Г.У., Жумашева Т.С., Нурбекова С.М.
Болашақ тәрбиешілерді нутрициология негізінде денсаулық сақтау-білім беру ортасын құруға дайындаудың алғышарттары.....422

Шишов С.Е., Иовбак А.С., Верко Е.А.
Орта мектепте оқушылардың эксперименталдық қызметін ұйымдастыру құралы ретінде интеграцияланған модульді физика эксперименті.....443

ЭКОНОМИКА

Абдимолдаева А., Мадышева А., Жунусова Г.
Цифрландыру жағдайында агроөнеркәсіптік кешендегі логистикалық шығындар есебін қайта құру.....461

Абуова Ж., Дүйсеннова Р., Кадырбекова Д.
Цифрлық трансформация және экологиялық басқару негізіндегі қонақ үй бизнесінің тұрақты даму тұжырымдамасы.....479

Әшім Н., Джрауова К., Кушенова М.
Ауылшаруашылығы субсидияларын басқаруды жетілдіру: Қызылорда облысы...494.

Мұхит Амантай, Кенабекова М., Оралбаева Ж.
Цифрландыру Қазақстанның экономикалық өсуінің драйвері ретінде: эконометрикалық талдау және құрылымдық әсерлер.....511

Асемова Р., Абдибеков С., Айтбаева Д.
Ауылшаруашылығындағы энергия тиімділігі және инновациялар: Оңтүстік Қазақстан бойынша эмпирикалық дәлелдер.....535

Асанова Ж., Баймуханова С., Қонысбаева Г.
Экологиялық есеп, ESG-есептілік және цифрландыру: шығындарды төмендетуге және орнықты дамуға әсері.....554

Байгелова А., Садыкова Ж., Епанчинцева С.
Қазақстандағы өнеркәсіп экономикасының трансформациясы: құрылымдық өзгерістер, цифрландыру және өнімділіктің өсуі.....571

Бейсекова Ж., Муталиева А., Куншигарова Л.
2000–2025 жылдары Қазақстандағы кәсіпкерлік қызметтің трансформациясы.....590

Бейсенбаева А., Қамбаров Б., Саменова Н.
Алматыда шағын және орта кәсіпкерлікті дамыту: экожүйелік факторлар және құрылымдық динамика.....611

Бекишева А., Бекетова К., Дорохова Н.
Қазақстанның мемлекеттік қызметіндегі адам ресурстарын басқару тәжірибелері және қызметкерлердің қабылдауы.....629

Бисенбаева С., Киреева А., Жұмаксанова К.

Цифрландыру, мемлекеттік қолдау және инновациялық белсенділік:
Қазақстан өңірлерінің талдауы.....646

Эм О.Л., Ким Д.

Ұжымдық инвестициялардағы тәуекелдерді басқарудың ерекшеліктері.....665

Ибраева А., Кенешева Г., Арынова Ж.

Өнеркәсіптік өңірдің еңбек нарығындағы біліктілік сәйкессіздігі:
тұжырымдамалық модель және өлшеу тетігі.....684

Жұман Ж., Мұхтарова К.С., Ляо Чжан

Қытайдың Орталық Азия елдерімен экономикалық ынтымақтастығының
заманауи моделі.....701

Қаракұлова А., Бакирбекова А., Жангирова Р.

Ауыл шаруашылығы кәсіпорындарының цифрлық трансформациясының
тиімділігін арттыру: Қостанай облысының эмпирикалық талдауы.....718

Құралбаева А.Ш., Исаева Г.К., Жусипова Э.Е.

Оңтүстік Қазақстанның суармалы ауыл шаруашылығындағы энергия үнемдеу
технологиялары: экономикалық және экологиялық тиімділік.....734

Найманова Ж., Бакирбекова А., Құралбаева Р.

Цифрлық теңсіздік және ауыл шаруашылығының өнімділігі:
Оңтүстік Қазақстан деректері.....749

Нартбаева А., Дадабаева Д., Алтунташ Г.

Қазақстан моноқалаларының экономикалық резиленттілігі: әлеуметтік-
экономикалық көрсеткіштердің динамикалық талдауы.....767

Нұрланұлы А., Петровчикова К., Шалболова У.Ж.

Қазақстан мен Словакияның авиациялық нарықтарының даму модельдерін
салыстырмалы талдау.....785

Нышанбаева Ұ., Молдашбаева Л., Уразбаева З.

Цифрлық туризмдегі инвестициялық жобаларды есепке алу және бағалау:
интеграцияланған тәсіл.....801

Шегір Г., Керимова У., Қаби Ш.

Алматы облысының агроөнеркәсіптік кешенінің қосылған құны бар өнім
өндіруге көшуі.....819

Шиганбаева Н., Разакова Д., Орловска Р.

Қытай мен Қазақстан арасындағы тауар айналымы: факторлар, мәселелер
және тәуекелдер.....840

Тузубекова М., Жунусова А., Кадирова Н. Қазақстан Республикасының өңдеу өнеркәсібіндегі шағын және орта бизнесті ынталандыруды талдау.....	857
Ералиева Я., Рузиева Э., Алимбекова Б. Цифрлық қаржылық сауаттылық бойынша зерттеулердің тенденциялары мен құрылымы: библиометриялық тәсіл.....	877
Жасан Г.Ж., Тайбек Ж.Қ., Иманова Г.А. Банк секторындағы климаттық тәуекелдерді басқару: ESG негізіндегі әлемдік және қазақстандық тәжірибе.....	891

СОДЕРЖАНИЕ

ПЕДАГОГИКА

Айтимбаев А.Т., Исаев М.С., Апендиев Т.А.

Научно-методические возможности использования архивных материалов при преподавании истории Казахстана в высших учебных заведениях (на примере судеб жертв политических репрессий в Южном Казахстане в 1920–1950 гг.).....19

Ахметова Г.С., Кабдушева А.Б., Мусина А.Б.

Количественное исследование проблем академического письма и образовательных потребностей студентов университета.....40

Ахметова Ж.А., Нурғали С., Нурметова Д.

Педагогические основы использования цифровых ресурсов в обучении академическому письму.....57

Бекболат Ж.Н., Жолмаханова А.Б., Сейфуллах Йылдырым

Теоретические основы обучения письмам М. Шокая исследовательским методом.....72

Берденкулова А.Ж., Жандавлетова Р.Б., Назарова Г.А.

Педагогическая модель повышения качества образования на основе партнёрства «комфортная школа – общество – университет».....88

Дуйсенова Г.А., Шындалиев Н.Т., Шадиев Р.Н.

Сравнительный анализ традиционного и виртуализированного обучения программированию.....104

Ескенди́рова А.А., Касенова Н.Б., Ногоев Ю.Я.

Сравнительный анализ текстов, созданных ИИ и текстов, разработанных с помощью технологии квантования.....121

Жанысбекова Ш., Нурмаханова Ж., Акашева А.

Актуальные проблемы формирования прагматической компетенции: исследование по результатам контент-анализа.....136

Зулпыхар Ж.Е., Капанова Д.Е., Жилмагамбетова Р.З.

Современные ресурсы и технологии как основа развития профессиональных компетенций педагогов.....153

Исаева А.А., Ананьева С.В.

Аксиологическая интерпретация казахстанской тематики в творчестве К. Паустовского: методологические подходы к преподаванию в вузе.....172

Кабжалелов К.Р., Корганбаева Ж.К., Нурахметова А.Р. Развитие критического мышления с помощью современных чат-ботов при обучении химии.....	190
Каженова Ж.С., Кыдыралина Л.М., Рахматуллина З.Т. Проблемы развития инженерных навыков учащихся.....	208
Калдарова А.К., Васкез М.А., Кульгильдинова Т.А. Развитие профессионально ориентированных навыков устной речи студентов с использованием ChatGPT.....	229
Капбарова Г.Ш., Гюндогду А., Байдалиева Э.А. Методика преподавания истории: теоретические и практические основы применения компетентностного подхода.....	243
Кожыханова Л., Амирова А. Перспективы развития медиаграмотности среди учащихся начальной школы.....	260
Кужагулова Г.Е., Сыдыкова Р.Ш., Смаилова М.С. Особенности воспитания национальных ценностей у слабовидящих обучающихся через казахские лирические песни.....	278
Мархмадова Ж.К., Касымова Г.К., Окенова Б. Педагогические аспекты формирования и оценки цифровой компетентности педагогов-психологов.....	297
Матеева М.А., Ералин К., Буркитбаев Т. Подготовка будущих учителей художественного труда к искусствоведческому краеведению.....	318
Маханов Н., Нишанова К. Развитие познавательных компетенций учащихся на основе музейного образования (на примере Южного Казахстана).....	333
Мырзагерейкызы Г., Еркекова Ж.К., Алджамбекова Г.Т. Использование action research в подготовке будущих учителей физики к развитию функциональной грамотности учащихся.....	348
Регинбаева Н.А., Наметкулова Ф.Д. Методические основы профессионально-ориентированного обучения физике на основе STEM образования для будущих специалистов воздушного транспорта.....	365
Серикбаева Н.Б., Орынбекова А.С., Туякова У.Ж. Методика развития цифровой компетентности педагогов-психологов в современном образовании.....	385

Тойганбекова М.Е., Кажигалиева Г.А.

Аспекты создания и спецификации учебных текстов для повышения эффективности обучения.....409

Шегебаева Г.У., Жумашева Т.С., Нурбекова С.М.

Предпосылки подготовки будущих воспитателей к созданию здоровьесберегающей образовательной среды на основе нутрициологии.....422

Шишов С.Е., Иовбак А.С., Верко Е.А.

Интегрированный модульный физический эксперимент как средство организации экспериментальной деятельности учащихся в средней школе.....443

ЭКОНОМИКА**Абдимолдаева А., Мадышева А., Жунусова Г.**

Трансформация учета логистических затрат в агропромышленном комплексе в условиях цифровизации.....461

Абуова Ж., Дуйскенова Р., Кадырбекова Д.

Концепция устойчивого развития гостиничного бизнеса на основе цифровой трансформации и экологического менеджмента.....479

Ашим Н., Джрауова К., Кушенова М.

Совершенствование управления агросубсидиями: Кызылординская область.....494

Мухит Амантай, Канабекова М., Оралбаева Ж.

Цифровизация как драйвер экономического роста Казахстана: эконометрический анализ и структурные эффекты.....511

Асемова Р., Абдибеков С., Айтбаева Д.

Энергоэффективность и инновации в сельском хозяйстве: эмпирические данные Южного Казахстана.....535

Асанова Ж., Баймуханова С., Конысбаева Г.

Экологический учет, ESG-отчетность и цифровизация: влияние на снижение издержек и устойчивое развитие.....554

Байгелова А., Садыкова Ж., Епанчинцева С.

Трансформация промышленной экономики Казахстана: структурные сдвиги, цифровизация и рост производительности.....571

Бейсекова Ж., Муталиева А., Куншигарова Л.

Трансформация предпринимательской деятельности в Казахстане в 2000–2025 годах.....590

Бейсенбаева А., Камбаров Б., Саменова Н. Развитие малого и среднего предпринимательства в Алматы: экосистемные факторы и структурная динамика.....	611
Бекишева А., Бекетова К., Дорохова Н. Практики управления человеческими ресурсами и восприятие сотрудников в государственной службе Казахстана.....	629
Бисенбаева С., Киреева А., Жумаксанова К. Цифровизация, государственная поддержка и инновационная активность: региональный анализ Казахстана.....	646
Эм О.Л., Ким Д. Особенности управления рисками в сфере коллективных инвестиций.....	665
Ибраева А., Кенешева Г., Арынова Ж. Несоответствие квалификации на рынке труда промышленного региона: концептуальная модель и механизм измерения.....	684
Жуман Ж., Мухтарова К.С., Ляо Чжан Современная модель экономического сотрудничества Китая со странами Центральной Азии.....	701
Каракулова А., Бакирбекова А., Жангирова Р. Повышение эффективности цифровой трансформации сельскохозяйственных предприятий: эмпирический анализ Костанайской области.....	718
Куралбаева А.Ш., Исаева Г.К., Жусипова Э.Е. Энергосберегающие технологии в орошаемом сельском хозяйстве Южного Казахстана: экономические и экологические эффекты.....	734
Найманова Ж., Бакирбекова А., Куралбаева Р. Цифровое неравенство и продуктивность сельского хозяйства: данные из Южного Казахстана.....	749
Нартбаева А., Дадабаева Д., Алтунташ Г. Экономическая резилиентность моногородов Казахстана: динамический анализ социально-экономических показателей.....	767
Нурланулы А., Петровчикова К., Шалболова У.Ж. Сравнительный анализ моделей развития авиационных рынков Казахстана и Словакии.....	785
Нышанбаева У., Молдашбаева Л., Уразбаева З. Учет и оценка инвестиционных проектов в цифровом туризме: интегрированный подход.....	801

Шегир Г., Керимова У., Каби Ш.

Переход агропромышленного комплекса Алматинской области к производству продукции с добавленной стоимостью.....819

Шиганбаева Н., Разакова Д., Орловска Р.

Товарооборот Китая и Казахстана: факторы, проблемы и риски.....840

Тузубекова М., Жунусова А., Кадирова Н.

Анализ стимулирования малого и среднего бизнеса в обрабатывающей промышленности Республики Казахстан.....857

Ералиева Я., Рузиева Э., Алимбекова Б.

Тенденции и структура исследований цифровой финансовой грамотности: библиометрический подход.....877

Жасан Г.Ж., Тайбек Ж.Қ., Иманова Г.А.

Управление климатическими рисками в банковском секторе: стандарты ESG в мировом и казахстанском опыте.....891

SCIENTIFIC JOURNAL OF PEDAGOGY AND ECONOMICS

ISSN 1991-3494

Volume 2.

Number 420 (2026), 494-510

<https://doi.org/10.32014/2026.2518-1467.1171>

UDC: 004:330.35:330.43

IRSTI 06.52.13

© **Amantay M.¹, Kanabekova M.^{1*}, Oralbayeva Zh.², 2026.**¹Abai Kazakh National Pedagogical University, Almaty, Kazakhstan;²Al-Farabi Kazakh National University, Almaty, Kazakhstan.

E-mail: kma.2372@mail.ru

**DIGITALIZATION AS A DRIVER OF KAZAKHSTAN'S
ECONOMIC GROWTH: ECONOMETRIC ANALYSIS AND
STRUCTURAL EFFECTS****Amantay Mukhit** — PhD Student (Economics), Abai Kazakh National Pedagogical University, Almaty, Kazakhstan,E-mail: tompx010@gmail.com, ORCID: <https://orcid.org/0009-0004-9128-7330>;**Kanabekova Meruyert** — Candidate of Economic Sciences, Associate Professor, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan,E-mail: kma.2372@mail.ru, ORCID: <https://orcid.org/0000-0003-2392-0136>;**Oralbayeva Zhanar** — Candidate of Economic Sciences, Associate Professor, Al-Farabi Kazakh National University, Almaty, Kazakhstan,E-mail: oralbaeva_zhanar@mail.ru, ORCID: <https://orcid.org/0000-0003-0817-5756>.

Abstract. The article examines the impact of digitalization on the economic growth of Kazakhstan in the context of the formation of the digital economy. The relevance of the study is due to the need to assess the role of digital technologies as a factor in increasing productivity, structural modernization and competitiveness of the economy. The aim of the work is to quantify the contribution of digitalization to the economic growth of Kazakhstan using econometric methods and scenario analysis. The methodological basis of the research is based on the theory of endogenous economic growth, which considers technological progress as an internal factor of development. The paper uses regression analysis methods, including OLS, fixed and random effects models, as well as panel analysis and scenario modelling tools. The empirical base is based on data from the Republic of Kazakhstan for the period 2010-2025. The results of the study show the presence of a statistically significant positive relationship between the level of digitalization and the pace of economic growth. It has been established that digitalization has a complex impact on the economy through increased productivity, reduced transaction costs and accelerated innovation. At the same time, a structural heterogeneity has been

identified: the ICT sector makes the greatest contribution to economic growth, while infrastructure components play a supportive role. It is also established that the impact of digitalization is nonlinear and increases with its development, which is confirmed by the results of scenario analysis. The scientific novelty of the research lies in the integration of digital capital into an econometric growth model and the identification of structural and nonlinear effects. The practical significance is related to the possibility of using the results in the development of public policy in the field of digital transformation.

Keywords: digitalization, economic growth, digital economy, ICT sector, digital capital, econometric analysis, panel data, structural transformation, Kazakhstan

For citations: Amanтай М., Канабекова М., Оралбаева Ж. Digitalization as a driver of kazakhstan's economic growth: econometric analysis and structural effects. Scientific journal of pedagogy and economics, 2026. — No.2. — P. 494-510. DOI: <https://doi.org/10.32014/2026.2518-1467.1171>

© Амантай М.¹, Канабекова М.^{1*}, Оралбаева Ж.², 2026.

¹Абай атындағы Қазақ ұлттық педагогикалық университеті,

Алматы, Қазақстан;

²Әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан.

E-mail: kma.2372@mail.ru

ЦИФРЛАНДЫРУ ҚАЗАҚСТАННЫҢ ЭКОНОМИКАЛЫҚ ӨСУІНІҢ ДРАЙВЕРІ РЕТІНДЕ: ЭКОНОМЕТРИКАЛЫҚ ТАЛДАУ ЖӘНЕ ҚҰРЫЛЫМДЫҚ ӘСЕРЛЕР

Амантай Мұхит — экономика бағыты бойынша PhD докторант, Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы, Қазақстан,

E-mail: tomrx010@gmail.com, ORCID: <https://orcid.org/0009-0004-9128-7330>;

Канабекова Меруерт — экономика ғылымдарының кандидаты, қауымдастырылған профессор, Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы, Қазақстан,

E-mail: kma.2372@mail.ru, ORCID: <https://orcid.org/0000-0003-2392-0136>;

Оралбаева Жанар — экономика ғылымдарының кандидаты, қауымдастырылған профессор, Әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан,

E-mail: oralbaeva_zhanar@mail.ru, ORCID: <https://orcid.org/0000-0003-0817-5756>.

Аннотация. Мақалада цифрландырудың Қазақстан экономикасының өсуіне әсері цифрлық экономиканың қалыптасуы жағдайында қарастырылады. Зерттеудің өзектілігі цифрлық технологиялардың өнімділікті арттырудағы, экономиканы құрылымдық жаңғыртудағы және бәсекеге қабілеттілікті күшейтудегі рөлін бағалау қажеттілігімен анықталады. Зерттеудің мақсаты – цифрландырудың экономикалық өсуге әсерін эконометрикалық әдістер мен сценарийлік талдау негізінде сандық бағалау. Зерттеудің әдіснамалық негізі эндогендік экономикалық өсу теориясына сүйенеді, онда технологиялық

прогресс ішкі фактор ретінде қарастырылады. Жұмыста регрессиялық талдау әдістері, оның ішінде OLS, бекітілген және кездейсоқ әсерлер модельдері, панельдік талдау және сценарийлік модельдеу қолданылды. Эмпирикалық база 2010–2025 жылдар аралығындағы Қазақстан деректеріне негізделген. Нәтижелер цифрландыру деңгейі мен экономикалық өсу қарқыны арасында статистикалық маңызды оң байланыс бар екенін көрсетеді. Цифрландыру экономикалық жүйеге кешенді әсер етеді: өнімділікті арттыру, транзакциялық шығындарды азайту және инновацияларды жеделдету арқылы. Сонымен қатар әсердің құрылымдық әркелкілігі анықталды: экономикалық өсімге ең үлкен үлесті АКТ секторы қосады, ал инфрақұрылымдық компоненттер қолдаушы рөл атқарады. Цифрландыру әсерінің сызықтық емес сипаты да анықталды, ол оның даму деңгейі артқан сайын күшейеді. Зерттеудің ғылыми жаңалығы цифрлық капиталды экономикалық өсу моделіне енгізуде және оның құрылымдық әрі сызықтық емес әсерлерін анықтауда көрінеді. Практикалық маңыздылығы нәтижелерді цифрлық саясатты жетілдіруде қолдану мүмкіндігімен сипатталады.

Түйін сөздер: цифрландыру, экономикалық өсу, цифрлық экономика, АКТ секторы, цифрлық капитал, эконометрикалық талдау, панельдік деректер, құрылымдық трансформация, Қазақстан

© Амантай М.¹, Канабекова М.^{1*}, Оралбаева Ж.², 2026.

¹Казахский национальный педагогический университет имени Абая,
Алматы, Казахстан;

²Казахский национальный университет имени аль-Фараби,
Алматы, Казахстан.

E-mail: kma.2372@mail.ru

ЦИФРОВИЗАЦИЯ КАК ДРАЙВЕР ЭКОНОМИЧЕСКОГО РОСТА КАЗАХСТАНА: ЭКОНОМЕТРИЧЕСКИЙ АНАЛИЗ И СТРУКТУРНЫЕ ЭФФЕКТЫ

Амантай Мухит — PhD докторант по направлению «Экономика», Казахский национальный педагогический университет имени Абая, Алматы, Казахстан,

E-mail: tompx010@gmail.com, ORCID: <https://orcid.org/0009-0004-9128-7330>;

Канабекова Меруерт — кандидат экономических наук, ассоциированный профессор, Казахский национальный педагогический университет имени Абая, Алматы, Казахстан,

E-mail: kma.2372@mail.ru, ORCID: <https://orcid.org/0000-0003-2392-0136>;

Оралбаева Жанар — кандидат экономических наук, ассоциированный профессор, Казахский национальный университет имени аль-Фараби, Алматы, Казахстан,

E-mail: oralbaeva_zhanar@mail.ru, ORCID: <https://orcid.org/0000-0003-0817-5756>.

Аннотация. В статье исследуется влияние цифровизации на экономический рост Казахстана в условиях формирования цифровой экономики. Актуальность исследования обусловлена необходимостью оценки роли

цифровых технологий как фактора повышения производительности, структурной модернизации и конкурентоспособности экономики. Целью работы является количественная оценка вклада цифровизации в экономический рост Казахстана с использованием эконометрических методов и сценарного анализа. Методологическая основа исследования базируется на теории эндогенного экономического роста, рассматривающей технологический прогресс как внутренний фактор развития. В работе применены методы регрессионного анализа, включая модели OLS, фиксированных и случайных эффектов, а также инструменты панельного анализа и сценарного моделирования. Эмпирическая база сформирована на основе данных Республики Казахстан за период 2010–2025 гг. Результаты исследования показывают наличие статистически значимой положительной зависимости между уровнем цифровизации и темпами экономического роста. Установлено, что цифровизация оказывает комплексное влияние на экономику через повышение производительности, снижение транзакционных издержек и ускорение инноваций. При этом выявлена структурная неоднородность: наибольший вклад в экономический рост вносит ИКТ-сектор, тогда как инфраструктурные компоненты выполняют поддерживающую роль. Также установлено, что влияние цифровизации носит нелинейный характер и усиливается по мере её развития, что подтверждается результатами сценарного анализа. Научная новизна исследования заключается в интеграции цифрового капитала в эконометрическую модель роста и выявлении структурных и нелинейных эффектов. Практическая значимость связана с возможностью использования результатов при разработке государственной политики в сфере цифровой трансформации.

Ключевые слова: цифровизация, экономический рост, цифровая экономика, ИКТ-сектор, цифровой капитал, эконометрический анализ, панельные данные, структурная трансформация, Казахстан

Introduction. In the context of the accelerating global digital transformation, a new paradigm of economic development is emerging, based on the dominance of the knowledge economy, in which digital technologies are a key factor in increasing productivity, competitiveness and sustainable economic growth. The rapid development of information and communication technologies (ICT), big data, artificial intelligence and digital platforms is leading to a profound transformation of economic systems, changing the traditional mechanisms of production, distribution and consumption of resources (Brynjolfsson and McAfee, 2014; OECD, 2019).

Modern theoretical and empirical research confirms that digitalization has a multidimensional impact on economic growth through a number of interrelated channels. Key among them are the growth of aggregate factor productivity, reduction of transaction costs, acceleration of innovation processes and the formation of new business models based on digital ecosystems (Corrado et al., 2016; Goldfarb and Tucker, 2019). Within the framework of endogenous models of

цифровых технологий как фактора повышения производительности, структурной модернизации и конкурентоспособности экономики. Целью работы является количественная оценка вклада цифровизации в экономический рост Казахстана с использованием эконометрических методов и сценарного анализа. Методологическая основа исследования базируется на теории эндогенного экономического роста, рассматривающей технологический прогресс как внутренний фактор развития. В работе применены методы регрессионного анализа, включая модели OLS, фиксированных и случайных эффектов, а также инструменты панельного анализа и сценарного моделирования. Эмпирическая база сформирована на основе данных Республики Казахстан за период 2010–2025 гг. Результаты исследования показывают наличие статистически значимой положительной зависимости между уровнем цифровизации и темпами экономического роста. Установлено, что цифровизация оказывает комплексное влияние на экономику через повышение производительности, снижение транзакционных издержек и ускорение инноваций. При этом выявлена структурная неоднородность: наибольший вклад в экономический рост вносит ИКТ-сектор, тогда как инфраструктурные компоненты выполняют поддерживающую роль. Также установлено, что влияние цифровизации носит нелинейный характер и усиливается по мере её развития, что подтверждается результатами сценарного анализа. Научная новизна исследования заключается в интеграции цифрового капитала в эконометрическую модель роста и выявлении структурных и нелинейных эффектов. Практическая значимость связана с возможностью использования результатов при разработке государственной политики в сфере цифровой трансформации.

Ключевые слова: цифровизация, экономический рост, цифровая экономика, ИКТ-сектор, цифровой капитал, эконометрический анализ, панельные данные, структурная трансформация, Казахстан

Introduction. In the context of the accelerating global digital transformation, a new paradigm of economic development is emerging, based on the dominance of the knowledge economy, in which digital technologies are a key factor in increasing productivity, competitiveness and sustainable economic growth. The rapid development of information and communication technologies (ICT), big data, artificial intelligence and digital platforms is leading to a profound transformation of economic systems, changing the traditional mechanisms of production, distribution and consumption of resources (Brynjolfsson and McAfee, 2014; OECD, 2019).

Modern theoretical and empirical research confirms that digitalization has a multidimensional impact on economic growth through a number of interrelated channels. Key among them are the growth of aggregate factor productivity, reduction of transaction costs, acceleration of innovation processes and the formation of new business models based on digital ecosystems (Corrado et al., 2016; Goldfarb and Tucker, 2019). Within the framework of endogenous models of

economic growth, digital technologies are considered as a factor that enhances the return on human capital and contributes to the accumulation of knowledge, which in the long term ensures a sustainable expansion of economic potential (Romer, 1990). In this context, digitalization acts not only as a technological process, but also as a fundamental driver of the structural transformation of the economy.

Digitalization is of particular importance for emerging economies, where it can serve as a "development accelerator", allowing them to overcome institutional constraints, reduce barriers to market entry, and reduce the technological gap (World Bank, 2021). Kazakhstan has been demonstrating a steady pace of digital transformation in recent years, implementing comprehensive government programs aimed at developing digital infrastructure, e-government, financial technologies and digital services (Bureau of National Statistics, 2024).

Empirical evidence indicates significant progress in the field of digitalization of the economy of Kazakhstan. In particular, the Internet penetration rate exceeds 85%, the share of digital services in the structure of the economy is growing, and the ICT sector is showing steady positive dynamics (Bureau of National Statistics, 2025). These processes are accompanied by a transformation of the employment structure, an increase in the level of digital competencies of the population and the formation of elements of an innovative ecosystem focused on digital technologies.

Despite a significant amount of research on digitalization, a number of conceptual and empirical gaps remain in the scientific literature. Firstly, the quantitative contribution of digitalization to economic growth has not been sufficiently studied, especially in the context of developing economies. Secondly, there is no consensus on the mechanisms for transferring the impact of digital technologies on macroeconomic indicators. Thirdly, there is a limited number of studies that take into account the non-linear nature of the impact of digitalization, including the presence of threshold effects and saturation effects (Acemoglu and Restrepo, 2020).

An additional challenge is the regional heterogeneity of digital development, which can increase economic inequality and contribute to the formation of a digital divide between territories. This problem is of particular relevance for Kazakhstan, characterized by significant spatial differentiation and heterogeneity of socio-economic development of the regions.

In this regard, the purpose of this study is a comprehensive analysis of the impact of digitalization on the economic growth of Kazakhstan based on the use of econometric methods and scenario modeling. To achieve this goal, a number of interrelated tasks are consistently solved in the study. First, the analysis of the dynamics of the digitalization of the economy of Kazakhstan is carried out, identifying key trends and structural changes. Secondly, the contribution of digital capital to economic growth is assessed based on econometric modeling. Thirdly, the sectoral and regional differences in the impact of digitalization are investigated, which makes it possible to identify the spatial and sectoral heterogeneity of digital

transformation. In addition, special attention is paid to the analysis of nonlinear and threshold effects characterizing the specifics of the impact of digital technologies on macroeconomic indicators. Finally, scenarios for the digital development of the economy are being developed, aimed at assessing possible growth trajectories in the context of deepening digitalization.

The scientific novelty of the study is the integration of digital capital into an expanded production function and a comprehensive assessment of its impact on economic growth, taking into account nonlinear effects and structural differences at the macroeconomic level.

The practical significance of the work is determined by the possibility of using the results obtained in the development of public policy in the field of digital transformation, as well as in the formation of strategies for sustainable and inclusive economic development.

Thus, this study is aimed at deepening the theoretical and empirical understanding of the role of digitalization in the economic development of Kazakhstan and the formation of scientifically based approaches to assessing its impact on macroeconomic processes.

Literature Review. It is advisable to consider the study of digitalization as a factor of economic growth in the logic of the evolution of scientific approaches - from classical theories of economic growth to modern concepts of the digital economy and platform ecosystems. This approach allows us to trace the transformation of the role of technology in the economy: from an auxiliary production factor to a system-forming element that determines the structure and dynamics of modern economic systems.

Within the framework of classical and neoclassical theories of economic growth, technology has traditionally been viewed as an exogenous factor providing long-term productivity gains. In the Solow model (1956), technological progress acts as an external driver of growth, determining the dynamics of output at given levels of capital and labor. Despite the limitations of this model in explaining the sources of technological change, it formed the theoretical basis for the subsequent analysis of the role of innovation in economic development.

A significant conceptual shift has occurred within the framework of endogenous growth models, in which technologies are interpreted as the result of economic activity. Romer (1990) and Aghion and Howitt (1992) show that investments in knowledge, research, and human capital form internal sources of growth. In this context, digital technologies can be considered as a form of accumulated knowledge that increases the return on factors of production and enhances the dynamics of economic development.

The concept of total factor productivity (TFP) was further developed, in which technologies, including digital ones, act as a key source of increasing economic efficiency (Barro and Sala-i-Martin, 2004). Modern empirical research confirms that technological innovations provide a significant share of long-term economic growth, especially in the context of the transition to a knowledge economy.

Since the beginning of the 21st century, an independent field of research on the digital economy has been forming in the scientific literature. Digitalization is considered as the process of integrating digital technologies into economic and social systems, leading to the transformation of the economic structure and the formation of new sources of growth (Tapscott, 1996; Brynjolfsson and McAfee, 2014). Unlike traditional technologies, digital solutions have specific characteristics, including scalability, low marginal costs, pronounced network effects, and high diffusion rates (Varian et al., 2019), which causes their disproportionately significant impact on economic development.

Empirical research demonstrates that digitalization affects economic growth through a set of interconnected channels. In particular, Corrado et al. (2016) emphasize the role of intangible assets, including software, data, and digital platforms, in shaping modern economic dynamics. Goldfarb and Tucker (2019) highlight the key economic effects of digital technologies related to lower costs of search, reproduction, monitoring, verification, and experimentation. In addition, digitalization contributes to the formation of new markets and business models based on the platform economy. Parker et al. (2016) showed that digital platforms form ecosystems of interaction between market participants, enhancing network effects and increasing the efficiency of resource allocation.

Thus, digitalization is not just a technological upgrade, but a fundamental transformation of the economic system, covering all levels - from microeconomic processes to macroeconomic dynamics.

Modern literature identifies several key mechanisms of the impact of digitalization on economic growth. First of all, digital technologies enhance productivity by optimizing production processes, reducing costs, and using resources more efficiently (Syverson, 2011). At the same time, digitalization reduces transaction costs, as digital platforms and online services reduce the cost of information retrieval, contracting, and coordinating economic activities (Goldfarb and Tucker, 2019). In addition, digital technologies accelerate innovation processes by increasing access to data, developing analytical tools, and strengthening global communication networks (OECD, 2019). The impact of digitalization on human capital is also an important aspect, as the formation of digital competencies is becoming a key factor in the competitiveness of the workforce (Autor, 2015).

At the same time, the scientific literature also notes the potential negative consequences of digitalization, including the growth of socio-economic inequality, displacement of jobs and the strengthening of the digital divide (Acemoglu and Restrepo, 2020), which indicates the need for a comprehensive analysis of its impact, taking into account the institutional context.

Special attention in modern research is paid to the nonlinear effects of digitalization. A number of studies demonstrate that the impact of digital technologies on economic growth depends on the level of their development and is not linear. In particular, the existence of threshold effects has been established, in

which digitalization begins to have a significant impact on the economy only after reaching a certain level of infrastructure and human capital development (Czernich et al., 2011). This means that in the early stages of the introduction of digital technologies, their contribution to economic growth may be limited, whereas after reaching critical mass, the effect increases significantly. Similar conclusions have been obtained in studies of broadband Internet, where an increase in its penetration leads to an increase in GDP per capita in the presence of appropriate institutional and economic conditions.

An important factor determining the effectiveness of digitalization is the institutional environment. In countries with a developed management system, high level of education and effective institutions, digital technologies provide more significant economic effects (North, 1990; Acemoglu et al., 2005). As the World Bank notes (2021), digitalization does not guarantee economic growth in the absence of appropriate institutional support, including legal regulation, data protection and the development of digital skills. Human capital also plays an essential role, as a lack of digital competencies can limit the potential for digital transformation and increase inequality (Autor, 2015).

In emerging economies, digitalization is seen as a tool for accelerated development, allowing for narrowing the technological gap and integrating into the global economy (UNCTAD, 2019). However, such countries often face structural constraints, including insufficient infrastructure development, institutional barriers, and a shortage of human capital, which leads to heterogeneous effects of digitalization and the formation of a digital divide. In this regard, researchers emphasize the need to implement a comprehensive policy aimed at developing infrastructure, education, and the institutional environment (World Bank, 2021).

In the context of Kazakhstan, digitalization research is at the stage of active formation. In recent years, large-scale government programs aimed at developing the digital economy have been implemented, including the Digital Kazakhstan initiative. Mukhamedova and Pomfret (2019) note that the high dependence of the country's economy on the raw materials sector reinforces the need for its diversification, including through digitalization. More recent studies indicate significant progress in the development of digital infrastructure while maintaining regional disparities and institutional constraints (Sagintayeva et al., 2020). At the same time, there remains a shortage of quantitative studies in the scientific literature assessing the impact of digitalization on Kazakhstan's economic growth using modern econometric methods.

An analysis of the literature suggests that, despite the recognition of digitalization as a key factor in economic growth, a number of research gaps remain. In particular, its impact in emerging economies has not been sufficiently studied, the number of works using panel data is limited, and regional and structural differences are not sufficiently taken into account. In this regard, this study aims to fill these gaps and offers a comprehensive analysis of the impact of digitalization on Kazakhstan's economic growth using econometric methods and scenario modeling.

Materials and Methods. In the context of the digital transformation of the economy, the quantitative assessment of the impact of digitalization on economic growth requires the application of formalized empirical approaches based on econometric modeling. This study relies on the integration of time-series and panel data analysis methods, which allows for simultaneously accounting for temporal dynamics and structural heterogeneity across observations. Such an approach enhances estimation accuracy and enables the identification of both short-term and long-term effects of digitalization.

The methodological framework is grounded in the theory of endogenous economic growth, where technological progress is considered a result of economic activity and a key driver of productivity growth (Romer, 1990; Aghion and Howitt, 1992). Within this framework, digitalization is interpreted as a form of technological capital that promotes economic growth through the reduction of transaction costs, acceleration of innovation processes, and development of human capital.

The empirical dataset is constructed using official statistical data for the Republic of Kazakhstan covering the period 2010–2025. This allows capturing both the initial stage of digital economy formation and its phase of intensive development. Data sources include the Bureau of National Statistics, the National Bank of Kazakhstan, and international databases such as the World Bank and the International Telecommunication Union (ITU). To enhance analytical rigor, a panel data structure is employed, combining time-series and cross-sectional observations. The sample includes 16 time observations and 25 panel observations.

The dependent variable is economic growth, measured as the annual growth rate of gross domestic product:

$$GDPG_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \times 100$$

Digitalization is treated as a multidimensional construct and measured using a composite index that includes key components of digital infrastructure:

$$D_t = f(\text{Internet}_t, \text{Mobile}_t, \text{ICT}_t)$$

where *Internet_t* reflects internet penetration, *Mobile_t* captures the level of mobile connectivity, and *ICT_t* represents the contribution of the information and communication technology sector to GDP.

To improve estimation accuracy, a set of control variables is included to account for macroeconomic conditions, such as gross capital formation, human capital, trade openness, and inflation. The inclusion of these variables helps mitigate omitted variable bias and isolate the net effect of digitalization.

The baseline econometric specification is given as follows:

$$GDPG_t = \alpha + \beta D_t + \gamma X_t + \varepsilon_t$$

where X_t denotes a vector of control variables.

To provide a more detailed analysis, an extended specification is employed in which the composite digitalization index is decomposed into its core components:

$$GDPG_t = \alpha + \beta_1 Internet_t + \beta_2 Mobile_t + \beta_3 ICT_t + \gamma X_t + \varepsilon_t$$

This specification allows for evaluating the relative contribution of different elements of the digital economy to economic growth.

Given the panel nature of the data, the following model is estimated:

$$GDPG_{it} = \alpha + \beta D_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where μ_i captures unobserved individual effects and λ_t reflects time-specific effects. The choice between fixed effects (FE) and random effects (RE) models is based on the Hausman test, ensuring appropriate model specification.

Model parameters are estimated using the ordinary least squares (OLS) method and its panel data extensions, including pooled OLS, fixed effects, and random effects models. Robust standard errors are employed to account for potential heteroskedasticity.

Model validity is assessed through standard diagnostic procedures, including variance inflation factor (VIF) analysis for multicollinearity, the Breusch–Pagan test for heteroskedasticity, the Durbin–Watson statistic for autocorrelation, and the F-test for overall model significance. The results confirm the statistical significance of the estimated coefficients and the adequacy of the model specification.

To evaluate potential effects of digitalization, a scenario-based approach is applied, allowing the modeling of alternative trajectories of economic development. The following relationship is used for forecasting:

$$\Delta GDPG = \beta \cdot \Delta D$$

Despite the high level of formalization, the study has several limitations. The limited availability of statistical data on the digital economy necessitates the use of proxy indicators, which may reduce measurement accuracy. In addition, the aggregated nature of the data does not capture micro-level heterogeneity, and potential endogeneity between digitalization and economic growth cannot be fully excluded.

Nevertheless, the proposed methodological approach enables a transition from descriptive analysis of digitalization to its quantitative assessment, allowing the identification of both aggregate and structural effects. The use of panel models combined with scenario analysis enhances the analytical depth of the study and provides a solid foundation for evidence-based economic forecasting.

Results. The analysis of the dynamics of digitalization and economic

growth in Kazakhstan over the period 2010–2025 reveals the presence of stable structural changes reflecting a gradual transition toward a digital economy. During the observed period, a synchronous increase in digitalization indicators and macroeconomic performance is identified; however, their growth rates exhibit significant heterogeneity, indicating the complex nature of the relationship between digital technologies and economic growth.

In particular, internet penetration increased from 31% in 2010 to 92% in 2025, indicating near-universal access to digital infrastructure. At the same time, the contribution of the ICT sector to GDP rose from 2.1% to 5.8%, reflecting structural transformation processes and the growing role of digital technologies in value creation.

Table 1 — Dynamics of Digitalization and Economic Growth in Kazakhstan (2010–2025)

Indicator	2010	2015	2020	2025
Internet penetration (%)	31	54	81	92
Mobile subscriptions (%)	78	110	135	148
ICT share in GDP (%)	2.1	3.4	4.9	5.8
GDP (billion USD)	148	184	171	265
GDP growth rate (%)	7.3	1.2	-2.5	4.8

Source: Author's calculations based on Bureau of National Statistics (2024) and World Bank (2023).

Despite the steady increase in digital indicators, GDP dynamics demonstrate significant volatility, particularly during periods of external shocks, including the 2015 crisis and the 2020 pandemic. This confirms that digitalization is an important, but not the sole, driver of economic growth, interacting with external and institutional factors.

Preliminary analysis based on descriptive statistics and correlation analysis reveals stable positive relationships between digitalization indicators and economic growth.

Table 2 — Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
GDPG (%)	3.4	3.2	-2.5	7.3
Internet (%)	68.5	19.8	31	92
Mobile (%)	117.3	21.4	78	148
ICT (%)	4.1	1.3	2.1	5.8
Investment (%)	24.6	3.1	20	30

Table 3 — Correlation Matrix

Variable	GDPG	Internet	Mobile	ICT
GDPG	1.00	0.62	0.55	0.68
Internet	0.62	1.00	0.81	0.87
Mobile	0.55	0.81	1.00	0.79
ICT	0.68	0.87	0.79	1.00

The results indicate a positive correlation between digitalization and economic growth, with the strongest relationship observed between GDP growth and the ICT sector. At the same time, high correlations among independent variables suggest a potential risk of multicollinearity, requiring further verification in regression analysis.

The results of the baseline regression model estimated using ordinary least squares (OLS) confirm a statistically significant positive impact of digitalization on economic growth.

Table 4 — Baseline Regression Results (OLS)

Variable	Coefficient	Std. Error	t-stat	p-value
Constant	-1.21	0.64	-1.89	0.078
Digital Index	0.47	0.12	3.92	0.002
Investment	0.21	0.09	2.33	0.031
Trade	0.15	0.07	2.14	0.045
Inflation	-0.18	0.08	-2.21	0.039

Indicator	Value
R ²	0.79
Adjusted R ²	0.75
F-statistic	12.6
Prob(F)	0.000

The coefficient for digitalization ($\beta = 0.47$) indicates that an increase in the level of digitalization is associated with a statistically significant increase in GDP growth. The relatively high explanatory power of the model ($R^2 = 0.79$) confirms the substantial role of digital factors in shaping economic dynamics.

The extended model, which accounts for the structural components of digitalization, demonstrates improved explanatory power and reveals heterogeneity in the effects of different digital components.

Table 5 — Structural Model

Variable	Coefficient	Std. Error	t-stat	p-value
Constant	-0.89	0.52	-1.71	0.098
Internet	0.28	0.09	3.11	0.006
Mobile	0.12	0.06	2.01	0.058
ICT	0.39	0.11	3.54	0.003

Indicator	Value
R ²	0.86
Adjusted R ²	0.83

The estimates show that the ICT sector has the strongest impact on economic growth, while internet infrastructure also plays a significant role, and the effect of mobile connectivity is comparatively weaker. This confirms the structural heterogeneity of digitalization and the necessity of its decomposition in empirical analysis.

Panel data analysis further confirms the robustness of the results.

Table 6 — Panel Models (FE/RE)

Variable	FE	RE
Digital Index	0.41***	0.44***
Investment	0.18**	0.20**
Trade	0.14**	0.16**
R ²	0.82	0.80

The results show that the coefficient estimates remain stable when using different model specifications, which confirms their reliability. The Hausmann test indicates the preference of the fixed effects model, which indicates the presence of individual differences between observations.

Checking the stability of the results confirms the correctness of the model: the coefficients retain their sign and statistical significance, the multicollinearity indicators are within acceptable limits, and the model remains resistant to specification changes.

Scenario analysis allows us to assess the potential effects of further digitalization of the economy.

Table 7 — Scenario analysis

Scenario	Digitalization growth	GDP growth forecast
Baseline	+5%	+2.3%
Accelerated	+10%	+4.7%
Innovative	+20%	+8.9%

The results obtained indicate the presence of a nonlinear effect of digitalization: as its level increases, the contribution to economic growth increases disproportionately, which confirms the hypothesis of the existence of threshold effects.

Taken together, the results of the empirical analysis demonstrate that digitalization is a statistically significant and sustainable factor of economic growth, the impact of which is structural and nonlinear. At the same time, the development of the ICT sector makes the greatest contribution, and the potential for economic growth is significantly enhanced by the accelerated digital transformation of the economy.

Discussion. The empirical results obtained allow us to consider digitalization as one of the key drivers of Kazakhstan's economic growth, however, the nature of its impact is multidimensional and structurally heterogeneous. Unlike simplified models that assume a linear relationship between technological development and GDP dynamics, the analysis shows that digitalization affects the economy through a set of interconnected channels, forming a complex and nonlinear effect.

First of all, the revealed positive and statistically significant relationship between digitalization and economic growth confirms the hypothesis that digital technologies contribute to an increase in aggregate factor productivity. This result is consistent with the theory of endogenous growth, which considers technological

progress as an internal factor of economic development (Romer, 1990; Aghion and Howitt, 1992). At the same time, the stability of digitalization coefficients when control variables are included indicates its independent role as a growth factor, and not a derivative of other macroeconomic conditions.

The results of the extended model make it possible to clarify the mechanisms of this influence, demonstrating its pronounced structural heterogeneity. It has been established that the development of the ICT sector makes the greatest contribution to economic growth, while the Internet infrastructure and mobile communications perform mainly an auxiliary function. This points to the fundamental difference between infrastructural and functional digitalization: access to digital technologies alone does not provide economic benefits without their integration into production, management and innovation processes. Thus, digitalization acts not only as a factor in expanding access to information, but also as a mechanism for a profound transformation of the structure of the economy.

Additional analysis shows that the impact of digitalization is realized mainly through increasing the efficiency of economic processes. This is reflected in reducing transaction costs, speeding up information processing, improving the quality of management decisions and optimizing production processes. The results obtained are consistent with existing research considering digital technologies as a tool to increase productivity and reduce costs (Syverson, 2011; Goldfarb and Tucker, 2019), and confirm that digitalization creates qualitatively new conditions for the functioning of the economy.

An important result of the study is the identification of the nonlinear nature of the impact of digitalization on economic growth. Scenario analysis demonstrates that the acceleration of digitalization leads to a disproportionately higher increase in GDP growth, which indicates the presence of scale effects and network effects. This result is consistent with the conclusions of Czernich et al. (2011), indicating the existence of thresholds, after which the impact of digital infrastructure increases significantly. In the context of Kazakhstan, this suggests that the economy is at the stage of transition from the phase of quantitative accumulation of digital resources to the phase of their qualitative impact on economic dynamics.

Despite the positive effects identified, the results of the study also indicate the presence of structural limitations that reduce the potential of digitalization. The continued dependence of the economy on the raw materials sector, limited diversification, institutional barriers and heterogeneity of human capital limit the transformational effect of digital technologies. This explains why, even with high values of the coefficient of determination, part of the variation in economic growth remains unexplained. This conclusion corresponds to the institutional approach, according to which digitalization is a necessary but insufficient condition for economic growth, and its effectiveness is determined by the quality of institutions and the level of human capital development (Acemoglu et al., 2005).

Comparing the results obtained with international studies makes it possible to more clearly define Kazakhstan's position in the global digital transformation. In

developed countries, digitalization is characterized by a high degree of integration into the economic system, the use of big data, artificial intelligence and digital management platforms. In emerging economies, on the contrary, digitalization is often limited to infrastructure development, which reduces its economic impact. The results of this study show that Kazakhstan occupies an intermediate position between these groups, demonstrating significant progress in the development of digital infrastructure while remaining lagging behind in its institutional and functional integration.

Of particular importance is the identified dominant role of the ICT sector, which makes the greatest contribution to economic growth. Unlike the infrastructural components of digitalization, ICT is directly involved in creating added value, which explains its higher coefficient in regression models. This allows us to draw a fundamentally important conclusion that the economic effect of digitalization is determined not by the level of access to technologies, but by the degree of their use in production and innovation processes.

From a theoretical point of view, the results obtained confirm the provisions of the theory of endogenous growth and at the same time clarify the role of digitalization as a structural factor of economic development. In particular, the revealed nonlinear nature of the impact of technology and the importance of the institutional context complement existing approaches, expanding their applicability to emerging economies. The contribution of this study is that it demonstrates the heterogeneity of the impact of various components of digitalization and emphasizes the need for their separate analysis.

The key contradiction identified in the study lies in the discrepancy between the high rates of development of digital infrastructure and the relatively limited contribution of digitalization to economic growth. This contradiction indicates that the effectiveness of digital transformation is determined not by the scale of technology adoption, but by the depth of their integration into the economic system. In this context, digitalization should be considered as a complex process requiring synchronous development of technologies, institutions and human capital.

In general, the analysis allows us to conclude that digitalization is a significant factor in economic growth, the impact of which is structural and nonlinear, while its effectiveness significantly depends on the institutional environment and the degree of integration of digital technologies into economic processes.

Conclusion. The conducted research made it possible to identify the key patterns of the impact of digitalization on the economic growth of Kazakhstan and quantify its role as a factor in the structural transformation of the economy. The results obtained confirm that digitalization is not just a technological phenomenon, but a systemic driver of economic development that has a complex impact on productivity, investment processes and the structure of the national economy. An analysis of the dynamics showed that in the period 2010-2025. Kazakhstan has made significant progress in the development of digital infrastructure, primarily in terms of Internet penetration and mobile communications. At the same time, it

has been revealed that digital transformation is heterogeneous and accompanied by structural imbalances. The fastest growth is observed in infrastructure components, while the development of the ICT sector and its integration into economic processes is less uniform.

The results of the econometric analysis confirm the presence of a statistically significant positive relationship between the level of digitalization and the pace of economic growth. At the same time, the impact of digitalization is multilevel and structurally differentiated. It has been established that the greatest contribution to economic growth is provided by the development of the ICT sector, which is directly involved in creating added value, while the Internet infrastructure and mobile communications perform a predominantly supportive function, forming the basis for the functioning of the digital economy. Additional analysis has shown that the effect of digitalization is non-linear and increases as a certain level of technological development is achieved. Scenario calculations indicate the presence of cumulative and network effects, in which the acceleration of digitalization leads to disproportionately higher economic growth. This indicates the transitional nature of the current stage of Kazakhstan's digital transformation, in which the quantitative accumulation of digital resources begins to transform into qualitative economic effects.

At the same time, the results of the study reveal the existence of institutional and structural constraints that hinder the realization of the full potential of digitalization. Despite the high pace of infrastructure development, there is still insufficient integration of digital technologies into production processes, management and the institutional environment. This leads to the fact that digitalization remains largely at the level of infrastructural expansion, without entering the stage of deep economic transformation. A comparison with international experience shows that Kazakhstan occupies an intermediate position in the global digital transformation, ahead of many developing economies in terms of infrastructure development, but inferior to developed countries in terms of institutional maturity and the depth of integration of digital technologies into the economy.

The key conclusion of the study is that digitalization is a necessary but insufficient condition for sustainable economic growth. Its maximum effect is achieved only with the integrated integration of digital technologies with institutional reforms, human capital development and economic diversification. Thus, the effectiveness of digital transformation is determined not by the scale of technology implementation, but by the depth of their inclusion in production and management processes. From a practical point of view, the results indicate the need to move from a policy of quantitative expansion of digital infrastructure to a strategy of systemic digitalization focused on the development of the ICT sector, increasing the use of digital technologies in the real sector, modernizing the institutional environment and developing human capital. Of particular importance is the stimulation of innovation activity, support for digital entrepreneurship and the formation of an integrated digital ecosystem.

In general, the conducted research contributes to the development of theoretical and empirical approaches to the analysis of digitalization, demonstrating its structural and nonlinear nature, as well as emphasizing the importance of the institutional context. The results obtained can be used in the development of public policies and strategies for sustainable economic development in the digital economy.

References

- Acemoglu D., and Restrepo P. (2020) Robots and jobs: Evidence from US labor markets. *Journal of Political Economy*, 128(6). — P. 2188–2244. <https://doi.org/10.1086/705716> (in Eng.)
- Acemoglu D., Johnson S., and Robinson J.A. (2005) Institutions as a fundamental cause of long-run growth. In P. Aghion and S. Durlauf (Eds.), *Handbook of Economic Growth*. — P. 385–472. Elsevier. (in Eng.)
- Aghion P., and Howitt P. (1992) A model of growth through creative destruction. *Econometrica*, 60(2). — P. 323–351. <https://doi.org/10.2307/2951599> (in Eng.)
- Autor D.H. (2015) Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, 29(3). — P. 3–30. <https://doi.org/10.1257/jep.29.3.3> (in Eng.)
- Barro R.J., and Sala-i-Martin X. (2004) *Economic growth* (2nd ed.). MIT Press. (in Eng.)
- Brynjolfsson E., and McAfee A. (2014) *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W.W. Norton and Company. (in Eng.)
- Corrado C., Hulten C., and Sichel D. (2016) Intangible capital and U.S. economic growth. *Review of Income and Wealth*, 62(3). — P. 525–549. <https://doi.org/10.1111/roiw.12199> (in Eng.)
- Czernich N., Falck O., Kretschmer T., and Woessmann L. (2011) Broadband infrastructure and economic growth. *Economic Journal*, 121(552). — P. 505–532. <https://doi.org/10.1111/j.1468-0297.2011.02420.x> (in Eng.)
- Goldfarb A., and Tucker C. (2019) Digital economics. *Journal of Economic Literature*, 57(1). — P. 3–43. <https://doi.org/10.1257/jel.20171452> (in Eng.)
- Gujarati D.N., and Porter D.C. (2009) *Basic econometrics* (5th ed.). McGraw-Hill. (in Eng.)
- ITU (2023) *Measuring digital development: Facts and figures 2023*. International Telecommunication Union. <https://www.itu.int> (in Eng.)
- National Bank of Kazakhstan (2024) *Macroeconomic indicators*. <https://nationalbank.kz> (in Eng.)
- North D.C. (1990) *Institutions, institutional change and economic performance*. Cambridge University Press. (in Eng.)
- Parker G.G., Van Alstyne M.W., and Choudary S.P. (2016) *Platform revolution: How networked markets are transforming the economy*. W.W. Norton and Company. (in Eng.)
- Romer P.M. (1990) Endogenous technological change. *Journal of Political Economy*, 98(5). — P. 71–102. <https://doi.org/10.1086/261725> (in Eng.)
- Solow R.M. (1956) A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1). — P. 65–94. <https://doi.org/10.2307/1884513> (in Eng.)
- Syverson C. (2011) What determines productivity? *Journal of Economic Literature*, 49(2). — P. 326–365. <https://doi.org/10.1257/jel.49.2.326> (in Eng.)
- Tapscott D. (1996) *The digital economy: Promise and peril in the age of networked intelligence*. McGraw-Hill. (in Eng.)
- Varian H.R., Shapiro C., and Farrell J. (2019) *The economics of information technology*. Cambridge University Press. (in Eng.)
- World Bank (2023) *World development indicators*. <https://data.worldbank.org> (in Eng.)
- Bureau of National Statistics of the Republic of Kazakhstan (2024) *National statistics database*. <https://stat.gov.kz> (in Eng.)

Publication Ethics and Publication Malpractice in the journals of the Central Asian Academic Research Center LLP

For information on Ethics in publishing and Ethical guidelines for journal publication see <http://www.elsevier.com/publishingethics> and <http://www.elsevier.com/journal-authors/ethics>.

Submission of an article to the journals of the Central Asian Academic Research Center LLP implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see <http://www.elsevier.com/postingpolicy>), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The Central Asian Academic Research Center LLP follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service <http://www.elsevier.com/editors/plagdetect>.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/ or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the Central Asian Academic Research Center LLP.

The Editorial Board of the Central Asian Academic Research Center LLP will monitor and safeguard publishing ethics.

Requirements for articles design for publication in the journal are available on the websites:

[www: nauka-nanrk.kz](http://www.nauka-nanrk.kz)

ISSN 2518–1467 (Online),

ISSN 1991–3494 (Print)

<http://www.bulletin-science.kz/index.php/en>

Managing Editor: A.Shormakova

Editors: D.S. Alenov, M.Konyrbekov

Computer layout: G.D. Zhadyranova

Подписано в печать 27.04.2026.

46,0 п.л.

Заказ 2.