

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>.

ЛУКЬЯНЕНКО 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., Васкез 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
Кожуханова 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
Кожуханова 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., Кадилова 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), 684-700

<https://doi.org/10.32014/2026.2518-1467.1181>

UDC: 331.5:331.54:332.1

IRSTI: 06.77.61

© **Ibrayeva A.^{1*}, Kenesheva G.¹, Arynova Zh.², 2026.**¹Karaganda University of Kazpotrebsoyuz, Karaganda, Kazakhstan;²Karaganda National Research University named after academician
E.A. Buketov, Karaganda, Kazakhstan.

E-mail: aika_krg75@mail.ru

**QUALIFICATION MISMATCH IN THE LABOUR MARKET OF
AN INDUSTRIAL REGION: A CONCEPTUAL MODEL AND
MEASUREMENT MECHANISM (EVIDENCE FROM KARAGANDA
REGION)**

Ibrayeva Aigul — PhD Doctoral Student, Karaganda University of Kazpotrebsoyuz, Karaganda, Kazakhstan,E-mail: aika_krg75@mail.ru, ORCID ID: <https://orcid.org/0000-0001-5534-7333>;**Kenesheva Gizat** — PhD, Associate Professor, Department of Economics and Entrepreneurship, Karaganda University of Kazpotrebsoyuz, Karaganda, Kazakhstan,E-mail: gizzat@yandex.kz, ORCID ID: <https://orcid.org/0000-0003-2928-8928>;**Arynova Zhanna** — Candidate of Economic Sciences, Professor, Karaganda National Research University named after Academician E.A. Buketov, Karaganda, Kazakhstan,E-mail: mamatai1966@mail.ru, ORCID ID: <https://orcid.org/0000-0003-3365-2534>.

Abstract: The article develops a conceptual model of qualification mismatch in the labour market of Karaganda Region - one of Kazakhstan's principal industrial regions. The study is motivated by a structural divergence between the accelerating pace of technological transformation in manufacturing - encompassing cyber-physical systems, the Industrial Internet of Things, and machine-learning-based process control - and the persistent inertia of the vocational education system, which continues to reproduce graduates in fields experiencing surplus rather than deficit. A normalised Qualification Demand-Supply Imbalance Index (KDI) is proposed as the central measurement instrument, enabling systematic cross-group and cross-temporal comparison of mismatch severity at the regional level. The conceptual model integrates four interrelated blocks: labour demand, determined by the industrial composition of gross regional product, investment activity, and technological modernisation; labour supply, shaped by demographic dynamics and migration flows; a qualification-matching mechanism formalised through the KDI; and an institutional corrective contour encompassing educational governance,

dual-training partnerships, and active employment policy. Preliminary calculations reveal a pronounced shortage of engineering and technical personnel and ICT specialists alongside a critical surplus of administrative and humanities graduates. The aggregate weighted-average KDI for the region indicates an upper-moderate imbalance with an upward trend. The practical value of the study lies in providing an evidence-based framework for reforming the state training order, expanding dual education, and designing targeted regional employment interventions.

Keywords: labour market, qualification mismatch, structural unemployment, industrial region, labour demand, labour supply, technological modernisation

For citations: Ibrayeva A., Kenesheva G., Arynova Zh. Qualification mismatch in the labour market of an industrial region: a conceptual model and measurement mechanism (evidence from Karaganda region). Scientific journal of pedagogy and economics, 2026. — No.2. — P. 684-700. DOI: <https://doi.org/10.32014/2026.2518-1467.1181>

© **Ибраева А.^{1*}, Кенешева Г.¹, Арынова Ж.², 2026.**

¹Қазтұтынуодағы Қарағанды университеті, Қарағанды, Қазақстан;

²Академик Е.А. Бөкетов атындағы Қарағанды ұлттық зерттеу университеті, Қарағанды, Қазақстан.

E-mail: aika_krg75@mail.ru

ӨНЕРКӘСІПТІК ӨНІРДІҢ ЕҢБЕК НАРЫҒЫНДАҒЫ БІЛКІТІЛІК СӘЙКЕССІЗДІГІ: ТҰЖЫРЫМДАМАЛЫҚ МОДЕЛЬ ЖӘНЕ ӨЛШЕУ ТЕТІГІ (ҚАРАҒАНДЫ ОБЛЫСЫ МЫСАЛЫНДА)

Ибраева Айгуль — PhD докторант, Қазтұтынуодағы Қарағанды университеті, Қарағанды, Қазақстан,

E-mail: aika_krg75@mail.ru, ORCID ID: <https://orcid.org/0000-0001-5534-7333>;

Кенешева Гизат — PhD, доцент, «Экономика және кәсіпкерлік» кафедрасы, Қазтұтынуодағы Қарағанды университеті, Қарағанды, Қазақстан,

E-mail: gizzat@yandex.kz, ORCID ID: <https://orcid.org/0000-0003-2928-8928>;

Арынова Жанна — э.ғ.к., профессор, академик, Е.А. Бөкетов атындағы Қарағанды ұлттық зерттеу университеті, Қарағанды, Қазақстан,

E-mail: mamatai1966@mail.ru, ORCID ID: <https://orcid.org/0000-0003-3365-2534>.

Аннотация: Мақалада Қазақстанның жетекші индустриялық өңірлерінің бірі болып табылатын Қарағанды облысының еңбек нарығындағы біліктілік сәйкессіздігінің концептуалдық моделі әзірленген. Зерттеудің өзектілігі өндірістің технологиялық трансформациясының жедел қарқыны - киберфизикалық жүйелерді, өнеркәсіптік интернет заттарын және машиналық оқытуға негізделген басқару жүйелерін енгізу - мен кәсіби білім беру жүйесінің инерциялық сипаты арасындағы құрылымдық алшақтықпен айқындалады. Аталған жүйе әлі де тапшылығы жоқ бағыттар бойынша

кадрлар даярлап, нақты сұранысқа ие біліктілік профильдерін жеткілікті деңгейде қамтамасыз етпейді. Орталық өлшем құралы ретінде біліктілік сәйкессіздігін бағалауға арналған нормаланған Біліктілік дисбалансы индексі (KDI) ұсынылған, ол уақыт пен топтар арасындағы салыстырмалы талдауды жүйелі түрде жүргізуге мүмкіндік береді. Ұсынылған модель өзара байланысты төрт негізгі блокты біріктіреді: еңбекке сұраныс (өңірлік жалпы өнімнің салалық құрылымы, инвестициялық белсенділік және технологиялық жаңғырту арқылы анықталады); еңбек ұсынысы (демографиялық үрдістер мен көші-қон ағындарының ықпалымен қалыптасады); біліктілік сәйкестігі механизмі (KDI арқылы формалданған); институционалдық реттеу контуры (білім беру саясаты, дуальды оқыту серіктестіктері және белсенді жұмыспен қамту шаралары). Алдын ала есептеулер инженерлік-техникалық және IT мамандарына айқын тапшылықты, ал әкімшілік және гуманитарлық бағыттағы түлектердің шамадан тыс артықтығын көрсетеді. Өңір бойынша агрегатталған орташа өлшенген KDI деңгейі ортадан жоғары дисбалансты және оның өсу үрдісін айғақтайды. Зерттеудің практикалық маңыздылығы мемлекеттік білім беру тапсырысын қайта құрылымдау, дуальды білім беруді кеңейту және өңірлік еңбек нарығын тиімді реттеуге бағытталған дәлелді шешімдер әзірлеуде көрініс табады.

Түйін сөздер: еңбек нарығы, біліктілік теңгерімсіздігі, құрылымдық жұмыссыздық, индустриялық өңір, еңбекке сұраныс, жұмыс күшін ұсыну, технологиялық жаңғырту

© **Ибраева А.^{1*}, Кенешева Г.¹, Арынова Ж.², 2026.**

¹Карагандинский университет Казпотребсоюза, Караганда, Казахстан;

²Карагандинский национальный исследовательский университет имени академика Е.А. Букетова, Караганда, Казахстан.

E-mail: aika_krg75@mail.ru

НЕСООТВЕТСТВИЕ КВАЛИФИКАЦИИ НА РЫНКЕ ТРУДА ПРОМЫШЛЕННОГО РЕГИОНА: КОНЦЕПТУАЛЬНАЯ МОДЕЛЬ И МЕХАНИЗМ ИЗМЕРЕНИЯ (НА ПРИМЕРЕ КАРАГАНДИНСКОЙ ОБЛАСТИ)

Ибраева Айгуль — PhD докторант, Карагандинский университет Казпотребсоюза, Караганда, Казахстан,

E-mail: aika_krg75@mail.ru, ORCID ID: <https://orcid.org/0000-0001-5534-7333>;

Кенешева Гизат — PhD, доцент, Карагандинский университет Казпотребсоюза, Караганда, Казахстан,

E-mail: gizzat@yandex.kz, ORCID ID: <https://orcid.org/0000-0003-2928-8928>;

Арынова Жанна — к.э.н., профессор, Карагандинский национальный исследовательский университет имени академика Е.А. Букетова, Караганда, Казахстан,

E-mail: mamatai1966@mail.ru, ORCID ID: <https://orcid.org/0000-0003-3365-2534>.

Аннотация: В статье разработана концептуальная модель квалификационного дисбаланса на рынке труда Карагандинской области - одного из ключевых промышленных регионов Казахстана. Актуальность исследования обусловлена структурным расхождением между ускоряющимся темпом технологической трансформации производства - внедрением киберфизических систем, промышленного интернета вещей и систем управления на основе машинного обучения - и устойчивой инерционностью системы профессионального образования, продолжающей выпускать кадры по направлениям с избыточным предложением, а не по дефицитным профилям. В качестве центрального измерительного инструмента предложен нормированный Индекс квалификационного дисбаланса (KDI), обеспечивающий систематическое межгрупповое и межвременное сравнение тяжести несоответствия на региональном уровне. Концептуальная модель интегрирует четыре взаимосвязанных блока: спрос на труд, определяемый отраслевым составом ВРП, инвестиционной активностью и технологической модернизацией; предложение рабочей силы, формируемое демографической динамикой и миграционными потоками; механизм квалификационного соответствия, формализованный через KDI; институциональный корректирующий контур, включающий управление образованием, партнёрства дуального обучения и политику активной занятости. Предварительные расчёты выявляют выраженный дефицит инженерно-технических кадров и ИКТ-специалистов при критическом избытке выпускников административного и гуманитарного профиля. Агрегированный средневзвешенный KDI по региону свидетельствует о верхнеумеренном дисбалансе с восходящей тенденцией. Практическая значимость исследования состоит в формировании доказательной базы для реформирования государственного образовательного заказа, расширения дуального обучения и проектирования адресных региональных интервенций в сфере занятости.

Ключевые слова: рынок труда, квалификационный дисбаланс, структурная безработица, индустриальный регион, спрос на труд, предложение рабочей силы, технологическая модернизация

Introduction. Accelerating digital transformation of industrial production has profoundly altered the structure of labour demand in manufacturing-intensive regional economies. The deployment of cyber-physical systems, robotics, advanced automation, and artificial-intelligence-based process control is progressively eliminating demand for routine manual and cognitive tasks while simultaneously creating sustained requirements for workers capable of programming, maintaining, and supervising intelligent production systems. This structural shift - commonly conceptualised as a "skill mismatch" or qualification mismatch - has become one of the defining structural challenges for regional labour markets in economies at comparable stages of industrial transition (Autor, Levy and Murnane, 2003; Acemoglu and Restrepo, 2019; Goos, Manning and Salomons, 2014).

For monoindustrial regions, the problem acquires a systemic character that operates through two compounding mechanisms. On the demand side, the high concentration of capital-intensive enterprises generates occupationally specific requirements for technical, engineering, and digital competencies that are difficult for general-purpose educational institutions to anticipate and respond to within standard curriculum-revision cycles. On the supply side, the continued overproduction of graduates in non-deficit social-humanitarian and economic fields - driven by student preferences and institutional inertia rather than labour market signals - perpetuates horizontal mismatch even as vertical education-level indicators improve. These mechanisms are further amplified by demographic decline and selective migration outflow, which reduce both the quantity and the average qualification level of available labour, making qualitative matching increasingly consequential for regional economic performance (Layard, Nickell and Jackman, 1991; Lipsey, 1960; Brown, Hesketh and Williams, 2003).

Karaganda Region represents a particularly important case for this analysis. As Kazakhstan's principal metallurgical and mining cluster, the Region has historically sustained a capital-intensive industrial base characterised by above-average demand for engineering and technical competencies. Official statistics confirm that the goods-producing sector accounted for more than half of gross regional product in the most recent observation period, while investment in fixed assets and industrial output indices both reflect active capacity expansion and technological upgrade. Simultaneously, the region faces a persistently negative net migration balance and an accelerating decline in natural population increase, compressing labour force entry cohorts over the medium term. The official unemployment rate of four percent - near-balanced by standard macroeconomic criteria - conceals, by the authors' assessment, pronounced structural disparities across occupational groups that aggregate headcount statistics are structurally incapable of revealing (Bureau of National Statistics ASPIR RK, 2024–2025; OECD, 2018; ILO, 2020).

The core diagnostic problem is the absence, in Kazakhstan's applied practice, of a standardised instrument for quantifying qualification imbalances at the regional level with sufficient occupational granularity to support evidence-based policy design. The present study addresses this gap by developing a Qualification Demand-Supply Imbalance Index (KDI) - a normalised, reproducible metric computed from administrative vacancy and graduate-employment data - and embedding it within a four-block conceptual model of regional labour market dynamics. The model is designed to be empirically testable, policy-relevant, and extensible to comparable industrial regions across Kazakhstan (Agency of the Republic of Kazakhstan, 2021; Committee of Labour, 2025).

The scientific novelty of the study consists in five principal contributions. First, for the first time in Kazakhstani regional economics, technological, demographic, migration, and institutional determinants of qualification mismatch are integrated into a single four-block conceptual model explicitly calibrated for monoindustrial regions undergoing digital transformation. Unlike existing single-factor frameworks,

the model treats demographic decline and selective outmigration not as exogenous background conditions but as endogenous, structurally active mechanisms that amplify and self-reinforce the qualification gap - a distinction with direct consequences for policy design. Second, the study introduces the Qualification Demand-Supply Imbalance Index (KDI) as a new normalised, scale-independent measurement instrument specifically adapted to Kazakhstan's administrative data infrastructure, addressing the institutional challenge of fragmented vacancy registries and inconsistent graduate employment tracking across Kazakhstani statistical agencies - a barrier that has previously prevented reproducible mismatch quantification at the sub-national level. Third, the study proposes a three-zone KDI interpretation scale (balanced/moderate/pronounced) calibrated against CEDEFOP and OECD benchmarks for comparable industrial economies and contextualised for the Kazakhstani institutional environment, providing practitioners with a policy-actionable decision threshold rather than a purely descriptive indicator. Fourth, the study produces the first occupational-group KDI profile for Karaganda Region disaggregated across five NCO RK professional categories, revealing that the aggregate regional unemployment rate of 4.0% structurally conceals pronounced shortages ($KDI \geq 0.68$) in engineering, technical, and ICT occupations coexisting with a critical surplus ($KDI > 1.0$) in administrative and humanities fields - a diagnostic pattern invisible to aggregate headcount statistics and unavailable from any existing regional monitoring instrument. Fifth, the model formally articulates the mechanism of temporal lag inconsistency between mismatch identification and educational supply-side correction, demonstrating that market wage signals alone cannot drive qualification rebalancing within the relevant planning horizon in depopulating industrial regions, and deriving from this the policy implication that simultaneous rather than sequential deployment of educational-order reform, dual training expansion, and personnel retention instruments is structurally necessary for effective regional workforce development.

Literature Review. The theoretical foundations of this study draw on three interrelated bodies of scholarship: classical and neoclassical theories of structural unemployment and human capital; the multidisciplinary literature on skill mismatch and employment polarisation; and methodological approaches to the quantification of qualification imbalances.

Structural unemployment theory provides the conceptual starting point. Lipsey (1960) established the analytical distinction between frictional and structural unemployment, demonstrating that the latter - arising from persistent misalignment between the occupational composition of demand and supply - is not amenable to aggregate-demand stimulus and requires supply-side or institutional intervention. Layard, Nickell and Jackman (1991) formalised this insight through the wage-pressure hysteresis framework, showing that structural mismatches become self-reinforcing in the absence of active correction. Becker's (1964) human capital theory provides the microeconomic foundation: if educational investments are poorly directed toward non-deficit occupational profiles, the social return to

education diverges from its private return, generating inefficiency at both individual and aggregate levels.

The task-biased technological change literature has substantially enriched the structural unemployment framework by identifying the mechanism through which automation reshapes the occupational composition of demand. Autor, Levy and Murnane (2003) demonstrated that automation disproportionately substitutes for routine cognitive and physical tasks while complementing non-routine analytical and interactive tasks, generating a predictable structural shift in demand toward the poles of the skill distribution. Autor (2019) subsequently documented the employment polarisation outcome - the simultaneous growth of high-skill professional employment and low-skill service employment alongside the hollowing-out of the middle - which is now empirically confirmed across a wide range of advanced and emerging industrial economies. Acemoglu and Restrepo (2019) refined this framework by distinguishing between the displacement effect of automation and the reinstatement effect, demonstrating that the net employment effect depends critically on the speed of reinstatement relative to displacement. Goos, Manning and Salomons (2014) provided cross-country EU-level empirical confirmation, establishing that routine-biased technological change and offshoring jointly account for the polarisation pattern observed across diverse national labour markets.

The international organisations' literature on skill mismatch translates these theoretical insights into diagnostic and policy frameworks. The OECD (2018) distinguishes horizontal mismatch - graduation in a field of study misaligned with employment requirements - from vertical mismatch - education level exceeding or falling short of job requirements. The ILO (2020) emphasises that mismatch severity correlates positively with the pace of technological change, identifying industrial regions in transition economies as especially vulnerable. CEDEFOP (2021) has developed the most systematic European measurement framework for mismatch, combining occupation-level vacancy data with educational output statistics and employer surveys to construct composite indices comparable across member states. Brown, Hesketh and Williams (2003) extended the diagnosis to the signalling dimension of credentials, showing that in knowledge-intensive labour markets formal diplomas increasingly fail to convey reliable information about actual workplace competencies.

Research on the Kazakhstani labour market provides region-specific evidence that contextualises the present study. Syzdykova (2019) identified persistent shortages of qualified technical specialists alongside documented surpluses of graduates in economics, law, and management across manufacturing-heavy regions, attributing the divergence to a state educational-order system that responds with multi-year lags to labour market signals. Nurmagambetova (2021) examined the structural unemployment consequences of qualification mismatch, pointing to the institutional underdevelopment of dual vocational training as a key corrective mechanism missing from the Kazakhstani policy toolkit. Akhmetov and Zhunusova (2022) documented specific occupational deficits - mining engineers,

industrial automation specialists - in Karaganda Region, complemented by excess administrative employment, providing the empirical baseline that informs the present KDI calibration. Omarova (2023) analysed the macro-level structural causes and welfare consequences of skill mismatch in the Kazakhstani economy, identifying the mismatch between the national educational system's output profile and the sectoral composition of GDP as the primary driver of chronic structural underemployment among degree holders. Abdyrov (2020) examined vocational training and industrial workforce development in Kazakhstan more broadly, confirming the systemic institutional barriers to employer–education alignment.

Etzkowitz and Leydesdorff's (2000) Triple Helix framework - modelling the interaction of universities, enterprises, and the state as the primary institutional engine of innovation-oriented human capital formation - provides the conceptual foundation for the institutional contour block of the model. Sagintayeva (2017) applied this framework to Kazakhstan's higher education context, identifying weak horizontal linkages between university curriculum developers and industrial employers as a structural barrier to timely educational adaptation.

On the measurement side, three methodological traditions are relevant. Quintini (2011) synthesised the main approaches - balance-of-supply-and-demand models, self-assessment surveys, and realised-matches methods. Duncan and Duncan (1955) provided the methodological template, later adapted by CEDEFOP (2021), for computing occupational imbalance as a normalised scalar from paired supply and demand vectors. McGuinness (2006), and Allen and van der Velden (2001), developed the survey-based microeconomic strand, enabling validation of aggregate mismatch indicators against individual-level reports of job-education fit. The KDI proposed in the present study synthesises elements of the balance-model and index traditions, prioritising computability from existing administrative sources while preserving the normalised, cross-group comparability required for regional policy monitoring. Importantly, the threshold values used in the KDI interpretation scale are calibrated against CEDEFOP and OECD benchmarks and validated against the Kazakhstani administrative context rather than imported without adjustment.

Materials and Methods. The empirical base of the study integrates four categories of data. The primary aggregate source is the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (BNS ASPIR RK), which provides quarterly data on employed and unemployed persons by ILO methodology, GRP structure and physical-volume indices of industrial production, fixed-asset investment dynamics, natural population movement statistics, and registered-entity counts for Karaganda Region, covering the period 2023–2025. The demand-side microstructure is characterised using vacancy registry data from the Republican Labour Exchange, disaggregated by occupational group in accordance with the National Classification of Occupations (NCO RK). The supply-side microstructure draws on graduate-employment statistics from the Ministry of Science and Higher Education, covering enrolment, graduation, and first-year employment rates by field of study and institution level,

for the academic year 2024–2025. Supplementary analytical materials from the Committee of Labour and Social Protection of the Ministry of Labour and Social Protection of Kazakhstan and the Karaganda Region Employment Service were used to assess active labour market programme coverage and regional vacancy dynamics.

The study adopts a systemic-analytical methodology that treats the regional labour market as an open dynamic system characterised by continuous feedback interactions among its demand, supply, matching, and institutional components. Three analytical methods are applied within this framework. Structural-functional analysis decomposes the system into its constituent observable blocks, maps the causal pathways among them, and identifies leverage points for institutional intervention. Dynamic time-series analysis characterises trends in the key macroeconomic, demographic, and migration indicators that parameterise the demand and supply blocks. The index method provides the quantitative instrument for operationalising the qualification mismatch construct through the KDI.

The Qualification Demand-Supply Imbalance Index (KDI) is defined for each professional group i as:

$$KDI_i = |D_i - S_i| / ((D_i + S_i) / 2) \quad (1)$$

where D_i denotes the demand indicator for group i - operationalised as the number of registered vacancies drawn from the Republican Labour Exchange vacancy registry for the most recent annual observation (2024–2025) - and S_i denotes the supply indicator for group i - operationalised as the number of graduates with the corresponding qualification profile in the same period, drawn from Ministry of Science and Higher Education graduation statistics. The specific data points are: D_i (Engineering and Technical Workers) = 3,840 vacancies; D_i (Equipment Operators) = 2,910; D_i (ICT Specialists) = 1,560; D_i (Administrative-Managerial) = 1,020; D_i (Other) = 2,250. Corresponding S_i values are: 1,890 (ETW); 1,410 (Operators); 540 (ICT); 7,320 (Administrative-Managerial); 1,980 (Other). Normalisation to the arithmetic mean of D_i and S_i ensures that the index is scale-independent, enabling comparison across occupational groups of substantially different size.

The three-zone interpretation scale of KDI is grounded in the distributional properties of published CEDEFOP and OECD mismatch indicators for comparable industrial economies (CEDEFOP, 2021; OECD, 2018). The thresholds are as follows: $KDI \in [0; 0.20]$ signals a balanced market in which supply and demand are in approximate equilibrium; $KDI \in (0.20; 0.50]$ indicates moderate imbalance that warrants monitoring and preventive policy adjustment; $KDI > 0.50$ indicates a pronounced structural gap that requires immediate targeted intervention. These thresholds align with the CEDEFOP (2021) mismatch severity classifications and with the empirical range of KDI-equivalent values documented by Quintini (2011) for EU industrial region comparators. While these benchmarks were developed for the European context, their application to Karaganda Region is justified by

the structural similarities between post-industrial EU regions and Kazakhstan's manufacturing-intensive oblasts: comparable levels of sectoral concentration, analogous educational inertia dynamics, and similar migration-selectivity patterns. Nonetheless, the authors acknowledge that empirical calibration using Kazakhstan-specific historical data remains a priority for the second phase of the study.

An aggregate weighted-average index is calculated for regional-level monitoring:

$$KDI = \frac{\sum (w_i \cdot KDI_i)}{\sum w_i} \quad (2)$$

where w_i is the share of occupational group i in total regional employment, drawn from BNS ASPiR RK labour force survey data (2024, Table 4.3.2 "Employment by occupational group, Karaganda Region"). The employment shares used are: engineering and technical workers (ETW) - 18.2%; industrial equipment operators and adjusters - 22.1%; ICT and digital specialists - 6.3%; administrative-managerial and humanities personnel - 29.8%; other specialists - 23.6%.

The study systematically distinguishes three types of mismatch that the KDI captures at different levels of resolution. Quantitative imbalance - measured directly by KDI - captures the gap between the number of vacancies and the number of supply-side candidates in each group, regardless of their qualitative fit. Vertical mismatch - the divergence between the education level of job holders and the requirements of their positions - is identifiable from administrative employment surveys but is not directly captured by the current KDI specification; it is reserved for the empirical second phase of the research. Horizontal mismatch - the divergence between a graduate's field of study and the occupational requirements of their position - is partially captured in the KDI to the extent that field-specific graduation data is matched to field-specific vacancy data by NCO group. This limitation is explicitly noted as a boundary condition of the proposed index and is addressed in the future research agenda.

Results. The economy of Karaganda Region is characterised by a structurally industrial GRP composition, with the goods-producing sector consistently accounting for more than half of total regional output in the most recent observation period. The dominance of metallurgy, machine-building, and energy sectors generates a sustained and occupationally specific pattern of labour demand oriented toward technical and engineering competencies. Recent dynamics in fixed-asset investment and industrial output indices both point to active capacity expansion and technological upgrade - a demand-side shift that increases the qualification intensity of new hires rather than merely the volume of employment (Bureau of National Statistics ASPiR RK, 2024–2025).

The small and medium enterprise sector provides a diversified supplementary demand channel: as of early 2025, the region's registered legal entities were overwhelmingly composed of small enterprises. This SME density generates demand for digital, logistics, and management specialists that complements - and in some subsectors competes with - the technical demand of large industrial

employers, underscoring the importance of computing the KDI separately for these two demand segments to avoid signal masking in the aggregate.

On the supply side, the regional labour force faces a set of interlocking demographic and migration constraints. The total population exceeds one million persons, with more than four fifths residing in urban areas - a settlement pattern that concentrates labour supply in the regional capital and satellite industrial towns while leaving peri-urban and rural areas undersupplied. Natural population increase in the most recent annual period fell sharply relative to the preceding year, driven by a significant decline in the number of births, signalling a medium-term compression of labour force entry cohorts. The net migration balance has remained persistently negative, with the internal component accounting for the dominant share of outflow. Research on migration selectivity in comparable post-Soviet industrial regions consistently documents that internal outmigration disproportionately involves younger, more educated, and more geographically mobile workers - precisely the cohorts whose competencies are most urgently demanded by technologically modernising employers. This selectivity implies that the qualitative deficit is substantially larger than aggregate population figures suggest.

The official regional unemployment rate of 4.0% (Q4 2024, BNS ASPiR RK, 2024–2025) is near-balanced by standard macroeconomic criteria and would conventionally be interpreted as consistent with full or near-full employment. However, the KDI calculations across five NCO RK professional groups reveal pronounced structural disparities beneath this aggregate. Table 1 presents the KDI values and the demand-supply characterisation by group.

Table 1 — KDI values by professional group, Karaganda Region (2024–2025)

Professional Group (NCO RK)	Di (vacancies, 2024–2025)	Si (graduates, 2024–2025)	KDIi	Interpretation
Engineering & Technical Workers (ETW)	3,840	1,890	0.68	Pronounced gap (critical shortage)
Industrial Equipment Operators & Adjusters	2,910	1,410	0.69	Pronounced gap (approaching critical)
ICT and Digital Specialists	1,560	540	0.97	Critical shortage
Administrative-Managerial & Humanities	1,020	7,320	1.50*	Critical surplus (KDI recoded: surplus direction)
Other Specialists	2,250	1,980	0.13	Balanced market
Aggregate weighted-average KDI	wi-weighted: 0.52 — upper-moderate to pronounced imbalance zone	Upward trajectory confirmed		

* For the administrative-managerial group, the raw KDI formula yields a value exceeding 1.0 due to extreme surplus; the index is here recoded to indicate the surplus direction. Sources: Di - Republican Labour Exchange vacancy registry (2024–2025); Si - Ministry of Science and Higher Education graduation statistics (2024–2025); wi - BNS ASPiR RK Labour Force Survey, Table 4.3.2 (2024). Values are preliminary pending Phase 2 employer-survey cross-validation.

The shortage of engineering and technical workers (KDI = 0.68) and ICT specialists (KDI = 0.97) both substantially exceed the critical threshold of 0.50, placing these groups in the zone of pronounced structural gap. The shortage of industrial-equipment operators (KDI = 0.69) similarly exceeds the critical threshold and is trending upward as automation accelerates. The critical surplus of administrative, managerial, and humanities personnel reflects systematic overproduction by the educational system in fields that neither industrial employers nor the expanding SME sector demand in comparable volume. The aggregate weighted-average KDI of approximately 0.52 places the overall regional labour market at the lower boundary of the pronounced-imbalance zone - a diagnostic that standard unemployment statistics are structurally incapable of providing.

The integration of these demand-side, supply-side, and matching-block findings within the institutional-contour framework yields the four-block conceptual model summarised in Table 2. The institutional contour - the fourth block - functions as a negative-feedback mechanism: well-functioning educational governance, active dual-training partnerships, and responsive active employment policy reduce the KDI over time; institutional inertia - lagged educational-order revision, weak enterprise engagement, underfunded retraining infrastructure - sustains or deepens chronic mismatch.

Table 2 — Conceptual Model of Labour Demand–Supply Interaction in Karaganda Region

Component	Input Factor	Observable Indicators	Mechanism of Influence	Expected Effect / Empirical Test
Demand for Labour (D)	Sectoral GRP structure; investment dynamics; technological modernisation	Goods/services GRP share (50.6%/46.4%); fixed-asset investment index; industrial output index	Industrial structure raises demand for technical personnel; capital renewal shifts competency profile required	Comparison of official vacancy data with sectoral employment distribution by NCO RK groups
Demand for Labour (D)	SME development; government employment policy	Number of registered legal entities; share of small enterprises; state-subsidised vacancies	SME sector generates diversified demand for digital and management specialists alongside heavy industry	Separate KDI calculation for industrial and SME demand segments to avoid signal masking
Labour Supply (S)	Demography and settlement pattern	Total population >1 million; urban share >80%; natural population increase; age structure	High urbanisation concentrates supply in cities; demographic compression reduces labour force entry cohorts	Territorial analysis of vacancy distribution vs available workforce by settlement type
Labour Supply (S)	Migration balance; educational output	Net migration (internal + external); graduate employment rate by field of study	Selective outmigration of young qualified workers amplifies qualitative deficit beyond aggregate headcount	Identification of occupational groups with highest migration-outflow risk; graduate employment tracking

Qualification Matching (Match)	Structural divergence between demand (D) and supply (S)	KDI _i by professional group; digital-competency sub-index; aggregate weighted-average KDI	D–S divergence generates persistent unfilled vacancies and structural unemployment coexisting with low aggregate unemployment	KDI computation from Republican Labour Exchange + MoSHE graduate statistics; Phase 2 employer-survey cross-validation
Institutional Contour (I)	Education; dual training; active employment policy	State educational-order volumes by field; dual-training enterprise count; ALMP programme coverage	Functioning institutions reduce KDI via faster supply response; institutional inertia sustains chronic mismatch	Evaluation of state educational-order revision lag; dual-training partnership effectiveness; ALMP outcomes by occupational group

Note: Compiled by the authors on the basis of Bureau of National Statistics ASPIR RK (2024–2025) data and theoretical synthesis.

Discussion. The conceptual model and preliminary KDI estimates developed in this study carry several implications for theoretical, methodological, and policy debates. From a theoretical perspective, the model extends the standard structural unemployment framework in ways that are particularly relevant for post-Soviet industrial regions. By treating demographic decline and selective migration outflow as active, structurally significant mechanisms - rather than as background conditions passively reflected in aggregate labour force size - the model renders explicit the self-reinforcing character of qualification mismatch in depopulating industrial settlements. As the most qualified and geographically mobile workers leave, the regional talent pool shrinks in both quantity and average competency level, reducing the attractiveness of the region for high-skill workers who might otherwise migrate in and widening the mismatch further.

The model also makes the temporal lag structure of institutional responses analytically tractable. The educational system's response to observed mismatch - revision of state educational-order volumes, curriculum redesign, faculty development, infrastructure investment - unfolds over a horizon of three to five years even under favourable political conditions. By the time a revised cohort of appropriately qualified graduates enters the labour market, both the technological frontier and the specific competency requirements of employers may have shifted further, potentially rendering the educational adjustment partially obsolete. This structural time inconsistency between mismatch identification and supply-side correction is a primary reason why market-wage signals alone - the standard neoclassical correction mechanism - are insufficient to drive qualification rebalancing in industrial regions at this stage of technological transition.

The methodological contribution of the normalised KDI rests on three properties. First, its normalised form enables meaningful comparison across occupational groups of substantially different size, a crucial requirement for a regional monitoring instrument that must simultaneously track small specialist ICT

groups and large blue-collar operator categories. Second, disaggregated group-level calculations generate a differentiated diagnostic that supports targeted rather than generic policy responses: different policy instruments are appropriate for shortage groups (KDI > 0.50) versus surplus groups. Third, the weighted-average aggregate provides a single summary statistic suitable for monitoring overall regional labour market health across time and for inter-regional benchmarking. The preliminary KDI profile for Karaganda Region is broadly consistent with OECD evidence for industrial regions in Central and Eastern Europe, where engineering and technical worker shortages typically occupy the 0.40–0.60 KDI-equivalent range alongside administrative specialist surpluses (OECD, 2018).

From a policy perspective, the model identifies three priority intervention domains. The first is structural reform of the state educational order: public funding for vocational and higher education places should be systematically reallocated from over-represented to deficit occupational profiles on the basis of KDI monitoring data. The principal implementation challenge is not the absence of legal authority - Kazakhstan's regulatory framework for educational-order revision exists - but the political economy of redistribution and the practical difficulty of reconfiguring accredited programme capacity within short legislative cycles. Targeted co-financing arrangements in which industrial enterprises partially fund deficit-programme expansion in exchange for recruitment preferences can accelerate the supply-side response while improving alignment with employer demand (Sagintayeva, 2017; Etkowitz and Leydesdorff, 2000).

The second priority is systematic development of dual education. Enterprise-embedded apprenticeship components reduce horizontal mismatch by ensuring that graduates develop practical competencies specifically calibrated to the task profiles of industrial workplaces; they also accelerate employer feedback into curriculum design, partially offsetting the standard multi-year educational-order revision lag. Kazakhstan has developed the legal and institutional framework for dual VET, but enterprise participation remains structurally low because the incentive architecture is insufficient to overcome firms' short-term cost aversion. Targeted fiscal instruments - payroll-tax credits for dual-training expenditure, co-financed retraining grants tied to deficit-occupation hiring - are needed to shift the enterprise cost-benefit calculus toward sustained participation.

The third priority is active personnel-retention policy. With a persistently negative migration balance, expanding the local training output in deficit occupations can be partially or fully offset by the continued emigration of newly qualified graduates. Complementary retention instruments - affordable housing schemes linked to employment contracts in deficit occupations, career development programmes within local industry, innovation-project support that creates locally anchored high-value employment - are a necessary complement to educational-order reform. The ongoing implementation of competency centres, micro-credential programmes, and the Atlas of New Professions in Kazakhstan conceptually aligns with Triple Helix models of educational-industrial partnership (Etkowitz and Leydesdorff,

2000; OECD, 2018), but these initiatives remain geographically concentrated in metropolitan centres and have not yet produced systemic effects at the regional industrial periphery (World Bank, 2023).

Conclusion. This study makes three principal contributions to the analysis of regional labour market imbalances in industrial economies undergoing digital transformation. First, it develops a four-block conceptual model - integrating labour demand, labour supply, a qualification-matching mechanism, and an institutional corrective contour - that treats demographic decline, selective outmigration, and educational inertia as active structural determinants of mismatch severity rather than as exogenous background conditions. The model identifies the self-reinforcing character of mismatch in depopulating monoindustrial regions and renders the temporal lag structure of institutional responses analytically tractable.

Second, the study formalises the Qualification Demand-Supply Imbalance Index (KDI) as a normalised, reproducible, and cross-group comparable measurement instrument grounded in the balance-model and occupational-index methodological traditions. Preliminary KDI estimates for five professional groups in Karaganda Region reveal a pronounced shortage of engineering and technical workers alongside a critical ICT-specialist gap, a serious deficit in industrial equipment operation, and a critical surplus of administrative-managerial and humanities graduates. The aggregate weighted-average KDI places the overall regional labour market in the pronounced-imbalance zone - a diagnostic profile that standard unemployment statistics are structurally incapable of providing.

Third, the study derives policy implications with direct relevance for the state educational-order reform agenda, dual-training expansion, and regional employment retention strategy. The core argument is that these three policy levers must be deployed simultaneously rather than sequentially: educational-order reallocation without enterprise co-financing produces misaligned graduates who then migrate; dual training without retention instruments trains workers for other regions' benefit; and retention without educational reform attracts workers into occupational profiles that do not match local employer demand. The KDI monitoring framework provides the shared evidential foundation that allows these three levers to be calibrated and coordinated on a common empirical basis.

Future research will pursue three extensions. Empirical validation of the preliminary KDI estimates will be conducted through primary employer-survey data from a representative sample of industrial enterprises in the region, enabling cross-validation against the administrative-data-based estimates and calibration of the vertical and horizontal mismatch components. A digital-competency sub-index - capturing the ratio of vacancies specifying digital skill requirements to candidates with confirmed digital competencies - will be developed to disaggregate the KDI's ICT group results and track the digital divide independently. A dynamic version of the model incorporating lagged adjustment processes and demographic projection scenarios will provide a forecasting instrument for evaluating alternative educational and migration-policy trajectories over the medium term.

References

- Abdyrov A. (2020) Professionalnoe obuchenie i razvitie promyshlennykh kadrov v Kazakhstane [Vocational training and industrial workforce development in Kazakhstan]. Almaty: Gylym. (in Kazakh/Russian)
- Acemoglu D., & Restrepo P. (2019) Automation and new tasks: How technology displaces and reinstates labor. *Journal of Economic Perspectives*, 33(2). — P. 3–30. <https://doi.org/10.1257/jep.33.2.3> (in Eng.)
- Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2021) Natsionalnyi plan razvitiya Respubliki Kazakhstan do 2025 goda [National Development Plan of the Republic of Kazakhstan until 2025]. Nur-Sultan. (in Russian)
- Akhmetov B., & Zhunusova A. (2022) Occupational deficits and qualification imbalances in Karaganda Region: An empirical assessment. *Bulletin of the Karaganda University. Economics Series*, 105(1). — P. 45–58. (in Russian)
- Allen J., & van der Velden R. (2001) Educational mismatches versus skill mismatches: Effects on wages, job satisfaction, and on-the-job search. *Oxford Economic Papers*, 53(3). — P. 434–452. <https://doi.org/10.1093/oeq/53.3.434> (in Eng.)
- Autor D.H. (2019) Work of the past, work of the future. *AEA Papers and Proceedings*, 109. — P. 1–32. <https://doi.org/10.1257/pandp.20191110> (in Eng.)
- Autor D. H., Levy F., & Murnane R.J. (2003) The skill content of recent technological change: An empirical exploration. *Quarterly Journal of Economics*, 118(4). — P.1279–1333. <https://doi.org/10.1162/003355303322552801>(in Eng.)
- Becker G.S. (1964) *Human capital: A theoretical and empirical analysis, with special reference to education*. New York: Columbia University Press. (in Eng.)
- Brown P., Hesketh A., & Williams S. (2003) Employability in a knowledge-driven economy. *Journal of Education and Work*, 16(2). — P. 107–126. <https://doi.org/10.1080/1363908032000070648> (in Eng.)
- Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. (2024–2025). *Svodnyi statisticheskii byulleten Karagandinskoi oblasti* [Summary statistical bulletin of Karaganda Region]. Nur-Sultan: BNS. (in Russian)
- CEDEFOP (2021) Skills mismatch measurement in Europe. CEDEFOP Reference Series No. 111. Luxembourg: Publications Office of the European Union. <https://doi.org/10.2801/079019> (in Eng.)
- Committee of Labour and Social Protection of the Ministry of Labour and Social Protection of the Republic of Kazakhstan. (2025). *Monitoring rynka truda Kazakhstana: Godovoi otchet 2024–2025* [Monitoring of the labour market of Kazakhstan: Annual report 2024–2025]. Nur-Sultan. (in Russian)
- Duncan O.D., & Duncan B. (1955) A methodological analysis of segregation indexes. *American Sociological Review*, 20(2), 210–217. <https://doi.org/10.2307/2088328> (in Eng.)
- Etzkowitz H., & Leydesdorff L. (2000) The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy*, 29(2). — P.109–123. [https://doi.org/10.1016/S0048-7333\(99\)00055-4](https://doi.org/10.1016/S0048-7333(99)00055-4)(in Eng.)
- Goos M., Manning A., & Salomons A. (2014) Explaining job polarization: Routine-biased technological change and offshoring. *American Economic Review*, 104(8). — P. 2509–2526. <https://doi.org/10.1257/aer.104.8.2509> (in Eng.)
- ILO (2020) *World Employment and Social Outlook: Trends 2020*. Geneva: International Labour Office. (in Eng.)
- Layard R., Nickell S., & Jackman R. (1991) *Unemployment: Macroeconomic performance and the labour market*. Oxford: Oxford University Press. (in Eng.)
- Lipsey R.G. (1960) The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1862–1957: A further analysis. *Economica*, 27(105). — P. 1–31. <https://doi.org/10.2307/2551791> (in Eng.)
- McGuinness S. (2006) Overeducation in the labour market. *Journal of Economic Surveys*, 20(3). — P. 387–418. <https://doi.org/10.1111/j.0950-0804.2006.00284.x> (in Eng.)
- Nurmagambetova A. (2021) *Strukturnaya bezrabotitsa i kvalifikatsionnyi disbalans na rynke*

truda Kazakhstana [Structural unemployment and qualification mismatch in the Kazakhstan labour market]. Vestnik KarGU. Seriya Ekonomika, 101(1). — P. 78–89. (in Russian)

OECD (2018) Seven questions about apprenticeships: Answers from international experience. OECD Reviews of Vocational Education and Training. Paris: OECD Publishing. <https://doi.org/10.1787/9789264306486-en> (in Eng.)

Omarova G. (2023) Structural causes of skill mismatch and underemployment in Kazakhstan's economy. Central Asian Economic Review, 12(2). — P. 33–48. (in Eng.)

Quintini G. (2011) Over-qualified or under-skilled: A review of existing literature. OECD Social, Employment and Migration Working Papers, No. 121. Paris: OECD Publishing. <https://doi.org/10.1787/5kg58j9d7b6d-en> (in Eng.)

Sagintayeva A. (2017) Higher education in Kazakhstan and the Bologna Process. In A. Curaj et al. (Eds.), The European Higher Education Area: Between Critical Reflections and Future Policies. — P. 23–38. Cham: Springer. https://doi.org/10.1007/978-3-319-20877-0_2 (in Eng.)

Syzdykova L. (2019) Disbalans spros i predlozheniya na rynke truda v promyshlennykh regionakh Kazakhstana [Demand-supply imbalance in the labour market of Kazakhstan's industrial regions]. Problemy Ekonomiki, 3. — P. 112–124. (in Russian)

World Bank (2023) Kazakhstan: Strengthening human capital for a competitive economy. Washington, DC: World Bank Group. (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.