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Determinants of Youth Unemployment in Kazakhstan and the Dynamics of the School-to-Work Transition

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Abstract

This study is devoted to a comprehensive analysis of the determinants of youth unemployment in Kazakhstan and the specifics of the transition from education to sustainable employment for young people. The aim of the work is to identify key structural, institutional and socio-economic factors that affect youth employment, as well as to assess the dynamics of Not in Employment, Education or Training (hereinafter – NEET) and employment indicators from 2020 to 2044. The methodological basis includes descriptive statistics, comparative analysis and correlation analysis. Initial data were obtained from official sources such as the Bureau of National Statistics of Kazakhstan, International Labor Organization, and World Bank, disaggregated by gender, region, and level of education. Results showed that between 2019 and 2039, the youth unemployment rate decreased from 7% to 6%, NEET decreased from 6% to 4%, and the proportion of informal employment fell from 18% to 9%.. Young women have consistently higher NEET rates (6.7% in 2024) than men (4.9%). The regions with the highest unemployment rates are Turkestan Oblast and Shymkent, at 7.8% and 7.2% respectively. Educational differences remain significant: the employment rate for young people with a higher education is 78%, compared to only 38.9% for those with basic secondary education. These results confirm the structural nature of youth unemployment, resulting from a mismatch between graduates' skills and job market demand, as well as regional imbalances and limited entry-level positions. Future research paths involve the development of more sophisticated quantitative models to evaluate government programs and their impact on job creation.

Keywords: Unemployment, Youth Unemployment, Social Factor, Social Policy, Informal Employment, Digital Transformation, Gender Gap

Қазақстандағы жастар жұмыссыздығының детерминанттары және еңбек нарығына көшу ерекшеліктері

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Түйін

Бұл зерттеу Қазақстандағы жастар жұмыссыздығының детерминанттарын және жас буынның білім алудан тұрақты жұмыспен қамтылуға көшу ерекшеліктерін кешенді талдауға арналған. Зерттеудің мақсаты – жастардың жұмыспен қамтылуына әсер ететін негізгі құрылымдық, институционалдық және әлеуметтік-экономикалық факторларды анықтау, сондай-ақ 2020–2024 жылдардағы NEET (Not in Employment, Education or Training) және жұмыспен қамтылу көрсеткіштерінің динамикасын бағалау. Әдістемелік база сипаттамалық статистиканы, салыстырмалы талдауды және корреляциялық талдауды қамтиды. Бастапқы деректер Қазақстан Республикасы Ұлттық статистика бюросының, Халықаралық еңбек ұйымының және Дүниежүзілік банктің ресми көздерінен алынып, жыныс, өңір және білім деңгейі бойынша бөлінген. Нәтижелер 2020–2024 жылдары жастар арасындағы жұмыссыздық деңгейі 7,0%-дан 6,2%-ға дейін, NEET үлесі 6,9%-дан 5,7%-ға дейін төмендегенін, ал бейресми жұмыспен қамту деңгейі 21,3%-дан 17,9%-ға дейін қысқарғанын көрсетті. Жас әйелдер арасындағы NEET көрсеткіші тұрақты түрде жоғары (2024 жылы 6,7%), ерлерге қарағанда (4,9%), ал жұмыссыздықтың ең жоғары деңгейі Түркістан облысында (7,8%) және Шымкент қаласында (7,2%) байқалады. Білім деңгейіне байланысты айырмашылықтар маңызды болып қала береді: жоғары білімді жастардың жұмыспен қамтылу деңгейі 78%-ға жетсе, негізгі орта білімі бар жастар арасында бұл көрсеткіш небәрі 38,9%-ды құрайды. Алынған нәтижелер жастар жұмыссыздығының құрылымдық сипатын растайды, ол түлектердің құзыреттері мен еңбек нарығындағы сұраныс арасындағы алшақтықты, өңірлік теңгерімсіздіктерді және сапалы бастапқы жұмыс орындарының шектеулілігін көрсетеді. Болашақ зерттеулер жолдары мемлекеттік бағдарламаларды бағалауға және олардың жұмыс орындарын құруға әсерін талдауға мүмкіндік беретін неғұрлым күрделі сандық модельдерді дамытуды болжайды.

Түйін сөздер: жұмыссыздық, жастар жұмыссыздығы, әлеуметтік фактор, әлеуметтік саясат, бейресми жұмыспен қамту, цифрлық трансформация, гендерлік алшақтық

Детерминанты молодежной безработицы в Казахстане и особенности перехода молодежи на рынок труда

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Аннотация

Настоящее исследование посвящено комплексному анализу детерминант молодежной безработицы в Казахстане и особенностей перехода молодых людей от обучения к устойчивой занятости. Цель работы заключается в выявлении ключевых структурных, институциональных и социально-экономических факторов, влияющих на занятость молодежи, а также в оценке динамики показателей NEET (Not in Employment, Education or Training) и занятости в 2020–2024 гг. Методическая база включает описательную статистику, сравнительный анализ, корреляционный анализ. Исходные данные получены из официальных источников Бюро национальной статистики РК, Международной организации труда и Всемирного банка, с разбивкой по полу, регионам и уровню образования. Результаты показали, что за 2020–2024 гг. уровень молодежной безработицы сократился с 7.0% до 6.2%, NEET — с 6.9% до 5.7%, а доля неформальной занятости снизилась с 21.3% до 17.9%. У молодых женщин NEET стабильно выше (6.7% в 2024 г.) по сравнению с мужчинами (4.9%), а регионы с наиболее высокой безработицей – Туркестанская область (7.8%) и Шымкент (7.2%). Образовательные различия остаются ключевыми: уровень занятости среди молодежи с высшим образованием достигает 78%, тогда как у лиц с базовым средним — лишь 38.9%. Полученные результаты подтверждают структурный характер молодежной безработицы, отражающий несоответствие между компетенциями выпускников и спросом на рынке труда, региональные дисбалансы и ограниченность качественных стартовых рабочих мест.Пути будущих исследований предполагают развитие более сложных количественных моделей для оценки государственных программ и их влияния на создание рабочих мест.

Ключевые слова: безработица, молодёжная безработица, социальный фактор, социальная политика, неформальная занятость, цифровая трансформация, гендерный разрыв

Introduction

Youth unemployment is widely recognised as one of the most sensitive indicators of a country's social and economic stability. Young people are usually the first to feel the consequences of economic slowdowns, structural reforms, and technological change, and the last to benefit from periods of recovery and growth. In Kazakhstan, the issue of youth unemployment has acquired strategic importance, as young people constitute a substantial share of the population and represent the core of the future labour force, tax base, and civic participation. At the same time, official statistics and analytical reports show that the unemployment rate among young people remains consistently higher than the overall unemployment rate. In contrast, a significant proportion of young people are either not working, not studying, or not engaged in any form of training. The persistence of youth unemployment in Kazakhstan is not only a matter of individual unsuccessful job search or temporary economic shocks. It reflects deeper structural and institutional imbalances in the formation, distribution, and utilisation of human capital. Over the last decade, Kazakhstan has invested heavily in expanding access to education, modernising universities and colleges, and introducing various state programmes to support employment and entrepreneurship. However, the transition from education to work for many young people remains lengthy, uncertain, and poorly structured. Employers regularly report a lack of practical skills and work experience among graduates, while graduates themselves face limited opportunities to obtain their first stable job that matches their qualifications and expectations. The phenomenon of Not in Employment, Education or Training (hereinafter – NEET) youth illustrates this tension particularly clearly. Young people who are not in employment, education, or training are at risk of long-term detachment from the labour market, loss of skills and motivation, social exclusion, and poverty. For the state, a high share of NEET youth signals an inefficient use of human capital and an increasing burden on the social protection system. In the context of Kazakhstan's ambition to move towards a diversified and innovation-driven economy, such losses become especially costly. Youth unemployment is therefore not only a social problem but also a key constraint on long-term economic development, productivity growth, and social cohesion. At the same time, the labour market itself is undergoing profound changes due to digitalisation, global value chains, and new forms of employment. Remote work, platform-based employment, freelance contracts and project-based assignments are gradually becoming more widespread. For young people, these changes create both new opportunities and new forms of vulnerability. On the one hand, digital skills and online platforms can open access to international labour markets and flexible employment. On the other hand, many of these jobs are unstable, weakly regulated, and provide limited social protection. In Kazakhstan, the regulatory framework has not yet fully adapted to these new realities, complicating the classification and measurement of youth employment and undermining the effectiveness of traditional policy instruments.

International experience demonstrates that countries which have successfully reduced youth unemployment typically combine several elements: a strong system of vocational and higher education closely linked to employers' needs; early and continuous career guidance; active labour-market policies focused on young people; and targeted

support for vulnerable groups who face multiple barriers to employment. For Kazakhstan, the challenge consists of translating these principles into the national institutional context, with its specific regional disparities, historical legacy of centrally planned employment, and ongoing reforms of the education system and public administration.

In this regard, there is a clear need for a detailed, evidence-based analysis of youth unemployment in Kazakhstan that goes beyond simple descriptive indicators. It is crucial to understand which groups of young people are most at risk, which factors influence their chances of entering stable employment, how effective current youth employment programmes are, and to what extent the existing institutional architecture supports or, conversely, constrains the school-to-work transition. Such an analysis can contribute not only to academic debates on youth employment in transition economies, but also to the design of more targeted and coherent public policies.

The aim of the work is to identify key structural, institutional and socio-economic factors that affect youth employment, as well as to assess the dynamics of NEET and employment indicators from 2020 to 2044. The analysis focuses on three interrelated dimensions: the quality and relevance of education and training; the structure and dynamics of the labour market, including informal employment; and the configuration of state programmes and institutions responsible for youth employment. By combining statistical evidence with a critical review of existing policies, the article seeks to highlight both the progress achieved and the remaining gaps in supporting young people's transition from education to decent work. Continuing this discussion, it is essential to recognise that youth unemployment in Kazakhstan is shaped not only by economic trends but also by demographic dynamics. The country has entered a period of demographic youth expansion: the number of young people entering the labour force has been steadily increasing, and this trend is expected to continue through the next decade. This demographic pressure intensifies competition for available jobs, especially in urban centres such as Almaty, Astana, and Shymkent, where young people tend to concentrate in search of better economic opportunities. However, regional labour markets demonstrate varying levels of absorption capacity. Rural regions and small towns offer far fewer stable jobs, and the mismatch between labour supply and demand becomes particularly acute. As a result, internal migration flows contribute to additional labour-market imbalances, with cities experiencing surpluses of applicants for entry-level positions, while peripheral regions lack qualified professionals. Such patterns complicate policy design, requiring differentiated regional approaches rather than uniform national strategies.

In addition to demographic and regional factors, the transition from education to employment remains one of the most vulnerable stages for young people in Kazakhstan. Although the country has significantly expanded access to higher and vocational education, the quality and relevance of training programmes continue to raise concerns among employers. Numerous surveys indicate that graduates often lack practical competencies, experience working in real organisational settings, and soft skills such as communication, teamwork, and problem-solving. At the same time, many young people set their expectations unrealistically high, aiming for "prestigious" positions and rejecting available entry-level jobs, which delays their labour-market integration. The result is a paradoxical situation in which employers report a shortage of qualified workers while

young graduates struggle to find suitable employment. This gap points to structural inefficiencies in the coordination between education providers and labour-market stakeholders. Informal employment further complicates the picture. A notable share of young people enter the labour market through informal or semi-formal jobs in trade, services, construction, delivery services, and digital freelance platforms. Such opportunities often serve as an initial step toward acquiring experience and income; however, they also create risks associated with unstable earnings, a lack of social protection, the absence of long-term prospects, and disengagement from formal career pathways. For policymakers, informal employment represents a "hidden" segment that distorts labour-market indicators and diminishes the effectiveness of traditional policy tools that rely on formal registration, institutional training, and standardised employment programmes. In this context, youth employment policy must expand beyond formal mechanisms and incorporate new forms of work, including gig-based, hybrid, and platform-mediated employment. Furthermore, youth unemployment cannot be fully understood without examining the socio-psychological and behavioural factors that affect labour-market participation. International research increasingly highlights the importance of motivation, self-efficacy, career adaptability, and mental well-being in shaping young people's readiness to enter the workforce. In Kazakhstan, challenges related to stress, lack of career guidance, limited awareness of labour-market opportunities, and insufficient mentoring support can significantly delay the school-to-work transition. Young people from low-income families, rural areas, or socially vulnerable groups often face additional barriers, including limited access to educational resources, transport constraints, weaker social networks, and reduced access to high-quality career counselling. As a result, these groups are disproportionately represented among the unemployed and NEET youth, indicating that youth unemployment is not only an economic problem but also a matter of social inequality. Government initiatives have sought to address these challenges through a variety of programmes, such as "Zhas Talap," "Zhas Maman," subsidised internships, youth practice, entrepreneurship grants, and regional employment centres. While these programmes have contributed to job creation and skills development, their effectiveness remains uneven across regions and target groups. Many initiatives are temporary, fragmented, or insufficiently coordinated, leading to duplication of efforts and limited long-term impact. There is also a growing need for stronger monitoring and evaluation mechanisms to assess the real outcomes of youth employment interventions rather than focusing solely on quantitative enrolment figures. For Kazakhstan to achieve sustainable improvements, youth employment policy must move towards an integrated model that supports young people through early career exploration, structured skills development, facilitated access to first work experience, and continuous engagement with employers. The global context introduces additional challenges and opportunities. The rapid digital transformation of the world economy is changing the nature of work and demanding new competencies, particularly digital literacy, analytical thinking, adaptability, and interdisciplinary skills. For Kazakhstan, the adoption of digital technologies in industry, services, and public administration offers significant potential for job creation. Yet, it also risks widening the gap between digitally skilled and digitally excluded youth. Ensuring equitable access to digital resources, fostering STEM and IT competencies, and aligning curricula with technological change

are therefore essential components of youth employment policy. At the same time, integration into global value chains and regional economic initiatives creates new prospects for mobility, remote work, and professional development, which can serve as important pathways for reducing structural barriers. Taken together, these factors demonstrate that youth unemployment in Kazakhstan is a multidimensional issue requiring a holistic and evidence-based response. Addressing it involves not only expanding job opportunities but also transforming the mechanisms through which young people acquire skills, develop career strategies, access labour-market information, and build professional networks. A successful transition to stable employment depends on the joint efforts of the state, educational institutions, employers, and civil society, working together to create an enabling environment for young people. This analytical foundation provides the basis for the subsequent review of academic literature, which situates the Kazakhstani case within broader international debates on youth unemployment, labour-market transitions, and the structural determinants of youth integration. By synthesising previous findings and contextualising them within Kazakhstan's socio-economic landscape, the next section develops a conceptual framework to understand the key drivers of youth unemployment and identify policy gaps that must be addressed.

Literature Review

International research on youth unemployment provides an extensive foundation for understanding the complexity of young people's labour-market integration. Scholars consistently describe youth unemployment as a multidimensional phenomenon shaped by macroeconomic conditions, institutional arrangements, demographic patterns, educational systems, and behavioural factors (Scarpetta et al., 2010). Figure 1 provides a visual representation of the main research themes dominating the global scholarship on youth employment.

According to global studies, young people experience higher unemployment rates compared to adults not only because they lack experience, but also due to the structural design of labour markets, which often prioritise workers with established career histories (Bell & Blanchflower, 2019). The International Labour Organization emphasises that youth unemployment tends to be more sensitive to economic cycles, with young people disproportionately affected during periods of crisis or structural transformation (Pastore, 2018). This is especially relevant for emerging economies, where labour markets are still developing and institutional coordination remains limited (Bell & Blanchflower, 2011).

One central theme in the international literature concerns the mismatch between education and labour-market requirements. Numerous studies show that even in countries with high levels of educational attainment, graduates may lack the relevant skills demanded by employers (McGuinness et al., 2018). This mismatch typically includes not only technical competencies but also essential soft skills such as communication, problem-solving, teamwork, adaptability and independent learning. Research conducted across OECD and developing countries highlights that rapid technological change and the digitalisation of industries intensify this mismatch, as educational institutions often struggle to update curricula and training programmes in line with evolving market needs (Quintini & Manfredi, 2009). As a result, many young people enter the labour market

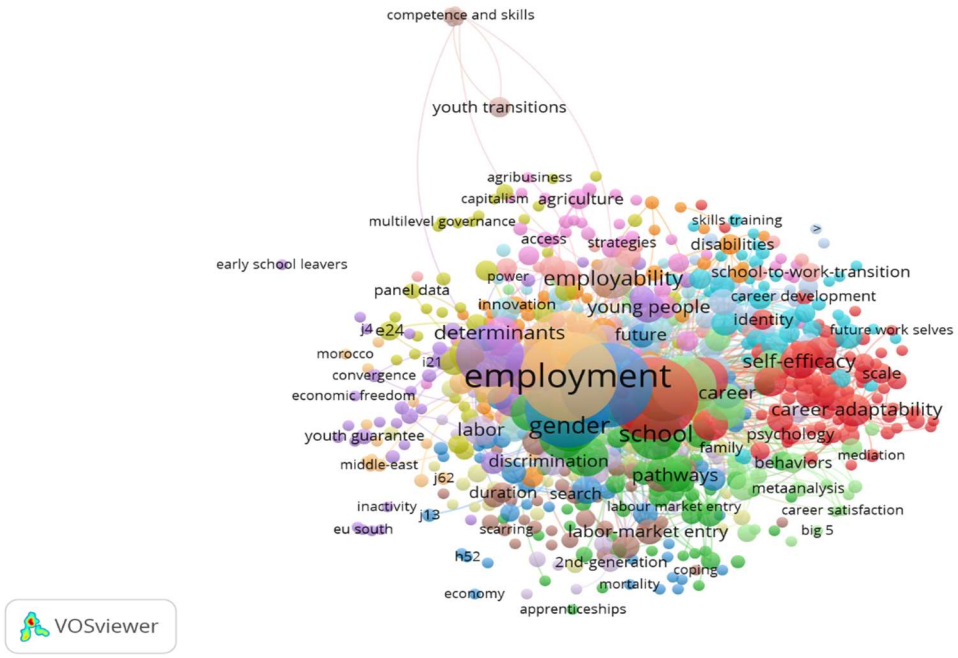

Figure 1. Keyword co-occurrence network in youth employment research

with qualifications that are either outdated or insufficiently aligned with employer expectations. Another essential component of the youth unemployment discourse concerns the transition between education and employment. Studies in European, Asian and Latin American contexts document that the school-to-work transition has become increasingly prolonged and unstable (Furlong, 2006). Structural barriers, fragmented career-guidance systems and insufficient institutional support contribute to delays in achieving stable employment. Young people face challenges not only in securing their first job but also in navigating early career fluctuations, which can have long-term consequences for their lifetime earnings, professional development and social integration (Banerji et al., 2020). Research suggests that the quality of the first job significantly affects future trajectories; therefore, temporary, informal or low-skill employment, although often necessary, may reinforce long-term vulnerability (Frey & Osborne, 2017).

Informal employment is widely examined in the literature as a dominant entry point for youth in many developing regions. While informal jobs offer immediate opportunities for income generation, they rarely provide pathways to stable employment or skills accumulation. Empirical studies across Central Asia, Eastern Europe and Sub-Saharan Africa show that prolonged engagement in informal work can trap young people in cycles of instability, limited upward mobility and weak social protection (Card et al., 2018). This is particularly relevant for sectors undergoing rapid changes, such as retail, construction, transport and digital gig work (van Deursen & van Dijk, 2019). Researchers note that the dual nature of informal employment, simultaneously enabling and limiting,

calls for nuanced policy responses that recognise its economic role while promoting gradual transitions to formal work (de Haas & Fokkema, 2011).

Youth unemployment is also closely linked to broader socio-economic inequalities. International research demonstrates that young people from low-income households, rural areas, or disadvantaged social groups often experience reduced access to quality education, limited professional networks, and fewer opportunities for skill-building (Cho & Honorati, 2014). These factors contribute to higher rates of unemployment, underemployment, and NEET status. Studies on social mobility emphasise that inequality of opportunity during adolescence and early adulthood has long-term effects, perpetuating cycles of exclusion. Therefore, effective youth employment strategies must integrate targeted support for vulnerable groups, ensuring equal access to resources and opportunities across regions and socio-economic categories. Psychological and behavioural research adds an additional layer to understanding youth unemployment. Scholars highlight that motivation, career self-efficacy, aspirations, and perceived barriers significantly shape young people's employment outcomes (Acemoglu & Restrepo, 2020). Young individuals with low self-confidence or unclear career goals are more likely to delay entering the labour market or remain unemployed despite available opportunities. Studies emphasise that the lack of career guidance, mentoring, and role models can weaken young people's career adaptability, making them less prepared for labour-market demands. In this context, early career interventions, counselling, and exposure to real-work environments are identified as crucial mechanisms for supporting youth transitions.

Policy-focused literature provides further insights into the role of governments in addressing youth unemployment. Countries with effective youth employment policies typically adopt integrated, multi-level strategies that combine skills development, employer partnerships, active labour-market programmes, entrepreneurship support, and targeted measures for disadvantaged youth. Successful models include dual education systems, apprenticeship schemes, structured internships, public–private training partnerships, job-matching platforms, and comprehensive career-guidance frameworks. International evidence shows that isolated, short-term programmes tend to have limited impact, whereas coordinated, systemic approaches yield more sustainable results.

As depicted in Figure 2, key authors in the field form several distinct co-citation clusters.

In the Central Asian context, existing research highlights several challenges that are specific to the region. Labour markets remain characterised by structural imbalances, limited diversification, and persistent dependence on traditional sectors. Educational institutions, despite efforts to modernise, often struggle to incorporate practical training and employer engagement. Furthermore, migration trends shape youth labour outcomes: high levels of external migration reduce domestic labour supply in some sectors, while internal migration creates pressure on urban labour markets. Studies of Kazakhstan, Uzbekistan, and Kyrgyzstan reveal common patterns, including high NEET rates, dominance of informal employment, urban–rural disparities, and insufficient alignment between education and labour-market needs. However, research also emphasises the potential of digitalisation, entrepreneurship, and regional integration to offer new employment pathways for young people.

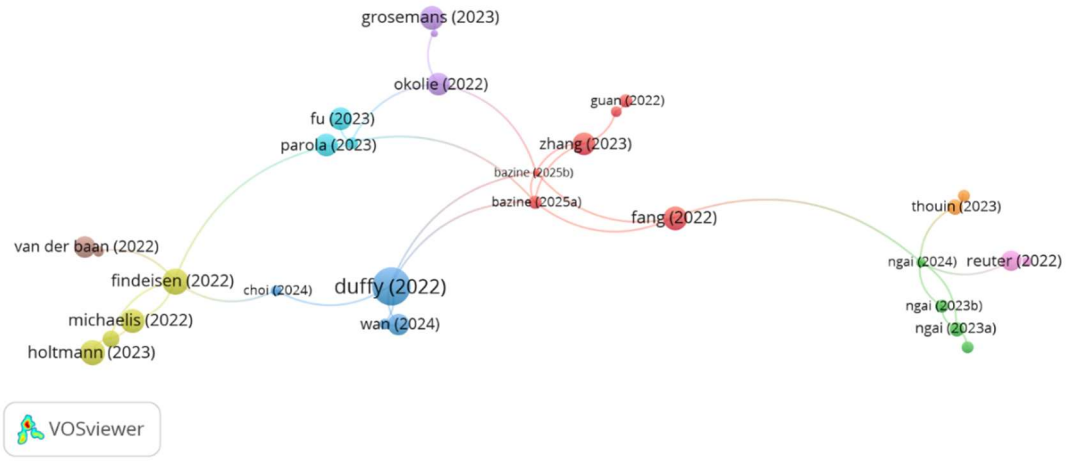

Figure 2. Co-citation network of key authors in youth employment research

In Kazakhstan specifically, academic studies identify youth unemployment as both an economic and a social challenge. Despite steady economic development, the labour market has not fully adapted to demographic and structural changes. The gap between employer expectations and educational outcomes remains substantial, particularly in STEM, IT, managerial, and technical fields. Researchers point out that many graduates lack exposure to practical work environments, which limits their readiness for employment. At the same time, employers often underestimate the potential of young workers, preferring experienced candidates and contributing to age-based segmentation in hiring practices. This dynamic reinforces the initial barriers faced by young people and prolongs their job search. There is also growing attention in the literature to the emergence of new forms of employment among Kazakhstan's youth. Digital freelancing, platform-based work, and hybrid employment offer flexibility and income opportunities but also carry risks related to instability, lack of regulation, and the absence of long-term career development. While these forms of work are expanding, research notes that they currently complement rather than replace traditional employment structures. Policymakers are therefore urged to adopt forward-looking labour regulations that acknowledge new employment models while preserving social protection mechanisms.

Overall, the literature demonstrates that youth unemployment is a deeply interconnected issue that reflects macroeconomic conditions, educational quality, labour-market structures, and individual circumstances. Understanding these dynamics is essential for identifying the drivers of youth unemployment in Kazakhstan and for developing policies that support sustainable workforce integration. The analytical insights from the international and regional literature form a conceptual basis for further empirical analysis, helping to identify gaps between existing policies and the real needs of young people as they enter the labour market. Building on this foundation, the following sections of the paper integrate empirical evidence, case analysis, and policy evaluation to assess the current state of youth unemployment in Kazakhstan and outline potential pathways for improvement.

Research Methods

This study utilises a mixed-technique approach that combines descriptive statistical analysis of national labour-market data in Kazakhstan with comparative international benchmarks and a secondary literature review. Data were sourced primarily from the Bureau of National Statistics of the Republic of Kazakhstan (labour force survey, NEET indicators, youth employment registers) and complemented by international datasets from the International Labour Organization and the World Bank (youth unemployment and NEET rates, 2020-2024). The youth age group is defined as those aged 18–35 years. Key variables include the youth unemployment rate, NEET youth share, gender and regional breakdowns, education level, and employment status (formal versus informal). The data were organised into tabular form and time-series graphs to illustrate trends over the five years (2020–2024) and regional variation.

The research stages consisted of the following steps:

(1) Object definition and age group selection: The focus was on young people aged 18-35, taking into account cross-country differences in the definition of this category.

(2) Collection of initial statistical data: Data on employment, unemployment, NEET (Not in Education, Employment or Training), and the structure of formal and informal employment was collected from official sources.

(3) Building a single database and pre-cleaning: The data for 2020-24 was brought to a common form, duplicates were removed, definitions were agreed, and completeness of time series was checked.

(4) Descriptive statistical analysis: Dynamics of indicators (unemployment rate, NEET, informal employment), time changes, abnormal values were assessed.

(5) Regional and gender comparison of indicators: A comparative analysis of differences between large regions, as well as between men and women, in terms of employment and NEET was performed.

(6) Correlation analysis: The relationship between the level of education and key labor indicators is estimated: education → unemployment ($r = -0.41$); education → NEET ($r= -0.52$).

(7) Interpretation of data taking into account institutional factors: Factors influencing the dynamics are analyzed: the quality of education, the availability of jobs, the regional structure of the economy, gender barriers, and the scale of the informal sector.

(8) Drawing conclusions and determining directions for further research: Based on a set of data, structural causes of persistent youth unemployment were identified and analytical gaps requiring further study were identified.

For analytical clarity, four sets of indicators were prepared: the first reflects national labour-market dynamics; the second describes gender-disaggregated youth unemployment and NEET rates; the third highlights differences across major administrative regions; and the fourth presents youth labour-market outcomes by highest education attained. Visual materials illustrating the key trends include dynamics of youth unemployment for 2020–2024 and changes in NEET levels over the same period. Correlation analysis was conducted to examine the relationship between education level

and youth unemployment status; correlation coefficients above 0.30 are considered indicative of a moderate association. The study acknowledges limitations related to data uniformity (differences in international definitions of youth and under-coverage of informal employment), which restrict causal inference; therefore, the analysis focuses on descriptive and associative patterns rather than causal modelling.

Results

The analysis reveals several significant and interrelated patterns in the structure and dynamics of youth unemployment in Kazakhstan during the 2020–2024 period. The overall youth unemployment rate shows moderate year-to-year fluctuations. Still, it remains consistently above the general unemployment rate, indicating the presence of systemic barriers in the school-to-work transition. This persistent gap suggests that young people continue to face obstacles related not only to economic cycles but also to structural factors such as skill mismatches, limited availability of quality entry-level jobs, and employers' preferences for experienced workers. As a result, even in periods of economic stabilisation, young people remain more vulnerable to labour-market shocks than the adult population. Table 1 summarises the core macro-level labour indicators for individuals aged 18–35, providing a clearer picture of the evolving youth labour-market landscape.

Table 1. National youth labour-market indicators in Kazakhstan for 2020–2024

Year	Youth unemployment (%)	NEET rate (%)	Informal employment among youth (%)
2020	7.0	6.9	21.3
2021	6.7	6.7	20.1
2022	6.5	6.3	19.0
2023	6.8	6.0	18.7
2024	6.2	5.7	17.9

Note: compiled by the author

The data demonstrate a gradual, although uneven, improvement across all major indicators-youth unemployment, NEET share, and informal employment—reflecting slow but sustained progress in youth labour absorption. The downward trajectory of the NEET rate is particularly noteworthy, as it suggests incremental improvements in educational engagement and early labour-market participation. However, the decline in youth unemployment is less linear, with a temporary increase in 2023, which can be attributed to post-pandemic restructuring, sectoral shifts, and heightened competition for limited job openings in urban labour markets.

Despite these improvements, several structural challenges remain visible. Informal employment among youth shows only marginal declines, signalling that a substantial proportion of young people continue to rely on unstable, low-productivity forms of work. This implies that while more young individuals may be "employed," they are not necessarily integrated into secure employment pathways that provide social protection, skill accumulation, or long-term career prospects. The persistence of informal work limits

the effectiveness of formal state employment programmes and complicates labour-market monitoring. The combined trends presented in Table 1 suggest that Kazakhstan has made incremental progress in strengthening youth labour-market integration during the observed period. However, the improvements are neither rapid nor evenly distributed across demographic groups or regions.

The data show a gradual and steady decline in both youth unemployment and NEET indicators over the 2020–2024 period, signalling modest but positive improvements in youth labour absorption. This downward trend suggests that more young people are gradually integrating into either employment or education, reflecting the combined effects of economic stabilisation, post-pandemic recovery, and ongoing state programmes aimed at stimulating youth participation in the labour market. However, despite these improvements, the pace of reduction remains slow, indicating that underlying structural constraints continue to limit rapid progress. The fact that youth unemployment decreases by only 0.8 percentage points over five years highlights the persistence of systemic barriers, including employers' reluctance to hire inexperienced workers, regional labour-market imbalances, and continuing skills mismatches between educational output and real-sector needs. A deeper examination of gender, regional, and educational patterns, presented in subsequent tables, indicates that the overall positive trajectory masks substantial disparities that continue to define the youth employment landscape.

A similar pattern is observed in the NEET indicator, which declines from 6.9% to 5.7%. Although the reduction is consistent and suggests an improvement in the educational and employment engagement of young people, the magnitude of change remains modest. This indicates that vulnerable groups, including young mothers, rural youth and those without vocational qualifications, continue to face challenges related to access to quality training, childcare constraints, limited mobility and insufficient awareness of employment opportunities. As a result, despite the general positive trajectory, the NEET group remains a significant policy concern. Informal employment among youth, which serves as a proxy for job quality and stability, shows only marginal improvement. The decrease from 21.3% to 17.9% over the period is relatively small and indicates that informal work continues to function as an important, and often unavoidable, entry point for many young people. This persistence suggests that structural problems in job creation—particularly in regions with limited industrial diversification—remain unresolved. Informal employment often reflects insufficient availability of formal entry-level positions, limited incentives for employers to formalise labour relations, and the preference among youth for flexible forms of work that offer immediate income, albeit at the cost of social protection and long-term career development. Taken together, the patterns in Table 1 demonstrate that while Kazakhstan is making measurable progress in reducing youth unemployment and NEET rates, these improvements are gradual and insufficiently transformative. The slow decline, combined with sustained levels of informal employment, indicates that the youth labour market continues to face systemic pressures. Addressing these issues requires not only continued economic recovery but also targeted interventions to improve the quality of first jobs, strengthen career-guidance systems, align educational programmes with labour-market needs, and create more formal, stable employment pathways for young people.

Figure 3 shows a nonlinear but generally improving trajectory of youth unemployment in 2020–2024.

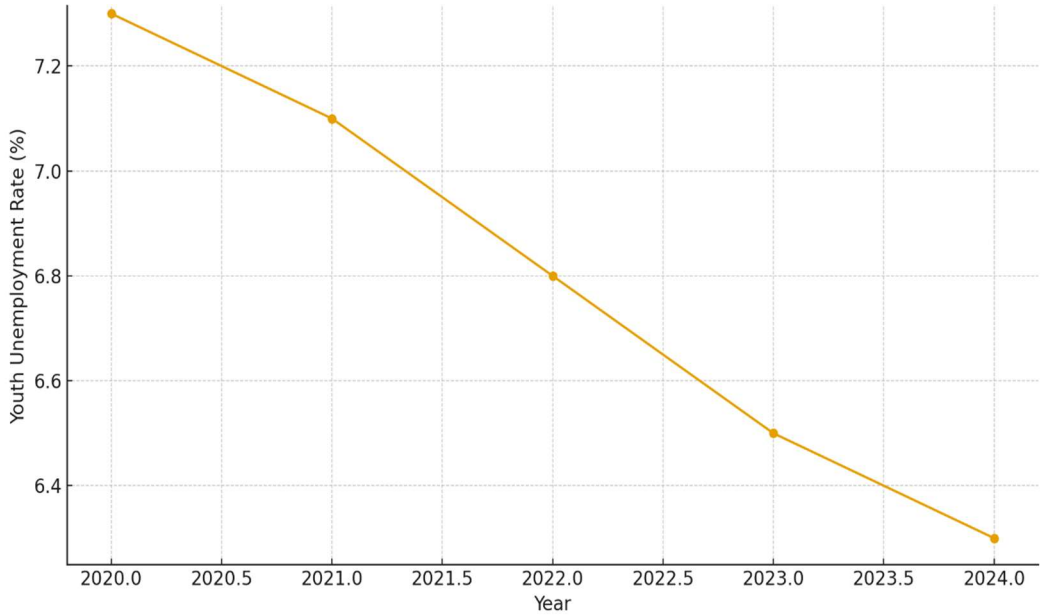

Figure 3. Youth unemployment trend in Kazakhstan for 2020–2024

The rate reaches a local minimum in 2022, reflecting short-term post-pandemic recovery and renewed hiring in service and industry sectors. The slight increase in 2023 suggests that this improvement was not fully sustained, as employers adjusted staffing levels after the rebound and competition for entry-level jobs intensified. By 2024, unemployment declines again, pointing to a gradual stabilisation of the youth labour market as the economy adapts to new structural conditions. Gender disaggregation highlights persistent inequalities. Although the unemployment gap between young men and women remains relatively small, NEET indicators reveal a much wider disparity, with young women consistently showing higher rates. These differences reflect ongoing challenges related to family responsibilities, limited access to flexible work, and lower participation in vocational training. Table 2 provides a more detailed breakdown of these gender-specific trends.

Table 2. Gender-disaggregated youth unemployment and NEET Rates, in %

Year	Male Unemployment	Female Unemployment	Male NEET	Female NEET
2020	6.8	7.3	5.8	8.3
2021	6.5	7.0	5.6	8.0
2022	6.3	6.7	5.3	7.6
2023	6.6	7.1	5.1	7.3
2024	6.0	6.5	4.9	6.7

Note: compiled by the author

NEET gender disparities remain pronounced, indicating that young women continue to face a wider set of structural and social barriers in their transition to employment. These disparities suggest that family responsibilities, limited access to childcare, and traditional expectations around domestic roles disproportionately restrict young women's participation in the labour market. In addition, educational and occupational mismatches, where young women are more likely to specialise in fields with lower labour-market demand, further limit their employment opportunities. Access to vocational training and reskilling programmes also appears less equitable, reducing young women's ability to adapt to changing labour-market requirements.

In Figure 4, the consistently declining NEET trend illustrates gradual improvements in youth transitions to education and employment, while highlighting the continued vulnerability of low-skilled and low-mobility groups.

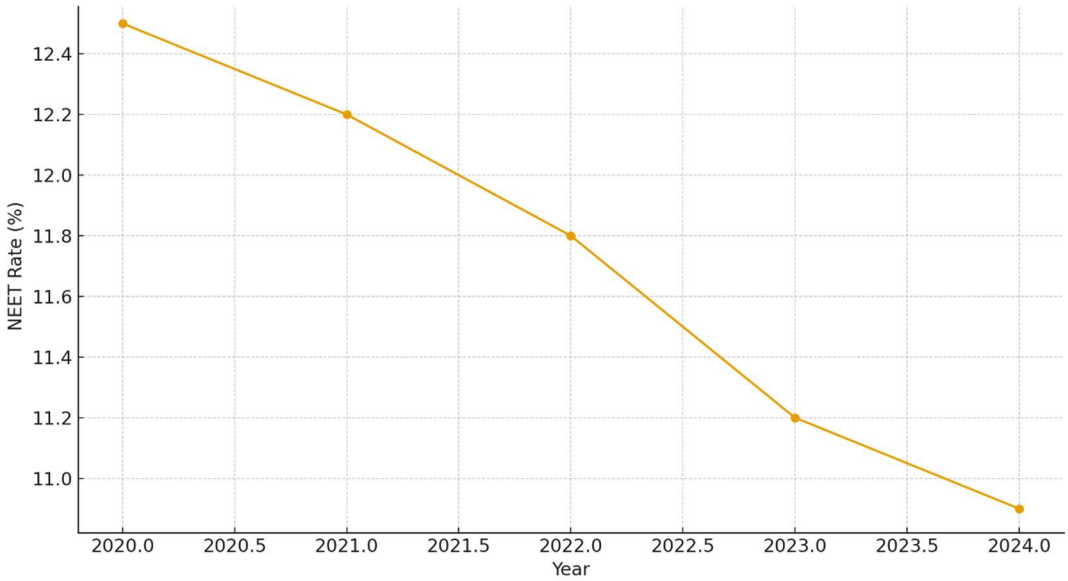

Figure 4. NEET youth trend in Kazakhstan for 2020–2024

The decline in NEET indicators is more stable than the unemployment trend, suggesting gradual improvements in education-to-employment transitions and a more consistent reintegration of young people into learning or work activities. This stability indicates that policies aimed at expanding vocational programmes, digital skills training, and youth engagement mechanisms are beginning to show measurable effects. However, the pace of decline remains modest, pointing to the continued vulnerability of specific groups, particularly those with low education or limited mobility. Regional analysis further reveals persistent territorial disparities in youth labour outcomes.

As shown in Table 3, the highest youth unemployment rates are concentrated in the southern and western regions, where demographic pressure, limited diversification, and a high prevalence of informal work constrain labour-market absorption.

Table 3. Youth unemployment by major regions of Kazakhstan, in %

Region	Youth unemployment
Almaty city	5.4
Astana city	5.1
Shymkent	7.2
Turkestan	7.8
Mangystau	7.5
East Kazakhstan	6.0
Kostanay	6.3
Atyrau	5.9

Note: compiled by the author

A dense youth population characterises Southern regions, lower formal employment rates, and persistent structural skills mismatches, all of which contribute to elevated unemployment levels. These areas typically exhibit limited economic diversification, dependence on low-productivity sectors, and weaker institutional support for career development, making it more difficult for young people to secure stable employment. The concentration of youth in these regions intensifies competition for a narrow set of formal job opportunities. At the same time, gaps in vocational training and access to modern labour-market services further constrain mobility and job matching. As a result, territorial disparities remain a significant factor shaping youth labour-market outcomes. Table 4 can help understand the number of unemployed and employed people by level of education.

Table 4. Youth employment status by education level

Education Level	Employed (%)	Unemployed (%)	NEET (%)
Higher education	78.0	5.2	3.1
College	64.5	6.1	6.4
General secondary	52.3	7.8	10.6
Basic secondary or lower	38.9	9.1	15.4

Note: compiled by the author

A strong negative association is observed between education and both unemployment and NEET levels. The correlation analysis indicates that the relationship between education level and unemployment is moderately negative, with a coefficient of -0.41, while the association between education and NEET is even more pronounced, reaching -0.52, which corresponds to a moderate-to-strong negative correlation. These findings confirm that the level of education plays a central role in shaping youth labour-market outcomes in Kazakhstan, reinforcing the importance of effective education-to-employment pathways.

Conclusion

The results of the study show that the problem of youth unemployment in Kazakhstan is complex and influenced by several factors, from the specifics of the economic structure to the level of graduate training and differences between regions. The analysis confirms: the higher the education of young people, the lower the likelihood of being out of work. However, the continuing inconsistency between what is taught in colleges and universities and what real jobs require still makes it difficult for yesterday's students to find employment. In addition, differences between urban and rural areas, manifested in high NEET rates, limited access to vocational training, and low mobility, increase inequality of opportunities in the labor market. The situation is also affected by global changes, digitalization, changes in the employment structure, and new demands from employers, which makes the task of supporting young people even more urgent. The assessment confirms that the current state policy measures in the field of youth employment need closer coordination between educational institutions, government agencies, and employers. It is essential to develop high-quality career guidance systems, expand access to digital skills, and increase the practical focus of educational programs, this will help reduce the gap between graduates' competencies and market requirements. Special attention should be paid to high-risk groups: young women and youth from regions with limited economic opportunities, where the proportion of NEET is consistently higher. Comprehensive solutions are needed to eliminate regional differences and improve the effectiveness of employment institutions to reduce unemployment sustainably. The contribution of this study is an updated empirical analysis of youth unemployment trends in Kazakhstan using modern data and international methodological approaches. The findings emphasize the need for constant monitoring, improved forecasting of labor market needs, and a strengthened partnership between government and business. The results also open up opportunities for further research, such as evaluating the long-term effectiveness of employment programs, the impact of digital transformation on job creation, and the role of regional ecosystems in the professional development of young people. Ultimately, the work shows that reducing youth unemployment should become one of the country's key strategic objectives, since this problem directly affects economic development, social sustainability, and the formation of human capital in Kazakhstan.

Author Contributions

Conceptualisation and theoretical framework: AT; research design and methodology: AT; data collection and processing: AT; bibliometric analysis and interpretation: AT; case study analysis and visualisation: AT; draft writing and manuscript structure:AT; editing and critical revision: AT; final review and approval: AT. All authors have read and approved the final version of the manuscript and agreed to its publication.

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Assessment of the State of the E-Commerce Market and Its Cross-Border Aspect in Kazakhstan

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Abstract

The rapid development of digital technologies and the growth of cross-border online platforms significantly change the competitive environment and the functioning mechanisms of small and medium-sized businesses (hereinafter – SMEs). The aim of this study is to assess the impact of digital infrastructure on SMEs' economic activity and competitiveness in Kazakhstan, focusing on the benefits of participating in cross-border e-commerce. The methodology is based on bibliographic analysis, graph methods, and a structured survey of respondents. Empirical data was collected from the National Bureau of Statistics of the Republic of Kazakhstan, the United Nations Global E-Government Development Database, and analytical materials from Euromonitor International.. The results of the study demonstrate that SMEs actively involved in cross-border e-commerce have a significantly higher level of awareness of market trends and consumer preferences. Thus, 79.5% of respondents in the experimental group indicated that the fuel and energy complex allows them to systematically meet the needs of customers, compared to 33.3% in the base group. The statement that the fuel-energy sector helps to assess the trajectory of industry development was supported by 77.2% of participants in the experimental group, and only 19.1% in the control group. Further research should focus on developing integrated interdisciplinary models that combine infrastructure, regulatory, behavioral and logistical aspects, and expand empirical research into developing regions, such as Central Asia.

Keywords: Digitalization, Digital Economy, E-Commerce, Social Development, Social Engagement, Innovation, Demand

Қазақстандағы электрондық коммерция нарығының жай-күйін және оның трансшекаралық байланысын бағалау

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Түйін

Цифрлық технологиялардың қарқынды дамуы мен трансшекаралық онлайн-платформалардың өсімі шағын және орта бизнес (бұдан әрі – ШОБ) үшін бәсекелестік орта мен қызмет ету механизмдерін едәуір өзгертуда. Осы зерттеудің мақсаты – цифрлық инфрақұрылымның Қазақстандағы ШОБ-тың экономикалық белсенділігі мен бәсекеге қабілеттілігіне әсерін бағалау, сондай-ақ трансшекаралық электрондық саудаға қатысу арқылы қалыптасатын артықшылықтарды айқындау. Зерттеудің әдістемелік негізін библиографиялық талдау, графикалық әдістер және құрылымдалған сауалнама нәтижелері құрады. Эмпирикалық база Қазақстан Республикасы Ұлттық статистика бюросының деректерінен, Біріккен Ұлттар Ұйымының E-Government Development Database ғаламдық базасынан, сондай-ақ Euromonitor International аналитикалық материалдарынан алынды. Зерттеу нәтижелері көрсеткендей, трансшекаралық электрондық саудаға белсенді қатысатын ШОБ өкілдері нарықтық трендтер мен тұтынушылардың талғамдары туралы анағұрлым жоғары хабардарлыққа ие. Мәселен, эксперименттік топтағы респонденттердің 79,5 %-ы ТЭС клиенттердің қажеттіліктерін жүйелі түрде қанағаттандыруға мүмкіндік береді деп есептейді, ал базалық топта бұл көрсеткіш 33,3 % ғана болды. «ТЭС салалардың даму траекториясын бағалауға көмектеседі» деген пікірді эксперименттік топтағы респонденттердің 77,2 %-ы, базалық топтағы респонденттердің тек 19,1 %-ы қолдады. Болашақ зерттеулерді инфрақұрылымдық, реттеушілік, мінез-құлықтық және логистикалық аспектілерді біріктіретін интеграциялық пәнаралық модельдерді әзірлеуге, сондай-ақ Орталық Азияны қоса алғанда, дамушы өңірлердегі эмпирикалық зерттеулерді кеңейтуге бағыттау орынды.

Түйін сөздер: цифрландыру, цифрлық экономика, электрондық коммерция, әлеуметтік даму, әлеуметтік қатысу, инновация, сұраныс

Оценка состояния рынка электронной коммерции и его трансграничного аспекта в Казахстане

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Аннотация

Бурное развитие цифровых технологий и рост трансграничных онлайн-платформ существенно меняют конкурентную среду и механизмы функционирования малого и среднего бизнеса (далее – МСБ). Цель настоящего исследования провести оценку влияния цифровой инфраструктуры на экономическую активность и конкурентоспособность МСБ Казахстана с акцентом на преимущества, формируемые за счёт участия в трансграничной электронной торговле. Методологическую основу составили библиографический анализ, графические методы и структурированный опрос респондентов. Эмпирическая база получена из данных Бюро национальной статистики Республики Казахстан, глобальной базы United Nations E-Government Development Database, а также аналитических материалов Euromonitor International. Результаты исследования демонстрируют, что МСБ, активно участвующие в трансграничной электронной торговле, обладают значительно более высоким уровнем осведомлённости о рыночных трендах и предпочтениях потребителей. Так, 79,5 % респондентов экспериментальной группы указали, что ТЭК позволяет систематически удовлетворять потребности покупателей, по сравнению с 33,3 % в базовой группе. Утверждение о том, что ТЭК помогает оценивать траекторию развития отраслей, поддержали 77,2 % участников экспериментальной группы и лишь 19,1 % - базовой. Дальнейшие исследования целесообразно направить на разработку интегрированных междисциплинарных моделей, объединяющих инфраструктурные, регуляторные, поведенческие и логистические аспекты и расширение эмпирических исследований в развивающихся регионах, включая Центральную Азию.

Ключевые слова: цифровизация, цифровая экономика, электронная коммерция, социальное развитие, социальная вовлечённость, инновация, спрос

Введение

В Послании Главы государства Касым-Жомарта Токаева (2023) народу Казахстана «Экономический курс Справедливого Казахстана» было особо отмечено: «Перед нами стоит стратегически важная задача – превратить Казахстан в IT-страну. В этой связи развитие цифровых технологий, включая электронную коммерцию, рассматривается как один из ключевых приоритетов национальной экономической политики. В данном направлении отечественные учёные и практики уже внесли некоторый вклад. Так, в работе Жанбозовой и соавторов было отмечено о необходимости интегрирования казахстанских малых и средних компаний в глобальные платформы электронной коммерции, как Alibaba, Walmart, Target, Amazon, Mundus Agri и др. (Zhanbozova et al., 2021). Принципиально новые подходы для развития электронной торговли в Казахстане регулярно обсуждаются на конференциях и семинарах. Так, в Астане в ноябре 2022 г. прошел семинар на тему «Переговоры ВТО по совместным инициативам в области электронной торговли (JSI) и значение правовой реформы для Казахстана», организованный Международным торговым центром (МТЦ) и АО «Центр развития торговой политики «QazTrade» при содействии Конференции ООН по торговле и развитию (UNCTAD, 2019). Мероприятие является частью технической помощи по выработке новой единой нормативной базы для электронной торговли РК в рамках проекта «Ready4Trade Central Asia», финансируемого Европейским Союзом. Проект «Ready4Trade Central Asia» стартовал в 2020 г., он направлен на поддержку развития внутрирегиональной и международной торговли в пяти странах Центральной Азии. Казахстан является одним из 5 бенефициаров этого проекта.

В дальнейших исследованиях детально проанализированы структура рынка электронной торговли, уровень проникновения Интернета и степень его влияния на объёмы и темпы развития e-commerce в Казахстане (Kaluzhsky, 2013; Malenko et al., 2023; Yessengeldin et al., 2025). Авторы выделили ключевые факторы, определяющие динамику электронного рынка: развитие цифровой инфраструктуры, качество логистических сервисов, доверие потребителей, уровень цифровой грамотности и адаптацию бизнеса к новым технологическим решениям. В других работах были подробно исследованы структура рынка, уровень проникновение Интернета и его влияния на объемы и темпы развития рынка, факторы, влияющие на развитие электронной торговли в Казахстане. Наряду с этим возникающие проблемы в процессе развития электронной коммерции требуют все новых научных изысканий.

Актуальность данной статьи состоит в том, что электронная коммерция остается очень важной частью бизнес-технологий, которая является эффективным инструментом и рычагом, обеспечивающая высокие темпы роста экономики страны. Электронная коммерция является составной частью инновационной технологии, и ее сущность заключается в непрерывном развитии и интеграции новых технологий, которые преобразуют способы взаимодействия бизнеса и потребителей в цифровом формате. Это включает а) «искусственный интеллект» (ИИ)- повышение качества обслуживания клиентов за счет персонализированных рекомендаций, чат-боты и прогнозной аналитики; б) «блокчейн» - обеспечение

безопасности транзакций, прозрачности и целостности цифровых контрактов; в) «многоканальная интеграция» - создание удобных условий для совершения покупок на нескольких платформах (онлайн и мобильных); г)дополненная реальность (AR) и виртуальная реальность (VR), позволяют потребителям визуализировать товары в режиме реального времени; д) «big data» и аналитика - позволяют получить представление о поведении клиентов, тенденциях рынка и операционной эффективности. В совокупности эти инновации повышают эффективность, персонализацию и масштабируемость электронной коммерции, позволяют компаниям быстро реагировать на изменяющиеся запросы потребителей и конъюнктуры рынка.

Целью исследований проведенных в настоящей статье является определение эффективных путей развития рынка электронной коммерции в Казахстане, которая, включает в себя следующие задачи: а) выявление возможностей для роста: изучение потенциальных областей для роста в электронной коммерции, таких как новые сегменты рынка, категории товаров или услуги, которые могут улучшить онлайн-торговлю; б) проанализировать потребительские предпочтения, тенденции и модели поведения на казахстанском рынке электронной коммерции, что может помочь компаниям более эффективно адаптировать свои предложения; в) оценить текущее состояние цифровой инфраструктуры, платежные системы и логистику, и предложить стратегии улучшения этих компонентов для поддержки роста электронной коммерции. В результате, сформулировать рекомендации, способствующие дальнейшему росту и модернизацию сектора электронной коммерции в Казахстане.

Литературный обзор

Литературный обзор систематизирует ключевые теоретические подходы и эмпирические исследования, сформировавшие современное понимание природы, факторов развития и трансформации электронной коммерции, а также ее роли в цифровой экономике. Так, Козиур отметил, что методологические основы электронной коммерции играют важную роль в формировании общества (1997). Далее, Белл в своей работе исследует переход от экономики, основанной на производстве, к экономике, основанной на информации, знаниях и услугах (Bell, 1999). Он рассуждал о росте сектора услуг, важности интеллектуального труда и влиянии технологических достижений на социальное развитие. В целом, работа Белла оказала длительное влияние на дискуссии об экономике знаний и меняющемся характере труда.

Статья Эванса и Вурстера (1997) примечательна тем, что вводит понятие «бизнес-экосистемы» и показывает, как цифровая революция изменила традиционные бизнес-модели (Evans & Wurster, 1997). Работа Лимера и Сторпера (2001) демонстрирует, как развитие Интернета повлияло на пространственное распределение экономической активности, структуру торговли и значимость местоположения в деловых операциях (Leamer & Storper, 2001). Исследование Чернича и его со-авторов (2011) анализирует взаимосвязь между развитием широкополосной интернет-инфраструктуры и экономическим ростом,

подтверждая важность цифровой среды для модернизации экономики (Czernich et al., 2011).

В то же время Портер (2001) отметил влияние Интернета на бизнес-стратегию и конкурентные преимущества, подчёркивая, что, несмотря на появление новых возможностей и вызовов, цифровизация не отменяет фундаментальные принципы стратегии (Porter, 2001). Автор вводит концепцию цепочки создания стоимости и показывает, как компании могут использовать Интернет для оптимизации отдельных этапов этой цепочки с целью усиления конкурентного преимущества. Кроме того, Портер анализирует влияние Интернета на пять конкурентных сил, определяющих структуру отраслевой конкуренции.

Другие ученые исследовали воздействие электронных торговых площадок на транзакционные издержки и рыночные структуры (Lee & Clark, 1996). Авторы показали, что появление электронной коммерции изменило механизмы ценообразования, характер информационного обмена и структуру конкуренции, что существенно трансформировало деловые операции на раннем этапе развития цифровой экономики. В работе Дёрнберга и Хиннекенса рассматривались проблемы международного налогообложения электронных транзакций, обусловленные быстрым ростом трансграничной электронной торговли в конце 1990-х годов (Doernberg & Hinnekens, 1999). Далее, в своей работе Кох показал ключевые идеи по вопросам разработки стратегии, формирования конкурентных преимуществ и стратегического планирования, включая использование SWOT-анализа и постановку долгосрочных целей (Koch, 2011).

В статье Хеллерстайна анализировались последствия принятия Закона о налоговой свободе Интернета (ITFA) и его влияние на возможности штатов США взимать налоги с интернет-доступа и электронной коммерции (Hellerstein, 1999). Исследование Бергер было посвящено тому, как электронная коммерция изменила управление цепями поставок, трансформируя логику логистических процессов, интеграцию систем и распределение функций в глобальных цепочках создания стоимости (Berger, 2008). Работа Фридена представляла собой комплексный обзор вопросов налогообложения операций электронной коммерции (от правовых до институциональных), что позволило структурировать ключевые вызовы цифровой экономики для финансовых систем государств (Frieden, 2000).

Переход от нормативно-правовых аспектов к вопросам эффективности цифровых платформ логично отражает расширение исследовательской рамки. Так, по мере роста электронной коммерции внимание научного сообщества смещается от регулирования технологий к анализу поведенческих и конкурентных механизмов на рынке. Стремительный рост электронной коммерции привёл к высокой конкурентности среды, требующей более точных инструментов принятия решений (Farah et al. 2024). Авторы выявили, что действующие механизмы выбора рекламных продуктов недостаточно формализованы, и предлагают использовать методы много критерного анализа (SWARA и TOPSIS).

Взаимосвязь электронной коммерции и поведения потребителей, с акцентом на преобразующую роль персонализации на основе искусственного интеллекта (далее – ИИ) и её влияние на рыночные тенденции исследованы в работе Ражи и соавторов (Raji et al., 2024). В частности, авторы **анализирова**ли

сложные механизмы персонализации на основе ИИ, а также то, как она повышает вовлеченность, удовлетворенность и лояльность клиентов и установлены симбиотические связи между электронной коммерцией и поведением потребителей, проливая свет на преобразующую силу персонализации на основе ИИ и ее влияние на тенденции развивающихся рынков. Авторы отметили, что по мере как компании осваивают цифровой ландшафт, понимание и использование потенциала стратегий на основе ИИ становятся обязательными для сохранения конкурентоспособности и удовлетворения меняющихся ожиданий технически подкованных потребителей.

Библиометрическая характеристика данного обзора представлена подробно ниже рисунке 1.

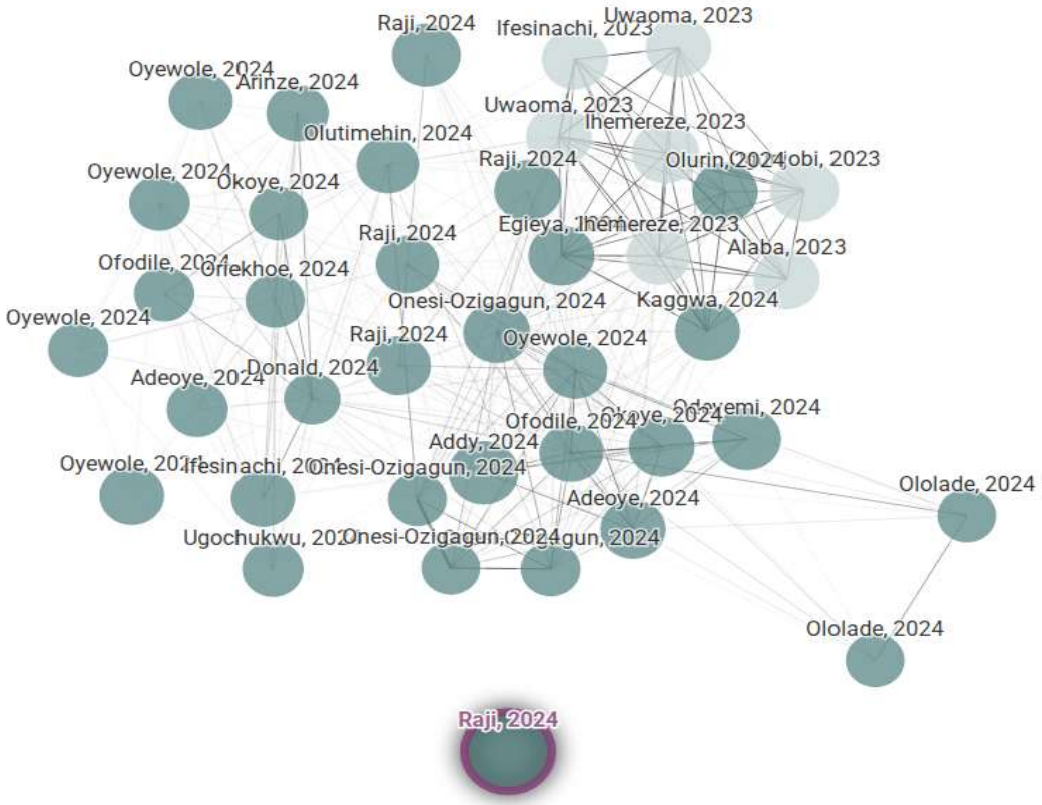

Рисунок 1. Библиометрический обзор литературных источников

В работе Толстоя и соавторов (2023) исследуется, каким образом эффективное формирование рыночной среды влияет на международную деятельность малых и средних предприятий, вовлечённых в трансграничную электронную коммерцию (Tolstoy et al., 2023). Опираясь на теорию эффектуации, исследователи предполагают, что компании могут стимулировать спрос на зарубежных рынках, создавая новые способы взаимодействия с клиентами в цифровом пространстве. Анализируя выборку из 99 шведских МСП, занимающихся электронной

коммерцией, авторы установили, что эффективное создание рынка положительно влияет на их международную деятельность. Предполагается, что этот положительный эффект достигается благодаря инсайдерской деятельности на международных рынках, что подтверждается деятельностью, связанной с международной маркетинговой аналитикой и международным нетворкингом.

Калужский в статье рассматривает вопросы регулирования электронной коммерции как в контексте России, так и с учетом мировых тенденций, и исследует следующие вопросы: институциональное регулирование; приоритеты; мировые тенденции электронной коммерции (Kaluzhsky, 2013).

На основе проведенного обзора можно отметить, что современная экономика постепенно смещается от производственной модели к экономике, основанной на информации, знаниях и услугах. Большинство исследователей сходятся во мнении, что цифровые технологии существенно изменили способы ведения бизнеса: трансформировали пространственное распределение экономической активности, структуру торговли и значение местоположения для компаний. Представленные работы также показывают, что электронная коммерция требует пересмотра стратегических подходов и даёт компаниям новые инструменты для повышения конкурентоспособности, развития логистики и оптимизации управления цепями поставок.

В то же время остаются области, которые пока изучены недостаточно. Во-первых, отсутствуют междисциплинарные модели, которые одновременно учитывали бы инфраструктуру, регулирование, поведение потребителей и особенности логистики. Во-вторых, наблюдается нехватка эмпирических исследований в развивающихся странах, в том числе в Центральной Азии, где условия цифровизации и институциональная среда существенно отличаются от рынков США, Европы и Китая. В-третьих, мало работ посвящено тому, как международные платформы взаимодействуют с национальными регуляторами и как такие механизмы влияют на доступ малых и средних предприятий к трансграничным рынкам.

Таким образом, при наличии значительного теоретического и практического материала развитие электронной коммерции всё ещё открывает широкий спектр нерешённых исследовательских задач, требующих дальнейшего изучения.

Данная научная работа рассматривает роль и значение цифровой инфраструктуры в стимулировании экономического роста и повышении эффективности деятельности отечественных МСБ за счёт использования трансграничных возможностей и положительных эффектов, возникающих благодаря инсайдерской активности на международных рынках. Такой подход позволяет внести вклад в развитие теорий интернационализации малого и среднего бизнеса Казахстана, акцентируя внимание на цифровом измерении трансграничной коммерческой деятельности.

Материалы и методы

Методологическая основа исследования формировалась на базе теоретических работ, рассмотренных в предыдущем разделе статьи. В этой связи

для иллюстрации и аналитического обобщения материалов были применены библиографический анализ, графические методы и опрос респондентов. Первичные данные за исследуемый период использовались из официальных источников, включая материалы Бюро национальной статистики при Агентстве по стратегическому планированию и реформам Республики Казахстан (2018–2024 гг.), глобальную базу данных ООН United Nations E-Government Development Database (UNeGovDD), а также аналитические обзоры международной компании по исследованию рынков Euromonitor International (2025). Исследование рынка электронной коммерции Казахстана охватывает период: 2018-2024 гг. и проведено посредством анализа удельного веса и темпов прироста электронной торговли в структуре общей розничной торговли страны. Выделены этапы развития электронной коммерции в динамике, раскрыты особенности и тенденции их изменения во временном аспекте.

Расчетно-аналитические разработки проводились методом сравнительного и структурного анализа в следующей последовательности:

(1) Анализ структуры рынка электронной коммерции и ее доли в общей розничной торговли Казахстана;

(2) Определение удельного веса субъектов (по категориям) МСБ по оказанию электронных услуг и их характеристика;

(3) Анализ структуры товарных групп реализованных маркетплейсами и оказанных ими виды услуг;

(4) Объем реализации товаров и услуг через маркетплейсы по видам экономической деятельности;

(5) «Опрос-оценка» респондентов о степени влияния ТЭК на деятельность МСБ.

Проведенные на основе таких методологических подходов исследования рынка электронной коммерции в Казахстане позволили объективно оценить современное состояние, выявить сильные и слабые стороны, а также возможности и отличительные особенности развития данной сферы.

Результаты исследования

В Казахстане объём продаж в сфере электронной коммерции, особенно в её розничном сегменте, демонстрирует высокие темпы роста в течение последних трёх лет. Динамика развития позволяет выделить два чётко выраженных этапа. Первый этап (2018-2021 гг.) характеризуется умеренными и относительно стабильными темпами прироста. Существенную роль играли начальные барьеры, связанные с уровнем цифровой готовности бизнеса и потребителей, состоянием логистики и общим доверием к онлайн-каналам продаж. Второй этап (2021-2024 гг.) отличается выраженным ускорением темпов роста и переходом к интенсивной фазе развития электронной коммерции.

На втором этапе темпы прироста уже имели интенсивный характер и, в конечном итоге достигли 14,1 % удельного веса в структуре общего объема розничной торговли страны (рисунок 2).

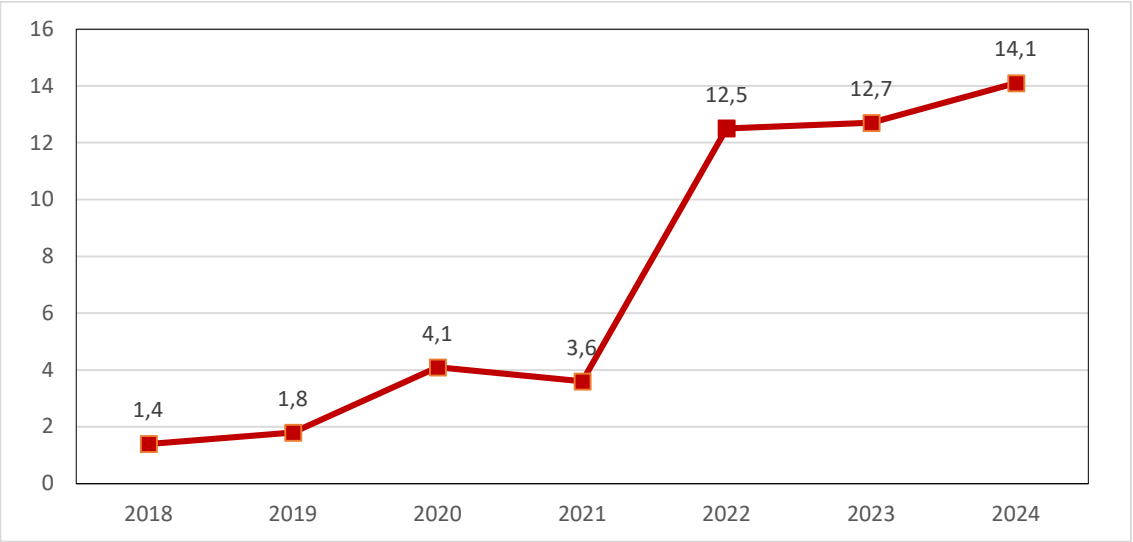

Рисунок 2. Доля электронной торговли в общей розничной торговли Казахстана за 2018-2024, в %

За период 2021-2024 гг. отечественный рынок электронной коммерции достиг объема в размере 3 156,4 млрд тенге, с ростом в 6,55 раза. Прирост к предыдущему году был наиболее высоким между 2021г. и 2022 г. (на 8,9 п.п.) После этого темпы роста замедлились до 1,4 п.п. В 2024 г. объем рынка розничной электронной коммерции (внутренний рынок) с учетом маркетплейсов составил 3156,4 млрд. тенге, из них оборот розничной торговли через платформу электронной коммерции (маркетплейс) составил 2679,8 млрд. тенге (84,9%), предприятий розничной торговли, осуществляющих реализацию товаров через собственный Интернет-ресурс – 476,5 млрд. тенге или 15,1% (рисунок 3.)

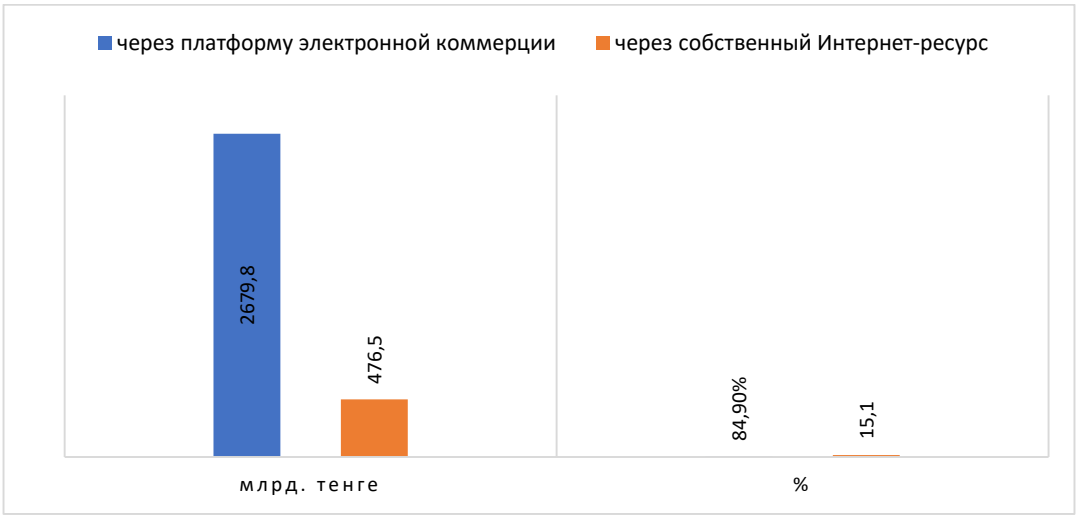

Рисунок 3. Структура рынка розничной электронной коммерции

Из этого следует вывод о том, что основную часть рынка занимают маркетплейсы, а именно: а) «Kaspi.kz» - лидер рынка, который является не только торговой площадкой, но и финансовым инструментом; б)«Wildberries.kz» - крупный международный игрок с сильными позициями в нашей стране; в) «Halykmarket.kz» - маркетплейс от Halyk Bank. Другие менее значимые маркетплейсы, такие как: «Sulpak», «Chocofamily», «Magnum», «OLX.kz» и «Lamoda». Все эти структуры являются участниками Трансграничной электронной коммерции (далее – ТЭК). Анализ структуры деятельности электронной коммерции в РК показывает, что удельный вес розничной торговли составляет 72% и оказанные услуги – 28%. При этом в 2024 году средний чек реализации через собственный Интернет-ресурс для розничных товаров составил 39 179 тенге, для оказанных услуг – 15 243 тенге.

Следует отметить, что иностранные компании показывают более высокий рост среднего чека, в то время как местные игроки активнее наращивают объемы продаж и число транзакций. Средний чек на маркетплейсах: а) товары: 17 572 тенге; б)услуги : 3 274 тенге. Рост частоты покупок и снижение среднего чека: в 2024 г. наблюдался рост числа транзакций при уменьшении средней стоимости заказа, что характерно для зрелых рынков и указывает на интеграцию онлайн-покупок в повседневную жизнь. Основной формой оплаты остаются дебетовые и кредитные карты, а также онлайн-банкинг. Оплата наличными уступает онлайн-платежам.

Объём электронной торговли через маркетплейсы в Казахстане по итогам 2024 г. составил 2,67 трлн. тенге – это на 51,6% больше, чем годом ранее. Удобство, широкий ассортимент и развитая логистика делают маркетплейсы всё более предпочтительным каналом для покупателей, в то время как собственные онлайн-ресурсы бизнеса теряют аудиторию и обороты. Таким образом, маркетплейсы становятся ключевыми игроками в структуре электронной торговли страны. Рост электронной торговли также приносит значительный прирост налоговый поступлений в бюджет. Так, по итогам 2024 г. лидером по налоговым отчислениям среди маркетплейсов стал «Kaspi.kz»: за 2024 г. компания направила в госказну 133,7 млрд. тенге – на 28,8% больше по сравнению с предыдущим годом. В топ-5 маркетплейсов по налоговым отчислениям в 2024 г. вошли также «Wildberries» (ТОО «ИМВБКЗ») – 37,5 млрд тенге, «Ozon» (ТОО «ОЗОН Маркетплейс Казахстан») – почти 10 млрд тенге, OLX - 3,6 млрд тг и Flip.kz - 831,4 млн. тенге.

Следует отметить, что 96,1% от общего объёма розничной электронной торговли через маркетплейсы приходится на малые и средние предприятия. Если рассматривать детальнее, то 79% – это средние предприятия, 17,1% – малые, и 3,9% – крупные компании. Таким образом, именно маркетплейсы стали драйвером развития сетевой торговли для МСБ в Казахстане, давая микро-, малому и среднему бизнесу готовую инфраструктуру, новые возможности роста и доступ к покупателям. Что касается самых популярных групп товаров, реализованных через маркетплейсы, то ситуация следующая (рисунок 4).

Рисунок 4. Структура товарных групп, реализованных через маркетплейсы за 2024

Важным фактором, стимулирующим интенсивное развитие рынка электронной коммерции в Казахстане, является высокий уровень цифровой трансформации экономики. По уровню электронного участия (EPI), Казахстан занимал 27-е место в мире согласно Индексу электронного участия ООН в 2024 г. United Nations (2025). Индекс электронного участия (E-Participation Index, EPI) оценивает, насколько эффективно государства используют цифровые технологии для вовлечения граждан в процессы государственного управления, включая доступ к информации, участие в принятии решений и предоставление обратной связи. По развитию электронного правительства (EGDI): Казахстан находится также на 24-м месте в мировом рейтинге по Индексу развития электронного правительства (EGDI) по данным ООН за 2024 г. Индекс EGDI (E-Government Development Index) измеряет уровень развития цифровых технологий, услуг и инфраструктуры для взаимодействия государства с гражданами и бизнесом. Эти позиции демонстрируют, что Казахстан достиг высоких результатов в области электронного управления и участия, активно внедряя инновационные технологии в государственные процессы и предоставление услуг гражданам. Тем самым появилась почти неограниченная возможность для желающих принять участие в электронном бизнесе, в качестве как продавца, посредника или покупателя. Одновременно с этим электронная коммерция дает возможность существенно расширить номенклатуру и ассортимент товаров, что в свою очередь стимулирует отечественных товаропроизводителей.

Далее, рассмотрим объем и структуру оказываемых услуг посредством маркетплейсов в электронном бизнесе Казахстана. В системе электронного бизнеса маркетплейсы стали одним из эффективных деривативов, позволяющие всем участникам торгового процесса в одинаково выгодных условиях вести свою деятельность. Принцип деятельности маркетплейсов основан на том, что чем

больший доход имеют участники, тем больше прибыли и у организаторов торговой платформы (рисунок 5).

Рисунок 5. Структура и виды услуг оказанные посредством маркетплейсов за 2024, в %

В части оказываемых услуг можно отметить, что большая часть услуг, оказываемых через маркетплейсы в 2024 г., связана с перевозкой пассажиров (50,3%). Следующие по объему идут прочие услуги (31,6%), билеты и бронирование мест на транспорт (9,6%). Наименьший интерес представляют услуги в области рекламы (1,8%) и бронирование и оплата услуг мест размещения (1,6%).

В отношении объема реализации товаров и услуг через маркетплейс по размерности предприятия: большинство услуг и товаров реализуются через малые предприятия (93%), в то время как средние предприятия составляют лишь 7% рынка.

В итоге можно сделать общий вывод. что в Казахстане наблюдается быстрый рост электронной коммерции, как в розничной торговле, так и в сфере услуг, особенно 2021-2024 гг., стали особенно успешными в этом плане, что может быть связано с увеличением числа маркетплейсов. Важно отметить, что большая часть рынка услуг через маркетплейс приходится на малые предприятия, что говорит об их гибкости и способности быстро адаптироваться к изменениям на рынке. Если анализировать ситуацию с розничной реализацией товаров и услуг посредством маркетплейсов, то можно отметить их преобладающую долю (58%), что

свидетельствует о доминировании традиционного розничного сегмента в электронной коммерции (рисунок 7).

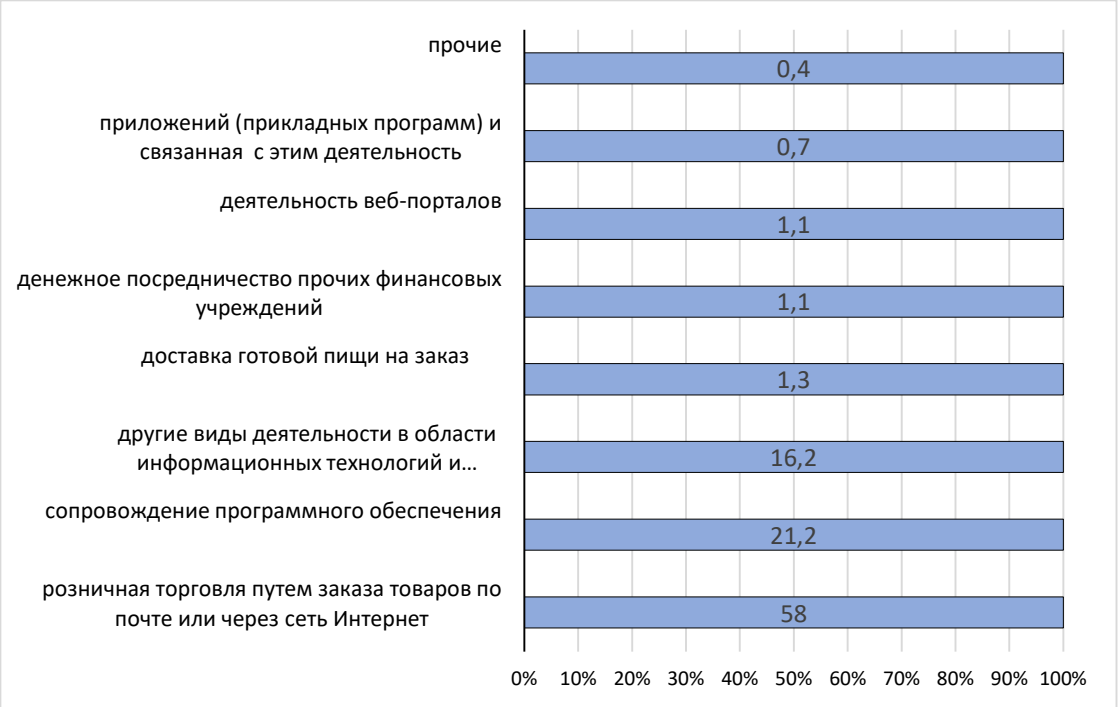

Рисунок 7. Объем реализации товаров и услуг через маркетплейсы по видам экономической деятельности за 2024, в %

Сопровождение программного обеспечения занимает 21,2%. Несмотря на то, что это далеко от лидера, это важный и значительный сегмент, особенно в контексте роста цифровизации. Остальные сегменты, функционирующие в системе информационных технологий, занимают 16,2%. Другие виды деятельности, такие как доставка готовой еды на заказ, денежное посредничество и деятельность веб-порталов, составляют небольшую долю от общего объема. Отсюда следует вывод, что несмотря на доминирование традиционных сегментов, таких как товары для дома и одежда, также наблюдается рост в сферах, связанных с технологиями и ИТ-услугами. Наличие такого множества категорий товаров в онлайн-продажах подтверждает, что потребители все больше доверяют покупкам через интернет и расширяют свои потребительские привычки.

Для эмпирического подтверждения гипотезы о том, что электронная коммерция в сфере розничной торговли способствует повышению эффективности деятельности субъектов МСБ, были использованы данные отечественных хозяйствующих единиц. Информационную базу исследования составили отчёты компаний, а также результаты опроса респондентов. Агрегированный массив данных, отражающий численность участников опроса, представленных субъектами МСБ, приведён в таблице 1.

Таблица 1. Контингент участников-респондентов

№	Группа наблюдения	Количество участников представляющие субъектов МСБ	
		использующие платформы «Marketplace»	не использующие платформы «Marketplace»
A	Базовая группа	4 (q_{11})	38 (q_{12})
B	Экспериментальная группа	42(q_{21})	2(q_{22})

Примечание: составлено авторами

Работа с респондентами велась как в форме интервью, так и посредством заполнения анкет с целью выяснение возникающих проблем при интернационализации электронной коммерции субъектами МСБ, а также о потенциальных возможностях данного ресурса для повышения эффективности деятельности хозяйств-участников. Для пилотного исследования респонденты были подразделены на две группы: а) «Базовая» подразумевается контингент-респондентов представляющие МСБ – незначительно или совершенно не принимающие участие на электронных платформах трансграничной торговли. «Экспериментальная» - активно принимающие участие на электронных платформах трансграничной торговли (Таблица 1).

Далее, данные группы были интегрированы в систему исследований для обработки эмпирической математической модели. Целью данного исследования состоит в определении степени влияния фактора {x} – «Трансграничной электронной коммерции» (далее - ТЭК) на «Уровень деятельности субъекта МСБ» {y}. При этом воспользуемся методологией расчета коэффициент корреляции Пирсона, [Pearson, Karl. (2017)] которая предполагает, что мы должны взять разность между каждым значениям - x_i переменной - y_i, и их средним значением $\bar{x}$ - $(x_i;\ y_i)$. Находим значение коэффициента – R:

$$|\ R\ |=|\ -0.8616\ |\approx 1$$

Абсолютное значение коэффициента ассоциации (R≈ 1) подтверждает тесную взаимосвязь рассматриваемых признаков. По значению полученного R-коэффициента можно убедиться в наличии тесной связи фактора – «Трансграничной электронной коммерции» на уровень деятельности субъекта МСБ. В силу того, что уже установлена достаточная степень взаимозависимости между рассматриваемыми факторами, то нами был проведен опрос-респондентов по определению степени их компетентности об оценке влияние ТЭК на деятельность МСБ у обеих групп (таблица 2).

Ответы анкеты оценивались по суммарному методу, основанному на соотношении вариантов «согласен» – «не согласен» с предложенными утверждениями: 1 балл присваивался за ответ «согласен» («да»), 0 баллов — за нейтральное отношение («не знаю»), и 1 балл — за ответ «не согласен» («нет»). Полученные результаты показали, что субъекты МСБ, входящие в экспериментальную группу, обладают более высокой осведомлённостью о

Таблица 2. Опрос-оценка влияние ТЭК на деятельность МСБ (основные)

№	Трансграничная электронная коммерция (ТЭК)	Опрашиваемые группы и количество участников					
		базовая группа			экспериментальная группа		
		«да»	«не знаю»	«нет»	«да»	«не знаю»	«нет»
1	ТЭК дает возможность систематически удовлетворить потребности клиентов-покупателей?	14	10	18	35	5	4
2	ТЭК позволяет оценить траекторию и структуру развития отраслей, обслуживающие клиентов-покупателей?	8	16	18	34	4	6
3	ТЭК позволяет определить предельные потребности клиентов-покупателей?	4	14	24	28	10	6
4	ТЭК позволяет ли найти возможности для Вашего бизнеса найти ту Продукцию, которая будет нужна потребителю в будущем?	2	18	22	18	12	14
5	ТЭК дает новые возможности для расширение розничной торговли МСБ?	17	14	11	31	9	4
6	ТЭК позволяет росту продаж и прибыли МСБ	12	17	13	26	8	10
7	ТЭК позволяет находит дополнительные источники инвестиции	3	18	21	24	6	14
8	ТЭК дает возможность расширит секторы рынка	7	15	20	19	9	16

Примечание: составлено авторами

преимуществах трансграничной электронной коммерции как инструмента расширения хозяйственной деятельности. Так, на вопрос «Трансграничная электронная коммерция позволяет систематически удовлетворять потребности клиентов-покупателей?» положительно ответили лишь 33,3 % представителей базовой группы, тогда как в экспериментальной группе этот показатель достиг 79,5 %, что свидетельствует о стремлении участников экспериментальной группы к диверсификации каналов сбыта и освоению трансграничных рынков.

Аналогичная разница наблюдается и в отношении оценки отраслевых тенденций. На вопрос «Трансграничная электронная коммерция позволяет оценивать траекторию и структуру развития отраслей, обслуживающих клиентов-покупателей?» утвердительно ответили 77,2 % респондентов экспериментальной группы и только 19,1 % базовой. Особенно значимы различия по вопросу о перспективах развития бизнеса: «Позволяет ли трансграничная электронная коммерция определить продукцию, востребованную потребителем в будущем?» Положительно ответили лишь 2 участника из 42 в базовой группе, в то время как в

экспериментальной группе утвердительный ответ дали 18 респондентов из 44. Существенная разница отмечена и в оценке влияния трансграничной электронной коммерции на итоговые показатели деятельности МСБ. На вопрос «Трансграничная электронная коммерция способствует росту продаж и прибыли?» положительно ответили 28,6 % респондентов базовой группы и 59,1 % участников экспериментальной группы (таблица 3).

Таблица 3. Итоговые показатели «Опрос-оценки»

№	Критерий эффективности ТЭК	Исследуемые группы		Разница (группа эксперимент. больше, чем базовая «+»)
		«Базовая» группа	«Экспериментальная» группа	
1	«удовлетворение потребностей клиентов»	14	35	+21
2	«понимание отраслевой динамики»	8	34	+26
3	«определение предельных потребностей»	4	28	+24
4	«прогноз перспективных товаров»	2	18	+16
5	«расширение торговли»	17	31	+14
6	«рост продаж и прибыли»	12	26	+14
7	«инвестиционные возможности»	3	24	+21
8	«расширение рынков»	7	19	+12

Примечание: составлено авторами

Сводные данные показывают, что респонденты «Экспериментальной группы» значительно чаще отвечает «да» по всем пунктам, что свидетельствует их убежденности о том, что участие МСБ в ТЭК повышает осведомлённость, вовлечённость и реальное восприятие выгод для бизнеса. Базовая группа чаще выбирает «не знаю» или «нет» из-за недостатка опыта или ограниченной информации. Поэтому, в среднем экспериментальная группа даёт на 18-20 положительных ответов больше.

Полученные результаты позволяют сформулировать следующие выводы. Во-первых, трансграничная электронная коммерция способствует более глубокому пониманию отраслевых трендов, обеспечивая субъектам МСБ доступ к рыночной аналитике и глобальным данным. Во-вторых, расширение информационной базы о поведении покупателей облегчает формирование спроса и построение прогнозов. В-третьих, использование инструментов ТЭК повышает способность предприятий прогнозировать будущую потребность в товарах и выбирать перспективные продуктовые направления. В-четвёртых, участие в трансграничной торговле расширяет понимание экспортных возможностей и географии продаж. В-пятых, ТЭК обеспечивает доступ к новым инвесторам и маркетплейсам, одновременно повышая доверие к бренду. В-шестых, участие в ТЭК способствует диверсификации бизнеса и выходу на новые ниши и сегменты рынка.

Заключение

Данная работа позволяет сделать следующие выводы и рекомендации.

1. Проведенная аналитическая работа свидетельствует о стойком непрерывном росте рынка розничной электронной коммерции в Казахстане, что подтверждается растущим интересом потребителей к онлайн-покупкам и укреплением позиций маркетплейсов в структуре рынка. Несмотря на то, что темпы роста объема рынка и количества транзакций замедлились в 2022 году по сравнению с предыдущими годами, рынок продолжает развиваться, что делает его привлекательным для инвесторов и бизнесменов.

2. Анализ показал высокую эффективность торговой платформы -ТЭК - «маркетплейс» и приводит к выводу о том, что необходимо создать и развивать отечественные коммерческие торговые площадки. К тому же для начала такой деятельности, нет особой необходимости создавать собственный интернет-магазин, достаточно стать участником платформы - маркетплейсов. Так поступают в основном начинающие «игроки» данной сферы, которые начинают свою деятельность с поиска нужных видов товара или услуг. Таковы первичные приемы и способы вновь прибывших «участников» данной сферы, занимающиеся поиском необходимых им товаров и услуг.

3. Можно утверждать с полным основанием о том, что на отечественном рынке в сфере розничной торговли «online-коммерция» диверсифицируется различными финансовыми бизнес-моделями и имеет тенденцию стабильного роста. Несмотря на доминирование традиционных сегментов, таких как товары для дома и одежда, также наблюдается рост в сферах, связанных с технологиями и ИТ-услугами. Наличие такого множества категорий товаров в онлайн-продажах подтверждает, что потребители все больше доверяют покупкам через интернет и расширяют свои потребительские привычки.

4. Относительно объемов розничной торговли по размерности предприятия можно отметить, что крупные предприятия доминируют (48,8%) в онлайн-торговле, составляя почти половину. То, что крупный бизнес имеет преимущество относительно малых предприятий объясняется многими причинами: разница арендных ставок, престижная потребность покупателей, предпочитающих предложения популярных супермаркетов, где отовариваются большинство населения. В пользу крупного бизнеса также играет эффект «масштабности», комфортабельная обстановка и обслуживание, широкий выбор товаров и услуг, всевозможные акции, бонусы и льготы для покупателей.

5. Аналитические выводы: (а) ТЭК способствует лучшему пониманию отраслевых трендов, доступу к рыночной аналитике и глобальным данным; (б) в рамках ТЭК доступно больше информации о поведении покупателей тем самым легче формировать спрос и прогнозы; (в) ТЭК улучшает способность прогнозировать будущий спрос и выбирать перспективные товары; (г) участие в ТЭК увеличивает понимание экспортных возможностей и расширение географии продаж; (д) ТЭК открывает доступ к новым инвесторам, маркетплейсам, а также улучшает доверие к бренду; (е) участие в ТЭК способствует диверсификации бизнеса, выходу на новые ниши и сегменты.

6. Цифровой бизнес на трансграничном рынке дает возможность для отечественного малого бизнеса получить четкое представление о том, что по какой траектории будут развиваться потребности клиентов в будущем и сигналы на перспективу: каким должен быть ассортимент предложений производителей и поставщиков, т.е. создаются ценности - цифровые услуги, что является особенно важным для относительного ограниченного внутреннего рынка Казахстана.

Author Contributions

Conceptualisation and theoretical framework: AT and HA; research design and methodology: AB and UT; data collection and processing: AT, HA, AB and UT; bibliometric analysis and interpretation: AT, HA, AB and UT; case study analysis and visualisation: AT, HA, AB and UT; draft writing and manuscript structure: AT, HA, AB and UT; editing and critical revision: AT; final review and approval: : AT and HA. All authors have read and approved the final version of the manuscript and agreed to its publication.

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A Gender-Inclusive Model for Sustainable Economic Development of Urban Ecosystems

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Abstract

In the context of accelerated urbanization and the transition to a low-carbon economy, the integration of the gender dimension into models of sustainable development of urban ecosystems is particularly important. The purpose of this study is to develop and substantiate a gender-inclusive model for sustainable economic development in cities in Kazakhstan, considering economic, social, and environmental factors in the framework of a "green" transition. The methodological basis for this study was an interdisciplinary and multi-level approach, including the creation of a system of 35 quantitative indicators, compositional indexing, spatially differentiated analysis, and elements of institutional and predictive analysis. The empirical base includes official statistical data, materials from national and regional development programs, as well as the results of specialized analytical and sociological studies, with mandatory gender disaggregation of employment and social infrastructure indicators. The results show that the implementation of the proposed model makes it possible to reduce the carbon intensity of the urban economy by 25-30% by 2030, while maintaining economic growth rates, and reduce gender gaps in access to employment, infrastructure, and decision-making mechanisms. The developed model can be used as a practical tool for strategic management of sustainable, low-carbon, and inclusive development of cities in Kazakhstan and other transforming economies.

Keywords: Gender, Gender Equality, Social Inclusion, Social Infrastructure, Sustainable Development, Low Carbon Economy, Urban Policy

Қалалық экожүйелердің тұрақты экономикалық дамуының гендерлік инклюзивті моделі

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Түйін

Жедел урбанизация үдерісі және төмен көміртекті экономикаға көшу жағдайында қалалық экожүйелердің тұрақты даму модельдеріне гендерлік өлшемді интеграциялау ерекше маңызға ие болуда. Зерттеудің мақсаты – «жасыл» көшу шеңберінде экономикалық, әлеуметтік және экологиялық факторларды ескеретін Қазақстан қалаларының тұрақты экономикалық дамуының гендерлік инклюзивті моделін әзірлеу және негіздеу. Зерттеудің әдіснамалық негізін 35 сандық көрсеткіштен тұратын индикаторлар жүйесін қалыптастыруды, композиттік индекс құруды, кеңістіктік дифференциацияланған талдауды, сондай-ақ институционалдық және болжамдық талдау элементтерін қамтитын пәнаралық және көпдеңгейлі тәсілдер құрайды. Эмпирикалық база ресми статистикалық деректерді, ұлттық және өңірлік даму бағдарламаларының материалдарын, сондай-ақ жұмыспен қамту мен әлеуметтік инфрақұрылым көрсеткіштерін міндетті түрде гендерлік дезагрегациялау арқылы алынған арнайы аналитикалық және социологиялық зерттеулердің нәтижелерін қамтиды. Алынған нәтижелер ұсынылған модельді енгізу 2030 ж. қарай қалалық экономиканың көміртекті сыйымдылығын 25–30% төмендетуге, экономикалық өсім қарқынын сақтауға және жұмыспен қамтуға, инфрақұрылымға және шешім қабылдау тетіктеріне қол жеткізудегі гендерлік алшақтықтарды қысқартуға мүмкіндік беретінін көрсетеді. Әзірленген модель Қазақстан қалаларының және басқа да трансформацияланушы экономикалардың тұрақты, төмен көміртекті және инклюзивті дамуын стратегиялық басқарудың практикалық құралы ретінде пайдаланылуы мүмкін.

Түйін сөздер: гендер, гендерлік теңдік, әлеуметтік интеграция, әлеуметтік инфрақұрылым, тұрақты даму, төмен көміртекті экономика, қалалық саясат

Гендерно-инклюзивная модель устойчивого экономического развития городских экосистем

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Аннотация

В условиях ускоренной урбанизации и перехода к низкоуглеродной экономике особую значимость приобретает интеграция гендерного измерения в модели устойчивого развития городских экосистем. Целью исследования является разработка и обоснование гендерно-инклюзивной модели устойчивого экономического развития городов Казахстана, учитывающей экономические, социальные и экологические факторы в рамках «зеленого» перехода. Методологической основой исследования послужили междисциплинарный и многоуровневый подходы, включающие формирование системы из 35 количественных индикаторов, композитное индексирование, пространственно дифференцированный анализ, а также элементы институционального и прогнозного анализа. Эмпирическая база включает официальные статистические данные, материалы национальных и региональных программ развития, а также результаты специализированных аналитических и социологических исследований с обязательной гендерной дезагрегацией показателей занятости и социальной инфраструктуры. Полученные результаты показывают, что внедрение предложенной модели позволяет к 2030 г. снизить углеродоемкость городской экономики на 25-30% при сохранении темпов экономического роста, а также сократить гендерные разрывы в доступе к занятости, инфраструктуре и механизмам принятия решений. Разработанная модель может быть использована как практический инструмент стратегического управления устойчивым, низкоуглеродным и инклюзивным развитием городов Казахстана и других трансформирующихся экономик. Разработанная модель представляет собой практический инструмент стратегического управления устойчивым, низкоуглеродным и инклюзивным развитием городов Казахстана и других трансформирующихся экономик.

Ключевые слова: гендер, гендерное равенство, социальная интеграция, социальная инфраструктура, устойчивое развитие, низкоуглеродная экономика, городская политика

Introduction

The process of urbanization and globalization has a significant impact on the formation of urban ecosystems, thereby creating transformational challenges. Today, 55% of the world's population lives in cities, and, according to United Nations forecasts, this share will increase to 68% by 2050 (United Nations, Department of Economic and Social Affairs, 2018). In this regard, ensuring balanced and sustainable development and the development of progressive technological solutions are key to urban spaces. Modern major megacities are key strategic centers for the development of the global economy. They are centers of concentration in such sectors as industry, science, education, energy (including renewable energy sources), healthcare and biomedical technologies, the environment and natural resource management, services and the service economy, etc. (Eliseev, 2016). Within this system, gender differences directly impact access to resources, mobility, security, and economic participation.

Academic literature emphasizes that social realities are often overlooked in urban development strategies. Women and vulnerable groups continue to face limited access to transportation, care infrastructure, digital services, and safe public spaces. These barriers not only create social vulnerability but also structurally limit economic opportunities, hindering full inclusion in the labor market, entrepreneurship, and decision-making processes. Thus, gender differences are no longer a secondary element but a crucial determinant of urban economic resilience.

A gender-inclusive model of sustainable economic development in urban ecosystems is emerging at the intersection of three key research fields: sustainable urban development theory, gender studies, and inclusive growth concepts. Classic works on the sustainable city by Newman and Kenworthy (2015) demonstrated that cities are becoming the primary sites of ecological and socioeconomic transition; the nature of urban development, transportation systems, and resource management determine sustainability trajectories and the quality of life of various social groups. However, in these and many subsequent models, the city is often conceptualized as a “gender-neutral” space, where differences in the needs of women and men, as well as vulnerable groups (women living alone, women with children, the elderly, migrants, etc.), remain on the periphery of analysis.

Feminist urban studies and gender studies of the last decade convincingly demonstrate that the “urban turn” has not automatically led to a reduction in gender inequality. Chant (2013) analyzed the phenomenon of the “feminization of poverty” and the situation of women in cities of the Global South, demonstrates that urbanization processes reproduce complex intersections of gender, poverty, and spatial marginalization; female households and women employed in low-paid service and informal economy sectors often find themselves in areas with the least infrastructure, with limited access to transportation, social services, and safe public spaces. These findings are reinforced by the work of Vera-Sanso (2012) described how older women's work in the informal economy contributes to family, national and global economies.

Moser (2012) has made a significant contribution to the theoretical understanding of the gender-inclusive city, developing the “gender planning” approach and exploring

the transformation of the global urban agenda through the prism of women's rights to the city, security, and participation in governance. Her work demonstrates that without systematically integrating a gender perspective into urban planning and budgeting, "inclusiveness" remains lip service. At the same time, most infrastructure solutions continue to reproduce male norms of everyday mobility and employment. Thus, a conceptual shift is required, from adding a "gender component" to rethinking the very logic of designing urban spaces and economic institutions.

Practice-oriented research by international organizations also notes that sustainable urban development without a gender lens is limited in scope. UN-Habitat (2020) reports emphasize that "urban prosperity" does not equate to improved status for women: despite growing GRP and investment activity, gender gaps persist in access to housing, transportation, formal employment, and safe public spaces. At the same time, contemporary sustainable development literature increasingly recognizes that an urban ecosystem is not only physical infrastructure (transportation, buildings, utilities), but also a set of formal and informal institutions, norms, practices of care, and the reproduction of human capital. A gender-inclusive approach allows for a new interpretation of sustainable urban economic development, examining it through the distribution of unpaid care labor, the spatial distribution of social infrastructure, the structure of employment in the "care" economy, and the safe movement of various population groups. This is emphasized by both gender and urban researchers, as well as by recent reports by UN Women and UN-Habitat on the concept of "caring cities" and gender-inclusive urbanism (UN-Habitat, 2020).

This study aims to theoretically substantiate and develop a gender-inclusive model of sustainable economic development in urban ecosystems. This concept views sustainability not simply as a harmonious combination of economic, environmental, and social components, but also as a tool for reducing gender inequality in access to urban resources, economic participation, and the distribution of benefits from urban development. The concept's goal is to establish a link between macroeconomic indicators of sustainable development and those aspects of daily life that matter at the micro level: safety, transportation accessibility, access to services, and the development of care infrastructure. This allows gender inclusiveness to be viewed as a necessary condition, rather than an optional complement, to sustainable development.

This work is based on the idea that the timely integration of gender aspects into urban planning and management processes improves program effectiveness, reduces population vulnerability, strengthens principles of social justice, and increases economic resilience. The study aims to: (1) analyze the scientific literature and identify areas in which the gender aspects of urban development have not yet been sufficiently studied; (2) to systematize international experience in implementing gender-sensitive approaches and develop a conceptual model for sustainable economic development of the urban ecosystem that takes into account the interests and needs of all gender groups. Based on the premise that technology, infrastructure, and urban institutions are not neutral, the study examines how existing power structures and cultural norms shape access to opportunities and resources for different population groups. Gender-responsive urban planning can significantly contribute to gender equality and women's empowerment by providing accessible infrastructure and services for water and sanitation, waste

management, electricity, transport, and housing; security of tenure, employment, and income opportunities through formal and informal labor markets; and safety and security for all citizens in growing urban areas.

Literature Review

In recent years, international organizations have consistently emphasized that sustainable urban development is impossible without integrating a gender perspective into infrastructure planning, management, and economic policy. Several key documents prepared by the World Bank, UNDP, and the OECD view gender inclusiveness as essential for improving the efficiency of urban economies, strengthening social resilience, and reducing the vulnerability of urban communities. This is creating a new paradigm: the city as a gender-sensitive ecosystem in which social, institutional, and spatial decisions mutually reinforce economic development.

The World Bank's report, the Business Case for Gender and Cities, draws a broader conclusion: urban economies benefit from women's inclusion because gender-responsive policies boost productivity, employment, and the tax base, and are therefore an important element of sustainable economic development (World Bank, 2023). UNDP considers gender inclusion in relation to social resilience and climate change. The report “Mainstreaming Gender in Urban Development” describes a structural approach to integrating gender equality into the urban policy cycle: diagnosis, design, budgeting, implementation, and monitoring (UNDP, 2021). The joint UNDP and OECD report Investing for Gender Equality and Inclusive Climate Action in Europe and Central Asia are significant for economic development, as it shows that ignoring the gender dimension in climate and green projects reduces their effectiveness and limits the potential of urban economies. Women living in cities face particular climate risks (overheating, lack of green spaces, mobility issues), and addressing them requires adaptive solutionsб from green infrastructure to gender-sensitive energy and transport models. Furthermore, the OECD (2025) provides a significant contribution to research on the intersections between gender, ecology, and the economy. The report “Gender Equality in a Changing World: Green Transition and Digital Transformation” emphasizes that the green transition and digitalization of cities can either accelerate equality or exacerbate existing gaps if women's access to innovation, digital services, technology, and green skills is not addressed.

Utkelbay (2025) finds that infrastructure development (such as safe street lighting and accessible public transportation) with digital solutions and gender-disaggregated data significantly improves women's mobility and safety, thereby expanding their economic opportunities and participation in urban life. However, the author concludes that technology-driven "smart" initiatives that fail to consider gender contexts reinforce the tendency to reproduce social inequality. For sustainable and equitable urban development, it is essential to integrate a gender perspective at the early stages of planning (Utkelbay, 2025).

The study found that residents' perceptions of Qonayev City in social and economic dimensions were higher than those in environmental and political ones. These differences demonstrate the importance of an integrated approach to urban development, in which

infrastructure, social services, and economic investment are integrated with environmental safety and transparent governance. Akbar et al. (2025) emphasized that to improve the sustainability and inclusiveness of the urban environment, it is essential to consider residents' views in planning. This enables the creation of more adaptive, equitable, and long-term development mechanisms that can include gender-sensitive solutions that enhance the participation of all population groups, including women,

Atakhanova and Baigaliyeva (2025) found that public infrastructure programs implemented in Kazakhstan's capital contributed to significant improvements in economic and social conditions (increased income, reduced poverty, and expanded access to housing and social services). However, intensive use of natural resources and the reduction of green and water areas call environmental sustainability into question, highlighting the need to integrate not only economic but also environmental and social (including gender-sensitive) approaches into planning. This means that to achieve truly sustainable urban development, it is essential to complement infrastructure investments with mechanisms that ensure equitable access for all population groups, including women, to economic opportunities, social benefits, and a clean urban environment, thereby strengthening inclusiveness and social justice in economic growth.

Letsoko et al. (2025) emphasized that traditional approaches to urban planning often assume a “universal user”, usually a physically able and economically active man, which leads to the neglect of women's specific needs for access to public spaces, transportation, and services, and, consequently, to the perpetuation of gender inequality. The review concludes that gender-sensitive planning, including safe public spaces, convenient mobility, and equal access to infrastructure, forms the foundation for building more inclusive and sustainable urban ecosystems, increasing economic opportunities for women, and promoting balanced socioeconomic development.

Lerman (2021) demonstrated that women in Central Asian countries continue to face significant constraints in the labor market, access to financial institutions, social services, education, and asset ownership, which hinders their full economic participation and reduces the potential for sustainable development. To achieve inclusive and sustainable economic growth, the author proposes government and institutional measures, including removing regulatory barriers to women's property rights, ensuring equal access to education and financial services, and supporting their labor and entrepreneurial activity, which could form the basis for gender-sensitive economic development mechanisms.

Research Methods

The methodology of this study relies on an interdisciplinary, systemic, and spatially differentiated approach to analyzing Kazakhstan's urban ecosystems, combining the concept of sustainable development, the low-carbon growth paradigm, the principles of transition to a green economy, and a gender-responsive approach to policy and governance. The integrated logic of the city's economic, social, and environmental subsystems serves as a cross-cutting framework, accounting for institutional, regulatory, and spatial factors, as well as gender structures of employment and participation in governance.

The analysis is conducted at three interconnected levels, corresponding to the proposed three-tiered governance system: macrolevel (government regulation); mesolevel (regional programs); and microlevel (municipal initiatives). Methodologically, the study is structured in several sequential stages.

(1) Diagnostic and analytical stage: organizing and structuring theoretical concepts related to sustainable and inclusive urban development, the transition to a low-carbon economy, and gender-responsive governance; selecting and systematizing indicators that reflect economic sustainability, social inclusion, and ecological balance (a total of 50 indicators, grouped into three clusters).

(2) Model-conceptual stage: creating a fundamental model of sustainable and inclusive development, highlighting key components: regulatory framework, governance and institutions, economic sustainability, social inclusion, environmental sustainability, infrastructure and technology, monitoring and evaluation; detailing the three-level governance system, including linking macro-, meso- and micro-level instruments with gender-oriented mechanisms; development of a monitoring system that includes economic, social and environmental indicators with mandatory gender disaggregation.

(3) Indicator System and Data Sources: The methodology is based on a system of 35 key indicators grouped into three clusters. Economic sustainability (15 indicators) – dynamics of GRP/GRP per capita, diversification of the urban economy, investment activity, innovation potential, resilience to external shocks, etc. Social inclusion (27 indicators) – access to education and healthcare, poverty level, gender equality in employment and income, women's participation in governance, access to care infrastructure and basic services, and overall well-being; Ecological balance (8 indicators) – air and water quality, energy consumption intensity, the share of renewable energy in the overall energy balance, waste recycling rate, provision of green spaces, per capita carbon dioxide emissions, and the state of urban ecosystems.

All indicators related to population and employment must be disaggregated by gender, and, where available, also by age, income level, and other sociodemographic characteristics. The information base consists of official government statistics, departmental and municipal reports, data from national and regional strategic documents, and results from specialized sample surveys and social surveys.

The quantitative portion of the study uses composite indices, which reduce the multidimensional system of indicators to a single generalized assessment. For the economic sustainability cluster, an aggregated economic sustainability index (hereinafter – ESI) is calculated as a weighted sum of normalized indicators. To ensure the model's alignment with national policy, a combination of institutional and strategic analysis methods is used: analysis of the Concept for the Transition of the Republic of Kazakhstan to a Green Economy and other strategic documents related to sustainable development, climate policy, and gender equality; comparison of national document targets with the logic of the sustainable and inclusive urban development model; identification of gaps between declared goals and actual implementation mechanisms at the macro, meso, and micro levels.

The results are used to refine the set of indicators, tools, and management mechanisms included in the model, as well as to formulate practical recommendations to align urban policy with national strategies. The research methodology thus provides a

logically coherent sequence, from conceptualizing the model and selecting indicators to quantitative assessment, spatial-gender analysis, and forecasting, allowing the developed model to be used as a practical tool for the strategic management of the sustainable and inclusive development of urban ecosystems in Kazakhstan.

Results

This study proposes a conceptual model for sustainable and inclusive urban development in Kazakhstan, integrating economic, social, and environmental aspects within a low-carbon growth paradigm and an inclusive urban ecosystems framework. Particular attention is paid to gender-focused mechanisms that ensure equal access for women and men to resources, infrastructure, employment opportunities, and participation in decision-making. The basic structure of Kazakhstan's model for ensuring sustainable urban economic development, grounded in SDG principles and inclusiveness, is presented in Table 1.

Table 1. Basic model

Model Component	Contents	Implementation tool
1. Regulatory framework	Development and adaptation of legislation in line with the UN Sustainable Development Goals (SDGs).	National programs, urban development strategies, regional regulations, gender-oriented budgeting, and legal protection mechanisms for vulnerable groups.
2. Governance and institutions:	Creation of a multi-level governance system involving the state, business, civil society, and women's/gender organizations.	Municipal councils, public councils, public-private partnerships (PPPs), digital platforms for participation that ensure equal access for women and men, quotas/targets for women's representation in local government.
3. Economic sustainability	Diversification of the urban economy, support for small and medium-sized businesses, and the introduction of green technologies, taking into account the gender characteristics of entrepreneurship and employment.	Investment incentives, innovation clusters, sustainable and green financing programs, and special programs to support women's entrepreneurship and self-employment.
4. Social Inclusion	Ensuring equal access to education, healthcare, housing, and infrastructure for all population groups, taking into account gender differences in needs and limitations.	Social programs, accessible environments, development of care infrastructure (kindergartens, childcare services), digitalization of public services, measures to reduce gender gaps in income and employment.
5. Environmental sustainability	Implementation of green building principles, carbon	Environmental standards, smart technologies, environmental

	footprint reduction, and renewable energy development, taking into account the gender-differentiated impact of environmental risks on health and quality of life.	monitoring systems, and environmental education with a focus on women and youth participation.
6. Infrastructure and technology:	Smart Cities development, digitalization, and sustainable transport with a focus on safe, accessible, and gender-sensitive urban environments.	The Internet of Things, big data, intelligent transportation systems, the creation of safe public spaces, lighting systems, and transport infrastructure that take into account the needs of women, children, and other vulnerable groups.
7. Monitoring and evaluation	A system of key performance indicators (KPIs) for assessing progress toward achieving the SDGs and inclusiveness, with mandatory gender disaggregation of data.	Sustainability indices, ESG reporting, international ratings, gender equality and participation indicators, and regular social surveys.

Note: compiled by the author

This model involves adapting the global principles of the SDGs to Kazakhstan's national and regional characteristics, emphasizing a balance among economic growth, social justice, gender equality, and environmental sustainability. The spatial differentiation of development strategies is critical. Differences in the level of economic development, economic structure, access to infrastructure, quality of human capital, and gender patterns of employment and women's participation in local governance require strategic approaches tailored to specific regional and local contexts. Considering spatial and gender specifics enables the development of more precise and effective policy measures, minimizing the risk of one-size-fits-all solutions that may prove ineffective or even exacerbate social and gender imbalances in certain regions. This is especially relevant in the context of the transition to a low-carbon economy, where the differentiation of decarbonization potential, renewable resource availability, levels of social protection, and adaptive capacity across regions requires a flexible combination of incentives, regulations, and support measures. Thus, a spatially differentiated and gender-sensitive approach is becoming a key element in ensuring sustainable and balanced development at all levels of territorial organization.

Key objectives for cities of national importance, such as Astana and Almaty, include the following: implementing advanced urban management technologies that take into account the interests of various social and gender groups; developing an environmentally friendly, low-carbon transportation sector and creating a transportation infrastructure that is comfortable and safe for women, children, and people with disabilities; optimization of energy consumption through digitalization and the use of data on real household consumption patterns.

The following development areas are relevant for industrial centers:

- upgrading technologies and modernizing production processes;
- implementing circular economy principles and creating jobs in environmentally friendly industries that are accessible to both men and women;
- creating carbon accounting systems.
- complemented by social and gender impact indicators.

For cities of national significance, including Astana and Almaty, the following strategic initiatives should be prioritized for sustainable development. The development of an effective urban governance system requires the consistent digitalization of key areas of life. The main objective is to create a comprehensive information field using intelligent technologies. This will enable continuous monitoring of the city's environmental indicators and public response, including consideration of gender and age differences. Central to this is the deployment of sensor networks to collect data on environmental indicators, traffic flows, and the use of public spaces. The data obtained becomes the foundation for forecasting and creating solutions that achieve a high level of safety, accessibility, and comfort in the urban environment for every resident. Urban governance is more than just the operation and maintenance of infrastructure and city services. It also involves civic participation and ensuring that all stakeholders are involved in decision-making. Women and men have different priorities and needs regarding infrastructure and services related to water and sanitation, transportation, and housing. Women's under-representation or insufficient participation in decision-making processes related to urban services and governance means that their needs and priorities are rarely taken into account in urban planning and investment.

The study proposes solutions to gender issues in urban development, including accessibility and acceptability of services and appropriate technology choices, location and pricing options, participation and representation of women in decision-making bodies, safety and security issues, a clean environment and better health, employment and entrepreneurship opportunities, and ownership of land, property, and assets.

Particular attention must be paid to ensuring the availability of energy-efficient solutions for low-income households and households where women bear the brunt of child and elder care, so that reducing carbon intensity does not come at the expense of increasing social burdens.

It is necessary to implement automated energy metering and management systems in buildings and structures, create digital twins of energy systems, and develop distributed energy systems based on renewable sources. The introduction of smart grids, which optimize energy flows and integrate alternative energy sources into urban infrastructure, plays a significant role.

Implementing these areas requires the development of comprehensive programs tailored to the specific needs of each city. For Astana, as the administrative capital, the creation of a model smart district with a full digital management cycle and integrated mechanisms for monitoring gender equality in access to services is of particular importance. Almaty, as a financial and economic hub, requires an emphasis on the digitalization of business infrastructure, the development of intelligent transport corridors, and ensuring the safety of the urban environment. Key success factors include the development of a regulatory framework that stimulates the implementation of innovative solutions, as well as the creation of public-private partnership mechanisms to

finance relevant projects, including those aimed at expanding women's economic opportunities. For Kazakhstan's industrial centers (Pavlodar, Temirtau, Ekibastuz, and others), the sustainable development strategy should be based on three key areas. The first is the technological modernization of production processes through the implementation of best available technologies (BAT) with a focus on energy efficiency and resource conservation.

The second area is the development of circular cities to address technological, economic, social, and environmental challenges. Particular attention should be paid to innovation, digitalization, and close collaboration with citizens, creating the conditions necessary for the implementation of circular solutions. This applies not only to manufacturing but also to the processing and service sectors, which traditionally employ a significant number of women.

The third area concerns the development of integrated carbon accounting and emissions management systems: automated monitoring systems, corporate carbon strategies, and internal carbon pricing mechanisms. For industrial enterprises, developing competencies in carbon management and ESG reporting is particularly important. This requires training specialists, including female economists, engineers, and analysts, capable of working with climate and environmental data.

The model envisages a three-tier management system (Table 2).

Table 2. Three-level management system for sustainable and inclusive urban development

Management level	**Tool and direction**	**Specific measure**
1. Macrolevel (Government regulation)	Regulatory Framework	- Adoption of low-carbon development laws that include provisions on gender equality and inclusion; - Development of national energy efficiency standards; - Tightening environmental standards for industry, taking into account social consequences;
	Green Finance System	- Creation of funds to support green projects; - Preferential lending for environmental and socially significant initiatives; - Issuance of sovereign green bonds, including instruments aimed at supporting projects that improve the situation of women and vulnerable groups;
	Carbon Pricing Mechanisms	- Introduction of a tax on CO_2 emissions; - Development of a quota trading system; - Stimulating carbon neutrality through tax incentives and subsidies, accompanied by an assessment of the distributional (including gender) effect;
2. Meso-level (Regional programs)	Industry specialization	- Development of cluster programs for industrial cities; - Support for renewable energy sources in regions with high energy potential; - Creation of eco-technoparks in single-industry towns with employment programs for women and youth;
	Migration flows	- Managing urbanization through resettlement programs; - Development of small towns to reduce the burden on megacities;

		- Job creation in depressed regions, including targeted support measures for migrant women and families with children;
	Natural and climatic features	- Adaptation of infrastructure to arid climates (water conservation); - Implementation of air quality monitoring systems in industrial centers; - Protection of biodiversity in urban areas, ensuring the participation of local communities and women's initiatives;
3. Microlevel (Municipal Initiatives)	Green building	- BREEAM/LEED building certification; - Energy-efficient residential renovation; - Use of eco-friendly materials in urban development; - Considering the needs of women, children, and the elderly when designing public spaces;
	Public transport	- Electrification of bus depots; - Development of bicycle path networks and pedestrian areas; - Implementation of intelligent traffic management systems; - Improving the safety of transport infrastructure (lighting, video surveillance, traffic routes) taking into account the gender dimension of urban safety;
	Low-emission zones	- Restricting access for vehicles below a certain environmental class; - Landscaping industrial perimeters; - Creating "green corridors" to improve the ecology and quality of the urban environment in areas where socially and gender-vulnerable groups reside.

Note: compiled by the author

The macro level of low-carbon development is supported by government regulation, including the development of a legal framework aimed at reducing the carbon footprint while simultaneously strengthening social and gender equity. Key instruments include green finance systems and carbon pricing mechanisms, which enable the use of economic levers to reduce emissions and support inclusive projects. At the meso-level, regional programs are modified to take into account the unique characteristics of each territory. Their development takes into account factors such as industry specifics, migration dynamics, the region's natural and climatic conditions, and gender aspects specific to local labor markets. The micro level involves the implementation of municipal initiatives aimed at creating a comfortable, safe, and environmentally sustainable urban environment for all categories of the population.

A key element of the model is a monitoring system based on 35 key indicators, grouped into three clusters:

- Economic sustainability (15 indicators);
- Social inclusion (27 indicators);
- Ecological balance (8 indicators).

Each cluster includes quantitative and qualitative indicators to assess the achievement of target values within the sustainable and inclusive development strategy (Table 3).

Table 3. Main groups of indicators of the monitoring system

Cluster	Indicator	
Economic sustainability (15 indicators)	1	GDP growth rate
	2	Inflation rate
	3	Government budget deficit/surplus (% of GDP)
	4	Government debt (% of GDP)
	5	Foreign investment volume
	6	Share of small and medium-sized businesses in GDP
	7	Unemployment rate
	8	Labor productivity
	9	Innovation activity index
	10	Share of high-tech exports
	11	Energy intensity of GDP
	12	Availability of business credit
	13	Level of digitalization of the economy
	14	Investment in R&D (% of GDP)
	15	Financial sector stability (stability index)
Social inclusion (27 indicators)	1	Poverty rate (% of population)
	2	Gini coefficient (income inequality)
	3	Access to basic education (% enrollment)
	4	Quality of education (PISA, average scores)
	5	Life expectancy
	6	Infant mortality rate
	7	Access to health services
	8	Gender equality level (WEF index)
	9	Women's participation in politics and the economy
	10	Housing affordability (cost/income)
	11	Social security level (pensions, benefits)
	12	Happiness/life satisfaction index
	13	Access to preschool education (% enrollment of children aged 3-6)
	14	Quality and availability of inclusive education (proportion of children with disabilities studying in mainstream schools)
	15	Women's access to vocational education and STEM programs (% participation)
	16	Gender pay gap (%)
	17	Involvement of vulnerable groups in the economic life of society (youth, people with disabilities, single parents)
	18	Employment rate of women raising young children (percentage) (%)
	19	Development of infrastructure for preschool-age childcare and supervision (kindergartens, crèches, day care centers)
	20	Urban Safety Index for Women (based on surveys and crime statistics)
	21	Digital Inclusion Gap
	22	Proportion of the population provided with social support in crisis situations (benefits, subsidies, targeted assistance)
	23	Accessibility of infrastructure for people with limited mobility (transportation, institutions, public spaces)
	24	Youth participation in socio-political life (%)

	25	Level of discrimination and rights violations (equal treatment index)
	26	Proportion of women entrepreneurs in the total number of SMEs
	27	Equal access to financial services (bank accounts, loans, microfinance, by gender)
Ecological balance (8 indicators)	1	CO_2 emissions (per capita)
	2	Share of renewable energy in the energy mix
	3	Air pollution levels (PM2.5, PM10)
	4	Drinking water quality (% of population with access)
	5	Waste recycling (% of total)
	6	Forest cover conservation (% change per year)
	7	Biodiversity (Living Planet Index)
	8	Energy efficiency (GDP per unit of energy)

Note: compiled by the author

All indicators related to population and employment must be disaggregated by gender, age, and other sociodemographic characteristics.

- Economic Sustainability (15 indicators) – financial stability, investment activity, economic diversification, innovation potential, resource management efficiency, resilience to shocks.
- Social Inclusion (27 indicators) – access to education and healthcare; poverty and social inequality; gender equality and women's participation in the economy and government; level of social protection and quality of life; availability of infrastructure and digital services; economic activity of vulnerable groups.
- Ecological Balance (8 indicators) – environmental quality, energy efficiency, waste management, biodiversity conservation, carbon footprint reduction.

Monitoring economic resilience in the context of the SDGs requires a systematic approach based on quantitative and qualitative indicators. The cluster includes 15 key indicators, grouped into three blocks:

(1) Economic growth and diversification;

(2) Investment and entrepreneurial activity (taking into account the gender structure of entrepreneurship);

(3) Resilience to external shocks.

Monitoring is based on dynamic analysis, comparative assessment (city benchmarking), and a normative approach (compliance with national and international standards).

Conclusion

Implementation of the model requires alignment with national development Particular attention should be paid to strategies, in particular the Concept for the Transition of the Republic of Kazakhstan to a Green Economy. It is crucial to ensure compliance with the provisions of this document, approved by Decree of the President of the Republic of Kazakhstan No. 577 of May 30, 2013, as well as with the goal of achieving gender equality (Goal 5 of the Sustainable Development Goals). This strategic document sets long-term guidelines for greening economic development, which requires

their operationalization within the framework of the developed model, taking into account gender-oriented mechanisms.

Aligning the model with sustainable development priorities requires reliance on the principle of strategic alignment, ensuring that decisions are consistent with the provisions of the Concept and national documents on gender equality. Practical implementation of this approach entails integrating energy conservation measures, expanding the use of alternative energy, introducing resource-saving technologies, optimizing waste management, and mechanisms to support women in the green sectors of the economy. Equally important is the alignment of the model's timeframe with the stages of transition to a sustainable economy, which envisage the phased implementation of measures in the short, medium, and long terms. Empirical research shows that ignoring the requirements of strategic planning and gender analysis at the national level reduces the effectiveness of local development models, generating institutional and regulatory contradictions.

Therefore, synchronizing the model with the Green Economy Transition Concept and the national gender equality agenda is a prerequisite for its practical feasibility. This requires not only taking into account the declared goals but also incorporating specific indicators, monitoring, and adjustment mechanisms in the model that are consistent with the methodology of strategic management for sustainable and inclusive development.

A forecast analysis shows that the implementation of the proposed measures will reduce the carbon intensity of the urban economy by 25–30% by 2030 while maintaining economic growth rates and simultaneously reducing gender and social disparities in access to development opportunities. Future research opportunities include the development of:

1. a methodology for assessing climate risks for urban agglomerations, taking into account gender-differentiated impacts;
2. climate change adaptation models that include mechanisms to support vulnerable groups;
3. green and socially responsible financing instruments for municipal projects that stimulate the economic empowerment of women and youth.

The proposed model forms the methodological basis for developing a comprehensive strategy for the sustainable and inclusive development of urban areas in Kazakhstan, taking into account both national priorities and the transition to a green economy, as well as global sustainable development goals, including gender equality and reducing inequalities in urban ecosystems.

Author Contributions

Conceptualisation and theoretical framework: MB; research design and methodology: MB; data collection and processing: MB; bibliometric analysis and interpretation: MB; case study analysis and visualisation: MB; draft writing and manuscript structure: MB; editing and critical revision: MB; final review and approval: MB. All authors have read and approved the final version of the manuscript and agreed to its publication.

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Artificial Intelligence as a Tool of National Security Resilience: Evidence from Singapore

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Abstract

In the context of accelerated digitalization and the expansion of the use of artificial intelligence (hereinafter – AI) in critical sectors, the importance of forming effective AI management models focused on ensuring the sustainability of national security is increasing. The purpose of this study is to analyze the risk-based approach to artificial intelligence management in Singapore and assess its contribution to strengthening national security resilience in the period 2020-2025. The methodological basis of the study was a qualitative analysis of regulatory and strategic documents, comparative institutional analysis, as well as thematic coding of AI management tools from the perspective of risk-based regulation theory. The results of the study show that Singapore's AI management model is based on a combination of "soft" regulation, technical verification, and intersectoral collaboration, which minimizes the risks associated with cyber threats, vulnerability of critical infrastructure, and reduced public trust, without limiting innovation activity. In 2023-2024, the level of AI adoption among small and medium—sized enterprises increased by more than three times, and among large companies - by more than 18 percentage points. The share of employees using AI tools in their professional activities has reached almost 74%, which indicates the deep integration of AI into socio-economic processes. The practical significance of the work lies in the possibility of adapting the Singapore model in the development of national AI management systems in countries with a high degree of digitalization, including Kazakhstan..

Keywords: Artificial Intelligence, National Security, Regulation, Smart Technology, Social Sustainability, Social Trust, Singapore

Жасанды интеллект ұлттық қауіпсіздік орнықтылығын арттыру құралы ретінде: Сингапур тәжірибесі

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Түйін

Жедел цифрландыру және жасанды интеллекттің (бұдан әрі – ЖИ) критикалық маңызы бар секторларда кеңінен қолданылуы жағдайында ұлттық қауіпсіздіктің орнықтылығын қамтамасыз етуге бағытталған ЖИ тиімді басқару модельдерін қалыптастырудың маңыздылығы арта түсуде. Осы зерттеудің мақсаты — Сингапурда жасанды интеллектті басқарудың тәуекелге бағдарланған тәсілін талдау және оның 2020–2025 жж. аралығында ұлттық қауіпсіздік орнықтылығын нығайтуға қосқан үлесін бағалау. Зерттеудің әдіснамалық негізін нормативтік-стратегиялық құжаттарды сапалық талдау, салыстырмалы институционалдық талдау, сондай-ақ тәуекелге бағдарланған реттеу теориясы тұрғысынан жасанды интеллектті басқару құралдарын тақырыптық кодтау құрады. Зерттеу нәтижелері Сингапурдағы жасанды интеллектті басқару моделі «жұмсақ» реттеуді, техникалық верификацияны және секторлар арасындағы өзара іс-қимылды ұштастыруға негізделгенін көрсетеді. Бұл тәсіл инновациялық белсенділікті шектемей, киберқауіптермен, критикалық инфрақұрылымның осалдықтарымен және қоғамдық сенімнің төмендеуімен байланысты тәуекелдерді барынша азайтуға мүмкіндік береді. 2023–2024 жж. шағын және орта кәсіпорындар арасында жасанды интеллектті енгізу деңгейі үш еседен астам өсті, ал ірі компаниялар арасында бұл көрсеткіш 18 пайыздық пункттен астам артты. Кәсіби қызметінде жасанды интеллект құралдарын пайдаланатын қызметкерлердің үлесі шамамен 74%-ға жетіп, ЖИ-дің әлеуметтік-экономикалық үдерістерге терең интеграцияланғанын дәлелдейді. Жұмыстың практикалық маңыздылығы жоғары цифрландыру деңгейіне ие елдерде, соның ішінде Қазақстанда, ұлттық жасанды интеллектті басқару жүйелерін әзірлеу барысында сингапурлық модельді бейімдеу мүмкіндігінде көрініс табады..

Түйін сөздер: жасанды интеллект, ұлттық қауіпсіздік, реттеу, ақылды технологиялар, әлеуметтік тұрақтылық, әлеуметтік сенім, Сингапур

Искусственный интеллект как фактор укрепления устойчивости национальной безопасности: опыт Сингапура

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Аннотация

В условиях ускоренной цифровизации и расширения применения искусственного интеллекта (ИИ) в критически важных секторах возрастает значимость формирования эффективных моделей управления искусственным интеллектом (далее – ИИ), ориентированных на обеспечение устойчивости национальной безопасности. Целью данного исследования является анализ риск-ориентированного подхода к управлению искусственным интеллектом в Сингапуре и оценка его вклада в укрепление устойчивости национальной безопасности в период 2020–2025 гг. Методологической основой исследования послужили качественный анализ нормативно-стратегических документов, сравнительный институциональный анализ, а также тематическое кодирование инструментов управления ИИ с позиций теории риск-ориентированного регулирования. Результаты исследования показывают, что сингапурская модель управления ИИ основана на сочетании «мягкого» регулирования, технической верификации и межсекторального взаимодействия, что позволяет минимизировать риски, связанные с киберугрозами, уязвимостью критической инфраструктуры и снижением общественного доверия, без ограничения инновационной активности. В 2023–2024 гг. уровень внедрения ИИ среди малых и средних предприятий увеличился более чем в три раза, а среди крупных компаний — более чем на 18 п.п. Доля работников, использующих ИИ-инструменты в профессиональной деятельности, достигла почти 74%, что свидетельствует о глубокой интеграции ИИ в социально-экономические процессы. Практическая значимость работы состоит в возможности адаптации сингапурской модели при разработке национальных систем управления ИИ в странах с высокой степенью цифровизации, включая Казахстан.

Ключевые слова: искусственный интеллект, национальная безопасность, регулирование, умные технологии, социальная устойчивость, социальный доверие, Сингапур

Introduction

Modern national security architectures are changing due to the quick global spread of artificial intelligence (hereinafter – AI) in public administration, cybersecurity, and defense. States are increasingly integrating algorithmic systems into fundamental security and governance functions to use AI for threat detection, intelligence analysis, cyber defense operations, and data-driven public service delivery. The way governments now present AI as a strategic asset for security and geopolitical competitiveness is highlighted by comparative studies of national AI strategies (Radu, 2021; Yerlikaya & Erzurumlu, 2021). AI is also becoming a more significant source of vulnerability. Research on AI for national security (e.g., financial networks, transportation, and energy grids) highlights the "predictability problem" and the emergence of new risk vectors, such as AI-driven cyberattacks, automation-enhanced disinformation, and cascading failures in critical infrastructure systems (Taddeo et al., 2022). AI's dual role as a security enabler and a source of intricate, systemic risks complicates conventional risk-management strategies and calls for more precise, risk-sensitive governance tools (Al-Hawawreh et al., 2024). Between 2020 and 2025, national strategies and governance frameworks for AI in security and defense have become a significant topic of discussion in academic and policy circles. Because it has created a risk-based, innovation-friendly vision of AI governance and begun to apply this logic to security-related fields, Singapore stands out in this broader global discourse. Thus, analyzing Singapore's approach from 2020 to 2025 offers a targeted lens through which small, highly digitalized states try to strike a balance between national security objectives and responsible AI governance.

A growing body of scholarship on AI governance and ethics, risk-based regulation, and AI and national security demonstrates the relevance of several strands to current debates about AI and security (Lütge & Uhl, 2021; Wirtz et al., 2022). More practitioner-oriented, Floridi et al. (2022) published a procedure called cap AI for assessing an AI system's conformity, which aims to serve companies as a governance tool to assess technologies in terms of legal compliance, ethical soundness, and technical robustness. Scholars even remark that AI ethics researchers have previously placed too much focus on the 'what' instead of the 'how' (Morley et al., 2021). However, most analyses focus on the EU, the United States, and China, and provide little examination of Singapore as a state that uses risk-based AI governance as an explicit national-security tool (Bernd et al., 2020).

The accelerating adoption of artificial intelligence in critical sectors has prompted growing scholarly and policy interest in governance frameworks that can mitigate AI-related risks while preserving the benefits of innovation (Bartneck et al., 2021; Kriebitz et al., 2022). In this context, risk-based governance combining ethical principles, institutional oversight, technical assurance, and sectoral adaptation is increasingly seen as essential for national security and systemic resilience. This literature review surveys foundational and recent works on AI governance globally and in Singapore, analyzes their contributions, and identifies research gaps that this article aims to address.

The broad debate around AI governance has generated a variety of frameworks and models aimed at embedding ethics, accountability, and risk management into AI deployment (Allahrakha, 2024). A recent systematic review of the AI governance

literature highlights that governance efforts typically address who governs, what elements are governed, when in the AI lifecycle governance occurs, and how it is implemented (Cheng & Zeng, 2022; Cohen & Suzor, 2024).

More technical and standards-oriented perspectives argue that governance must not remain at the level of principles alone. For example, a proposed "roadmap to society's trust" suggests that responsible AI systems should be anchored in four interlinked dimensions: regulatory context; trustworthy AI technologies and standardization; auditability and accountability; and governance processes, thereby ensuring holistic oversight across technical, social, and institutional domains. Moreover, recent scholarship calls for harmonization between international standards and national/regional regulatory contexts. For instance, a 2025 study proposes a "Comparative Risk-Impact Framework" that aligns ISO AI standards with diverse regulatory environments, underscoring the importance of context-aware standardization and risk management.

These global and conceptual works provide a theoretical and normative foundation: robust AI governance should combine ethical principles, enforceable standards, technical assurance, and institutional accountability. However, they also underscore a challenge: governance frameworks that are too abstract risk remaining symbolic, while overly technical ones may lack social or institutional legitimacy. This tension motivates empirical and context-specific studies, such as governance implementation in particular states. This article assesses how Singapore's risk-based approach to AI governance contributed to national security resilience between 2020 and 2025. The object of the study is Singapore's national security strategy in the context of accelerated digitalisation and the expanding role of artificial intelligence. The subject is the set of Singapore's risk-based AI governance instruments and their function in reinforcing national security resilience.

The study pursues four objectives: (1) to conceptualise the linkages between AI governance, risk-based regulation, and national security; (2) to map Singapore's key AI governance initiatives from 2020 to 2025; (3) to analyse how these instruments operationalise a risk-based regulatory logic; and (4) to examine their alignment with Singapore's broader security and defence strategies.

Methodologically, the study employs qualitative document analysis, comparative assessment, and analytical synthesis, drawing on governance theory, risk-regulation concepts, and national-security resilience frameworks. The working hypothesis is that Singapore's risk-based AI governance contributes to national security primarily by strengthening digital resilience, institutional trust, and public–private coordination, rather than through rigid regulatory control.

A pioneering example of national-level AI governance is provided by the Model AI Governance Framework, developed by the IMDA and the Personal Data Protection Commission (hereinafter – PDPC). The first edition was released in January 2019; its second edition followed on 21 January 2020. The 2020 revision refined the 2019 edition by strengthening the implementability of the guidelines: it emphasizes internal governance structures, clear accountability, data governance, risk-based operational measures (such as bias mitigation, robustness, reproducibility), and stakeholder communication. Importantly, the Model Framework is technology and sector-agnostic,

allowing it to complement but not replace sectoral/regulatory requirements when appropriate.

To help organizations operationalise the Model Framework, the PDPC/IMDA published complementary documents: an Implementation and Self-Assessment Guide for Organisations (ISAGO), a Compendium of Use Cases, and a "Guide to Job Redesign in the Age of AI." These support practical alignment with the Framework across different contexts. Through these measures, Singapore moved from abstract AI ethics toward a living governance ecosystem, one that offers concrete, actionable practices for organisations deploying AI.

Recognising that principles and guidelines alone may be insufficient, especially for high-risk or sensitive AI applications, Singapore's governance architecture includes a technical verification layer: AI Verify. First released in May 2022, AI Verify is described as "the world's first AI governance testing framework and toolkit", combining technical tests and process-based checks to assess compliance with 11 governance principles: transparency, explainability, reproducibility/robustness, safety, security, fairness, data governance, accountability, human agency and oversight, inclusive growth, and societal/environmental well-being.

By providing objective, reproducible testing and governance reports, AI Verify helps organisations demonstrate that their AI deployments align with their claimed principles, enabling transparency and accountability in practice. As AI technology evolved, especially with the rise of generative models, Singapore updated its governance approach. In January 2024, the AI Verify Foundation, together with IMDA, proposed a Model AI Governance Framework for Generative AI (MGF-GenAI) to extend governance coverage to the unique risks posed by generative AI. This evolution illustrates Singapore's adaptive, risk-based approach: governance is not static but dynamically updated to respond to technological developments and emerging risks.

Despite these advancements, academic and policy literature cautions against over-reliance on principles or voluntary frameworks. The 2025 systematic review of AI governance frameworks finds that while many frameworks exist, they vary widely in scope, coverage, and enforceability; there is no consensus on which combination of principles, tools, and processes constitutes "good governance". Moreover, the "roadmap to trustworthy AI" approach argues that technical and institutional mechanisms of regulation, standardization, and auditability must operate together, but notes that many existing practices remain fragmented or voluntary.

In a global comparison, a 2025 study that aligns ISO AI standards with multiple national regulatory frameworks finds that voluntary standards often lack enforcement mechanisms and may fail to address region-specific risks, such as data privacy, social context, or national security. This underscores a core critique: voluntary or principle-only governance may be insufficient for high-stakes AI applications, especially where national security or critical infrastructure is involved. For Singapore specifically, publicly available reports and documentation do not appear to offer systematic, empirical evaluations of how widely and effectively organisations adopt the Model Framework or AI Verify. There is limited academic research assessing whether the use of AI Verify correlates with a lower incidence of bias, security breaches, or other AI-related harms in critical sectors. This gap complicates assertions about the real-world effectiveness of

Singapore's governance approach. Finally, while frameworks like MGF-GenAI attempt to anticipate new risks, the dynamic, evolving nature of AI rapid innovation, cross-border deployment, and supply-chain dependencies may outpace governance updates, leaving unforeseen vulnerabilities, especially in national-security relevant domains.

Materials and Methods

This study investigates how Singapore's national security is reinforced through a risk-based model of artificial intelligence governance between 2020 and 2025. The methodological design was developed to capture both the structural components of Singapore's governance system and the mechanisms through which AI-related risks are classified, mitigated, and incorporated into broader national security strategies. The research is grounded in the assumption that the systematic deployment of regulatory and technical assurance instruments contributes to reducing technological vulnerabilities, strengthening critical infrastructure resilience, and reinforcing institutional accountability. At the same time, the study explicitly acknowledges several challenges, including regulatory gaps associated with rapidly evolving AI capabilities, partial reliance on private-sector compliance, and persistent tensions among innovation, ethical governance, and security imperatives. To address the complexity of these dynamics, the research was structured into several sequential stages. Each stage applied distinct analytical procedures and methodological approaches, allowing for a comprehensive and multi-layered examination of Singapore's AI governance model and its security implications.

Stage 1. Systematic literature review and conceptual grounding

The first stage consisted of a structured and systematic examination of academic and policy literature related to AI governance, risk management, and national security. The primary objective of this stage was to identify existing conceptual frameworks, establish the theoretical foundations of the study, and assess the relevance of international research to Singapore's governance model.

The literature search focused on peer-reviewed journal articles, government publications, and policy analyses that addressed four core thematic areas: (1) risk-based approaches to AI management; (2) governance mechanisms for high-risk AI applications; (3) the interaction between AI systems and national security; (4) models of digital and institutional resilience in technologically advanced states.

Sources were identified using major academic databases, including Scopus, Web of Science, and SSRN. These databases were selected for their high coverage of peer-reviewed research in technology governance, security studies, and public policy. In addition, materials from authoritative international organizations such as the Organization for Economic Cooperation and Development (hereinafter – OECD) and institutions of the European Union were included to ensure alignment with global regulatory standards.

To ensure both relevance and currency, the review covered publications issued between 2019 and 2024, a period that corresponds to the consolidation of risk-based regulatory models and the global acceleration of AI deployment. Keywords used for the

literature search included combinations of the following terms: AI governance, risk-based regulation, national security, digital resilience, AI assurance, algorithmic accountability, and critical infrastructure protection. This stage also included a comparative review of international regulatory frameworks, most notably the OECD AI Principles and the European Union's risk-tiered AI regulatory approach. These frameworks were used as reference points to assess the normative positioning of Singapore's governance model within global discourse. Through this comparison, the study identified key governance dimensions that informed subsequent analysis.

Based on the insights extracted from the literature, three analytical dimensions were formulated and used consistently throughout the study: (1) governance tools and regulatory instruments; (2) risk classification logic and mitigation strategies; (3) the institutional and strategic links between AI governance and national security outcomes. These dimensions enabled the development of a coherent conceptual framework for analyzing how Singapore integrates security considerations into civil sector AI regulation.

Stage 2. Collection and selection of primary and secondary data

The second stage involved the systematic collection of documentary materials that are central to understanding Singapore's AI governance architecture. This stage relied primarily on document-based qualitative research, which is well-suited for policy-oriented and institutional analyses of governance systems. The primary sources comprised official national strategies, regulatory frameworks, and technical assurance documents issued by Singapore's public authorities. These included: The National AI Strategy (2019); The National AI Strategy 2.0 (2023); The Model AI Governance Framework (Second Edition, 2020); The Model Framework for Generative AI (2024); Official AI Verify documentation and technical guidelines; Sector-specific regulatory guidelines issued by the Monetary Authority of Singapore (MAS), including the FEAT and FAIR principles and the Veritas toolkit.

These materials were selected because they collectively define Singapore's national approach to AI governance, its classification of AI-related risks, procedural safeguards, and the allocation of institutional responsibilities. The documents also provide empirical evidence of how security-relevant principles such as robustness, accountability, and operational reliability are embedded into regulatory practice. Secondary sources included analytical publications by international organisations, policy think tanks, and academic research centres that examine Singapore's digital governance model in the broader context of global regulatory trends. These sources were used to contextualise national policy decisions within comparative governance debates and to identify areas of convergence or divergence between Singapore and other jurisdictions.

All sources were screened using three key criteria: (1) direct relevance to AI risk governance or national security; (2) institutional credibility of the issuing body; (3) analytical depth and empirical grounding. This rigorous screening ensured that the dataset remained focused, reliable, and aligned with the study's objectives.

Stage 3. Qualitative document analysis and thematic coding

The third stage consisted of a detailed qualitative analysis of the collected documents using a structured thematic coding approach. This stage was designed to extract

governance-relevant content, identify regulatory patterns, and assess how security principles are operationalised across policy instruments. The analysis proceeded in several sequential steps. First, all policy documents and regulatory frameworks underwent close reading, during which key governance elements, including regulatory mandates, oversight mechanisms, enforcement tools, and security-related provisions, were manually identified and extracted. Second, a manual coding scheme was developed based on the three analytical dimensions identified in Stage 1. This coding scheme was structured around the following thematic categories: AI-related risks identified by policymakers; sector-specific and cross-sectoral risk mitigation instruments; institutional responsibilities and interagency coordination mechanisms; explicit references linking AI governance to digital defence and national security objectives; and procedural frameworks for testing, verification, and technical assurance. Third, an iterative coding process was applied to the documents. This involved multiple rounds of coding to refine analytical categories, identify patterns of consistency or divergence, and detect gaps between formal regulatory intentions and practical enforcement mechanisms.Through this process, the study reconstructed how Singapore operationalises principles of responsible, safe, and secure AI across different regulatory layers. The thematic analysis also made it possible to trace how technical assurance mechanisms such as AI Verify function as bridges between high-level governance principles and real-world system deployment.

Stage 4. Comparative and integrative analysis

The fourth stage employed comparative analysis to evaluate Singapore's AI governance model against both internal and international reference points. This dual comparative design was essential for identifying the internal coherence of Singapore's regulatory system as well as its positioning within global governance trends. Internally, the study compared high-level strategic documents such as the National AI Strategy 2.0 with sector-specific regulatory frameworks and technical assurance mechanisms. This comparison examined how abstract governance principles are translated into operational tools within different sectors, especially finance and public services. Special attention was given to how MAS guidelines interact with national-level strategies and how AI Verify complements sectoral regulation.

This internal comparison revealed the structure of Singapore's so-called "risk to resilience" governance pipeline, demonstrating how risk identification, regulatory classification, assurance testing, and institutional oversight function as mutually reinforcing components. Externally, Singapore's model was compared with international frameworks, particularly the OECD AI Principles and the EU's risk-based regulatory approach. This international comparison allowed the identification of key areas of regulatory convergence, such as transparency and accountability requirements, as well as areas of divergence, particularly in Singapore's stronger emphasis on technical testing infrastructure and whole-of-government coordination. This comparative component enabled the identification of unique features of Singapore's governance architecture, especially its integration of national-security considerations into predominantly civil and commercial regulatory domains.

Stage 5. Synthesis, validation, and assessment of limitations

The final stage consisted of synthesising findings across all previous stages and validating analytical interpretations through cross-source triangulation. Data extracted from academic literature, official policy documents, and international analytical reports were jointly reviewed to ensure internal consistency and methodological robustness. This synthesis stage enabled the construction of a cohesive analytical narrative linking governance mechanisms with national security outcomes. It allowed the study to move beyond descriptive analysis and toward an integrated assessment of how Singapore's AI risk governance contributes to technological resilience, institutional accountability, and security assurance.

The study explicitly acknowledges several methodological limitations. First, the analysis is based exclusively on open-source materials, without access to classified defence documents. Second, rapid advancements in AI technologies generate temporal constraints on the durability of the findings. Third, the absence of expert interviews limits insight into internal policymaking processes and strategic deliberations. Despite these limitations, the multi-stage design ensures a methodologically robust foundation for assessing Singapore's evolving AI governance ecosystem.

In accordance with the journal's ethical standards, artificial intelligence (AI) tools were used strictly within acceptable limits. Artificial Intelligence Technology (ChatGPT, version 5.1) it was used exclusively to improve the language, correct errors and increase clarity, as well as to organize references and verify the consistency of citations. Artificial intelligence tools were not used to interpret data, develop scientific arguments, draw conclusions, or create new research content. The author bears full responsibility for the accuracy, integrity and originality of the research manuscript.

Results

The empirical findings reveal that Singapore's AI governance architecture between 2020 and 2025 is built upon four interdependent pillars: the National AI Strategy 2.0, the Model AI Governance Framework, the AI Verify assurance ecosystem, and a set of sectoral and security-oriented initiatives. Together, these instruments create a multilayered, risk-based governance model that operationalizes both technological innovation and national-security imperatives.

First, The National AI Strategy 2.0 (NAIS 2.0) articulates Singapore's strategic vision of AI as a "force for good," grounding its approach in three overarching systems, ten institutional enablers, and fifteen national-level actions. This structure reflects Singapore's intentional shift from a sector-specific AI policy to a comprehensive governance model that addresses societal, economic, and security dimensions simultaneously.

NAIS 2.0 highlights several national-security concerns:

(a) increasing exposure to algorithmic vulnerabilities,

(b) deepfake-driven disinformation,

(c) cross-border cyberattacks targeting critical infrastructure,

(d) geopolitical risks related to computing dependency and AI supply chains.

As emphasized in official sources (Smart Nation Singapore, 2023), the strategy embeds resilience as a foundational principle. This positions AI not only as a driver of economic transformation but also as a domain requiring defense-oriented safeguards, including secure infrastructure, trusted data flows, and unified public trust.

Second, the Model AI Governance Framework (2nd edition) serves as the ethical and procedural backbone of Singapore's AI governance ecosystem. It operationalizes human-centric values-transparency, fairness, robustness, and accountability - into institutional practices widely adopted across both public and private sectors (PDPC, 2020). Although voluntary, the Framework exerts strong normative influence due to its practical applicability and alignment with international standards. Its expansion in 2023-2024 to address generative AI technologies demonstrates regulatory adaptability in response to emerging risks (Kumar & Narayanan, 2021). This positions Singapore at the forefront of global conversations on AI governance, especially for small states requiring flexible yet credible regulatory systems.

Third, a distinctive feature of Singapore's governance model is its emphasis on assurance and validation, realized through the AI Verify testing infrastructure. As articulated in IMDA documentation (2023), AI Verify enables organizations to: assess explainability and robustness, identify vulnerabilities in AI systems, implement accountability safeguards, and benchmark practices against international standards. The establishment of the AI Verify Foundation and its rapid growth, now comprising more than 60 organizations, indicates strong domestic and international recognition of Singapore's role in shaping AI-assurance norms. For a small state reliant on global digital flows, assurance-driven governance enhances both national trust and external interoperability.

Fourth, MAS's risk-management approach operationalizes responsible AI through concrete tools designed to minimize algorithmic bias, systemic instability, and security vulnerabilities. These instruments serve national-security functions by safeguarding sensitive financial systems and preventing cascading failures (MAS, 2022). Singapore integrates AI directly into its Digital Defense pillar under Total Defense and through the Digital and Intelligence Service (DIS) established in 2022. These initiatives strengthen cyber-intelligence capabilities and support early identification of adversarial AI threats (MINDEF, 2022). Workforce development initiatives, such as Work-Learn programmes, are further enhancing resilience by building AI literacy and defensive capabilities at the societal level.

The integration of these instruments demonstrates a coherent risk-based governance approach grounded in broader theoretical frameworks of technological governance, resilience studies, and national-security strategy. Rather than adopting rigid or punitive regulation, Singapore implements a layered model: high-level ethical guidelines, technical assurance toolkits, sectoral risk-based adaptations, and national-security integration. This aligns with international scholarship emphasizing adaptive, context-sensitive AI governance models.

Figure 1 provides a consolidated representation of Singapore's risk-based AI governance architecture and illustrates how the different components identified in the empirical analysis function as an integrated system that supports national security.

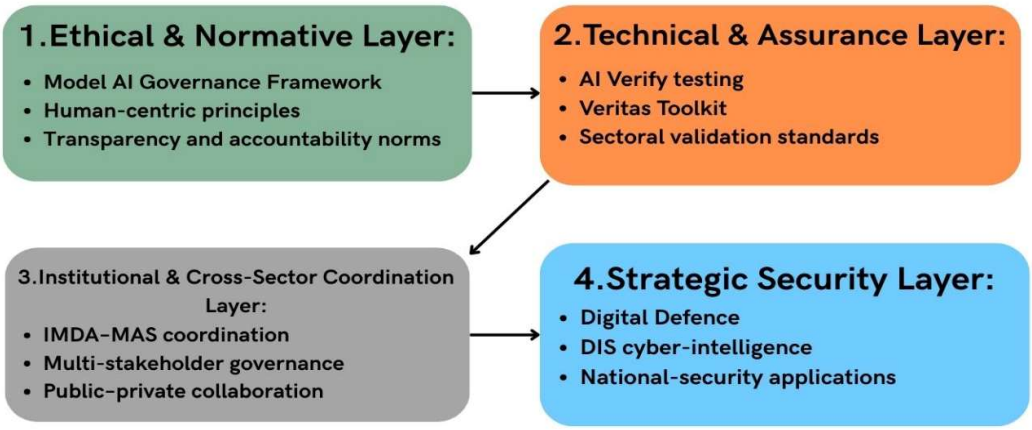

Figure 1. Singapore's risk-to-resilience governance pipeline

The figure visually organizes Singapore's governance instruments into four mutually reinforcing layers, demonstrating that the country does not rely on a single regulatory framework, but instead operationalizes AI oversight through a coordinated, multi-level governance pipeline.

The first layer, the Ethical and Normative Layer, reflects Singapore's emphasis on human-centric governance principles articulated in the Model AI Governance Framework. As the article's findings show, these principles form the foundation of all subsequent governance measures by embedding fairness, transparency, and accountability into AI use across sectors. This normative base ensures that risk mitigation begins at the design stage and provides the ethical anchor that guides both public and private actors.

The second layer, the Technical and Assurance Layer, corresponds to the empirical results that highlight the central role of AI Verify and the Veritas Toolkit in Singapore's governance ecosystem. These tools translate high-level principles into concrete procedures for testing, validation, and risk classification. Figure 1 makes clear that assurance mechanisms function as the operational core of Singapore's risk-based approach: they identify vulnerabilities, measure model performance, and ensure compliance with safety and robustness requirements in high-risk domains. This directly connects to the article's conclusion that Singapore prioritizes verifiable risk reduction rather than prescriptive regulation.

The third layer, Institutional and Cross-Sector Coordination, captures the interaction between IMDA, MAS, private firms, and industry consortia that the study identifies as essential for governance adaptability. The empirical analysis demonstrates that Singapore's success relies on its whole-of-government model and constant engagement with industry stakeholders. Figure 1 illustrates this coordination as a distinct functional layer, highlighting its role in aligning technical safeguards with sector-specific needs and enabling rapid policy updates as AI technologies evolve.

The fourth layer, the Strategic Security Layer, visualizes how AI governance is embedded in national-security initiatives such as Digital Defence and DIS cyber-

intelligence operations. This reflects one of the study's central findings: Singapore treats AI governance not merely as a regulatory or economic matter, but as a pillar of national resilience. The figure shows how security institutions rely on the upstream layers - ethical standards, technical assurance, and institutional coordination - to support threat detection, infrastructure protection, and defense readiness. This layered integration explains why Singapore's model is particularly effective for a small, highly digitalized state facing complex cyber and geopolitical risks.

By combining these four layers into a single governance pipeline, Figure 1 enhances the interpretive clarity of the article's results. It shows that Singapore's risk-based governance is not an isolated collection of policies, but a structured system in which ethical norms, assurance mechanisms, institutional collaboration, and security strategy work together to produce national-security outcomes. The visual thus reinforces the study's central argument: Singapore's ability to align innovation, risk management, and strategic resilience arises from the coordinated interaction among governance layers rather than from traditional regulatory control.

The novelty of Singapore's model lies in its alignment of AI governance with national resilience, rather than with solely economic or innovation objectives. Unlike the EU (rights-based regulation) or the US and China (market-driven or state-security-driven models), Singapore blends flexible regulation with operational assurance, grounded in the institutional logic of Total Defense. The linkage between public trust, digital resilience, and national security is more explicit in Singapore's model than in most other small states. This makes the Singaporean case analytically significant: it demonstrates how a small, highly digitalized state uses governance capacity, rather than coercive regulation, to secure AI ecosystems and national security simultaneously.

Table 1 presents a consolidated set of indicators that illustrate how Singapore's AI governance ecosystem has expanded and matured between 2019 and 2024.

Table 1. Key quantitative indicators of Singapore's AI governance ecosystem

Governance element	Index	Year
AI adoption SMEs	From 4.2% to 14.5%	2023-2024
AI adoption non-SMEs	From 44.0% to 62.5%	2023-2024
Workers using AI	73.8%	2024
AI Verify Foundation members	>60 general	2023
Veritas consortium	From 17 to 25 organizations	2019-2020

Note: compiled by the authors based on the source (IMDA, 2022)

The most striking finding is the rapid acceleration of AI adoption across segments of the economy, demonstrating that Singapore's risk-based regulatory approach is not merely theoretical but actively shaping behavior among both large enterprises and SMEs. The growth from 4.2% to 14.5% AI adoption among SMEs, alongside a sharp rise from 44.0% to 62.5% among non-SMEs, reflects a national environment in which firms perceive AI as both accessible and strategically necessary. This pattern aligns with Singapore's broader objective under NAIS 2.0 to normalize AI across all sectors, not only among digitally intensive industries.

Equally important is the finding that 73.8% of workers already use AI tools, signaling that AI is no longer limited to specialized technical staff but has diffused into daily professional routines. This mass-level integration strengthens the country's Digital Defense posture by building a workforce capable of recognizing, managing, and responding to digital risks. It is definitely an essential component of Singapore's resilience-oriented national security strategy.

The expansion of the AI Verify Foundation, with more than 60 general members, underscores Singapore's ambition to shape global assurance standards. Its growing network mirrors how small advanced states amplify influence through niche leadership rather than military or economic scale. Similarly, the Veritas consortium's growth from 17 to 25 organizations demonstrates that risk-based governance is gaining traction within finance, a sector central to national security due to data-sensitivity and systemic exposure.

Taken together, the indicators describe a governance ecosystem that is not only expanding in scale but deepening in sophistication. Singapore's model demonstrates an ability to combine voluntary frameworks, technical assurance, and sector-specific initiatives into a coherent architecture that strengthens national security while sustaining innovation - an approach increasingly relevant to other small, highly digitalized states. A pressing question shaping contemporary national security debates is whether AI governance should rely on strict regulatory frameworks, as seen in the EU, or on a risk-based, assurance-driven approach, like Singapore's, to safeguard security while enabling innovation. For small, globally connected states such as Singapore, the challenge has been to identify a governance model that ensures digital resilience, trust, and strategic autonomy, without inhibiting economic competitiveness or technological progress (IMDA, 2023).

Singapore's risk-based model relies on a combination of soft law, public–private collaboration, and verification mechanisms that promote security through shared responsibility rather than government dominance. The development of AI Verify, internationally recognized as the first testing framework combining technical and governance assessments, demonstrates Singapore's emphasis on assurance over coercion (GovTech, 2024). This contrasts with the EU's command-and-control logic under the EU AI Act, which mandates risk classification and compliance obligations enforced through legal penalties (EU Commission, 2023). Singapore's approach tries to avoid the rigidity and compliance burden associated with such regulatory systems.

A central element of Singapore's strategy is its integration of AI governance into its broader security doctrine, particularly Total Defense, which frames national security as a whole-of-society effort. By embedding AI governance into cybersecurity, economic security, and psychological resilience strategies, Singapore positions AI as both an opportunity and a vulnerability requiring systematic management (MHA, 2022). This holistic integration marks a distinctive divergence from many Western models, which treat AI primarily as a regulatory or ethical issue rather than a fundamental aspect of national security.

The concept of the "governance pipeline" in Singapore consists of several interlinked components. First, a technical pipeline built through testing, verification, and risk-classification mechanisms, such as AI Verify, Model AI Governance Frameworks,

FEAT/FAIR guidelines for financial institutions, and technical sandboxes. These systems enhance trust and allow critical sectors (finance, healthcare, transport) to adopt AI safely. Second, an institutional pipeline that involves continuous cooperation among state agencies, private-sector firms, multinational technology companies, and academic institutions. This pipeline ensures that governance adapts quickly to technological change and aligns with industry needs (IMDA-MAS Joint Report, 2024). Third, a strategic security pipeline, which integrates AI governance with counter-disinformation strategies, cyber defense operations, and critical infrastructure protection.

The core strategic question "Should we regulate AI more heavily?" may be reframed as: "Does Singapore's risk-based, soft-law pipeline provide greater national security and resilience than adopting a rigid regulatory system like the EU?" Balancing these competing models remains one of Singapore's most significant governance challenges (Tan, 2025).

Strengthening Singapore's risk-based pipeline offers several advantages:

(1) It enhances international credibility by aligning with OECD transparency and accountability principles.

(2) It maintains innovation agility in a fast-changing technological environment.

(3) It reinforces digital trust, a cornerstone of Singapore's national security strategy.

Adopting a strictly regulated system similar to the EU AI Act would strengthen Singapore's international alignment with major economic blocs and offer more enforceability. However, it may significantly hinder innovation, reduce investment attractiveness, and undermine Singapore's competitiveness in global AI development. The environment in which Singapore operates, marked by geopolitical rivalry, rapid technological shifts, cybersecurity threats, and economic vulnerability to global supply chains, requires a governance model that is flexible, resilient, and strategically integrated with defence planning. Singapore's risk-based approach, supported by its strong cybersecurity institutions and its whole-of-government coordination, positions the country as a leading example of how small states can maintain autonomy amid global technological competition (Liew, 2025).

The "pipeline paradigm" in Singapore is therefore more than a regulatory model: it represents a flow of standards, institutions, verification mechanisms, and security practices connecting industry, state, and society. Singapore's decision to deepen this risk-based pipeline while also selectively aligning with international regulatory blocs provides the most realistic strategy for maintaining both national security and technological leadership. A hybrid approach allows Singapore to remain interoperable with the EU and OECD ecosystems while preserving the flexibility, speed, and innovation advantages of its soft-law governance. This hybrid strategy enhances autonomy, reduces vulnerability, and positions Singapore as a regional leader in AI governance capable of shaping emerging security norms across Asia.

Conclusion

This study examined Singapore's risk-based approach to AI governance from 2020 to 2025 and evaluated its contribution to national security. The findings confirm the

hypothesis that flexible, assurance-driven AI governance can strengthen national security not by enforcing strict legal controls, but by building digital resilience, institutional trust, and whole-of-society preparedness. Singapore's model illustrates how small, technologically ambitious states can safeguard critical systems while simultaneously promoting innovation. The analysis identified several features that make Singapore's model distinct in the global governance landscape. Its reliance on collaborative, consensus-based mechanisms, the use of soft-law instruments combined with technical assurance tools, and the integration of AI oversight within broader doctrines such as Total Defense position AI governance as an essential pillar of national resilience. Unlike more prescriptive frameworks such as the EU AI Act, Singapore's system prioritizes adaptability, sectoral partnerships, and continuous testing rather than strict regulatory enforcement.

However, the study also revealed structural limitations. The voluntary nature of Singapore's assurance ecosystem may create enforcement gaps, especially for actors operating outside the cooperative environment. Additionally, the innovation security trade-off remains difficult to manage, as overly flexible frameworks risk underestimating high-risk AI misuse. Measuring the direct security impact of these policies is another persistent challenge. Despite these constraints, Singapore's approach offers meaningful lessons for other states. For countries like Kazakhstan, balancing digital modernization, security concerns, and the need for multi-vector cooperation, Singapore provides a viable template. A risk-based, partnership-oriented model allows states to enhance cybersecurity, strengthen public trust, and promote innovation without adopting overly rigid regulatory systems or compromising strategic autonomy.

Overall, Singapore demonstrates that AI governance can function as a security multiplier when embedded within a broader national-resilience strategy. By leveraging transparency, assurance, and cross-sector collaboration, states can create a stable and trustworthy digital environment capable of withstanding emerging AI-related threats.

Author Contributions

Conceptualisation and theoretical framework: AB and ZS; research design and methodology: NN; data collection and processing: AB, ZS and NN; bibliometric analysis and interpretation: AB, ZS and NN; case study analysis and visualisation: AB, ZS and NN; draft writing and manuscript structure: AB; editing and critical revision: ZS and NN; final review and approval: AB, ZS and NN. All authors have read and approved the final version of the manuscript and agreed to its publication.

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Human Capital Development and Transformation of Labor Resources in Kazakhstan

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Abstract

In the context of structural and demographic changes, accelerated digitalization, and increasing demands on the quality of the workforce, the analysis of labor resources is of key importance for the sustainable socio-economic development of Kazakhstan. The purpose of this article is to analyze the dynamics and structural transformation of the labor force in Kazakhstan with an emphasis on the development of human capital, changes in age, gender, educational, and sectoral employment structure. The methodological basis of the research consists of methods of comparative, structural, and economic-statistical analysis, as well as trend analysis, used to assess the dynamics of employment, unemployment, and qualitative characteristics of the workforce. The empirical base of the study is based on official data from the Bureau of National Statistics (2024), materials from sample surveys of the labor force, as well as regulatory documents in the field of employment and qualifications. The results of the study showed that in 2019-2024. The employment rate in the country remained at a high level (about 65%), while the unemployment rate remained stable in the range of 4.7-4.9%. The number of employees increased by almost 5%, while the share of workers with higher and technical education increased, which together account for more than 90% of employment. The prospects for further research are related to the development of models for forecasting the demand for competencies, evaluating the effectiveness of the National Qualifications System, and analyzing the impact of digital transformation on employment quality and labor productivity.

Keywords: Labor Market, Employment, Quality of Employment, Human Capital, Social Sustainability, Social Transformation, Social Risk, Unemployment

Қазақстанда адами капиталды дамыту және еңбек ресурстарын трансформациялау

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Түйін

Құрылымдық және демографиялық өзгерістер, цифрландырудың жеделдеуі және жұмыс күшінің сапасына қойылатын талаптардың артуы жағдайында еңбек ресурстарын талдау Қазақстанның әлеуметтік-экономикалық дамуының тұрақтылығын қамтамасыз ету үшін ерекше маңызға ие. Осы мақаланың мақсаты – адами капиталдың дамуына басымдық бере отырып, Қазақстандағы еңбек ресурстарының динамикасы мен құрылымдық трансформациясын, сондай-ақ жұмыспен қамтудың жас ерекшелік, гендерлік, білім беру және салалық құрылымындағы өзгерістерді талдау. Зерттеудің әдіснамалық негізін жұмыспен қамту, жұмыссыздық және жұмыс күшінің сапалық сипаттамаларының динамикасын бағалау үшін қолданылған салыстырмалы, құрылымдық және экономикалық-статистикалық талдау әдістері, сондай-ақ трендтік талдау құрайды. Зерттеудің эмпирикалық базасы Қазақстан Республикасы Ұлттық статистика бюросының ресми деректері, жұмыс күші бойынша іріктемелі зерттеулер материалдары, сондай-ақ жұмыспен қамту және біліктілік саласындағы нормативтік-құқықтық құжаттар негізінде қалыптастырылды. Зерттеу нәтижелері 2019–2024 жылдары елдегі жұмыспен қамту деңгейінің жоғары деңгейде (шамамен 65%) сақталғанын, ал жұмыссыздық деңгейінің 4,7–4,9% аралығында тұрақты болғанын көрсетті. Жұмыспен қамтылғандар саны шамамен 5%-ға артты, бұл ретте жоғары және техникалық білімі бар қызметкерлердің үлесі өсті, олар жиынтығында жұмыспен қамтылғандардың 90%-дан астамын құрайды. Болашақ зерттеулердің перспективалары құзыреттерге сұранысты болжау модельдерін дамытуға, Ұлттық біліктілік жүйесінің тиімділігін бағалауға және цифрлық трансформацияның жұмыспен қамту сапасы мен еңбек өнімділігіне әсерін талдауға байланысты.

Түйін сөздер: еңбек нарығы, жұмыспен қамту, жұмыспен қамту сапасы, адами капитал, әлеуметтік тұрақтылық, әлеуметтік трансформация, әлеуметтік тәуекел, жұмыссыздық

Развитие человеческого капитала и трансформация трудовых ресурсов в Казахстане

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Аннотация

В условиях структурных и демографических изменений, ускоренной цифровизации и роста требований к качеству рабочей силы анализ трудовых ресурсов приобретает ключевое значение для устойчивого социально-экономического развития Казахстана. Целью данной статьи является анализ динамики и структурной трансформации трудовых ресурсов в Казахстане с акцентом на развитие человеческого капитала, изменения в возрастной, гендерной, образовательной и отраслевой структуре занятости. Методологическую основу исследования составляют методы сравнительного, структурного и экономико-статистического анализа, а также трендовый анализ, применённые для оценки динамики занятости, безработицы и качественных характеристик рабочей силы. Эмпирическая база исследования сформирована на основе официальных данных Бюро национальной статистики Республики Казахстан, материалов выборочных обследований рабочей силы, а также нормативно-правовых документов в сфере занятости и квалификаций. Результаты исследования показали, что в 2019–2024 гг. уровень занятости в стране сохранялся на высоком уровне (около 65%), а уровень безработицы оставался стабильным в пределах 4,7–4,9%. Численность занятых увеличилась почти на 5%, при одновременном росте доли работников с высшим и техническим образованием, которые в совокупности формируют более 90% занятости. Перспективы дальнейших исследований связаны с развитием моделей прогнозирования спроса на компетенции, оценкой эффективности Национальной системы квалификаций и анализом влияния цифровой трансформации на качество занятости и производительность труда.

Ключевые слова: рынок труда, занятость, качество занятости, человеческий капитал, социальная устойчивость, социальная трансформация, социальный риск, безработца

Introduction

Labor resources constitute one of the key components of a state's economic development. The effective utilization of the workforce determines the potential for increasing labor productivity, stimulating economic growth. Modernizing economic sectors. And strengthening the social well-being of the population. In the context of Kazakhstan, the analysis of labor resources is particularly relevant due to ongoing demographic changes, the development of the digital economy, and rising requirements for workers' competencies. And shifts in the sectoral structure of employment. An important factor is the compliance of national statistical data with the standards of the International Labour Organization (hereinafter – ILO), which ensures data comparability and enables in-depth scientific analysis of labor market phenomena and trends.

Today, the development of labor resources is not merely a statistical category but one of the key pillars of Kazakhstan's socio-economic stability. Amid rapid technological shifts, demographic waves, and the evolving logic of the global market, the individual – along with their education, qualifications, and adaptability – becomes the central driver of economic growth. Therefore, analyzing the current state and dynamics of labor resources essentially represents an exploration of the country's future.

The period from 2019 to 2024 proved to be both a time of significant challenges and new opportunities for Kazakhstan's labor market. The economy experienced a pandemic shock, restructured sectoral priorities, accelerated digitalization, and faced increasing demands for workforce quality. Nevertheless, the labor market demonstrated resilience: employment increased from 8.78 million to 9.21 million people, while the unemployment rate remained within the range of 4.7-4.9%. Behind these figures lie enterprise adaptability, rapid structural adjustments, and the growing importance of human capital.

Changes in the age structure of employment are particularly illustrative. Kazakhstan is gradually entering a phase of mature demographic balance, where the primary burden falls on the most economically active age groups – those aged 25 to 54. This cohort accounts for nearly 70% of total employment, forming the so-called "core" of the labor force – the segment that determines production dynamics, innovation potential, and household income stability. In contrast, youth participation has declined, highlighting the need for flexible educational pathways and new approaches to early professional orientation.

Equally significant are shifts in the educational structure of employment. In recent years, the share of workers with vocational and technical education has increased, reflecting a stronger orientation toward mid-level competencies. At the same time, nearly half of all employed individuals possess higher education. Kazakhstan is increasingly becoming a society in which human capital represents a tangible resource rather than a declarative concept. At the same time, structural imbalances are becoming more evident, including skill mismatches with sectoral demands, shortages of technical specialists, and an oversupply of labor in traditional fields.

The sectoral structure of employment is also transforming. The share of agriculture is declining, while trade, healthcare, education, construction, information and communication technologies, and the financial sector are strengthening their positions.

The economy is gradually shifting toward services and knowledge-based activities, which necessitate new professional standards, workforce training systems, and qualification assessment mechanisms. In this context, the role of the National Qualifications System (2025) becomes critically important, as it integrates education, business, and the state through unified requirements for the quality of human capital. At the same time, one of the key challenges of recent years has been the decline in real wages, which intensifies social risks and limits opportunities for human capital accumulation. Despite growth in nominal incomes, the purchasing power of the population decreased in 2022-2023, making the issue of job quality and fair remuneration particularly acute.

Thus, the analysis of Kazakhstan's labor resources in 2019-2024 reveals not merely changes in statistical indicators but deep processes shaping the future of the national economy. These include transformations in labor demand, educational strategies. Sectoral distribution, qualification requirements, and the population's standard of living. Understanding these processes is a necessary prerequisite for effective public policy aimed at modernizing the labor market, increasing productivity, and strengthening social balance within society. Thus, the purpose of this article is to analyze the dynamics and structural transformation of the labor force in Kazakhstan with an emphasis on the development of human capital, changes in age, gender, educational, and sectoral employment structure.

Literature Review

The analysis of labor resources and the labor market represents a key area of economic research, encompassing issues of employment, human capital, migration, and the efficiency of workforce utilization. In the global academic literature, one of the foundational contributions is the human capital theory developed by Becker (1993), which establishes a clear relationship between investments in education and labor productivity. Other classical works, including those by Samuelson and Nordhaus (2009), emphasize the mechanisms of labor supply and demand, as well as the role of institutional factors in shaping labor market outcomes.

A substantial contribution to the study of structural changes in labor markets was made by Autor, who analyzed the impact of technological automation on the displacement of middle-skilled jobs (Autor, 2015). Research by Freeman addresses the transformation of the global workforce in the context of an open world economy (Freeman, 2007). In the post-Soviet space, the works of Kapelyushnikov are particularly significant, as they analyze the institutional characteristics of labor market development in transition economies and examine the factors behind low labor mobility and employment flexibility (Kapelyushnikov, 2012).

O'Clery (2022) examined the concept of labor network "modularity," demonstrating how workers' skills and mobility shaped labor market structures. This approach was particularly relevant for the development of network-based methodologies used to analyze labor resource configurations. Koval (2022) investigated the architecture of online labor management platforms (the human cloud), emphasizing their role in assessing qualification–competency structures and the application of digital tools in

human resource management. Li (2022) analyzed the impact of the IT revolution on the redistribution and transformation of labor resources across economic sectors. Furthermore, Qiu (2024) explored the relationship between the digital economy and the evolution of labor resource structures, highlighting skill shifts and changing qualification requirements.

Sakib (2023) examined the influence of emerging trends and challenges on the availability of labor resources and their application in external HRO/HR services. Lee (2023) focused on the analysis of labor resource development in the construction sector, examining employment structures, workforce needs, and labor productivity monitoring. Dong et al. (2024) described the factors influencing employment and workforce structure within enterprises – policy, market, and firm–level employment – using empirical models of value creation and the effects of employment structure. Wysocka (2021) emphasized demographic effects in the study of labor resource conditions and structures, including age composition and the share of the working-age population.

In Kazakhstan, the analysis of labor resources has been developing in the context of economic modernization and demographic change. One significant direction includes labor market studies conducted by Sabirova (2020) and Kaliyeva (2020), who examined skill mismatches between workforce qualifications and employer needs, as well as challenges related to youth employment. Aliyeva (2025) analyzed the impact of state employment policy on regional disparities in labor activity. Particular attention to labor market digitalization is given by Insebayeva and Beyssembayev (2023), who study the effects of digital platforms on employment structures and skill demand. Beisembina (2025) examines the development of human capital and the quality of labor resources in Kazakhstan.

Joint studies by KISI (the Kazakhstan Institute for Strategic Studies) also analyze the impact of demographic challenges on youth employment growth and substantiate the need to enhance the efficiency of labor resource utilization in the context of the transition to an innovation-driven economy (KISI, 2025). Thus, both domestic and international studies form a comprehensive theoretical and empirical foundation for analyzing Kazakhstan's labor market. They emphasize the importance of human capital, institutional factors, demographic dynamics, and technological change in shaping a high-quality labor potential.

Methodology

The methodological framework of the study is based on a comprehensive approach to examining the dynamics and structure of labor resources in the Republic of Kazakhstan over the period 2019-2024. The research employs comparative, structural, descriptive, economic–statistical, and trend analysis methods, which made it possible to identify key patterns in labor market development and to assess the impact of demographic, economic, and institutional factors on its formation.

The methodological concept of the study is based on an integrated approach to the analysis of the dynamics and structural changes of the labor resources of the Republic of Kazakhstan for the period 2019-2024 and includes a sequence of interrelated analytical stages. At the first stage, a theoretical and methodological research base was formed,

including an analysis of domestic and foreign scientific publications on the labor market, human capital and structural transformation of employment, as well as the study of international and national regulatory documents in the field of employment and qualifications. At the second stage, empirical data was collected and systematized based on official statistics from the Bureau of National Statistics of the Republic of Kazakhstan, materials from sample surveys of the labor force and administrative data from bodies implementing state employment policy. The comparability of the indicators has been verified, taking into account the methodology of the ILO and changes in national legal norms. At the third stage, comparative and structural analysis methods were applied to assess changes in the level of employment, unemployment and economic activity of the population, as well as transformations in the age, gender, educational and sectoral structure of the workforce. At the fourth stage, economic and statistical methods were used, including the calculation of relative indicators, growth rates, shares and indices, which made it possible to quantify the dynamics of key characteristics of the labor market and the quality of the workforce. At the fifth stage, a trend analysis was conducted aimed at identifying sustainable trends and long-term trajectories of labor development in the context of demographic changes and digital transformation of the economy. At the final stage, the interpretation of the results was carried out, conclusions and practice-oriented recommendations were formulated, aimed at improving state policy in the field of workforce development, human capital and forecasting labor market needs.

Comparative analysis was used to examine changes in employment, unemployment, and economic activity indicators over time, as well as to assess differences by gender. Age groups and types of economic activity. Structural analysis enabled the identification of the distribution proportions of labor resources across economic sectors, the determination of dominant industries, and the tracking of changes in the occupational and qualification structure of the workforce.

Economic and statistical methods included the calculation of relative and average values, growth rates, shares, and indices of real and nominal wages, providing a quantitative assessment of the ongoing changes. Trend analysis was applied to identify dynamic patterns and to determine the presence of long-term trajectories in labor market development.

The empirical basis of the study was formed using data from the Bureau of National Statistics (2024), regulatory and legal acts governing employment and qualification systems, statistical compilations, and materials from academic publications. The processing of the collected information involved methods of systematization, aggregation, and tabular and graphical data presentation, ensuring the clarity and reliability of the results obtained. This methodological approach made it possible to conduct a comprehensive analysis of labor resources and to draw well-founded conclusions regarding the current state and prospects of Kazakhstan's labor market.

Results

Given that the structure of employment has a significant impact on socio-economic development, the following section analysis the dynamics of labor resources. The analysis of labor resource dynamics indicates that the overall level of employment in the

Republic of Kazakhstan remains consistently high. In 2024, the employment-to-population ratio amounted to 65%, while the unemployment rate stood at 4.7% (Figure 1).

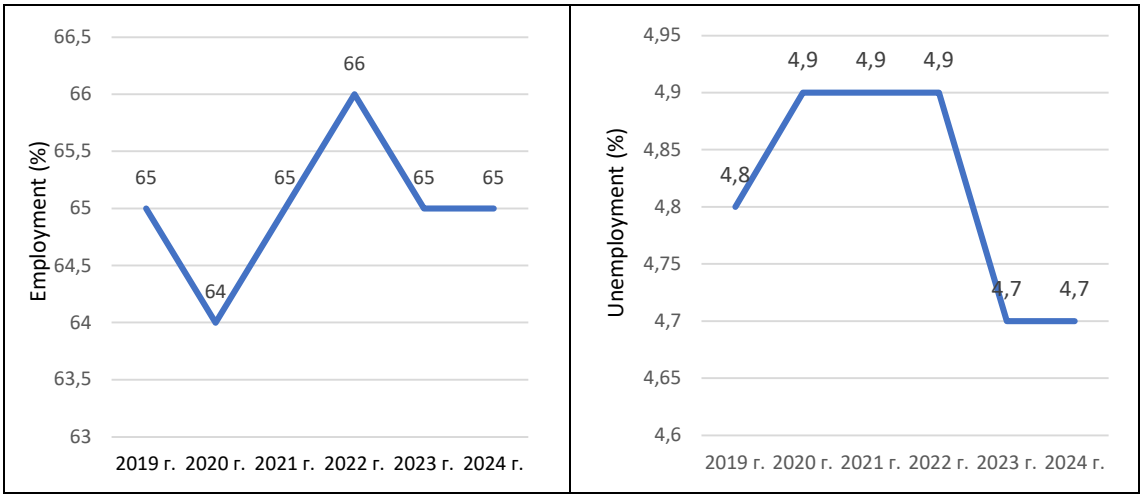

Figure 1. The level of employment and unemployment in Kazakhstan for 2019-2024

In 2024, the unemployment rate, calculated in accordance with the ILO methodology, remained stable compared to 2023 and amounted to 4.7%. As of the end of December 2024, a total of 191.9 thousand individuals were registered as unemployed with the employment authorities of the Ministry of Labor and Social Protection of the population of the Republic of Kazakhstan. The share of registered unemployed in 2024 increased by 0.2 percentage points compared to 2023, reaching 2% of the labor force. The youth unemployment rate among individuals aged 15 to 34 amounted to 3.1% (Figure 2).

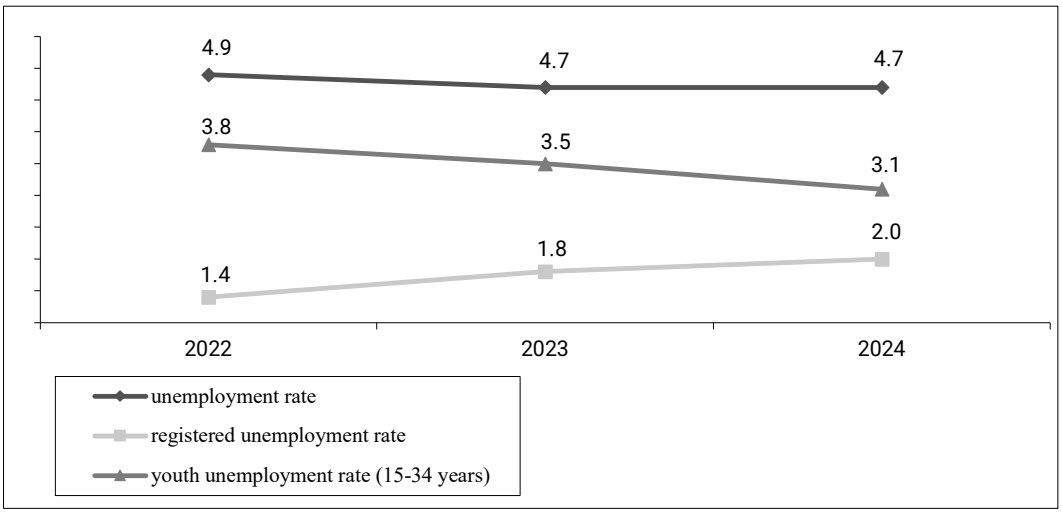

Figure 2. Unemployment rate, %

Following the 2020 pandemic, labor market trends indicate a confident recovery: the number of employed persons increased to 9.2 million, while the economically active population reached 9.66 million. The growth of the labor force can be attributed to population increase, rising educational attainment, improved conditions for labor migration, and the expansion of self-employment opportunities. According to the data presented in Table 1, between 2019 and 2024, the population of Kazakhstan increased by 8.9%, from 18.39 million to 20.03 million people, reflecting demographic growth and an expansion of the potential labor supply. In parallel, the labor force increased by 4.8%, while the employed population grew by 4.9%, indicating the economy's capacity to absorb additional labor supply while maintaining a relatively low unemployment rate of 4.7%.

Thus, the share of employed persons in the total population amounted to 65% in 2024, which is 0.2 percentage points higher than in 2019, despite a temporary decline in 2020-2021 due to the consequences of the pandemic. The absolute number of unemployed individuals in 2024 was slightly lower than in 2019, while the overall unemployment rate decreased from 4.8% to 4.7% (Table 1).

Table 1. Key labor market indicators in Kazakhstan for 2019-2024

Indicator	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Population size	18394642	18630920	18878966	19503159	19766 807	2003384 2
Labor force, thousand persons	9 221,5	9 180,8	9 256,8	9 429,8	9 534,1	9664,0
Employed population	8 780,8	8 732,0	8 807,1	8 971,5	9 081,9	9214,2
Employees, thousands of persons	6 681,6	6 686,7	6 710,2	6 847,3	6 893,4	7015,1
Self-employed population, thousand persons	2 099,2	2 045,4	2 096,9	2 124,2	2 188,5	2199,1
Unemployed population, thousand persons	440,7	448,8	449,6	458,3	452,2	449,8
Unemployment rate, %	4,8	4,9	4,9	4,9	4,7	4,7
Youth unemployment rate, % (aged 15-24)	3,6	3,8	3,7	3,8	3,8	3,7
Youth unemployment rate, % (aged 15-34)	3,7	3,8	3,8	3,8	3,5	3,1
Long-term unemployment rate, %	2,2	2,2	2,1	2,3	1,2	1,0
Average duration of unemployment, months	5,4	5,2	6,7	7,0	5,9	4,9
Persons outside the labor force, thousand persons	3 934,0	4 076,8	4 093,3	4 301,4	4 393,5	4512,8
*Data are based on ILO methodology and annual labor force sample surveys. **Changes in the legal definition of youth in Kazakhstan (extension of the upper age limit to 35 years since 2023) are taken into account.						

Note: compiled by the authors

This trend is characteristic of an economy that has experienced a shock (the pandemic), followed by recovery and a moderate improvement in labor market conditions. The number of employees increased throughout the entire period under review, indicating a strengthening of the formal sector and, most likely, growth in the number of jobs within organizations. At the same time, the number of self-employed individuals also increased, albeit at a more moderate pace, confirming the gradual reallocation of labor from informal and semi-formal employment towards more stable wage employment.

According to the data in Table 1, of the 9.2 million employed persons in 2024, 76.1% were employees and 23.9% were self-employed. This reflects the preservation of the overall employment structure alongside absolute growth in both categories: the number of employees increased by 4.99%, while self-employment rose by 4.7%. The simultaneous increase in both wage employment and self-employment against the backdrop of declining unemployment indicates an expansion of employment opportunities and a certain diversification of forms of economic participation. This trend corresponds to a process of structural transformation, whereby a portion of the self-employed is gradually integrated into the formal sector, while another segment consolidates within sustainable entrepreneurial activity.

The youth unemployment rate (ages 15-24) remains relatively stable but has shown a slight decline in recent years, which may be interpreted as an improvement in young people's entry conditions into the labor market. Unemployment indicators for the broader age group of 15-34 years also demonstrate a downward trend, reflecting reduced risks of prolonged transitions from education to stable employment.

The long-term unemployment rate (the share of individuals searching for a job for an extended period) declined by the end of the period compared to 2019-2020. This dynamic is positive, as long-term unemployment leads to skill depreciation and social marginalization. The reduction in this indicator may be attributed to stronger labor demand and more active employment policies.

The average duration of unemployment, measured in months, decreased by 2024 compared to its peak values in 2021-2022, indicating more effective job placement and increased "throughput capacity" of the labor market. A decline in this indicator contributes to reducing the social costs of unemployment and suggests improved matching between workers' qualifications and employers' requirements. The number of persons outside the labor force increased, which may be associated with both demographic factors (a growing share of inactive age groups) and institutional factors (extended education, caregiving responsibilities, and early exits from employment).

The age structure of the labor force is one of the key indicators of labor market conditions, economic productivity, and the quality of human capital (Republic of Kazakhstan, 2016). Kazakhstan, like most countries in the region, is facing demographic changes, including a declining share of youth and gradual population aging. In this context, the analysis of employment distribution by age groups becomes particularly relevant, as it allows for the identification of strategic risks and opportunities for labor market development. During the analyzed period, the number of employed persons increased from 8.78 million in 2019 to 9.21 million in 2024, corresponding to a growth

of 4.9%. Despite a temporary decline in employment in 2020 due to the impact of the COVID-19 pandemic, the subsequent years demonstrate steady recovery and gradual growth.

Employment growth was accompanied by changes in its age structure, reflecting underlying demographic processes (Table 2).

Table 2. Employed population by age group in Kazakhstan for 2019-2024, thousand persons

Year	Total	Including by age group, years						
		15	16-24	25-34	35-44	45-54	55-64	65 and over
2019	8780,829	333	1055,316	2697,658	2214,188	1825,603	930,965	56,766
2020	8732,040	634	1052,083	2645,787	2219,081	1809,399	936,799	68,257
2021	8807,113	194	1014,127	2619,867	2280,732	1839,710	982,186	70,297
2022	8971,539	508	931,181	2637,692	2470,136	1835,420	1019,885	76,717
2023	9081,920	298	942,032	2613,461	2537,309	1820,071	1076,616	92,133
2024	9214,184	299	970,787	2658,338	2581,886	1827,955	1073,383	101,536

Note: compiled by the authors

Thus, the age cohort of 35-44 years is the most numerous, increasing from 2.21 million persons in 2019 to 2.58 million in 2024. This group accounted for 28% of total employment, underscoring its central role in the country's production system. This cohort is characterized by a high level of professional qualifications, stable employment, and maximum economic activity. The growth in its size indicates a shift of the economic core toward mature age groups. The 25-34 age cohort accounts for approximately 20% of total employment (2.61-2.70 million persons in 2023-2024). Despite a slight decline in numbers after 2019, this group provides an inflow of young, skilled workers and remains the most mobile segment of the labor market. The decline may be associated with a demographic wave, as the cohort born during the fertility decline of the 1990s entered the 25-34 age range.

The 25-34 age cohort accounts for approximately 20% of total employment (2.61-2.70 million persons in 2023-2024). Despite a slight decline in numbers after 2019, this group provides an inflow of young, skilled workers and remains the most mobile segment of the labor market. The decline may be associated with a demographic wave, as cohorts born during the fertility decline of the 1990s entered the 28-34 age range. The share of the 45-54 age group has also remained at around 20% (1.82-1.84 million persons). This cohort consists of experienced professionals, often occupying managerial positions. Its stability highlights its importance for the reproduction of skilled labor.

Youth employment (up to 28 years of age) shows a downward trend. The number of individuals aged 16-24 decreased from 1.05 million in 2019 to 0.93 million in 2022. This decline can be attributed to the demographic downturn of the early 2000s, intensified competition in the labor market, longer durations of education, and difficulties associated with first-time employment. These factors may pose potential risks of a shortage of young workers in the medium term. The increase in the number of employed persons aged 55-64, from 930 thousand to 1.07 million, can, in our view, be explained by the increase in

the retirement age, the active labor market participation of pre-retirement individuals, and the development of non-standard forms of employment that are more suitable for older workers.

The increase in the number of employed persons aged 65 and over during the period 2019-2024 amounted to 44.8 thousand individuals and is associated with improvements in the health status of older people, rising life expectancy, and the expansion of the service sector and self-employment opportunities. Thus, the core of the labor force consists of workers aged 29-54, who account for 68% of total employment, or nearly two-thirds of all workers in the country. The predominance of individuals aged 35-44 (approximately 2.58 million persons) and 29-34 (over 1.85 million persons) is particularly notable. In percentage terms, the distribution is as follows: individuals aged 35-44 account for 28% of total employment; those aged 29-35 account for 20%; the 45-54 age group accounts for 20%; youth (under 28 years of age) account for approximately 19%. At the same time, the labor force is undergoing an aging process, characterized by a declining share of youth and increasing participation of older workers. These trends necessitate the adaptation of employment policies, vocational education systems, and social protection mechanisms.

The identified trends of labor resource dynamics make it possible to further assess the gender structure of employment in greater detail (Figure 3).

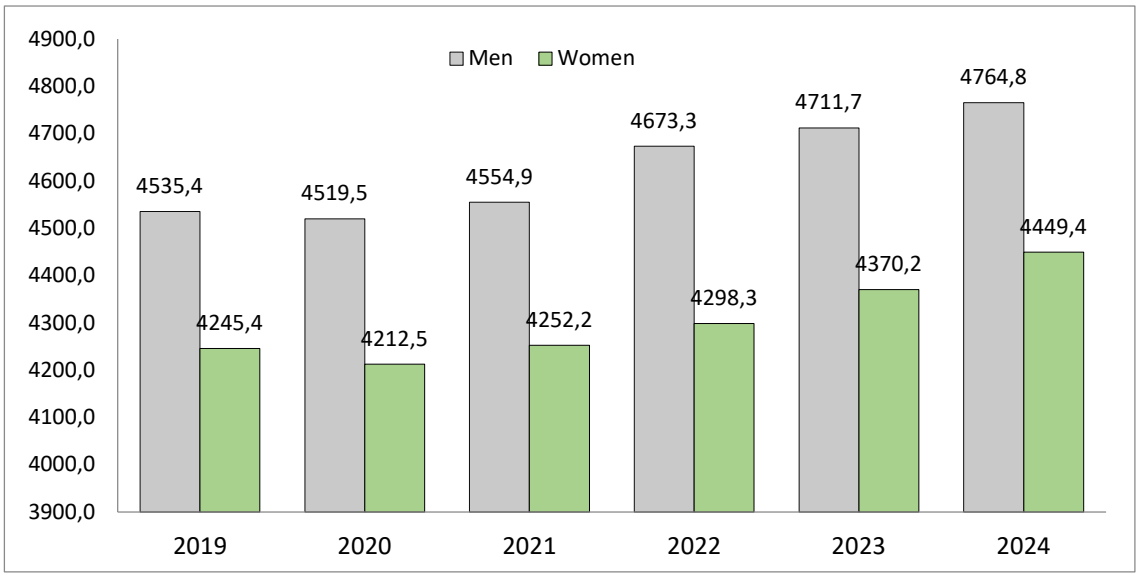

Figure 3. Employed population by gender in Kazakhstan for 2019-2024

The gender structure of the labor market reveals a certain degree of asymmetry. In 2024, the labor force participation rate among men amounted to 73.5%, while among women it was approximately 63.3%. At the same time, 36.7% of women were outside the labor force. Consequently, the gender gap in employment levels reaches around 10 percentage points. However, this gap has been gradually narrowing due to the increasing share of women with higher education and the development of flexible forms of employment. According to the data presented in Table 3, an analysis of statistical

indicators for 2022-2024 reveals several key trends: an increase in the share of workers with higher education, a rise in the educational attainment of the self-employed, and changes in the proportions between wage employees and self-employed individuals.

Additional data for in-depth analysis: annual industry breakdown of employment (the number of women and men in each industry), regional salary structure, distribution by job level and age cohort, and data on bonuses and administrative payments. These additional variables will allow us to more accurately identify the specific factors that caused the widening gap in 2023 and where targeted interventions are needed.

Table 3 presents the calculated gender pay gap alongside primary wage data, providing a consolidated view of key indicators for this period.

Table 3. Employed population by employment status and educational attainment for 2019-2024, thousand persons

Indicator	Year	Population with educational attainment. total	Including		
			Higher and postgraduate education	Technical and vocational education	Primary, lower secondary, and general secondary education
Employed population, total (persons)	2019	8 780, 829	3 422,471	-	1 656,419
	2020	8 732, 040	3 709,231	-	1 591,817
	2021	8 807,113	28,016	-	5 241,734
	2022	8 971,539	4 017,424	4 370,784	583,331
	2023	9 081,920	3 982,708	4 471,157	628,055
	2024	9 214,184	3 915,025	4 741,623	557,536
Wage employees (persons)	2019	6 697,623	2 923,428	-	985,010
	2020	6 686,666	3 142,199	-	928,445
	2021	6 710,206	26,070	-	3 685,021
	2022	6 847,300	3 324,412	3 236,262	286,626
	2023	6 893,429	3 294,190	3 284,438	314,801
	2024	7 015,108	3 256,473	3 472,657	285,978
Self-employed workers (persons)	2019	-	-	-	-
	2020	-	-	-	-
	2021	-	-	-	-
	2022	2 124,239	693,012	1 134,522	296,705
	2023	2 188,491	688,518	1 186,719	313,254
	2024	2 199,076	658,552	1 268,966	271,558

Note: compiled by the authors

The analysis demonstrates a gradual modernization of human capital and a structural transformation of the labor market. In terms of educational attainment, the employment structure is as follows: 42.5% of employed individuals have higher and postgraduate education; 51.5% have technical and vocational education; 6% have secondary or lower levels of education. This indicates that nearly every second worker possesses higher education, and the share of skilled labor continues to increase steadily. Compared to 2019, the growth in the proportion of individuals with higher education is estimated at approximately +3 percentage points, which is consistent with trends in economic digitalization and the modernization of labor potential.

During 2022-2024, a stable upward trend in the number of workers with higher and technical education was observed, reflecting qualitative growth in human capital. Despite a moderate decline in the number of employed individuals with higher education in 2023-2024 (a decrease of 2.5% compared to 2022, corresponding to a reduction of 34.7 thousand persons in 2023 and an additional 67.7 thousand persons in 2024), this category remains the largest in absolute terms. It accounts for approximately 42-44% of total employment and constitutes the core segment of the skilled workforce. This decline may be associated with demographic factors, migration dynamics, and the redistribution of employment across educational levels. The analysis revealed a steady increase in the number of employed persons with technical and vocational education: by 100.4 thousand in 2023 and by 270.4 thousand in 2024. The total increase over the two years amounted to 370.8 thousand persons, or approximately 8.5%.

At the same time, the dynamics of employment among individuals with primary, lower secondary, and general secondary education were uneven. In 2023, their number increased by 44.7 thousand, followed by a decline of 70.5 thousand in 2024; overall, however, the figures remained within the range of 0.55-0.63 million persons. The main contributing factors include the displacement of unskilled labor, modernization of economic sectors, the growing importance of education and qualifications, and generational replacement effects, whereby younger cohorts are more educated than older ones.

Thus, the employment structure is increasingly dominated by skilled workers. The two largest groups – those with higher education and those with technical and vocational higher education – together accounted for more than 90% of total employment in 2024. The fastest growth is observed in the technical and vocational education group, reflecting the industrial and service-oriented transformation of the economy. The group with lower levels of education is shrinking, indicating a reallocation of labor toward more highly skilled occupations. Having analyzed the distribution of employment by gender and age, the discussion now turns to the sectoral structure of the labor market. The sectoral composition also exhibits signs of structural transformation. The largest sectors in terms of employment in 2024 are presented in Table 4.

Table 4. Sectoral structure of employment

Sector	Share of employment, %	Change, 2019→2024
Trade and motor vehicle repair	16,6	+0,7 p.p.
Education	13,0	+0,9 p.p.
Industry	12,6	+0,2 p.p.
Agriculture	11,2	-1,8 p.p.
Transportation and storage	7,3	+0,4 p.p.
Construction	7,2	+0,5 p.p.
Healthcare and social services	6,3	+0,5 p.p.
Other services	4,2	+0,8 p.p.

Note: compiled by the authors

A comparison between 2019 and 2024 reveals a noticeable decline in employment in the agricultural sector (from 1.18 million to 1.03 million persons, or a decrease of 13%), alongside simultaneous growth in trade, education, construction, and services. This

is a transition from a resource–based economy toward a service-oriented model. Employment is also increasing in the information and communication sector (+16,8%) and in financial activities (+6.3%), confirming the ongoing process of digitalization and the transition to a knowledge-based economy (Table 5).

Table 5. Employed population by major economic activities, thousand persons

Indicator	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Employed in the economy, total	8 780,8	8 732,0	8 807,1	8 971,5	9 081,9	9214,2
Agriculture, forestry, and fishing	1184,7	1175,1	1176,4	1108,9	1078,7	1 027,9
Industry	1094,9	1089,2	1098,0	1121,2	1121,5	1 157,8
Mining and quarrying	279,9	276,9	277,9	274,8	277,5	284,3
Manufacturing	583,6	581,8	585,6	613,7	605,6	625,9
Electricity, gas, steam, hot water supply, and air conditioning	150,2	149,0	150,1	148,1	148,9	155,1
Water supply; waste collection, treatment, and disposal; remediation activities	81,2	81,5	84,3	84,6	89,6	0,1
Construction	635,6	630,9	641,4	658,9	642,3	665,5
Wholesale and retail trade; repair of motor vehicles and motorcycles	1431,1	1421,3	1451,9	1497,9	1515,1	1 529,0
Transportation and storage	637,9	617,5	609,5	640,6	647,7	670,1
Accommodation and food service activities	196,9	193,7	190,9	198,4	214,3	232,5
Information and communication	161,7	159,7	161,7	166,5	187,8	188,5
Financial and insurance activities	190,5	189,0	184,9	186,3	201,7	202,5
Real estate activities	154,5	158,4	168,4	166,1	151,1	162,9
Professional, scientific, and technical activities	256,4	254,7	247,3	253,7	265,0	263,6
Administrative and support service activities	292,3	285,5	287,5	280,8	272,8	277,2
Public administration and defense; compulsory social security	495,3	489,3	484,1	508,5	523,7	517,0
Education	1108,7	1109,5	1120,1	1142,3	1183,0	1 198,4
Human health and social work activities	502,7	512,4	526,0	561,2	577,5	583,9
Arts, entertainment, and recreation	142,0	138,4	134,7	137,9	139,4	154,2
Other service activities	295,8	307,5	324,4	342,5	360,2	383,3

Note: compiled by the authors

Thus, the growth of the services sector, ICT, logistics, and financial activities aligns with the global trend of digitalization and the transition to a knowledge-based economy. A logical continuation of the analysis of sectoral employment distribution is the study of wage dynamics. In 2023, the nominal wage index increased to 115.3 (2019-100);

however, the real wage index amounted to only 102.7, indicating a decline in purchasing power of 5-6% due to inflation. Therefore, nominal wages show a stable upward trend, while real wages are declining under the influence of inflation. Despite the growth in nominal incomes, real household incomes are decreasing, posing challenges for ensuring an adequate standard of living and necessitating adjustments in wage policy and social protection measures. It is also notable that the real wage index decreased from 108.8 in 2021 to 102.7 in 2023 (Figure 4).

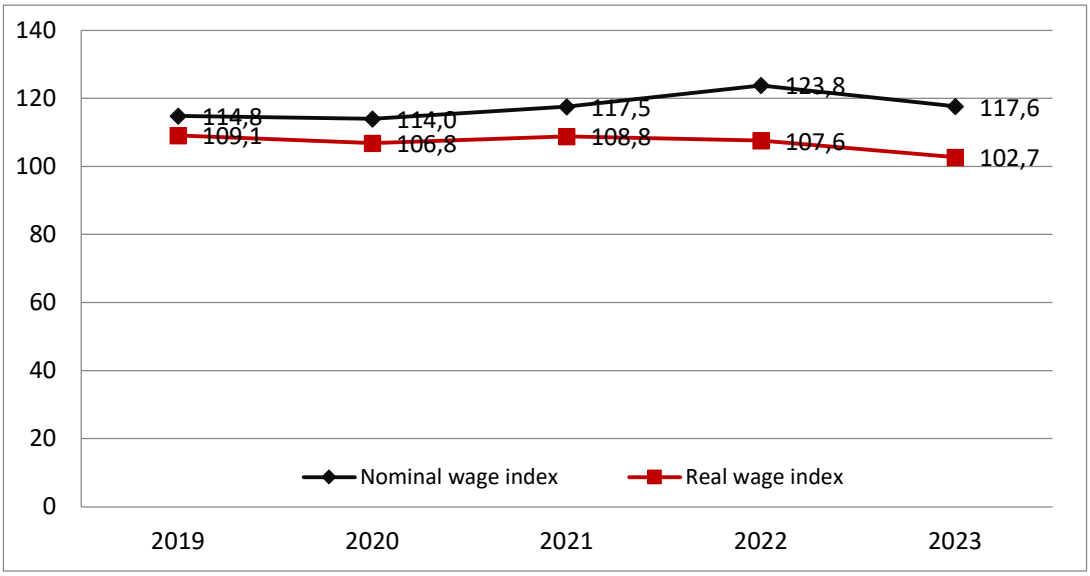

Figure 4. Nominal and real wage indices for 2019-2023

This gap reflects the decline in household purchasing power, the influence of macroeconomic factors, and the need to modernize the wage system. The analysis of the dynamics and structure of Kazakhstan's labor resources for 2019-2024 allows the following conclusions.

(1) The labor market is resilient, demonstrating a high employment level (65%) and low unemployment (4.7%).

(2) Structural renewal of employment is occurring – occurring-the formal sector is expanding, long-term unemployment is decreasing, and youth unemployment is stabilizing.

(3) Educational and professional modernization of the workforce is evident, with technical and higher-educated personnel dominating.

(4) The services sector is becoming the leading driver of employment, consistent with the global trend toward digitalization and the knowledge-based economy.

(5) The main challenge remains the decline in real wages, necessitating improvements in income regulation mechanisms and increased labor productivity.

In Kazakhstan, the qualifications and competencies of labor resources are regulated and developed through the National Qualification System (hereinafter – NQS). The NQS represents a comprehensive set of legal and institutional tools aimed at aligning the

demand for qualified personnel from the labor market with the supply of qualifications from the education system (Republic of Kazakhstan, 2023).

The NQS is a systematic description of qualification levels recognized in Kazakhstan's labor market. The NQS consists of eight levels, each of which defines the requirements for workers' knowledge, skills, and competencies and includes:

(1) Professional standards – documents establishing general requirements for knowledge, skills, abilities, and work experience in a specific professional field. For example, in human resource management, standards have been approved for strategic HR, organizational development, and workforce planning, recruitment, and other areas.

(2) Qualification assessment and recognition centers – accredited organizations that evaluate and recognize candidates' professional qualifications. Recognition can be mandatory or voluntary, depending on industry and employer requirements.

The NQS is designed to align educational programs with employer demands, improve workforce quality, and develop a competitive human capital potential.

Conclusions

The conducted analysis of the transformation of labor resources in the Republic of Kazakhstan for 2019-2024 allows for a number of substantive conclusions, reflecting key trends and challenges in the development of the national labor market.

Firstly, during the analyzed period, the labor market was characterized by relative stability and gradual recovery following the crises triggered by the 2020 pandemic. Employment levels remained resilient, and unemployment rates stayed low, indicating the economy's capacity to adapt to both external and internal challenges.

Secondly, the study of the structure of the economically active population revealed gender and age differences. Men exhibit higher labor force participation, while a significant proportion of women remain outside the labor force. The age structure of employment shows a concentration of workers in the most productive age groups (29-44 years), providing favorable potential for economic growth while simultaneously requiring strategic attention to support young specialists and pre-retirement workers.

Thirdly, sectoral analysis indicates that Kazakhstan's employment structure remains multi-sectoral. The largest contributions to total employment come from trade, education, industry, and agriculture. At the same time, the role of the services sector – including ICT, finance, logistics, and other areas linked to the digital transformation of the economy-is increasing. These changes reflect a gradual transition toward a knowledge-based economy and the growing complexity of professional requirements.

Fourthly, wage dynamics analysis revealed a discrepancy between nominal income growth and the decline of real wages due to inflation. This highlights the need to adjust social protection mechanisms and improve the wage system to strengthen household purchasing power and reduce inequality.

Fifthly, the NQS plays a particularly important role in the development of labor resources, serving as a key tool to ensure alignment between employer demand and the supply of qualification. The introduction of professional standards and the development of qualification assessment and recognition systems contribute to improving the quality of human capital and fostering sustainable employment in the long term.

Overall, the results indicate that Kazakhstan's labor market development in 2019-2024 occurred under conditions of moderate growth and gradual structural transformation. Key directions for improving state police in the field of labor resources include increasing real incomes, expanding employment opportunities for vulnerable groups, promoting formal employment, developing professional competencies, and implementing tools for forecasting labor market needs. Consistent implementation of these measures will ensure sustainable development of the country's labor potential and enhance the quality of human capital.

Recommendations:

1. Support for youth and women in the labor market – including expanding professional orientation programs, internships, subsidized employment opportunities, accessible retraining measures, the development of flexible employment forms, and the creation of conditions that enable balancing work and family responsibilities.
2. Promotion of formal employment and entrepreneurship – through the development and implementation of state measures to reduce administrative barriers, provide tax incentives for microbusinesses, promote digital business registration, and expand access to microfinance programs. These measures will facilitate the transition of informal activities into the formal sector and strengthen economic activity among the population.
3. Implementation of progressive professional standards and NQS mechanisms – to ensure that the qualification structure of labor resources meets the needs of modern economic sectors. Active updating of professional standards, development of qualification assessment centers, and integration of NQS into educational programs will improve workforce quality, mobility, and alignment of competencies with employer requirements.
4. Ensuring control over inflation and growth of real incomes – through strengthening anti – inflationary policies, modernizing wage systems, and ensuring transparency in wage indexation mechanisms. These measures will help maintain real income levels and stimulate domestic demand, a critical factor for economic growth.
5. Development of a labor demand forecasting system – rapid structural changes in the economy require timely forecasting of future demand for professions and competencies. Creating continuously updated forecasting models and integrating labor market, education, and demographic data will enhance workforce planning efficiency. This will serve as a basis for designing educational programs oriented toward future – oriented industries and reduce mismatches between labor supply and demand.

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Conceptualisation and theoretical framework: MK and IB; research design and methodology: TK; data collection and processing: MK, IB and TK; bibliometric analysis and interpretation: MK, IB and TK; case study analysis and visualisation: MK, IB and TK; draft writing and manuscript structure: MK and IB; editing and critical revision: IB and TK; final review and approval: MK and TK. All authors have read and approved the final version of the manuscript and agreed to its publication.

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