

DIGITAL TRANSFORMATION OF PUBLIC ADMINISTRATION IN LABOR MARKET REGULATION: DECENT WORK, INNOVATION AND STRONG INSTITUTIONS IN KAZAKHSTAN



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ABSTRACT

Digital platforms, artificial intelligence, and integrated public information systems are changing not only how public employment services are delivered but also the very object of state labour market regulation, while the employment outcomes of this shift in transition economies remain poorly quantified. This study examines the digital transformation of public administration within Kazakhstan's labour market regulatory system. It assesses whether changes have kept pace with the expansion of digital employment tools across the employment structure, unemployment, and labour productivity. The study employs annual official statistics from the Bureau of National Statistics and administrative data from the Enbek.kz Electronic Labour Exchange and regulatory documents for 2018–2025, applying dynamic, structural-functional, correlation and institutional analysis. The results show that the employed population grew by 7.5% to 9,345.8 thousand; wage employment grew faster (8.0%) than self-employment (6.0%); unemployment fell from 4.9% to 4.5%, and youth unemployment from 3.8% to 2.9%; while gross value added per employed person rose 2.4-fold. Labour productivity correlates strongly with wage employment ($r = 0.992$) and vocational qualifications ($r = 0.979$) and negatively with youth unemployment ($r = -0.894$). The registered digital labour market recorded 1.454 million resumes against 1.328 million vacancies in 2025, a tension coefficient of 1.095. The findings suggest that digital transformation has advanced faster than aggregate labour market indicators, and that Kazakhstan is moving from an administrative-reactive to a platform-based, data-driven model of employment regulation. That aggregate balance on the digital platform coexists with qualification and territorial mismatches that constrain decent work, reduce inequalities, and strengthen institutions.

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INTRODUCTION

The labour market of the mid-2020s is being reshaped simultaneously by generative artificial intelligence, digital platforms and new forms of employment, and this reshaping has become a central problem for public administration. Estimates for the United States indicate that about four-fifths of the workforce could see at least one-tenth of their tasks affected by large language models (Eloundou et al., 2024); field evidence shows productivity gains of roughly 15% for workers assisted by generative AI (Brynjolfsson et al., 2025), and platform data already record a 20–50% decline in demand for substitutable freelance skills alongside rising demand for complementary skills (Teutloff et al., 2025). AI creates and displaces labour demand simultaneously (Choi & Leigh, 2024); its wage effects differ sharply across occupational groups (Engberg et al., 2025), and exposure to AI has become a measurable predictor of unemployment risk (Frank et al., 2025). For a state that regulates employment, these shifts mean that the object of regulation the structure of jobs, skills and matching is moving faster than the traditional instruments of registration, benefit payment and subsidized job creation.

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At the same time, the instruments themselves are being digitized. About half of the public employment services (PES) in OECD countries already apply AI, mainly for matching job seekers to vacancies (Brioscú et al., 2024); digital technologies are reshaping the relationship between the welfare state and citizens (Alexopoulou, 2025); and automated administrative decision-making produces both synergies and trade-offs with the principles of good governance (Roehl & Hansen, 2024). The scientific problem addressed in this paper is that the digitalisation of labour market regulation changes two things at once the delivery channel of public services and the substance of regulatory decisions yet the literature on transition economies rarely assesses whether changes in employment, unemployment, and productivity keep pace with this digital transformation.

Kazakhstan offers an instructive case. Its public administration combines modernising, digitally driven reforms with persistent post-Soviet legacies (Knox & Orazgaliyev, 2025), and the country is a regional leader in digitalisation and AI policy in Central Asia (Kurmangali et al., 2024). Digital state capacity is now treated as part of the national policy architecture (Amirova, 2026). However, two-thirds of civil service job postings still do not specify digital skills (Sabdenov et al., 2025), and e-government financing remains uneven (Shevyakova et al., 2024; Imanbekova et al., 2024). The labor market, in turn, shows structural rather than aggregate problems: youth unemployment shocks have the largest effect on total unemployment (Beisembina et al., 2025), internet penetration reduces youth unemployment in the short run (Barzhaksyyeva et al., 2026), a gender gap in youth unemployment has widened again since 2017 despite rapid growth of digital readiness (Baidalinova et al., 2026), regions differ five-fold in readiness for platform-based models (Varavin et al., 2025), and generational differences in digital skills shape labor market participation (Serikkyzy et al., 2025). The platform economy is expanding regional entrepreneurship and employment (Utebaliyeva et al., 2026), while measuring the digital economy itself requires context-specific indices (Denissova et al., 2025). By the end of 2025, about 9.3 million people were employed in Kazakhstan; the unemployment rate was 4.6%, and 23.1% of the employed were self-employed, so the stability of headline indicators coexists with structural imbalances that require better targeted instruments of state intervention.

The topic's relevance to the Sustainable Development Goals is direct. Digital employment services affect decent work and inclusive growth (SDG 8), industrial innovation in public infrastructure (SDG 9), reduced inequalities in access to jobs (SDG 10), and the effectiveness and accountability of institutions (SDG 16). Digital inclusion of vulnerable groups is now a recognized condition for equitable public service ecosystems (Liu et al., 2025), and studies in developing economies show that platform work expands employment, but its contribution to structural transformation depends on state capacity (Cook & Rani, 2025; Shannaq et al., 2025). Evidence from Bangladesh confirms that digital literacy and financial self-efficacy, rather than access alone, determine the adoption of digital services (Islam & Khan, 2024) and that perceived security is the strongest driver of acceptance of digital channels (Islam, Hasan, et al., 2024), which is equally relevant for citizens interacting with a digital labour exchange.

The study aims to assess the digital transformation of public administration within Kazakhstan's labour market regulatory system and to determine whether measurable changes in the structure of employment, unemployment, and labour productivity have accompanied the expansion of digital employment tools in 2018–2025. To achieve this aim, the study systematizes the multilevel system of state regulation, analyses the dynamics and structure of employment using official statistics, computes growth rates, structural shares, the tension coefficient of the registered digital labour market and Pearson correlations between productivity, employment and unemployment indicators, and evaluates the transition from an administrative-reactive to a platform-based model of regulation.

The remainder of the paper is organized as follows. The literature review synthesises international and Kazakhstani research on the digitalisation of public employment services, algorithmic profiling and the digital welfare state, and formulates the purpose and hypotheses. The materials and methods section describes the data, variables and analytical procedure. The results section presents the institutional architecture of regulation, the dynamics of the labour market and the digital intermediation indicators. The discussion compares the findings with previous studies, and the conclusions summarise the contributions, implications, limitations, and directions for future research.

LITERATURE REVIEW

Research on the digital transformation of labour market regulation has developed along four interrelated strands: the digitalization of public employment services; the use of algorithms and artificial intelligence for profiling and matching; the digital welfare state and street-level discretion; and country-specific evidence on e-government and labour market change in Kazakhstan and comparable economies. Each strand is reviewed below in relation to the aim of this study.

The first strand documents how digital technologies can reshape the entire service chain of public employment services, from job seeker registration to profiling, matching and outcome monitoring. Pieterse et al. (2023) show for Latin America and the Caribbean that the digital maturity of a PES depends not only on infrastructure but on channel integration, data quality and the capacity of organizations to adapt business processes, and identify five dimensions of transformation: strategy, operations, public engagement, organizational change and data stewardship. The International Labour Organisation (2023a) reaches similar conclusions for Asia and the Pacific, where digital platforms simplify job search for young people but risk widening the digital divide for those without skills or infrastructure. Comparative work confirms that there is no universal model. Ingold et al. (2025) find that employment service digitalization in the United Kingdom remained comparatively underdeveloped due to market competition and data concerns. In contrast, digitalization in Australia proceeded rapidly, raising concerns about the pace of change. Sacchi and Scarano (2025) demonstrate that even EUR 5.4 billion in NextGenerationEU funding does not, by itself, produce digital transformation in Italy; organizational restructuring, interoperability, and regional implementation capacity are decisive. Ball et al. (2023) add that different technological solutions alter the administrative discretion of frontline staff in welfare-to-work programs in different ways, so that outcomes depend on how technology is embedded in organizational processes.

The second strand concerns the shift from digitalization to algorithmic management. Broecke (2023) maps the range of AI applications in labour market matching job description generation, candidate sourcing, resume processing, chatbots, and algorithmic matching and notes that concerns about robustness, bias, privacy, and explainability hold back adoption. Brioscú et al. (2024) find that about half of OECD public employment services already use AI, mostly for job seeker vacancy matching, and stress algorithmic transparency and the involvement of staff and clients. Gallagher and Griffin (2025) show that reporting the accuracy of algorithmic profiling as a single headline percentage obscures high false-positive rates and misleads policymakers, while Haug et al. (2026) trace how a Danish machine-learning tool for profiling the unemployed lost legitimacy over seven years and was terminated because of concerns about discriminatory design. Sztandar-Sztanderska (2026) demonstrates that human oversight of automated decisions in welfare administration is shaped by policy, organizational, professional, and technological contexts rather than by caseworkers' cognitive overreliance alone. In the private sector, algorithmic management brings coordination gains alongside surveillance, bias, and alienation (Zhang et al., 2025), and AI hiring tools can reproduce rather than remove human bias at the data, design, and decision stages (Kelan, 2024). Citizens, moreover, hold public organizations no less responsible for discriminatory outcomes produced by algorithms than they do officials, and more so when the algorithm was developed in-house (Alon-Barkat et al., 2025). Roehl and Hansen (2024) systematize these tensions by mapping automated administrative decision-making against nine principles of good governance and distinguishing achievable synergies from hard trade-offs. Islam, Khan, et al. (2025) similarly identify technical, ethical, data-security and governance challenges of AI that require regulatory frameworks. This literature establishes a fundamental distinction that guides the present study: an electronic service changes the delivery channel, whereas an algorithmic system can change the substance of a government decision such as a job seeker's risk category, a recommended training program, or a suitable vacancy.

The third strand, the digital welfare state, examines the citizen's side of these systems. van Toorn et al. (2024) argue that digital welfare technologies intensify surveillance and social sorting of marginalised groups and represent a continuity with, rather than a rupture from, historical state control; Zakharova et al. (2024) conceptualise the resulting tension between care and control. Evidence from the United Kingdom shows that automated, earnings-driven benefit payments impose temporal, financial and emotional administrative burdens on claimants (Bennett et al., 2026), that claimants navigating several digital benefits face an unpredictable multilevel maze (Bennett, 2026), and that interface design itself structures access to social security in an 'interface first' bureaucracy (Meers et al., 2025). Street-level workers, for their part, regard digitalization as meaningful when it automates routine tasks but leaves final decisions under human control (Marienfeldt, 2025), deploy countermeasures against technology-driven constraints on discretion (Northcott, 2026), and, in the Austrian PES, 'tame' uncertain AI futures by reframing them as a means of reclaiming discretion (Zenkl, 2025). Adoption on the citizen side depends on ICT skills, confidence in technology and connection quality, with large socioeconomic disparities (Gijón et al., 2025), and technical, social and institutional barriers exclude marginalized groups from e-government unless digital literacy programs and partnerships are in place (Djatkiko et al., 2025; Liu et al., 2025). Labour market information systems that transform administrative statistics and online job postings into occupation- and skill-level intelligence are the analytical precondition for a predictive, rather than reactive, regulatory model (International Labour Organisation, 2023b; Tzimas et al., 2024).

The fourth strand is the Kazakhstani and regional evidence. Orazgaliyeva et al. (2023) show that e-government improves public administration efficiency in Kazakhstan, while gaps remain in digital governance infrastructure, and Abil and Bauyrzhankyzy (2023) propose assessing digital transformation through the lens of public value trust, service delivery, outcomes, and effectiveness rather than by the number of information systems. Imanbekova et al. (2024) and Shevyakova et al. (2024) link the effectiveness of digital modernisation to the orientation of services toward citizens and to the institutional and financial conditions of implementation, while Dyussenov (2025) cautions that the same platforms enable centralised data collection. Kurmangali et al. (2024) place Kazakhstan among the Central Asian leaders in AI and digitalisation policy, and Knox and Orazgaliyev (2025) characterise its administration as hybrid. Within the civil service, competency development is the primary driver of employee satisfaction in a digital human-centred HRM ecosystem (Dauyeshova et al., 2026), digital skills are rarely specified in recruitment (Sabdenov et al., 2025), and job training is a leading determinant of employee motivation in organizations generally (Islam, Islam, & Yasmin, 2024). On the labor market side, Kurmanov et al. (2023) find that human capital and regional entrepreneurial activity are the strongest influences on regional labor markets under digitalization; Makrushin (2023) associates labor market digitalization in the Eurasian Economic Union with lower unemployment; Barzhaksyyeva et al. (2026) estimate that a 1% rise in internet penetration lowers youth unemployment by about 0.27% in the short run; and Togaibayeva et al. (2026) show that ICT spending growth is positively associated with regional labor productivity. Ramazanova et al. (2026) find that gross value added per employee correlates strongly with wage employment and qualifications but that the education-productivity link disappears in first differences, implying that productivity responds to the composition of competencies rather than to the volume of graduates. Platform employment is the most contested area: Insebayeva and Beysembayev (2023) show that platforms in Kazakhstan offer flexibility and higher pay but reproduce precarity through algorithmic wage control and contractor classification; Cook and Rani (2025) and Au-Yeung (2026) show that the contribution of platform work to structural transformation and social protection depends on existing labor market institutions; Suieubayeva et al. (2023) and Akhter et al. (2022) link digital entrepreneurship to digital literacy and digital self-efficacy; and Varavin et al. (2025) and Utebaliyeva et al. (2026) document large regional differences in readiness for the platform economy. Youth labour market mismatches (Berdibekov et al., 2026), the gender gap (Baidalinova et al., 2026), and the effects of AI on employability skills (Alabri & Shannaq, 2025) complete the picture. Hasan et al. (2025) also warn that digitalisation can initially reduce organisational performance because of implementation costs, a finding relevant to public organisations investing in digital infrastructure.

Taken together, the literature shows that the digitalisation of labour market regulation is a socio-technical and

institutional process whose outcomes depend on organisational integration, data quality, human oversight, and digital inclusion, and that Kazakhstan has built substantial digital infrastructure. At the same time, structural problems of qualification, territorial and gender mismatch persist. Three gaps remain. First, the international PES literature is dominated by OECD cases, and transition economies with hybrid administrations are rarely analyzed. Second, Kazakhstani studies examine either e-government or the labour market, but seldom the relationship between the pace of regulatory digitalization and labour market outcomes. Third, there are contradictions regarding whether digitalization lowers unemployment (Makrushin, 2023; Barzhaksyyeva et al., 2026) or primarily changes the interaction mechanism without altering aggregate outcomes (Sacchi & Scarano, 2025; Hasan et al., 2025). The purpose of the study is therefore to assess the digital transformation of public administration in Kazakhstan's labour market regulatory system during 2018–2025 and to determine whether measurable changes in the employment structure, unemployment, and labour productivity have accompanied the expansion of digital employment tools. The following hypotheses are tested:

H₁: The expansion of employment in Kazakhstan in 2018–2025 was accompanied by a structural shift toward wage employment and a decline in overall and youth unemployment, indicating a gradual formalization of the labour market.

H₂: Labour productivity (gross value added per employed person) is positively associated with wage employment and vocational and higher qualifications in the workforce, and negatively associated with unemployment.

H₃: Registered labour supply on the Enbek.kz Electronic Labour Exchange exceeds registered demand, so the tension coefficient of the digital labour market exceeds 1, and aggregate balance coexists with structural mismatch.

H₄: The development of digital mechanisms of state regulation in 2018–2025 proceeded more intensively than the change in aggregate employment and unemployment indicators.

MATERIALS AND METHODS

The study employs a comprehensive approach to assessing the digital transformation of public administration within the Republic of Kazakhstan's labour market regulatory system. The information base comprises annual official statistics from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2026), materials from the Ministry of Labour and Social Protection of the Population, and administrative data from Enbek.kz Electronic Labour Exchange, and regulatory and strategic documents, above all the Concept for Labour Market Development for 2024–2029 (Government of the Republic of Kazakhstan, 2023). The observation period is 2018–2025 (eight annual observations); 2025 values are preliminary. The unit of analysis is the national labour market, supplemented by gender-disaggregated employment rates.

The variables are defined as follows. The labor force (LF) and the employed population (E) are measured in thousands of persons according to International Labour Organization methodology; hired (wage) workers (W) and self-employed persons (S) are the two components of E; the share of employees (w) and the share of the self-employed (s) are structural ratios; the unemployment rate (U) and the youth unemployment rate (U15–34) are expressed in percent; labor productivity (P) is gross value added per employed person in thousand tenge; and human capital is proxied by the number of employed persons with higher education (HE) and with technical and vocational education (TVET), in thousands. Digital intermediation is measured by the number of vacancies (V) and resumes (R) posted on Enbek.kz.

The analytical procedure comprises four stages. In the first stage, systems analysis and synthesis of the academic literature and normative legal acts were used to define theoretical approaches to the digitalization of public employment services, platform-based regulatory mechanisms and the application of artificial intelligence in the labour market, and comparative analysis was used to relate international PES models to Kazakhstan's emerging model. In the second stage, economic-statistical and dynamic analysis was applied to the indicators listed above. The absolute change and the growth rate of indicator x over the period were calculated as

$$g = (x_{2025} / x_{2018} - 1) \times 100 \quad (1)$$

and the compound average annual growth rate as

$$CAGR = [(x_{2025} / x_{2018})^{1/7} - 1] \times 100 \quad (2)$$

Structural shares were computed as $w = W / E \times 100$ and $s = S / E \times 100$. The tension coefficient of the registered digital labour market, which characterizes the ratio of labour supply to registered demand on the electronic platform, was calculated as

$$K = R / V \quad (3)$$

Where $K > 1$ indicates that registered supply exceeds registered demand, and $100 / K$ gives the number of vacancies per 100 resumes. In the third stage, the strength of association between labour productivity, employment structure, qualifications and unemployment was assessed with the Pearson correlation coefficient

$$r = \Sigma(x_i - \bar{x})(y_i - \bar{y}) / \sqrt{[\Sigma(x_i - \bar{x})^2 \Sigma(y_i - \bar{y})^2]} \quad (4)$$

With eight observations (six degrees of freedom), the critical values of r are 0.707 at the 5% level and 0.834 at the 1% level, and these thresholds are used to interpret the coefficients. Correlations were additionally computed on first differences to check whether common trends drive the relationship between levels. Because of the limited number of annual observations and methodological inconsistencies in some digital indicators, multiple regression was deliberately not used

as the primary method for demonstrating a causal effect of digitalisation on employment; instead, the study relies on dynamic, structural, and comparative analyses, which avoid statistically unsound inference from small samples. The fourth stage applied structural-functional and institutional analysis: the development of the regulatory system was examined sequentially across the electronic delivery of employment services, the development of Enbek.kz, the digital registration of job seekers, online vocational training, the integration of state information systems and the implementation of algorithmic matching of vacancies with resumes, and the key directions of reform were identified through analytical synthesis.

The strength of the design lies in its use of complete official time series, a transparent set of indicators that can be replicated for monitoring the digital transformation of public employment services, and the combination of quantitative and institutional evidence. Its weaknesses are the short annual series, the absence of a consistent multi-year series for digital indicators, and the descriptive nature of the correlations, which establish association rather than causation. Hypotheses H₁, H₂, & H₃ are tested quantitatively, whereas H₄ is assessed by comparing the dynamics of aggregate indicators with the structural-functional evidence on the digital regulatory infrastructure.

RESULTS

State regulation of the labour market in Kazakhstan comprises legal, economic, organisational, and digital mechanisms aimed at ensuring employment, reducing unemployment, developing professional skills, protecting labour rights, and balancing labour supply and demand. A shift in strategic objectives characterises the current phase: the focus is moving from the quantitative creation of jobs and the registration of the unemployed toward the quality of employment, human capital development, targeted support, and the digitalisation of labour market infrastructure. The institutional foundation for this transition is the Concept for Labour Market Development for 2024–2029 (Government of the Republic of Kazakhstan, 2023), which provides for regional employment maps, monitoring of job creation through information systems, professional development of career centre staff, the migration of active employment support measures to the Enbek.kz platform and the use of artificial intelligence to match vacancies with resumes. As a result, a multilevel system of state regulation is taking shape (Table 1).

Table 1. Multilevel system of state regulation of the labour market in Kazakhstan

Area of regulation	Key tools	Changing the approach
Employment regulation	career centers, subsidized jobs, public works, vocational training	from unemployment registration to an individual employment pathway
Job creation	sectoral and regional programs, regional employment maps	from the number of jobs to quality jobs
Qualification regulation	national Qualifications System, professional standards, Skills Enbek	from formal education to skills in demand by employers
Information regulation	Enbek.kz, information systems of the MLSP	from fragmented information to a digital labour market ecosystem
Digital regulation	online services, electronic employment contracts, AI matching	from electronic services to algorithmic employment support
Platform work	"Platform employment" service, social protection mechanisms	formalization of new forms of employment
Forecasting	monitoring of personnel demand, labour market data	from reactive response to predictive regulation
Territorial regulation	regional maps, labour mobility	consideration of labour-surplus and labour-deficit areas

Note. MLSP = Ministry of Labour and Social Protection of the Population of the Republic of Kazakhstan.

The regulatory framework thus establishes the institutional conditions for labour market development under digital transformation. Table 2 presents indicators characterizing the labour force, the structure of employment, unemployment, labour productivity, and the qualification structure of the employed for 2018–2025.

Table 2. Indicators characterising the labour market in the Republic of Kazakhstan, 2018–2025

Year	Labour force, thousands	Employed population, thousands	Hired workers, thousands	Self-employed individuals (thousands)	Share of employees, %	Postgraduate higher education, thousands
2018	9138.6	8695.0	6612.5	2082.5	76.0	3360.2
2019	9221.5	8780.8	6681.6	2099.2	76.1	3308.1
2020	9180.8	8732.0	6686.6	2045.4	76.6	3709.2
2021	9256.7	8807.1	6710.2	2096.9	76.2	3565.4
2022	9429.8	8971.5	6847.3	2124.2	76.3	4017.4
2023	9534.1	9081.9	6893.4	2188.5	75.9	3982.7
2024	9664.0	9214.2	7015.1	2199.1	76.1	3927.3
2025*	9786.5	9345.8	7138.9	2206.9	76.4	4056.8

Year	Share of self-employed (%)	Unemployment rate (%)	Youth unemployment (%)	Gross Value Added per employed person, thousand tenge	TVET (secondary vocational education), thousands
2018	24.0	4.9	3.8	6173.2	3466.4
2019	23.9	4.8	3.7	6869.8	3701.9
2020	23.4	4.9	3.8	7111.9	3431.0
2021	23.8	4.9	3.8	8423.4	3786.9

2022	23.7	4.9	3.8	10083.2	3999.4
2023	24.1	4.7	3.5	11354.2	4157.8
2024	23.9	4.7	3.1	12886.0	4561.3
2025	23.6	4.5	2.9	14592.4	4698.5

Note. Data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2026). * Preliminary data.

Over the period under review, Kazakhstan's labour market was characterized by steady growth in key employment indicators. The labour force expanded from 9,138.6 thousand in 2018 to 9,786.5 thousand in 2025 (+7.1%, or 0.98% per year), and the employed population rose by 7.5% (1.04% per year) to 9,345.8 thousand. The most notable growth occurred among wage and salary workers, whose number increased from 6,612.5 thousand to 7,138.9 thousand (+8.0%), while the number of self-employed persons grew more slowly (+6.0%). Wage employment accounted for 80.9% of the net increase in employment (526.4 of 650.8 thousand), and its share in total employment edged up from 76.0% to 76.4% while the share of the self-employed declined from 24.0% to 23.6%. Concurrently, the overall unemployment rate fell from 4.9% to 4.5% and youth unemployment from 3.8% to 2.9%. The number of employed persons with higher education grew by 20.7% (2.73% per year) and with technical and vocational education by 35.5% (4.44% per year), both far faster than employment itself, and gross value added per employed person rose from 6,173.2 to 14,592.4 thousand tenge, or 2.4-fold in nominal terms (Figure 1).

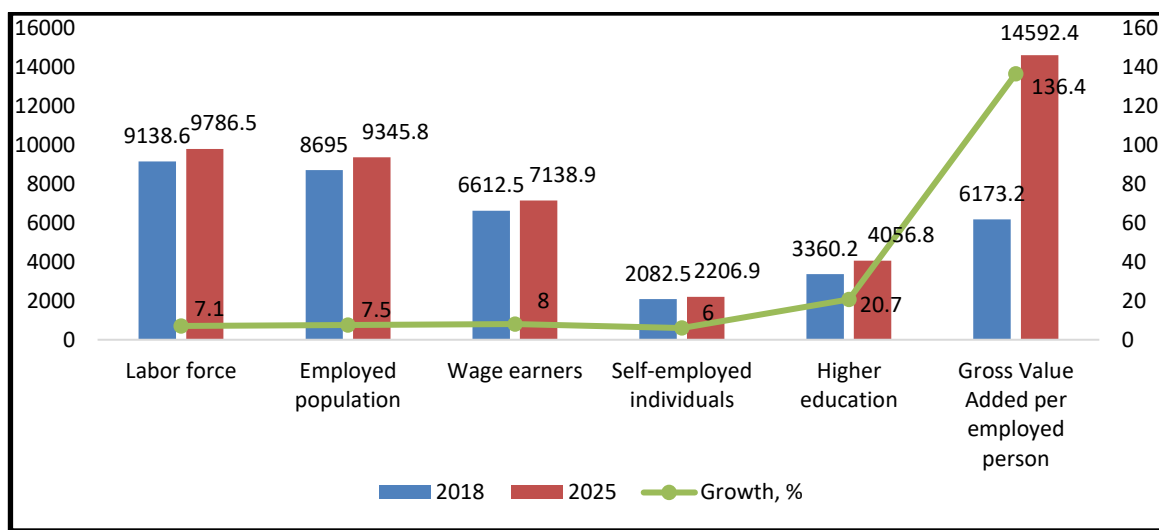


Figure 1. Labour market indicators of Kazakhstan in 2018 and 2025 (thousand persons; GVA per employed person in thousand tenge) and their growth rates, %

The employment structure remains stable, with a gradual decline in the share of the self-employed, indicating formalization of the labour market. By the end of 2025, approximately 9.3 million people were employed; of these, 7.2 million (76.9%) were wage and salary workers and 2.1 million (23.1%) were self-employed. The employment rate of the population aged 15 and older stood at 64.7%, and the unemployment rate, calculated using the International Labour Organisation methodology, was 4.6%. Compared with 2024, total employment increased by 106.5 thousand, driven primarily by wage employment (Figure 2).

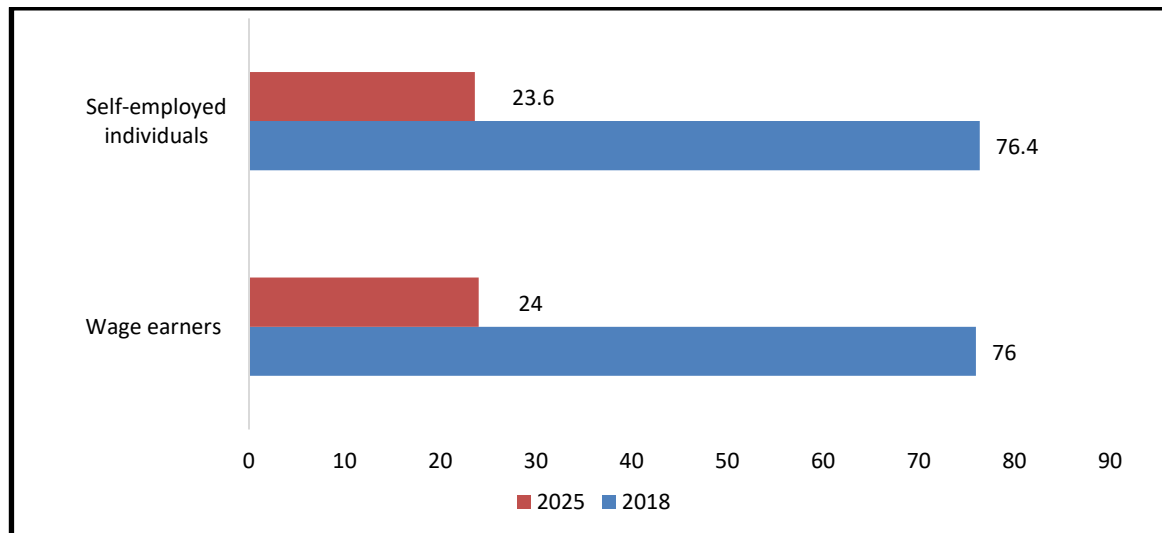


Figure 2. Structure of employment by status in Kazakhstan in 2018 and 2025, %

These indicators point to the relative stability of the quantitative parameters of the labour market and confirm H₁: employment growth has been accompanied by a shift toward wage employment and lower overall and youth unemployment. The shift is, however, modest 0.4 percentage points in the employee share over seven years so formalization is gradual rather than rapid. A stable unemployment rate alone is also insufficient to evaluate the effectiveness of state regulation. Unemployment in the third quarter of 2025 stood at 4.6% and youth unemployment (ages 15–34) at 3%. However, the Concept itself projects an annual inflow of more than 300,000 young people into the labour market by 2029, so the state faces the challenge not merely of maintaining a low statistical unemployment rate but of ensuring the creation of jobs that match the growing labour supply. The Concept explicitly identifies the misalignment of qualifications with labour market requirements, informal employment, unequal access to jobs and territorial disparities as the key constraints. Gender differences are one such structural dimension: the employment rate of men exceeded that of women by 9.8–11.8 percentage points throughout 2020–2025 (Table 3), and while the male rate declined from 72.1% to 69.8%, the female rate remained almost constant at about 60%, so the gap narrowed only because the male rate fell; in absolute terms, the number of employed men continued to exceed the number of employed women in 2023–2025 (Figure 3).

Table 3. Employment rate of the population aged 15 and older by gender in Kazakhstan, 2020–2025 (%)

2020			2021			2022		
total	men	women	total	men	women	total	men	women
65.9	72.1	60.3	66.0	72.2	60.4	65.3	71.4	59.8
2023			2024			2025		
total	men	women	total	men	women	total	men	women
65.2	70.9	60.0	65.0	70.4	60.1	64.7	69.8	60.0

Note. Data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2026).

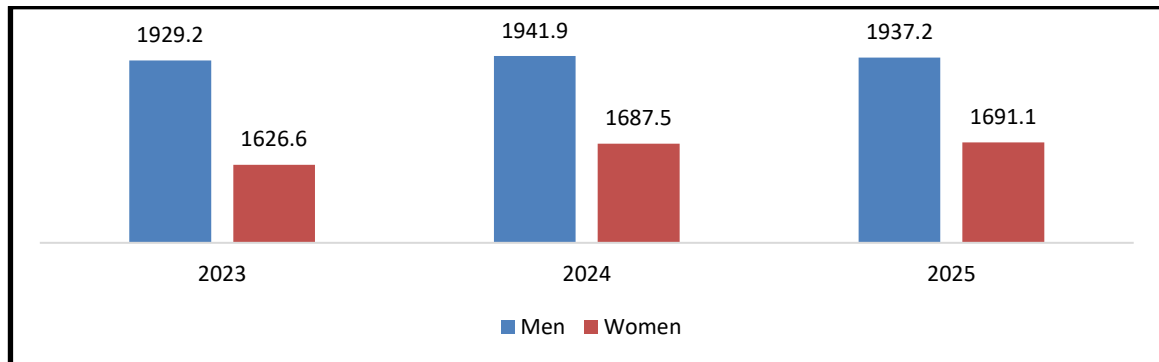


Figure 3. Number of employed men and women in the Republic of Kazakhstan, 2023–2025, thousand persons

To quantify the intensity of the labour market transformation, growth rates and average annual rates of change were calculated for all indicators (Table 4). The ranking of growth rates is itself informative: the qualification structure of the employed (TVET +35.5%, higher education +20.7%) and labour productivity (+136.4%) changed several times faster than the labour force (+7.1%) and employment (+7.5%), whereas unemployment declined by 0.4 percentage points and youth unemployment by 0.9 percentage points. The aggregate quantity of labour has therefore been comparatively inert, while its composition and productivity have changed substantially.

Table 4. Growth and structural indicators of the labour market in Kazakhstan, 2018–2025

Indicator	2018	2025	Absolute change	Growth rate, %	Average annual growth, %
Labour force, thousand	9,138.6	9,786.5	647.9	7.1	0.98
Employed population, thousand	8,695.0	9,345.8	650.8	7.5	1.04
Hired workers, thousand	6,612.5	7,138.9	526.4	8.0	1.10
Self-employed, thousand	2,082.5	2,206.9	124.4	6.0	0.83
Share of employees, %	76.0	76.4	0.4 p.p.	–	–
Share of self-employed, %	24.0	23.6	–0.4 p.p.	–	–
Employed with higher education, thousand	3,360.2	4,056.8	696.6	20.7	2.73
Employed with TVET, thousand	3,466.4	4,698.5	1,232.1	35.5	4.44
GVA per employed person, thousand tenge	6,173.2	14,592.4	8,419.2	136.4	13.08
Unemployment rate, %	4.9	4.5	–0.4 p.p.	–	–
Youth unemployment rate, %	3.8	2.9	–0.9 p.p.	–	–

Note. Calculated from Table 2 using equations (1)–(2); p.p. = percentage points; TVET = technical and vocational education; GVA = gross value added.

Table 5 reports the Pearson correlations between labour productivity, employment structure, qualifications and unemployment. Gross value added per employed person is very strongly associated with the number of hired workers ($r = 0.992$) and with employed persons holding technical and vocational qualifications ($r = 0.979$), strongly associated with

employed persons holding higher education ($r = 0.855$), and negatively associated with the overall ($r = -0.849$) and youth ($r = -0.894$) unemployment rates; all of these coefficients exceed the 1% critical value of 0.834. Higher education is the weakest correlate: its association with unemployment ($r = -0.550$) and youth unemployment ($r = -0.588$) does not reach the 5% threshold. The overall and youth unemployment rates move closely together ($r = 0.943$).

Table 5. Pearson correlation coefficients between labour market indicators in Kazakhstan, 2018–2025 ($n = 8$)

Indicator	E	W	S	HE	TVET	P	U	U15–34
Employed population (E)	1							
Hired workers (W)	0.995	1						
Self-employed (S)	0.949	0.912	1					
Employed with higher education (HE)	0.817	0.837	0.704	1				
Employed with TVET	0.988	0.976	0.957	0.754	1			
GVA per employed person (P)	0.993	0.992	0.930	0.855	0.979	1		
Unemployment rate (U)	-0.885	-0.875	-0.857	-0.550	-0.861	-0.849	1	
Youth unemployment rate (U15–34)	-0.921	-0.919	-0.865	-0.588	-0.917	-0.894	0.943	1

Note. Calculated from Table 2 using equation (4). Critical values of r : 0.707 ($p < 0.05$) and 0.834 ($p < 0.01$). In first differences, the correlation of P with W is 0.760 and with TVET is 0.683, whereas with HE it is -0.159 and with U it is -0.433.

The first-difference correlations qualify these results. Year-on-year changes in productivity remain positively associated with changes in wage employment ($r = 0.760$, significant at the 5% level) and, more weakly, with changes in vocational qualifications ($r = 0.683$). However, the association with higher education disappears ($r = -0.159$), and the association with unemployment weakens ($r = -0.433$). H2 is therefore supported for wage employment and vocational qualifications and only partially supported for higher education and unemployment: productivity responds to the expansion of formal employment and to the composition of competencies rather than to the volume of graduates.

The digital component of the regulatory system is summarised in Table 6. The Enbek.kz Electronic Labour Exchange has gradually evolved from a tool for posting vacancies and resumes into a core component of the state's employment regulation infrastructure, integrating registration of job seekers, active employment support measures, the Skills Enbek online training service, the Platform Employment service and algorithmic matching of vacancies with resumes. In 2025, 1.328 million vacancies and 1.454 million resumes were posted on the platform. The tension coefficient of the registered digital labour market calculated by equation (3) is $K = 1.095$, corresponding to approximately 109–110 resumes per 100 vacancies, or 91.3 vacancies per 100 resumes; registered supply exceeded registered demand by 126 thousand positions. H3 is thus confirmed: the digital platform records a moderate excess of supply over demand. The coefficient is close to unity, indicating a comparatively balanced aggregate state of the registered market. However, it does not imply equilibrium because the aggregate ratio obscures mismatches between the professional and territorial structures of vacancies and resumes.

Table 6. Indicators of digital labour intermediation on the Enbek.kz Electronic Labour Exchange, 2025

Indicator	Value
Vacancies posted, million	1.328
Resumes posted, million	1.454
Excess of resumes over vacancies, thousand	126
Tension coefficient of the registered digital labour market ($K = R / V$)	1.095
Resumes per 100 vacancies	109.5
Vacancies per 100 resumes	91.3
Ratio of Enbek.kz resumes to the unemployed population (440.7 thousand)	3.3
Ratio of Enbek.kz vacancies to the annual net increase in employment (106.5 thousand)	12.5

Note. Calculated from Enbek.kz administrative data and Table 2 using equation (3).

Two further ratios in Table 6 illustrate the scale of digital intermediation relative to the traditional indicators. The number of resumes posted in 2025 was 3.3 times the number of unemployed persons (440.7 thousand), which means that the digital platform serves not only the registered unemployed but also employed job seekers, students and the self-employed; and the number of vacancies was 12.5 times the net annual increase in employment, which shows that the platform mediates the reallocation of labour far more than the creation of net new jobs. By 2025, the vast majority of unemployment registrations were carried out online, and active employment measures had migrated to the platform. The structural-functional analysis therefore supports H4: while the aggregate indicators of employment changed by 7–8% and unemployment by less than one percentage point over seven years, the digital regulatory infrastructure changed qualitatively from electronic delivery of individual services to an integrated platform with online registration, online training, electronic employment contracts, a platform-employment service and algorithmic matching so that digital transformation proceeded more intensively than the change in aggregate labour market outcomes.

Overall, the analysis indicates that state regulation of Kazakhstan's labour market is transitioning from an administrative-compensatory model to one that is digital, targeted and based on forecasting and analytics. While the traditional system focused on registering the unemployed, providing employment measures, and subsidizing specific jobs,

the modern model is increasingly built around job quality, skills development, digital profiling, data integration, and the intelligent matching of labour supply and demand. The persistence of territorial, qualification and gender disparities, however, indicates that digitalization should be viewed not as the ultimate goal of the reform but as a tool for enhancing the precision and effectiveness of state regulation.

DISCUSSIONS

The results fully support H_1 and H_3 , support H_2 for wage employment and vocational qualifications, and support H_4 based on structural-functional evidence. The gradual formalisation of employment (H_1) is consistent with Makrushin's (2023) finding that labour market digitalisation in the Eurasian Economic Union coincided with lower unemployment, and with the short-run negative effect of internet penetration on youth unemployment estimated by Barzhaksyyeva et al. (2026). At the same time, the modest size of the structural shift 0.4 percentage points in the employee share and 0.4 points in the unemployment rate over seven years cautions against attributing aggregate outcomes to digitalization. This reading is closer to Sacchi and Scarano (2025), who show that large digital investment changes organisational processes before it changes labour market outcomes, and to Hasan et al. (2025), who find that digitalisation initially depresses organisational performance due to implementation costs. The Kazakhstani evidence thus reconciles the contradiction identified in the literature: digitalisation changes the mechanism of interaction among the state, employers, and job seekers, and its effect on ultimate outcomes materialises slowly and through structural channels.

The correlation results (H_2) reproduce and extend the findings of Ramazanova et al. (2026), who also report that gross value added per employee correlates at 0.99 with wage employment and at about 0.9 with qualifications, and that the education–productivity association vanishes in first differences. The present study finds that the association with vocational qualifications survives differencing ($r = 0.683$). In contrast, the association with higher education does not, suggesting that the composition of competencies demanded by employers matters more for productivity than the expansion of higher education. This is in line with Kurmanov et al. (2023), who identify human capital as the strongest influence on regional labour markets under digitalization, and with Togaibayeva et al. (2026), who find that ICT spending, rather than fixed-asset investment, is associated with productivity growth. It also resonates with the international evidence that AI substitutes for knowledge-intensive tasks while creating demand for complementary skills (Engberg et al., 2025; Choi & Leigh, 2024; Teutloff et al., 2025): the qualification structure, not the volume of labour, is where digital transformation registers first.

The tension coefficient of 1.095 (H_3) indicates a registered digital labour market that is close to aggregate balance but tilted toward excess supply. The interpretation must be cautious. Cook and Rani (2025) and Insebayeva and Beysembayev (2023) show that platform-mediated employment expands opportunities while reproducing precarity and old institutional problems; the fact that resumes on Enbek.kz exceed the number of unemployed persons more than threefold means that the platform captures job-to-job mobility and underemployment that the unemployment rate does not. The persistent gender gap in employment rates and the widening youth gender gap reported by Baidalinova et al. (2026) show that aggregate balance on the platform does not translate into equal access, echoing the findings of Gijón et al. (2025), Djatmiko et al. (2025) and Liu et al. (2025) that ICT skills and institutional barriers structure who benefits from digital public services. Evidence from other developing economies that digital literacy, self-efficacy and perceived security drive adoption of digital services (Islam & Khan, 2024; Islam, Hasan, et al., 2024; Akhter et al., 2022) implies that the effectiveness of a digital labour exchange in Kazakhstan will depend as much on user capabilities and trust as on the platform's algorithms.

The structural-functional evidence for H_4 places Kazakhstan among the countries that have moved from electronic service delivery to platform-based and increasingly algorithmic regulation, as described for OECD PES by Brioscú et al. (2024) and for Latin America by Pieterse et al. (2023). This transition raises the governance questions documented in the algorithmic profiling and digital welfare state literature: accuracy reporting (Gallagher & Griffin, 2025), legitimacy (Haug et al., 2026), human oversight (Sztandar-Sztanderska, 2026; Marienfeldt, 2025), responsibility for algorithmic discrimination (Alon-Barkat et al., 2025), administrative burden on claimants (Bennett et al., 2026) and the balance of care and control (Zakharova et al., 2024; van Toorn et al., 2024). In a hybrid administration (Knox & Orazgaliyev, 2025) with limited digital competencies in the civil service (Sabdenov et al., 2025) and a human-centered HRM ecosystem still under construction (Dauyeshova et al., 2026), these questions are not secondary: the value of digital transformation, as Abil and Bauyrzhankyzy (2023) argue, should be judged by public value accessibility, quality of employment and shorter job search rather than by the number of services digitized. Why, then, do the results show intensive digital transformation with limited aggregate change? The most plausible explanation, consistent with Roehl and Hansen (2024) and Ball et al. (2023), is that digital tools have so far replaced the channel and improved the information base of regulation without yet altering the deeper determinants of labour demand regional economic structure, the quality of jobs and the alignment of education with employer needs which the Concept for 2024–2029 identifies as its own priorities. The prospects, therefore, lie in using the platform's integrated data for predictive regulation, monitoring algorithmic matching for accuracy and fairness, and coupling digital intermediation with regional and qualification policies.

CONCLUSIONS

The purpose of this study was to assess the digital transformation of public administration within Kazakhstan's labour market regulatory system and to determine whether measurable changes in the employment structure, unemployment, and labour productivity accompanied the expansion of digital employment tools in 2018–2025. The study established that the labour market remained quantitatively stable employment grew by 7.5% to 9.3 million, wage employment accounted for four-fifths of the increase, unemployment fell from 4.9% to 4.5% and youth unemployment from 3.8% to 2.9% while the composition and productivity of labour changed substantially: vocational and higher qualifications of the employed grew three to five

times faster than employment, and gross value added per employed person rose 2.4-fold. Labour productivity is strongly associated with wage employment and vocational qualifications, and this association persists after first differencing for these variables but not for higher education. The registered digital labour market recorded a tension coefficient of 1.095, or 109–110 resumes per 100 vacancies, a near-balanced aggregate state that coexists with qualification, territorial and gender mismatches. Digital transformation proceeded more intensively than changes in aggregate outcomes, and its primary result at the current stage is a change in the mechanism of interaction among the state, employers, and job seekers rather than in ultimate labour market outcomes.

The novelty of the paper lies in linking, for a transition economy with a hybrid administration, the structural-functional assessment of digital regulatory infrastructure with quantitative indicators of labour market change, and in proposing a compact, replicable set of indicators growth and structural rates, the tension coefficient of the registered digital labour market, the ratios of platform activity to unemployment and to net job creation, and level and first-difference correlations for monitoring the digital transformation of public employment services. Theoretically, the results support the distinction between digitalisation, which changes the delivery channel, and transformation, which changes the substance of regulatory decisions, and they show that the first stage is observable in the regulatory mechanism before it is observable in outcomes.

For practice, three implications follow. Public employment services should use the integrated data from the electronic labour exchange for predictive regulation forecasting occupational demand, identifying skill imbalances, and targeting active measures rather than for reporting alone. The accuracy, transparency and fairness of algorithmic matching and profiling should be monitored and reported, and final decisions on access to support should remain under human oversight. Digital intermediation should be coupled with regional, qualification and gender-sensitive policies and with digital literacy programs, because aggregate balance on the platform does not guarantee equal access to decent work. These measures contribute directly to decent work and economic growth, resilient public infrastructure, reduced inequalities and effective institutions.

The study has limitations. The annual series is short; a consistent multi-year series of digital indicators is not available; the correlations establish association rather than causation; and the tension coefficient is computed for a single year at the national level. Future research should build a regional and occupational panel of Enbek.kz data to estimate the effect of algorithmic matching on job search duration and job quality, evaluate the accuracy and fairness of profiling tools with administrative microdata, and compare Kazakhstan with other Central Asian and Eurasian Economic Union countries to establish whether the pattern of rapid digital transformation and slow aggregate change is general to hybrid administrations.

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