

SOCIAL SCIENCES

MODERN HUMAN CAPITAL SYSTEM FOR A DIGITAL KAZAKHSTAN: CHALLENGES, MECHANISMS AND STRATEGIC PATHWAYS

Wang Xingguo

Student, AI-Farabi Kazakh National University Kazakhstan, Almaty

Nietalina Gaukhar

Tutor, AI-Farabi Kazakh National University Kazakhstan, Almaty

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Abstract

In the context of global digital transformation, Kazakhstan, long reliant on oil and minerals, aims to shift from a resource-based to an innovation-driven economy. This transition depends on building a modern human capital system aligned with digitalization, especially as industrialization accelerates. This paper examines the current state, structural challenges, operational mechanisms, and strategic pathways for human capital modernization in Kazakhstan, integrating quantitative data (2020–2025) and international best practices. Using the World Bank HCI, labor market statistics, and digital indicators, it finds notable progress—including a rise in HCI+ ranking, high internet penetration, strong education metrics, many innovative firms, and widespread digital transaction adoption—but persistent bottlenecks: skill mismatches, regional digital divides, brain drain, and weak industry-education links. A three-pillar framework is proposed: Digital Skill Ecosystems, Inclusive Digital Labor Markets, and Governance & Financing Mechanisms. Empirical analysis shows strong correlations between digital skill adoption and labor productivity, and between digital infrastructure and human capital outcomes. Actionable phased strategies are suggested, such as AI curriculum integration, scaling dual vocational education, digital social protection systems, and a talent retention ecosystem, to position Kazakhstan as a regional leader in human capital and digital innovation by 2035.

Keywords: Human Capital System; Digital Transformation; Kazakhstan; Skill Mismatch; Labor Market

1. Introduction

Kazakhstan, an upper-middle-income Central Asian nation with a projected GNI per capita of \$15,100 in 2025 (above the World Bank's upper-middle-income threshold of \$14,005), is experiencing robust economic growth—forecast at 5.5% by the Eurasian Development Bank and 5.6% by Kazakhstan's Ministry of National Economy in 2025. However, its economic growth remains overly dependent on natural resources, which account for over 40% of exports and 20% of GDP. To address this over-reliance, the Kazakh government is prioritizing economic diversification through strategic investments in automotive manufacturing, home appliances, and metallurgy in 2025, initiatives expected to create over 20,000 new jobs, secure \$30 billion in foreign direct investment (FDI), and raise fixed asset investment to 30% of GDP by 2025.

To achieve the *Kazakhstan 2050 Strategy* and *Digital Kazakhstan 2025* national goals, the country must transition to knowledge-intensive, digital, and inclusive growth, where human capital becomes the primary driver of productivity and competitiveness. The World Bank's 2020 Human Capital Index (HCI) scores Kazakhstan at 0.63, indicating a child born today will realize only 63% of their potential productivity by age 18—placing Kazakhstan ahead of most Central Asian peers (e.g., Uzbekistan: 0.55, Kyrgyzstan: 0.48) but lagging behind OECD economies (average: 0.76) and digital leaders like Singapore (0.88) and South Korea (0.85).

Digital transformation presents both opportunities and risks for Kazakhstan: artificial intelligence (AI) could boost productivity for 70% of the workforce but automate 29% of job functions by 2030. Success in this

transition hinges on reengineering the human capital system to equip citizens with future-proof digital, cognitive, and adaptive skills; bridge regional and social digital divides; ensure inclusive labor market participation; and strengthen institutional coordination across education, employment, health, and innovation sectors.

This paper addresses four core research questions: (1) What is the current state of Kazakhstan's human capital system and its key digital-era challenges? (2) What quantitative relationships exist between digital infrastructure, skill development, and labor market outcomes? (3) What operational mechanisms underpin effective digital human capital modernization? (4) What strategic pathways can accelerate Kazakhstan's transition to a modern digital human capital system? The study contributes empirical evidence on digital human capital gaps in Central Asia, providing a data-driven framework and policy recommendations aligned with global best practices and Kazakhstan's national context.

2. Current State, Challenges and Analytical Framework

This study combines quantitative (2020–2025) and qualitative data to analyze Kazakhstan's human capital system. Quantitative data includes World Bank HCI and labor statistics, Kazakhstan's Bureau of National Statistics (KBNS) metrics, Coursera's 2026 Global Skills Report, the UN E-Government Index (2024), and national innovation surveys. Qualitative data encompasses *Digital Kazakhstan 2025*, the *National Development Plan 2025–2029*, and international case studies (Singapore's SkillsFuture, Germany's dual VET, Finland's interdisciplinary education, South Ko-

rea's human capital strategy). Analysis methods include descriptive statistics, correlation and regression analysis, gap analysis, and policy scenario analysis.

Kazakhstan has made notable progress in human capital and digital transformation. Key human capital indicators include a 2025 HCI+ global ranking of 42nd (1st in Central Asia), 74 years of life expectancy, 12.5 years of expected schooling, 15–20% youth unemployment (down 2% since 2018), and 72% female labor force participation (25+). Digitally, the country boasts 90.9% internet penetration, 85% mobile broadband coverage, 89% digital transaction adoption, and a UN E-Government Development Index of 0.90 (24th globally), with the digital economy accounting for 6.1% of GDP in 2024 (up from 2.8% in 2018).

Despite this progress, critical gaps persist: a 22.3-percentage-point urban-rural digital literacy divide (90.5% vs. 68.2%), 3.5 million workers needing re-skilling by 2030, 57% of 2022 VET graduates in non-core sectors, and ~15,000 skilled professionals emigrating annually. Core structural challenges include misalignment between education and the digital economy, rural-urban disparities in education quality and infrastructure, youth employment and NEET crises, brain drain and talent scarcity, and fragmented governance with insufficient funding (human capital spending at ~12% of GDP vs. OECD's 18–25%).

To address these challenges, the study proposes a three-pillar analytical framework for a modern digital human capital system: (1) Digital Skill Ecosystems (encompassing early childhood to lifelong learning, with a focus on curriculum alignment and AI/STEM integration); (2) Inclusive Digital Labor Markets (covering youth employment, gender equity, rural development, and formalization); and (3) Governance & Financing Mechanisms (focused on institutional coordination, data governance, and diversified funding).

3. Operational Mechanisms and Strategic Pathways

Five interlocking operational mechanisms are critical to implementing the three-pillar framework, supported by phased strategic pathways (2026–2035) to position Kazakhstan as a regional human capital and digital innovation leader.

First, the Demand-Driven Digital Skill Formation Mechanism (Pillar 1) mandates 50% employer representation on VET/university boards for curriculum co-design, scales German-style dual VET to 100,000 places by 2028, integrates AI and data literacy into all K-12 and higher education curricula, and launches a national lifelong learning platform in partnership with Coursera (targeting 1 million users by 2028).

Second, the Inclusive Digital Labor Market Integration Mechanism (Pillar 2) implements a Youth Guarantee 4.0 (ensuring 15–29-year-olds access internships/jobs within 6 months with digital training), expands gender digital empowerment (500 subsidized nurseries by 2028, 75% female labor force participation target), establishes 2,000 rural digital service hubs by 2030, and simplifies formalization processes to reduce informal employment to <20% by 2035.

Third, the Health & Resilience for Digital Productivity Mechanism (Pillar 2) achieves 100% rural telemedicine coverage by 2028, modernizes 3,000 primary care clinics, mandates workplace wellness for digital workers, and launches the *Kazakhstan Talent* program (grants, tax breaks, housing) plus a \$500 million diaspora venture fund to reverse brain drain.

Fourth, the Digital Governance & Accountability Mechanism (Pillar 3) establishes a Presidential Human Capital Council for cross-ministerial oversight, launches a National Human Capital Observatory for real-time data-driven policy adjustments, and ties 70% of education/health funding to performance outcomes.

Fifth, the Sustainable Financing Mechanism (Pillar 3) increases public investment in education to 6% of GDP and health to 5% of GDP by 2030, scales public-private partnerships (PPPs), and introduces Individual Learning Accounts with government-matched savings for lifelong learning.

Phased strategic pathways prioritize short-term quick wins (2026–2028: digital infrastructure for schools, teacher training, youth internships), medium-term scaling (2029–2031: full AI curriculum integration, universal social protection, reverse brain drain), and long-term excellence (2032–2035: OECD-level HCI, global talent hub status, 18% of GDP in human capital spending).

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