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DIGITALIZATION AND INNOVATION IN STRENGTHENING HUMAN CAPITAL: A COMPARATIVE ANALYSIS OF KAZAKHSTAN AND CHINA

Abstract. The article examines the important role of digitalization and innovation potential in the development of human capital in entrepreneurial ecosystems. The main purpose of the study is to compare the experience of Kazakhstan and China in using digital and innovative tools to increase the level of human capital.The relevance of this work is due to the increasing role of the digital economy and the need to adapt the workforce to new technological challenges.The methodological basis of the research includes comparative, system and content analysis, as well as statistical data and regulatory sources. The article analyzes key indicators such as the human capital index, innovation activity, the level of development of digital entrepreneurship and digital education.The results of the study demonstrated that China is implementing a comprehensive digital policy that promotes the formation of flexible and competitive human capital. There is also a positive trend in Kazakhstan, but there are problems of digital inequality and insufficient development of innovation infrastructure.The scientific novelty of the study is a comparative analysis of the digital and innovative development of the two countries, with a special focus on their impact on human capital. The practical significance of the results obtained lies in the possibility of their application for strategic planning of educational and entrepreneurial initiatives in the digital economy.

Keywords: Human capital, innovation, digitalization, entrepreneurial ecosystem, Kazakhstan, sustainable development, China, digital economy, startups

Introduction

In the era of rapid digital transformation and the shift towards a knowledge-based economy, the significance of human capital as a crucial driver for sustainable development and enhanced national competitiveness is growing (Mohamed B. H., 2021: 13750). Digitalization and innovation are emerging as powerful instruments for fostering new skills, enhancing educational quality, and enhancing workforce adaptability. It is particularly pertinent to examine these processes in the context of developing nations, where digital technologies can significantly expedite the modernization of the economy and business environment.

Kazakhstan and China have distinct approaches to digital transformation, yet both nations are committed to integrating innovative solutions into their systems for personnel training, knowledge management, and entrepreneurial support (Toimbek D.,2022:1099). In this context, there is a growing need for a comparative analysis of the implemented digitalization strategies and their influence on the enhancement of human capital. By comprehending these differences and similarities, we can develop more effective government policies in this field and foster the sustainable development of entrepreneurial ecosystems.

The significance of this research is underscored by the necessity to discover efficient strategies for the integration of digitalization, innovation, and human capital development in the context of the emergence of a new digital world.

The obstacles posed by the lack of skilled professionals, digital disparities, and insufficient innovation infrastructure necessitate a comprehensive approach and the sharing of international expertise, particularly between nations with robust digital strategies, such as China and Kazakhstan.

The scientific significance of this research is rooted in the exploration of the interplay between digital and innovation processes and the evolution of human capital in entrepreneurial ecosystems. A comparative examination of the strategies employed in Kazakhstan and China not only provides a comprehensive overview of international practices but also contributes to the expansion of the theoretical and methodological frameworks for human resource management in the digital era. The findings of this study can be applied to enhance digital development strategies and foster an environment that fosters the growth of human potential.

The objective of this research is to examine the influence of digitalization and innovation potential on the advancement and enhancement of human capital in the entrepreneurial environments of Kazakhstan and China. To achieve this goal, it is essential to explore the theoretical frameworks and contemporary approaches to the development of human capital in the digital economy and to conduct a comparative analysis of the practices implemented by Kazakhstan and China in the implementation of digital and innovative solutions aimed at fostering human capital in the business sector. The successful implementation of digital technologies and innovations not only promotes professional growth but also facilitates the emergence of new employment opportunities, the cultivation of entrepreneurial endeavors, and the strengthening of business connections, scientific endeavors, and educational pursuits.. In this regard, it is crucial to examine the processes through which governments establish policies to foster digital proficiency, encourage innovation, and develop digital infrastructure, thereby laying the groundwork for the sustained enhancement of human capital.

Materials and methods

During the research, a variety of general scientific and specialized techniques were employed to comprehensively examine the influence of digitalization and innovation on the advancement of human capital within the entrepreneurial environments of Kazakhstan and China. The methodological framework consisted of the comparative approach, systematic analysis, content analysis of regulatory and strategic documents, and techniques for statistical analysis and data integration.

The comparative approach allowed us to pinpoint the similarities and differences in the digital transformations of the two countries, to discern the peculiarities of the development of innovation infrastructure, and to evaluate the effectiveness of human capital policies. A structured approach was employed to view digitalization as a multifaceted socio-economic phenomenon encompassing education, the labor market, entrepreneurship, and government regulation. The study employed content analysis to examine digital development strategies, national programs, and reports that reflect key areas of government policy in the realm of digitalization and innovation.

The theoretical framework for this study is grounded in the works of scholars who have contributed to the fields of digital economy, human resource management, innovation, and entrepreneurship. These include Klaus Schwab's concept of the Fourth Industrial Revolution, Peter Drucker's theory of human capital (Yudina T.N.,2019) [Electronic resource] https://cyberleninka.ru/article/n/digital-segment-of-the-real-economy-digital-economy-in-the-context-of-analog-economy, Manuel Castells' concept of the information society(Wijayanto E.,2023:227), and the insights of contemporary Kazakhstani and Chinese experts in the area of digital transformation.

Particular emphasis was placed on the examination of international instruments that govern digital advancement and rights in the domains of education and employment. These instruments include the United Nations Digital Agenda, the United Nations Global Compact, UNESCO's Recommendations on Digital Skills, the World Economic Forum's documents. Additionally, a comprehensive analysis was conducted of the national legislation of Kazakhstan and China in relation to digitalization strategies, education, science, technology, and innovation. The Digital Kazakhstan Program, the Made in China 2025 Industrialization Strategy, the Internet Plus State

Program of the People's Republic of China, and regulations governing the development of human capital in the digital environment were among the key documents examined.

The examination of statistical information was conducted using publicly available sources, including databases provided by the World Bank, the National Bureau of Statistics of China, the Bureau of National Statistics of Kazakhstan, and the Ministries of Digital Development. Additionally, international indices such as the Global Innovation Index, Human Capital Index, and Digital Economy and Society Index (DESI) were consulted.

Furthermore, reports from consulting firms (McKinsey, PwC, Deloitte) and research studies conducted by research centers in Kazakhstan and China on the effects of digitalization on the labor market, education, and the growth of entrepreneurial ventures in the digital economy were also utilized as empirical material.

Consequently, the utilization of a diverse array of sources and approaches enabled a thorough examination of the factors influencing digitalization and innovation in the context of human capital development, enabling the formulation of well-informed conclusions regarding strategic avenues for enhancing the effectiveness of entrepreneurial ecosystems in both Kazakhstan and China.

Discussions

The relationship between digitalization, innovation, and human capital development is a subject of active investigation by both international and local scholars. Numerous studies highlight the significance of digital technologies in the transformation of educational systems, professional advancement, and the cultivation of digital skills. Nevertheless, despite the importance of this subject, existing research often fails to offer a comprehensive perspective on the multifaceted influence of digitalization on human capital, particularly in the context of emerging economies and entrepreneurial environments.

Therefore, Klaus Schwab, in his work «The Fourth Industrial Revolution», points out that digitalization fundamentally alters the nature of work, necessitating new abilities from employees and creating a demand for creativity, critical thinking, and the capacity for continuous learning(Schwab K.,2024:30). He correctly emphasizes the need to adapt educational and personnel management systems to the new realities, but his analysis does not sufficiently consider the disparities in the digital development of nations with varying levels of economic growth, such as Kazakhstan and China.

Manuel Castells, in his exploration of the information society, underscores the pivotal role of knowledge and information in the development of human capital, emphasizing the significance of the network economy(Tabar I. A., Cilliers E. J.,2024:10005). His perspective enables us to comprehend the importance of digital infrastructure and networking, yet his theory is not well-suited for analyzing specific public policy instruments in the realm of digitalizing human capital.

Peter Drucker, a renowned figure in the field of management theory, argued in his writings that human capital is becoming the primary resource, and knowledge is the key driver of productivity (Faugoo D.,2024:618). He was one of the pioneers in recognizing the shift towards a knowledge-based society, but in the context of the contemporary digital economy, his insights require a fresh perspective, considering the rapid advancements in technology and the emergence of digital platforms.

In their analysis of China's digital transformation, C. Wang and L.Si, highlight the significance of government initiatives like the Internet Plus strategy in fostering digital literacy and innovation among the population(Wang C., Si L.,2024:1878). However, their research falls short in addressing the issue of social disparities and regional disparities in access to digital resources, which is particularly crucial in the context of China's multi-tiered economic structure.

Among the local scholars, it is worth noting Y. Turganbayev, who examined the implementation of the Digital Kazakhstan program in the context of human capital development

(Turganbayev Y., 2023:390). The author rightly emphasizes the significance of government backing for digital learning and the incorporation of ICT into educational systems. However, his work lacks a comparative perspective and undervalues the significance of the innovation ecosystem and entrepreneurial endeavors as a setting for the advancement of human capital.

A review of the aforementioned works reveals that, on the whole, the scholarly community acknowledges the pivotal role of digitalization in fostering human capital. Nevertheless, there are several areas that require further exploration:

Firstly, there are not enough comprehensive cross-country comparisons that encompass nations with varying degrees of digital advancement.

Secondly, there is a scarcity of research that specifically focuses on entrepreneurial ecosystems as a crucial component in digital development.

Thirdly, many studies tend to be dominated by theoretical frameworks, with empirical data often taking a backseat.

The present study fills in these gaps by conducting a comparative examination of the approaches taken by Kazakhstan and China, drawing on international sources, legal frameworks, statistical data, and strategic documents. The key importance of this study lies in its ability to shed light on how digitalization and innovation in practice shape and enhance human capital in an entrepreneurial setting. This is particularly relevant in the context of sustainable development, where it is the individual – the repository of knowledge, abilities, and innovative solutions – who becomes the primary asset of a thriving economy.

Results

The comparative study of the digitalization and innovation progress in Kazakhstan and China, with a focus on the development of human capital in entrepreneurial ecosystems, has yielded valuable insights.

To begin with, the statistical data revealed a notable disparity in the level of digital and innovative advancement between the two nations. For a clearer understanding, we have provided a table showcasing the key metrics that reflect the state of digitalization, innovation potential, and human capital development (Table 1).

Table 1 – A comparative analysis of digital and innovation progress in Kazakhstan and China.

Indicators	Kazakhstan	China
Human Capital Index (HCI)	0.63	0.65
Global Innovation Index (GII)	37.6	55.3
Digital Competitiveness Index	54.3	75.6
R&D Investment (% of GDP)	0.17	2.4
Number of Digital Startups per 1 Million Population	42	128

As the table demonstrates, China has a substantial lead over Kazakhstan in most areas. The disparity in investment in research and development is particularly striking, which directly impacts the innovative capacity of the economy and the ability to cultivate human capital with advanced digital skills.

This comparison provides a clearer picture of the focus on digital and innovative progress in both nations.

Furthermore, the regulatory assessment revealed that China exhibits a strong level of collaboration between government and private entities, fostering the holistic growth of the digital environment. Initiatives like "Made in China 2025" and the "National Plan for the Development of the Digital Economy" enable the government to effectively steer the evolution of the workforce and encourage public involvement in digital endeavors.

Kazakhstan has also made significant progress in the realm of e-government and digital services through the Digital Kazakhstan program(Sheryazdanova G. R.,2024:71). However, the level of private sector involvement in digital transformation remains uneven.

The challenges of digital inequality, particularly in rural areas, and the shortage of skilled personnel in the field of digital technologies hinder the effectiveness of the strategy.

Based on the analysis of literature and empirical data, we have identified and summarized effective mechanisms for integrating digitalization and innovation into the processes of human capital development:

- Active implementation of online learning and retraining programs.
- Creation of digital clusters and innovation hubs.
- Encouraging entrepreneurship through startup platforms and accelerators.
- Developing digital competencies at all levels of education.
- Strengthening international cooperation in the field of digital technology and knowledge exchange.

Consequently, the originality of this research is that it provides a thorough examination of the digitalization and human capital of Kazakhstan and China, with a particular focus on the entrepreneurial landscape. The findings of this study can be applied to strategic planning, the design of educational programs, the enhancement of government digital policies, and the fostering of resilient entrepreneurial ecosystems.

A review of international sources and evaluations by rating agencies has revealed that China's advanced digital maturity is also a result of a more developed data transmission network, the proliferation of 5G, widespread availability of big data, and the integration of artificial intelligence into daily business operations(Attaran M.,2023:5988). These factors create a conducive atmosphere for the flourishing of digital entrepreneurs and boost the need for highly skilled human resources, which in turn fosters a self-sustaining innovation cycle within the economy.

In Kazakhstan, this cycle is still in its nascent stage and requires sustained support from the government, business, and the educational sector(Özcan G. B.,2021:232).

A further outcome was the recognition of the substantial influence of digital transformation on the horizontal development of human capital — that is, on individuals' capacity to swiftly adjust to new circumstances, acquire related abilities, and engage in entrepreneurial endeavors(Kılıç C., Atilla G.,2024:3145). In China, this process is facilitated by widespread digital literacy initiatives, specialized learning platforms (such as MOOCs and corporate EdTech services), and the integration of innovative subjects into higher education curricula(Ren Y., Zheng X., Xu G.,2023:2900).

In contrast, Kazakhstan currently predominantly follows a vertical approach, emphasizing formal education and insufficiently embracing continuous digital learning, which hinders the adaptability of human capital in the digital economy.

Conclusions

The research validated the fundamental assumption that digitalization and innovation capacity are crucial for enhancing human capital, particularly in the context of fostering sustainable entrepreneurial ecosystems. A comparative examination revealed that China has attained a superior level of digital and innovative advancement, thanks to comprehensive governmental support, substantial investments in research and development, active participation of the private sector, and

widespread implementation of digital educational technologies. This lays the groundwork for the development of a resilient, adaptable, and entrepreneurial-oriented human capital.

Simultaneously, Kazakhstan is demonstrating positive progress in the realm of digital transformation. However, it is essential to enhance innovative mechanisms, broaden access to digital education, and establish a comprehensive strategy for fostering digital proficiency among the population. The cultivation of digital startups, the implementation of contemporary learning paradigms, the promotion of innovation, and the refinement of regulatory frameworks are pivotal areas that, when executed, will enable Kazakhstan to align with the best international practices(Smagulova G., Gonçalves M.,2024:4).

The findings of this study possess not only theoretical value but also practical relevance. They can be applied in the formulation of public policy, the design of educational programs, and the strategic management of the business environment in the digital economy.

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ЦИФРОВИЗАЦИЯ И ИННОВАЦИИ В УКРЕПЛЕНИИ ЧЕЛОВЕЧЕСКОГО КАПИТАЛА: СРАВНИТЕЛЬНЫЙ АНАЛИЗ КАЗАХСТАНА И КИТАЯ

Аннотация. В статье рассматривается важная роль цифровизации и инновационного потенциала в развитии человеческого капитала в предпринимательских экосистемах. Основная цель исследования заключается в сравнении опыта Казахстана и Китая в использовании цифровых и инновационных инструментов для повышения уровня человеческого капитала. Актуальность данной работы обусловлена возрастающей ролью цифровой экономики и необходимостью адаптации трудовых ресурсов к новым технологическим вызовам. Методологическая основа исследования включает сравнительный, системный и контент-анализ, а также данные статистики и нормативные источники. В статье проанализированы ключевые индикаторы, такие как индекс человеческого капитала, инновационная активность, уровень развития цифрового предпринимательства и цифрового образования. Результаты исследования продемонстрировали, что в Китае осуществляется комплексная цифровая политика, которая способствует формированию гибкого и конкурентоспособного человеческого капитала. В Казахстане также наблюдается положительная динамика, однако существуют проблемы цифрового неравенства и недостаточного развития инновационной инфраструктуры. Научная новизна исследования заключается в сравнительном анализе цифрового и инновационного развития двух стран, с особым акцентом на их влияние на человеческий капитал. Практическая значимость полученных результатов заключается в возможности их применения для стратегического планирования образовательных и предпринимательских инициатив в условиях цифровой экономики.

Ключевые слова: Человеческий капитал, инновации, цифровизация, предпринимательская экосистема, Казахстан, устойчивое развитие, Китай, Цифровая экономика, стартапы

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АДАМИ КАПИТАЛДЫ НЫҒАЙТУДАҒЫ ЦИФРЛАНДЫРУ ЖӘНЕ ИННОВАЦИЯЛАР: ҚАЗАҚСТАН МЕН ҚЫТАЙДЫҢ САЛЫСТЫРМАЛЫ ТАЛДАУЫ

Аннотация. Мақалада кәсіпкерлік экожүйелердегі адами капиталды дамытудағы цифрландыру мен инновациялық әлеуеттің маңызды рөлі қарастырылады. Зерттеудің негізгі мақсаты адами капитал деңгейін арттыру үшін цифрлық және инновациялық құралдарды пайдаланудағы Қазақстан мен Қытайдың тәжірибесін салыстыру болып табылады.Бұл жұмыстың өзектілігі ретінде цифрлық экономика рөлінің артуы және еңбек ресурстарын жаңа технологиялық сын-қатерлерге бейімдеу қажеттілігі болып табылады. Зерттеудің әдіснамалық негізі салыстырмалы, жүйелік және мазмұнды талдауды, сондай-ақ статистикалық мәліметтер мен нормативтік дереккөздерді қамтиды. Мақалада адами капитал индексі, инновациялық белсенділік, цифрлық кәсіпкерліктің даму деңгейі және цифрлық білім беру сияқты негізгі индикаторлар талданып қарастырылады. Зерттеу нәтижелері Қытайда икемді және бәсекеге қабілетті адами капиталды қалыптастыруға ықпал ететін кешенді цифрлық саясат жүргізіліп жатқанын айқындап көрсетеді. Қазақстанда да оң динамика байқалады, алайда цифрлық теңсіздік және инновациялық инфрақұрылымның жеткіліксіз дамуы проблемаларының барлығын көрстеді. Зерттеудің ғылыми жаңалығы екі елдің цифрлық және инновациялық дамуын салыстырмалы талдау болып табылады, олардың адами капиталға әсеріне ерекше назар аударылады. Алынған нәтижелердің практикалық маңыздылығы оларды цифрлық экономика жағдайында білім беру және кәсіпкерлік бастамаларды Стратегиялық жоспарлау үшін қолдану мүмкіндігі болып табылады.

Кілт сөздер: Адами капитал, инновациялар, цифрландыру, кәсіпкерлік экожүйе, Қазақстан, тұрақты даму, Қытай, цифрлық экономика, стартаптар

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