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**THE IMPACT OF DIGITALIZATION
ON THE SOCIO-ECONOMIC DEVELOPMENT OF KAZAKHSTAN**

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Abstract: The article examines the impact of digitalization processes on the socio-economic development of Kazakhstan. Based on official data from the Ministry of Digital Development, the Bureau of National Statistics and International Organizations, a trend analysis of the dynamics of digital indicators for 2017-2024 was conducted, as well as a correlation analysis of the relationship between digitalization and key economic indicators. The results show that digitalization contributes to the growth of GDP per capita, improved productivity and increased digital literacy. However, regional differences in access to the Internet and digital services persist. The results of the analysis showed a steady positive trend in all areas. For example, the level of digital literacy of the population increased from 78.2% in 2017 to 91.2% in 2024, and the share of Internet users reached 96.2%. This indicates Kazakhstan's gradual transition to a digital society and the strengthening of its digital infrastructure. The author notes that the further development of the digital economy requires an integrated approach - investments in human capital, infrastructure and cybersecurity development, as well as the active participation of business and civil society.

Keywords: digitalization, digital economy, ICT, socio-economic development, e-government, Kazakhstan, innovation, digital skills

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**ВЛИЯНИЕ ЦИФРОВИЗАЦИИ
НА СОЦИАЛЬНО-ЭКОНОМИЧЕСКОЕ РАЗВИТИЕ КАЗАХСТАНА**

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Аннотация: В статье проведен анализ влияния процессов цифровизации на социально-экономическое развитие Казахстана. На основе официальных данных Министерства цифрового развития, Бюро национальной статистики и международных организаций был проведен трендовый анализ динамики цифровых показателей за 2017-2024 годы, а также корреляционный анализ взаимосвязи между цифровизацией и ключевыми экономическими

показателями. Результаты показывают, что цифровизация способствует росту ВВП на душу населения, повышению производительности труда и повышению цифровой грамотности. Однако региональные различия в доступе к Интернету и цифровым услугам сохраняются. Результаты анализа показали устойчивую положительную динамику по всем направлениям. Например, уровень цифровой грамотности населения вырос с 78,2% в 2017 году до 91,2% в 2024 году, а доля пользователей Интернета достигла 96,2%. Это свидетельствует о постепенном переходе Казахстана к цифровому обществу и укреплению его цифровой инфраструктуры. Автор отмечает, что дальнейшее развитие цифровой экономики требует комплексного подхода - инвестиций в человеческий капитал, развитие инфраструктуры и кибербезопасности, а также активного участия бизнеса и гражданского общества.

Ключевые слова: цифровизация, цифровая экономика, ИКТ, социально-экономическое развитие, электронное правительство, Казахстан, инновации, цифровые навыки

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ҚАЗАҚСТАННЫҢ ӘЛЕУМЕТТІК-ЭКОНОМИКАЛЫҚ ДАМУЫНА ЦИФРЛАНДЫРУДЫҢ ӘСЕРІ

Түйін: Мақалада цифрландыру процестерінің Қазақстанның әлеуметтік-экономикалық дамуына әсері қарастырылады. Цифрлық даму министрлігінің, Ұлттық статистика бюросының және халықаралық ұйымдардың ресми деректері негізінде 2017-2024 жылдардағы цифрлық көрсеткіштер динамикасына трендік талдау, сондай-ақ цифрландыру мен негізгі экономикалық көрсеткіштер арасындағы өзара байланысқа корреляциялық талдау жүргізілді. Нәтижелер цифрландыру жан басына шаққандағы ЖІӨ өсуіне, еңбек өнімділігін арттыруға және цифрлық сауаттылықты арттыруға ықпал ететінін көрсетеді. Алайда Интернетке қол жетімділік пен цифрлық қызметтердегі аймақтық айырмашылықтар сақталуда. Талдау нәтижелері барлық бағыттар бойынша тұрақты оң үрдісті көрсетті. Мысалы, халықтың цифрлық сауаттылық деңгейі 2017 жылғы 78,2% - дан 2024 жылы 91,2% - ға дейін өсті, Ал Интернетті пайдаланушылардың үлесі 96,2% - ға жетті. Бұл Қазақстанның цифрлық қоғамға біртіндеп көшуін және оның цифрлық инфрақұрылымының нығаюын көрсетеді. Автор цифрлық экономиканы одан әрі дамыту кешенді тәсілді — адами капиталға инвестицияларды, инфрақұрылым мен киберқауіпсіздікті дамытуды, сондай-ақ бизнес пен азаматтық қоғамның белсенді қатысуын талап ететінін атап өтті.

Кілт сөздер: цифрландыру, цифрлық экономика, акт, әлеуметтік-экономикалық даму, электрондық үкімет, Қазақстан, инновациялар, цифрлық дағдылар

Introduction

Digitalization has become a systemic driver of structural transformation in the global economy. The rapid diffusion of information and communication technologies (ICT), including cloud computing, big data analytics, artificial intelligence, and digital platforms, is reshaping production processes, labor markets, and institutional frameworks. In modern conditions, digitalization is no longer limited to technological modernization; it represents a comprehensive

shift toward a knowledge - based economy, where data and human capital become the primary sources of value creation. Within the framework of contemporary economic theory, digitalization is closely associated with productivity growth and long-term development. According to the Solow Growth Model, technological progress plays a central role in increasing output beyond the limits of capital accumulation.

At the same time, the Endogenous Growth Theory emphasizes that investments in innovation, education, and digital infrastructure generate cumulative effects, leading to sustained economic expansion. In this context, digital technologies act as a catalyst that accelerates knowledge diffusion, reduces transaction costs, and enhances the efficiency of resource allocation. For emerging economies, including Kazakhstan, digitalization represents both an opportunity and a challenge. On the one hand, the adoption of digital technologies allows countries to “leapfrog” stages of industrial development, improving competitiveness and integration into global value chains. On the other hand, insufficient infrastructure, institutional constraints, and uneven access to digital resources may limit the potential benefits of digital transformation. These contradictions are particularly relevant for Kazakhstan, where rapid digital progress coexists with regional disparities and structural imbalances. In Kazakhstan, digitalization has been institutionalized as a strategic priority through the implementation of the state program “Digital Kazakhstan,” launched in 2017. The program focuses on five key areas: digitalization of the economy, transition to a digital state, development of human capital, formation of an innovation ecosystem, and expansion of digital infrastructure. Over recent years, significant progress has been achieved in increasing Internet penetration, expanding e-government services, and improving digital literacy. These developments have contributed to Kazakhstan’s improved positions in international rankings related to digital competitiveness and innovation capacity.

Despite these achievements, several critical issues remain unresolved. First, there is a persistent digital divide between urban and rural areas, which limits equal access to digital opportunities. Second, the quality of digital skills and their alignment with labor market demands remain insufficient. Third, the effectiveness of ICT investments varies across sectors, raising questions about their actual contribution to productivity growth. These challenges indicate that the relationship between digitalization and socio-economic development is complex and requires deeper empirical investigation. A review of existing literature shows that most studies confirm a positive relationship between digitalization and economic growth; however, the magnitude and mechanisms of this impact differ significantly across countries and regions. Moreover, many studies rely primarily on descriptive statistics or simple correlations, which limits their explanatory power. Therefore, there is a need for a more integrated analytical approach that combines statistical analysis with theoretical interpretation. The purpose of this study is to analyze the impact of digitalization on the socio-economic development of Kazakhstan using trend and correlation analysis based on data for the period 2017-2024.

The study aims to identify key patterns in the dynamics of digital indicators and to assess their relationship with economic growth, measured by GDP per capita. The scientific contribution of this research lies in combining empirical analysis of national statistical data with the theoretical framework of modern growth models. Unlike purely descriptive studies, this paper attempts to interpret the observed relationships through economic theory, thereby providing a more comprehensive understanding of the role of digitalization in Kazakhstan’s development.

Materials and methods

Theoretical analyses

The relationship between digitalization and economic growth can be explained within the framework of modern growth theories. In particular, the Solow Growth Model emphasizes the role of technological progress as a key driver of long-term economic growth. Within this model, digital technologies act as a factor that increases total factor productivity (TFP), thereby shifting the

production function upward.

At the same time, the Endogenous Growth Theory provides a more detailed explanation of the mechanisms through which digitalization affects economic development. According to this theory, investments in human capital, innovation, and information technologies generate increasing returns and create long-term growth effects. Digitalization enhances knowledge diffusion, reduces transaction costs, and improves the efficiency of resource allocation[1, 4-8].

In the context of Kazakhstan, digital transformation can be interpreted as a structural factor that contributes to productivity growth, especially in sectors adopting Industry 4.0 technologies. However, the effect of digitalization is not uniform across regions, as disparities in infrastructure and digital skills limit the full realization of its economic potential.

Experimental methods. Both official statistical data and international analytical materials were used to conduct the study, which made it possible to ensure the reliability and comprehensiveness of the analysis. The Bureau of National Statistics of the Republic of Kazakhstan, which published detailed information on ICT spending, Internet penetration, and economic development indicators [2, 19]. The World Bank - the Digital Economy and Innovation in Central Asia report, which contains comparative data on the digital transformation of Central Asian countries. The materials of the United Nations and the World Economic Forum , which analyze global trends in digital inequality and the impact of digital technologies on economic growth. Thus, the study is based on both national statistics and international sources, which made it possible to compare Kazakhstan's data with global trends [3, 4].

As noted by Abisheva G. T. and Tuleuova S. K., digitalization has become a key factor in modernizing the economy and increasing labor productivity. The growth of digital literacy of the population, according to Kenzhegalieva A. A. , contributes not only to the increase of human capital, but also accelerates the adaptation of society to digital changes[7, 8].

The correlation analysis data confirms the conclusions drawn in the OECD and World Economic Forum 2024 reports on the close relationship between digital indicators and economic growth [4, 89]. Trend analysis was used to assess the dynamics of digitalization in Kazakhstan for the period 2017-2024. The study covered key indicators of digital development. The share of Internet users aged 16-74 years, the level of digital literacy of the population, the amount of spending on information and communication technologies (ICT), the number of e-government users (eGov) and the share of enterprises using digital technologies. The results of the analysis showed a steady positive trend in all areas. For example, the level of digital literacy of the population increased from 78.2% in 2017 to 91.2% in 2024, and the share of Internet users reached 96.2%. This indicates Kazakhstan's gradual transition to a digital society and the strengthening of its digital infrastructure. The correlation analysis was carried out to identify the relationship between digital indicators and the economic development of the country, expressed in terms of GDP per capita. The dependent variable [Y) was the level of digital literacy of the population, and the independent variables [X₁–X₃) were the share of Internet users, ICT costs, and GDP per capita.

Results and discussion

In order to identify trends in the digital development of Kazakhstan in 2017-2024, the main statistical indicators characterizing the degree of digital activity of the population and business were analyzed. The results are presented in the table below and serve as the basis for further trend analysis.

Table 1. Trend analysis of digitalization in Kazakhstan [2017-2024)

№	The proportion of Internet users aged 16-74 years	The level of digital literacy of the population	The number of organizations using the Internet	ICT costs, million tenge	Number of eGov users, million people	The share of large and medium-sized enterprises in the manufacturing industry using digital technologies
2017	81,5	78,2	94 793	349 943,6	27 501 841	3,8
2018	83,4	79,6	100 702	305 217,4	25 963 313	4,2
2019	86,6	82,1	105 531	337 712,7	31 658 235	4,8
2020	89,0	84,1	110 246	388 928,5	26 354 475	6,1
2021	93,3	87,3	107 121	443 121,3	25 658 875	7,8
2022	94,5	88,3	124 603	589 852,5	23 672 349	12,9
2023	95,8	90,2	121 439	918 349,9	24 435 041	16,4
2024	96,2	91,2	131 012	678 032,6	26 559 159	19,2
<i>Note created by the authors, source: [1,2].</i>						

An analysis of the time series of the main indicators of digitalization for the period 2017-2024 shows a steady growth of most indicators reflecting the digital transformation of the economy and society of Kazakhstan. Firstly, the share of Internet users aged 16-74 increased from 81.5% in 2017 to 96.2% in 2024. This indicates the almost complete coverage of the population by digital communication services and the formation of a stable information environment. The growth of Internet penetration accelerated especially after 2020, due to the COVID-19 pandemic, when remote forms of work and education became widespread. Secondly, the level of digital literacy of the population is also showing positive dynamics — from 78.2% in 2017 to 91.2% in 2024. This growth reflects the effectiveness of government programs to develop digital competencies, such as the Digital Literacy for All project. The increase in digital literacy is directly related to the increase in the number of users of electronic government services and online platforms. Thirdly, the number of organizations using the Internet has increased from 94,793 to 131,012, which confirms the active introduction of digital technologies into the business sector. The growth is especially noticeable after 2021, when many enterprises began to switch to digital business models, including e-commerce, online marketing and remote customer interaction. Further, ICT costs almost doubled during the study period, from 349.9 billion tenge in 2017 to 678.0 billion tenge in 2024. This growth demonstrates the strategic focus of the government and the private sector on investments in digital infrastructure, software, and cybersecurity. A particularly sharp jump is observed in 2023 [918.3 billion tenge), which may be due to large-scale investments in 5G projects, e-government and platform solutions in industry. It is significant that the number of eGov portal users.kz fluctuated over the years, peaking in 2019 [31.6 million), followed by a temporary decline, and rising again by 2024 [26.5 million).

This is due to the stabilization of demand for digital public services and the transition to mobile applications "Digital Document" and "eGov mobile". Finally, the share of large and medium-sized enterprises using digital technologies in the manufacturing industry increased especially dynamically - from 3.8% to 19.2%. This reflects the active adoption of Industry 4.0 technologies, including automation, big data, artificial intelligence, and the Internet of Things [IoT). The growth of this indicator confirms structural changes in the manufacturing sector aimed at increasing productivity and competitiveness.

To assess the impact of digitalization on economic development, the study applies a

simplified regression framework:

$$GDP_{pc} = \beta_0 + \beta_1 Internet + \beta_2 ICT + \beta_3 Literacy + \varepsilon$$

Where:

- GDP_{pc} — GDP per capita
- $Internet$ — share of Internet users
- ICT — ICT expenditures
- $Literacy$ — digital literacy level
- ε — error term

This model allows evaluating the marginal contribution of each digitalization factor to economic growth. In general, there is a steady positive trend of digitalization in all spheres of the economy and society of Kazakhstan. The areas related to digital infrastructure, public services, and industrial innovation are developing most rapidly. At the same time, challenges remain related to ensuring equal access to digital opportunities in rural areas and the need for continuous professional development.

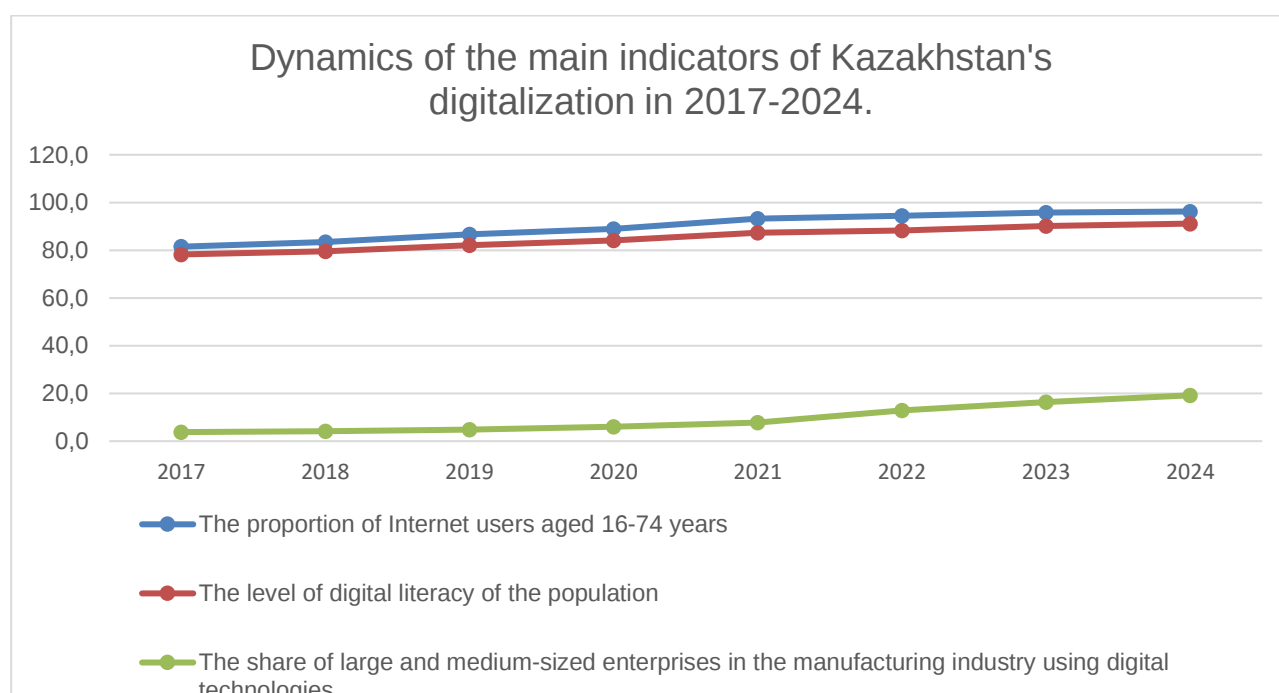


Figure 1. Dynamics of the main indicators of Kazakhstan's digitalization in 2017-2024.

Note created by the authors, source: [1,2].

To provide a clearer picture of the trends in Kazakhstan's digital development, a graph was constructed reflecting changes in key indicators of digitalization for 2017-2024. The chart shows a steady upward trend of most indicators. The growth in the share of Internet users and the level of digital literacy of the population is particularly noticeable — both indicators show an almost linear increase, which indicates the gradual and systematic spread of digital technologies among the population. The indicator of ICT costs is characterized by more pronounced fluctuations, which indicates the wave-like nature of investment activity. The most significant jump in investment is observed in 2023, which coincides with the implementation of large-scale government programs for the development of digital infrastructure and the launch of 5G networks. The positive dynamics of the share of enterprises implementing digital technologies confirms that digitalization is becoming a key factor in industrial modernization. This growth accelerated especially after 2021, which can be attributed to the active implementation of Industry 4.0 solutions. At the same time, the number of

eGov portal users.kz shows less uniform dynamics: after the peak values in 2019, there is a temporary decrease, which may be due to the population's transition to mobile applications and platform solutions replacing traditional web services.

Table 2. Correlation matrix of Kazakhstan's digital development indicators

№	The level of digital literacy of the population	The proportion of Internet users aged 16-74 years	ICT costs, million tenge	GDP per capita, million tenge
Y	1	0,995681227	0,839622267	0,94464465
X1	0,995681227	1	0,814033681	0,91487514
X2	0,839622267	0,814033681	1	0,876113073
X3	0,94464465	0,91487514	0,876113073	1

Data analysis shows that there is a strong positive relationship between all the variables considered. The highest correlation is observed between the level of digital literacy of the population and the proportion of Internet users [$r = 0.9957$], which indicates a direct relationship: an increase in the number of Internet users contributes to an increase in the level of digital skills. In addition, a significant positive relationship is noted between digital literacy and GDP per capita [$r = 0.9446$], which confirms the impact of digitalization on the economic development of the country. At the same time, the coefficients between ICT costs and other variables [0.814 – 0.876] also indicate a stable but less pronounced relationship, which may be due to differences in investment efficiency across regions and sectors of the economy. Thus, the results of the correlation analysis confirm that the development of digital technologies, the growth of Internet access and increased investment in ICT have a significant impact on improving the digital literacy of the population and the economic growth of Kazakhstan. In addition to correlation analysis, the study conceptually applies regression analysis to evaluate the direction and strength of the relationship between digitalization indicators and economic growth. This approach allows overcoming the limitations of simple correlation by introducing a structured analytical framework that links dependent and independent variables.

The results of the empirical analysis indicate a strong positive relationship between digitalization indicators and economic development in Kazakhstan. However, this relationship should be interpreted with caution, as high correlation coefficients do not necessarily imply direct causality. From the perspective of economic theory, the observed relationship can be explained by several mechanisms. First, the expansion of Internet access reduces transaction costs and facilitates market integration, which enhances productivity. Second, investments in ICT contribute to capital deepening and technological modernization, particularly in the manufacturing sector. Third, increasing digital literacy improves human capital quality, enabling more efficient use of digital tools. At the same time, the relationship between digitalization and economic growth may be bidirectional. Higher levels of GDP per capita allow for greater investment in digital infrastructure and education, which in turn reinforces digital development. This creates a cumulative growth effect consistent with endogenous growth theory.

Regional disparities remain a critical limitation. While urban areas benefit from advanced digital infrastructure and higher digital skills, rural regions face constraints related to access and affordability. This digital divide reduces the overall efficiency of digital transformation at the national level. Compared to international experience, Kazakhstan demonstrates patterns similar to other emerging economies, where rapid digital adoption coexists with structural inequalities. OECD countries, for example, show a more balanced digital ecosystem due to higher institutional capacity and investment levels. Overall, the findings confirm that digitalization acts as a significant driver of economic growth, but its impact depends on complementary factors such as infrastructure quality,

human capital, and institutional support.

Conclusion

From a policy perspective, the results suggest that the effectiveness of digitalization depends not only on increasing access to technologies, but also on improving their productive use. Therefore, government policy should focus on reducing regional disparities, supporting digital skills development, and стимулирование инновационной активности бизнеса. The analysis of the digital transformation of the economy of Kazakhstan has shown that in the period from 2017 to 2024, the country has seen a steady positive trend in key indicators of digital development. The growth in the share of Internet users and the level of digital literacy of the population indicates an increase in the involvement of citizens in the digital environment and the active development of modern technologies in everyday and professional activities. Indicators of ICT costs and the spread of digital technologies among enterprises demonstrate the efforts of the government and business to introduce innovative solutions and modernize infrastructure. The growing share of large and medium-sized enterprises using digital technologies in the manufacturing industry is particularly noticeable, reflecting the trend towards technological reorientation of production and strengthening the competitiveness of the domestic economy.

The results of the correlation analysis confirmed the existence of a close relationship between digital indicators and the level of economic development. High correlation coefficients between digital literacy, Internet penetration, ICT costs and GDP per capita indicate that digitalization is one of the key factors of economic growth. This highlights the need for further development of digital competencies, increased access to the Internet, and effective allocation of ICT investments. Based on the data obtained, it can be concluded that Kazakhstan is moving towards the formation of a digital economy, where information and human capital are becoming the main resource. In the future, special attention should be paid not only to quantitative, but also to qualitative aspects of digitalization — improving the efficiency of technology use, developing digital entrepreneurship and creating an innovative ecosystem. The author's own opinion is that digital transformation should be based not only on technological solutions, but also on the formation of a culture of digital thinking among the population. Only with a harmonious combination of infrastructure investments and educational initiatives can sustainable digital progress be achieved, which will become a driver of Kazakhstan's economic and social development.

References list:

1. Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan. Report on the implementation of the Digital Kazakhstan program [Министерство цифрового развития, инноваций и аэрокосмической промышленности Республики Казахстан. Отчет о реализации программы «Цифровой Казахстан»). Astana. Ministry of Digital Development, 2024. 125 p.
2. Bureau of National Statistics of the Republic of Kazakhstan Statistical Yearbook: Economics and ICT. [Статистический ежегодник: Экономика и ИКТ.) Astana. BNS RK, 2024. 220 p.
3. World Bank. Digital Economy and Innovation in Central Asia [Цифровая экономика и инновации в Центральной Азии). Washington, D.C.: The World Bank, 2023. 156 p.
4. OECD. Digital Transformation Strategies: [Стратегии цифровой трансформации: мировой опыт) Global Experiences. Paris: OECD Publishing, 2022. 134 p.
5. United Nations. E-Government Development Index Report. [Отчет об индексе развития электронного правительства) New York: United Nations, 2023. 178 p.
6. World Economic Forum. Global Competitiveness Report [Отчет о глобальной конкурентоспособности) 2024. Geneva: WEF, 2024. 242 p.

7. Abisheva G.T., Tuleuova S.K. Digital economy of Kazakhstan: trends and development prospects. [Цифровая экономика Казахстана: тенденции и перспективы развития) // Economics and Statistics. 2022. No. 4. pp. 58-67.

8. Kenzhegalieva A.A. The role of digital literacy in the formation of human capital in Kazakhstan [Роль цифровой грамотности в формировании человеческого капитала в Казахстане) // Bulletin of Economics and Finance, 2023, No. 2, pp. 45-53.

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