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DIGITALIZATION AS A FACTOR OF ECONOMIC GROWTH OF KAZAKHSTAN

M. Amantay[1]*, M. Kanabekova[1], G. Nurlikhina[2], Zh. Oralbayeva[3]

[1] Abay Kazakh National pedagogical university, Almaty, Kazakhstan
[3]Almaty humanitarian-economical university, Almaty, Kazakhstan
[4]Al-Farabi Kazakh National university, Almaty, Kazakhstan

**Corresponding author email: mukit010@mail.ru*

Abstract. *The article considers digitalization as one of the factors in the development of the economy. To prove this, authors use dynamic series in Kazakhstan with parameters for information and computer technologies (ICT) and GDP itself. Based on these data, a linear model is formed through correlation and regression analysis. The digital economy covers a wide range of aspects, including the development of information and communication technologies, the integration of digital platforms, the automation of production processes and the introduction of innovations in various sectors of the economy. The main trends of digitalization in Kazakhstan and the world, their impact on the competitiveness of enterprises are considered. In parallel, an analysis of foreign experience in the field of economic development is carried out considering the processes of digitalization; the field in which Kazakhstan ranks 36th in the corresponding rating. The actual development of information technology has made it possible to improve many business processes and to create added value in the form of the use of new applications for certain types of activities. UN Sustainable Development Goal 9, "Building Resilient Infrastructure, Promoting Inclusive and Sustainable Industrialization and Innovation," will further expand access to ICT. In conclusion, the authors gave proposals for the development of the economy of Kazakhstan within the framework of digitalization in general for further economic development.*

Keywords: *digitalization, information and communication technologies, gross domestic product, economic development, financial technologies, economic growth factors.*

Main provisions. In modern conditions, digitalization acts as one of the determining factors that significantly affects the development of the business economy. Growing progress in the field of information and communication technologies, along with the active introduction of digital solutions in various industries, leads to significant changes in the functioning of enterprises. Digital technologies not only optimize operational processes, but also open new opportunities for innovation, increase management efficiency and provide companies with competitive advantages in the world arena. In the context of globalization and increasing competitive pressure, adaptation to digital transformations is becoming a prerequisite for the successful development of business structures.

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Introduction. The current stage in the development of the world economy is characterized by a deep transformation of its structural foundations under the influence of technological progress, digital innovation and global informatization. The emergence and active spread of digital platforms, intelligent control systems, as well as big data and artificial intelligence technologies have led to qualitative changes in production processes, institutional mechanisms and models of interaction between economic agents. These changes affect not only the technological landscape, but also the fundamental foundations of economic growth, social differentiation and international competitiveness.

In this context, digitalization acts not just as a technological modernization, but as a new stage in the development of the economy, associated with the formation of the digital economy as a special macro system based on data, algorithms and network effects. Researchers interpret digitalization as a new production paradigm capable of redistributing resources, changing the channels of value creation and redefining the role of humans in the economic process [1].

It should be emphasized that the digital economy is becoming a strategic resource for sustainable development, a tool for improving the efficiency of public administration and business competitiveness. At the level of state policy, digitalization is considered as a priority area that forms innovative drivers of growth and economic sustainability. At the same time, remains the relevance of assessing the impact of digitalization on the socio-economic dynamics of specific countries, including Kazakhstan, where the process of digital transformation is complex and intersectoral.

The purpose of this study is to assess the impact of digitalization on the macroeconomic development of the Republic of Kazakhstan in the context of a modern transformational economy. To achieve this goal, the following tasks are solved in the work:

– conducting a comparative analysis of the international experience of digitalization and its impact on economic development;

– systematization of empirical data and normative approaches to digital transformation in leading countries of the world;

– building a model of dynamic interaction of digitalization parameters and key indicators of macroeconomic growth, considering Kazakhstan's specifics;

– formation of practical recommendations to strengthen the role of digital technologies in the sustainable socio-economic development of Kazakhstan.

The set goal and the logic of tasks determine the scientific and applied significance of the study, the results of which can be used both in the analytical work of state bodies and in strategic planning of the digital transformation of the country's economy.

Literature review. The development of the economy of any country in modern conditions is due to a wide range of factors, among which the process of digitalization is of particular importance. The introduction of digital technologies has a multiplier effect on production processes, management, labor market and investment activity, forming the basis for sustainable economic growth. However, it is worth noting that for developing countries, the transition to a digital economy is a much more complex and resource-intensive task compared to industrialized countries. This is primarily due to the limited availability of technological infrastructure, insufficient digital maturity of institutions, as well as the limited financial and human resources necessary to implement large-scale digital transformations [2].

At the same time, the rapid development of information and communication technologies and their widespread integration into key areas of economic and social activity are becoming strategically important for both government institutions and the private sector. For both sides, digital transformation acts not only as a tool to increase efficiency and competitiveness, but also as a condition for adapting to global challenges and accelerated rates of technological change [3].

Researcher Chihiro Watanabe and others note that most countries with developed information and communication technology (ICT) infrastructure are experiencing prolonged stagnation due to the 'built-in' trap in ICT development. However, some countries have been able to maintain a high level of global competitiveness based on ICT [4].

At the same time, researcher Antonio Fernandez-Portillo and others expressed the opinion that there is a positive impact of ICT on GDP as a whole and even rank the performance of the indicators that ICT makes up by GDP growth, which makes it possible to note that the number of Internet users is the highest indicator of productivity [5].

Modern research confirms that ICT plays a key role in transforming economic systems, contributing to productivity growth, lower transaction costs and the formation of new business models. ICTs are changing the traditional ways of carrying out economic transactions through the development of e-commerce, remote financial services and online business [6].

The development of information and communication technologies, the Internet of Things (IoT) and digital platforms has significantly transformed the dynamics of doing business in the global economy. Digitalization of production and management processes has changed the principles of value chain organization, reduced transaction costs and increased the transparency of the business environment [7].

It should be noted that digital investment is becoming an important factor in macroeconomic sustainability and growth. Studies confirm that investments in digital infrastructure and technologies have a double effect: in the short term, they contribute to accelerating the growth rate of gross domestic product (GDP) by stimulating business activity and employment and, in the long term, they create the basis for sustainable growth of potential GDP through increasing productivity, expanding innovation potential and modernizing the sectoral structure of the economy [8].

However, along with the positive contribution of digitalization to economic development, methodological challenges remain related to an accurate assessment of its contribution to GDP. One of the key challenges of the digital economy is the limitations of traditional methods of measuring GDP, which do not fully reflect the added value created by digital platforms, intangibles and network effects. In this regard, the researchers point out that a potential direction for solving this problem could be the analysis of the joint evolution of digital technologies and systems of national accounts. This approach implies the integration of statistical methods with elements of hedonic pricing, focused on the qualitative characteristics of digital products and services, which can provide a more accurate assessment of economic dynamics in the context of digital transformation [9].

According to S. Rastorguyev, factors determining intensive economic growth are advanced training of labor resources and the introduction of advanced technologies that contribute to the growth of labor productivity and the rational use of resources. The author emphasizes that it is the combination of human capital and technological innovation that forms the basis of sustainable development, ensuring qualitative shifts in the structure of the economy and its competitiveness at the global level [10].

Given these prerequisites, in the context of modern digital transformation, many states are actively introducing digital technologies into various sectors of the economy. The use of digital solutions contributes to the creation of innovative products and services, including in areas such as asset management, lending and insurance. As noted in several studies, digital platforms make it possible to form new models of interaction between providers and consumers of financial services, significantly reducing transaction costs and increasing availability [11]. In the Republic of Kazakhstan, this process has been practically embodied in the rapid development of the fintech industry. Initially covering mainly the financial sector, digital technologies gradually began to be introduced into other sectors of the economy (trade,

logistics, education, public administration, etc.). This cross-industry effect is due to the high adaptability of digital solutions and the desire to increase the efficiency and transparency of business processes.

Kazakh researchers A. Alimbaev and B. Bitenova rightly note that digital technologies are increasingly replacing traditional factors of production, such as capital, labor and land, in the background. In their opinion, it is digital solutions that are becoming a new way of organizing production, ensuring not only an increase in economic efficiency, but also a significant increase in added value [12]. Digital technologies are transforming the structure of the economy, contributing to qualitative changes in industries and accelerating the processes of modernization and innovative development. In the long run, this effect increases, giving economic growth additional acceleration and sustainability through the widespread introduction of intelligent systems, automation of processes and an increase in the level of digital literacy of the population.

Thus, modern research confirms the key role of digitalization in ensuring sustainable economic growth and structural transformation of the economy. ICT, digital platforms and digital infrastructure investments have multiplier effects on productivity, innovation and competitiveness. This focuses on challenges related to the methodology for measuring the digital contribution to GDP, as well as differences between developed and developing countries in the speed and quality of digital transformation. In the context of Kazakhstan, digitalization is showing positive dynamics, especially in the financial and public sectors, with the prospect of further expansion to all spheres of the economy. Analysis of theoretical and empirical approaches shows that digital technologies are becoming not only a tool for modernization, but also a new paradigm for economic development.

Materials and methods. This study is based on a methodological approach that combines quantitative and qualitative analysis methods to assess the impact of digitalization on economic development. The empirical base was based on official statistics published by international organizations (such as the World Bank, the International Telecommunication Union (ITU), OECD), as well as national statistical authorities of the Republic of Kazakhstan.

The digital competitiveness analysis was based on the IMD World Digital Competitiveness Ranking (WDCR), as well as data on the distribution and use of information and communication technologies (ICT) by country. We used indicators of Internet penetration, computer literacy, the share of digital investments, the development of the fintech sector, the level of automation and the integration of ICT into production processes.

The methodological basis of the study includes content analysis of scientific publications and strategic documents on the topic of the digital economy; comparative analysis of digital transformation in different countries with an emphasis on the Republic of Kazakhstan; economic and statistical methods, including trend and correlation analysis to identify the relationship between ICT diffusion and key macroeconomic indicators such as GDP per capita, labor productivity and investment activity.

The methods of analysis relied on the interpretation of data in the context of the UN Sustainable Development Goals, in particular Goal 9, as well as scientific approaches to assessing the impact of digital technologies on macroeconomic indicators.

Results and discussion. Amid the rapid digital transition, the global economic agenda demonstrates a steady trend towards the integration of ICT into key sectors of economic activity. Research results confirm that digitalization is becoming an integral element of not only financial and administrative processes, but also contributes to the structural transformation of the economy as a whole. Digital technologies are being actively introduced into an increasing number of areas, becoming critical for the functioning of modern economic and social systems. As a result, there is growing competition between countries for leadership in digital transformation and technological sovereignty.

Against this background, the development of digital competitiveness is of particular importance, which is considered as one of the key factors of sustainable economic growth and innovative development of national economies (Figure 1).

The global digital competitiveness rating for 2022 presented in the figure, reflecting the position of countries in accordance with the level of development of digital infrastructure, access to technologies and digital capabilities of economies. The leading group of the rating includes highly developed countries: Denmark (100%), USA (99.81%), Sweden (99.81%), Singapore (99.48%) and Switzerland (98.23%), demonstrating systemic digital maturity and sustainable investment in innovative technologies.

The Republic of Kazakhstan ranks 36th with an integral indicator of 73.03%, ahead of a number of countries of the European Union. Thus, the level of digital competitiveness of Kazakhstan exceeds the indicators of such states as Portugal (70.84%), Italy (66.23%), Poland (63.09%) and Turkey (55.02%). This indicates the country's significant potential in the digital sphere and the effectiveness of the steps taken by the state to develop the digital economy, despite infrastructure and institutional constraints.

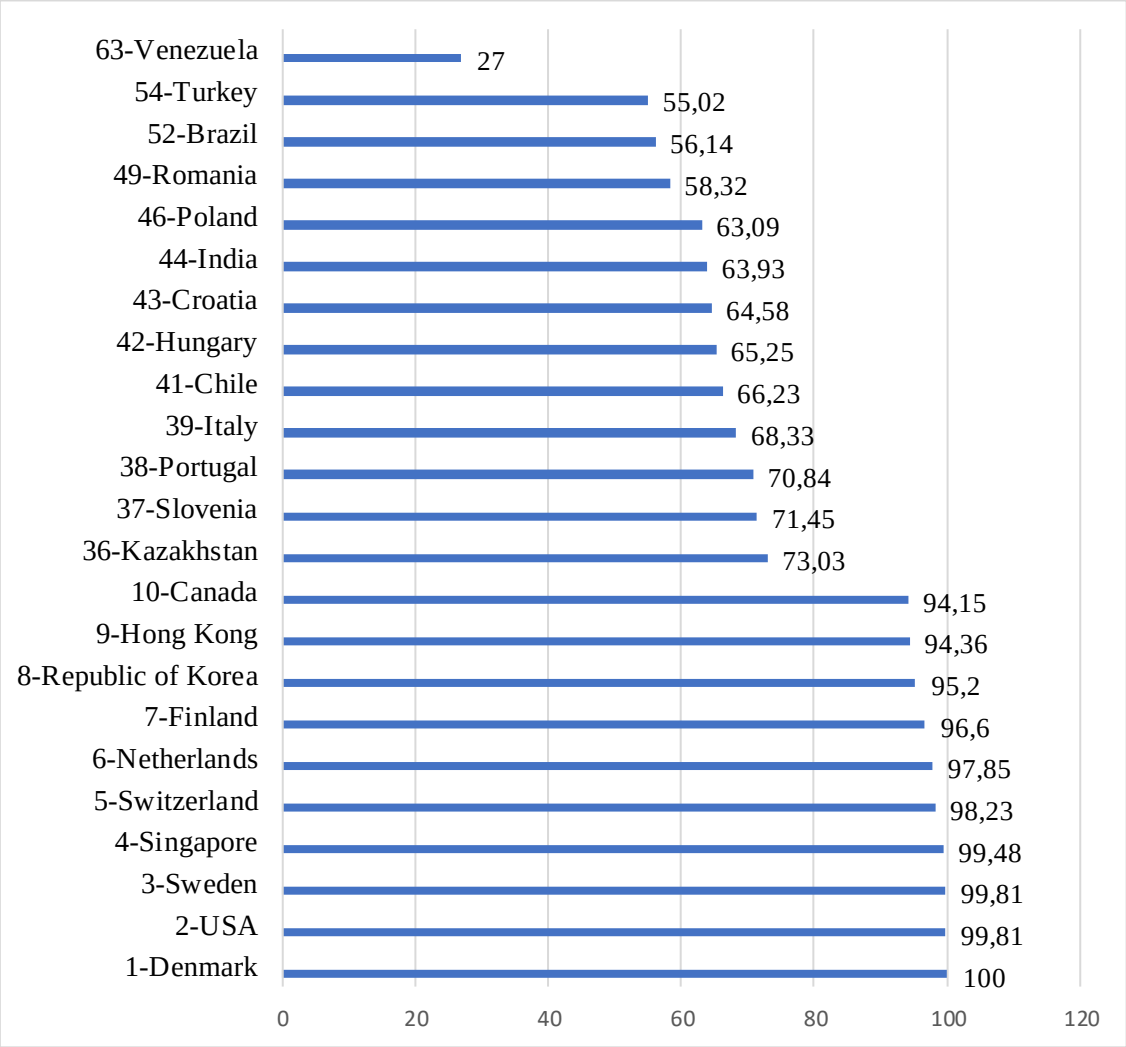

Figure 1 – World Digital Competitiveness Ranking, 2022

Note: based on source [13]

This situation reflects the general trend of strengthening Kazakhstan's position in the global digital transformation and emphasizes the need for further strategic initiatives aimed at strengthening technological independence and expanding digital services.

Of course, if we consider financial technologies as a whole, many information services and applications in the Republic of Kazakhstan have a high reputation, so marketplaces and ecosystems KASPI, wildberries.kz, Halykmarket.kz and others

Figure 2 shows the total ICT costs and the number of Internet subscribers using the data from Table 1.

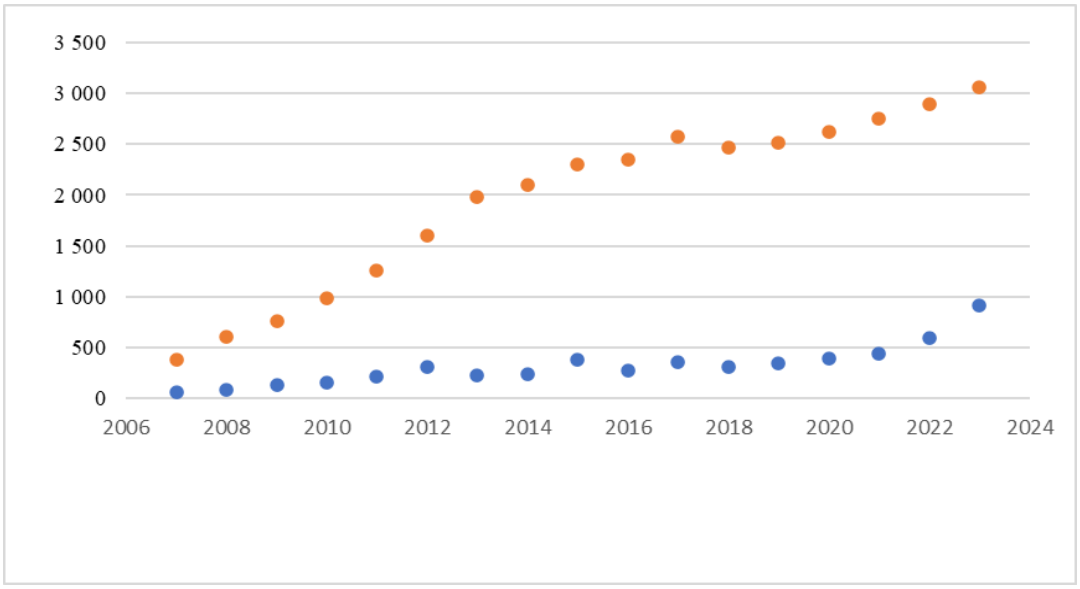

Figure 2 – Total ICT costs and number of Internet subscribers

Note: based on source [14]

Over 17 years, total ICT costs have grown from 53 billion tenge in 2007 to 918 billion tenge in 2023, which shows an increase of 17.17 time, that is, an average of 100% annually. At the same time, the number of subscribers from 381 thousand units in 2007 to 3,059 thousand units in 2023, which showed an increase of 8.02 time or 47.2% annually. At the same time, on average, 1 subscriber accounted for 156.4 thousand tenge of costs, but in 2023 this figure increased to 300.2 thousand tenge, and the minimum level of costs was in 2013-2014 when it was at the level of 112 thousand tenge - 113 thousand tenge.

Moreover, the COVID-19 pandemic contributed to the significant growth of Internet users, when many began to use online services. Meanwhile, total ICT costs increased 2.3 time (from 388.9 billion tenge in 2020 to 918.4 billion tenge in 2023).

Table 1 shows ICT and GDP indicators. Thus, over 17 years of observation, the total cost of training employees related to the development and use of ICT amounted to 57.8 billion tenge. There are 11.8 billion tenge in 2017 and 14.3 billion tenge in 2022. GDP for this period increased from 12.85 trillion tenge in 2007 to 120.56 trillion tenge in 2023, that is, 9.3 time. On average, the increase in GDP annually occurred by 15%, but if we take the period after the COVID-19 pandemic, then the annual growth was 20%. It should also be noted that during this period, total ICT costs increased 2 time.

Table 1 – ICT and GDP indicators

Year	Number of fixed Internet subscribers (thousand units)	Total ICT costs (including the organization of public administration) (million tenge)	Personnel training costs related to ICT development and use (million tenge)	GDP (billion tenge)
2007	381	53 486	712	12 850
2008	601	78 159	1 167	16 053
2009	757	126 597	828	17 008
2010	986	147 538	1 435	21 816
2011	1 262	214 180	1 397	28 243
2012	1 607	309 821	2 217	31 015
2013	1 976	220 848	3 432	35 999
2014	2 101	237 079	1 831	39 676
2015	2 306	375 600	1 491	40 884
2016	2 353	269 527	1 276	46 971
2017	2 580	349 944	11 816	54 379
2018	2 462	305 217	2 134	61 820
2019	2 512	337 713	8 138	69 533
2020	2 621	388 929	1 398	70 714
2021	2 754	443 121	2 055	83 952
2022	2 900	589 853	14 364	103 766
2023	3 059	918 350	2 162	120 561
Note: based on source [14]				

At the same time, the scientific literature emphasizes the direct relationship between the level of digitalization of the population and macroeconomic indicators. Thus, researcher Dorde Mitrovic notes that an increase in the number of Internet users in developed countries leads to an increase in GDP per capita, focusing on the fact that digital inclusiveness of the population is becoming a key factor in sustainable economic growth and increasing national competitiveness [15]. This statement confirms the importance of creating an affordable and high-quality digital infrastructure as the basis for inclusive economic development.

Using statistical information from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, the level of digital literacy of the population, which is assessed by the proportion of users who have the skills to use a personal computer, smartphone, tablet, laptop; standard programs; Since 2018, residents from 6 to 74 years old have grown from 79.6% of the total population to 90.2% in 2023.

The actual development of information technologies has made it possible to improve many business processes and create added value in the form of the use of new applications for certain types of activities.

Sustainable Development Goal 9, proclaimed by the UN, is aimed at developing infrastructure and stimulating innovation. One of its key areas remains the expansion of access to ICT – in 2023 this figure was 98.2%. [16].

Considering the data of Table 1, we correlate between absolute indicators, such as the number of fixed Internet subscribers, total costs of information and communication technologies, employee training costs associated with the development and use of ICT and GDP.

Analysis of the data in Table 2 shows a pronounced positive correlation between the number of fixed Internet subscribers and the level of GDP. This suggests that the number of

fixed Internet subscribers strongly affects the development of the country's economy, which shows a high dependence of 87.29%, which implies a strong correlation and partial multicollinearity in the model. In addition, the total costs of information and communication technologies are highly dependent on GDP of 92.61%.

There is also an average link between employee training costs related to ICT development and use and GDP of 44.56%.

Table 2 – Relationship between indicators

Indicators	Number of fixed Internet subscribers (thousand units)	Total costs for information and communication technologies (taking into account the organization of public administration) (million tenge)	Employee training costs associated with ICT development and use	GDP (billion tenge)
Number of fixed Internet subscribers (thousand units)	1			
Total costs for information and communication technologies (taking into account the organization of public administration) (million tenge)	0,785469	1		
Employee training costs associated with ICT development and use	0,450367	0,319045	1	
GDP (billion tenge)	0,872937	0,926171	0,445677	1

At the same time, the value of the coefficient of determination R^2 = 96.02% indicates a high accuracy of approximation of the model, which indicates its good correspondence to the studied process. The multiple correlation coefficient is 92.2% [17].

The significance level of Fisher's test (Significance F) is much less than 0.05, which means that the model is important, where the significance of F is $1.84 * 10^{-7}$, which is less than 0.05.

Based on the dynamic series from 2007 to 2023, that is, 17 observations, GDP, taking into account correlation-regression analysis, will have a linear equation (1), which is as follows:

$$y = -5089,49+11,0395x1+0,0991x2+0,7472x3, \text{ where} \quad (1)$$

x1 is the number of fixed Internet subscribers;

x2 – total costs for information and communication technologies (taking into account the organization of public administration);

x3 – employee training costs associated with the development and use of ICT.

Thus, it is worth noting that the share of total ICT costs from GDP increased from 0.41% in 2007 to 0.76% in 2023. The number of fixed Internet subscribers from 2007 to 2023 increased 8.02 times, which is an average increase of 47% annually.

The digital economy creates many benefits for consumers and society. Consumers have received many benefits from the development of the digital economy, although this effect is not directly reflected in GDP indicators [18].

For the further development of digitalization and, accordingly, the economy of Kazakhstan, it is necessary:

– to improve the information situation to prevent theft of personal data of citizens of kazakhstan. for example, on march 5, 2024, the state technical service jsc discovered a leak of more than 2 million personal data of Kazakhstanis who are clients of the microfinance organization zaimer.kz (mfo robokash.kz llp). at the same time, Kazakhstanis who have never used the services and are not clients of the specified microfinance organization received warnings [19].

– to reduce the share of foreign applications, while developing and implementing their own applications, which will be safe and can be controlled by the state.

– to build new facilities for the generation of electric energy, since large volumes are needed to process requests for ai and bigdata.

– further training in computer literacy and cybersecurity to train its own specialists capable of developing and implementing its own applications with a high degree of security.

As a result of the study, it was found that the rapid development of new technologies had a significant impact on the expansion of ICT capabilities and their active introduction into various sectors of the economy. Digital technologies have ceased to be only an auxiliary tool and have begun to act as a new way of organizing production, contributing to economic growth, increased process efficiency and a significant increase in added value.

Of particular importance is the growth in the number of Internet users, which directly correlates with the dynamics of GDP, confirming the role of digital infrastructure as a key driver of the development of the national economy. In the context of digital transformation, a qualitatively new model of management is being formed, in which human capital is strengthened due to digital literacy, skills in interacting with new technologies and readiness to work in a cyber-physical environment.

At the same time, it was revealed that digitalization inevitably creates challenges in the field of information security, especially in the context of the use of biometric data and artificial intelligence algorithms. These challenges require timely legal, technological and ethical adaptation by both government institutions and business and society at large.

Thus, the results obtained indicate that digital transformation has a comprehensive impact on the economic system, transforming not only its production parameters, but also the institutional foundations, social processes and regulatory mechanisms. This creates the preconditions for the development of evidence-based digital development strategies that take into account both economic benefits and potential risks.

Conclusion. Digitalization acts as a powerful catalyst for economic growth and structural transformation of the national economy of Kazakhstan. The integration of information and communication technologies into key business sectors has a significant multiplier effect on macroeconomic indicators. The development of digital infrastructure, an increase in the number of Internet users, an increase in investment in ICT, as well as an increase in the digital literacy of the population demonstrate a positive impact on the dynamics of GDP.

The results of the analysis confirm the positive correlation between the level of development of information and communication technologies (ICT) and the main macroeconomic indicators. In particular, the increase in the number of Internet users, the expansion of digital services in the financial sector and investments in digital infrastructure have a multiplier effect on gross domestic product, labor productivity and innovation activity.

Thus, digitalization is a strategic direction capable of ensuring sustainable and inclusive economic development, subject to systemic government support, adaptive educational policies and targeted investments in digital transformation. The results obtained can be used as a basis for improving the national digital strategy aimed at increasing the global competitiveness of Kazakhstan in the digital economy.

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ЦИФРЛАНДЫРУ ҚАЗАҚСТАННЫҢ ЭКОНОМИКАЛЫҚ ӨСУ ФАКТОРЫ РЕТІНДЕ

М. Амантай[1]*, М. А. Қанабекова[1], Г. Б. Нурлихина[2], Ж. З. Оралбаева[3]

[1]Абай атындағы Қазақ Ұлттық педагогикалық университеті, Алматы, Қазақстан
[2]Алматы гуманитарлы-экономикалық университеті, Алматы, Қазақстан
[3]әл-Фараби атындағы Қазақ Ұлттық Университеті, Алматы, Қазақстан

Түйін. *Мақалада цифрландыру экономиканың даму факторларының бірі ретінде қарастырылады. Осыны дәлелдеу үшін ақпараттық-компьютерлік технологиялар (АКТ) және ЖІӨ-нің өзі бойынша параметрлері бар Қазақстан бойынша динамикалық қатарларды пайдалана отырып. Осы мәліметтер негізінде корреляциялық-регрессиялық талдау арқылы сызықтық модель құрылады. Цифрлық экономика ақпараттық-коммуникациялық технологияларды дамыту, Цифрлық платформаларды интеграциялау, өндірістік процестерді автоматтандыру және экономиканың әртүрлі секторларына инновацияларды енгізуді қоса алғанда, көптеген аспектілерді қамтиды. Қазақстанда және әлемде цифрландырудың негізгі үрдістері, олардың кәсіпорындардың бәсекеге қабілеттілігіне әсері қарастырылды. Сонымен қатар, цифрландыру процестерін ескере отырып, Экономикалық даму саласындағы шетелдік тәжірибеге талдау жүргізіледі, онда Қазақстан тиісті рейтингте 36-шы орында. Ақпараттық технологиялардың нақты дамуы көптеген бизнес-процестерді жетілдіруге және белгілі бір қызмет түрлеріне жаңа қосымшаларды пайдалану түрінде қосымша құн құруға мүмкіндік берді. БҰҰ бағдарламасы болып табылатын «тұрақты инфрақұрылым құру, барлығын қамтитын және тұрақты индустрияландыру мен инновацияларға жәрдемдесу» орнықты дамудың 9-мақсатына сәйкес АКТ-ға қолжетімділікті одан әрі кеңейту көзделеді. Қорытындылай келе, авторлар одан әрі экономикалық даму үшін тұтастай цифрландыру шеңберінде Қазақстан экономикасын дамыту жөнінде ұсыныстар берді.*

Түйінді сөздер: *цифрландыру, ақпараттық-коммуникациялық технологиялар, жалпы ішкі өнім, экономикалық даму, қаржылық технологиялар, экономикалық өсу факторлары.*

ЦИФРОВИЗАЦИЯ КАК ФАКТОР ЭКОНОМИЧЕСКОГО РОСТА КАЗАХСТАНА

М. Амантай[1]*, М.А. Канабекова[1], Г.Б. Нурлихина[2], Ж.З. Оралбаева[3]

[1]Казахский Национальный педагогический университет имени Абая, Алматы, Казахстан
[2]Алматинский гуманитарно-экономический университет, Алматы, Казахстан
[3]Казахский Национальный университет имени аль-Фараби, Алматы, Казахстан

Резюме. *В статье рассматривается цифровизация как один из факторов развития экономики. Для доказательства этого используя динамические ряды по Казахстану с параметрами по информационно-компьютерным технологиям (ИКТ) и самого ВВП. На основе этих данных формируется линейная модель через корреляционно-регрессионный анализ. Цифровая экономика охватывает широкий круг аспектов, включая развитие информационно-коммуникационных технологий, интеграцию цифровых платформ, автоматизацию производственных процессов и внедрение инноваций в различные секторы хозяйства. Рассмотрены основные тенденции цифровизации в Казахстане и мире, их влияние на конкурентоспособность предприятий. Параллельно проводится анализ зарубежного*

опыта в сфере экономического развития с учётом процессов цифровизации, где Казахстан занимает 36-е место в соответствующем рейтинге. Фактическое развитие информационных технологий позволило совершенствовать многие бизнес-процессы и создать добавочную стоимость в виде использования новых приложений на определенные виды деятельности. В соответствии с Целью 9 устойчивого развития «Создание стойкой инфраструктуры, содействие всеохватной и устойчивой индустриализации и инновациям», являющая программой ООН, предполагается дальнейшее расширение доступа к ИКТ. В заключении авторами даны предложения по развитию экономики Казахстана в рамках цифровизации в целом для дальнейшего экономического развития.

Ключевые слова: *цифровизация, информационно-коммуникационные технологии, валовый внутренний продукт, экономическое развитие, финансовые технологии, факторы экономического роста.*

Information about the authors:

Amantai Mukhit* *– PhD doctoral student, Kazakh National Pedagogical University named after Abai, Almaty, Kazakhstan, e-mail: mukit010@mail.ru*

Kanabekova Meruert Adilkhanovna *– Candidate of Economics, Acting Associate Professor, Kazakh National Pedagogical University named after Abai, Almaty, Kazakhstan, e-mail: kma.2372@mail.ru, ORCID ID: https://orcid.org/0009-0007-8041-2599*

Nurlikhina Gulmira Bulatovna *– Doctor of Economics, Professor, Almaty University of Humanities and Economics, Almaty, Kazakhstan, e-mail: gnurlihina@mail.ru, ORCID ID: https://orcid.org/0000-0001-8718-6984*

Oralbayeva Zhanar Zakariyanovna *– Candidate of Economics, Associate Professor, Al-Farabi Kazakh National University, Almaty, Kazakhstan, e-mail: oralbaeva_zhanar@mail.ru, ORCID ID: https://orcid.org/0000-0003-0817-5756*

Авторлар туралы ақпарат:

Амантай Мұхит* *– PhD докторанты, Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы, Қазақстан, e-mail: mukit010@mail.ru*

Қанабекова Меруерт Адильхановна *- э.ғ.к., қауымдастырылған профессор м.а., Абай атындағы Қазақ ұлттық педагогикалық университеті, Алматы, Қазақстан, e-mail: kma.2372@mail.ru, ORCID ID: https://orcid.org/0009-0007-8041-2599*

Нұрлихина Гүлмира Булатқызы *– э.ғ.д., профессор, Алматы гуманитарлық-экономикалық университеті, Алматы, Қазақстан, e-mail: gnurlihina@mail.ru, ORCID ID: https://orcid.org/0000-0001-8718-6984*

Оралбаева Жанар Закарияқызы *- э.ғ.к., қауымдастырылған профессор, әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан, e-mail: oralbaeva_zhanar@mail.ru, ORCID ID: https://orcid.org/0000-0003-0817-5756*

Информация об авторах:

Амантай Мухит* *– докторант PhD, Казахский Национальный педагогический университет имени Абая, Алматы, Казахстан, e-mail: mukit010@mail.ru*

Канабекова Меруерт Адильхановна *– к.э.н., и.о. ассоц. профессор, Казахский Национальный педагогический университет имени Абая, Алматы, Казахстан, e-mail: kma.2372@mail.ru, ORCID ID: https://orcid.org/0009-0007-8041-2599*

Нурлихина Гульмира Булатовна *– д.э.н., профессор, Алматинский гуманитарно-экономический университет, Алматы, Казахстан, e-mail: gnurlihina@mail.ru, ORCID ID: https://orcid.org/0000-0001-8718-6984*

Оралбаева Жанар Закарияновна *– к.э.н., ассоциированный профессор, Казахский Национальный университет имени аль-Фараби, Алматы, Казахстан, e-mail: oralbaeva_zhanar@mail.ru, ORCID ID: https://orcid.org/0000-0003-0817-5756*

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