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# Digitalization of the Economy of Kazakhstan as a Factor of Innovative Development

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**ABSTRACT**
At the present stage of socio-economic development, the digital economy begins to play a dominant role in public life, having a significant impact on almost all of its components. According to the World Economic Forum (WEF), digitalization has great potential for business and society and over the next 10 years could bring more than $ 30 trillion in revenue to the global economy. This suggests that the development of information and communication technologies is one of the strategic directions of economic modernization. Moreover, investments in the development of digital technologies contribute to strengthening the strategic position of any country in the long term. World practice shows that the concepts of "digital economy" and "knowledge economy" are becoming inextricable and the role of science as an objective connecting link is growing. The article considers the promising areas of research and development in the digital economy, identifies the corresponding problems in the development and the role of Kazakhstan in the international scientific and technological exchange in terms of solving digitalization problems.
***Keywords:*** *digital economy, scientific and technological development, research and development, digital technology, transformation*

## 1. INTRODUCTION

Currently, scientific and technological development – the transformation of science and technology into a key factor in the country's development and ensuring its ability to effectively respond to big challenges is considered as a strategic path for socio-economic transformation in Kazakhstan. The main resources of such development are the intellectual potential of the nation, fundamental science, technology and innovation, which are based on the latest knowledge about nature, man and society. The results obtained in the course of scientific research contribute to the development and dissemination of knowledge through the educational system and increasing the overall intellectual potential of society. The leading role of science requires appropriate approaches to forecasting and managing knowledge, including in terms of the necessary resource support. It should be borne in mind that investing in knowledge does not give quick returns, but works for the future.

## 2. RESEARCH METHODOLOGY

As a methodological approach, a systematic approach is used, within the framework of which methods of logical, statistical analysis and synthesis are provided. In the study of the development state and trends of the digitalization of the economy of Kazakhstan, empirical general scientific methods of cognition were used.
The method of observation and collection of facts made it possible to assess the current state of information and communication technologies in the Republic of Kazakhstan, to identify the existing problems. The program "Digital Kazakhstan" was used as an empirical material.

## 3. RESULTS

The proliferation of digital technologies over a long period determines the development paths of economy and society and more than once has led to fundamental changes in people's lives. The development of the digital economy is one of the priority areas for most countries - economic leaders, including the USA, Great Britain, Germany, Japan, etc. As a rule, they are characterized by a long period of realization of the "digital development agenda" and continuity of priorities - from building a basic information and communication infrastructure to formation of a coordinated policy in this area and support

programs for the widespread adoption of digital technologies.

In recent years, another wave of model transformation has also been unfolding in the social sphere, caused by the advent of a new generation digital technologies, which, due to the scale and depth of influence, are called "end-to-end" - artificial intelligence (AI), robotics, new wireless communications technologies and several others. According to experts, their implementation can increase labor productivity in companies by 40 percent [1]. In the near future, it is the effective use of new digital technologies that will determine the international competitiveness of both individual companies and entire countries that form the infrastructure and legal environment for digitalization.

Today, at a new stage in the development of digital technologies, one of the main challenges is the exponential increase in the quantity, quality and variety of relationships between organizations, citizens and socio-economic systems, accompanied by discontinuous dynamics in the number of transactions and volumes of accessed data and leading to more complex and synchronized integration of "everything with everything", the consequences of which are not yet fully realized. Such transformations will require from people new skills and competencies, readiness to use new technologies in everyday life. Of particular importance is the formation of educational programs that meet global trends, and personalized learning paths that can provide «digital literacy».

In Kazakhstan, ensuring the accelerated implementation of digital technologies in the economy and social sphere is one of the national development goals. To accelerate the pace of development of the economy of the Republic of Kazakhstan and improve the quality of life of the population through the use of digital technologies in the medium term, as well as creating conditions for the transition of the economy of Kazakhstan to a fundamentally new development path, ensuring the creation of a digital economy of the future in the long term, the Program "Digital Kazakhstan" was developed in 2017 "(hereinafter - the Program) [2].

Achieving the goal of the Program involves moving along two development vectors:

1. «Digitalization of the existing economy» – ensuring a pragmatic start, consisting of specific projects in the real sector, launching projects for digitalization and technological re-equipment of existing sectors of the economy, government agencies and developing the digital infrastructure.
2. «Creating the digital industry of the future» – ensuring long-term sustainability, launching the country's digital transformation by increasing the level of human capital development, building institutions of innovative development and, in general, the progressive development of the digital ecosystem.

The program, which will be implemented in the period 2018-2022, will provide added momentum to the technological modernization of the country's flagship industries and will create conditions for large-scale and long-term growth in labor productivity.

For the successful solution of these objectives the moderately favorable conditions have developed regarding the technological proposal. Thus, the ICT sector is one of the most dynamically developing segments of the Kazakhstani economy. For the 2010–2017 period it grew by 7 percent. The share of the production and sale of goods (services) in the ICT industry in the total GDP is 3.5 percent. The number of organizations in the ICT sector increased from 4,899 units in 2010 to 10,192 in 2018. At the end of 2018, the number of fixed Internet subscribers was 2,462.4 thousand, 99.8 percent of which with using high-speed broadband access [3].

Over the past year, the IT market of Kazakhstan has shown the significant growth, and in 2017 the market volume amounted to 685,785 million tenge (Figure 1), which is for 23 percent more than in the previous year. The reason for this is an increase in the market of IT equipment from 286,787 million tenge in 2016 to 365,095 million tenge in 2017, and an increase in the market.

However, in most developed countries, the ICT sector plays a more important role – its share in the added value of the business sector in the OECD countries is 1.6 times higher than in Kazakhstan (5.4 and 3.5 percent, respectively), and from the leaders of the technological offer – Korea, Sweden, Finland – our country is 2-3 times behind in this indicator [4].

International comparisons on the combination of factors demonstrate the promising positions of Kazakhstan in the key indicators of the development and implementation of digital technologies. So, in 2018, Kazakhstan took the 39th place in the UN ranking on the e-government development index in the world, including the 8th in Asia, the 26th in the "online service" indicator. In the key global rating of ICT development, calculated under the auspices of the UN - ICT Development Index, – Kazakhstan in 2016 occupied the 52nd place out of 175, without changing its position since 2015.

However, the average data download speed in Kazakhstan was 18.85 Mbit/s (a year earlier – 18.79 Mbit/s), while the world average reached 31.95 Mbit/s, having increased over the year from 25.38 Mbit/s. The fastest Internet is in the United Arab Emirates (UAE) (87.01 Mbit/s), South Korea (83.09 Mbits) and Qatar (82.59 Mbit/s).

Demand for digital technologies is generally characterized by positive dynamics. The level of digital development of households is already quite consistent with current trends. The proportion of the population aged 6-74 years who have the skills to use a personal computer, smartphone, tablet, laptop, standard programs, receiving services via the Internet was 79.6 percent. 83.4 percent of households have broadband Internet. The gap in the access to the Internet of urban and rural residents is narrowing: in 2013 it was 1.5 times (72.8 and 49.5 percent of households, respectively), in 2018 it was 1.2 times (79.5 and 66, 5 percent). The spread of the Internet among the population is accompanied by an increase in the intensity of its use: the share of the most active (daily) Internet users over the

past 8 years has grown by 2.3 times, reaching 60.6 percent in 2018.

Kazakhstani organizations have widely mastered the basic and relatively simple digital technologies, but only a few have carried out deep automation and restructured business processes for advanced digital technologies. Today, 82 percent of domestic organizations already use broadband Internet, 65 percent - have mastered the technology of electronic data exchange. Like the whole world, Kazakhstan is everywhere introducing cloud services into the lives of citizens. In recent years, many online projects have appeared. Starting from e-government, where you can get various certificates without leaving your home as well as register a legal entity. And ending with medical virtual cards, where you can see the results of the tests and share them with specialists.

In the republic, work is underway to optimize public services. Thus, 723 public services were analyzed, 556 road maps were approved and implemented. This work allowed to reduce paper workflow by 70 million documents and gives an indirect economic effect of more than 8 billion tenge.

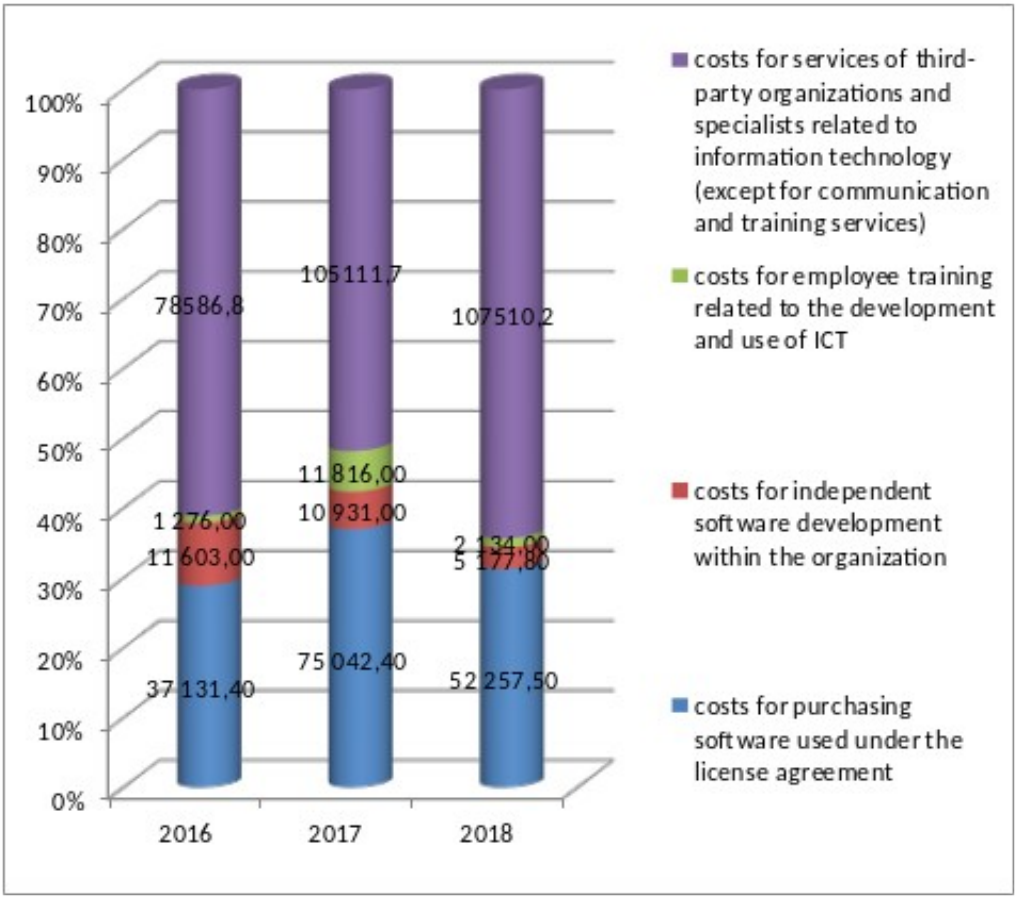
Of great importance for improving the convenience of citizens of receiving public services is the use of mobile technology. For this, a new mobile application was launched – eGov mobile, Telegram messenger and social networks are actively used. Thus, the most popular services are now provided through these mobile applications.

In 2018, for the effective implementation of advanced technologies in 5 ministries, the “digital” vice ministers were appointed, and Digitalization Offices were formed in the central and local government bodies. The economic effect of the work carried out amounted to 218 billion tenge in 2018, and for 9 months of 2019 - 305 billion tenge. 3 more “digital” vice ministers were appointed in the ministries of industry and infrastructure development, energy and internal affairs.

This year Kazakhstan launched the Smart Bridge integration platform, which will allow government agencies to quickly integrate their databases and information systems with each other. This system was developed based on the experience of Estonia and allows to eliminate bureaucracy between government agencies during the integration processes, reduce the cost of the process of connecting the systems to each other, as well as create new services for business companies.

Today, the platform hosts more than 300 services with which it is already possible to carry out accelerated integration. Moreover, private companies will also be able to integrate with the services of government agencies, creating on their basis new services for their customers.

In order to stimulate the demand of citizens and organizations for digital technologies, it is important not to be limited to measures of direct financial support, government procurement of digital technologies and “manual” management, which are characteristic of the project management model. By themselves, apart from a favorable institutional environment, they will not bring a multiplier effect and are unlikely to be able to provide a wide coverage of private companies, stimulate a massive increase in demand for digital technologies and volumes of off-budget investments, especially in the context of many years of stagnation of innovative activity. However, ICT costs are rising in Kazakhstan (Figure 1). As it can be seen from the figure, the largest share in the cost structure is occupied by the cost of paying for services of third-party organizations and specialists related to information technologies (except for communication and training services), and their amount grows from year to year. And the costs of employee training related to the development and use of ICT occupy a small share, while the experience of developed countries shows that one of the important roles in shaping the digital economy is human capital.




*compiled by the authors

**Figure 1** Cost structure for ICT in Kazakhstan in the period 2016-2018.

The speed of changes in the industry of information and communication technologies poses challenges for the domestic system of education and science.

Moreover, under the influence of digital technologies, radical changes are taking place in the organization and methods of scientific research, forms of employment in science, mechanisms for protecting and commercializing the results of intellectual activity. The rapid growth in the volume of accumulated data (both poorly structured and unstructured) entails the development of new technologies and methods for collecting, processing and storing information. The scientific community is moving to a new research paradigm: significant scientific results can be obtained on the basis of the intellectual analysis of huge data sets in various subject areas [5. 6].

Sciences are actively developing with "intensive use of data." AI and machine learning technologies have tremendous potential for increasing the productivity of science. However, the widespread use of AI methods is hindered by the need to adapt them to poorly structured data and chaotic, rapidly changing research conditions (for example, in climatology); the fears about the lack of transparency of decision-making processes in their use; the high cost of computing resources for advanced AI research; the lack of special educational and training courses in AI.

Digitalization makes science more open, encouraging researchers to adapt open access practices and collaboration through new digital tools. The formation of digital platforms for scientific research can significantly reduce the time and material costs of conducting experiments, collecting and processing information, and provide remote access to advanced scientific infrastructure. Inclusive innovations and open innovation ecosystems (open makerspaces, livinglabs, fablabs) are actively developing [7]. Effective tools are being introduced for accounting, legal protection and commercialization of the results of intellectual activity in the advanced scientific and technological fields (in terms of patentability, copyright, registration of rights to software products, industrial designs, intellectual property protection regimes), based on new opportunities of their fixation and putting into circulation (blockchain technology, etc.) as well. New research practices and initiatives are being developed to facilitate the collection of missing data through the integration of a growing number of participants into scientific activities (for example, urban planning with the use of smartphones).

Digital technologies make it possible to better take into account the opinion of society when making socially significant decisions in science, to involve the population in the processes of data collection and posing research questions (citizenscience) [8].
Of particular interest is the study of the experience of involving a wide range of stakeholders in research in South Korea. A government-sponsored research program was initiated, in which citizens first offer questions and issues for future research and then scientists develop proposals to respond to a public request.
In the Netherlands, the National Research Program was developed on the basis of 11.7 thousand questions that were proposed by a wide range of stakeholders: scientists, citizens, business [9]. Such public consultations were made possible through the use of digital platforms. The Open Air Laboratories (OPAL) initiative has been implemented in the UK since 2007. Its goal is to replenish environmental knowledge by involving the public in research. The project is funded by the British National Lottery Grant by university research teams that recruit volunteers to collect scientific data in areas such as biodiversity and environmental pollution. In total, more than 1 million people are involved in the project, including almost 4,000 schools and 2,800 organizations. The main result of this initiative is a significant expansion of the scientific base characterizing biodiversity and the state of the environment [10].

## 5. DISCUSSION

One of the main conditions for large-scale government investments in the implementation of digital technologies is the assessment of the contribution of relevant measures to economic growth in terms of cost-benefit ratios. Regardless of the scenario of economic development, guarantees of a sufficient return on such investments are required to justify the feasibility of their implementation.
The greatest effect of digitalization can be achieved in high-tech sectors of the service sector and high-tech industries, the effectiveness of which can grow at a faster pace than other sectors of the economy. Digitalization will require not only growth in investments in digital technologies, but also a radical modernization of the infrastructure of almost all sectors of the economy (with the exception of the extractive sectors, where this process has already occurred to a large extent), which will ensure high growth rates of the contribution of the capital factor to value added. In a number of sectors, the influx of highly qualified personnel will not be able to compensate for the release of low-skilled personnel, which will lead to a negative contribution of the labor factor to the growth rates of individual sectors of the economy.
The key factor in the success of digitalization processes is the availability of highly qualified personnel in sufficient volumes and relevant jobs, as well as a training system for specialists with certain competencies for the development and implementation of digital technologies.
The transition to a digital economy is significantly changing the labor market: along with the spread of information technology in all areas of life, digital skills are becoming critically important from the point of view of employers. A large-scale transformation of requirements for specialists is expected, since many operations that have not been affected by previous waves of the digital technologies adoption can be automated in the near future. The key competency that determines the competitive advantages of the companies of the future is big data analytics and the systemic link between specific sectors of the economy and higher education. The ability to work with large arrays of structured and unstructured information can improve the quality of forecasting the demand, optimize processes, etc.

## 6. CONCLUSIONS

The analysis of digitalization of the economy of Kazakhstan in the current conditions has revealed that it is necessary to ensure mass digital literacy of specialists. Namely, their development of the key competencies of the digital economy, the corresponding skills of using information and communication technologies. It follows logically from the above that, first of all, the teaching staff should be highly competent in the field of ICT.
There are a large number of educational technologies, but most of them do not take into account that training should be aimed at the future, should be taught to predict and be ahead of modern achievements in science and technology. To solve this problem, it is necessary to ensure a stable systemic relationship between specific sectors of the economy and higher education. Scientific and technical problems, to which higher school directs its efforts, should be determined, first of all, by the demands of the economy and society, and not by the inertia factor, when the same scientific or technical problem has been operated by a particular department for decades, irrespective of the possibility (or lack of opportunity) of the commercialization of the results of scientific and technical activities. This problem is essentially a systemic one. In this regard, there is a need to create an effective tool for the exchange of information between the business community, manufacturing organizations and other domestic structures that are able to select and adequately formulate real objectives that need to be solved for the innovative development of Kazakhstan.
A statement of everything is that in the existing realities of our time there is a demand for highly qualified specialists with a wide specialization not only in the field of information technology, but also in economics.

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## APPLICATION DISCLOSURE

The authors did not report any potential conflicts of interest.
This article belongs to a special section «Digital technologies in the management of socio-economic systems».
ICT - information and communication technologies.
AI - artificial intelligence.
OECD - Organization for Economic Co-operation and Development.
UN - United Nations Organization.
UAE - United Arab Emirates.

## REFERENCES

[1] Ivanov V. V., Malinetskiy G. G. Sifrovaya ekonomika: mify, real'nost', perspektiva [Digital economy: myths, reality, perspective]. M.: the Russian Academy of Sciences, 2017. p. 56.

[2] Programma "Sifrovoy Kazakhstan", utverzhdennaya postanovleniyem Pravitel'stva Respubliki Kazakhstan ot 12 dekabrya 2017 goda № 827 [Digital Kazakhstan Program, approved by Decree of the Government of the Republic of Kazakhstan dated December 12, 2017 No. 827]. Retrieved from URL:https://online.zakon.kz/document/?doc_id=37168057#pos=5;-155

[3] Statisticheskiy sbornik «Razvitiye svyazi i informatsionno-kommunikatsionnykh tekhnologiy v Respublike Kazakhstan 2014- 2018» [Statistical digest "Development of communications and information and communication technologies in the Republic of Kazakhstan 2014-2018"]. Retrieved from URL: https://stat.gov.kz/

[4] 3-iy vypusk analiticheskogo otcheta «Razvitiye otrasli informatsionno-kommunikatsionnykh tekhnologiy v Respublike Kazakhstan za 2019god». [3rd edition of the analytical report "Development of the information and communication technology industry in the Republic of Kazakhstan for 2019"].URL:https://zerde.gov.kz/press/news/%D0%BE%D1%82%D1%87%D0%B5%D1%82%202019.pdf

[5] Sagintayeva S.S., Zhanbayev R.A., Abildina A.Sh., Integration of foresight methods in the educational process aimed at improving the economic efficiency of master's and PhD theses on the basis of increasing the communication connectivity of the scientific and educational space // Advances in Economics, Business and Management Research, volume 105. 1st International Scientific and Practical Conference on Digital Economy (ISCDE 2019), pp. 38-43

[6] Sagintayeva S. S. Nauka i obrazovaniye v Kazakhstane: zarisovki na fone mirovoy turbulentnosti [Science and education in Kazakhstan: sketches against the backdrop of global turbulence], Scientific and technical journal "VESTNIK of the Almaty University of Energy and Communications", 2018. Special issue. - S.7-12. (in Russ)

[7] Gupta, R., Mejia, C., Kajikawa, Y. Business, innovation and digital ecosystems landscape survey and knowledge cross sharing, Technological Forecasting and Social Change, Volume 147, (2019), P. 100-109

[8] Litvintseva, G. P., Shmakov, A. V., Stukalenko, Ye. A., Petrov, S. P.. Otsenka sifrovoy sostavlyayushchey kachestva zhizni naseleniya v regionakh Rossiyskoy Federatsii [Assessment of the digital component of the quality of life of the population in the regions of the Russian Federation]. Terra Economicus, 2019, 17(3), 107-127. DOI: 10.23683/2073-6606-2019-173-107-127 (in Russ).

[9] Ekaterina Albats, Allen Alexander, Maral Mahdad, Kristel Miller, Ger Post Stakeholder management in SME open innovation: interdependences and strategic actions, Journal of Business Research, In press, corrected proof Available online 31 October 2019

[10] Davies, L., Bell, J. N. B., Bone, J., Head, M., P. C. L. White Open Air Laboratories (OPAL): A community-driven research programme, Environmental Pollution, Volume 159, Issues 8–9, 2011, Pages 2203-2210. https://doi.org/10.1016/j.envpol.2011.02.053