

SWOT and PEST analysis of current state and prospects for the development of artificial intelligence in Kazakhstan

Aitolkyn Ashimova ^{a*}, Aigerim Alzhanova ^b

^{a,b} *al-Farabi Kazakh National University, Almaty, 050040, Kazakhstan*

Abstract: Artificial intelligence (AI)-based technologies are beginning to play an increasing role in the economic development of countries, and many national governments are already developing strategic plans to introduce AI into all areas of society. However, to achieve the goal of becoming an AI-driven government, Kazakhstan must effectively prepare for the transformation by anticipating the various challenges associated with the introduction of AI-based technologies. The purpose of this article is to assess the potential for further adoption of AI technologies in Kazakhstan using methods such as SWOT and PEST analyses. The authors tried to conclude how favorable the conditions for technological development are from the political, economic, social, and technological points of view. For Kazakhstan to use the full potential of artificial intelligence technology and advanced analytics, a lot of joint efforts on the part of the state, private businesses and residents of the country will also be required. At the population level, we can talk about the formation of habits of using technology to facilitate everyday life, as well as the development of digital ways of working.

Keywords: artificial intelligence, SWOT-analysis, PEST-analysis, information technology, digitalization.

1. Introduction

Technology has developed and evolved considerably over the past few decades. Artificial Intelligence (AI) has entered almost every sphere of our lives, quietly gaining more and more space. Innovative instruments are released practically every other day, a plethora of scientific articles are published every day. Trying to keep up with everything is simply not realistic. Artificial intelligence-based methods, such as natural language processing with machine learning algorithms and deep neural networks, are actively used to detect and moderate content on social media platforms.

Advanced communication technologies have changed the way, nature and speed of news, and communications. There have been significant advances in artificial intelligence due to advances in algorithms, computing power, and data (Ofcom, 2019). Natural language processing is a subset of artificial intelligence that uses computer-assisted text analysis techniques (Hirschberg and Manning, 2015). Natural language processing is a computational linguistic field that uses computational methods to learn and understand human language (Hirschberg, Manning, 2015).

While the pandemic and foreign policy tensions are still factors in global disharmony that require a great deal of effort and resources to overcome complexity, the digital agenda as the foundation of the economy of the future is not off the table. And many nations continue to steadily build their technological capabilities. At the same time, the increasing influence of technological trends and the widespread use of automation leads to increased competition in the global market. The world is increasingly immersed in the field of digital control and management systems using artificial intelligence, an innovative focus of the current technological mainstream.

AI-based technologies are capable of performing a wide range of human cognitive functions, such as voice recognition, image recognition, and so on. However, to achieve the goal of becoming an AI-driven government, Kazakhstan must effectively prepare for the transformation by anticipating the various challenges associated with implementing AI-based technologies. The government will need to identify the challenges associated with AI in advance in order to prepare its workforce effectively.

This article aims to assess the potential of further implementation of artificial intelligence technologies in Kazakhstan using SWOT and PEST methods of analysis. Conclusions are drawn on how favorable the conditions for technological development are from a political, economic, social, and technological point of view.

2. Methods and materials

The main method used in this study is content analysis, which allows both quantitative and qualitative sampling. In addition, in the course of the study, authors also applied comparative analysis to evaluate the positive and negative aspects of the implementation of artificial intelligence in the developing economy, and to analyse its readiness for further technological development. The SWOT analysis in this article examines the strengths, weaknesses, potential opportunities, and threats of using electronic platforms based on various artificial intelligence tools. SWOT analysis is a method of strategic planning, which consists in identifying the factors of the internal and external environment of the organization, which is currently widely used for analysis in all areas. Each component in the SWOT analysis will be divided into four PEST aspects: political, economic, social, and technological.

3. General overview

The active implementation of digitalization ideas in almost all spheres of human society has become one of the main trends of state development in many countries in recent decades (Petrov, 2020). The term digitalization is now common in the context of rebranding a complex set of processes and problems that have been known and long discussed as issues of computerization and informatization. These issues also include topics of the development of information and telecommunication technologies, the computer revolution, information society, and knowledge society. Understanding the process of changing terminology in the public and academic consciousness allows us to see these changes from a new angle, and understand the emergence of the terms “digital society” and “digital world” (Mironova, 2021). According to the authors, the process of digitalization is also continuously linked to the development of AI technologies and their application in everyday life, as the former is a necessary prerequisite for the latter.

In the case of Kazakhstan, there is a push for the widespread introduction of public information services and the modernization of management based on information technologies at the official state level. These services include the introduction of electronic government (egov.kz) and gradual digitalization of the public space as in the state program “Digital Kazakhstan”. The authors view the process of digitalization as a preliminary step toward introduction and implementation of various instruments based on artificial intelligence.

On June 25, 2020, the state amended and supplemented the Law of the Republic of Kazakhstan dated November 24, 2015 “On

Informatization” on the regulation of digital technologies.¹ The amendment introduced novel concepts such as “intelligent robot”, “national artificial intelligence platform”, and “operator of the national artificial intelligence platform” to the legislative body. According to the Law “On Informatization”, “intelligent robot” stands for “an automated device that performs a certain action or is inactive, taking into account the perceived and recognized external environment.” The need for the legislative amendment stems from the fact that already various government organizations and NGOs in Kazakhstan have been integrating bots into their platforms to communicate with the public.

The early rollout of AI-based systems is important for both governmental and commercial organizations since these technologies constantly learn a certain skill through progressive learning algorithms. According to the OECD website, by 2022 there are seven ongoing projects related to the sphere of AI or digitalization. Among others, these programs include “Digital Kazakhstan”, “Artificial Intelligence Research and Development Support Fund”, Project on Fostering Productive Innovation”, “Pilot Project on AI for Cancer Research”, and “Smart Data Ukimet”.² The projects are aimed at attracting the world’s leading manufacturers of artificial intelligence solutions to the country; using artificial intelligence in health care; and elevating the living standards of each resident in the country using digital techniques; a set of tools to monitor economic growth and implementation of government programs. The strengthening of digitalization continues with the help of the “Digital Kazakhstan” program for 2018-2022, the purpose of which is to accelerate the pace of economic development and improve population quality of life, as well as the transformation of public administration in the future.

4. Literature review

With the advent of various technology based on AI systems, the topic of regulation of such systems is concerning academic researchers. A growing number of commentators, scientists, and entrepreneurs have expressed alarm regarding the increasing role that autonomous machines are playing in society, with some suggesting that government regulation may be necessary to reduce the public risks that AI will pose (Scherer, 2016). Other researchers turned their attention to the impacts of automation and other AI technologies on labor markets. The common estimation is that artificial intelligence can substitute capital for labor in the case of prediction tasks and may indirectly affect decision tasks by increasing or decreasing the relative returns to labor as opposed to capital for decision tasks (Agrawal, et al., 2019).

There are several studies conducted recently on the topics related to artificial intelligence in Kazakhstan. For instance, Ayapova and Skripnikova attempted to determine whether an audience would be able to distinguish texts written by automated systems from human-written ones (Ayapova, Skripnikova, 2022). The results showed that the majority of readers were able to differentiate machine-written texts, however, they were not ready for such content to appear in the Kazakhstani media. Study participants considered them to be of poor quality, incomprehensible, and logically unrelated and, in principle, respondents preferred text written by skilled journalists. Prior to that Ayapova described the features of artificial intelligence applications in journalism and concluded that the use of AI in creative content today is possible only in those news articles that do not demand a semantic load and an objective assessment of the material (Ayapova, 2021).

Media is not the only field where Kazakhstani researchers explored possibilities of AI usage in the country. For instance, Tlembayeva analyzed international legal acts and studied the activities of international organizations to conceptualize an international legal framework on issues related to the regulation of artificial intelligence. The author compared national strategies and

¹Law of the Republic of Kazakhstan dated June 25, 2020 No. 347-VI 3PK “On making amendments and additions to some legislative acts of the Republic of Kazakhstan on the regulation of digital technologies” // Information and Legal System of Regulatory Legal Acts of the Republic of Kazakhstan. – <http://adilet.zan.kz/rus/docs/Z2000000347>

² OECD. Policy initiatives for Kazakhstan. <https://oecd.ai/en/dashboards/policy-initiatives?conceptUri=http:%2F%2Fkim.oecd.org%2FTaxonomy%2FGeographicalAreas%23Kazakhstan>

legislation in the AI field of such countries as Korea, the USA, Japan, China, Russia, Kazakhstan, and members of the European Union (Tlembayeva, 2021).

The article also relies on the insight from the study conducted by Karmys and Bastaubaeva, who analyzed the process of personnel management in public administration in Kazakhstan in the context of digitalization (2018). The authors have analyzed the main political programs for the implementation of digitalization, as well as the main aspects to improve the efficiency of human resource management using the latest digital technology. One of the conclusions in the articles states that different approaches of state bodies in naming common contests and outdated ways of posting information on Internet resources contribute to complicating the search and selection of data of interest. Authors believe that the development of a unified information standard for the posting of vacancies will properly implement the policy of digitalization policy of the electronic government and will provide an opportunity to easily find the necessary information.

In connection with the topic of digitalization, another issue of heightened public and academic interest in the country is the digital divide. Economically, the whole of Kazakhstan loses from the digital divide, because hundreds of thousands of people are not involved in digitalization and are limited in their ability to realize the fruits of their labor and be participants in market relations. Digital inequality is another factor contributing to the economic gap between different regions of countries. Kurmanov et al. (2022) explore the development of a statistically valid index to assess the digital divide between the regions of Kazakhstan: resource (oil and gas) regions and regions where the service sector dominates the GRP. The authors conclude that the Digital Divide in the regions of Kazakhstan creates an asymmetry of information and knowledge and, therefore, negatively affects the production and dissemination of information and knowledge, which, in turn, negatively affects innovation processes.

5. SWOT and PEST analysis of current state and prospects for the development of artificial intelligence in Kazakhstan

5.1. Strengths

Political aspects. The “Digital Kazakhstan” program for 2018-2022, adopted in 2017 as the formulation of a new state policy, can be attributed to the strengths of the development of digital technologies in the country. The program aims to propel the process of digitalization in the country forward, obtaining considerable investment for these purposes at the same time. About \$441 million will be allocated for this purpose, and \$528 million is expected to be raised from quasi-public sector entities (there are only 6,400 companies currently operating in this sector) (Karmys, Bastaubaeva, 2018). The program covers the allocation of educational grants in the field of information technology, training and retraining of civil servants in addition to the further development of the process of universal digitalization. Before the adoption of “Digital Kazakhstan”, the “Informational Kazakhstan” program was in operation, which played an important role in increasing the availability of information infrastructure not only for corporate structures, but also for citizens of the country.³ This program also contributed to the development of the transition to the information society, the improvement of public administration, and the creation of “open and mobile government” institutions.

Economic aspects. The volume of the IT market in Kazakhstan at the end of 2020 exceeded \$1.35 billion, while the number of companies operating in the country in this industry amounted to more than 10 thousand.⁴ IT sector in Kazakhstan receives great state support, providing ample opportunities for the digital transformation of the state and commercial sectors. The main part of this large-scale development was the Digital Kazakhstan program, as well as local technology centers created to support

³ In accordance with the Decree of the President of the Republic of Kazakhstan dated February 1, 2010 No. 922 “On the Strategic Development Plan of the Republic of Kazakhstan until 2020”

⁴ <https://kapital.kz/tehnology/106988/ob-yem-uslug-v-sfere-it-sostavil-za-2021-god-646-mlrd-tenge.html>

start-ups. The introduction of systems with artificial intelligence has accelerated due to the difficulties of the past two years, analysts say. Companies in many industries have begun to actively look for ways to increase efficiency and expand the opportunities provided by artificial intelligence technologies. Most IT systems developers are already using some form of AI technology, and its application is becoming critical to successful system sales.

Social aspects. The favorable social aspects include an increase in social mobility in the country, as a raise in the well-being of the population as a whole has a positive impact on technological development. In the first Global Social Mobility Index presented by the World Economic Forum Kazakhstan ranked 38th among 82 countries presented in the study.⁵ Moreover, according to the indicator of working conditions that was also measured in the ranking the country ranked 16th, ahead of such developed countries as Canada or Australia. Another important indicator of social mobility is access to education, which Kazakhstan received 32nd place in the index. Access to education not only provides the most important social functions in society but also prepares the scientific and technological basis for future developments in all fields including digitalization and AI application.

Technological aspects. Technology based on AI instruments and big data analysis gradually becoming state priorities and the government is taking proactive measures in this direction. For instance, Nazarbayev University, one of the leading national educational and research institutions, is working with the World Bank to create a national cluster of artificial intelligence and data centers. This is an important step in creating a complete decision-making ecosystem Driven Government, whose capabilities include the analysis of a large array of industry data and will allow management decisions to be made based on big data. According to the latest E-Government Survey conducted by the UN, Kazakhstan has the highest E-Government development index in landlocked developing states and successfully digitalized such significant industrial sectors as logistics and transport (2022). The use of artificial intelligence will continue to help optimize many areas of the economy. Notable examples of successful digitalization to date include the introduction of a smart traffic system and a highway assets control program based on digital technologies.

5.2. Weaknesses

Political aspects. Despite the fact that the state is committed to allocating increased funds for technological development, corruption is widely seen as a serious problem in Kazakhstan, mainly in the area of public spending. Although difficult to measure, according to some reports, in 2014 damage caused by corruption-related offenses in the country amounted to 1 billion tenge (Shibutov, et al., 2018). Another concerning problem is the phenomenon of so-called "anticipatory institutionalization" in Kazakhstan, according to which many institutions created for certain developmental purposes do not actually work. One of the examples of such anticipatory institutionalization was the state e-learning system established and budgeted in 2012, which has not been put into operation due to the lack of widespread broadband Internet, the lack of Internet in schools, etc. (Sheryazdanova, 2020). Various media outlets showed that since the beginning of 2022, there has been a wave of corruption scandals in Kazakhstan that called for many changes made at the legislative level to increase penalties for corruption offenses.⁶ Nevertheless, corruption remains a significant problem for the country's economic and political development.

Economic aspects. One of the serious obstacles to dynamic economic development in Kazakhstan is the lack of human capital. The studies show that there is a continuous lack of qualified human capital to meet the needs of the labor market in Kazakhstan (Ramashova, 2015). In a similar vein, there is a severe personnel shortage in the IT field. According to a KPMG survey among IT managers in Kazakhstan and Central Asia, 90% of the respondents named the main problem in the implementation of digital projects -

finding the qualified personnel.⁷ At the same time, 64% of companies that participated in the survey felt the effects of the economic downturn related to the recent global pandemic, and 25% were forced to reduce the share of IT projects as a result. Due to the characteristics of the development of information technologies, the requirements for specialists in this industry are constantly increasing, which only exacerbates the problem of shortage of personnel and further development.

Social aspects. Digital inequality is one of the acute social problems in Central Asia. According to the UN E-Government Survey, nearly 50% of the population in the region lacks digital connection, and Kyrgyzstan, Tajikistan, and Turkmenistan were significantly below the global average (54%) in terms of the number of individuals using the internet (38%, 22%, and 21%, respectively) (UN, 2020). In comparison to its regional neighbors, Kazakhstan shows higher levels of digitalization, however, the vast territory (2.724 million square kilometers, ninth largest in the world) increases the cost of building telecommunication infrastructure. The country is scarcely populated and many remote cities and villages lack the infrastructure to support universal access to communication technologies. This, in turn, affects the level of overall digital literacy in the population. In 2021, the average level of digital literacy among Kazakhstanis aged between 6 and 74 was 79.6%, with the lowest level at 68.9% (Akmola region) and the highest at 87.2% (Almaty city) (Kurmanov, et al., 2022). Digital disparities between regions create potential for informational and knowledge asymmetry and may lead to the distortion of technological innovation.

Technological aspects. The application and development of AI-based technologies imply that the country must have a strong national research base, which is one of the key areas for increasing its competitiveness. Prioritization of science involves an increased infusion of funds for research and development by the state. However, the National Bureau of Statistics indicates that the share of domestic R&D expenditures in the ratio to gross domestic product (GDP) was 0.12% in 2019, and did not exceed 0.13% in 2020 and 2021.⁸ Despite the fact that the Strategic Development Plan of the Republic of Kazakhstan until 2025 aims to bring the share of spending on R&D in GDP to 1% by 2025, the low share of spending in GDP can negatively affect technological innovation, its structure and quality. Moreover, the main burden of funding domestic expenditures on R&D in Kazakhstan in 2020 fell on the national budget - 48%, which was 13.7% more than a year earlier, which indicates a low level of interest from Kazakhstani businesses in investing in the research base of the country. The reason for this may be the fact that Technological renewal at Kazakhstani enterprises occurs largely on the basis of borrowing foreign technologies and equipment. According to a survey conducted in 2017, the heads of enterprises in the real sector of the economy named suppliers of equipment, materials, components, and software as the main source of information about innovative technologies. Scientific articles and published research results on topics relevant to enterprises are not in demand (Ibrayev, 2018).

5.3. Opportunities

Political aspects. At the international forum "Digital Almaty 2021 – Digital Reloaded: The Leap to a New Reality," Kazakh President Kassym-Jomart Tokayev identified the development of artificial intelligence technology and big data analysis as one of the priorities for future sustainable economic development.⁹ He also announced plans to attract 500 billion tenge in this direction in the following 5 years. The period of the global pandemic has only accelerated the process of digitalization; this applies, for example, to remote government services, remote identification, and the opening of accounts for social benefits. And the availability of real-time data, as well as the help of machine intelligence in forecasting based on incomplete or implicit information, will fundamentally change the quality of decisions. This focus on improving decision-making is adjacent to the new concept of the "Listening State", which is being developed, the essence of which

⁵ https://economy.kz/en/Novosti_ekonomiki_Kazahstana/id=1751

⁶ Corrupt officials are being caught more often in Kazakhstan. What does this indicate? <https://informburo.kz/interview/v-kazaxstane-stalischashe-lovit-korrupcionerov-o-cyom-eto-svidetelstvuet>

⁷ Kazakhstan has an acute shortage of IT-specialists - a study. <https://ism.kz/kazakhstan-ostro-nuzhdaetsya-v-it-specialistah-issledovanie>

⁸ <https://www.ncste.kz/ru/nauka-kazaxstana-v-ozhidanii-proryiva>

⁹ <https://kapital.kz/tehnology/93211/natsional-nyy-klaster-iskusstvenno-intellekta-poyavit-sya-v-kazakhstan.html>

is a rapid and effective response to the needs of citizens. In Kazakhstan, the need to transition to the concept is caused by the crisis of public service, the level of trust of citizens in public institutions is low and public involvement is not at an appropriate level.

Economic aspects. Already at present, companies in Kazakhstan are actively introducing various AI tools into their services. These include the visual facial recognition system used by banks such as Kaspi and Jusan for the identification or issuing instant cash loans. Many banks, which by nature depend on the quality of communication with customers, have also begun to implement various virtual assistants to improve service quality and optimize resources. AI technology will become more sophisticated, and perhaps virtual assistants are learning how to perform more complex tasks. Such instruments as chatbots that have become commonplace can assist handling customer calls by reminding them to ask the right questions and providing the right information, such as customer data and product information. At the same time, there is a growing need for data analysts, because it is the quality and purity of the data that determines the success of introducing machine learning into business sectors. Data science has become an integral part of the business organization to identify the difficulties and then try to find a solution among the technology tools. Data science has become an integral part of business organization, allowing computers to be tasked with monotonous and repetitive tasks, and allowing people to focus on tasks of greater complexity, which only improves the efficiency of companies.

Social aspects. In recent years, the state has shown in every possible way that it is ready to invest in technological innovations, which later can be widely used in society. Investing in technological innovation involves certain risks; and, the government can mitigate this risk through various government programs. At the same time, international organizations also play an important role in facilitating the implementation of innovative research programs and the commercialization of developments in the interests of improving the quality and relevance of scientific research and stimulating commercial innovation. One such program is the World Bank-funded project "Kazakhstan: Fostering Productive Innovation". This project contributed to the implementation of the PneumoNet program in the healthcare sector, which uses AI solutions to quickly and accurately detect seventeen of the most pathogenic lung diseases such as pneumonia, tuberculosis, cancer and COVID-19.¹⁰ Today, the PneumoNet system is connected to 240 medical devices in 130 health care organizations and polyclinics, which conduct 30,000 screenings each month. Such programs contribute to the introduction of AI-based technologies and provide further opportunities for improvement of the well-being of the population.

Technological aspects. According to the UN study on E-Governments, for upper-middle-income country Kazakhstan has very high online service index and its online services provision are closer to the high-income countries (2020). Successes in the development of e-government services objectively show that Kazakhstan is reducing its digital divide that were discussed in the part social aspects of weaknesses in this analysis. In addition, one of the target indicators of the program "Digital Kazakhstan" is planned to place Kazakhstan in the top 30 countries on the Information and Communication Technology Development Index by 2022. Achieving this objective of "Digital Kazakhstan" will increase the efficiency of e-government and allow the state level to prepare a common coordinated activity for further innovation.

5.4. Threats

Political aspects. In recent years there has been a sharp increase in threats to information security in the banking and industrial sectors and in government information systems. And even though in a ranking of 194 countries on the level of cybersecurity of the Global Cybersecurity Index, Kazakhstan ranked 31 out of 182 places¹¹, the threat of cyber breaches looms high in the sector. Kazakhstan does not develop its own information systems, borrowing digital technologies and cybersecurity systems developed in other

countries (Karmys, Bastaubayeva, 2018). In such a situation, critical state information and communication infrastructure under high risks of attack. This combined with relatively lax law regarding cybercrime in the country are the main potential threats in implementation of future AI programs.

Economic aspects. From 2022, in Kazakhstan, foreign Internet companies selling their goods and services in Kazakhstan will have to pay value added tax (VAT) in the amount of 12 percent. It is believed that the digital tax will equalize the competitive conditions for resident and foreign companies.¹² However, one of the weaknesses of introducing a digital tax is the fact that it can harm local start-up companies at the initial stage of their expansion (Kachur, 2022). The information technology market, the most science-intensive and technologically complex industry, is one of the most import-dependent industries in Kazakhstan. Combined with the globalization of the world economy and other factors, such as the ability of businesses to exploit gaps and differences in national tax rules, new ways of doing business create tensions against traditional tax concepts and mechanisms and deprive certain jurisdictions of tax revenues.

Social aspects. The use of AI-based tools in increasingly complex production tasks, might escalate the likelihood of mass elimination of jobs due to automation increases (Sorgner, 2017). In Kazakhstan, automation to the greatest extent may affect the oil and gas and mining and metallurgical industries. For example, the system of an intelligent field, which is already involved in some industries, allows real-time visual processing of large flows of information from field facilities, their subsequent analysis in order to quickly respond and improve the production process at the fields. While the process of automation in manufacturing and changes in the workplace are incremental, even a potential reduction in jobs can have large negative effects in society in terms of the perception of AI in general.

Technological aspects. As it was noted in the section of weaknesses in the field of AI development, the country faces lack of highly skilled human capital and, at the same time, there is severe underfunding of domestic R&D expenditures in the ratio to GDP. These factors combined leads to the fact that Kazakhstan does not develop its own information systems, which makes the economy dependent on the supply of equipment, software and services from abroad. This increases the dangers of rising costs for the development and upkeep of local IT infrastructure in the event of a change in foreign policy and foreign economic conditions. Dependence on the import of information technologies, means of informatization and information protection, the use of which may harm the national interests of the country (Karatayeva, 2019).

The results of the combined SWOT and PEST analysis on the prospects for the development of artificial intelligence in the modern realities of Kazakhstan, conducted by the authors in this article, are presented in the form of a table below.

Table 1 - Results of SWOT and PEST analysis.

SWOT/PEST	Strengths	Weaknesses	Opportunities	Threats
Political aspects	Implementation of "Digital Kazakhstan" program for 2018-2022	Corruption in the area of public spending	Prioritization of AI and big data for future sustainable development	Threats to information security due to lack of domestic systems
Economic aspects	Expanding volume of the IT market in Kazakhstan	Lack of human capital	Companies actively introducing AI tools into their services	Digital taxes stifling local technological companies
Social aspects	Comparatively high levels of social	Digital inequality	Implementing AI solution into	Use of AI-based tools might lead to job

¹⁰ <https://www.vsemirnyjbank.org/ru/news/feature/2022/04/14/in-kazakhstan-artificial-intelligence-and-the-research-commercialization-behind-it-is-saving-lives>

¹¹ <https://ncsi.ega.ee/country/kz/>

¹² https://tengrinews.kz/kazakhstan_news/internet-pokupki-mogut-podorozhat-iz-za-naloga-google-457943/

Technological aspects	mobility in the country	various social aspects	losses
	Creation of the national cluster of artificial intelligence and data centers	Limited R&D expenditures in the ratio to GDP	High online service index can increase the efficiency of E-Government

6. Conclusion

The constant development and application of cognitive machine technology in all walks of life is inevitable. President Tokayev, in his election program, noted the importance of digitalization and his readiness to fully promote the spread of artificial intelligence technology. To cope with technological advances, the state must incorporate elements of AI technology into curricula and offer appropriate technology courses that prepare students to implement AI technology to equip them with the necessary skills, knowledge and thinking to facilitate the integration of AI systems. The expected social effect of the obtained results is an increase in digital culture, an improvement in the indicator of "civility. It is the values understood and accepted by each participant in the digital transformation that can smooth out resistance in a difficult period. Digital skills, their application in professional activities, readiness to innovative technological challenges are the basis of successful digital development and an integral part of the digital culture in the system of public administration.

Today, Kazakhstani developers need to create the necessary legal conditions for approbation of new technological solutions in the field of AI, which will further ensure their predictable and safe operation, as well as protect them from possible administrative barriers and, consequently, increase the level of investment attractiveness of domestic science in the international arena.

In order for Kazakhstan to use the full potential of artificial intelligence technologies and advanced analytics, it will also require a lot of joint efforts on the part of the state, private business and residents of the country. The state is responsible for creating the necessary infrastructure and environment to promote technological innovation. The role of the state in promoting the development of new AI technologies and in-depth analytics as a major customer of such technologies in the private sector is also essential. On the other hand, private businesses can make a significant difference by structuring and labeling available data for use in the implementation of AI and advanced analytics technologies. At the population level, we can talk about the formation of habits of using technology to facilitate everyday life, as well as the development of digital methods of work.

REFERENCES

- Agrawal, A., Gans, J. S., & Goldfarb, A. (2019). Artificial Intelligence: The Ambiguous Labor Market Impact of Automating Prediction. *The Journal of Economic Perspectives*, 33(2), 31–50.
- Ayapova, S. (2021). "Zarubezhnyye i kazakhstanskiye media ob ispol'zovanii iskusstvennogo intellekta v zhurnalistike [Foreign and Kazakh media on the use of artificial intelligence in journalism]." *AI-Farabi kazakh national university. Herald of journalism*, 60(2), 95-104. doi:10.26577/HJ.2021.v60.i2.10 – (In Russian)
- Ayapova, S., & Skripnikova, A. (2022). Ai and human created media texts: experiment results. *AI-Farabi kazakh national university. Herald of journalism*, 64(2), 78-84. doi:10.26577/HJ.2022.v64.i2.08
- Hirschberg, J., Manning, H.D. (2015) Advances in natural language processing. *Science*. 349(6245):261–266. <https://doi.org/10.1126/science.aaa8685>

- Ibrayev, A. (2018). Science in Kazakhstan: waiting for a breakthrough. *National Center For State Scientific And Technical Expertise*. <https://www.ncste.kz/ru/nauka-kazaxstana-v-ozhidanii-proryviva>
- Kachur, O. (2022). About the digital tax in the global economy. *Modern Economy: Problems And Solutions*. Volume 8 (2022): August. DOI: <https://doi.org/10.17308/meps/2078-9017/2022/8/135-147>
- Karataeva, L. (2019). Information Security in Kazakhstan: particular aspects, statistics and risks. *Central Asian Bureau for Analytical Reporting*. <https://cabar.asia/en/lesya-karataeva-information-security-in-kazakhstan-particular-aspects-statistics-and-risks>
- Karmys, G. S., Bastaubayeva, A. Z. (2018). "Swot and pest analysis of digitalization of HR processes in the civil service of Kazakhstan" *Issues of State and Municipal Administration*, no. 1, pp. 140-163.
- Kurmanov, N.; Niyazov, M.; Tolysbayev, B.; Kirdasinova, K.; Mukhiyayeva, D.; Baidakov, A.; Syrlybayeva, N.; Satbayeva, A.; Aliyev, U.; Seitzhanov, S. (2022) Digital Divide of Resource-Based (Oil and Gas) and Service-Dominated Regions. *J. Open Innov. Technol. Mark. Complex*. 8, 184. <https://doi.org/10.3390/joitmc8040184>
- Mironova D.W. "Ot kartin mira k tsifrovomu miru? [From World-Pictures to the Digital World?]" *Russian Journal of Philosophical Sciences*. 2021;64(4):110-121. – (In Russian).
- Ofcom Report. (2019). Use of AI in online content moderation. Available at: <https://www.ofcom.org.uk/research-and-data/online-research/online-content-moderation>
- Petrov, D.S. (2020). "Stadii tsifrovoy transformatsii predpriyatiya [Stages of digital transformation of an enterprise]". *International scientific review*, (LXVI), 39-40. – (In Russian)
- Ramashova A., Yessengeldin B., Sitenko D. (2015). Development of human potential in the innovation economy of Kazakhstan. *Public Policy Adm.* 14(2):209–220.
- Scherer, Matthew U. (2015). Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies. *Harvard Journal of Law & Technology*, Vol. 29, No. 2, Spring 2016, Available at SSRN: <https://ssrn.com/abstract=2609777> or <http://dx.doi.org/10.2139/ssrn.2609777>
- Sheryazdanova, G. (2020). Digital Kazakhstan: The Role Of It In Modern Conditions Of Kazakhstani Reality. *KAZNPU Bulletin. Series of Sociological and Political sciences*. 71, 3, 196–207. DOI: <https://doi.org/10.51889/2020-3.1728-8940.27>. – (In Russian)
- Shibutov, M., Didenko, O., Zlotnikov, S., Arystambayeva, S., Malyarchuk, N., Kovalyeva N. (2018). Report On The Prevention Of Corruption In Kazakhstan (The Viewpoint Of Civil Society). *Civic Foundation Transparency Kazakhstan*.
- Sorgner A. (2017). The Automation of Jobs: A Threat for Employment or a Source of New Entrepreneurial Opportunities? *Foresight and STI Governance*, vol. 11, no 3, pp. 37–48. DOI: 10.17323/2500-2597.2017.3.37.48
- Tlembaeva Zh. Y. (2021). On some issues of legal regulation of the use of artificial intelligence technology in the digital transformation. *Vestnik Voronezh State University. Series: Law*, (4 (47)), 331-349. – (In Russian)
- United Nations Report. (2022). E-Government Survey 2022. The Future of Digital Government. ISBN 978-92-1-12321-34
- United Nations Report. (2020). E-Government Survey 2020. Digital Government in the Decade of Action for Sustainable Development. United Nations, ISBN: 978-92-1-123210-3

