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ASSESSMENT AND DEVELOPMENT OF THE TECHNOLOGICAL POTENTIAL OF KAZAKHSTAN: PROSPECTS AND OPPORTUNITIES

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ABSTRACT. The purpose of the article is to assess and identify the possibility of developing the technological potential of Kazakhstan. The research methods include a set of principles, general scientific and special approaches, and techniques of scientific knowledge. The article proposes a methodology for assessing the technological potential of Kazakhstan developed by the author, the advantage of which is its versatility and the ability to use private indices to assess specific components or individual elements, depending on the objectives of the analysis, available information and the current situation in the country's economy. The article also presents the dynamics of the introduction of innovations in industrial enterprises of Kazakhstan and identifies the industries that are leaders in this indicator. Particular attention is paid to the technological potential of Kazakhstan through the prism of the transformation of the sectoral structure of industrial production in the country. It is noted that the growth in the share of the manufacturing industry and the reduction in the share of the energy and raw materials sector are noticeable. In addition, the structure of the high-tech sector of the processing industry of the Republic is considered and it is found that the largest share is in the production of computers, electronic and optical products. The promising directions for the development of Kazakhstan's technological potential are separately substantiated and measures to achieve the set goals are formalized.

KEYWORDS: technologies, potential, economy, Kazakhstan, market, index, industry.

Оценка и развитие технологического потенциала Казахстана: перспективы и возможности

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АННОТАЦИЯ. Целью статьи является оценка и выявление возможности развития технологического потенциала Казахстана. Методы исследования включают набор принципов, общих научных и специальных подходов, а также методов научного знания. В статье предложена разработанная автором методика оценки технологического потенциала Казахстана, преимуществом которой является ее универсальность и возможность использования частных индексов для оценки конкретных компонентов или отдельных элементов в зависимости от целей анализа, имеющейся информации и текущей ситуации в экономике страны. В статье также представлена динамика внедрения инноваций на промышленных предприятиях Казахстана и определены отрасли, являющиеся лидерами по данному показателю. Особое внимание уделено технологическому потенциалу Казахстана через призму трансформации отраслевой структуры промышленного производства в стране. Отмечается, что заметен рост доли обрабатывающей промышленности и сокращение доли энергетического и сырьевого сектора. Кроме того, рассмотрена структура высокотехнологичного сектора перерабатывающей промышленности республики и установлено, что наибольшая доля приходится на производство компьютеров, электронной и оптической продукции. Отдельно обоснованы перспективные направления развития технологического потенциала Казахстана и формализованы меры по достижению поставленных целей.

КЛЮЧЕВЫЕ СЛОВА: технологии, потенциал, экономика, Казахстан, рынок, индекс, промышленность.

Қазақстанның технологиялық әлеуетін бағалау және дамыту: перспективалар мен мүмкіндіктер

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Аңдатпа.Мақаланың мақсаты Қазақстанның технологиялық әлеуетін дамыту мүмкіндігін бағалау және анықтау болып табылады. Зерттеу әдістері қағидаттар жиынтығын, жалпы ғылыми және арнайы тәсілдерді, сондай-ақ ғылыми білім әдістерін қамтиды. Мақалада Қазақстанның технологиялық әлеуетін бағалаудың автор әзірлеген әдістемесі ұсынылған, оның артықшылығы оның әмбебаптығы және талдау мақсаттарына, қолда бар ақпаратқа және ел экономикасындағы ағымдағы жағдайға байланысты нақты компоненттерді немесе жекелеген элементтерді бағалау үшін жеке индекстерді пайдалану мүмкіндігі болып табылады. Мақалада сондай-ақ Қазақстанның өнеркәсіптік кәсіпорындарында инновацияларды енгізу серпіні ұсынылған және осы көрсеткіш бойынша көшбасшы болып табылатын салалар айқындалған. Елдегі өнеркәсіптік өндірістің салалық құрылымын трансформациялау призмасы арқылы Қазақстанның технологиялық әлеуетіне ерекше назар аударылды. Өңдеу өнеркәсібі үлесінің өсуі және энергетикалық және шикізат секторы үлесінің қысқаруы байқалады. Бұдан басқа, республиканың қайта өңдеу өнеркәсібінің жоғары технологиялық секторының құрылымы қаралды және неғұрлым көп үлестің компьютерлер, электрондық және оптикалық өнімдер өндірісіне келетіні анықталды. Қазақстанның технологиялық әлеуетін дамытудың перспективалық бағыттары жеке негізделген және қойылған мақсаттарға қол жеткізу жөніндегі шаралар ресімделген.

Түйін сөздер: технологиялар, әлеует, экономика, Қазақстан, нарық, индекс, өнеркәсіп.

INTRODUCTION. Currently, modern civilization is at the beginning of a technological revolution based on "green" technologies and Industry 4.0. The rapid pace of progress leads to the fact that many activities, industries, industrial sectors, and the skills they require are becoming obsolete. McKinsey research shows that more than 50% of

the workforce worldwide is at risk of losing their jobs due to automation, and a study by the World Economic Forum shows that 42% of the core professional skills needed today will change significantly by 2030[1] .All these facts convincingly prove the fact that the world economy is on the threshold of a huge industrial era that creates new large markets and millions of jobs, but at the same time generates previously unknown risks, forcing countries to develop industrial strategies to secure their place in the new global digital economy.

The above issues are very relevant and significant for Kazakhstan, since, firstly, the country is one of the largest markets in the field of technological innovation in Central Asia, which means it can compete in the global segment of high-tech goods. Secondly, Kazakhstan is the largest energy producer in the region, which opens up wide opportunities for it in the clean energy sector. Thirdly, huge potential for development and innovation has been accumulated in the manufacturing industry; from 2015 to 2022, the volume of production in the industry increased from 3 to 10 trillion tenge (3.5 times). The highest growth was recorded in the metallurgical industry (from 1.1 to 4.6 trillion tenges), food (from 630 billion to 1.5 trillion tenges), and mechanical engineering (from 281 billion to 1.1 trillion tenges). Gross value added in the manufacturing sector has grown over the years from 2 to 7 trillion tenge [2].

Missing or not taking advantage of the opportunity for Kazakhstan to join the new technological wave due to insufficient policy attention or lack of investment in developing the skills and potential of advanced human resources will have long-term negative consequences. 17 advanced technologies such as artificial intelligence, the Internet of Things, and green hydrogen already represent a $1.5 trillion market that could grow to $9.5 trillion by 2030, which is about three times the current size of India's economy.

In this context, no doubt accelerating Kazakhstan's transition from the second stage of development, which is based on efficiency, to the third - development based on innovation and knowledge, requires a structural restructuring of the country's industrial system. The first step that will allow us to begin identifying promising areas of innovative and technological development is to analyze and assess the current state of the country's scientific and technological potential.

The goal is to assess and identify opportunities for the development of Kazakhstan's technological potential. Among the scientists who have paid significant attention to the study of the state of scientific, technical, and innovative development of Kazakhstan over the past few years, it is worth noting in particular: [3;4]. Issues of commercialization of scientific and technical developments and methods of bringing high-tech products of Kazakhstan enterprises to new markets were considered in their publications by Moldabekova A.T., Filipp R., Akhmatova Z.B. [5].

In their research, scientists focus on the most pressing and problematic issues of technological development of the industry of Kazakhstan, such as an outdated material and technical base, a small percentage of advanced equipment and technologies, and limited financial potential, which does not allow financing innovative projects at the required level. At the same time, the managerial aspects of the introduction of advanced technologies - the presence of a clear strategy for the most progressive industries and industries, vectors of receipt and directions of innovative technologies, etc. - remain insufficiently studied. One of the central sources in our study was the work of Gokhberg and Koryagina [6], Innovation and Technology: National and Regional Development. This work provided us with a valuable theoretical basis for analyzing national and regional aspects of technological development, which allowed us to develop sound recommendations for Kazakhstan. The study emphasizes the importance of a strategic approach to innovation and develops concepts that have proven useful for assessing the state of Kazakhstan's technological potential. An important contribution to our study was the reports of the World Bank and OECD. In particular, the Global Innovation Index 2023[7] and the Science, Technology, and Innovation Outlook 2022[8] provided up-to-date data on global trends in innovation and technology. These sources allowed us to benchmark Kazakhstan against international standards, identify existing gaps, and identify key areas for improvement. Shukurov and Kozhakhmetov[9], Technological Innovation in Kazakhstan: Trends and Challenges, directly influenced our research by providing a detailed overview of current trends and challenges in technological development in Kazakhstan. This research helped us to better understand the country's internal challenges and potential, as well as assess the effectiveness of the initiatives being implemented.

To analyze successful practices, we relied on the works of Lee and Kim [10]. Successful Technology Initiatives in Emerging Economies: Lessons from South Korea and Israel, and the report by McKinsey & Company [11], Innovative Practices in Emerging Markets: A Comparative Analysis. These sources provided examples of effective technologies and innovative solutions applied in emerging economies, which allowed us to extract useful lessons and offer specific recommendations for adapting successful practices to the conditions of Kazakhstan. An important aspect of our study was the consideration of the investment climate and educational programs. The book by Porter [12], The Competitive Advantage of Nations, gave us a deep understanding of competitive advantages that play a key role in shaping the investment environment. The UNCTAD report [13], World Investment Report 2023, provided up-to-date data on global investment trends, which contributed to a more accurate analysis of the investment climate in Kazakhstan. Finally, Hargreaves and Fullan [14], Professional Capital: Transforming Teaching in Every School, and the World Economic Forum [15], The Future of Jobs Report 2021, formed the basis for analyzing educational programs and their impact on training personnel for the technology sector. These sources helped us understand how education systems can support innovative development and meet the needs of the technology market. Thus, the literature used provided a rich theoretical and empirical context for our study. The analysis of these sources allowed us to better understand current trends, identify successful practices, and develop substantiated recommendations for increasing the technological potential of Kazakhstan.

MATERIALS AND METHODS. In this study, a set of principles, general scientific and special methods, and techniques of scientific knowledge, determined by the stated purpose of the article, were used to assess the technological potential of Kazakhstan and identify opportunities for its development. In the course of the study, modern concepts of management, scientific research management, strategic management, as well as the works of domestic and foreign economists devoted to the problems of managing scientific and technological progress, in particular managing the technological potential of industries, were used. The research methods included analysis and synthesis, which consisted of using data from statistical reports, scientific publications, and specialized studies to identify key aspects and trends in the development

of Kazakhstan's technological potential. The comparative analysis was aimed at assessing the state of Kazakhstan's technological potential in the context of international experience and practices of other countries. The expert assessment method involved the opinions of specialists and experts in the field of managing scientific and technological progress and strategic management to formulate recommendations for the development of technological potential. The case stage method included a study of specific examples of the successful implementation of technological initiatives in various sectors of the economy of Kazakhstan and other countries. The data analysis method involved the use of statistical and econometric methods to process and interpret quantitative data on technological potential and its development.

We have identified the following research objectives:

1.Assessing the current state of Kazakhstan's technological potential: Analyzing the current level of development of the country's technological capabilities, including infrastructure, innovative resources, and the level of scientific and technological progress in key sectors of the economy.

2.Identifying key factors influencing the development of technological potential: Studying factors that facilitate or hinder the development of technological potential, such as government support, investment, educational programs, and innovative initiatives.

3. Comparison of Kazakhstan's technological level with international benchmarks: analysis of the country's current situation in the context of global trends and best foreign practices in order to identify the key advantages, limitations and prospects for the development of the technology sector.

4.Formulating recommendations for increasing technological potential: Developing proposals to improve strategies and policies aimed at stimulating innovative development, improving the investment climate, and supporting research and development.

5.Analysis of successful examples and practices: A study of successful cases of implementation of technological initiatives in various sectors of the economy both in Kazakhstan and abroad, to identify successful practices and possible solutions for application in local conditions.

Thus, the study was based on an integrated approach that combines a theoretical understanding of modern concepts and methods with the practical application of analysis and assessment tools, which allowed for a comprehensive assessment of the technological potential of Kazakhstan and the identification of opportunities for its development.

RESULTS AND DISCUSSIONS. First of all, it should be emphasized that the foundation of the scientific and technological progress of the state is its technological potential. It is part of the structure of the country's overall economic potential and includes a set of resources, tools and capabilities that ensure the implementation of scientific and technical activities. [16]. There is currently no single approach and agreed opinion to the interpretation of the definition of technological potential. Therefore, in the opinion of the author, within the framework of the conducted research, the category of "technological potential" should be interpreted as the ability of the system to transform the actual level of its production capabilities to a fundamentally new level to meet the needs of the market, individual economic entities and consumers that arise in the process of evolution. At the same time, the effective use of technological potential makes it possible to move from the traditional mode of production to a new, more innovative, and progressive one. The analysis of the current state of the technological potential of Kazakhstan includes a comprehensive study of several key factors that together form a picture of the current level of technological development of the country. First of all, an important aspect is the assessment of the infrastructure, which includes an analysis of the state and quality of the technical base. This involves examining the availability and condition of modern manufacturing facilities, communications systems, and logistics networks, as well as infrastructure facilities such as research laboratories and technology parks that support technology development.

In addition, it is important to take into account the level of innovation resources, which characterizes the activity in the field of start-ups, the availability and quality of research and innovation centers, as well as the effectiveness of state innovation support programs. Assessing the level of innovation resources also includes an analysis of opportunities for the commercialization of scientific developments and the introduction of new technologies into practical activities, which can significantly affect the competitiveness of the national economy.

Another critical element is the level of scientific and technological progress in key sectors of the economy. This includes a study of the degree of integration of advanced technologies into production processes and an analysis of successful examples of the implementation of innovative solutions and their impact on overall economic indicators. The analysis should cover such industries as information technology, energy, mechanical engineering, agro-industrial complex, and other key sectors of the economy, which can serve as indicators of the overall level of technological development.

Thus, a comprehensive approach to assessing the technological potential of Kazakhstan allows not only to identification of current achievements in this area but also to determine the main areas for further development, including the need to improve infrastructure, strengthen support for innovative initiatives, and increase the level of scientific and technological progress in key industries. Identifying key factors that influence the development of technological potential is an important part of the analysis aimed at understanding the dynamics of technological progress. This study covers both positive and negative aspects that can promote or, conversely, hinder the growth of technological potential. One of the main factors is government support, which includes various forms of funding and incentives aimed at stimulating scientific research and innovation. It is important to consider both direct funding of scientific and technological projects and indirect measures, such as tax incentives for companies developing new technologies or government grants for research. The quality and effectiveness of government support can significantly affect a country's ability to develop and implement advanced technologies.

Investment is another significant factor that plays a key role in the development of technological potential. The study should include an analysis of the volume and sources of private and corporate investment in technology start-ups and innovative projects. The availability of capital for research and development is directly related to the possibilities for the implementation of new technological solutions and their commercialization.

Educational programs also play an important role in the development of technological potential. The effectiveness of educational institutions in training qualified specialists capable of working with new technologies and implementing them in practice has a significant impact on the level of technological progress. The analysis should cover both higher education in science and technology and programs for additional training and retraining of specialists.

Innovative initiatives, including start-ups and new

technology companies, are another key factor. The study should consider the level of activity in the start-up sector, the presence of incubators and accelerators that facilitate the development of new ideas, as well as the interaction between scientific institutions and businesses to implement innovations in various sectors of the economy.

To assess the technological potential of Kazakhstan, the methodology is proposed, which includes the following stages:

1.Formation of a database for calculating integral indicators of technological potential in the context of various industries. The source of information for each selected block is the official statistical collections of the republic.

2. Formation of a matrix of initial data [*X*]:

$$X = \begin{bmatrix} X_{11} & \dots & X_{1j} & \dots & X_{1m} \\ X_{21} & \dots & X_{2j} & \dots & X_{2m} \\ & & \vdots & & \\ X_{i1} & \dots & X_{ij} & \dots & X_{im} \\ & & \vdots & & \\ X_{n1} & \dots & X_{nj} & \dots & X_{nm} \end{bmatrix}$$

where j is the number of features *(j = 1, 2, ..., m)*; i is the number of blocks for which it is advisable to carry out a study of the technological potential *(i = 1, 2, ..., n)*; X_{ij} is the value of the j-feature characterizing the state of the *i*-block of the technological potential.

3. Calculation of partial indices of a specific sub-block, which characterize the level of a certain aspect of each block of technological potential: for stimulating indicators: $K_s = \frac{X_{ij}}{X_{ij\max}}$, for destimulating indicators $K_{ds} = \frac{X_{ij\min}}{X_{ij}}$

4. Calculation of summary partial integral indices characterizing certain aspects of the technological potential for the *j*-sub-block of the *i*- i-block using the formula for the geometric mean of partial integral indices.

$$K_{\text{sum.part.int.ij}} = \sqrt[m]{K_{\text{part.int.1}} \times K_{\text{part.int.2}} \times K_{\text{part.int.m}}}$$

5. Calculation of group integral indices that characterize certain aspects of technological potential using the formula of the geometric mean of summary partial integral indices.

6. Calculation of the general integral index of technological potential using the formula of the geometric mean of two group integral indices that characterize certain blocks.

7. Ranking of the obtained results using partial, group, and general indices.

8. Determining the class of the level of technological potential using the general integral index by the assessment scale (Table 1).

Table 1 - Classification of the level of technological potential of Kazakhstan.

№	Technological potential level class	Meaning
I	Critical	K≤ 0,200
II	Low	0,201 ≤K≤ 0,400
III	Satisfactory	0,401 ≤K≤ 0,600
IV	Average	0,601 ≤K≤ 0,800
V	High	0,801 ≤K≤ 1,000

Note – compiled by the authors.

The presented methodology is universal and its value lies in the fact that partial indices for blocks and sub-blocks can be selected depending on the assessed industry, available information, and the tasks facing the assessor.

It is not possible to fully present the results of assessing the technological potential of Kazakhstan using this methodology within the framework of one article, so we will only outline some key points.

The processes of introducing innovations in the industrial sector of Kazakhstan were characterized by clearly expressed positive trends (Fig. 1). Since 2015, there has been a steady increase in the introduction of new technological processes and an increase in the number of names of mastered production of innovative products.

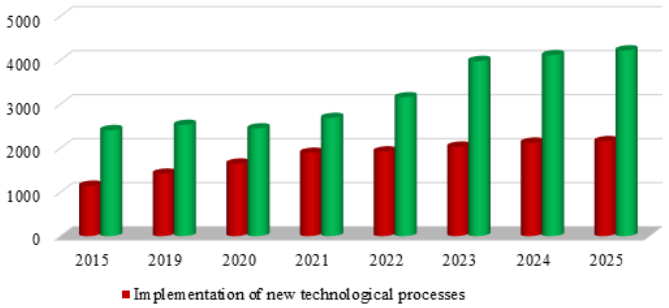


Figure 1. Dynamics of innovation implementation at industrial enterprises of Kazakhstan, units

Note – compiled by the authors.

Structural analysis of the implementation of innovations in the industrial sector showed that this process was most active in the mechanical engineering, food, chemical, and petrochemical industries. The implementation of innovations by industrial enterprises of Kazakhstan through the use of new technological processes in production was most active in the manufacturing industry [5]. Thus, in 2015-2025, on average, 97.5% of the total number of these processes in the industrial complex belonged to this sector. The transformation of the sectoral structure of industrial production in the country demonstrates the technological potential of Kazakhstan and the dynamics of its development. Thus, the growth in the share of the manufacturing industry and the reduction in the share of the energy and raw materials sector are noticeable. It should be noted that in recent years, the share of the high-tech sector has grown most dynamically among the manufacturing industries in the country. Over the specified period, it increased by an average of two to three times and was at the level of 15-30% of the total industrial output (see Table). 2.

Table 2 - Share of high-tech products in the structure of industrial production in Kazakhstan

Indicators	Years		
	1990	2003	2025
Industrial output, total, % including:	100	100	100
high-tech industry	10,3	15,4	30,3
from it:			
aerospace engineering	1,0	1,5	2,5
pharmaceuticals	1,6	2,7	3,5
office and computer equipment	2,1	4,7	7,3
communication equipment	1,9	2,3	10,2
medical equipment	3,7	4,2	6,8
other industries	89,7	84,6	69,7

Note – compiled by the authors.

According to the Eurostat classification, the high-tech sector includes such areas of economic activity as the production of basic pharmaceutical products and medicines, the production of computer, electronic and optical equipment, as well as the manufacture of satellite, tele-

communications and related equipment. Based on data from the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, an analysis of the structure of Kazakhstan's high-tech manufacturing sector for the period 2020-2025 was carried out, the results of which are presented in Table 3.

Table - 3. Structure of the high-tech manufacturing industry in Kazakhstan, %.

Indicators	2020	2021	2022	2023	2024	2025
Industry, total	100,0	100,0	100,0	100,0	100,0	100,0
High-tech activities, including:	4,23	4,05	4,14	3,98	3,97	4,23
Production of computers, electronic and optical products	1,94	2,20	2,07	2,09	2,28	2,55
Production of basic pharmaceutical products and preparations	0,70	0,85	0,76	0,80	0,81	0,77
Production of satellite, telecommunications, and related equipment	1,59	1,00	1,31	1,09	0,88	0,91

Note – compiled by the authors

Taking into account the results of the analysis, according to the author, in order to develop and strengthen the technological potential of Kazakhstan, it is advisable to implement the state industrial policy in three directions: the formation of the foundation of the seventh technological order; development of the service sector within the framework of the sixth technological structure and a gradual transition from the fifth to higher orders based on the country's raw material advantages.

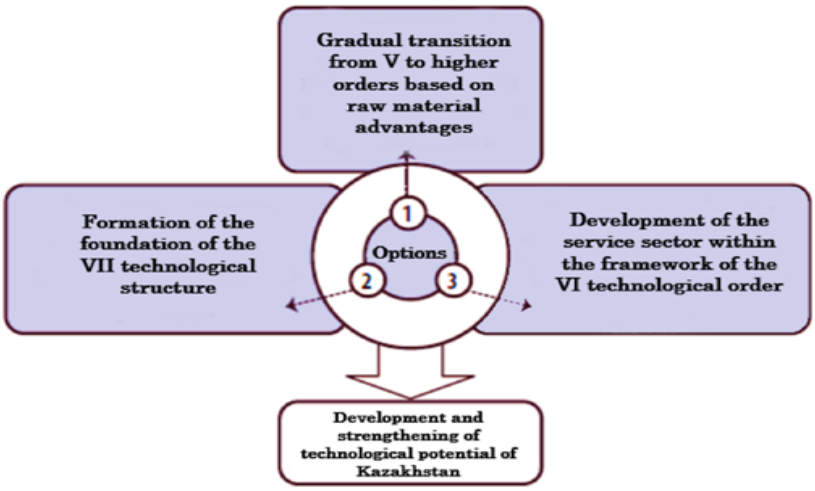


Figure 2. Promising areas for the development of Kazakhstan's technological potential.

Note -compiled by the authors.

Implementation of initiatives and projects within the three areas noted in Fig. 2 will help achieve progressive proportions between intellectual potential and other resources in the economy of Kazakhstan, as well as support the transition to creating competitive advantages in high-tech industries.

Implementation of the designated initiatives and projects involves the implementation of the following priority steps:

- provision of state financial support to industrial enterprises for the implementation of scientific research and development, which will contribute to the restoration of the factory scientific sector and enhance the implementation of scientific and technical results in industrial production processes;
- creation of favorable conditions for industrial enterprises to finance research and development related to their production activities, which requires reducing the tax burden on innovatively active business entities;
- development of a system of patent and licensing structural divisions at industrial enterprises to increase the protection of intellectual property.

Comparison of Kazakhstan's technological potential with international standards includes a comprehensive assessment of the country's position in the context of global trends and best practices of other countries. Against the backdrop of global leaders such as the United States, China, South Korea, and the European Union, Kazakhstan demonstrates a growing interest in the introduction of innovative technologies, but the level of implementation of advanced solutions in the country remains lower. In particular, in the field of artificial intelligence and other high technologies, Kazakhstan is already taking its first steps, but the scale and depth of its initiatives are significantly inferior to those observed in leading countries. An important aspect is the technological infrastructure. Leading countries of the world have highly developed scientific laboratories, technology parks, and innovation centers, which contribute to rapid technological progress. Kazakhstan is also taking steps in this direction by creating technology parks and research centers such as Astana Hub and Nazarbayev University. However, the level of infrastructure development in Kazakhstan still requires significant improvements to reach the standards of world leaders. This requires additional investment and modernization of existing resources. Scientific research in Kazakhstan is in the stage of active growth but has not yet reached the level characteristic of advanced countries. The number of publications in leading scientific journals, the number of patents, and international recognition of research in Kazakhstan remain below the indicators of leading countries such as the United States and Germany. Increasing funding for scientific research and active cooperation with international scientific communities can help

improve the situation.

In the area of educational programs, Kazakhstan also emphasizes training qualified specialists, which is reflected in the activities of educational institutions such as Nazarbayev University. Despite these efforts, the education system in Kazakhstan requires modernization and adaptation to modern requirements. This will allow graduates to acquire the necessary skills and knowledge to work in the rapidly developing technology sector, which is important for strengthening the country's position.

Therefore, a comprehensive assessment of Kazakhstan's technological potential, taking into account international benchmarks, indicates that the country has significant opportunities for further technological and innovative development. However, to reach the level of world leaders, it is necessary to focus on expanding and modernizing the technological infrastructure, increasing funding for scientific research, adapting educational programs, and introducing successful international practices. These measures will strengthen Kazakhstan's technological potential and bring it closer to the levels of leading countries.

First of all, it is necessary to develop and implement more flexible and targeted strategies to support innovative development. This may include the creation and implementation of national programs aimed at developing key high-tech industries, such as artificial intelligence, biotechnology, and nanotechnology. It is important to ensure the integration of these programs with educational institutions and research centers in order to create an ecosystem conducive to the generation and commercialization of innovative ideas. It is also necessary to consider the possibility of introducing tax incentives and subsidies for companies investing in research and development, which stimulates the private sector to actively participate in innovation processes.

Improving the investment climate is another key task. It is necessary to create a more predictable and transparent investment environment, which includes simplifying regulatory procedures and reducing administrative barriers. It is important to introduce measures aimed at protecting the rights of investors and ensuring their confidence in long-term investments. To attract foreign investment, Kazakhstan should be actively promoted as an attractive place for business, offering favorable conditions and incentives for international investors. The creation of special economic zones and technology parks that will offer investors additional benefits and resources can also be considered.

Support for scientific research and development requires an integrated approach, including increasing funding for scientific projects and developing cooperation between scientific institutions and industry. It is necessary to create conditions for interdisciplinary research that will contribute to the generation of new knowledge and technologies. An important aspect is also the development of mechanisms for the commercialization of scientific developments, which will allow researchers and entrepreneurs to effectively transform scientific achievements into practical innovations. For this purpose, programs to support start-ups funded by scientific grants and venture capital can be introduced. In addition, greater attention should be paid to international cooperation in science and technology. Participation in international scientific projects and networks facilitates the exchange of knowledge and experience and improves the quality of scientific research and its compliance with international standards. Establishing partnerships with foreign universities and research centers can be an important step in implementing best practices and technologies. An example of the successful implementation of technological initiatives in Kazakhstan is the digitalization project for the agro-industrial complex. In this project, the introduction of innovative solutions, such as crop management systems and soil data analysis, significantly increased the efficiency of agricultural production. These technologies, developed and implemented within the framework of the national program, demonstrated how digitalization can improve results in key sectors of the economy.

Another significant example is the creation and development of technology parks, such as Astana Hub, which has become a center for startups and innovative projects. This technology park provides startups with access to the necessary resources, mentoring support, and investments, which contributes to their development and successful commercialization of innovative ideas. The use of the technology park model and its structures, adapted to the specifics of local conditions, can serve as a guide for the creation of similar initiatives in other regions of Kazakhstan.

Among foreign examples, successful practices from South Korea and Israel can be highlighted. South Korea, thanks to its strategy in the field of technological development, has been able to achieve significant success in the field of information technology and electronics. The country actively uses strategies to support startups and innovative companies, including tax incentives and grants, as well as the creation of innovative clusters. Israel, in turn, is known for its achievements in the field of startups and high technology, which was made possible by state support, as well as the presence of a favorable investment environment and a high concentration of scientific research.

Successful practices from these countries can serve as examples for Kazakhstan in developing strategies to support technological initiatives. For example, introducing elements such as special economic zones for start-ups and innovative companies, as well as grant and tax incentive systems, can help accelerate technological development in the country. In addition, the creation of innovation centers and science parks that support start-ups can help develop local initiatives and attract additional investment.

CONCLUSION. The study confirmed that Kazakhstan has significant technological potential, which is currently not fully realized. In particular, this concerns such key industries as energy, manufacturing, and information. The country's technological potential has significant opportunities for growth and development, but this requires further improvement of infrastructure and stimulation of innovative initiatives.

The most important factors influencing the development of technological potential, such as government support, investment in research and innovation, and educational programs, have been identified. Effective use of these factors can significantly increase Kazakhstan's competitiveness in the international arena.

The analysis showed that although Kazakhstan has potential, its current achievements in technology and innovation are inferior to international standards. To achieve competitiveness at the global level, it is necessary to integrate the best practices of other countries and adapt them to local conditions.

Based on the analysis, recommendations were formulated for the further development of Kazakhstan's technological potential. These include strengthening government support for innovative projects, improving the investment climate, developing scientific and educational institutions, and introducing advanced technologies in key sectors of the economy.

A study of successful examples of implementing technological initiatives both in Kazakhstan and abroad allowed us to identify effective practices and approaches

that can be adapted to local conditions. These examples serve as a guide for future strategies and will help optimize the process of implementing innovations. Thus, the study confirms the need for a comprehensive approach to developing Kazakhstan's technological potential, which takes into account both domestic features and international experience.

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CLUSTER ANALYSIS OF THE DEVELOPMENT POTENTIAL OF YOUTH ENTREPRENEURSHIP IN RURAL AREAS OF KAZAKHSTAN

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ANNOTATION. Depending on the level of development of demographic, economic, and infrastructural resources, the potential for youth entrepreneurship in rural areas may vary between regions. Identifying these differences will enable the development and implementation of more locally adapted support measures for young entrepreneurs. Therefore, the aim of this study is to determine the potential for youth entrepreneurship development in the regions of the Republic of Kazakhstan through cluster analysis based on their socioeconomic and infrastructural indicators. A literature review resulted in the development of a set of indicators