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THE ROLE AND IMPORTANCE OF SCIENCE IN STIMULATING ECONOMIC GROWTH

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Abstract. In the article, author analyzes the positions of the leading countries in the world competitiveness rankings and statistical data on how much these countries spend on research and development (R&D). Comparative analysis of data for the most competitive countries of the world and for Kazakhstan has confirmed that there is a close relationship between the level of development of scientific infrastructure and the competitiveness of the country. This paper outlines the regulatory framework

in the field of science which has been adopted, amended and updated in Kazakhstan over the years of independence (between 1991 and 2021). In accordance with recent changes in legislation, the importance of research universities is growing, and it is expected that cooperation between scientific organizations and the private sector will gradually strengthen in order to commercialize the results of scientific activities of domestic scientists. But to achieve these goals, it is necessary to build an effective innovation policy of the country, the key part of which is the financing of science. In the final part of the paper author tries to formulate recommendations for solving the existing difficulties in the development of domestic science, which, in turn, can increase the competitiveness of the country and stimulate economic growth.

Keywords: science, research and development (R&D), research university, financing of science, competitiveness, economic growth.

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ЭКОНОМИКАЛЫҚ ӨСУДІ ЫНТАЛАНДЫРУДАҒЫ ҒЫЛЫМНЫҢ РӨЛІ МЕН МАҢЫЗЫ

Аннотация. Мақалада автор әлемдік бәсекеге қабілеттілік рейтингтеріндегі жетекші елдердің орындары мен осы елдердің зерттеулер мен әзірлемелерге қанша қаражат жұмсайтыны туралы статистикалық мәліметтерді талдайды. Әлемнің бәсекеге ең қабілетті елдеріне және Қазақстанға қатысты деректерді салыстырмалы талдау ғылыми инфрақұрылымның даму деңгейі мен елдің бәсекеге қабілеттілігі арасында өзара тығыз байланыс бар екенін растады. Мақалада Қазақстанда тәуелсіздік жылдарында (1991 және 2021 жылдар аралығы) ғылым саласында қабылданған, өзгертілген және жаңартылған нормативтік-құқықтық базаның қысқаша сипаттамасы берілген. Заңнамадағы соңғы өзгерістерге сәйкес, зерттеу бағытындағы университеттердің маңызы артып келеді және отандық ғалымдардың ғылыми қызметінің нәтижелерін коммерцияландыру мақсатында ғылыми ұйымдар мен жеке сектор арасындағы ынтымақтастық біртіндеп нығая түседі деп күтіледі. Бірақ бұл мақсаттарға қол жеткізу үшін тиімді инновациялық саясат құрылуы қажет, ал оның негізгі элементтерінің бірі ғылымды қаржыландыру екені белгілі. Қорытынды бөлімде автор отандық ғылымды дамытудағы қазіргі қиындықтарды шешу бойынша ұсыныстар жасайды. Қиындықтар шешімін тапса, елдің бәсекеге қабілеттілігі артып, экономикалық өсу ынталандырылады.

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РОЛЬ И ЗНАЧЕНИЕ НАУКИ В СТИМУЛИРОВАНИИ ЭКОНОМИЧЕСКОГО РОСТА

Аннотация. В данной статье автор анализирует позиции ведущих стран в мировых рейтингах конкурентоспособности и статистические данные о том, сколько эти страны тратят на исследования и разработки. Сравнительный анализ данных по наиболее конкурентоспособным странам мира и по Казахстану подтвердил, что существует тесная взаимосвязь между уровнем развития научной инфраструктуры и конкурентоспособностью страны. Статья содержит краткое описание нормативно-правовой базы в области науки, которая была принята, изменена и обновлена за годы независимости в Казахстане (за период с 1991 по 2021 гг.). В соответствии с последними изменениями в законодательстве значение исследовательских университетов растет, и ожидается, что сотрудничество между научными организациями и частным сектором будет постепенно укрепляться с целью коммерциализации результатов научной деятельности отечественных ученых. Но для достижения этих целей необходимо выстроить эффективную инновационную политику страны, ключевой частью которой является финансирование науки. В заключительной части автор пытается сформулировать рекомендации по решению существующих трудностей в развитии отечественной науки, что, в свою очередь, может повысить конкурентоспособность страны и стимулировать экономический рост.

Ключевые слова: наука, исследования и разработки, исследовательский университет, финансирование науки, конкурентоспособность, экономический рост.

INTRODUCTION

In recent years, Kazakhstan has increasingly raised issues of the development of domestic science and the real use of domestic scientific developments in practice. It is known that the developed and industrial countries pay great attention to the field of science. And this is reflected in various world rankings of the competitiveness of countries.

Since 2004, the Global Competitiveness Report (hereafter GCR) published by the World Economic Forum (WEF), ranks countries based on the Global Competitiveness Index (GCI). WEF was established in 1971 as a non-profit foundation and headquartered in Geneva, Switzerland. It is independent, impartial and not tied to any special interests. The GCI integrates the macroeconomic and microeconomic

aspects of competitiveness into a single index. The variables are organized into 12 pillars and each pillar represents an area considered as an important determinant of competitiveness (Official information from WEF).

There is another competitiveness ranking published by another world organization which is called International Institute for Management Development (hereafter IMD). IMD is an independent academic institution with Swiss roots and global reach, founded 75 years ago by business leaders (Official information from IMD). First published in 1989, annual report on the competitiveness of countries developed by the IMD is called World Competitiveness Yearbook (WCY). This comprehensive report, first of all, analyzes and ranks countries based on how they manage their competencies and resources to achieve long-term value creation. According to this ranking, competitiveness landscape is based on 20 major indicators which are grouped into 4 categories: economic performance, government efficiency, business efficiency and infrastructure (World Competitiveness Ranking). Please refer to table 1 to find out similarities and differences between above-mentioned two rankings.

Table 1. Indicators of two competitiveness rankings published by WEF and IMD

Global Competitiveness Report	World Competitiveness Yearbook
12 pillars of GCI	Competitiveness Landscape
Institutions	I. Economic Performance
Infrastructure	Domestic Economy
ICT adoption	International Trade
Macroeconomic stability	International Investment
Health	Employment
Skills	Prices
Product market	II. Government Efficiency
Labor market	Public Finance
Financial system	Tax Policy
Market size	Institutional Framework
Business dynamism	Business Legislation
Innovation capability	Societal Framework
	III. Business Efficiency
	Productivity & Efficiency
	Labor Market
	Finance
	Management Practices
	Attitudes and Values
	IV. Infrastructure
	Basic Infrastructure
	Technological Infrastructure
	Scientific Infrastructure
	Health and Environment
	Education
Source: compiled by author based on official information from WEF and IMD	

As it can be observed from the table above, a component dedicated to science is present in both rankings: in the first list it is called innovation and in the second list it is called scientific infrastructure. This means that science and the level of its development are of particular importance in determining the competitiveness of a country. The rating developed by the WEF includes more than 100 countries, while the report published by the IMD provides coverage of more than 60 countries of the world. As a rule, the leading countries demonstrate more significant investments in research and development (R&D) than the rest of the globe. The results of the study by Abaidilda (2020) also suggest that states that pay particular attention to R&D financing are on leading positions in the world. The study claims that an effective innovation policy leads to stable growth and development of the economy, as well as to the transition to a new technological level (Abaidilda, 2020).

Understanding and analyzing the experience of the most competitive countries in development of science infrastructure is important to define possible ways and opportunities for Kazakhstan to build an effective innovation policy. Science, technology and innovations are crucial in improving economic performance and social welfare. Therefore, it is important to analyze current situation and difficulties in developing domestic science in order to formulate practical recommendations for bringing it to a higher quality level.

RESEARCH MATERIAL AND METHODS

The theoretical and methodological bases of the article include studies of primarily domestic authors and researchers devoted to this topic. As a methodological basis of the research, the author applies theoretical and statistical analysis, generalization and concretization. For this research author uses the most recent available data collected from international organizations, such as the WEF, the IMD, UNESCO and official national statistics of the Republic of Kazakhstan.

RESULTS AND DISCUSSION

According to the WEF, in the GCI in 2019, Kazakhstan ranked 55th out of 141 economies, while the following entered the top 10: Singapore, the United States, Hong Kong SAR, the Netherlands, Switzerland, Japan, Germany, Sweden, the United Kingdom and Denmark, respectively (WEF).

According to the 2021 IMD World Competitiveness Ranking Results, the rank of Kazakhstan was the 35th out of 64 countries, while this list was topped with Switzerland (1st), Sweden (2nd), Denmark (3rd), the Netherlands (4th), Singapore (5th), Norway (6th), Hong Kong SAR (7th), Taiwan (8th), the United Arab Emirates (9th) and the United States (10th). It is important to highlight that economic performance in the 2021 rankings is mostly depended on innovation, digitalization, welfare benefits, and social cohesion (IMD).

In the list of the 10 top-performing countries, 7 countries are repeated in both rankings; the only thing is that they have somewhat changed positions. Therefore, it is interesting to look at the statistics on science financing in these countries. Gross

expenditures on R&D (GERD) as a share of GDP in many of the most competitive countries of the world are given in Table 2.

Table 2. GERD as a share of GDP in some of the most competitive countries of the world (%)

Country	GERD	Year
United States of America	3.08	2019
Sweden	3.34	2018
Denmark	3.00	2018
Netherlands	2.16	2018
Switzerland	3.37	2017
Singapore	1.94	2017

Source: compiled by author based on UNESCO data

The UNESCO Science Report was launched in 1993 under the title of World Science Report. Since then, UNESCO has published seven reports in the series. They are aimed to build an understanding of how science governance is shaping development agendas of countries all over the world (UNESCO information). The latest report published in June 2021, urges countries to invest more in research and innovation in order to succeed in their transition to 'green' and digital economies. In other words, future economic competitiveness of countries will depend on how successful and at the same time quick will be that transition.

UNESCO reports that 80% of countries still invest less than 1% of GDP in R&D. This despite the fact, that most regions of the world demonstrated growth in research expenditure between 2014 and 2018. Unfortunately, Kazakhstan is among those eight out of ten countries. According to the latest data presented in the National Report on science published in 2021, Kazakhstan devoted 0.13% of its GDP to science in 2020 (National Report on science, 2021). Both the UNESCO report and the National report on science document that Kazakhstan fixed the target of devoting 1% of GDP to R&D in its state programs. To exemplify, one of the priorities of Kazakhstan 2030 Strategy (1997) was to increase expenditure on R&D to 1% of GDP by 2015; and within the framework of the State Program for the Development of Education and Science for 2020-2025 (2019) this indicator planned to be amounted to 1% by 2025. The table below depicts that the State Program planned to increase science financing gradually from 0.13% in 2020 to 1% by 2025.

Table 3. Planned GERD on R&D as a percentage of GDP

2020	2021	2022	2023	2024	2025
0.13	0.15	0.2	0.35	0.49	1

Source: State Program for the Development of Education and Science of the Republic of Kazakhstan for 2020-2025

The target indicators were not achieved during the planning period, with the exception of 0.13% in 2020. Moreover the above-mentioned State Program

became invalid, and on October 12, 2021, the national project «Quality Education «Educated Nation» was approved by a government decree (adilet.zan.kz). However, this project aims to improve the quality of education at all levels of education process in the country. The need for a separate program document on the scientific and technological development of the country was declared by the President in his Message in 2020. Additionally, it is expected that the task of this document will be to involve science in solving problems at the national level (akorda.kz). It means that the results of scientific activity of scientists and researchers of Kazakhstan must solve real problems in the country's economy, thereby contributing to the economic development and improvement of the quality of life of everyone in the country. In the next message, in 2021, the President continues to consider the development of science as the most important priority, and more specifically addresses the issues of science financing. This includes ensuring stable and decent salaries for leading scientists, the introduction of direct funding for research institutes engaged in fundamental science and an increase in the time period of grant financing from 3 to 5 years (akorda.kz). The head of the state also gives a high priority to developing applied medical science and agricultural science.

During the last years, authors from Kazakhstan have often published articles on the topic of the importance of science in the social and economic development of the country. For example, Mussayeva and Yessentay (2021) hold the view that the leadership of developed countries, such as the USA, Japan, and OECD members, lies in the knowledge industry. They believe that this leadership is provided by national scientific laboratories, universities, corporate research units. These authors draw attention to the significant share of universities in R&D activities: from 25% in Europe to 15% in Japan (Mussayeva et.al., 2021).

Kazakhstan has undertaken systematic measures at the state level to solve the problems existing in the field of science. Over the years of independence (1991-2021), the country has adopted a number of laws and developed a range of state programs for the development of science.

Table 4. Regulatory framework in the field of science in Kazakhstan (1991-2021)

№	Law	Date	Main content	New details
1	On science and the state scientific and technical policy	January 15, 1992	- State budget allocations; - Equity participation on a contractual basis with interested enterprises, associations, banks and other business entities.	State budget funds primarily finance fundamental scientific research
2	On science	July 9, 2001	- For targeted funding in the form of grants for fundamental, initiative and risk-based research at the expense of the republican budget and other sources not prohibited by the	Among the basic principles of state policy: selection and promotion of priority areas of scientific and technological development in accordance with national interests and

3	On science	February 18, 2011	- legislation; - Own financial resources of the participants of scientific and technical activities; - Financial resources attracted from sponsors; - Grants received from national and foreign sponsors – both individuals and legal entities; Financing of applied scientific research can be carried out at the expense of borrowed funds. Forms of financing of scientific and technical activities: - Basic financing; - Grant financing; - Program-targeted financing; - Financing of scientific organizations engaged in fundamental scientific research.	- long-term goals of social and economic development of the country - The concept of *a research university;* - Initiation of the National Report on Science; - National center of science and technology evaluation was created to ensure the transparency and publicity of the evaluation of scientific and technological projects and programs.
4	On commercialization of the results of scientific and technical activities	October 31, 2015	Mechanisms of commercialization of the results of scientific and technical activities: - Conclusion of a license agreement and/or a contract of assignment of exclusive rights to the results of scientific and technical activities; - Creating a startup company; - Implementation (use) of the results of scientific and technical activities in own production.	The state incentive measures are provided to participants of the commercialization of the results of scientific and technical activities in the forms of - reward payments; - grants for commercialization of results; - assistance in the creation of production facilities that produce high-tech products; - professional development and retraining programs.
5	On Amendments and Additions to some Legislative Acts of the Republic of Kazakhstan on Science	March 31, 2021	Amendments and Additions to the Law adopted in February 18, 2011	- *endowment fund* within the structure of organizations of higher or postgraduate education, investment income of which will be used to finance scientific and educational activities; - Annual Award «Best scientific worker»;
Note: compiled by the author based on Legal information system of Regulatory Legal Acts of the Republic of Kazakhstan (adilet.zan.kz)				

It should be noted that the law «On science» adopted in 2011 introduced the concept of a *research university* for the first time and it even has a separate article with such a title (Chapter 3, Article 10) (adilet.zan.kz). According to the Law, the main task of the research university is the integration of scientific activity and educational process at all levels of higher and postgraduate education. In turn, the assignment of the status of a research university is carried out on the basis of a special decree of the Government of the Republic of Kazakhstan. To date, the status of a research university has been assigned to a number of educational institutions, among which there are Nazarbayev University, Kazakh National Agrarian University, Kazakh National Technical University named after K. Satpayev, Kazakh National Medical University named after S. Asfendiyarov, Karaganda Medical University (adilet.zan.kz). Research universities have been tasked with the responsibility of creating and strengthening ties in the education-science-production chain and demonstrating concrete results. However, domestic studies on this topic, as well as the opinions of doctors of sciences and professors in different fields, world and national statistical data demonstrate a lack of interaction between science and production, and a weak development of the scientific infrastructure.

To be more specific, it is worth paying attention to the figure below, which illustrates the conditions under which domestic scientists and researchers could make an appreciable contribution to the development of the economy on the example of the opinion of Doctor of Biological Sciences.

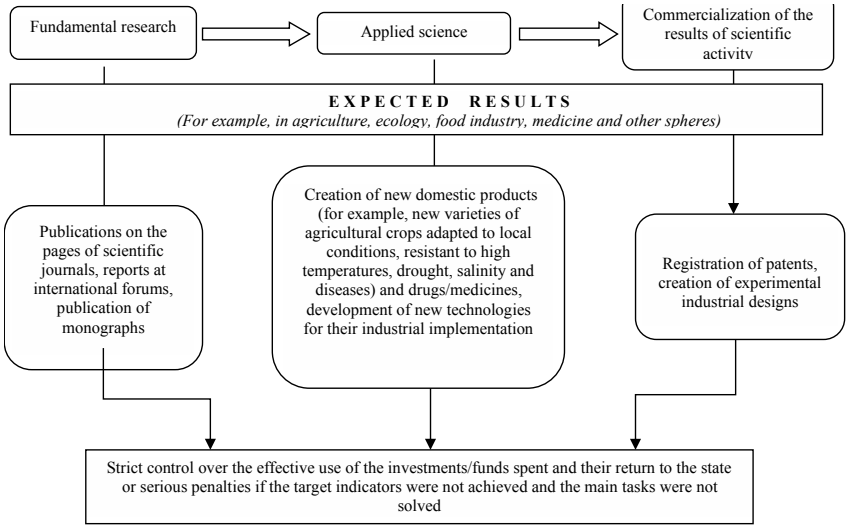

Figure 1. The chain in science

Figure 1. The chain in science

Note: compiled by the author based on Sadanov, 2022 (Kazahstanskaya pravda)

Scientific advancements and achievements of scientists should ideally bring real economic benefits and financial investments should pay off. But for this it is necessary to fundamentally increase the effectiveness of scientific research and their

early implementation into practice. There is no doubt that strict control will have a pivotal role in effective use of funds allocated as financial source of support for Kazakhstan's science.

CONCLUSION

Despite numerous initiatives taken in recent years, the country's scientific infrastructure and the level of development of domestic science still remains at a low level. There are separate mechanisms to support science as a whole, but this study revealed a weak interaction between science and production. This is also reflected in the share of science financing in GDP, and according to the recent statistics, Kazakhstan now spends less that 1% of its GDP in R&D. The findings of this study confirmed the close relationship between the volume of science financing and the competitiveness of the country.

Our country sets ambitious strategic goals, including becoming one of the 30 most developed countries in the world. If Kazakhstan strives to succeed in achieving these goals in the near future, it is necessary not only to set targets in official documents and state programs, but also to have a clear algorithm of actions for their achievement. If the collaboration of research universities with the private sector and production can be achieved, it will be possible to increase both GDP and consequently, spending on science too. It is absolutely important to diversify the sources of science financing, because the government as a single source cannot guarantee a significant increase in spending on science. Scientific discoveries and developments of domestic scientists should bring tangible benefits to the economy. And the role of the state is especially important in creating all the favorable conditions for their motivation and in preventing outflow of human capital. Through creation of material and social support for scientific staff there will be opportunities for the country to utilize knowledge, skills, expert opinion, as well as the experience of every scientist, including the potential of graduates of the Bolashak program. Shaping the future of advanced manufacturing and competitive economy is not possible without competent human resources. Every field of activity in the country must be provided with specialists and experts of the appropriate profile. Furthermore, development programs for individual industries should be based on the studies, observations or recommendations of those professionals, of course by taking into account the national characteristics and global challenges for Kazakhstan.

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