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ORGANIZATIONAL AND FINANCIAL ASPECTS OF THE SCIENTIFIC SPHERE DEVELOPMENT IN KAZAKHSTAN

This paper analyzed the state and trends in science, identifies positive and negative factors affecting the development of Kazakhstani science, identifies priority directions for its development. The article revealed the scientific potential of Kazakhstan in terms of the following indicators: the number of organizations performing R&D; the number personnel involved in the implementation of R&D; the internal R&D expenditures. Significant factors limiting innovation in Kazakhstan are low scientific potential: lack of competent staff; lack of internal R&D expenditures. It revealed that in Kazakhstan with the existing system of financing science, there is no opportunity to increase the Research and Development (R&D) expenses. The results allowed concluding that it is necessary to strengthen the relationship between the science and real sector, commercialization of the scientific activities' results on the basis of the public-private partnerships.

Keywords: science, scientific sphere, higher education, entrepreneurship, R&D, innovation, innovative activity, innovative personnel, R&D expenses, science and business.

Кілт сөздер: ғылым, ғылыми сала, жоғары білім, кәсіпкерлік, ҒЗТКЖ, инновация, инновациялық қызмет, инновациялық кадрлар, ҒЗТКЖ-ға арналған шығындар, ғылым және бизнес.

Ключевые слова: наука, научная сфера, высшее образование, предпринимательство, НИОКР, инновация, инновационная деятельность, инновационные кадры, затраты на НИОКР, наука и бизнес.

JEL classification: O 31, O 33

Introduction. Implementation of the most important Kazakhstani strategic documents, such as the Kazakhstan-2050, the 100 concrete steps to implement the 5 Institutional Reforms, the Third Modernization of Kazakhstan and the Moder-nization of Public Consciousness, Entry the club of top 30 most developed countries of the world, accelerated and high-quality economic growth, innovative and high-tech development requires:

– mobilization of the country's research potential and international research implementation;

– support the research system and technological modernization.

In this regard, an urgent task is to analyze the state and trends in science, identifies positive and negative factors affecting the development of Kazakhstani science, identifies priority directions for its development.

The objectives of the article:
– analysis of scientific potential;
– analysis the financing of R&D;
– conclusions and recommendations for scientific sphere further development.

Brief literature review. In Kazakhstan, the enterprises' research and innovation activities remain very low. So, according to many researchers [1-3], innovation has not a positive and significant effect on entrepreneurship development.

Kazakhstan's economy is characterized by unstable dynamics and is still mainly focused on the extractive industries, which does not allow for a transition to a new qualitative level of development, increasing competitiveness and positive

structural changes [4].

According to many researchers [5-6], at any link in the science-production cycle, various obstacles may arise that inhibit the innovation process or reduce the effectiveness of innovation.

These include:

– corruption in the conduct of competitions and research orders;

– monopolies in science and industry;

– unhealthy competition in the markets for scientific products, investment and consumer goods.

According to scientists [7-9], education and science are the main factors of the economy. The articles of famous scientists [10-12] emphasize that without a corresponding higher education and modern research institutions, with qualified and educated people, no country is able to ensure real sustainable economic development.

Thus, it is necessary to clearly define innovative goals, create institutional conditions, and mobilize the scientific potential for the transition to a new type of development.

Main part. Let's analyze the main factors in the scientific sphere development in Kazakhstan.

According to the Bureau of National Statistics, 386 organizations were engaged in R&D in 2019, which is 41 units more than in 2012 (345 organizations) (table 1).

Table 1

The total number of organizations performing R&D by sector of activity, 2012-2019, units*

Organization, sector	Years								Modification 2019/ 2012 (+/-)
	2012	2013	2014	2015	2016	2017	2018	2019	
Entrepreneurship	105	110	149	154	149	146	149	158	53
Higher education	121	112	105	103	103	99	95	92	-29
Government	69	78	101	94	100	101	103	100	31
Non-profit	50	41	37	39	31	40	37	36	-14
Total	345	341	392	390	383	386	384	386	41

Compiled according to the Bureau of National Statistics

Despite the fact that the scientific organizations network is undergoing intensive development in Nur-Sultan city, Almaty city continues to be the leader in science and innovation in Kazakhstan. 138 organizations were engaged in R&D in Almaty in 2019 or 36% of all research organizations in Kazakhstan.

In table 1 the data also indicate that 41% of the total number of organizations belonged to the entrepreneurial (business) sector in 2019, which includes production/sale enterprises of goods or services.

The number of organizations in the entrepreneurship sector increased by 53 units in 2019 compared to 2012.

The higher education sector is the second largest number of scientific organizations. The higher education sector includes higher education institutions, regardless of the legal status, sources of their financing, associated with them or experimental stations and clinics, research institutes that are under their control. 92 units in higher education sector were engaged in R&D in 2019. The number of organizations in the higher education sector decreased by 29 units compared to 2012.

The Government sector is represented by ministries that ensure the satisfaction of the society' and public administration needs. Non-profit organizations, mainly or fully financed and controlled by the State, are also included in this sector. The number of organizations in Govern-

ment sector has an extensive network of R&D. Their number of units in this sector is not stable and varies from year to year. So, in 2019, Research and Development was carried out by 100 units. This is 31 units more than in 2012.

Non-profit sector is the smallest number of organizations performing R&D in 2019. Non-profit sector includes organizations that do not aim at making a profit (foundations, professional societies, public organizations, etc.). Their number was 36 units in 2019.

Thus, in 2019 compared to 2012 the reduction of organizations occurred in the non-profit sector and in the higher education sector, by 14 and 29 units, respectively.

The number of organizations performing research in the higher education sector reached a minimum in 2019, decreasing to 29 units compared to 2012.

In 2019 21 843 people were involved in R&D, including 14 124 research experts (table 2).

Table 2

Personnel involved in the implementation of R&D, 2012-2019, (people)*

Name	Years								Modifi-cation 2019/2012 (+/-)
	2012	2013	2014	2015	2016	2017	2018	2019	
Researchers	13494	17195	18930	18454	17421	17205	17454	14124	630
Technicians	4731	3586	3882	3692	3326	2797	2836	2734	-1997
Other	2179	2931	2981	2589	2238	2079	2088	1985	-194
Total	20404	23712	25793	24735	22985	22081	22378	21843	1439

Compiled according to the Bureau of National Statistics

We can see from the data in table 2 that from 2012-2014 the dynamics of the personnel number engaged in R&D is positive. However, since 2015 the science sphere in Kazakhstan has suffered a radical reduction in staff amid increased crisis phenomena in the economy and, as a result, a reduction in the level of wages. Organizations involved in technical testing, engineering surveys and architectural bureaus were most affected. Also, it should be noted that the decrease in personnel in the science sphere follows the decrease in the contribution of the industry to economic growth.

So, next we examine in more detail the problem of organizing the financing of R&D carried out from the state budget and the private sector (table 3).

Table 3

Internal R&D expenditures by main sources of financing, 2012-2019, (mln tenge)*

Name	Years								Modification 2019/ 2012 (+/-)
	2012	2013	2014	2015	2016	2017	2018	2019	
State budget	30 712	39 273	43 343	40 719	35 440	35 979	32 145	35 966	5254
Own funds	14 073	17 836	19 858	25 356	26 338	28 187	34 251	37 710	23637
Other financing	3467	4563	3145	3227	4770	4717	5827	4568	1101
Total	51 253	61 672	66 347	69 302	66 600	68 884	72 224	82 333	31080

Compiled according to the Bureau of National Statistics

In table 3 we can see than more than half of all internal R&D expenditures are covered from the State budget.

So, the internal R&D expenditures in 2019 amounted to 82 333 million tenge, of which:

– 37 710 million tenge – own funds;

– 35 966 million tenge – total budget funds;

– 4 568 million tenge – other financing.

The volume of budgetary funds in all internal R&D expenditures in 2019 compared to 2012 increased by 31 080 million tenge.

The reduction of budgetary funds in financing R&D since 2015 has forced organizations to use their own funds more actively. As a result, the share of financing from own sources in 2019 compared to 2012 increased by 23 637 million tenge. In addition, a decrease in government spending on Research and Development forced organizations engaged to look for other sources of funding, such as loans, the share of which increased by 1 101 million tenge in 2019 compared to 2012.

Among the main sources of funding science sphere there are almost no business representatives. According to the OECD for US and EU companies the share of the real sector in total Research and Development expenses at the level of 60-65% is optimal. And at the same time, financing of R&D in many developed and developing countries at the level of 60-75% is carried out precisely by the entrepreneurial sector of the national economy.

Thus, an analysis of R&D expenses indicates that with the existing system in financing science sphere in Kazakhstan there is no opportunity to increase the expenditures on R&D.

The main consumer of R&D is the manufacturing sector, which has been reducing its activity recently. This affects negatively in production.

Table 4 presents data on internal R&D expenditures by types.

Table 4

Internal R&D expenditures by types, 2012-2019, (mln tenge)*

Name	Years								Modification 2019/ 2012 (+/-)
	2012	2013	2014	2015	2016	2017	2018	2019	
Internal R&D expenditures, total	51 253	61 672	66 347	69 302	66 600	68 884	72 224	82 333	31 080
Fundamental research	12 063	18 197	15 260	15 838	13 809	10 785	10 629	11 044	-1 019
Applied research	28 898	33 369	38 394	36 959	35 841	40 909	43 278	52 620	23 722
Experimental development	10 291	10 106	12 692	16 505	16 949	17 188	18 317	18 666	8 375

*Compiled according to the Bureau of National Statistics

The data in table 4 show that the overall reduction in internal R&D expenditures most negatively affected the funding of fundamental research. In 2019 their volume decreased by 1 019 million tenge compared to 2012. In this period, the applied research expenditures increased by 23 722 million tenge. It should also be noted that the amount of Experimental development expenditures in 2019 compared to 2012 increased by 8 375 million tenge.

Conclusion. The science is an essential part of the national heritage, a fundamental resource for the country's economic and social transformations. The country's science and scientific potential largely determine its place in the global community, in solving internal problems.

Significant factors limiting innovation in Kazakhstan are low scientific potential:

– lack of competent staff;

– lack of internal R&D expenditures.

Since 2015, the scientific sphere in Kazakhstan has been undergoing a radical reduction in staff amid growing crisis in the economy and, as a result, a reduction in the level of wages.

Among the main sources of funding for science there are almost no business representatives. According to the OECD, at present, for US and EU companies, the share of the real sector in total Research and Development expenses at the level of 60-65% is optimal. Financing of research in many developed countries of the world at present at the level of 60-75% is carried out precisely by the entrepreneurial sector.

An analysis of R&D expenses indicates that with the existing system in financing science sphere in Kazakhstan there is no opportunity to increase the expenditures on R&D. In addition, the main consumer of R&D is the manufacturing sector, which has been reducing its activity recently. This affects negatively in production.

In this situation, we believe that it is necessary to strengthen the relationship between the science and real sector, commercialization of the scientific activities' results on the basis of the public-private partnerships.

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**ҚАЗАҚСТАННЫҢ ҒЫЛЫМИ САЛАСЫН ДАМЫТУДЫҢ ҰЙЫМДАСТЫРУШЫЛЫҚ
ЖӘНЕ ҚАРЖЫЛЫҚ АСПЕКТІЛЕРІ**

Аңдатпа

Мақалада ғылым саласының қазіргі жағдайы мен негізгі тенденцияларына талдау жасалып, қазақстандық ғылым мен инновациялық салаға әсер ететін оң және теріс факторларды анықтау қарастырылған. Еліміздің ғылыми саласын одан әрі дамыту үшін ұсыныстар ұсынылды. Мақалада Қазақстанның ғылыми әлеуеті келесі көрсеткіштер бойынша қарастырылады: ғылыми ұйымдардың саны, ғылыми кадрлардың саны, ҒЗТКЖ қаржыландыру көлемі мен көздері. Зерттеу нәтижелері бойынша Қазақстандағы инновацияларды шектейтін факторлар анықталды: құзыретті персоналдың жетіспеушілігі және ҒЗТКЖ-ға жұмсалатын шығындардың төмен деңгейі. Қазақстанда ғылым мен зерттеулерді қаржыландырудың қолданыстағы жүйесі кезінде ғылыми-зерттеу және тәжірибелік-конструкторлық жұмыстарды орындауға арналған шығындарды ұлғайту мүмкіндігі жоқ екені анықталды. Алынған нәтижелер қазіргі жағдайда ғылым мен экономиканың нақты секторымен өзара байланысын күшейту, мемлекеттік-жеке меншік әріптестік негізінде ғылыми қызмет нәтижелерін коммерцияландыру қажет деген қорытынды жасауға мүмкіндік берді.

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**ОРГАНИЗАЦИОННЫЕ И ФИНАНСОВЫЕ АСПЕКТЫ РАЗВИТИЯ
НАУЧНОЙ СФЕРЫ КАЗАХСТАНА**

Аннотация

В статье проводится анализ состояния и основных тенденций в науке, выявление позитивных и негативных факторов, влияющих на казахстанскую науку и инновационную сферу. Предложены рекомендации для дальнейшего развития научной сферы страны. В статье научный потенциал Казахстана рассматривается по следующим показателям: количество научных организаций, численность научных кадров, объем и источники финансирования НИОКР. По результатам исследования определены факторы, ограничивающие инновации в Казахстане: нехватка компетентного персонала и низкий уровень расходов на НИОКР. Полученные результаты позволили сделать вывод, что в сложившейся ситуации необходимо усиление взаимосвязи науки с реальным сектором экономики, коммерциализация результатов научной деятельности на основе государственно-частного партнерства.