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## Current issues of financing research and development in Kazakhstan

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**Abstract.** *The article examines the research and development work's (here and after - R&D) financing sources and changes in its cost. It examines the main indicators of science and development in Kazakhstan and provides an overview of the sources dedicated to this problem.*

*Reviewing the issues of R&D financing the conclusion that it is necessary to activate and attract private capital in Kazakhstan's practice has been made. The R&D finances to a greater extent free of charge, but there is a low degree of its implementation effectiveness. As far as the share of private business financial resources in R&D higher, the greater an effect of its returns in GDP. The private investments return to GDP is higher due to their profit orientation, flexibility and more active participation in innovative projects. Private companies try to choose highly promised projects and turn out to be more productive returns. The paper presents: a correlation analysis showing the dependence of the GDP and domestic R&D costs; a forecast of further growth in domestic R&D costs. The growth of R&D costs is an important aspect for the formation of a knowledge-based economy, as well as increasing the level of R&D costs to the industrialized countries level.*

**Keywords:** *R&D, forecast, GDP, science impact, economics, cost, correlation.*

## **Introduction**

Currently modern scientists consider the development of knowledge-intensive production as the most important factor in economic growth. Thus, those countries with the highest rates of development of knowledge-intensive industries become intellectual leaders, which in the future allows them to become leaders in the overall ranking of world highly developed countries. These processes are also important for accelerating the global economy globalization [1].

Many developed countries regularly invest billions of dollars to support new technologies in order for their economies to be competitive in the global market, and then introduce them into economic activities. In turn, this significantly increases the population standard of living by optimizing working conditions and quality education.

For Kazakhstan, achieving the goal of becoming one of the developed, competitive countries is associated with solving a number of tasks, including overcoming commodity dependence and increasing the share of non-primary exports to 70%, creating a diversified industrial sector, increasing R&D costs to 3% of GDP and the formation of a knowledge-based economy, the development of human capital [2].

The «digital era» has made fundamental changes not only in human life, but also affected all spheres of social production in general. A person currently consumes not only «visible products», but also invisible ones, and these are knowledge and information. It also has given a powerful impetus to the development of the era of the «knowledge-based economy» (here and after - NBE). In turn, the NBE can give countries a chance to open up new opportunities.

During NBE, there is a qualitative transformation of the production factors. Knowledge and information are becoming the leading factors of production power, with high-tech industries becoming key industries. Also, knowledge and new technologies are systematically included in conservative industries, as a result of which adjacent or integrated industries (energy, communications, medicine, transport) have appeared. Intellectual resources open up opportunities to create material values for people with limited natural resources.

Deciding on allocating funds for R&D one of the key issues is the return on investment – innovations are characterized by a high level of uncertainty, and the well-known argument that the lack of a result in science is also a result does not seem too convincing from the point of view of the authorities allocating financial resources. Therefore, it is necessary to analyze the relationship between the allocated funds and the country's economic development indicators [3].

Currently, Kazakhstan has lack of a methodology, information and statistical base for analyzing the processes of using scientific knowledge in industry. This not allow getting a complete picture of the potential and dynamic of the knowledge-intensive economy. The problems of accelerated technological modernization are associated with the formation of a knowledge-intensive industry and knowledge-intensive services. OECD countries give a separate place to the study of processes in the field of «knowledge intensive services».

There have not yet been any special studies devoted to the in-depth study of this problem in Kazakhstan [4].

**Problem statement.** The high-tech technologies promotion is one of the drivers of economic development. Advertising new technologies and the digitalization of many areas, the attention of both representatives of science and government authorities to knowledge-intensive production has been focused recently.

The introduction of high-tech technologies into the production sector is relevant due to their ability to stimulate economic development, which also reflected in the population living standards and an increase in some intensive indicators.

Based on this, the purpose of this work is analyzing the link between GDP and domestic R&D expenditures in Kazakhstan.

The cost of R&D is the key indicator of the country's innovative progress. Being a relative value, they are calculated by adding up all R&D costs, both public and private, during the year.

Developed countries spend billions of dollars supporting breakthrough equipment, which are subsequently introduced into their business practices. This allows the country's economies remain competitive. By growing labor productivity, it is possible to offset disadvantages such as the lack of its own natural resources, small territorial size and an increasing number of aging populations. In general, by improving working conditions it is possible to improve the citizen's standard of living, the possibility of receiving high-tech medical care, and modern advanced education by them. Under the influence of new information and technologies the transformation of economic activity is constantly taking place [5].

**Methodology.** General scientific research methods as following: generalization, statistical methods, comparative and correlation analysis, as well as the forecasting method are used. Doing economic analysis, such techniques as comparison, grouping were applied. Using economic and mathematical methods (the method of correlation and regression analysis, modeling, etc.) calculations were carried out.

**Results/discussion.** Korchagova L.A. et al., Tapscott, D. considered the concept, structure of a knowledge-intensive economy, the impact of knowledge-intensive and innovation on the development of the economy in the state [1, 6]. In particular, touching upon the issues of the complexity of the knowledge-intensive sphere, its components and the classification of industries according to the degree of technology and knowledge-intensive, as well as the impact of information technology on its development. Sagieva R.K. and others studied the issues of qualitative characteristics of the knowledge-intensive economy, as well as indicators for estimating the cost of knowledge production [7]. Datsayeva R.S. and others considered the history of the introduction of the concept of NBE and the possibilities of its formation on the example of Russia and China [8]. Similarly, Li, J. and others considered «comparing the economic power of China and the United States from the point of view of the knowledge economy. The authors conceptualize knowledge-based economic power, establish a system of indicators for comparing it between China and the United States, and conduct comparisons

and analyses based on them» [9]. George, E. S. In his work, he argued that education is the key to further growth of the national economy [10]. Florentina C. and others considered the knowledge management process impact on the economy, namely how the correct use of information resources affects the socio-economic result of organizations [11].

Hadad, S. considered the impact of financing research and innovation on economic development. In particular, the role of investments in education, support for entrepreneurship, and the creation of new technologies [12]. Podra, O. studied the intellectual resources and human capital impact on the country competitiveness and its further innovative progress [13].

Alabugin A.A. and Mukhortova N.A. studied the relationship between the indicator of the problem of assessment and the quality of regulation of knowledge-intensive development processes [14]. Gubachikov B.A. et al. considered knowledge and information as the fourth factor of production in the economy [8]. Dnisev F.M. and others presented forecast scenarios for the development of the knowledge-based economy in Kazakhstan, in particular, the relationship between the level of R&D expenditures and GDP [4]. Proposals are also given for the development of effective methods of financing high-tech industries in Kazakhstan. Satybaldin A.A. and others investigated in their work the trends of the expansion of the service sector in the world and Kazakhstan and the prospects for industrial development, in particular, the knowledge sector of intensive services [15]. Sagieva R.K. and Zhuparova A.S. considered the problems of lack of financing and its inefficient use of R&D in Kazakhstan [16]. The authors also conducted an analytical review of the literature studying the knowledge-based economy, the problems of effective financing of R&D in foreign countries, and the mechanism of state support [7].

A number of domestic and foreign authors such as: Moldabekova A., Dmitriev S.G., etc., Raschenya, T. F., Sysoeva M. S. in their works identify the relationship between R&D costs and GDP using regression analysis and predictive modeling methods [17, 3, 18, 5].

According to the data, the top five countries with the highest R&D spending include all major economies: United States, followed by China, Japan, Germany and the Republic of Korea. However, the rating changes dramatically if we consider it in accordance with the indicator that is used to monitor SDG 9 (R&D expenditures as a percentage of gross domestic product (GDP)). According to this indicator, the Republic of Korea, which is the world leader, comes out on top, followed by Israel, Japan, Finland and Sweden [19].

However, R&D spending remains low in most countries of the world. Many regions, including Kazakhstan, set their own goals for R&D spending. Thus, our country, in the Concept of Development of Higher Education and Science in the Republic of Kazakhstan 2023-2026, in order to increase the global competitiveness of Kazakh science and increase its contribution to solving applied problems at the national level, plans to gradually increase R&D costs from all sources to 1% of GDP [4].

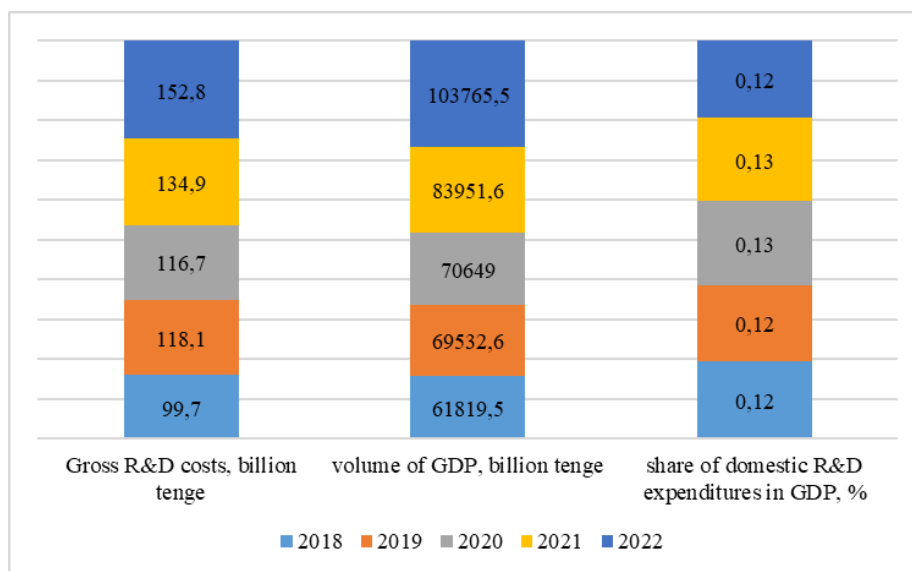


Figure 1 - Kazakhstan R&D costs [20, 21]

Figure 1 shows the positive dynamics of R&D financing costs in the Republic of Kazakhstan for 2018-2022. At the same time, in 2022, the increase in gross R&D expenditures amounted to 53.1 billion tenge (53%), GDP by 41,946 billion tenge (68%), and the share of domestic R&D expenditures in GDP remained unchanged at 0.12%.

In the countries with the most developed economies producing industrial products of the fifth and higher technological levels, the share of research and development costs reaches 78% [22].

The internal current costs of research and development are the actual costs of the state, expressed in monetary form, which are aimed at carrying out research and development on the territory of the country [22].

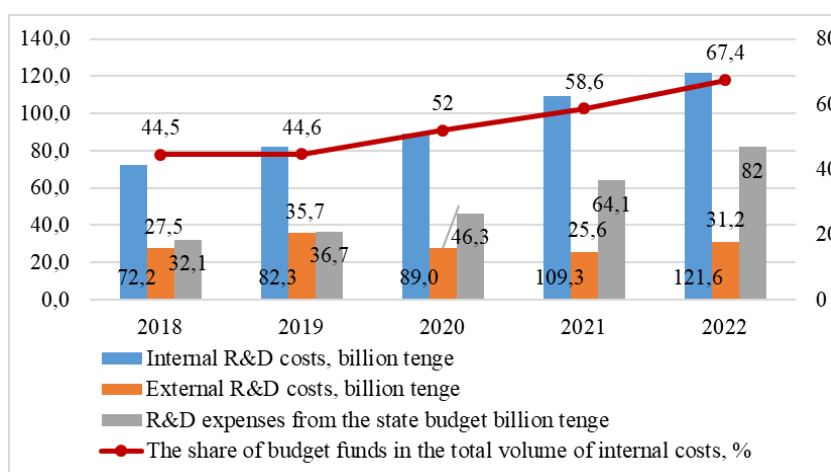


Figure 2– Kazakhstan Internal and external R&D costs [20, 21]



From Figure 2 a growth trend in the following indicators: internal R&D costs increased by 49.4 billion tenge (68%), external costs 3.7 billion tenge (13%), R&D costs from the state budget 49.9 billion tenge (155%) and the share of budget funds in total internal costs increased by 22.9% is seen.

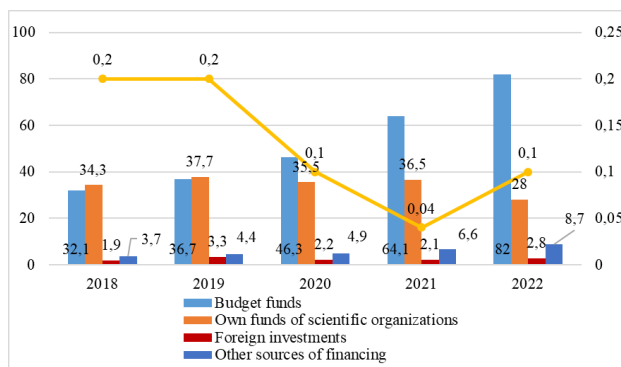


Figure 3 - Internal R&D costs by sources of financing [20]

Figure 3 shows the dynamics of domestic R&D expenditures by sources of financing for 2018-2022, while an increase in positions: budget funds – 49.9 billion tenge (255.4%); foreign investments – 0.9 billion tenge (147.3%); other sources of financing – 5 billion tenge (235.1%) are obvious. The decrease traced by positions: own funds of scientific organizations – 6.3 billion tenge (81.6%); Loans from banks – 0.1 billion tenge (50%).

In 2022, the largest share in 2022 of the source of R&D financing is budget funds of 67.4%, i.e. the state. Next, in descending order are: own funds of scientific organizations – 23%, other sources of financing – 7.2%, foreign investments – 2.3% and loans from banks – 0.1% [24].

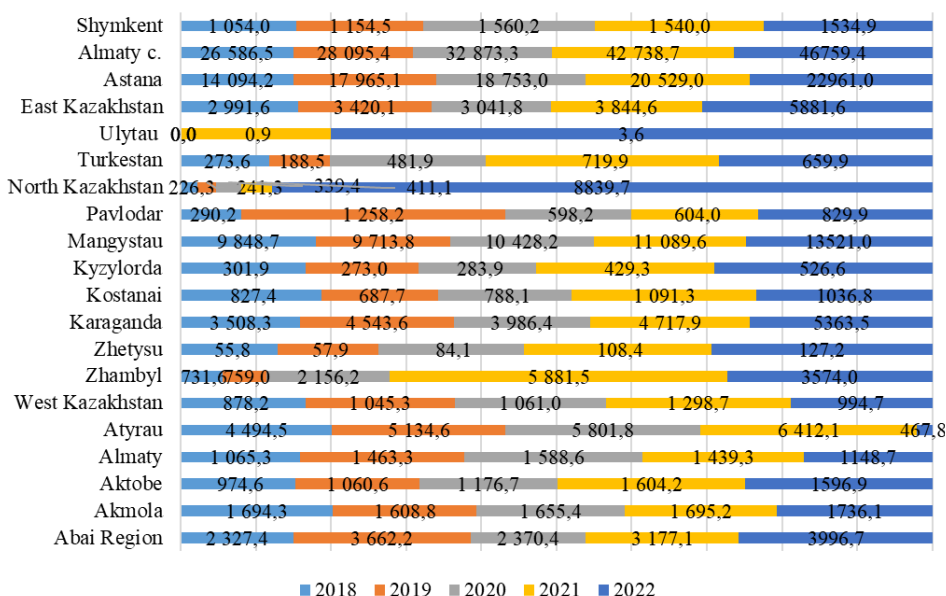


Figure 4 - Kazakhstan Internal R&D costs by region, million tenge [23]

From Figure 4, we see that the largest share of domestic R&D expenditures of the Republic of Kazakhstan in 2022 by region: Almaty city 38.4% (46,759.4 million tenge), Astana city 18.8% (22,961.0 million tenge), Mangystau region 11.1% (13,521.0 million tenge). In contrast, the lowest share of internal R&D costs is observed in the regions of Ulytau 0.002% (3.6 million tenge), Zhetisu 0.1046% (127.2 million tenge), Atyrau 0.3848% (467.8 million tenge). The low level of R&D costs in the regions of Ulytau and Zhetisu is explained by the fact that they were formed in June 2022.

It should also be noted that despite the short period of operation in the new status, the internal R&D costs in the Abai region amounted to 3.28% (KZT 3,996.7 million). In general, in the context of the regions, there is a steady increase in internal R&D costs.

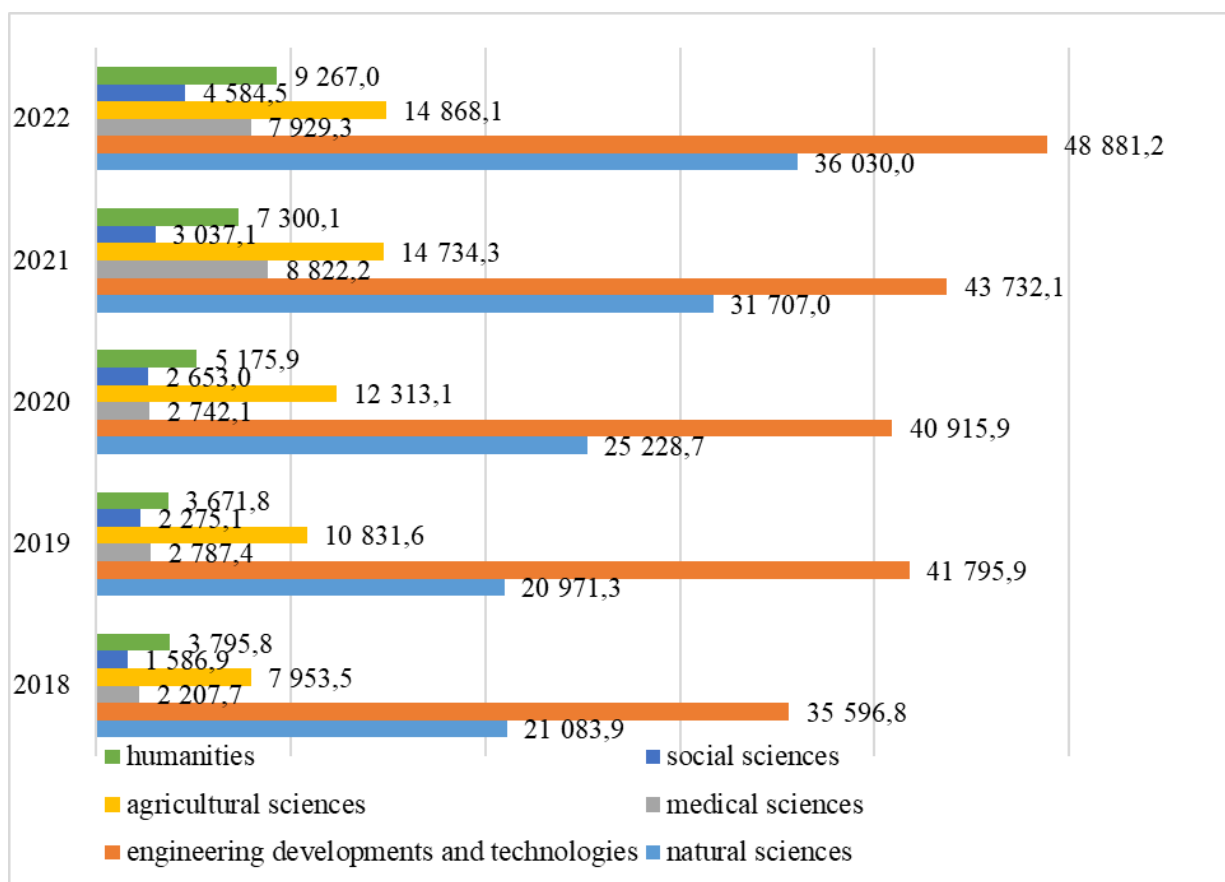


Figure 5 - Internal R&D costs by branches of science, million tenge [23]

Figure 5 shows the progress of internal R&D costs by branch of science in 2018-2022. The largest share of internal costs is accounted for engineering developments and technologies 40.2%, an increase in 2022 amounted to 13,284.4 million tenge (137.3%); natural sciences 29.7% - (+14,946.1 million tenge (170.8%)), agricultural 12.2% - (+ 6 914,6 (186,9%)), humanitarian 7,6% - (+5 471,2 (244.1%)), medical 6,5% - (+5 721,1 (359,1%)), social sciences 3,8% (+2 997,6 (288,8%)). Against the background of a general increase in internal R&D costs in all branches

of science, agricultural sciences lag behind and show minimal increase. A sharp increase in medical sciences in the structure of domestic R&D costs is observed in 2021 and 2022 in connection with the COVID-19 pandemic and the development of Kazakhstan's own KAZVAC vaccine.

The availability of highly qualified researchers and specialists who professionally possess the knowledge and skills of scientific activity is one of the main conditions for the national science functioning. The scale and structure of the science human resources are considered today as the country's most important research resource element. The effectiveness of this resource depends on many conditions and factors [22].

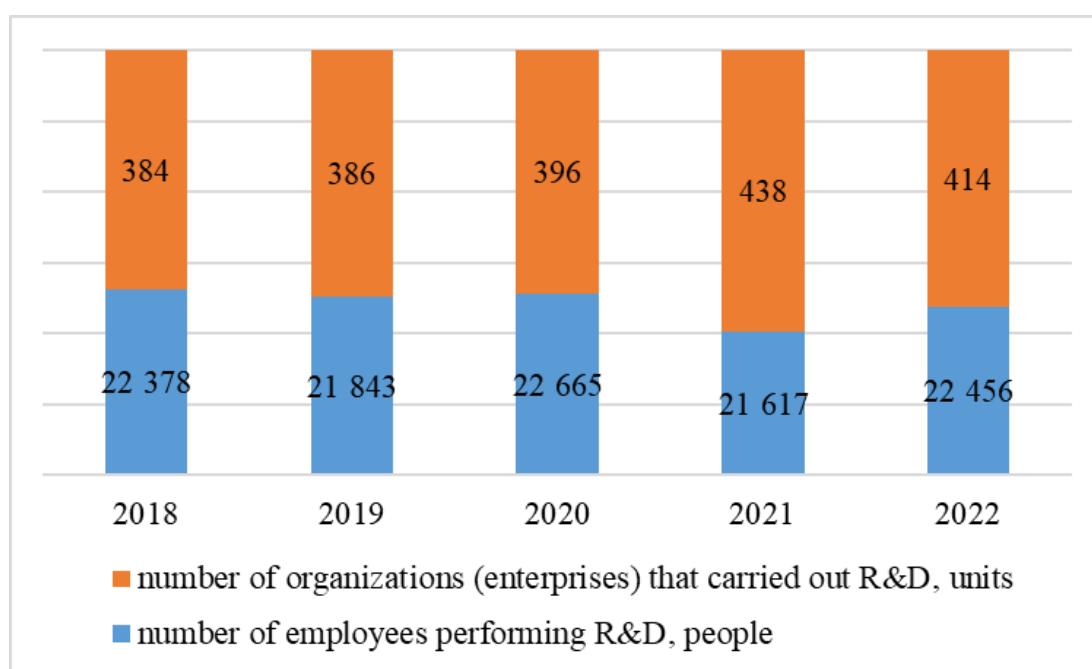


Figure 6 - Number of employees and organizations engaged in Kazakhstan R&D [23]

The number of organizations (enterprises) engaged in Kazakhstan R&D works for 2018-2022 is shown on Figure 6. The growth in this period amounted to 30 units (107.8%). But it should also be noted that in 2022, compared to the previous year, the number of organizations decreased by 24 units, i.e. 5.4%. The intensification in the number of employees performing R&D during the analyzed period amounted to 78 people (0.3%).



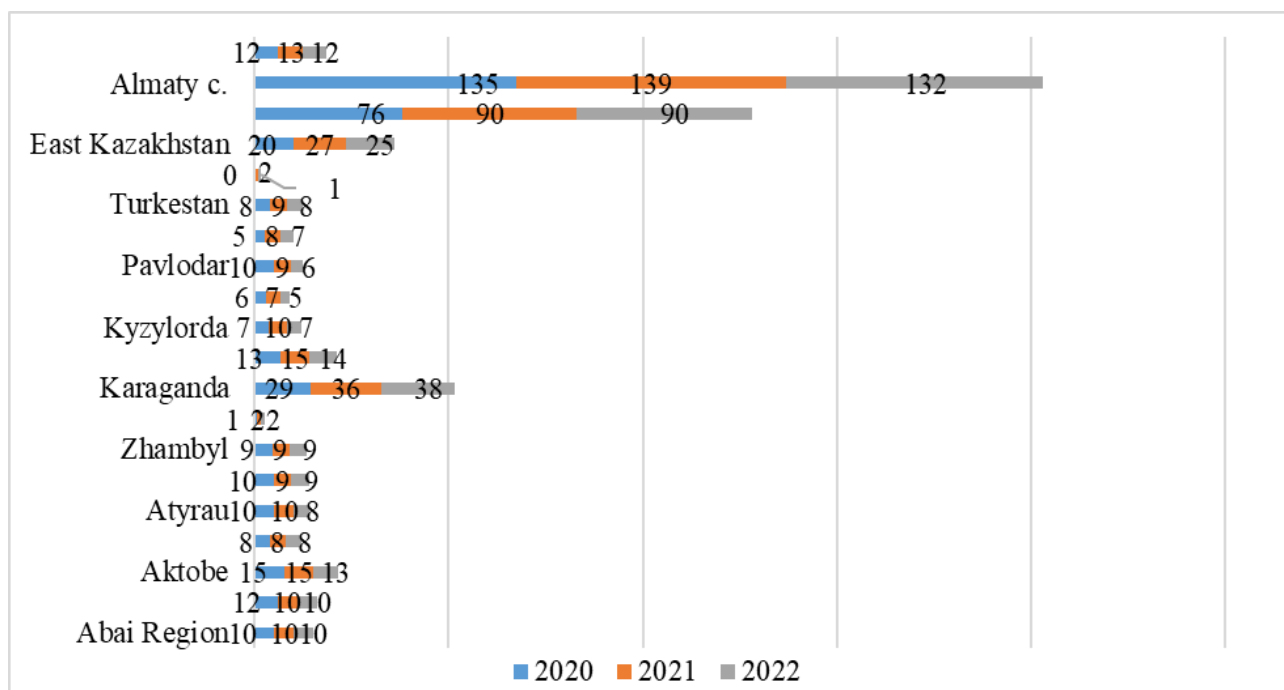


Figure 7 - The number of organizations (enterprises) engaged in R&D [23]

In 2022 the organization (enterprises) units engaged in R&D in the following areas: Almaty 31.8% (132 units), Astana 21.7% (90 units), Karaganda 9.1% (38 units) and East Kazakhstan 6% (25 units) show the largest proportion.

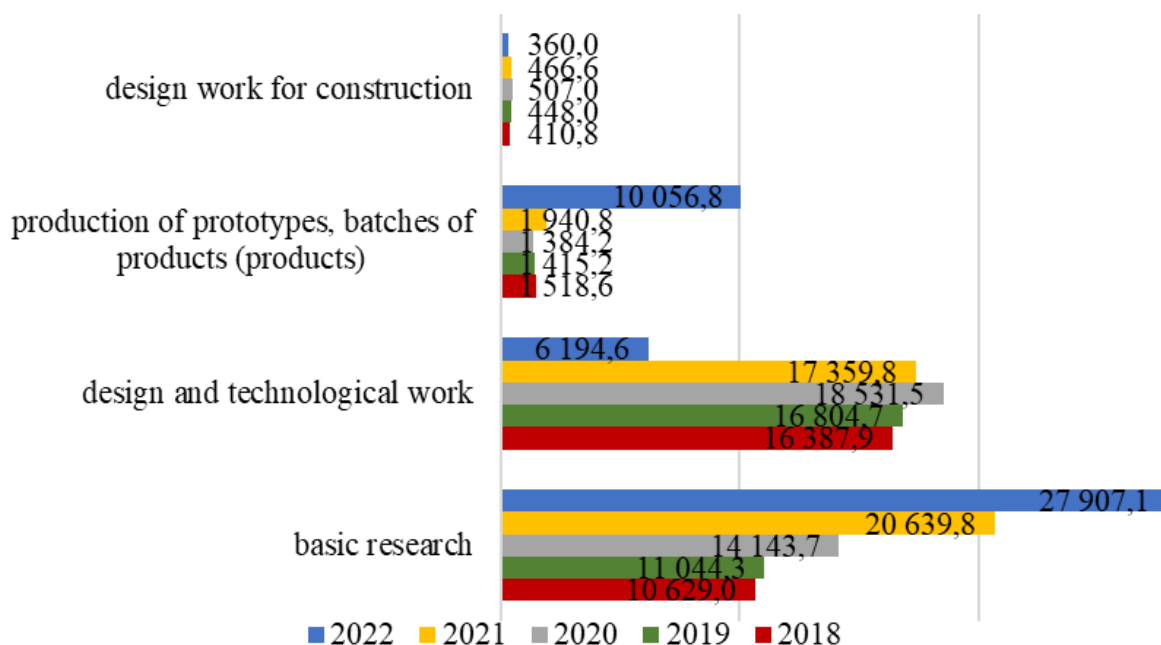


Figure 8 - Internal R&D costs by type of work, million tenge [23]

Figure 8 shows the change in internal R&D costs by type of work performed in 2018-2022. The largest share in 2022 falls on basic research of 63%, while the increase amounted to 17,278.1 million tenge (163%); the manufacture of prototypes, batches of products (products) is 23% - 8,538.2 million tenge (562%). The reverse pattern is observed for the following types of work: design and technological work, the share in 2022 amounted to 14%, while during the analyzed period there was a reduction of 10,193.3 million tenge (62%); design work for the construction of 1% - the decline amounted to 50.8 million tenge (12%).

It should be noted that in the context of the types of work on basic research and the manufacture of prototypes, batches of products (products) for 2018-2022, there is a gradual positive trend. In turn, there has been a drop in design and technological work and design work for construction since 2020.

«...the costs of basic research, both in nominal terms and in equity, exceeded the costs of experimental design, thereby reducing the productive function of science, the results of which are intended for the introduction of innovations, innovations, new technologies, forms of organization, etc. into production. This leads to the fact that the main direction of Kazakh science is becoming a purely cognitive function, for which almost two thirds of the state budget funds are attracted» [4].

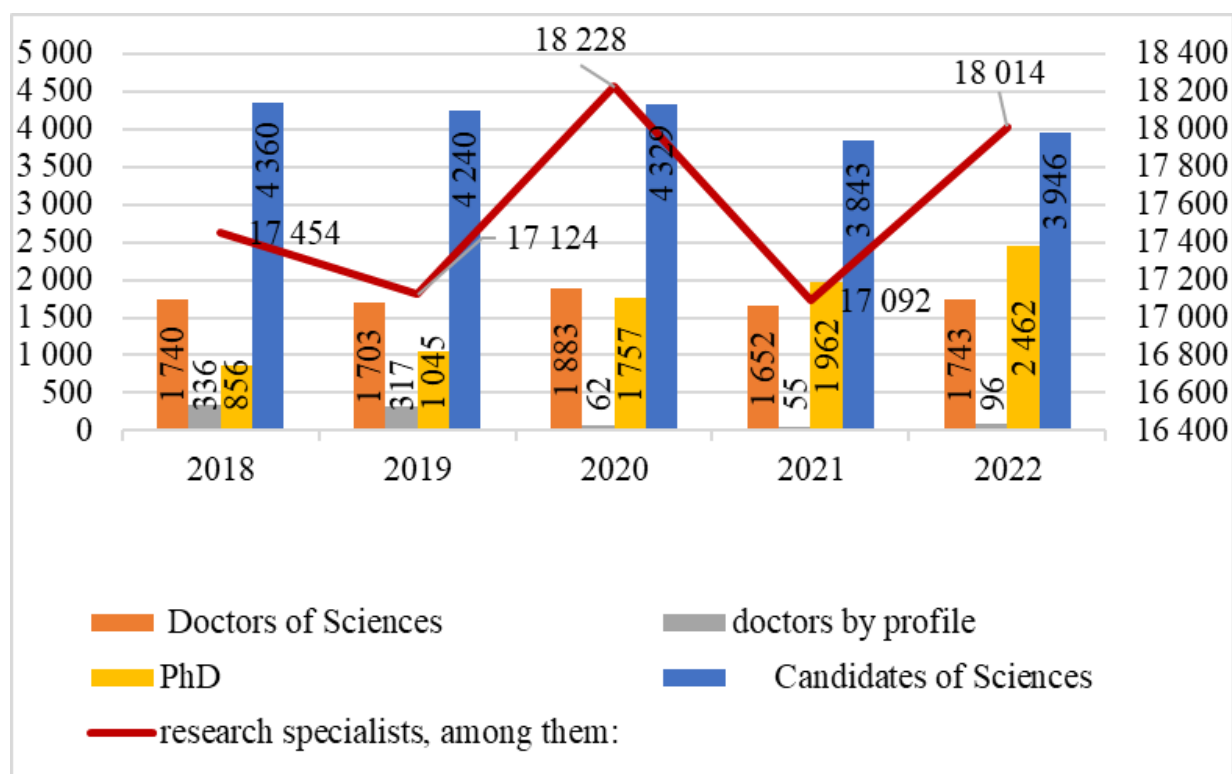


Figure 9 – Distribution of personnel by qualification in the Republic of Kazakhstan [23]

As shown in Figure 9, the distribution of personnel by qualification is in the following order: the position of specialists in total for 2018-2022 increased by 560 people (3%). Among

them: Doctors of Sciences, the growth was 3 people (0.2%), Doctors of Philosophy PhD 1,606 people (188%). The cut in staff can be traced by positions: 240 doctors (71%) and 414 candidates of sciences (9%).

A review of the scientific literature on the impact of science on the country's socio-economic development allows us to highlight the most important aspects for further study. In assessing the relationship between indicators of science and socio-economic development, it is important to pay attention to detailed indicators [19].

Regression analysis is a statistical method of investigating the effect of one or more independent variables on a dependent variable. The main issue is the existence and strength of the relationship between these variables [10].

In quantifying the impact of GDP on the science development, secondary data on various indicators of the country's economy and science were used:

- GDP at current prices, billion tenge, (PCC-1, SCC-1);
- volume of innovative products produced, billion tenge (KF2, KZ2);
- gross R&D costs, billion tenge (PCC-3, SCC-3);
- internal R&D costs, million tenge (PCC-4, SCC-4);
- the number of employees performing R&D, people (PCC-5, SCC-5);
- labor costs, million tenge (PCC-6, SCC-6).

The database from 2018 to 2022 was formed according to the Kazakhstan's Bureau of National Statistics data.

Correlation analysis (Spearman and Pearson correlation coefficients) using the MS Excell statistical package was used to determine the strength and direction of the closeness of the relationship between the selected variables. Based on the results of the correlation analysis, the most interrelated variables were identified (Table 1).

Table 1 – Data from the correlation and regression analysis of science indicators

|                    |               |               |               |               |
|--------------------|---------------|---------------|---------------|---------------|
| value              | PCC-1 и PCC-4 | PCC-2 и PCC-3 | PCC-5 и PCC-6 | PCC-1 и PCC-2 |
| <b>Pearson CC</b>  | <b>0,97</b>   | <b>0,66</b>   | <b>0,01</b>   | <b>0,79</b>   |
| value              | SCC-1 и SCC4  | SCC-2 и SCC-3 | SCC-5 и SCC-6 | SCC-1 и SCC-2 |
| <b>Spearman CC</b> | <b>1,00</b>   | <b>0,50</b>   | <b>0,10</b>   | <b>0,71</b>   |

\*Note: compiled by the author

Correlation analysis showed that internal R&D costs correlate with GDP (PCC-1, SCC-1) and the values showed a high level of close relationship: Pearson coefficient was 0.97, Spearman's was 1.0. An approximately similar situation can be observed between the indicators of GDP and the volume of innovative products produced (PCC-2, SCC-2), where the relationship at the coefficient level was 0.79 and 0.71, respectively, thereby demonstrating an above-average level of dependence.

The relationship of other variables such as the number of employees performing R&D (PCC-5, SCC-5) and labor costs (PCC-6, SCC-6), as well as the volume of innovative products

produced (PCC-2, SCC-2) and gross R&D costs (PCC-3, SCC-3) was not noted, the Pearson coefficient was 0.01 and 0.66, Spearman's was 0.1 and 0.5, respectively.

Based on the values of the correlation coefficients, it can be concluded that there is a strong correlation between the variables under consideration in the models. A positive correlation means that high values of one variable are associated with a high value of another. A negative correlation means an inverse relationship. All correlation coefficients between GDP and the independent factors selected for analysis are significant, i.e. they can have a noticeable effect on the value of GDP [10].

The authors analyzed the impact of GDP on internal R&D costs, which showed the closeness of a linear relationship between productive (internal R&D costs) and factorial (GDP) characteristic SCC. The R<sup>2</sup> value was 0.989. At the same time, the constructed trend line is characterized by a certain increase in the values of both indicators.

Based on the correlation and regression analysis, Figure 10, the author presents simulated scenarios for predicting further growth in domestic R&D costs, subject to stable GDP growth.

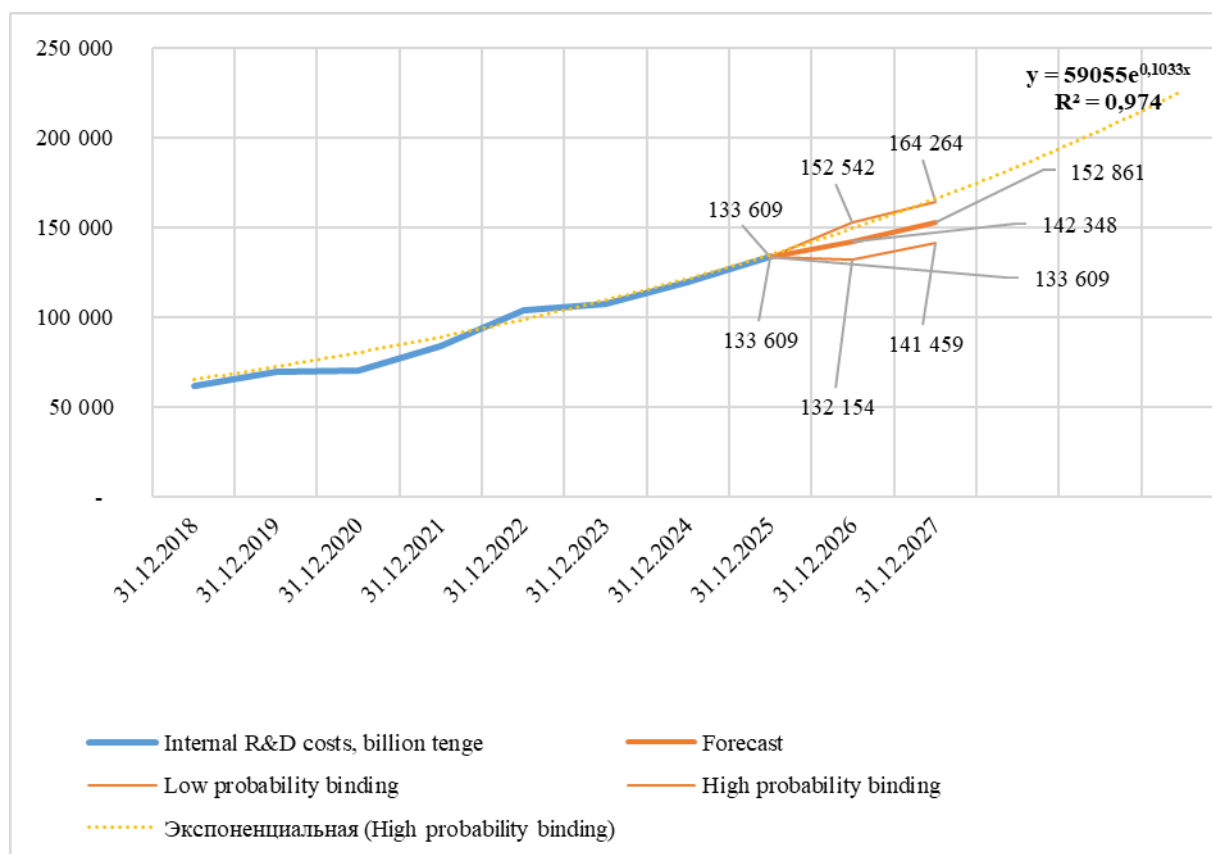


Figure 10 - Forecast scenarios for further growth of internal R&D costs

Thus, after modeling the relationship between the indicators, there is a strong relationship between the level of gross domestic product and changes in innovation costs was defined.

Under a pessimistic financing scenario, R&D costs by 2027 will amount to 141,459 billion tenge, under an optimistic development scenario – 164,264 billion tenge, under an optimal development scenario - 152,861 billion tenge. Research and development work is of practical importance in the development of an innovative economy [10].

Conclusions. From all of the above, the following conclusions can be drawn:

1) The analysis showed the following trends in R&D financing in Kazakhstan:

– Despite the positive dynamics of R&D financing costs in Kazakhstan, the share of domestic R&D costs in GDP has remained unchanged over the past 5 years;

– In the structure of the types of R&D expenditures in Kazakhstan, the main share is consistently represented by internal costs along with external ones, while both R&D expenditures from the state budget increase from year to year, and the share of budget funds in the total volume of internal costs has increased. The own funds of scientific organizations, as well as attracted foreign funds, occupy a smaller share. All this confirms the predominant state financial support for R&D;

– Against the background of active engineering developments and technologies, natural, social, and humanitarian sciences, R&D of agricultural sciences is funded at a very low level. At the same time, it was found that the COVID-19 pandemic stimulated developments in the field of medical sciences in 2021 and 2022 related to the development of Kazakhstan's own vaccine. It is noteworthy that more than half of scientific research works are carried out on fundamental developments, as well as the manufacture of prototypes, batches of products;

– Consideration of the human resources potential of Kazakhstan's science participating in R&D showed a tendency to reduce research organizations with a simultaneous slight increase in the number of employees. Moreover, the main concentration of the country's scientific potential is represented in large cities of republican significance, Astana, Almaty and in the Karaganda region. In Kazakhstan, the involvement of new high-quality personnel in science is decreasing, this is confirmed by data on the distribution of personnel by qualification: the main share of the increase can be seen in the number of PhD doctors and ordinary specialists, while the number of doctors in the profile and candidates of sciences is significantly decreasing.

2) Correlation and regression analysis revealed the closest relationships between GDP growth and domestic R&D costs, which allowed the author to model further financing scenarios. The pessimistic scenario will develop according to the scenario of inertial development. All three scenarios confirmed that with stable GDP growth, R&D costs will also increase, but the share of costs itself will remain at the same level.

3) Public financing plays a significant role in stimulating and supporting R&D. First of all, this is justified by the fact that the creation of new scientific knowledge requires significant investments, and the guarantees of its commercialization and income generation are very insignificant.

Therefore, representatives of the business sector are reluctant to take risks related to the financing of scientific research. The state finances scientific research because the real. The value of R&D is the resulting knowledge that can benefit society as a whole in terms of education, health, care and conservation of the environment, etc.



In general, the overall picture of funding sources demonstrates the process of crowding out all other sources of government spending [6].

4) Kazakhstan needs to reconsider the financing vectors in favor of attracting foreign capital as investments in R&D, as well as increase other extra-budgetary sources of financing, such as private capital. For these purposes, it is necessary to develop programs that stimulate private capital of entrepreneurs to participate in R&D with the subsequent implementation of their results in their own production.

In Kazakhstan, it is also necessary to develop R&D in such fields of science to stimulate new information technologies, cybersecurity, biomedicine, biotechnology, renewable energy sources, nanotechnology.

In conclusion, information in the field of knowledge plays a key role in the knowledge economy. In this context, we can observe the growing importance of human, intellectual and social capital, as well as the increasing role of creativity as an important factor in sustainable long-term development. The creative aspect of economic activity involves abandoning old methods and established traditions in favor of innovation, originality and diversity. Knowledge is becoming an important strategic resource for companies, so they should pay special attention to developing strategies for using knowledge to increase competitiveness based on a rational assessment of both internal resources and external factors [11].

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### **Қазақстандағы ҒЗТҚЖ-ны қаржыландырудың өзекті мәселелері**

**Түйінеме.** Жұмыста Қазақстан республикасындағы ғылымның жай-күйі мен дамуының негізгі көрсеткіштері талданды. Мақалада ҒЗТҚЖ қаржыландыру көздері және оның шығындарының динамикасының өзгеруі зерттелген. Авторлар осы мәселеге арналған дереккөздерге шолу жасайды. Мақала авторлары ҒЗТҚЖ-ны қаржыландыру мәселелерін талдап, қазақстандық заманауи жағдайларда ҒЗТҚЖ-ны қаржыландыру саласына жеке капиталды жандандыру және тарту қажет деген қорытындыға келді. Мемлекет ҒЗТҚЖ-ны өтеусіз негізде қаржыландырады, алайда ҒЗТҚЖ енгізу тиімділігінің төмен деңгейі байқалады. ҒЗТҚЖ-да жеке бизнестің қаржылық ресурстарының үлес салмағы неғұрлым жоғары болса, ҒЗТҚЖ-ны ЖІӨ-ге қайтарудың әсері соғұрлым көп болады. ЖІӨ-ге жеке инвестициялардың қайтарымы олардың пайдаға бағдарлануына, икемділігіне және инновациялық жобаларға белсенді қатысуына байланысы жоғары. Жеке компаниялар әдетте жоғары қайтарымды уәде ететін және өнімдірек болатын жобаларды таңдауға тырысады. Жұмыста жалпы ішкі өнім деңгейінің және ҒЗТҚЖ ішкі шығындарының тәуелділігін көрсететін корреляциялық талдау,

ҒЗТҚЖ ішкі шығындарының одан әрі өсуін болжау қарастырылды. ҒЗТҚЖ шығындарының өсуі ғылымды қажетсінетін экономиканы қалыптастыру, сондай-ақ ҒЗТҚЖ шығындарының деңгейін индустриялық дамыған елдер деңгейіне дейін арттыру үшін маңызды аспект болып табылады.

**Түйінді сөздер:** ҒЗТҚЖ, болжам, ЖШӨ, ғылым, экономика, шығындар, корреляция

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### **Актуальные вопросы финансирования НИОКР в Казахстане**

**Аннотация.** В работе проанализированы основные показатели состояния и развития науки в Республике Казахстан. В статье исследованы источники финансирования на НИОКР и изменения динамики затрат на НИОКР. Авторы приводят обзор источников, посвященных этой проблеме.

Авторы статьи провели обзор вопросов финансирования НИОКР и пришли к выводу, что в казахстанских современных условиях необходимо активизировать и привлечь частный капитал в область финансирования в НИОКР с дальнейшим внедрением в практическую деятельность. Государство в большей степени финансирует НИОКР на безвозмездной основе, однако наблюдается низкая степень эффективности внедрения НИОКР. Чем выше удельный вес финансовых ресурсов частного бизнеса в НИОКР, тем больше эффект от отдачи НИОКР в ВВП. Отдача от частных инвестиций в ВВП выше из-за их ориентированности на прибыль, гибкости и более активного участия в инновационных проектах. Частные компании обычно стараются выбирать проекты, которые обещают высокую отдачу и оказываются более продуктивными. В работе представлены: корреляционный анализ, показывающий зависимость уровня валового внутреннего продукта и внутренних затрат на НИОКР; прогноз дальнейшего роста внутренних затрат на НИОКР. Рост затрат на НИОКР является важным аспектом для формирования наукоемкой экономики, а также повышения уровня затрат на НИОКР до уровня индустриально развитых стран.

**Ключевые слова:** НИОКР, прогноз, ВВП, затраты, экономика, корреляция.

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