CRITERIA FOR THE EFFECTIVENESS OF RESEARCH AND PRODUCTION SPHERE

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https://doi.org/10.5281/zenodo.11411696

Abstract*. The article, based on scientific research of foreign experience and research work of domestic economists using the method of comparisons and mathematical calculations, substantiates the criteria that influence the formation of the scientific and production sphere and its efficiency.*

Keywords*: Scientific and technological progress (STP), Investment, innovation, scientific research, commercialization, scientific and production sector (SPS), research and development work (R&D).*

INTRODUCTION

Taking into account the national characteristics of Uzbekistan and, accordingly, the Decree of the President of the Republic of Uzbekistan dated September 11, 2023 "On the strategy "Uzbekistan-2030"" No. UP-158, which provides specific measures to further deepen and ensure economic growth, as well as its future strategy [1 page .3], we have studied the sphere of scientific production as the foundation of scientific and technical progress. To understand the essence of NTP itself, let us first turn to the factors of economic growth

MATERIALS AND METHODS

During the 1980-2020s, a significant number of studies were conducted on the phenomenon of scientific and technological changes as a factor in economic growth. Different researchers studied different periods for different countries, and used different methods for this. However, the results turned out to be approximately the same, namely:

Economic growth is ensured by the following factors:

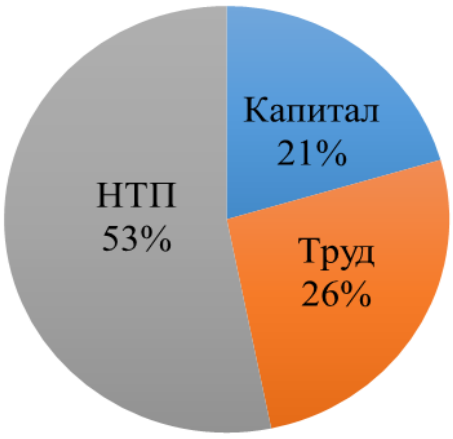

Fig 1 Factors ensuring economic growth.

capital (20.5%), labor (26.3%), scientific and technical progress (53.2%) (Figure 1).

The works of many foreign scientists, such as O.S. Andreeva [2. pp. 45-48], I. Dezhine [3. pp. 110-116] and S.N. Kozmenko [4. p. 115-123], Polozhikhin[8.pp.12-41], Sorokin D.E[7.pp.52-60].as well as Uzbek scientists like Astanakulova O[9.pp.48-50] Adilova Z[6.p.25], Yusupova N., Mirzabekova O. [5.p.197-99], and many others. In these works, scientists studied the foundations

of the evolutionary economic and institutional theory of scientific and technical progress, the concepts and patterns of development of the national innovation system, the technological development of knowledge-intensive production organizations, in other words, they studied scientific and technological progress itself and the factors influencing its development. Little has been studied about the scientific and production sphere itself, its essence, its place and role in the creation of scientific and technical progress, the search for forms of its connection to investment processes, starting from the very first stages of development, or the author has not encountered scientific research in this direction.

The purpose of our research is to substantiate the essence of the scientific and production sphere and the factors influencing it.

For this, we selected research and development organizations and their research work in the field of physics and technology in the Republic of Uzbekistan. In the report of the President of the Academy of Sciences of the Republic of Uzbekistan B. Yuldashev on the 80th anniversary of the Academy of Sciences of the Republic of Uzbekistan, the following were noted:

Over the past 5 years, research organizations of the Academy of Sciences of the Republic of Uzbekistan have completed and sent to the Intellectual Property Agency of the Republic of Uzbekistan over 500 applications for protective documents - patents for inventions and certificates for software products. More than 250 patents of the Republic of Uzbekistan for inventions and certificates for software products have been received, and the process of licensing them has intensified. Of the 43 approved in 2020 for implementation in real sectors and spheres of the economy, 39 innovative projects are the development of physicists in Uzbekistan; on this basis, scientists have developed and introduced into production a number of effective innovative technologies:

- Effective nuclear technologies, based on them, the production and export of a number of domestic radioactive drugs, as well as radiation-colored natural crystals, has been established.

- New technologies created on the basis of local raw materials of more than 30 original domestic medicines mastered by the pharmaceutical industry.

- The technology for producing high-quality aviation fuel “Jet A-1”, jointly created with manufacturers, and its industrial production for Boeing and Airbus airliners.

- Combined Stirling engines up to 5 kW were created (license sold in the USA).

- A joint international patent has been received for gene knockout technology with the University of Texas, USA (Uzbekistan’s share is 70%), and patents have also been received from Russia, Egypt and China, the technology is also patented in India, and the protection of this technology extends to 140 countries around the world. All this shows the solid role and place of activity of physical research workers in the economy of the republic.

- The annual volume of exports of scientific products of the Academy of Sciences of the Republic of Uzbekistan for the period 2018 – 2021 amounted to 5.5 – 5.9 million US dollars

In recent years, the number and volume of funding for innovative projects has increased more than 6 times [report on the 80th anniversary of the Academy of Sciences of the Republic of Uzbekistan].

The sustainable socio-economic development of the Republic of Uzbekistan, the ongoing modernization of production, as well as the processes of globalization pose new problems for scientists that require a priority solution. The entry of the Republic of Uzbekistan into the world's economically developed countries is unthinkable without a breakthrough into new areas of

knowledge and technology, which would accelerate the process of integration of the country into the world economy. Uzbekistan faces the most important challenge - the implementation of the policy of accelerated industrial development. Without energy development, the transition from an agrarian-industrial to an industrial-innovative structure is hardly possible. Moreover, in Uzbekistan, for the first time in Central Asia, by 2030 it is planned to complete the construction of a nuclear power plant with a total capacity of 2400 MW, with two VVER-1200 generation "3+" units, with a capacity of 1200 MW each, which will provide Uzbekistan with inexpensive electricity and will give impetus to development science and education, in such areas as fundamental sciences, nuclear energy, chemical industry, mechanical engineering, construction and others. This, in turn, requires improving the infrastructure, which is capable of integrating the interests of science, education, government and business.

When identifying the scientific and production sphere, it will be possible to collect sufficient argumentation in order to primarily consider it at the micro level, or to make it exclusively the object of macroeconomic analysis.

With this formulation of the question, the identification of the scientific and production sphere of Uzbekistan becomes not just a task of scientific research, but an urgent necessity for the development of the country's economy.

The success of the country's entire economy depends on the ability of scientists. Innovative development gives impetus to the development of equipment and technology for import substitution and reduces dependence on imports. Statistical data show the state of republican trade turnover in the period 2018-2022. (Table 1.)

Table 1

Dynamics of export and import volumes of the Republic of Uzbekistan (2018-2022) (billion US dollars)

№	Indicators	2018 y	2019 y	2020 y	2021 y	2022 y
1	Imports	19,439 billion	24,3 billion	20,412 billion	17966,1	264,8 million
2	Exports	13,9 billion	17,9 billion	5,1 billion	10357,2	2,96 billion

Based on the results of January-February 2023, the volume of exports of goods and services amounted to 1982.6 million dollars. USA. In the structure of exports: goods account for 82.2% of total trade turnover. Of these, industrial goods are 19.4%; food products - 7.0%; finished products - 6.0%; The volume of imports amounted to 5,783.3 million US dollars. In the import structure: machinery and equipment - 41.3%; industrial goods - 14.8%; chemicals - 13.8%; This shows that imports are dominated by equipment and machinery. Imports in 2022 totaled $28 billion, up 18.3% to $4.37 billion over 2021. With an effective mechanism for the operation of the NPS, this part of imports is significantly reduced, so that the country has enough scientific potential capable of developing equipment within the country, and there is also enough cheese for this

To study the essence of NPS, it is advisable to set a number of specific initial premises, which, being targets, at the same time define relatively strict boundaries of the study.

Firstly, the study of the scientific and production sphere based on the characteristics of modern macroeconomic processes taking place in the world as a whole should also reflect the characteristics of the national economy of Uzbekistan.

Secondly, to study the stages of scientific research corresponding to the economic development of our country, based on the national characteristics of the economy of Uzbekistan, and give a description of the role of science and technology in each stage.

Thirdly, to study the organizational and structural forms of development of the scientific and production sphere from the point of view of their focus on its implementation in a priority area. The definition of NPS from this perspective from a methodological point of view excludes an absolute character; it must be tied to a certain stage of economic development of our country, as well as specific specifics, reflecting the characteristics of the national economy. Each stage must have its own adapted NPC.

The change in the dominant technological structures in the economy is determined not only by the progress of scientific and technological progress, but also by the inertia of society's thinking; new technologies appear much earlier than their mass development. And this is the result of the knowledge-intensive work of scientists and researchers.

Representatives of 8 countries - Sweden, Great Britain, Finland, Germany, Belgium, China, Russia and Belarus at the TECHNOPROM forum, which was held in 2010, discussed the nature of six technological structures and its modern properties.

According to the calculations of scientists in 2010, the share of the productive forces of the fifth technological order in the most developed countries was approximately 60%, the fourth - 20%, the sixth - 5%. According to estimates, the sixth technological mode in these countries began in 2014-2016.

Regarding Uzbekistan, it should be noted that technologies relying on manual labor with technical means of empirical origin form their basis, which slows down the introduction of new technology. Every major scientific and technological shift gives rise to a rapid massive restructuring of production. This moment of self-accelerating development creates its own mechanism for the reproduction of scientific and technological progress.

NTP is defined as "the process of improving the means of labor, which are the initial basis for the development of the productive forces of society. Its content, forms, directions and pace are determined, first of all, by the method of production "the term "scientific and technological progress" reflects the real processes taking place in the modern world, and above all, the process of ever-increasing integration of science and technology and increasingly intensive advancement to a leading place namely science."

First of all, we need to dwell on the motivational factors for the development of scientific and technological progress. In the largest scientific works on this issue, the logic of the research is different. As a rule, the patterns of development of scientific and technological progress, its functioning in the system of the reproductive mechanism are first revealed, then its organizational forms and structures are studied, and only then a transition is made to socio-economic issues, including incentive relations

RESULTS

In modern conditions, the situation is different, regardless of the internal laws of scientific and technological progress (the importance of which cannot but be recognized); the main incentives for its development lie in the motives associated with the choice of ways to use limited production resources in economic entities at the microeconomic level. Macroeconomic motivational impulses are also realized in the actions of subjects of microeconomics, i.e., in this case, priority in the structure of motives for economic activity lies in the sphere of

microeconomics. But the conditions that promote or hinder their development are formed at the macroeconomic level.

For the latter reasons, in our opinion, there is a need not just to consider the mechanism for introducing or deploying scientific and technical progress, but to look for those organizational forms that, on the one hand, would actually contain motives for this at the microeconomic level, and on the other hand, would be susceptible to the macroeconomic level. regulation. The totality of such forms in the national economy will form the basis of the NPS. Here the next problem immediately arises: the adequacy of the content of the process to the forms of its organization.

This implies the following requirement for the definition of NPS, which is that it must perform a certain set of macroeconomic functions that have an internal hierarchy. In this hierarchy, the leading function at each specific point in time becomes a necessary element.

In our opinion, the mechanism of NPS formation can be schematically represented in Figure 2.

Fig.2. Mechanism for the formation of the scientific and production sphere

Naturally, such a definition cannot become absolute due to the constant variability of the economic situation. But each specific stage of economic development must have its own fundamental goals.

DISCUSSION

If all of the above is considered in relation to Uzbekistan, then progress in science is inextricably linked with the progress of the entire system of political, social and economic transformations undertaken in Uzbekistan, which will stimulate an increase in the level of pre-university and university training of future scientists.

The created infrastructure does not yet meet the needs of the country's rapidly growing population. Time is also needed to train highly professional teaching and scientific personnel. In this regard, the increase in the number of educational institutions does not yet mean an increase in the quality of education.

The number of universities in the Republic of Uzbekistan and their dynamics are shown in table 2

Table 2

The number of universities in the Republic of Uzbekistan per 1 million people in dynamics from 2017/18 to 2022/23 academic year

№	Number of universities	2018/19	2019/20	2020/21	2021/22	2022/23
1	Number of state universities	98	119	127	154	191
2	Number of non-state universities	1	4	5	17	41
3	Number of foreign universities	10	16	18	25	28
4	Number of professional teaching staff (thousand people)	26,6	30,6	32,1	37,4	41,7
5	Number of graduates (thousand people)	70,3	70,8	83,9	103,9	101,9
2	In Tashkent	33	51	72	73	76

Measures are being taken to improve the management and structure of scientific organizations and institutions that contribute to improving the quality of education. For example, a “smart university” is being created in the country, combining four modules into a single whole: management, science, study and financing. This explains the other side of scientific and technological progress - the development of its subjective elements - the level of education of the population and personnel training

The effectiveness of science is determined by the effectiveness of scientific organizations, which are reflected in scientific and technical resources and scientific potential, scientific leadership in the field of specialization and the ratio of external funding and own income, that is:

-resource;

- personnel;

-scientific;

- financial viability.

The mere presence of unique equipment does not make scientific research productive; there must be trained, qualified scientists in their field, the latest methods for processing the results obtained, new management decisions for selecting the best applications. This is how target indicators for the effectiveness of science appear at the present stage.

Since technological progress is determined by R&D expenditures, these expenditures are closely related to the country's GDP. With an increase in GDP, savings and consumption increase accordingly (Table 3). Here, each economic entity decides on its own the accumulated fund according to market laws. Research institutions hardly have such an opportunity.

Table 3

Dynamics of GDP growth for 2018-2022

№	Indicators	2018 y	2019 y	2020 y	2021 y	2022 y
1	GDP billion sums	426641	532713	605515	738425	888342

2	Consumption fund	321522	403230	454350	563971	699479
3	Accumulation fund	105113	129482	151165	174454	188845

The state of the share of people engaged in scientific activities, in terms of cost growth, is shown in Table 4. Based on these tables, we currently have a rather contradictory situation; on the one hand, there is the fact of scientific and technological progress and the implementation of research and development activities in the course of using financial sources of investment, which is reflected in the national accounting system.

Table4.

Specific share of all people engaged in scientific activities, according to the growth of costs for science in the Republic of Uzbekistan

№	Number of people employed in the economy of the Republic	2018 y	2019 y	2020 y	2021 y	2022 y
1	Population of the Republic of Uzbekistan	31298,9	33905,0	33905,2	34860,2	35603,4
2	Total employed population	13,3 million	13,5 million	16,8	13,7	13,8
3	From these, those engaged in scientific activities	2230 thousand	2260 thousand	4200 thousand	5180 thousand	5300 thousand
4	Expenditures on science in the structure of GDP (percentage)	0,05	0,1	0,2	0,5	0,5

On the other hand, there is no corresponding sector of the national economy, represented in the aggregate of institutional units (business entities). Let us define this contradiction as a formal-substantive contradiction in the development of scientific and technological progress, since it most clearly shows the moment of development of content outside of strict organizational (institutional) forms.

At this time, research costs are mainly covered by the state. The question arises: how much government funds will be enough?

All these and other questions require a scientific answer, which can be given when forming the NPS. At the same time, there is one rather strange unity of views on the way out of the situation. In its most condensed form, it is ensuring the flow of investment.

To form it, you need to enter diagnostics:

1. The need for financing, how much finance is required;

2. The situation in the field of financing, i.e. where can you find finance;

3. Risk assessment of this research work;

4. Determine the limitations (political, institutional) based on the diagnostics, determine the financing strategy:

a. What is the state of government funding?

b. Private financing opportunities;

c. Off-budget funding opportunities;

d. Possibilities of other types of financing for this R&D.

CONCLUSION

Based on the generalization and systematization of the above definitions, the following definition can be justified: “NPS is a specific complex of the national economy that does not have strict subjective definition, its activities are based on the financial relationships of the state, the private sector and scientific and production organizations, its functioning increases the degree efficient use of limited production resources by improving the scientific and technical parameters of their use, ensuring an improvement in the quality and structure of the goods and services produced.”

From the above studies, the following conclusions can be drawn.

The following factors influence the prediction of NPS:

• economic - level of economic growth of GDP, size and composition of budget allocations for research and development, level of investment in scientific research and technological innovation;

• technological - progress in scientific research and development, technological innovations and prospects for their application, the level of accessibility of new technologies for enterprises;

• political - government policy in the field of support and development of scientific and technological innovation, tax incentives and benefits for innovative companies, laws and regulations governing intellectual property and patenting.

• global economic climate and trends in the development of science and technology, global demand for products and technologies produced in this area;

• sociocultural - level of education, availability of qualified specialists and researchers.

The key aspects of forecasting the development of NPS are:

-investments in research and development (R&D);

-technological innovation

-level of education and scientific personnel

-government policy and support

-global economic trends and market demand.

Based on this, we can claim that the NPS is the foundation of the NTP.

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