PUBLIC-PRIVATE PARTNERSHIP AS A TOOL FOR IMPROVING RESEARCH AND DEVELOPMENT SECTOR

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ABSTRACT
The article is devoted to the issues of scientific and innovative developments sector, foreign experience in solving insufficient financing problems through mechanisms of interaction between the state and business, and the use of this experience for Russia. Since international scientific and technical cooperation in the second half of the 20th and beginning of the 21st century has become the close attention subject of both individual states and influential international organizations, many countries are considering this form of cooperation, which has become an intersection of the science interests sphere, science and technology policy and foreign policy as an instrument for developing its own scientific potential and economic growth for a long-term perspective. The importance of the role that science and innovation play in determining the competitiveness of states, determining their place in the international division of labor, no one doubts. As for Russia, today everyone understands the need for speedy introduction of its economy into an innovative way of development, and it is impossible to do this without active development of science. The data analysis testifies to a certain increase in the expenditures of the federal budget on science. However, this increase is directed only at covering the costs of current items, but does not provide such expenditure items as acquisition of intangible assets, devices and equipment, overhaul of fixed assets.

KEY WORDS
Scientific and innovative sector, cooperation, competitiveness, labor, federal budget, research, development.

A detailed examination of the foreign experience of cooperation between the public and private sectors of the economy in financing R & D shows that all developed countries use one or another form of co-financing of business financing with the state within the framework of public-private participation, giving the business significant benefits for these purposes.

Key words: scientific and innovative sector, international scientific and technical cooperation (ISTC), competitiveness, international division of labor, federal budget, public-private participation, innovations, research and development (R & D)

Introduction. The relevance of this topic is undeniable for a number of reasons at the present time. First, the trends in the modern global world have developed in such a way that knowledge and advanced technologies determine everything today. Practice shows that the scientific and technical potential and the economy development level are directly proportional to their change. But the maintenance of science at an appropriate level is becoming more expensive every year, and conducting research in one country is becoming more complicated, so all the countries of the world began to cooperate in their efforts to achieve common goals. Naturally, Russia in this regard is no exception, especially if it seeks to take its place among the leading countries.

Secondly, it is not by chance that the EU, the US, China and Japan are taken as example. These are the countries that have the highest scientific, technical and innovative potential, they are global leaders, and cooperation with them is an opportunity to accelerate the process of catching-up development for our country. Thirdly, the constant monitoring of trends in the development of international scientific and technical cooperation of the country, their analysis and evaluation helps identify and develop the most priority areas and areas of
cooperation in accordance with national interests, develop sound scientific and technical policies and effectively influence the economy country, stimulating its growth.

To write the article, materials of such researchers and scientists as Udaltsova N.L., Airapetyan M.S., Gordeev A., Plakitkina L.S., Rick Norment etc., as well as electronic resources from official websites of institutional bodies (World Bank, UNESCO, Russian Federal State Statistics Service, etc.) were used.

Main part. In modern conditions, the science effectiveness is increasingly determined by the characteristics of the scientific and technological potential, which includes the totality of personnel, financial, logistical, information, organizational and other resources necessary for the scientific and technological activities implementation.

World practice shows that science cannot function normally efficiently without a scientific and technological potential stable build-up. It’s condition largely depends on the financing amount. The society development progress can be ensured only by systematic growth basis in the financing volume of the scientific and technical sphere balanced by costs types, work types, fields of science and socio-economic goals. The science-technical progress (STP) dynamics requires a continuous increase in R & D costs, as the process of acquiring new knowledge with increasing time factor becomes more expensive.

The group of indicators characterizing the state science state is usually divided into two large subgroups: indicators of scientific and technical potential (financing, number of employees, number of staff of researchers of the highest qualification, etc.) and evaluation of scientific performance (number of publications, patent statistics, technological balance of payments, etc.). Below is a brief analysis of several key indicators of the development of Russian science.

Thus, in 2016, the total amount allocated to civil science from the federal budget was 402,7 billion rubles, which is clearly reflected in the Figure 1. This is 3,8 times more (in constant prices) than in 2000’s [1]. The main increase in appropriations was for 2000-2013 years almost 4,8 times, in the next three years, their volume, due to the growing budget constraints in the conditions of the economic crisis caused by the simultaneous effect of a number of internal and external factors, declined by 21,2% as a whole.

In 2017-2019 years it is planned to allocate more than 300 billion rubles annually for civil science (in current prices). At the same time, their share in federal budget expenditures will remain at the level of 2016 – 2,4%. The largest value of this indicator was registered in 2013 – 3,19%, which was to a certain extent due to the active scientific and technical policy pursued by the state. Appropriations as a percentage of GDP for the period 2000-2013 years rose from 0,23% to 0,60%, reaching a maximum value, and subsequently decreased to 0,47%.

![Figure 1 – Allocations for civil science from the federal budget [1]](image-url)
In allocations for civilian science, more than a quarter - 26.1% in 2016 accounted for fundamental and 73.9% for applied scientific research (Figure 2). During the last 6 years, the share of basic research did not exceed 30%, in 2017 it is planned to increase it to 34.9%, and in 2019 - to 40.4%.

In the allocations structure for civilian science, by subsections of the budget classification, the largest share - 62.4% in 2016 falls on applied scientific research in the field of the national economy. The share of applied research in the field of health care is 4.6%, education – 2.9%, national issues – 3.7%, in 2017 their values will increase against the decline in the share of applied research in the field of national economy (up to 51%).

The analysis of Figure 3 data indicates a certain cost escalation of federal budget on science. However, this increase is aimed only at covering the costs of current articles (commonly, wages, deductions for payment of a single social tax, partial compensation of
material costs, communal payments), but does not provide, in accordance with the needs, such articles of costs as the acquisition of intangible assets, devices and equipment, major repairs of capital stock. And this is despite the fact that the level of wages in science still be one of the lowest in country. The results of calculations show that at the present time, costs on science under all sources is 10-15% of minimum necessary need.

Federal targeted scientific and technical programs are the most important mechanism of scientific, technical and innovation policies realization. The analysis shows that they do not envisage a mechanism for financing the R & D results implementation, as well as transferring these results to other federal target programs for the same purposes. This disadvantage is not eliminated in the Federal Targeted Scientific and Technical Program «Research and Development in Priority Directions for the Development of the Scientific and Technical Complex of Russia for 2007-2012», approved by the order of the Russian Federation Government of August 17, 2006. The absence of mechanism that involve scientific and technical activities results reduces the effectiveness of ongoing R & D.

In conditions of scientific and technical sphere chronic underfunding, basically, the growth of science effectiveness is impossible. According to expert estimates, the average Russian scientist is equipped with the equipment necessary for research, ten times lower than his col-leagues from industrialized countries. Thus, the authors come to the conclusion that it is ne-cessary to attract investment infusions from the business side to scientific and technical de-velopments.

Today, the interaction organization between the state sector and business structures is one of the main ways to ensure the development investment potential of all branches that the national economy has including science. The precondition for creation of such partnerships became confidence that private business is more mobile and, therefore, functions more efficiently than government structures [4].

The areas where applies such form of partnership differ by country, and the leading positions are taken by projects for the creation and development of energy and transport infrastructure. The more developed the country, the greater the diversity in the application of the public pri-vate partnership mechanism, exactly more from its usage for physical development to spheres, connected with humankind potential development, that is, the post-industrial nature of its use. According to the World Bank, in the low- and middle-income countries between 1990 and 2015, the most frequently implemented public private partnership projects in the energy sector accounted for 41% of the total number of projects, 27% in the transport and roads, 17% in communications, 15% in provision of water supply and development of sewerage and cleaning systems [5], and in developed countries more and more projects using instruments public private partnership tools are introduced in education, health, social welfare, culture, housing and communal services.

The cooperation attractiveness in public-private partnership lies in the possibility of combining strong suits of each participant [6]. For the state sector, this is a legal authority, a protectionist procurement policy, a balance of goals for meeting public needs, labor and capital resources, and for the private sector - effective management, latest technologies, efficient production facilities, cash management experience, integrated resource use.

Postindustrial countries experience analysis shows that sustainable economic growth achiev-ing is possible only through intensive development of innovation activity, which implies the growth of new products and technologies through scientific discoveries and inventions, the introduction of more efficient business processes, organizational structures and management mechanisms. The main role in this is played by research organizations - generators of new knowledge. The search of new knowledge is a key stage in scientific and technological progress. The main questions are: how to get this knowledge most effectively, how to trans-form them into innovation with minimal cost, which are necessary for economic development. In the context of the economy globalization and stiff competition in the world market, the an-swers to these questions are becoming a key tool in the fight for economic and social stability [6]. The mechanism of public private partnership successfully takes root in the research field, which is quite proper, since only 15% of the developments receive a positive result, and the remaining 85% are not profitable. Consequently, business does not
seek to invest in risky projects with a low probability of making a profit and prefers to support the existing technologies.

A detailed examination of the foreign experience of cooperation between the state and private sectors of the economy in financing R & D shows that all developed countries use some form of business finance cooperation with the state within the framework of public-private partnership, providing the business with significant benefits for these purposes [7].

The practice of public-private partnership in the United States has a long history - the first formats emerged more than two hundred years ago in the period of American statehood establishment. Now thousands of cooperation projects between the state and business are successfully implemented both at the federal level and at a lower level in the USA.

These forms of relations in the country is understood as «... an agreement between a state and a private company that is agreed in a contractual form, allowing the latter to participate in state ownership and perform functions traditionally in the responsibility of public authority in a contractual form» [8].

The term «public-private partnership» defines a wide range of relations in the range of more or less simple contracts on which a private company takes certain risks and agrees to a system of penalties, to complex, technically difficult projects involving construction, modernization, operation of objects and their management. The most efficient business cooperation with the state in the USA is through venture funds. Venture funds fund not only R & D, but also the creation of an experimental-innovative product with bringing it to the stage of production.

The funds allocating scheme looks as follows: after the sanction of the Congress, the US Department of the Treasury sends cash tranches to the account of each participating in pro-gram federal agency. Then these funds are allocated directly in the form of grants and loans to research centers, businesses, non-governmental organizations, as well as local authorities upon consideration of related applications.

For example, such beneficiary is the National Science Development Fund, an independent federal agency, created by the Congress in 1950 «to promote the progress of science, improve the health, prosperity and well-being of the nation, and ensure national defense». With an annual budget of about $ 6.06 billion, he finances about 20% of all basic research of federal level, conducted by USA colleges and universities. The Fund is the main source of federal funding in many areas, including mathematics, computer engineering and social sciences [9].

The United States has a rich positive experience of actively stimulating innovative development. For example, in 1986, a law was enacted that facilitated the procedure for the use of intellectual property rights by individuals, as a result of which the number of issued patents increased several times. According to the number of patents, American transnational corporations are leaders.

After the adoption the Federal law about how to transfer technology in 1996, the USA sharply simplified the organization of interaction between universities, research centers and private business, and already in 2006 a new law on supporting R & D was adopted in the United States, according to which scientific organizations will receive until 2015 year financial support in the amount of 86 billion dollars.

One of the main features of American national innovation system establishment in the late XIX - early XX century was the close relationship between industrial corporations and universities.

The higher education decentralization, the financing of state educational institutions by the state authorities meant a close scientific research link to the economic needs of the region.

The USA experience shows that the innovation process can be successfully developed through both private and public funding. Everything depends not on the source of investment, but on its effectiveness. An important role is played by the nature of investment climate in the country, the development of the legislative framework, regulating the relations of participants in the innovation process, the information and logistical scientific research support, cooperation between subjects of innovation.
In the USA, the share of innovations state financing in recent years begins to exceed private investment. The state support system in the post-crisis period is characterized by the spread of the program-targeted approach. At the same time, financial resources are concentrated on priority technological and sectoral areas. For example, in the aerospace industry, government spending is received by more than 75% of firms and laboratories, engaged in R & D in this area [10].

In Germany, the research and innovation sphere, the public private partnership mechanism has been developing since the late 1990s. One of the most famous is the Frankfurt Innovation Center of Biotechnology (Frankfurter Innovationszentrum Biotechnologie Gmbh), organized on the basis of public private partnership in 2002 (partnership partners - the government of the federal state of Hesse, the municipality of Frankfurt-on-Main, the Industrial and Commercial Chamber of Frankfurt-on-Main). This center specializes in the treatment of inflammatory diseases and the central nervous system diseases innovations introduction and on protein research. In its premises work divisions of pharmaceutical companies (among them nine German companies and two foreigners - American and British), one information technology company, the American Research Institute and the Center of Research, Development and Security of Medicines at Goethe University (Frankfurt-on-Maine) [11].

In 2000, the Hochschul-Informations-System Gmbh, which is funded from the federal and regional budgets, specializing in the development of software for higher education institutions, conducting research in higher education sphere, planning of university construction and university management, launch a volumetric review of B. Vogel and B. Stratmann «Public-private partnership in sphere of research: new forms of cooperation between science and business». In the future there appeared a number of publications devoted to the topic of public private partnership in sphere of research and innovation. So, it is possible to indicate the fol-lowig works:

- collective work under aegis of the Association for the Coordination of Planning and Stimula-tion the Development of Science in Germany «Recommendations to Public-Private Partner-ships acting in sphere of University Medical Research», 2007;

In Europe, the current scientific and technical programs are focused on conducting of funda-mental research and demonstration projects realization aimed at solving socially significant problems. In addition to direct financing, there is a system of subsidies, tax incentives. For the program implementers is given the assistance of innovation centers and techno parks is provided.

In Germany, public private partnership in research and innovation sphere is defined as co-operation between a government-funded, science and private business that goes beyond the individual research projects implementation and is characterized by long-term institutionaliza-tion, association of interacting parties resources, the parties aspirations to achieve aims, that complement each other and joint participation of parties use of profits and coverage of losses.

By the beginning of 2010s, there were at least 20 independent research organizations in Germany (that model of public private partnership, which is characterized by maximum closeness and formalization of cooperation between partners). There are two main financing forms for these organizations:

- starting financing is provided by private business, then it is implemented by university and firm (firms) on a parity basis,
- the university provides placements, the firm (firms) - pay staff costs and other current spending.

The leading body for public private partnership in sphere of research and innovation is the Federal Ministry of Education and Research, which released a regulatory document in
2011 - the main directions for realization the stimulating program «Research Campus - Public Private Partnership in sphere of Innovation».

Acceptance of applications for state subsidies within the federal program framework «Re-search Campus - Public-Private Partnership in sphere of Innovation» ended on February 15, 2012; the first competition results were announced in September 2012. From the 90 applica-tions received, the jury, under the presidency of the German Academy of Technical Sciences president H. Kagermann, and the President of the Leibniz Society, E. Richel, determined ten winners. Based on the average ten-year period of public private partnership implementation and the annual sum of subsidies of 1-2 million euros, each winning partnership will receive up to 20 million euro from the Federal Ministry of Education and Research [9].

Norway's experience in financing R & D and the state and business interaction in the energy sector is indicative. The State Research Committee of Norway participates in the R & D cata-log formation, carries out funding for R & D, which universities and institutes carry out to further their application in the industry.

The Research Committee of Norway mainly performs R & D financing for the following four main programs:
- «EFFEKT» - research project in the field of energy exchange with other countries and net-work monopolies study. The main objective of this project is to increase the profitability of companies in the electricity industry in Norway;
- «NYTEK» - research in the field of effective technologies with the renewable resources use;
- «SAMRAM» - socio-economic and environmental aspects studies of the electric power in-dustry functioning in Norway;
- «General research in the field of energy» - fundamental research of energy production and consumption [9].

Non-governmental research and development financing is carried out at the expense of funds attracted by the Federation of Electricity Industry of Norway («EnFo») from business structures. This organization coordinates demand for R & D in the industry. Every year the Federation issues a catalog in which R & D is presented, requiring additional co-financing, as well as new projects planned for implementation. Participants in the Federation of «EnFo» are companies in the electricity sector of Norway, express their opinion on the financing of those R & D projects, that they consider most relevant.

State funding provided by the Norwegian Research Committee is intended not only for the four main areas of the electricity sector mentioned above, but also for financing other R & D programs is represented in the directory of the Federation of Electricity in Norway.

Along with direct budget allocations for the financing of R & D in Norway, various state, public and private funds are widely used (the Foundation for the Development of Research and Development in Industry, the Football Fund, the funds of F. Nansen, A. Jare). Norway main-tains scientific links with many countries all over the world and it is a member of more than 50 international and regional scientific organizations. Through the funds system, provided financial of R & D, in which representatives of large foreign business in Norway, for example, Alcatel, Siemens, ABB, Statiol, and others participate [7].

France at the beginning of the XXI century held innovative reform, creating the Agency on Innovation and investing about half a billion euros in it [6]. Simultaneously, interaction between participants in innovation activity was facilitated, namely, employees of higher educational institutions were able to share in the work of small innovative enterprises, combining it with teaching and other activities.

In France, the state is investor number one, which realizes more than 80 programs, including the development and supply of weapons and military equipment systems, and more than 300 projects, the development and supply of innovative technologies, including weapons, is state. Annual government contracts orders are implemented for a total more than 10 billion euros, 25 % of which are weapons programs in the framework of European cooperation. In June 2008, strategic priorities for defense and security for the next 15 years were clarified in France, the «White Paper on Defense» is French doctrine on defense and
national security. By 2020, 377 billion euros are planned to be spent on the provision of the French Armed Forces, of which 200 billion will go for the acquisition of new military technique and equipment, including innovative developments [9].

In Japan, targeted programs are a means of stimulating new high-technology industries, such as electronics, robotics, information systems. They facilitate the conduct of scientific research in the business field of business in priority areas of the country. To this end, the program-targeted funding is indicative, while programs and topics define the basic directions of private business. Thus, the impact on innovative programs of enterprises was created, orienting private business on the development of strategically important technologies. The program-target method in Japan is a forecast combination of scientific and technological development with direct and indirect economy regulation measures.

A comprehensive approach is carried out to support innovation in Japan where the state:

- finances private companies engaged in R & D, subsequent the provision of a state order;
- participates in joint financing of R & D through various funds, attracting extra budgetary sources of funding.

For example, the Japan Center for Technologies finances, together with small and medium-sized businesses, the necessary fundamental and applied R & D [12].

For Russia, the issue of public-private partnership in the R & D field is an important element of economic development: the link between science and production, the formation of a com-petitive national research and development sector, and reaching a new level of innovative development. The solution of this issue is another question, how to make Russian business the main customer for R & D, considering that without economic motivation to impose even the best developments on business, it is almost impossible.

In Russia, a number of fundamental documents related to the development of scientific and technical sphere were adopted: «Policy framework of the Russian Federation in the Field of Science and Technology Development for the Period Until 2010 and Further Prospects», «Long-Term Scientific and Technological Development of the Russian Federation for the Period up to 2025», Federal Target Program «Research and development in priority areas of the scientific and technological complex development of Russia for 2007-2012», Federal Target Program «National technological base for 2007-201» and others. To implement them, specific legislative norms and mechanisms for interaction of innovative development partners are needed. These include economic and legal relations:

- between subjects of innovation activity arising in the course of its implementation in any field, regardless of the organizational and legal form of the enterprise;
- relations arising in the process of creation, industrial development, distribution and commercial use of innovations;
- relations arising when investing are implemented in innovation projects by Russian and foreign investors.

The state dispose a fairly large arsenal of opportunities in the innovation sphere development on the partnership with business terms. Along with innovative projects financing it is necessary:

- to create preferential conditions for the innovation activities implementation and incentives for Russian and foreign investors participating in the implementation of innovative programs and projects in accordance with the procedure of establishing by federal legislation;
- to organize purchase for state needs of science-intensive products, technique and newest technologies;
- to place state orders on implementation of science and research, development and technological works;
- to assist the innovation activity infrastructure development;
- to create conditions for the professional development of specialists in the field of management and international cooperation in innovation sphere.
To solve all these problems, it is necessary to remove existing contradictions and gaps in current legislation.

**Conclusion.** Proceeding from all the above, it can be concluded that the public-private partnership mechanism has become widespread in the sphere of R & D in developed countries. In the context of public-private partnership programs, technical training and research networks are being created, grant support for the development of new commercially oriented technologies is provided, through systems of industry development assistance. Within the framework of strategies for economic development of regions, the authorities integrate federal laboratories, universities, industrial consortia, testing and certification centers into a single innovation cycle. Partnerships and joint programs take into account the possibilities of new technologies, the need for new markets, the financial opportunities and management necessary to succeed in these markets.

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