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Technological Sovereignty Projects as a Tool for Innovative Development of the Russian Economy

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Abstract. Currently, in the new geopolitical context and amid external restrictions imposed by the West, the achievement of technological sovereignty is becoming the most important feature of a new emerging development model for Russia. In this regard, there is a need to find new and most effective ways and tools to address this problem. Our work considers the issue of implementing the project approach and the transition to a full innovation cycle economy through the formation of technological sovereignty projects that are pointed out as the main tool for ensuring technological independence as stated in the Concept for Technological Development of the Russian Federation up to 2030. Special attention is paid to the development of scientific and methodological approaches to the formation of such a tool in the context of analyzing the existing accumulated experience in the implementation of projects of a full innovation cycle, primarily comprehensive scientific and technological programs and projects implemented in the light of the objectives contained in the Strategy for Scientific and Technological Development of the

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Russian Federation adopted in 2016. We point out the importance of defining the boundaries of the full innovation cycle, which is interpreted by researchers in different ways. Since technological sovereignty projects are designed to turn into a tool for building their own reproduction chains, they should not end with the introduction of new technology; rather, they should enter mass production and contain a detailed investment component for the creation and reconstruction of production facilities. In this regard, we analyze the procedure for selecting priority areas for the development of technological sovereignty projects and their resource provision; we assess the effectiveness of state tools for supporting such projects; and propose measures to improve the organization of the process of formation and implementation of technological sovereignty projects. The implementation of the package of measures we put forward should help accelerate scientific and technological development and reduce Russia's technological dependence.

Key words: technological sovereignty, full innovation cycle, innovative development model, national innovation system, critical and end-to-end technologies, integrated scientific and technological programs, technological sovereignty projects.

Introduction

Shifting to an innovative development model in Russia has been discussed at least for the past two decades. However, over the years, the country has failed to create a national innovation system that ensures effective interaction between science and industry. The current export-raw material development model has limited both the demand for technological innovations and their supply. This problem has become system-wide, hindering the transformation of the Russian economy toward the formation of a competitive innovation-oriented economic system.

At the state level, it has not been possible to work out mechanisms for attracting business to scientific and technological development. With free access to technology imports from abroad and the opportunity to make quick profits, businesses did not have sufficient motivation to make risky investments in R&D and bring their results to market. "Throughout the pre-crisis period, Russia has been actively importing the results of foreign R&D as part of imports of finished goods, that is, the results of R&D expenditures in other countries ("import of expenditures" on R&D amounting to about 1–1.5% of GDP per year)" (Belousov, 2023). In fact, these funds could be spent on conducting own R&D in the country. At the same time, despite the fact that Russia has a significant scientific reserve, it is rather poorly used and is being transformed into an increase in high-tech exports. According to estimates (Klepach, 2023), today more than 60% of technologies are bought abroad. And the country's position in the global high-tech market has been extremely low for a long period of time (the share does not exceed 0.3%[1]). Many scientific achievements, which have not been embodied in a specific product within the country, go abroad in the form of sales of research and development results. We should point out that it is R&D agreements that form a surplus in Russia's balance of payments.

All this points to the weakness of the national innovation system that has developed in the country, which continues to be "open-ended" in terms of using its own developments for the needs of the domestic economy (Lenchuk, 2023). In such conditions, the most important task of the national scientific and technological complex is not just to increase the scale of research activity, but to increase

[1] Indicators of the development of Russian science: A comparative analysis (2023). Issue 5. Moscow: IPRAN RAN. P. 122.

its effectiveness by orienting the research and development sector to the needs of the real sector of the economy and innovative business, in particular, reducing barriers between producers and consumers of knowledge (Simachev, Kuzyk, 2021).

At the same time, the current geopolitical situation requires fundamentally new solutions in the field of scientific and technological development. The restrictions imposed on investments and technology exports to Russia deprive the country of the most important drivers of economic growth and objectively determine the need to rely on its own scientific and technological potential and strengthen technological sovereignty to build its own production chains. Thus, the research and development sector should be focused on the needs of the real sector of the economy and innovative business in particular.

In the Address to the Federal Assembly of the Russian Federation on February 29, 2024, the President of the Russian Federation noted that we "need to achieve technological sovereignty in cross-cutting areas that ensure the sustainability of the entire economy of the country. These are means of production and machine tools, robotics, all types of transport, unmanned aviation, marine and other systems, data economics, new materials and chemistry"[2]. It is also necessary to create products based on our own developments that can compete in global markets, primarily in such areas as space, new energy, and nuclear technologies. The solution of these tasks involves, first of all, the establishment of internal cooperation chains that ensure the implementation of a full innovation cycle in the creation of new technologies and products. Technological sovereignty projects should become a tool for organizing such interaction. Acting as an engine for updating the technological base of Russian industry, they should ensure that the Russian economy can embark on the path of sustainable development.

However, given that in conditions of unprecedented external pressure, this task will be solved with extremely limited financial resources, it becomes necessary to develop a clear organizational scheme for the formation of projects of a full innovation cycle in the development and implementation of products critical for the development of the country. In turn, this requires clarifying some conceptual approaches to determining the essence of technological sovereignty projects, as well as developing scientific, methodological and organizational approaches to their formation and implementation. The search for an answer to these questions determines the aim of this study.

On some definitions and concepts

The process of creating innovative products is widely considered in the scientific literature (Freeman, 1996; Perez, 2002; Groot, Franses, 2005; Golichenko, 2006; Khlebnikov, 2016) and, as a rule, is interpreted as a set of stages of the scientific and technological cycle of innovations, including a sequence of steps: fundamental research – experimental design – prototype – introduction of new products or technologies into mass production. In other words, the innovation cycle of product creation refers to the path from the birth of a new idea to its implementation into a finished product capable of entering a competitive market (Khairulin, 2015; Vasetskaya, 2020). However, a comparative analysis of the available approaches to the definition of innovation cycles indicates that there is no unity among researchers in the interpretation of this concept. The essence of the discrepancies is the boundaries of the innovation cycle, the number and content of the stages that the authors include in the innovation lifecycle.

[2] Presidential Address to the Federal Assembly of the Russian Federation. Available at: http://www.kremlin.ru/events/president/transcripts/73585

The boundaries and stages change depending on the implemented approach of researchers to determining the life cycle of innovation: product, process, marketing approaches, etc. For example, it is noted that " a product-based approach usually includes analysis of the introduction of competitive products of innovative goods or services into the innovation lifecycle" (Vasetskaya, 2020), whereas within the framework of a process-based approach, the innovation cycle does not go beyond the stage of bringing new products to market.

At the same time, the problem of ensuring Russia's technological sovereignty significantly expands the boundaries of considering the innovation cycle. According to the definition given in the Concept for Technological Development of Russia for the period up to 2030, technological sovereignty is understood as "the presence in the country (under national control) of critical and end-to-end technologies of its own development lines and production conditions based on them, ensuring a sustainable opportunity for the state and society to achieve their own national development goals and realize national interests"[3]. At the same time, we are talking not only about the development and implementation of new technologies, but also about the organization of large-scale production on their basis, which in fact means the transition to the economy of a full innovation cycle, ensuring the creation of products based on own development lines. In this context, the life cycle goes beyond the introduction of products to the market and also includes stages from market development up to obsolescence of products and abandonment of their production.

Thus, technological sovereignty projects should not be limited only to the stage of development of new technologies, but should also extend to the introduction of these technologies at national enterprises with subsequent production of products that are competitive, at least in national markets (Yurevich, 2023).

Such a new macroeconomic approach is planned to be implemented through the further development of the project-based approach by using technological sovereignty projects, which are becoming the most important tool for building their own reproduction chains at the present stage. However, before considering the main methodological approaches to the development and implementation of such projects, it is necessary to analyze the existing experience in the formation of projects and programs of the full innovation cycle.

On the experience of forming projects and programs of the full innovation cycle

The focus on the need to strengthen state policy toward the formation of mechanisms for business interaction with the domestic scientific and technological complex was manifested in the Strategy for Scientific and Technological Development of Russia (hereinafter referred to as the Strategy) adopted in 2016. This document for the first time outlined the need to develop comprehensive scientific and technological programs and projects (CSTP) of the full innovation cycle, which were to act as the main mechanisms for the implementation of scientific and technological priorities outlined in the Strategy. The CSTP received further regulatory consolidation within the framework of the Rules for the development, approval, implementation, adjustment and completion of complex programs, complex projects, approved by RF Government Resolution 162, dated February 19, 2019 (hereinafter referred to as the Rules), as well as the Rules for issuing grants in the form of subsidies from the federal budget for the implementation of complex scientific and technological programs of the full innovation

[3] Concept for Technological Development of Russia for the period up to 2030: RF Government Resolution 1315-r, dated May 20, 2023. Available at: http://government.ru/docs/all/147621/ (accessed: January 15, 2024).

cycle and complex scientific and technological projects of the full innovation cycle approved by RF Government Resolution 1439, dated September 15, 2020.

According to the Rules, comprehensive scientific and technological programs and projects of the full innovation cycle are defined as a set of coordinated activities or a set of works linked by tasks, deadlines and resources, including scientific research and stages of the innovation cycle before the creation of technologies, products and services. Initiators of such complex projects and programs can be interested public authorities, members of the Council for Priority Areas of Scientific and Technological Development of the Russian Federation, organizations of the real sector of the economy, development institutions, etc.[4] The Rules also established a mechanism for the development and adoption of such projects, which includes many stages of approval (Shepelev et al., 2021). At the same time, a special role in the formation of such projects was assigned to the Ministry of Education and Science of the Russian Federation, acting as responsible for the entire process of preparing the CSTP.

We should note that the experience of developing complex projects and programs of the full innovation cycle, accumulated in 2018–2022, has been studied in some detail, and the results are presented in scientific papers (Vasetskaya, Fedotov, 2020; Shepelev et al., 2021); therefore, within the framework of this study, we will briefly focus only on the most critical bottlenecks in the organization of the process the development and implementation of the CSTP and the reasons for their "stalling", which did not allow them to turn into an effective tool for solving important problems of scientific and technological development.

The main work on the selection of projects was entrusted to the Councils for Priority Areas of Scientific and Technological Development of the Russian Federation, which in the period 2019–2021 reviewed 132 applications, but only five projects were approved by the Presidential Council for Science and Education and sent to the Ministry of Education and Science of the Russian Federation for submission to the Government of the Russian Federation. In turn, the Government of the Russian Federation approved four projects, the implementation of which began in 2022–2023. These are projects for launching the production of domestic protein components for infant formula; creation of environmentally safe industrial productions of basic high-tech chemical products for various industries; development and implementation of a complex of environmentally friendly technologies in the fields of exploration and extraction of solid minerals; creation of new composite materials5. The main objectives, expected results and the amount of funding for ongoing projects are shown in *Table 1*.

These data indicate the general orientation of the implemented projects towards import substitution, a high level of expected results and a significant amount of attracted extra-budgetary financing. At the same time, it is quite difficult to assess the effectiveness of the implementation of these projects at the moment, since the projects went through a long process of signing bilateral agreements between all project participants, financing of the first three projects began only in 2023, and the fourth in 2024, and in much smaller amounts than planned. According to VEB experts, the approved state program of scientific and technological development for the current

[4] Rules for the development, approval, implementation, adjustment and completion of complex programs, complex projects, approved by RF Government Resolution 162, dated February 19, 2019. Available at: https://base.garant.ru/72184148/

[5] Report on the implementation of the state scientific and technological policy in the Russian Federation and on the most important achievements made by Russian scientists (2023). Moscow: RAS. Pp. 83–84.

Table 1. Implemented comprehensive scientific and technological projects of the full innovation cycle

Project	Execution period	Goals	Expected results	Financing and structure (budget / extra-budget), million rubles
1. Infant dry milk formulas	2021–2024	Development and production of effective and economical integrated technological solutions for the industrial production of carbohydrate and protein components of breast milk substitutes to provide children with domestic adapted dry milk formulas for the first 6 months of their life	Creating the Russian production of carbohydrate-protein components of breast milk substitutes with improved (compared to Western analogues, for example Prolacta) characteristics for the manufacture of breast milk substitutes	1500 (300/1200)
2. Petrochemical cluster	2022–2027	Import substitution and reduction of the burden on the environment through scientific and technical development and industrial development of complex economically highly profitable and environmentally advanced petrochemical technological processes and products based on them	Creating a technological base and mastering a new generation of advanced complex and environmentally advanced petrochemical processes; obtaining 26 patents and know-hows; transfer of 10 new technologies for the introduction; annual turnover of production of products developed within the framework of the CSTP will amount to 16.9 billion rubles and provide more than 16 billion rubles of budget revenues by 2030, which will many times exceed the budget costs for the implementation of the project	5080 (980/4100)
3. Clean coal – green Kuzbass	2022–2026	Creation of a complex of technologies that increase the efficiency of coal mining and coal refining, a high level of industrial safety and ecology, reduce the risks of occupational diseases, as well as the formation of an effective management system for research, innovation, production and market launch of new products	Creation and implementation of systems and technologies that increase the efficiency of coal mining and coal refining, as well as effective mining of hard-to-recover reserves of coal seam deposits; creation and implementation of technology and equipment to improve the efficiency of degassing of hazardous coal seams; creation and implementation of a comprehensive technology for processing waste from coal mining and coal refining with the release of rare and rare earth elements, etc.	3594 (1654,8/1949,1)
4. New composite materials	2023–2027	Ensuring technological sovereignty and scientific and technological leadership of the country by creating advanced technologies for the production of composite materials and products made from them to meet the growing demand of key sectors of the Russian economy (nuclear, transport and construction industries, energy)	Development and implementation in strategic industries of at least 42 technologies that correspond to global market trends; ensuring technology transfer to the real sector of the economy and organizing mass production of a wide range of composite materials, their chemical components and products based on them – 45 new types of modern products with revenue from their sale of 8.1 billion rubles in 2030.	6797,6 (3398,8/3398,8)
Source: own compilation based on information available at https://kntp.ntr.ru/				

period has cut the funding for the CSTP to 2.3 billion rubles per year (10 times less than the initial passport of the national project "Science"), which does not allow even the already approved programs to be considered as powerful drivers of the full scientific and technological cycle (despite the fact that the possibility of extra-budgetary financing by the participants of the CSTP, as a rule, is provided)[6].

Evaluating the established algorithm of the procedure for the selection and approval of complex scientific and technological programs and projects as a whole, we cannot but note a number of weaknesses. One of the most important problems is that the subject of the CSTP was formed "from below" on the basis of proposals from research organizations and various business entities, outside the structured process of its coordination and alignment with the goals and objectives of the development of the main sectors of the national economy and industry, which does not provide an end-to-end process of developing and implementing (bringing to market) promising technological innovations. In other words, the process of forming complex scientific and technological projects took place outside the logic of the overall strategic planning process. The proposed projects were mainly aimed at solving narrowly sectoral non-systemic problems of individual economic sectors and focused on creating scientific and technological reserves, prototypes, without mass production development of innovative technologies. In particular, this is confirmed by the targets and expected results of the four ongoing projects.

We should note that the CSTP projects submitted to the councils for scientific and technological areas, as a rule, had a weak elaboration of financial support issues, assessment of promising markets for new products, payback periods, etc. Business clearly showed caution, continuing to live in the paradigm of "everything can be bought abroad", instead of launching a production based on our own developments.

From an organizational point of view, the process of selecting and approving the CSTP was multi-stage and unnecessarily complicated; thus, its implementation took too long. Some researchers also noted the lack of legally binding documents regulating the relationship between the parties in the process of implementing the CSTP; differences in the level of scientific and technical groundwork; lack of information to assess the risks and effectiveness of a project or program (Shepelev et al., 2021).

In order to overcome the identified shortcomings, a number of amendments were made to the CSTP training system, which were reflected in Presidential Decree 143, dated March 15, 2021 "On measures to improve the effectiveness of state scientific and technological policy" and Presidential Decree 144 "On certain issues of the Presidential Council for Science and Education". These decrees were supposed to help remove the identified barriers to the formation of the CSTP and improve the organizational mechanism for their preparation and implementation, which, in turn, was supposed to increase the effectiveness of interaction between the state, science and business. However, the geopolitical and geo-economic situation in the country that changed in 2022 required new solutions.

A new stage in the formation of projects of the full innovation cycle

In 2022, with the introduction of unprecedented sanctions by the West against Russia, the need to form end-to-end projects of a full innovation cycle has increased even more, but this process has

[6] Economics of scientific and technological breakthrough and sovereignty. Interdepartmental Working Group on Technological Development under the Government Commission on Modernization and Innovative Development; VEB Institute for Research and Expertise (2024). Moscow: RUDN. 140 p. Available at: https://inveb-docs.ru/attachments/article/2024_04/Ekonomika-nauchno-tehnologicheskogo-proryva.pdf (accessed: April 20, 2024).

received a slightly different content. Restricting exports to the Russian Federation from Western countries of a wide range of high-tech products, technologies and components, limiting the supply and maintenance of software was primarily aimed at impeding Russia's technological and economic development in order to strengthen its lag behind the technology leaders.

The situation was complicated by the degradation of production and scientific and technological potential in most civilian sectors of the domestic industry that occurred in the post-Soviet period, which resulted in a high dependence of various sectors of the Russian economy (up to 70–80%) on imports of technologies, equipment, and software. For example, according to RANEPA calculations, on the eve of 2022, machine tool construction was import-dependent by 95.3%, microelectronics – by 92%, pharmaceuticals – by 87.9%, chemical industry – by 53%, shipbuilding – by 64.7%, medical industry – by 60.1%, aircraft industry – by 52.8%7. In the context of increasing sanctions pressure, such dependence poses the threat of an increase in a new wave of large-scale reductions in production capacity and output in various sectors of the Russian economy.

The RF Government understands the need to overcome technological dependence as soon as possible; this is evidenced by the approval of the *Concept for Technological Development for the period up to 2030* (RF Government Resolution 1315-r, dated May 20, 2023; hereinafter – the Concept), which was supposed to update the Strategy for Scientific and Technological Development of the Russian Federation adopted in 2016. The document emphasized that the main challenges and threats for Russia in the current decade are its lagging behind the most developed countries in terms of innovation-oriented economic growth, which is determined by low motivation of developers of technological solutions to create appropriate industries, weak protection of technological entrepreneurs, lack of financial resources and relatively small capacity of the domestic market of high-tech products, as well as disruption of the functioning of production systems (disruption of production chains) under the influence of sanctions restrictions in the field of technology. It was emphasized that in conditions of high dependence on imports of machinery and equipment, there is a "threat of degradation of production systems in a wide range of industries"[8].

In order to address the current challenges to the scientific and technological development of the country, the Concept provides for the transition to a new stage of technological development of the Russian economy, the goal of which is to achieve technological sovereignty based on its own lines of development of high-tech technologies and the organization of production based on them. We are talking about achieving three key goals by 2030 *(Tab. 2)*.

First of all, we are talking about achieving technological sovereignty in the field of critical technologies for various sectors of the national economy, where it is expected to achieve parity with the leading countries; as well as in the field of end-to-end technologies, where a more ambitious task is set – to achieve technological leadership. However, in the conditions of existing severe restrictions in financial, human and material resources, as well as in the field of scientific reserves, it is impossible to solve this task without forming a system of scientific and technological priorities defining groups of technologies that are critically important for the development of the real sector of the economy and ensuring sustainable economic growth of the country.

All three goals outlined in the Concept are

[7] *Vedomosti*. March 19, 2024.

[8] Concept for Technological Development of Russia for the period up to 2030: RF Government Resolution 1315-r, dated May 20, 2023. Available at: http://government.ru/docs/all/147621/ (accessed: January 15, 2024).

Table 2. Key goals of ensuring Russia's technological sovereignty

No.	Goal	Indicators of achievement of the goal by 2030
1.	Ensuring national control over the reproduction of critical and end-to-end technologies	Achieved level of technological sovereignty by product types; achieved level of development of critical and end-to-end technologies (in accordance with the established list); reduction of the coefficient of technological dependence by 2.5 times; increase in internal research and development costs (at comparable prices) by at least 45 percent
2.	Transition to innovation-oriented economic growth; strengthening the role of technology as a factor in the development of the economy and the social sphere	Increase in the level of innovative activity of organizations by 2.3 times; increase in the cost of innovative activity (in comparable prices) by 1.5 times; increase in the volume of innovative goods, works, and services (in comparable prices by 1.9 times); increase in the number of patent applications by 2.4 times; increase in the number of registered large technology companies by 5 times, including small ones by 2.3 times; 3-fold increase in the growth rate of private investments in small technology companies
3.	Technological support for sustainable operation and development of production systems	Growth of non-primary non-energy exports (1.5 times in comparable prices); increase in the share of manufacturing organizations engaged in technological innovations (1.6 times); increase in the share of high-tech industrial products produced on the territory of the Russian Federation in the total volume of consumption of such products (up to 75 percent); achieving a share of goods produced using best available technologies (up to 100 percent at industrial facilities that have a negative impact on the environment, classified as category I)
Compiled according to: Concept for Technological Development for the period up to 2030 (RF Government Resolution 1315-r, dated May 20, 2023).		

planned to be achieved by activating the tools of the project-based approach – development and implementation of "technological sovereignty projects", which mean "projects of a full innovation cycle for the production of high-tech products based on own development lines using critical and end-to-end technologies, covering all stages of the innovation cycle, including personnel and regulatory aspects" (Vasetskaya, 2020). However, in order for these projects to be really aimed at ensuring technological sovereignty, it is necessary to conduct comprehensive *studies of scientific and methodological approaches* to their formation.

The implementation of an integrated approach to the formation of a full innovation cycle economy involves, first of all, designing priority *projects of technological sovereignty* in key economic sectors, which should include coverage of the entire life cycle of the creation and use of end-to-end and critical technologies and products based on them – from the stage of R&D to mass implementation of the results in industrial production. We should note that expanding the boundaries of the innovation cycle constitutes the fundamental difference between technological sovereignty projects, enshrined in the Concept, and complex scientific and technologi-cal programs and projects that were developed within the framework of the Rules in 2019–2021. Therefore, technological sovereignty projects should contain a detailed investment component for the creation of new or reconstruction of existing production facilities necessary for the large-scale development of new types of products.

At the same time, in order to obtain the status of a technological sovereignty project, the project must meet certain requirements and criteria that are set out in RF Government Resolution 603 "On approval

of priority areas for technological sovereignty projects and projects of structural adaptation of the Economy of the Russian Federation"[9] and in the Regulation on the conditions for classifying projects as projects of technological sovereignty and projects of structural adaptation of the economy of the Russian Federation. Such projects will be provided with government support measures, including in terms of investment support.

On scientific and methodological approaches to the development and implementation of technological sovereignty projects

The initial and core element of the entire scientific and technological development management system is the definition (and occasional clarification) of technological priorities. According to the Concept, the source of technological priorities in terms of end-to-end technologies is a scientific forecast (foresight); in terms of critical technologies, the country's needs for the production of systemically important types of high-tech products, such as microelectronics, machine tools and equipment, turbines, etc.[10] It worth mentioning that the development of a long-term forecast of scientific and technological development is provided for by Federal Law 172 "On strategic planning in the Russian Federation". Like a long-term forecast of socio-economic development, it should form the basis for the entire system of strategic planning documents. We should note that the last time such a forecast was developed in 2014 and has not been updated since then. Besides, the development (or updating) of a long-term forecast of scientific and technological development should be organically integrated into the general cycle of formation of the entire package of strategic planning documents and take into account not only current global trends, but also the situation in the Russian economy, both in the context of the current level of technological development of the main economic sectors, and common tasks and directions of socio-economic development of the country (Lenchuk, 2023). In this context, it is advisable to supplement the forecast with the results of a technological audit of the most important sectors of the Russian economy in terms of their compliance with the advanced achievements of technological progress and an assessment of their dependence on imported technologies.

Based on such an analysis and forecast, proposals should be formed for the development of promising end-to-end technologies (can be implemented in the format of a "National technology initiative"), as well as proposals for a set of priority critical technologies necessary for the development of the most important sectors of the national economy, forming the basis for the development of technological sovereignty projects. We should note that RF Government Resolution 603 "On approval of priority directions of technological sovereignty projects and projects of structural adaptation of the economy of the Russian Federation", dated April 15, 2023, contains a list of such technologies, but the genesis of their formation is not clear. The format and scale of their implementation remain open in the absence of strategies for the development of relevant industries updated for new conditions.

The launch and successful implementation of technological sovereignty projects require addressing a number of organizational issues, including the procedure for the formation of projects, selection of qualified customers and lead performers, definition of requirements for organizations involved in the implementation of projects; procedure for monitoring and control over implementation, formation of requirements for technological maps and passports of such a project.

[9] On approval of priority areas for technological sovereignty projects and projects of structural adaptation of the Economy of the Russian Federation: RF Government Resolution 603, dated April 15, 2023.

[10] Concept for Technological Development of Russia for the period up to 2030: RF Government Resolution 1315-r, dated May 20, 2023. Available at: http://government.ru/docs/all/147621/ (accessed: January 15, 2024).

We should note that the approach to organizing the process of formation and implementation of technological sovereignty projects can be carried out in two formats: first, centralized, when qualified customers and lead performers are determined at the state level, and relations between lead performers and performers are built in the format of state orders. Another format is decentralized, in which the head contractor of the project is selected on a competitive basis; in the future an open platform is formed for those who want to participate in the implementation of the project on a contractual basis.

In both cases, the most important task for the head contractor is to form a cooperative chain of a full innovation cycle for the development of critical technologies and production of high-tech products, within which all participating organizations of the project will be united on a contractual basis. It is also possible for participants in the chain to join consortia or holdings. Scientific and technological support of the project is in the area of special responsibility of the head contractor; in this regard, within the framework of the project, they can form an order for research and development of appropriate technologies.

Resource provision is one of the central issues that should be determined already at the stage of project formation. In terms of financial support, technological sovereignty projects can be supported by both budgetary and extra-budgetary funds.

Speaking about budgetary financing of technological sovereignty projects, it is important to note that the financial costs of their implementation should be prioritized already at the stage of forming the federal budget for the next year and the corresponding planning period. Technological sovereignty projects can also be carried out within the framework of investment projects included in the relevant register of such projects.

Financial support for technological sovereignty projects in the field of end-to-end technologies with a high share of the research component can be carried out on the basis of *grant funding* in the form of subsidies from the federal budget for research and development work, provided that extra-budgetary co-financing is at least 50% of the total financial support for a comprehensive project. In this regard, it is advisable to rely on the above-mentioned Rules for issuing grants in the form of subsidies from the federal budget for the implementation of complex scientific and technological programs of the full innovation cycle and complex scientific and technological projects of the full innovation cycle, approved by RF Government Resolution 1439, dated September 15, 2020.

In relation to technological sovereignty projects aimed at creating critical technologies, financial support mechanisms may be more diverse. Along with receiving subsidies from the federal budget, projects can be funded by private companies and financial development institutions.

In order to attract extra-budgetary financing, the state also creates certain preferential conditions for business. In particular, the above-mentioned RF Government Resolution 603 approved a list of projects that meet the requirements of technological taxonomy, that is, structured to meet the challenges of ensuring technological sovereignty and structural adaptation of the economy. They are provided with the possibility of obtaining bank loans at more preferred rates by lowering risk coefficients[11]. This should make it possible to finance technological sovereignty projects from the domestic banking sector, which, with a total asset volume of about 120 trillion rubles (76% of the total assets of the country's financial market), allocates no more than 2 trillion rubles for investment loans (Aganbegyan, 2022).

[11] RF Government Resolution 603, dated April 15, 2023. Available at: http://goverment.ru/docs/all/147043/

The Bank of Russia has adopted its own regulatory documents on the application of special measures to support technological sovereignty projects. According to the regulator, the burden on capital as a result of the application of special measures can be reduced from 10 to 70% of the standard credit risk on a loan, depending on the category of project and the quality of loan. The Bank of Russia estimates a possible total increase in the amount of loans due to the taxonomy of projects to 10 trillion rubles. Reducing the risk coefficients for projects should ensure a reduction in the lending rate by 0.5–1 percentage points. compared to the market rate. At the same time, we cannot but agree with some researchers who note that such a reduction in the lending rate in conditions when the actual rate reaches 20% and above is unlikely to provide the necessary economic attractiveness for technological sovereignty projects (Nikolaev, 2023).

In fact, the increase in the key interest rate in Russia has reduced incentives for banks to invest in technological sovereignty projects – the "savings" on capital that creditors can receive when providing financing under the taxonomy are offset by the increased cost of money in the market. According to VEB's forecast, in the second year of the taxonomy (in 2024), the amount of financing will reach 350–400 billion rubles. Previously, it was assumed that after the launch of the taxonomy tool, incentive measures to form a loan portfolio for technological sovereignty projects would allow attracting 1–2 trillion rubles in the first year[12].

Currently, VEB plays a special role in the formation and implementation of technological sovereignty projects, which performs the functions of maintaining a register of projects that meet the requirements of the taxonomy of technological sovereignty projects. At the beginning of 2024, the register contained 11 projects that were credited on special conditions, the total amount of loans was 234 billion rubles[13]. The largest part of the technological sovereignty projects selected are related to mechanical engineering, shipbuilding and port infrastructure, the rest of the projects are quite heterogeneous, related to instrument engineering, energy and infrastructure.

Along with the taxonomy, there are other potentially effective credit and financial instruments aimed at increasing the volume of investments in technological sovereignty projects: for example, new measures of state support for private business such as cluster innovation platform, project finance factory, etc. (Sokolov, Filatov, 2023). In particular, the "project finance factory" tool, when money loans are allocated on the basis of syndicated loan agreements with commercial banks, is already used in the practice of lending to technological sovereignty projects. In addition, in some cases, VEB itself acts as a manager within the syndicate, while simultaneously providing loan funds to borrowers. To date, VEB has funded three projects totaling 79 billion rubles[14].

We think that building a full-fledged interaction of instruments among themselves can significantly reduce the cost of credit funds attracted for the implementation of technological sovereignty projects, increase the activity of private investors and the banking sector in the investment process.

Conclusion

The main scientific and methodological approaches proposed in the framework of this study to the formation and implementation of technological sovereignty projects, as the most important tools at a new stage of scientific and technological development in Russia, determine only the general outline of this process and, undoubtedly, need further specification. The success of the case will largely depend on the system-wide

[12] Available at: https://www.rbc.ru/finances/17/06/2024/666c46609a7947be98fa25af?from=from_main_1

[13] Available at: https://www.rbc.ru/economics/22/12/2023/6582d8c79a7947bea7950a13?ysclid=lsn6bv7tgm660792629

[14] Ibidem.

work on the part of all participants in this process, as well as on the quality of management decisions made by public authorities in this area.

We consider it extremely important not only to identify the priority areas in which technological sovereignty projects should be formed, but also to bring them to specific projects within the framework of a cross-cutting scientific, technological and innovative vertical. As noted above, the selection of priorities and projects should be based on qualitative forecasts and technological audit of industries. Moreover, we should note that the requirements for technological sovereignty projects stated in the Concept in terms of ensuring parity or leadership in technology with leading countries today may look overly ambitious. In the context of severe sanctions pressure, the implementation of less ambitious scientific and technological projects that ensure sustainable functioning of the Russian economy may become extremely relevant for Russia. In addition, the need to rank projects according to the degree of importance and relevance is dictated by existing budget constraints in the current situation, as well as other resource constraints, including those related to personnel. Forming an effective system of tools to support technological sovereignty projects remains an equally important issue.

In the organizational and methodological aspect, it is necessary to address the issue concerning the authorized executive authorities ensuring the development and implementation of projects of a full innovation cycle. For projects related to the development of end-to-end technologies, such bodies may be the Ministry of Education and Science of Russia, relevant ministries and state corporations; for projects in the field of critical technologies – the Ministry of Industry and Trade of Russia, state corporations. At the same time, comprehensive and integrated management of technological sovereignty projects in the future requires creating a permanent supranational body overseeing this work. In Soviet times, such functions were performed by the State Committee for Science and Technology, which united the work of all departments and made comprehensive decisions.

Effective interaction of all participants in the full innovation cycle project requires a special information and analytical digital platform that provides end-to-end project support, monitoring and control over the implementation of all its stages from development to introduction into production. All information on the progress of the project should be accumulated on the platform, and summary reports on its implementation should be reflected.

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