Necessary and sufficient conditions for the competitiveness of the «technological sovereignty of Russia» project

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Abstract. The article analyzes the problem of gaining technological sovereignty in terms of formational and civilizational approaches. The paper highlights the stages of Russia's acquisition of technological sovereignty: from economic – through scientific and technological – to technological one. It initially interpreted as import substitution (less often – as proactive import substitution), later – as the creation of its own competitive technologies. According to this stage, the purpose of forming technological sovereignty acquired the status of a priority for the domestic national economy. The author gives definition of technological sovereignty as an economic category. Namely, the expanded reproduction of technological self-sufficiency based on the design, implementation, and development of key technologies in an open-closed economic system. On the one hand, the author highlights the necessary conditions for the competitiveness of the «technological sovereignty of Russia» project, and refers to them those that ensure the simple reproduction of Russia's technological self-sufficiency, or its survival in a hybrid war. On the other hand, author substantiates the sufficient conditions for the competitiveness of the project named above. Moreover, those should ensure the expanded reproduction of Russia's technological self-sufficiency, or its development in a hybrid war. As a result, author comes to the conclusion that despite the importance of creating the necessary and sufficient conditions, the implementation of the «technological sovereignty of Russia» project does not guarantee the successful innovative development of industries without appropriate institutional and economic conditions for their modernization.

Keywords: competitiveness, technological sovereignty, industrial policy, critical technologies, core technologies, supporting industries technologies, autarkical model, open-closed economic system.

JEL codes: O14, O25, O33, P51

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Introduction

The technological development of society was considered in terms of theoretical economics, but rather as a minor one; the major one were the property relations (within the framework of the formational approach of K. Marx & F. Engels (1961), V.I. Lenin (1969) etc. Nevertheless, it also was considered in cultural, social, historical, legal, etc. relations (within the framework of the civilizational approach of A. Toynbee (2009), K. Jaspers (2017), P. Sorokin (2000), U. Rostow (1961), E. Toffler (2010), N.Ya. Danilevsky (1985) et al. Indeed, it is surprising, since it is the technological basis that is the platform on which essential property relations are built (as relations between people regarding the appropriation of factors and production results in the interests of certain subjects of public life). Moreover, it is the way labour is connected with the means of production determining the system of relations of production, distribution, exchange, and consumption of any society. This causal dependence is particularly clearly indicated in the formational approach: production relations should correspond to the level and nature of the development of productive forces. On the other hand, there are critical historical periods when the problem of technological rearmament voluntarily and involuntarily become primarily in terms of the the theoretical economic research. It is a transition to a new technological paradigm which associated with the beginning of a new big wave of the K-cycle, or an issue of

the society survival (as a result of natural or military events).

Many Russian scientists concerns with the idea of technological sovereignty: O.V. Andreeva (2014), A.A. Afanasiev (2023), A.V. Efimov & S.A. Tikhonovskova (2022), I.B. Konstantinov & E.P. Konstantinova (2022), A. Neklyudov & I. Livshits (2016) etc. They considered this concept in a conceptual, methodological sense, and in the context of technological sovereignty of the Russian Federation building strategy.

Recently, the purpose of Russian economic technological sovereignty was formulated as a prior one (for the period up to 2030)[1]. Currently, it is caused by both reasons: the development of the sixth technological way of life, and the life support of Russian society in the face of unprecedented anti-Russian sanctions that have escalated into an undeclared war against the Russian Federation. The purpose of this paper is to study this problem to the identification of necessary and sufficient conditions for the acquisition of technological sovereignty of Russia, which will ensure its technological competitiveness.

Main Part

The issue of "technological sovereignty"

Since early times, this issue has been considered through the theory of comparative advantages in international exchange by D. Ricardo (2008). In accordance with it, full technological independence is possible when implementing a self-reliance model. The autarkical model guarantees autonomy from international cataclysms, and ensures the invulnerability of national development, no matter what demands, or even ultimatums, are made by the other nations. However, such independence provides reducing of benefits of the international labour division, and the consequent decline the living standards. Meanwhile, in case of deformation of this system, causal connections are also transforming. Currently, as a result of a hybrid war against Russia, it decreased economic efficiency considerations and made the economy subordinated on politics and geopolitics. Therefore, technological sovereignty is a necessary condition for the country survival and the maintenance of economic and political independence.

There was no concept of "technological sovereignty" in Soviet encyclopaedias. The technological method of production was considered as "a historically defined way of combining various components in the system of productive forces, primarily man and technical means of labour" (Economic Encyclopedia, 1980). The basis of this definition is the position of K. Marx, who introduced the term "technological method of production" (Marx, 1974). However, the textbooks considered only the social mode of production (within the framework of the formational approach) as a specific way of combining productive forces and production relations (Course of Political Economy, 1973; Medvedev, 1988).

The term "sovereignty" (from fr. Souveraineté) literally means supremacy, domination, independence in various matters (Brockhaus and Efron Encyclopedic Dictionary, 1901; Great Soviet Encyclopedia, 1976). In this paper we do not consider the political interpretation of the complex category of "sovereignty" in the form of state, national, and national sovereignty. Economic sovereignty is associated with independence in the economic sphere, or economic independence of a state or region from other states or regions (Dictionary of Financial and Economic Terms, 2021; Reisberg, 2023).

The world science began to use the term "technological sovereignty" recently. There were two reasons for the emergence of this concept: on the one hand, the scientific and technological revolution began to play the role of a factor ensuring not only the economic success of states, but also their security, primarily in the information and communication sphere, and, on the other hand, the development of post-industrial society increased the role of the knowledge economy as the most important branch of the national economy. Therefore, any technological and information dependence became a condition for increasing the gap in the

[1] *Decree of the Government of the Russian Federation No. 603 on 04.15.2023 "On Approval of Priority Directions of Projects of Technological Sovereignty and Projects of Structural Adaptation of the Economy of the Russian Federation and Regulations on the Conditions for Assigning Projects to the Technological Sovereignty Projects and Projects of Structural Adaptation of the Economy of the Russian Federation, on Providing Information on Projects of Technological Sovereignty and Projects of Structural Adaptation of the Economy of the Russian Federation and Maintaining a Register of these Projects, as well as Requirements for Organizations Authorized to Submit Conclusions on the Compliance of Projects with the Requirements for Projects of Technological Sovereignty and Projects of Structural Adaptation of the Economy of the Russian Federation". Available at: http://government.ru/docs/all/147043/ (accessed 01.02.2023).*

global competitiveness (Prikhodko, 2022).

In Russia, the transition from economic to technological sovereignty can be considered as the category of "scientific and technological sovereignty". It appeared in connection with the activities of the Information and Analytical Center of the President Administration 30 years ago. The wave of anti-Russian sanctions after the return of Crimea in 2014 led to interest in the import substitution projects. However, the term has acquired particular relevance since 2022, after the start of the Special Militarty Operation. It was the result of the unprecedented sanctions pressure of the collective West on Russia. Indeed, it became obvious that a simple replacement of foreign analogues, and the mechanical replacement of some foreign suppliers by other ones, is insufficient, and it is necessary to design and develop own competitive technologies[2].

According to the amendments of 2023 to the Federal Law "On Industrial Policy" of 2014, technological sovereignty is not the protection of the national economy as the preservation of human, financial, technological, and material potential. It could contribute to the industrial development as a whole[3]. In this concept, there is no necessary requirement to ensure the preservation of potential and its development, but also the implementation of technologies which would not allow the economy to become technologically dependent.

The modern interpretation of technological sovereignty does not identify it with the absolute isolation of the national economy from the world. It considers the technological sovereignty over critical technologies to ensure well-being and competitiveness. It is also provides scientific, technical, and industrial development of the country to establish and maintain its own technologies and the necessary infrastructure, as well as guaranteeing the independence of politics and economy from foreign technologies[4]. Key technologies should be developed independently or borrowed from other economies without unilateral structural dependence. In other words, dependence is still allowed, but it should ideally be minimized. It makes it possible to evaluate technological relations with other countries as partnerships in which technological sovereignty should be considered as a "strong negotiating position" ensuring "mirror deals"[5].

Russian scientific literature interprets the issues on what technologies are critical ones. S. Yu. Glazyev proposes to distinguish core technologies and technologies of supporting industries technologies providing the possibility of deploying nuclear directions and their transition from the origin to the growth. In terms of the sixth technological order, its core consists of nanobiotechnology, cellular technologies, methods of genetic engineering, artificial intelligence, and robotics (Glazyev, 2019). Electrical engineering, aviation, space, nuclear industry, instrument engineering, machine tool construction, education, communications retain their role of supporting industries technologies from the technological order, as so as healthcare, agriculture, the creation of new materials with predetermined properties, chemical, metallurgical complex, construction, shipbuilding, and automotive industry.

In terms of the last 10 years, and in more applied aspect, there is the set of key technologies: 5G Internet, production of electric cars and self-driving cars, 3D printing, artificial intelligence and Big Data, VR and AR (virtual reality and augmented reality), cloud data storage, Internet of Things, quantum computing, blockchain, brain implants[6]. Nevertheless, there are country-specific features. Hence, the EU countries rely on energy and digital transformation of the economy, quantum computing, artificial intelligence, and blockchain; China – on 5G, green energy, wireless cars, and quantum technologies; Japan – on robotics, "green", and space exploration; Russia – on unmanned transport, manufacturing of electric vehicles and personal medical

[2] *Meeting with young nuclear scientists (2023). Website of the President of Russia: official website. September 8th. Available at: URL:http://www.kremlin.ru/events/president/news/72220 (accessed 01.02.2023).*

[3] *Federal Law No. 245-FZ of 13.06.2023 "On Amendments to the Federal Law "On Industrial Policy in the Russian Federation" and Article 44 of the Federal Law "On General Principles of the Organization of Public Power in the Subjects of the Russian Federation" (2023). Available at: http://publication.pravo.gov.ru/document/0001202306130070?index=1 (accessed 01.02.2023).*

[4] *Andrey Belousov Named the Main Directions of Technological Policy (2022). Rospatent. July 18. Available at: https://rospatent.gov.ru/ru/news/belousov-tehnologicheskayapolitika-18072022 (accessed 01.02.2023); Denis Manturov: We Will Ensure Our Technological Sovereignty Over Critical Technologies (2023). Rossiyskaya Gazeta, June 14 (in Russian).*

[5] *Why Technological Sovereignty Is Important for Russia. RBC: official website. June 9th. Available at: https://www.rbc.ru/newspaper/2022/06/10/62a0e95b9a79472d8b713207 (accessed 01.02.2023).*

[6] *10 Key Technologies of the Last Decade (2020). Skillfactory: official website. December 18. Available at: https://habr.com/ru/companies/skillfactory/articles/533668/ (accessed 01.02.2023).*

devices, pharmaceutical, chemical, energy, and aviation industries, as well as projects to create infrastructure and provide services (Goryacheva, 2023).

The domestic scientific literature interprets the technological sovereignty as criteria for achieving it, or as achieving a stable state of the country's economic system (Afanasyev, 2022); as an element of the scientific and technological security system goal (Kokoshin, 2015); as the ability of the state or organization to independently control and manage their own technological resources, infrastructure, and processes, as well as design and develop their own technologies (Yankovskaya, 2022); as the utilitarian and applied aspect as "full or partial withdrawal of the technological chain (chains) from external cooperation" (Egerev, 2022); or, on the contrary, as a state of the economy in which any imports within the framework of the production of commodities of proper quality are compensated by proceeds from the sale of their own exports (Faltsman, 2018). In our opinion, it does not guarantee the achievement of technological sovereignty. Moreover, Faltsman's definition obviously does not correspond to the meaning put into the concept and is more suitable for the term "foreign trade sovereignty" or "foreign trade security". The inclusion of the requirement to compensate imports at the expense of exports in the definition is not complemented by the condition to ensure the exchanges do not cause unequal development, because if compensation is provided at the expense of trade in raw materials and agricultural goods, there can be no issue of technological sovereignty.

The author gives definition of technological sovereignty as an economic category. Namely, the expanded reproduction of technological self-sufficiency based on the design, implementation, and development of key technologies in an open-closed economic system.

Necessary conditions for the competitiveness of the "technological sovereignty of Russia" project

In accordance with the author's definition of technological sovereignty, we believe that the necessary conditions for the competitiveness of the "technological sovereignty of Russia" project include those ensuring the simple reproduction of Russia's technological self-sufficiency, or its survival in a hybrid war.

The establishment of these conditions began with the import substitution policy. The concept of technological sovereignty replaced the previous import substitution strategy, which emerged in 2014. The first wave of sanctions against Russia in 2014 resulted in restrictions on imports of some key goods, which required local production, i.e. import substitution. Therefore, the Government of the Russian Federation adopted Decree No. 1936-r on 30.09.2014 "On Approval of the Plan to Promote Industrial Import Substitution". The plan was designed for the period up to 2020, and included 23 sectoral action plans on import substitution. The Government of the Russian Federation has adopted a number of decrees on import substitution, a special government commission has been established. Over the period 2015-2018, 1.6 trillion RUB of budget funds were allocated for the purpose of import substitution. However, the import substitution plan was implemented only partially, for example, for the production of certain food products. In general, by 2020, the policy of import substitution has not become a significant factor in the growth of industrial production. It is quite difficult to really characterize the situation, since the materials for assessing the results of the import substitution policy implementation are not available in the official publications of Rosstat, the Government of the Russian Federation, etc.

In 2022, due to the withdrawal of a significant number of foreign companies from the domestic market, massive sanctions restrictions on the import of many critically important goods, and the disruption of logistics chains, it became vital for Russia to develop effective compensatory mechanisms to maintain the stability of the national economy. The model of import substitution formed in previous years did not meet these requirements.

Meanwhile, the concept of technological sovereignty, in contrast to the import substitution doctrine designed for a short-term period, due to its universal nature and potential ability to provide a radical solution to the issues of restructuring the country's economy, is most correspond to the long-term economic and national interests of Russia. The President of the Russian Federation drew attention to this both during the St. Petersburg International Economic Forum in 2023[7] and during his speech at the XX meeting of the Valdai

[7] *Results of SPIEF-2023 (2023). Vedomosti, June 19. Available at: https://www.vedomosti.ru/press_releases/2023/06/19/.*

International Discussion Club in October 2023[8].

In practice, according to the Decree of the Government of the Russian Federation No. 603 on 04.15.2023, there are 13 priority areas, which can be referred to the technologies of the supporting industries technologies rather than to nuclear technologies: aviation industry, automotive industry, railway engineering, medical industry, oil and gas engineering, production of agricultural machinery, specialized machine-building sector, machine building, shipbuilding, pharmaceuticals, chemical industry, electronics, and energy. For example, in the aviation industry, projects will be implemented to design civil and cargo aircraft, unmanned aerial vehicles, spacecraft and satellites. In the medical industry, the priority is the development of pacemakers, prostheses, surgical instruments, artificial lung ventilation devices, etc. In agricultural engineering, the emphasis is on the production of domestic combines, tractors and their parts.

The priority areas include industries with the level of production localization is now less than 50%.

The Decree No. 603 also identified priorities for projects of structural adaptation of the modern economy realities. They are required for the creation or modernization of infrastructure that allows reorienting transport and logistics flows to Southern ans East friendly countries. Such projects, in particular, include the construction of seaports, shipyards, the design and development of industrial technology parks, the construction of customs warehouses, and various products transportation services.

Projects within priority areas will benefit from the special bank approach in approving loans, lower interest rates, and more active participation of development institutions.

The implementation of structural economy adaptation projects requires a new strategy of foreign economic activity, the appearance of which is expected by the end of 2023. The emphasis is on the processes of deglobalization, which presuppose the establishment of a "development enclave" by Russia. At the same time, the United States, Germany, and other EU countries are following the same path and establish their own enclaves, relying on protectionism and the development of domestic demand. First Deputy Prime Minister of the Russian Federation A. Belousov define it as an "own strategic sustainability". It is ubiquitous, although in the West it depends on the positions of the ruling parties and groups and may change with the change of public authorities[9].

Anyway, the strategic plan for Russian foreign economic relations is to establish two tracks. The Russian authorities call the first track (or space) integrational one, and reduce it primarily to the EAEU (common infrastructure, standards, market access rules, etc.). The second space includes a kind of "distant circle of supporting countries", in which included Asian, partly Latin American and African partners of the Russian Federation. This approach corresponds, of course, to the modrern realities. The main problem is their strategic stability. Meanwhile, the Russia partner countries in the EAEU have a negative attitude towards this association and the dominant role of Russia. Therefore partners are developing the other niches in the global economy. Nevertheless, they can change their preferences depending on the needs and conjuncture, and pay great attention to relations with the West.

Based on the foreign economic strategy being developed by the government, it can be expected that the Russian authorities will pay more attention to the infrastructure for international settlements, cooperate with exporters, helping them to work in new sales markets through support and information. The development of transport corridors, including those such as the North-South corridor, remains a focus to ensure their secure operation in terms of border crossing and flow speed.

To solve the problem of developing domestic demand, special attention is paid to small and medium-sized enterprises (SMEs). A new national project to support SMEs is expected to be developed. The authorities see this as a way to keep people employed (including a special focus on youth business) and to ensure their income. In turn, as a result of the measures taken, SMEs are expected to take a more active part in solving the tasks of achieving technological sovereignty (with a stake on high-tech developers), increasing labor productivity, developing domestic tourism, etc. Essentially, the intention is to avoid the image of SMEs as

[8] *Meeting of the Valdai Discussion Club (2023). Website of the President of Russia: official website. October 5th. Available at: http://www.kremlin.ru/events/president/news/72444/videos (accessed 01.02.2023).*

[9] *Belousov Announced a Paradigm Shift in the Functioning of the World Economic Space (2023). TASS: official website. October 21. Available at: https://tass.ru/politika/19081911(accessed 01.02.2023).*

traders and other service industries. In other words, the idea is to move away from the image of SMEs as trading and other service industries. Instead, the aim is to establish a "technological", "productive" SME, partly export-oriented, related to big business and the authorities.

However, SMEs are not able to launch the process of self-reproduction of the economy as a whole and prevent the stagnation of entire industries (for example, civil aviation or machine tool construction, which is a key for the country's technological sovereignty). About 20,000 machines are produced in Russia today. It is only 0.001% of the world output of machine tools. Hence, the output of the Russian machine tool industry is only 0.02% of Russia's GDP[10].

The Higher School of Economics regularly conducts surveys of enterprises in various sectors of the Russian economy. One of the latest (conducted in 2023) concerns with about 1,000 industrial enterprises. When asked about their dependence on imported equipment, 18% of enterprises consider this dependence as an extremely high; 37% – as is low one. The rest rated this dependence as moderate.

Experts believe the production rate should be about 40 thousand machines. With approximately this scale of domestic production, Russia can achieve real technological sovereignty.

But it is necessary to make the ruble a full-fledged investment mechanism. By Academician S.Yu. Glazyev, the size of the Central Bank's key rate should be significantly lowered – up to a near-zero or even zero value for enterprises of supporting industries, i.e. group "A" enterprises (production of capital goods) to ensure their rapid development. In the meantime, a key rate is very high, so macroeconomic policy will be focused on the presidential election in March 2024.

Necessary conditions for the competitiveness of the "technological sovereignty of Russia" project

In accordance with the author's definition of technological sovereignty, the necessary conditions for the competitiveness of the "technological sovereignty of Russia" project include those ensuring the simple reproduction of Russia's technological self-sufficiency, or its survival in a hybrid war.

To ensure these conditions, it is necessary to achieve the development of key technologies which can drive the country innovative development for example, in terms of the nuclear industry. It is one of the purposes of Government Decree No. 1315-r on May 20, 2023, which approved the Concept of Technological Development for the period up to 2030[11]. According to it, by the end of the third decade of the XXI century, the Russian Federation should have its own scientific, personnel, and technological base of critical and end-to-end technologies. The country is planned to create conditions for high-intensity business innovation activity, which will operate in a comfortable regulatory environment. In addition, by 2030, the national economy should ensure the production of high-tech products of microcircuits and other microelectronics, high-precision machine tools and robotics, aerospace equipment, drones, medicines and medical equipment, telecommunications equipment, software, etc. At the same time, the share of domestic goods in the total volume of consumption should be at least 75%.

A special system of indicators was created to monitor the achievements. Thus, in order to ensure technological sovereignty, it is necessary to achieve an increase in internal research and development costs by at least 45%. For the transition to innovation-oriented economic growth, the level of innovation activity in industry and other areas should increase by 2.3, and the costs for these purposes – by 1.5 times. Also, by 2030, the volume of innovative goods, works, and services should increase by 1.9 times, and the number of patents by 2.4 times. For the sustainable functioning and development of production systems, it is necessary to increase the number of manufacturing enterprises using technological innovations by 1.6 times.

Indeed, the main mechanisms for achieving those purposes it are also defined. They are: forming of end-to-end technological priorities for science, education and for economic sectors; focusing on technological development, key components: searching of new organizational forms of interaction between science, education and business; development of technology transfer infrastructure in the economy and HR. The

[10] *The Government is Ready to Solve the Machine Tool Problem (2023). Expert: official website. June 27. Available at: https://yandex.ru/turbo/expert.ru/s/2023/06/27/pravitelstvo-prigotovilos-reshit-stanochnuyu-problemu/ (accessed 01.02.2023).*

[11] *Government Decree No. 1315-r (2023) on May 20, 2023. Russian Government: official website. May 25. Available at: http://government.ru/docs/48570/ (accessed 01.02.2023).*

Ministry of Economic Development of Russia together with the Ministry of Education and Science of Russia has been instructed to develop a plan of priority measures for the concept implementation[12].

The expanded reproduction of technological sovereignty in Russia depends on a number of factors affecting scientific and technological progress and the economic development. There are some of them:

1) Financing of R&D.

Indeed, Russia expenses on science and technology are about 1.3% of GDP; the leading countries – 2-6%. According to the OECD, Israel is the leader in 2022 with an index 5.9%[13]. An increase in funding for science and technology can become an incentive for new technologies development; it increases the Russian companies' competitiveness. However, nowadays the level of funding is not sufficient.

2) Scientific and technical base quality.

The development of scientific and research centers, universities and technology parks can stimulate the establishment of new technologies and attract investment.

3) Human potential.

It represented by highly qualified scientists and engineers. Ensuring conditions for attracting them to the high-tech industry can significantly increase Russia's competitiveness. For instance, the "Mendeleev Card" project. It is a large-scale program to support talented youth. Cardholders receive preferences and discounts for additional education, the use of electronic libraries, travelling, business trips, etc.

However, the number of employees engaged in research and development for the period from 2000 to 2021 decreased by a quarter: from 887.7 thousand to 662.7 thousand people. The number of employed in the scientific field during this period decreased by a fifth: from 426 thousand to 340.1 thousand people. The number of graduate students for the period 2000-2021 decreased from 117.7 thousand to 90.2 thousand, or by 23.1%. The number of doctoral students over the same period of time decreased in 4.5 times: from 4,213 to 932 (Science. Technologies. Innovations, 2023).

4) Availability of high-quality infrastructure (laboratories, innovation centers, business workshops, etc.).

This infrastructure can help in the design and commercialization of new technologies. However, the number of R&D institutions in the period from 2000 to 2021 decreased by 39.4%: from 2686 to 1627; the number of design centres decreased by 26.7%: from 318 to 233; the number of design and survey companies decreased from 85 to 13, i.e. 6.5 times (Science. Technology. Innovation, 2023). It is equivalent to the absence of R&D infrastructure in the country[14].

5) Regulatory environment.

Developing a supportive environment for research, innovation and high-tech industries can attract investment and promote technological sovereignty. It involves the development of legislation ensuring the protection of intellectual property, support for small and medium-sized enterprises in high-tech and the facilitation of procedures for registering and obtaining licences for innovations.

6) International cooperation.

Participation in international projects and programs can help to access to new technologies, sharing experience and knowledge with foreign colleagues and attracting investments into the Russian economy.

The comparison of the costs of R&D, the quality of the scientific and technical base and with the scientific and technological results provides the interested data. Russia ranks fifth among 13 countries by the number of people engaged in R&D in 2021 – 7.2 times less than the leader – China. In relative terms, based on 10 thousand people employed in the economy, Russia is in ninth place (Science. Technologies. Innovations, 2023). Therefore, the positions of the Russian Federation on personnel in the innovation sphere can be interpreted

[12] *The Russian Government has approved the Concept of Technological Development until 2030 (2023). Ministry of Science and Higher Education of the Russian Federation: official website. May 25. Available at: https://minobrnauki.gov.ru/press-center/news/novosti-ministerstva/68378/ (accessed 01.02.2023).*

[13] *Gross domestic spending on R&D (2022). Organisation for Economic Co-operation and Development: official website. Available at: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm (accessed 01.02.2023).*

[14] *Belousov Reported on the Lack of Infrastructure for Development in Russia (2023). TASS: official website. April 24th. Available at: https://tass.ru/ekonomika/17593993 (accessed 01.02.2023).*

as average ones.

In terms of R&D expenditures (in $ USD, by teacher stuff), the Russian Federation was in tenth place with $47.6 billion; the gap of the leader – the United States – was 15 times (Science. Technologies. Innovations, 2023). In relative terms, as a percentage of GDP, Russia is the last in the list of 13 countries.

In terms of patents, the Russian Federation in 2020 was in the last place out of 10 countries, scoring 0.9% in the volume of patent applications for inventions (Nauka. Technologies. Innovations, 2023). Here, the lag behind the leader – China – with its 44% is calculated by dozens of times.

The practical implementation of R&D in the economic activities of companies and organizations is presented in Table 1.

Table 1 – Russia's innovation activity, 2021 (compared to 27 European countries)

Indicator name	The value of the indicator	Place in the ranking of 28 countries
The level of innovation activity of organizations:		
• Belgium	71.3	1
• Germany	68.8	2
• Finland	68.7	3
• Russia	11.9	27
• Romania	10.7	28
The share of innovation activity costs in the total volume of goods shipped, works performed, services:		
• Serbia	3.6%	1
• Lithuania	2.1%	2
• Russia	2.0%	3
The share of innovative goods, works, services in the total volume of goods shipped, works performed, services:		
• Ireland	36.9%	1
• Spain	21.7%	2
• Finland	19.3%	3
• Russia	5.0%	28

Source: Science. Technologies. Innovations, 2023.

Meanwhile, correlation the costs of innovative development with the results of this development allows us to conclude these costs as ineffective ones. The standards based in the Concept of Technological Development are clearly insufficient. We agree with V.Yu. Katasonov, according to him, "international correlations characterizing Russia's positions in the field of science and technology make a rather poor impression" (Katasonov, 2023).

The development of technological sovereignty in Russia, on the one hand, depends on an integrated approach and taking into account all the factors above. It is necessary to provide support for R&D, establish regulatory environment, develop infrastructure and train highly qualified personnel, and finally achieve a higher return on this support. This approach can ensure the achievement, as well as the development of technological sovereignty and increase Russia's competitiveness worldwide (Dunenkova, 2023). Conversely, technological sovereignty may not be sufficient for the successful innovative industrial development if there are no appropriate institutional and economic conditions for their development. The existence of technological sovereignty in the medical industry, for example, does not guarantee the successful development of medical education, research and infrastructure required to develop new medical products and services. Overall, technological sovereignty is an important factor for the innovative development of economic sectors, but its role must be assessed in association with other factors such as scientific and educational institutions,

infrastructure and economic conditions.

Conclusion

Hence, the study revealed the evolution of Russia's technological sovereignty from import substitution to the development of its own competitive technologies. Recently Russian government formulated the priority task of acquiring technological sovereignty by the Russian economy (by 2030). It also was conditioned by the development of the sixth technological mode, and life support of the Russian society in the conditions of unprecedented anti-Russian sanctions, which have turned into an undeclared war against the Russian Federation. However, technological independence does not correspond to complete autarky. Otherwise, it should guarantee the independence of national politics and economy from foreign technologies. The author gives definition of technological sovereignty as an economic category. Namely, the expanded reproduction of technological self-sufficiency based on the design, implementation, and development of key technologies in an open-closed economic system. The necessary conditions for the competitiveness of the "technological sovereignty of Russia" project provide a simple reproduction of Russia's technological self-sufficiency, or its survival in a hybrid war. Therefore, the sufficient conditions for the competitiveness of the project named above. Moreover, those should ensure the expanded reproduction of Russia's technological self-sufficiency, or its development in a hybrid war. Nowadays, in the sphere of science, technology and innovations, Russia's backwardness from the world leaders is significant. Moreover, Russia backwards in terms of GDP. As a result, the implementation of the "technological sovereignty of Russia" project does not guarantee successful innovative development of industries without appropriate institutional and economic conditions for their modernisation.

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CONFLICT OF INTEREST

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AUTHORS' CONTRIBUTION

Galina A. Rodina – conceptualization, project administration, writing – original draft.
Natalia S. Brillante – writing – review & editing.

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