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The review "Russian economy. Trends and outlooks" has been published by the Gaidar Institute since 1991. This is the 45th issue. This publication provides a detailed analysis of main trends in Russian economy, global trends in social and economic development. The paper contains 5 big sections that highlight different aspects of Russia's economic development, which allow to monitor all angles of ongoing events over a prolonged period: the monetary and budget spheres; financial markets and institutions; the real sector; social sphere; institutional changes. The paper employs a huge mass of statistical data that forms the basis of original computation and numerous charts confirming the conclusions.

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5.3 The state of science and innovation in Russia in 2023¹

In 2023, the agenda of science and innovation sector focused on solving tasks in order to ensure technological sovereignty through the creation of own development lines – from R&D to the production of new technological items. In line with this agenda, the existing programs to support scientific organizations and universities, as well as the Russian Science Foundation competitions, were adjusted. The Russian Academy of Sciences dealt with the issues of reorganization of expert work in the country, expansion of its influence in this area, and managed to strengthen mutually beneficial partnership with NRC “Kurchatov Institute”, which during the year affiliated 13 institutes previously under the jurisdiction of the Ministry of Science and Higher Education of the Russian Federation.

There were no significant developments in the innovation sector. Moreover, private sector expenditures on R&D have generally decreased. However, industry experts² noted an increase in the interest of certain technology companies in investing in R&D due to the withdrawal of foreign technology suppliers from the Russian market.

1. Science on the agenda of technological sovereignty

The goal of ensuring technological sovereignty has become a priority in the state science and technology policy. First Deputy Prime Minister Andrei Belousov called the achievement of technological sovereignty a new stage of technological development.³ In accordance with this goal, the existing instruments of science support were adjusted and supplemented (e.g., the tasks of scientific and

1 Author: *Dezhina I.G.*, Doctor of Economic Sciences, Leading Researcher, Gaidar Institute; Head of the Analytical Department on Science and Technology Development, Skolkovo Institute of Science and Technology.

2 *Krasnova V., Matveeva A.* Innovation as a way of survival // *monocle*. 25.12.2023. No. 1–3. P. 36–41. URL: <https://monocle.ru/monocle/2024/03/innovatsii-kak-sposob-vyzhivaniya/>

3 *Andrei Belousov*: Russia enters a new phase of technological development. 24.04.2023. URL: <http://government.ru/news/48329/>

educational centers, the Russian Science Foundation, in the context of the Priority-2030 Program).

It is worth noting that practical steps to ensure technological sovereignty in recent years have been taken not only in Russia. The impetus for this was given by the pandemic, due to which the established value chains were disrupted.¹ In the current economic environment, achieving absolute technological sovereignty is impossible due to the fact that the degree of internationalization of such chains has increased, including through the spread of digitalization. Therefore, the tasks of formation of technological sovereignty are solved by different countries in certain strategically important areas, where the state seeks to ensure the creation of its own technologies.

It is worth noting that practical steps to ensure technological sovereignty in recent years have been taken not only in Russia. The impetus for this was given by the pandemic, which disrupted the established value chains. In the current economic environment, it is impossible to achieve absolute technological sovereignty due to the fact that the degree of internationalization of such chains has increased including through the spread of digitalization. Therefore, the tasks of formation of technological sovereignty are solved by different countries in certain strategically important areas, where the state seeks to ensure the creation of its own technologies.

In May, the Concept of Technological Development of Russia for the period until 2030² was approved. where technological sovereignty is defined as “the presence in the country (under national control) of critical and cross-cutting technologies of its own development lines and output of products based on them, ensuring the sustainable ability of the state and society to achieve their own national development goals and realize national interests”. Thus, a new concept of “own development lines” is introduced, which is defined as a set of measures (projects, programs) and conditions that ensure the creation and sustainable development of specific domestic technologies and products based on them, including the development of their new generations.

The first version of the priority projects of technological sovereignty for the period until 2030 was approved by the Russian Government Decree No. 603³ in

- 1 *Edler J., Blind K., Kroll H., Schubert T.* Technology sovereignty as an emerging frame for innovation policy. Defining rationales, ends and means // *Research Policy*. 2023. Vol. 52. No. 6. DOI: 10.1016/j.respol.2023.104765; *Mazzucato M.* Mission-oriented innovation policies: challenges and opportunities // *Industrial and Corporate Change*. 2018. Vol. 27. No. 5. P. 803–815. DOI: 10.1093/icc/dty034.
- 2 Concept of Technological Development of Russia for the period until 2030. Approved by the Edict of the Government of the Russian Federation dated May 20, 2023. No. 1315-p. URL: <http://publication.pravo.gov.ru/document/0001202305250050>
- 3 Decree of the Government of the Russian Federation of April 15, 2023. No. 603 “On Approval of Priority Areas of Projects of Technological Sovereignty and Projects of Structural Adaptation of the Economy of the Russian Federation and Regulations on the Terms of Attributing Projects to Projects of Technological Sovereignty and Projects of Structural Adaptation of the Economy of the Russian Federation and Maintenance of the Register of These Projects, as well as Requirements for Organizations Authorized to Provide Opinions on the Conformity of Projects with the Requirements for Technological Sovereignty Projects and Projects for Structural Adaptation of the Economy of the Russian Federation”. URL: <http://publication.pravo.gov.ru/Document/View/0001202304170025>

April 2023, even before the Concept was adopted. A total of 13 areas of sectoral development were identified, each of which contains lists of technologies that need to be developed, including due to sanctions that led to the loss of access to modern imported equipment. Not all areas can be referred to as “breakthrough”, about half of the topics were included in the list due to the need for in-house development of existing foreign technologies.¹

The following development indicators are planned to be achieved by 2030 by means of formation of own development lines:²

- reduce the technological dependency ratio by 2.5 times;
- raise the level of innovation activity by 2.3 times;
- triple patent activity;
- increase the growth rate of innovative goods by 1.9 times.

The organization of work within the framework of new research consortia, including universities, research institutes and companies is an integral part of the policy of ensuring technological sovereignty. Their design can be based on elements of past – although not large-scale – experience of such cooperation. One example is the program of partnership between universities and institutes of the Russian Academy of Sciences and companies, which commenced in 2010³ and in many cases led to the strengthening of bilateral partnerships. However, this program allocated relatively modest funds for short periods of time, so they were used to develop small technological products or to improve existing ones. There is also experience of using this approach by development institutions. Since 2022, the Engineering and Innovation Support Center has been financing small technology companies under “future thing” contracts with grants ranging from Rb25 mn to Rb250 mn.⁴

In October 2023, the government announced the launch of major projects (which have been repeatedly used as “megaprojects”⁵) in key areas of technological sovereignty. The products and technologies that the first 10 projects will lead to are diverse: diesel engines, machine tools, medicines and medical devices, chemical, electronic and radio-electronic products, unmanned aerial systems, airplanes and ships.⁶

In order for science to contribute to technological sovereignty, domestic spending on R&D must grow by at least 45% by 2030.⁷ So far, the dynamics of

1 *Petrova V., Sapozhnikov O.* A thought with a flight altitude cap // *Kommersant*. April 10, 2023. No. 61/П. P. 2. URL: <https://www.kommersant.ru/doc/5925857>

2 *Andrei Belousov:* Russia enters a new stage of technological development. April 24, 2023. URL: <http://government.ru/news/48329/>

3 Business and science cooperation. Decree (of 09.04.2010.) No. 218. URL: <https://pp218.ru/>

4 Engineering and innovations support center. URL: <https://inno-sc.ru/grants/>

5 The notion of “megaprojects” was first introduced in the early 2000s, when large public funds were allocated to technology projects carried out by consortia of companies and universities. For more details, see: *Dezhina I.G.* New instruments of state stimulation of innovation activity // *Innovations*. 2005. No. 4. URL: <https://cyberleninka.ru/article/n/novye-instrumenty-gosudarstvennogo-stimulirovaniya-innovatsionnoy-deyatelnosti>

6 *Kuzmin A.* Mishustin announced the launch of technological sovereignty megaprojects // *Rossiyskaya Gazeta*. 24.10.2023. URL: <https://rg.ru/2023/10/24/mishustin-zaiavil-o-zapuske-megaproektov-tehnologicheskogo-suvereniteta.html>

7 The Russian Government approved the Concept of Technological Development until 2030. Ministry of Science and Higher Education of the Russian Federation. 25.05.2023. URL: <https://minobrnauki.gov.ru/press-center/news/novosti-ministerstva/68378>

both budgetary and private funding of science are such that this indicator seems unrealistic. Thus, starting from 2025, it is planned to reduce budget expenditures on civilian research and development. In turn, the funding received by institutes within the framework of the state assignment, according to the estimates of Academician D.M. Markovich,¹ is sufficient only for the payment of basic salaries to researchers and support staff, and there are no funds for the renewal of equipment, purchase of materials and components. Despite the difficulties of financial support, science, according to A.A. Fursenko, assistant to the President of the Russian Federation, should *"have an early edge in the world scientific development, but for this purpose it is necessary to clearly prioritize, and it will inevitably have to give up something"*.² Most likely, the priorities will be related to the scientific support of individual projects of technological sovereignty.

In addition to extra funding, changes in R&D personnel policy are required, as new tasks demand a different system of incentives that is not related to increasing publication activity. This mainly concerns the reorientation of researchers towards solving applied problems, where publications cannot be the main outcome of work.

Firstly, today the main pool of personnel for the development of own technologies are specialists from medium-sized growing technology companies. They are engaged in the development of niche technologies and products based on their own research. Secondly, the talent pool is represented by teams actively working under contracts and grants. The process of their "reorientation" is likely to be resisted, however it is necessary in the context of a significant change in the technological base of the economy. It is also important to use the opportunities of the current situation, when for the first time in a long time there is a minimal increase in personnel. According to the results of 2022, there were slightly more researchers (only by 0.17%), and their total number reached 340,700 people. The

addition is most likely due to the withdrawal from the market of a number of analytical and consulting services, including foreign ones, where qualified, but not necessarily "with degree" personnel worked. The transition to the sphere of science became a logical, although, perhaps, temporary, decision for them. This explanation is supported by the fact that while the number of researchers was growing, the share of researchers with academic degrees was decreasing. Over the year, there were 2.1% fewer candidates of science and almost 3.2% fewer doctors of science.³

2. Financing of research and development

Expenditure on science as a share of GDP fell to an all-time low of 0.94% in 2022, a drop even compared to the low level of 2021 (0.96% of GDP). This is

1 Kolesova O. Create cannot be bought. New production chains were formed at Technoprom-2023 // Poisk. 02.09.2023. No. 34–35. P. 2–3. URL: https://poisknews.ru/science_politic/sozdat-nelzya-kupit-na-tehnoprome-2023-formirovali-novye-proizvodstvennyye-ctepochki/

2 Andrei Fursenko urged to "have an early edge" in Russian science // Science. TASS. 19.05.2023. URL: <https://nauka.tass.ru/nauka/17790201>

3 Martynova S., Ratai T., Tarasenko I. Personnel of Russian science // Science. Technologies. Innovations. Express-information. HSE ISSEK. 10.11.2023. URL: <https://issek.hse.ru/news/871682314.html>

roughly in line with the level of 1998 (0.95%),¹ when the country faced a serious economic crisis. In 2023, according to preliminary estimates, spending on science is below 1% of GDP.² Having said that, in current prices these expenditures were growing, while in constant prices they dropped by 4.7%³ over the year. The structure of expenditures by sources of funding remained virtually unchanged. More than 2/3 of domestic R&D expenditures (67.3%) were funded by the state, while the share of the business sector accounted for 28.9%, which was a decrease compared with the previous year. In constant prices, the volume of funds of the business sector for R&D decreased by 5.1%.

For 2024, allocations are planned below the level of 2023, and in 2025 there may be a sharp reduction in funding. The maximum allocations for R&D under the state program "Scientific and Technological Development of the Russian Federation", where budget expenditures on civil science are accumulated, are planned for 2024, but this is 1.4% below the level of 2023, and taking into account inflation, R&D funding is reduced even more significantly (*Table 8*).

Table 8

Dynamics of civilian R&D allocations in 2024–2026

Indicator	2024	2025	2026
Federal budget civilian R&D allocations, total, Rb bn	557.1	436.2	504.4
<i>Change to the previous year, %</i>	-0.9	-21.7	+15.6
Including R&D under the state program "Scientific and Technological Development of the Russian Federation"	546.0	426.3	492.7
<i>Change to the previous year, %</i>	-1.4	-21.9	+15.6

Sources: Annex 14 to the Explanatory Note to the Federal Law "On the Federal Budget for 2024 and the Planned Period of 2025 and 2026", own calculations.

In 2024, the National Project "Science and Universities" is planned to reduce funding by 4.3%⁴ compared to the Federal Law No. 466-FZ.⁵ In terms of federal projects included in the National Project "Science and Universities", spending will be cut by more than half for the federal project "Development of infrastructure for scientific research and training", by 10% – for the federal project "Development of integration processes in science, higher education and industry", by almost 8% – for the federal project "Development of large-scale scientific and scientific-technological projects in priority research areas". These are the projects that boost the development of cooperation between science and business, support the renewal of the infrastructure of scientific activity and promote the faster use of research results in the economy. This being said, spending on the federal

1 Science indicators-2006. Stat. digest. Moscow: HSE, 2006. P.60.

2 Science. Technologies. Innovations: 2024. Brief stat. digest. Moscow: HSE ISSEK. P. 42.

3 *Martynova S., Ratai T.* Financing of Russian science in the new context: at year-end 2022 // Science. Technologies. Innovations. Express-information. HSE ISSEK. 02.11.2023. URL: <https://issek.hse.ru/news/870116078.html>

4 Allocations are itemized only for 2024 in Annex 12 to the Explanatory Note to the Draft Federal Law "On the Federal Budget for 2024 and the Planned Period of 2025 and 2026".

5 Federal Law "On the Federal Budget for 2023 and for the planning period of 2024 and 2025" dated 05.12.2022 No. 466-FZ. URL: https://www.consultant.ru/document/cons_doc_LAW_433298/

project “Human Capital Development for the benefit of regions, industries and the research and development sector” will increase by 85.7%. 80% of the funding under this project is intended for “the creation of new laboratories, including under the leadership of young promising researchers”. However, it is the “cheapest” among the federal projects of the National Project “Science and Universities” (its financing in 2024 will amount to Rb10.7 bn, or 7% of the allocations for federal projects of the National Project). Having being said, another federal project “Creation of a network of modern campuses” appears, but it is not focused on the creation of infrastructure for the transfer of scientific results to the real economy.

Expenditures on basic research (according to the name of the sub-section of the CDF) will increase compared to previous plans, and their share in total R&D expenditures will grow steadily and will amount to 46.8% in 2024, 53.8% in 2025 and 54.9% in 2026 (*Table 9*). At the same time, their share in relation to GDP will remain at the level of 0.1%.¹

Table 9

Budget allocations for fundamental research

Type of expenditure	2024	2025	2026
Fundamental research (subsection CDF), Rb bn	260.8	234.5	277.0
Share in total expenditures for civilian R&D, %	46.8	53.8	54.9
Russian Science Foundation, Rb bn	31.6	35.2	35.5

Sources: Annex No. 14 to the Explanatory Note, Annex No. 15 to the Federal Law “On the Federal Budget for 2024 and for the Planned Period of 2025 and 2026”, own calculations.

Grant funding of fundamental research from the Russian Science Foundation (RSF) will increase in absolute value, but will decline compared to that provided for by the Federal Law No. 466-FZ, while the Foundation remains the only source of grant competitive funding of fundamental and exploratory research. Since the Foundation receives funds from the budget, it follows the priorities of the state policy. Based on the new course towards technological sovereignty, the RSF has introduced contests related to the development of technological solutions in the interests of industry. On the one hand, this trend is important and is in line with the changes taking place in the world with similar funds, which also increasingly support transformational research. On the other hand, projects of this type require much more funding, and the planned increase in the RSF budget is clearly insufficient.

In October 2023, the first RSF grant contest for technological projects in the Microelectronics area was completed, and 10 three-year projects were funded.² The logistics of this area of RNF work are not simple. Project topics were selected in accordance with the interests of customers from the business sector. Therefore, prior to the announcement of the contest, the most promising thematic areas were selected from among those proposed by the companies. The contest among

¹ According to Annex 15 to the Explanatory Note to the draft Federal Law “On the Federal Budget for 2024 and for the planning period of 2025 and 2026”.

² *Volchkova N.* From the mount to the plant floor. RSF form bridges between science and industry // Poisk. 13.10.2023. No. 41. P. 4–5. URL: <https://poisknews.ru/granty/so-stenda-v-chez-rmf-navodit-mosty-mezhdu-naukoj-i-proizvodstvom/>

potential project implementers was small: there were 14 applications for 10 grants awarded. This is due to the strict and unusual for the scientific community in the context of the competition, according to which the results of work should be accepted by the company-customer and be ready to be used in production.

In the future, project contests should be launched in five more strategic areas: medicine, agriculture, genetic resources, green energy and scientific instrument manufacture.¹ This requires not only more substantial financial resources (if not limited to single projects), but also the recruitment of relevant expert practitioners, as well as the search for companies interested in the developments of research institutes and universities.

In general, however, budgetary funding for applied research will decrease, so the choice of priorities should become more stringent. Currently, the development of infrastructure and material base for R&D, thanks to which research results can be quickly translated into the economy, as well as a number of thematic areas, such as the development of civilian industries, aviation, electronics, health care, can be considered as such priorities.

Funding for scientific instrumentation and infrastructure (improvement of the material base of science) will decline in 2024. Including the federal project "Development of domestic civil instrumentation for scientific research", the funding will amount to Rb3.7 bn per year (in 2024-2025) and Rb3.8 bn in 2026, which is a slight decrease compared to that provided for by epy Federal Law No. 466-FZ. Thus, the project remains in the pilot stage.

The dynamics of R&D allocations by key technological areas is presented in *Table 10*. Compared to 2024, funding will fall, especially in 2025. The cumulative annual reduction of allocations by the level of 2024 for all allocated programs will amount to 22-26%. It is also worth noting that the majority of programs for 2024 are allocated less funding than planned under the Federal Law No. 466-FZ.

Table 10

Budget allocations for applied R&D in priority areas of technological development, Rb bn.

Type of expenditure	2024	2025	2026
Federal projects in the field of electronics development ²	18.2	17.1	18.3
Federal project "Promotion of research and development in civilian industries"	8.3	11.2	11.8
Departmental project "Conducting applied scientific studies for the development of aircraft construction in the Russian Federation"	35.9	15.8	16.7
Federal project "Development, standardization and serial production of remotely piloted aircraft systems and their components"	5.9	5.9	5.9
SP RF "Health care development"	3.0	2.5	2.6
Total	71.3	52.5	55.3
in % on 2024	–	-26.4	-22.4

Sources: Annex 14 to the Explanatory Note, Annex 24 to the Federal Law "On the Federal Budget for 2024 and the Planned Period of 2025 and 2026", own calculations.

- 1 Volchkova N. Fruits of the decade. The Russian Science Foundation summarized interim results // Poisk. 17.11.2023. No. 45–46. P 6. URL: <https://poisknews.ru/news/vrossii/plody-desyatiletiya-rossijskij-nauchnyj-fond-podvel-promezhutochnye-itogi/>
- 2 "Development of electronics manufacturing technologies", "Applied research, development and implementation of electronic products".

Thus, the planned volume of budget allocations for R&D does not correspond to the scale of the tasks set to achieve technological sovereignty. The structure of budget expenditures on civil R&D is more in line with a stable import-oriented economy. In the 3–5-year perspective, it would be important to raise budget funding for applied research and development.

3. Government measures to mitigate the consequences of sanctions

The state policy on overcoming the sanctions developed along the lines laid down in 2022.¹ The greatest attention was paid to two directions: 1) creation of own databases of scientific journals, whose publications will be recognized when assessing the performance of scientific research of individual scientists, postgraduate degree seekers, and organizations as a whole; 2) reorientation of international scientific cooperation to countries that did not impose sanctions.

Last year, work continued on the adjustment of two lists of scientific journals: the so-called "White List", which includes publications indexed in the Scopus / Web of Science databases, and the VAK list. In addition, new projects have appeared: ISCI (International Science Citation Index) and RSJ (database "Russian Scientific Journals" – a project of the Russian Research Institute of Economics, Policy and Law in Science and Technology (RIEP)). Apparently, the two new initiatives are far from being finalized, as there is little public information about them. According to some responses, the RSJ duplicates existing Russian databases, and it is up to publishers to form it by manually entering information about their journals.² This diversity of lists is somewhat disorienting for both the scientific community and, ultimately, the science administration.

Since the national evaluation system was not created over the year, in November 2023, the Russian Government issued a Decree where the moratorium on reporting on the publication of articles in publications indexed in Scopus/Web of Science was now extended until December 31, 2024, and the last year's instruction to "develop a system for evaluating the effectiveness of scientific research and development" in 8-months' time was repeated.³

In 2023, the first results of the measure, according to which publications in journals indexed in international databases become optional, became apparent. The publication activity of Russian scientists in such journals began to decline: in 2022 – by 14.4% compared to 2021 (Scopus database), and Russia's share in the

1 In detail see: *Dezhina I.G.* The state of science and innovations // Russian Economy in 2022. Trends and Outlooks. Issue 44 / Edited by A.L. Kudrin, V.A. Mau, A.D. Radygin, S.G. Sinelnikov-Murylev Moscow, Gaidar Institute Press, 2023. Pp. 430–435.

2 Beliaeva S. Shall we manage ourselves? The exit of foreign databases from Russia is not a verdict. // Poisk. 26.05.2023. No. 21. P. 14. URL: <https://poisknews.ru/konferenczii/spravimsya-sami-uhod-zarubezhnyh-baz-dannyh-iz-rossii-ne-prigovor/>

3 The RF Government Decree of 10.11.2023 No. 1884 "On Amending Resolution No. 414 of the Government of the Russian Federation of March 19, 2022". URL: <http://government.ru/docs/all/150458/>

global flow of publications fell from 3.6 to 3% over the year.¹ The analytical center "Expert AC"² recorded a decrease in the number of publications from universities – former participants of the Project "5-100". The indicators of their publication activity declined to the level of 2015–2016. At the same time, the reorientation of universities towards Eastern partners from China, India, Pakistan and Turkey commenced.

For the country as a whole, the importance of scientific collaboration has increased not only with India, China and Turkey, but also with Kazakhstan and Saudi Arabia. According to preliminary estimates, in 2023 China became the main scientific partner (19% of joint publications).³ Having said that, the number of joint Russian-Chinese papers in 2023 slightly dropped compared to 2022.⁴ However, in percentage terms, the collaboration went up due to a sharp decrease in collaboration with the previous main scientific partners (with the USA and Germany).⁵

At the level of individual subject areas (e.g., medicine, artificial intelligence research, astronomy), the dependence on partners from unfriendly countries remained high,⁶ and in general, in all scientific areas, the share of collaborations with "unfriendly countries is still higher than with friendly countries".⁷

The reorientation of scientific organizations and universities towards cooperation with the countries of the East was a response to the state policy in the field of international scientific collaboration. Now the priority is given to collaboration with countries that did not impose sanctions. Furthermore, the list of unfriendly countries was gradually growing. Against this background, the country continued to withdraw from long-term international scientific and technical programs. The Decree of the Government of the Russian Federation on withdrawal from the European scientific and technical program "Eureka"⁸ became a landmark. The program commenced in 1985, Russia joined it in 1993 to promote

- 1 *Kotsemir M., Streltsova E., Filatov M.* Publication activity of Russian scientists in the new realities // Science. Technologies. Innovations. Express-information. HSE ISSEK. 11.12.2023. URL: <https://issek.hse.ru/news/879121802.html>
- 2 Rating of publication activity of Russian universities – 2023 // ARETT. Analytical center "Expert". 15.05.2023. URL: <https://acexpert.ru/publications/rating/reiting-publikatsionnoi-aktivnosti-rossiiskikh-universitetov-2023>
- 3 *Kotsemir M., Streltsova E., Filatov M.* Publication activity of Russian scientists in the new realities // Science. Technologies. Innovations. Express-information. HSE ISSEK. 11.12.2023. URL: <https://issek.hse.ru/news/879121802.html>
- 4 *Van Noorden R.* Data hint at Russia's shifting science collaborations after year of war // Nature. 24.02.2023. URL: <https://www.nature.com/articles/d41586-023-00552-w>
- 5 *Matthews D.* China becomes Russia's biggest collaborator after war decimates science ties with the west // Science-Business. 22.02.2024. URL: <https://sciencebusiness.net/news/international-news/china-becomes-russias-biggest-collaborator-after-war-decimates-science-ties>
- 6 The definition of "unfriendly countries" is given in the Edict of the Government of the Russian Federation No. 430-p dated 05.03.2022. URL: <http://government.ru/docs/44745/>. Unfriendly countries include Russia's main scientific partners (USA, Germany, UK, Italy and France).
- 7 Rating of publication activity of Russian universities – 2023 // ARETT. Analytical center "Expert". 15.05.2023. URL: <https://acexpert.ru/publications/rating/reiting-publikatsionnoi-aktivnosti-rossiiskikh-universitetov-2023>
- 8 The RF Government Decree of 14.03.2023 No. 391 "On the Withdrawal of the Russian Federation from the European Science and Technology Program "Eureka". URL: <http://publication.pravo.gov.ru/Document/View/0001202303150017>

domestic scientific and technical developments in the markets of the EU countries and to gain access to new technologies that were created within the framework of the program. Partnerships in information technology and telecommunications, energy, transportation, robotics, laser technology, ecology and biotechnology¹ have been particularly successful. In turn, on the part of unfriendly countries, the severing of ties with Russia led to increased wariness at the level of individual organizations and scientists towards any potential foreign partners. Various aspects of cooperation – from security to practical aspects of organizing scientific and technical collaborations – began to be reconsidered.² Russian partners in various projects were gradually being replaced abroad.³

At the governmental level, there are plans to expand ties with five countries that joined BRICS on January 1, 2024 (these are Saudi Arabia, UAE, Egypt, Ethiopia and Iran). It is worth noting that BRICS is primarily a political and economic alliance, and scientific and technological cooperation was not given a leading role. However, as most of the new countries strive for import substitution, production localization and technological sustainability, there are grounds for cooperation in technology development and adaptation, joint ownership of intellectual property rights and other areas that contribute to the formation of technological sovereignty. For Russia, cooperation with the BRICS countries may also provide an opportunity to enter new technological markets.

In terms of the level of resources invested in innovative development and the results obtained, Russia is approximately in the middle of the group of new BRICS countries (Fig. 1).

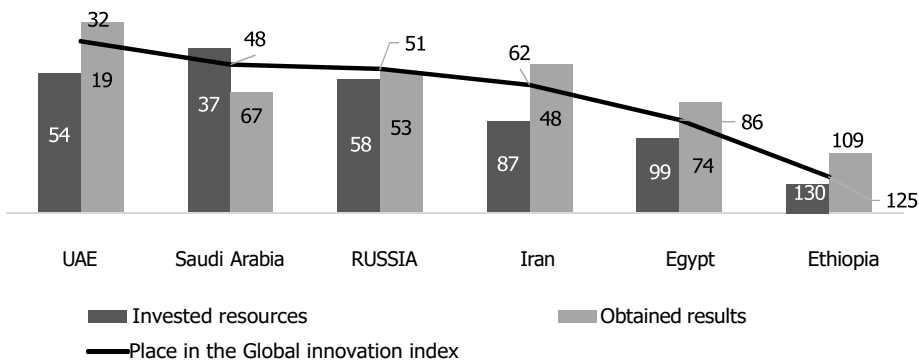


Fig. 1. Ratings of resources invested and results obtained, place in the Global Innovation Index, by new BRICS countries and Russia (2023)

Source: Global innovation index (GII) – 2023. URL: https://www.wipo.int/global_innovation_index/en/2023/index.html

- 1 Farewell to Eureka. Russia withdraws from the European program // Poisk. 24.03.2023. No. 12. P. 2.
- 2 Naujokaitytė G. War in Ukraine prompts shifts in thinking about international cooperation in science // Science| Business. 02.03.2023. URL: <https://sciencebusiness.net/news/International-news/war-ukraine-prompts-shifts-thinking-about-international-cooperation-science>
- 3 Ruffini P.-B. Guerre en Ukraine, sanctions académiques et diplomatie scientifique: Quelques réflexions à partir des résultats d'une enquête récente. 2023. (hal-04110773).

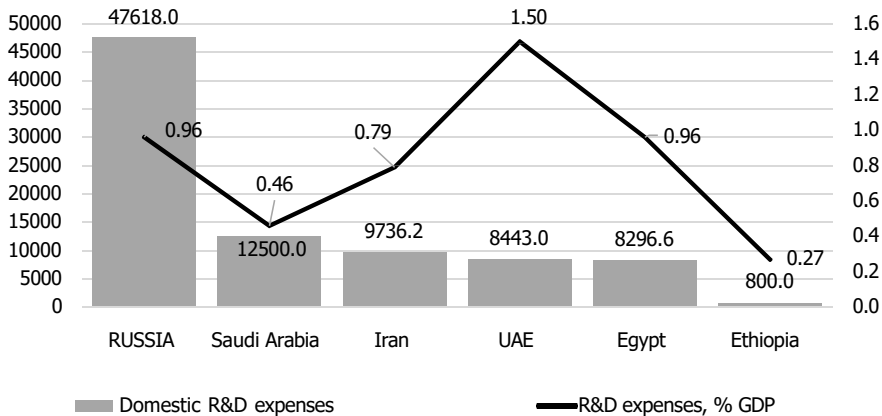


Fig. 2. Expenses on R&D: new BRICS countries and Russia, 2021 or the year nearest to it

Sources: Indicators of science – 2023. P. 346, 348; UNESCO data. URL: <http://data.uis.unesco.org/Index.aspx?queryid=115>

At the same time, in terms of R&D expenditures in absolute terms, Russia significantly overtakes these countries, and in terms of expenditures on science in GDP it is at the level of Egypt (Fig. 2).

For all these countries, the main scientific partners are either countries in their region or leading scientific powers (USA, EU, Canada, Australia). Having said that, based on patenting data, it is possible to identify overlapping areas of interest: medical technologies and pharmaceuticals,¹ measurements, new materials, civil engineering. Most likely, the potential for cooperation lies not primarily in the field of “pure” science, but in the field of practical application of R&D results.

4. Estimates of sanctions implications

Despite the fact that two years have passed since the introduction of sanctions against Russian science, studies on the extent of their impact are still few and lag behind the dynamically changing situation. The available estimates show that the imposed sanctions have significantly complicated the research activities of 60-70% of researchers from medical, natural, agricultural and technical sciences due to high dependence on imported instruments, equipment and materials.²

Analysis of the sanctions’ impact on the work of the most productive group of researchers and teachers belonging to the 1st-5th percentiles of the RSCI³ core showed that more than 3/4 (76.2%) of them faced at least one of the

1 According to the analysis of PCT patents, WIPO data base. URL: <https://www3.wipo.int/ipstats/ips-search/patent>

2 Gusev A.B., Yurevich M.A. Russia’s scientific policy – 2022: a profession is not more precious than the motherland. Moscow: “Pero” press, 2022. Pp. 17–18.

3 The total sample size was about 2,000 people. Source: Dezhina I.G., Nefedova A.I. Estimates of the impact of sanctions on the work of highly productive Russian researchers // Sociological studies. 2023. No. 12. Pp. 19–31. DOI: 10.31857/S013216250029334-0

restrictive measures. The most tangible were restrictions on access to digital resources and libraries (57.5%), to reagents and materials (51.6%), to foreign software, equipment and databases (48.1%). One in three (32.3%) were denied acceptance of articles to foreign journals and/or had a foreign internship canceled (31.5%). One in five faced rejections by foreign colleagues from co-authorship in a publication (20.7%), and almost as many (18.8%) were denied participation in foreign scientific events.

Representatives of natural sciences were the most affected by the sanctions, however, they were less likely than the average in the sample to face refusals to accept articles in foreign journals. Technical and medical sciences were the next most affected by the sanctions. For the former, the restriction of access to digital resources and foreign software, equipment and databases was significant. Representatives of medical sciences, in turn, suffered the most from reduced access to reagents and materials, as well as from the cancellation of foreign internships. In terms of age structure, the greatest pressure of sanctions was felt by researchers under 35 years of age, who were actively involved in international cooperation.

The consequences of economic sanctions turned out to be the most widespread. Restrictions on access to material and technical base and information resources were noted by 72.8% of respondents, among young scientists – 87%.¹ At the same time, the breakdown of ties in various forms of international cooperation affected slightly more than half of scientists (56.3%). The “weaker” impact of sanctions associated with the breakdown of international relations can be explained by the fact that not all researchers, even highly productive ones, were involved in international cooperation.

As a consequence of the restrictive measures, the participation of Russian researchers in international conferences has decreased.² In 2022, the share of papers with the participation of Russian authors dropped by 40% and continued to decline in 2023. To illustrate this, we can cite data on Journal of Physics conferences cited by the UK Institute of Physics. Russian researchers actively participated in the conferences, as physics remains a strong research area in Russia. In 2021, Russian authors presented almost 6 thousand papers, in 2022 – already a little more than 1 thousand. In 2023, according to information as of November, only 106 Russian papers were submitted.³

According to the study devoted to the assessment of the business climate in Russian science,⁴ in three years managers of research institutes and universities expect complications in the types of activities related to international cooperation.

1 *Dezhina I.G., Nefedova A.I.* Estimates of the impact of sanctions on the work of highly productive Russian researchers // Sociological studies. 2023. No. 12. Pp. 19–31. DOI: 10.31857/S013216250029334 0

2 *Matthews D.* News in depth: Russian researchers disappear from academic conferences as isolation bites // Science| Business, 14.11.2023. URL: <https://sciencebusiness.net/news/international-news/news-depth-russian-researchers-disappear-academic-conferences-isolation>

3 *Ibid.*

4 *Doing science in Russia: attitudes and expectations.* 14.12.2022. URL: <https://issek.hse.ru/mirror/pubs/share/802296588.pdf>

It is predicted that access to databases of publications and patents, as well as opportunities to publish in foreign scientific publications, to speak at conferences abroad, and to organize international events in Russia will be reduced.

5. Science in universities

In 2023, the main government initiatives aimed at the development of science in higher education institutions continued. First of all, these are the programs "Priority-2030" and World-class Scientific and Educational Centers (WECs).

The Priority 2030 Program¹ has been adjusted in line with the changing science policy and the new priorities of the country's regional development. This was reflected in the addition of regional tracks (Far Eastern, which appeared at the end of 2022, and Arctic in 2023²), as well as new areas of activity, such as the creation of digital chairs for training and retraining of IT specialists, apparently due to their significant outflow from the country in 2022-2023. Specialists in this area are really needed, because so far, as noted by the Chairman of the Government of the Russian Federation Mikhail Mishustin, the share of domestic developments in new software products is only about 20%.³

In November 2023, the Russian Government issued a Decree,⁴ according to which the requirement for universities – candidates for participation in the program in terms of the number of full-time students is changed (lowering the "entry" bar from 4,000 to 2,500 people, apparently, for the possibility of developing new regional tracks), as well as increased emphasis on the fact that the participating universities should present the results of research and development in demand in the economy, assessed, among other things, by their contribution to the development of cross-cutting and critical technologies.

Orientation on final practical results is also being strengthened for world-class research and education centers. In 2023, a Decree of the Government of the Russian Federation changed arrangements of awarding grants to the existing 15 SPEs and future centers that may enter the program after rotation. Now the size of grants will depend on the results of the previous year, so the gradation of SPCs by the amount of funding allocated to them is introduced (3 categories: maximum, basic and minimum grant size).⁵ The principle of SPCs rotation will be

1 In 2023, 119 universities from 50 regions of the country participated in the Program, and 10 universities had "candidate" status to join the program. This is an increase compared to the initial pool of universities (106). Source: Study in leading universities // Национальные проекты. рф. URL: <https://национальныепроекты.рф/opportunities/uchitsya-v-vedushchikh-vuzakh>

2 Russian Ministry of Education and Science will adjust the "Priority-2030" program for higher education institutions of the Arctic zone // Ministry of Science and Higher Education of the Russian Federation. 31.05.2023. URL: <https://minobrnauki.gov.ru/press-center/news/novosti-ministerstva/68605/>

3 Conference "Digital Industry of Industrial Russia". URL: <https://cipr.ru/stream-2023>

4 The RF Government Decree of 29.11.2023 No. 2018 "On Amendments to Decree of the Government of the Russian Federation No. 729 of 13.05.2021". URL: <https://www.garant.ru/products/ipo/prime/doc/408004391/>

5 The RF Government Decree No. 1100 dated 04.07.2023 "On Amendments to Certain Acts of the Government of the Russian Federation" (the document has not entered into force). URL: <https://www.garant.ru/products/ipo/prime/doc/407238744/>

linked to this: centers that fall into the third category twice will be dropped from the program.

In the assessment of SPCs, quantitative parameters will be supplemented by qualitative ones, showing the achievements of SPCs, as well as the level of integration of universities, research institutes and companies that are part of them. Nowadays, SPCs integrate 145 universities, 140 scientific organizations and 319 technology companies.¹

At the moment, not much is known about the effectiveness of the SPC instrument. The SPC program has been implemented for 5 years and its funding has increased from Rb1.6 bn in 2022 to over Rb1.8 bn in 2023.² According to the data of the Ministry of Education and Science, thanks to the work of the SPC, more than 3,000 patents for inventions in priority areas of scientific and technological development were obtained and more than 2,000 technologies³ were developed. It is not known how useful the patented inventions are, where exactly the technologies are used, and whether the results correspond to the scale of resources invested in the SPC.

At the end of 2023, a new call for proposals for the support of SPCs was announced, the results of which and the amount of funding will be known in 2024. It is expected that the call will result in a ranking of applications from SPCs based on three groups of criteria describing the potential of the center, involvement and the potential of the region.⁴ The potential of the region will be assessed based on the presence of SEZs, technology parks and other technical infrastructure.

In general, university science continues to grow in terms of the scale and specific weight of R&D performed there. According to the latest available data, the share of the university science sector in R&D expenditures increased to 10.8%, which is a small but significant increase (in 2018 it was 9.7%), and in absolute terms in current prices, R&D expenditures in universities increased by 17% over the year (although in constant 2015 prices remained virtually unchanged).⁵

At the same time, the cooperation between universities and companies is still poorly established – the funds of the business sector in the financing of university science decreased by 3.5% over the year. Having said that, funding from foreign sources fell by more than half, but this change is quite logical in the context of sanctions.

Nevertheless, some positive shifts in cooperation between universities and companies in connection with the tasks of technological sovereignty began to surface. The projects of leading universities and medium-sized high-tech

- 1 Assessment of HSE ISSEK. See: Reznik I. How the symbiosis of science and business works for regional economies // RBC+. 07.12.2023. URL: <https://plus.rbc.ru/news/64ccb7a87a8aa901aac1cf09>
- 2 Reznik I. How the symbiosis of science and business works for regional economies // RBC+. 07.12.2023. URL: <https://plus.rbc.ru/news/64ccb7a87a8aa901aac1cf09>
- 3 For the entire period of operations of SPC. See: Petrova V., Morris S., Khristich A. Education competition // Kommersant. 07.07.2023. No. 121. P. 2. URL: <https://www.kommersant.ru/doc/6085020>
- 4 Ranking mechanics. SPCs will compete for grants // Poisk, No. 44, November 3, 2023. P. 4.
- 5 Martynova S.V., Ratai T.V., Repina A.A., Kotsemir M.N. University science today // Science. Technologies. Innovations. Express-information. HSE ISSEK. 28.11.2023. URL: <https://issek.hse.ru/news/876050309.html>

companies focused on the creation and development of their own lines of development of critical elements of new technologies have begun to take shape. Examples include MSU and the partner company "Unihimtek" working in the field of composite materials; Skoltech, MSU, MIPT, FIC of Chemical Physics named after N.N. Semyonov, RIAC of the Russian Academy of Sciences. Skoltech, MSU, MIPT, Semenov FIC RAS, in collaboration with companies developing and producing various types of energy storage devices and their individual components; Samara State Medical University in cooperation with companies developing medical equipment; TUSUR working with manufacturers of niche radio electronics.¹ Such universities plan to rely on technology companies to become developers of technologies and products at a level not lower than technology readiness level (TRL) 6-7.²

Apparently, the university research sector is still focused on the publication of articles rather than on practical work in the interests of industry. Given the modest scale of funding and the number of researchers (about 11% of the total number of employees performing R&D), universities demonstrate an unusually high level of publication activity. In 2022, about 70% of Russian publications in scientific editions indexed in the Scopus database were prepared with the participation of university researchers,³ although this is a slight drop compared to the level of 2019-2021.

Another change is related to the training of higher-qualified personnel. In 2022 compared to 2021, the number of PhD thesis defenses increased by 16% (in 2021 the increase was 23%, but from a low base – after the pandemic low of 2020).⁴ However, the system of scientific training has not yet recovered. Thus, compared to 2015, the number of defenses was lower by almost a quarter (24%).

The increase in PhD thesis defenses observed for the second year may be the result of changes in the requirements for theses and dissertation councils. At the end of 2020, the preparation of dissertations became a mandatory condition of the final certification of graduate students, and according to the order of the Ministry of Education and Science of 2021,⁵ the requirements for the composition

1 *Dezhina I., Ponomarev A.* Universities in the context of transition to a new model of technological development // *Science Management: Theory and Practice*. 2023. Vol. 5. No. 4 (in print).

2 Technology readiness level – a scale for assessing the readiness of technologies during their development. The first level of readiness is the description of the idea and basic principles of the technology, the last, ninth level is the testing of the prototype in real setting, confirming the readiness of the technology for serial production. Levels 6-7 correspond to the availability of a model or prototype, in an environment close to the real one, and then under field conditions. See: GOST 3 58048-2017. Technologies transfer. Methodological guidelines for assessing the level of technology readiness. P. 5.1.

3 *Martynova S.V., Ratai T.V., Repina A.A., Kotsemir M.N.* University science today // *Science. Technologies. Innovations*. Express-information. HSE ISSEK. 28.11.2023. URL: <https://issek.hse.ru/news/876050309.html>

4 *Martynova S., Streltsova E.* PhD thesis defenses are on the rise again // *Science. Technologies. Innovations*. Express-information. HSE ISSEK. 08.09.2023. URL: <https://issek.hse.ru/news/858083982.html>

5 Order of the Ministry of Education and Science of Russia of 07.06.2021 No. 458 "On Amendments to the Regulations on the Council for the Defense of Dissertations for the Degree of Candidate of Sciences, for the Degree of Doctor of Sciences, approved by the Order of the Ministry of Education and Science of Russia of 10.11.2017 No. 1093".

of dissertation councils were adjusted. The minimum number of dissertation council members was reduced from 19 to 11 people, and the quorum was reduced to 2/3 of all dissertation council members regardless of the form of their participation.¹ This facilitates and accelerates the process of passing the defense of prepared dissertation works.

In the meantime, according to preliminary and not yet confirmed by the Ministry of Science and Higher Education data, in 2023, the number of thesis defenses fell by 22% at once,² i.e. almost returned to the level of 2021. The explanations can be very different – from the emergence of competitive demand for specialists on the part of companies in the absence of a system of remuneration for having an academic degree to the transition to a new nomenclature of research specialties, because of which some dissertation councils restructured their procedures and temporarily did not work. The new system of postgraduate training has been in place for only two years, and it will be possible to interpret the effects in 4-5 years at the earliest.

6. Initiatives of the Russian Academy of Sciences

Three directions were key in the RAS activity. The first was the promotion of its policy in the field of scientific and technological guidance and expert activity. The second was the development of proposals to change the approaches to the assessment of research institutions and their rating. The third direction was related to the deepening of interaction and partnership between the RAS and NRC Kurchatov Institute (hereinafter referred to as NRC KI).

In the direction related to the expert activity, the aspiration of the Academy's executives to concentrate various types of expert activity and to get the right to determine how and by which experts they should be carried out prevailed. Up to now the RAS experts have been authorized to conduct expert examination of state assignments, which, according to available data, are approved by 99%, since it is known that the draft state assignments by 70-80% have already been fulfilled.³ The task of expert activity is reduced to answering the question whether the application complies with the available heading of topics and requirements for publication activity. In other words, it is practically an ex post examination. Nevertheless, at the end of the year, the President of the RAS Gennadiy Krasnikov reported that the examination of state assignments became stricter and the number of negative conclusions increased threefold.⁴

1 *Martynova S., Streltsova E.* PhD thesis defenses are on the rise again // Science. Technologies. Innovations. Express-information.. HSE. ISSEK.. 08.09.2023.. URL.: <https://issek.hse.ru/news/858083982.html>

2 *Strogova E.* Number of thesis in Russia over the year contracted by 22% // RBC. 21.02.2024. URL: https://www.rbc.ru/technology_and_media/21/02/2024/65d49b5f9a79474bfaa9e935

3 *Medvedev Yu.* The RAS President Gennady Krasnikov: Only science can ensure the country's technological sovereignty. // Rossiyskaya Gazeta.. 24.04.2023.. No.. 90.. URL.: <https://rg.ru/2023/04/25/akademii-do-vostrebovaniia.html>

4 Meeting with the RAS President Gennady Krasnikov. 30.01.2024. URL: <http://kremlin.ru/events/president/news/73347>

The Russian Academy of Sciences' officials proposed to change the system of formation of state assignments so that not to move from what has already been achieved, but to allocate and support really promising work.¹ The idea is that institutes should first send their applications to the RAS, where the departments of the branches of science² will assess the degree of demand for future research results. It is also possible to involve large state-owned companies, such as Rosatom, Rostec or Roscosmos, in the selection process to form a set of topics that may be of interest to companies in the future 3-7 years.

The RAS officials also promoted the idea that the results of scientific research should be evaluated not by publication activity, but by the demand for them by industry or other research institutes.³ In addition, it was proposed to revise all expert councils of the country and eliminate the duplication of expert functions,⁴ as it disperses energy and resources. The desire of the RAS to control various expert examinations is understandable, but this intention to actually monopolize (or, more mildly, to "streamline") the system of various expert examinations may lead to a decline in quality and erroneous decisions.

The RAS also became involved in the expertise of "roadmaps" of high-tech projects, including quantum technologies, artificial intelligence, new materials and mobile communication systems,⁵ and was able to promote the approval of subprogram 6 of the Program of Fundamental Scientific Research for 2021–2030. "Fundamental and prospecting scientific research in the interests of national defense and state security".⁶ The program was agreed upon by the end of 2023⁷ and its actual implementation will commence in 2024. At the first stage, funding will amount to about Rb10 bn per year and will continue to grow. ⁸ The RAS plans to develop topics related to biological and food security.⁹

- 1 *Medvedev Yu.* The RAS President Gennady Krasnikov: Only science can ensure the country's technological sovereignty // *Rossiyskaya Gazeta*. 24.04.2023. No. 90. URL: <https://rg.ru/2023/04/25/akademiia-do-vostrebovaniiia.html>; RAS changes the system of research expert activity // *Indicator.ru*. 29.11.2023. URL: <https://indicator.ru/humanitarian-science/ran-menyaet-sistemu-nauchnoi-ekspertizy.htm>
- 2 Branch of the Russian Academy of Sciences. URL: <https://www.ras.ru/sciencestructure/departments.aspx>
- 3 *Belyaeva S.* Return to the best. The head of the RAS reported on accomplishments and prospects // *Poisk*. 17.11.2023. No. 45–46. P. 3. URL: <https://poisknews.ru/science-politic/vozvrashhenie-k-luchshemu-glava-ran-soobshhil-o-sdelannom-i-perspektivah/>
- 4 The President of the Russian Academy of Sciences proposed to streamline the field of expert activity in Russia // *Nauka*. TASS. 8.02.2023. URL: <https://nauka.tass.ru/nauka/16998083>
- 5 Meeting with the RAS President Gennady Krasnikov. 30.01.2024. URL: <http://kremlin.ru/events/president/news/73347>
- 6 The RF Government Edict of 31.10.2020 No. 3684-p. URL: <http://static.government.ru/media/files/skzOODEvyFOIBtXobzPA3zTyC71cRAOi.pdf>
- 7 *Vedeneeva N.* The RAS President Krasnikov activated the adoption of a scientific defense program // *MKRU*. 2.11.2022. URL: <https://www.mk.ru/science/2022/11/02/prezident-ran-krasnikov-aktiviroval-prinyatie-nauchnoy-oboronnoy-programmy.html>
- 8 *Belyaeva S.* Return to the best. The Head of the RAS reported on accomplishments and prospects // *Poisk*. 17.11.2023. No. 45–46. P. 3. URL: <https://poisknews.ru/science-politic/vozvrashhenie-k-luchshemu-glava-ran-soobshhil-o-sdelannom-i-perspektivah/>
- 9 *Nedyuk M.* "The RAS takes an active part in the formation of critical infrastructure" // *Izvestia*. 30.04.2023. URL: <https://iz.ru/1503276/mariia-nediuk/ran-aktivno-uchastvuet-v-formirovaniikriticheskoj-infrastruktury>

The desire for comprehensive expert activity was also manifested in the fact that the RAS signed a cooperation agreement with the Internet encyclopedia Ruviki, an analogue of the Russian-language Wikipedia, the beta-testing of which was launched on June 27, 2023. By the end of 2023, it was planned to review at least 2500 articles.¹

The second area of focus of the RAS related to changing the system of categorization of institutes, which determines the distribution of funding among them. Research institutes can belong to one of three categories – the first (the highest), the second or the third, when due to weak performance the organization receives the smallest funding, which does not allow to significantly update the material and instrumentation base. Such a system is criticized by the Academy for the Matthew effect (the weak cannot become stronger, the strong multiply their advantages and successes), as well as for excessive reliance on quantitative indicators, which do not always reflect the demand for the results obtained. The trade union of the RAS employees also opposed the division of institutes into categories, as it “disadvantages” those who fell into the second and third categories,² although they were probably there because of insufficient performance.

It is proposed to make the assessment “multifactorial” – so that institutions have individual indicators, and instead of categories to introduce rating. Then, according to the Academy executives, the institutes will have an incentive to increase their positions in the rating.³ However, the transition to rating itself is of little value if it is not connected with decisions on funding. If rating is a transition to equalized distribution of funds, then the efficiency of the former academic sector of science is unlikely to increase.

The third direction of the RAS activity developed most dynamically. It was connected with the expansion of NRC KI by merging new institutes with simultaneous transition of the center under the scientific and methodological leadership of the RAS. The opinion that de facto NRC Kurchatov Institute has become the Academy of Sciences 2.0 is increasingly heard.⁴

On February 7, 2023, an Edict of the Government of the Russian Federation was published, expanding the list of research organizations, in respect of which SRC “Kurchatov Institute” exercises powers of the founder and property owner. The list includes 7 institutes, whose removal from the officials of the Ministry of Science and Higher Education of the Russian Federation was agreed by the RAS:⁵

- 1 Evolution of academic expert activity // *Nezavisimaya Gazeta*. 20.09.2023. URL: https://www.ng.ru/editorial/2023-09-20/2_8831_red.html
- 2 *Kotlyar P.* Hopes for a big budget and problems with openness. What scientists say about the first year of work of the new president of the RAS // RTVI. 20.09.2023. URL: <https://rtvi.com/news/dengi-uvoleniya-aresty-i-vozvrat-k-vremenam-kashpirovskogo-chto-govoryat-uchenye-o-pervom-gode-raboty-novogo-prezidenta-ran/>
- 3 *Mischenko E.* With new challenges and psychiatrist’s certificates: the first day of the General Meeting of the RAS // *InScience*. 23.05.2023. URL: <https://inscience.news/ru/article/discussion/12393>
- 4 *Morozov A.* General meeting of the RAS in working order // *Nezavisimaya Gazeta – nauka*. 23.05.2023. URL: https://www.ng.ru/nauka/2023-05-23/10_8730_situation.html
- 5 The RF Government Edict of 07.02.2023 No. 268-p. URL: <http://publication.pravo.gov.ru/Document/View/0001202302080007>

- Institute of Macromolecular Compounds;
- I.V. Grebenshchikov Institute of Silicate Chemistry;
- Federal research center "Crystallography and Photonics";
- Institute for Systems Research;
- Institute for Design Problems in Microelectronics;
- V.G. Mokerov Institute of Ultrahigh Frequency Semiconductor Electronics;
- Valiev Institute of PhyNRCs and Technology.¹

The total number of institutes under the jurisdiction of NRC KI increased to 18. Finally, in October, the Institute of Design Problems in Microelectronics (IPPM RAS, Zelenograd)² merged with NRC KI, and the number of institutes became 19.

The official explanation of the RAS and the Ministry of Education and Science³ was that the merger was necessary for the creation and implementation of advanced technologies in the field of microelectronics and new materials. The NRC KI executives repeatedly drew an analogy between this task and the Soviet atomic project. However, some prominent academicians opposed this decision, as well as the fact that it was approved behind the scenes by the RAS executives. For example, Academician R.I. Nigmatulin expressed the opinion that the accession of institutes should have been discussed with scientists, rather than *"pushing the takeover through the government, using their power"*. And that *"it is dangerous when only one scientist without opponents has contact with the head of state and pushes through the very top projects that cannot be critically analyzed by other scientists"*.⁴ In addition, large-scale nuclear projects are implemented through the creation of new institutes, not by affiliating several existing ones to one organization. At least, this is how both the atomic and rocket-space projects were carried out; and the Siberian Branch of the USSR Academy of Sciences was created according to the same model. Academician A.R. Khokhlov also pointed to the behind-the-scenes nature of decision-making on the merger of institutes and, in general, insufficient openness of the RAS executives.⁵ Indeed, the problem with openness was obvious: the directors of some institutes learned from the press about their assignment to the Kurchatov Institute.⁶

1 The RF Government Edict of 07.02.2023 No. 268-p. URL: <http://publication.pravo.gov.ru/Document/View/0001202302080007>

2 The RF Government Edict of 12.10.2023 No. 2815-p. URL: <http://publication.pravo.gov.ru/document/0001202310130045>

3 *Vasiliyeva A.* The Kurchatov Institute was enriched with science // Kommersant. 13.02.2023. № 26/П. С. 5. URL: <https://www.kommersant.ru/doc/5825034>

4 *Morozov A.* General meeting of the RAS in working order // Nezavisimaya Gazeta – Nauka. 23.05.2023. URL: https://www.ng.ru/nauka/2023-05-23/10_8730_situation.html

5 *Kotlyar P.* Hopes for a big budget and problems with openness. What scientists say about the first year of work of the new president of RAS // RTVI. 20.09.2023. URL: <https://rtvi.com/news/dengi-uvoleniya-aresty-i-vozvrat-k-vremenam-kashpirovskogo-chto-govoryat-uchenye-o-pervom-gode-raboty-novogo-prezidenta-ran/>

6 *Vedeneeva N.* President of the Kurchatov Institute revealed for the first time who made the decision to reform RAS // MKRU. 21.04.2023. URL: <https://www.mk.ru/science/2023/04/21/prezident-kurchatovskogo-instituta-vpervye-raskryl-kto-prinimal-reshenie-o-reforme-ran.html>

Simultaneously with the affiliation of institutes, NRC KI came under the scientific and methodological management of the RAS.¹ And, thus, a mutually beneficial exchange was achieved: the RAS, in fact, receives under its leadership a number of institutes that became part of NRC KI, and the center itself becomes even more influential. At the same time, according to the RAS executives, it has no goal to gradually return the former academic institutes. According to the RAS President, the return of institutes comes into conflict with the main function of the Academy – to conduct expert activity. G.Y. Krasnikov sees an opportunity for the RAS to become a kind of State Committee on Science and Technology, coordinating the activities of federal executive authorities, state corporations and other structures in research and technology sphere.² Nevertheless, in the same logic of “hidden merger of institutes” as in case of NRC KI, but without a wide public resonance, the creation of the Southern Association of Scientific Institutions under the scientific and methodological guidance of the RAS took place.³ The Southern Association includes 37 institutes, stations and reserves, 150 branch and academic research institutes, 62 universities.⁴

As a consequence of the strengthening and expansion of NRC KI, it became possible to promote certain areas of scientific and technological development. The initiative of NRC KI to develop “nature-like” technologies appeared. The President of NRC KI Corresponding Member of the Russian Academy of Sciences M.V. Kovalchuk called “nature-like” technologies not even the seventh technological mode, but a new concept of the noosphere,⁵ as they exist in harmony with the surrounding world and allow restoring the balance between the biosphere and technosphere, which has been disturbed by man. “Nature-like” technologies are linked with ecology and new energy (bioenergy) and in general with technologies that organically fit into the living nature. In turn, Science Minister V.N. Falkov links “nature-like” technologies with solving climate problems, obtaining new materials, as well as technologies in the field of transportation and energy.⁶ Since there is no clear definition, the question arises whether this is not a reincarnation of the disciplines of “bionics” or

- 1 RAS will provide scientific and methodological guidance to the scientific activities of the Kurchatov Institute PAH // RAS. 29.03.2023. URL: <https://new.ras.ru/activities/news/glava-ran-gennadiy-krasnikov-soobshchil-o-perevode-kurchatovskogo-instituta-pod-nauchno-metodicheskoy>
- 2 *Vedeneeva N.* The RAS President Krasnikov spoke about the revival of microelectronic technologies in Russia П // MKRU. 09.11.2023. URL: <https://www.mk.ru/science/2023/11/09/prezident-ran-krasnikov-rasskazal-o-vozhrozhdenii-v-rossii-mikroelektronnykh-tehnologiy.html>
- 3 *Erknapehian M.* The course to a unified scientific space. The RAS President Gennady Krasnikov spoke at the meeting of the State Duma Committee on Science and Education // Scientific Russia. 09.11.2023. URL: <https://scientificrussia.ru/articles/kurs-na-edinoe-naucnoe-prostranstvo-prezident-ran-gennadij-krasnikov-vystupil-na-zasedanii-komiteta-gosdumy-po-nauke-i-obrazovaniyu>
- 4 *Subbotin A.* Listen to us! Russian scientists will have to provide answers to the transformation of the world order // Poisk. 26.05.2023. No. 21.Pp. 2–3. URL: <https://poisknews.ru/ran/poslushajte-nas-otvety-na-transformacziyu-miroporjadka-predstoit-dat-rossijskim-uchenym/>
- 5 Presentation by Mikhail Kovalchuk at the session “Nature-like technologies: an era of human development” at the III Congress of Young Scientists. 28.11.2023. URL: <https://конгресс.наука.рф/program/>
- 6 Falkov believes that nature-like technologies have the potential to boost progress in science // Science. TASS. 04.11.2023. URL: <https://nauka.tass.ru/nauka/19202037>

“biomimetic”, which is an approach to the creation of technological devices in which the idea and basic elements are borrowed from living nature.¹

Executive Order of the President of the Russian Federation “On the Development of Nature-Like Technologies in the Russian Federation”,² issued on November 2, 2023, instructs the government to determine “the basic principles and criteria for classifying technologies as nature-like” (paragraph 1a of the Decree). In other words, it is necessary to develop something that has not yet been clearly described. Amid limited resources, which predetermine a rigid choice of priorities, it would be important for the scientific community to explain what the innovation of “nature-like” technologies consist in and how they will ensure “harmony with the surrounding nature”.

The RAS executives, summarizing the results of the year, noted the establishment of the St. Petersburg Branch of the RAS³ and, thus, the return of historical buildings to the Academy, as well as the solution of social issues of the RAS members (improved medical care and increased scholarships) as the most important achievement. From January 1, 2024 the size of payments to academicians and corresponding members of the RAS and other state academies will be increased by 1.5 fold. The monthly payment to an academician of the RAS will amount to Rb150,000, to a corresponding member – Rb75,000.⁴ Moreover, in connection with the 300th anniversary of the Russian Academy of Sciences, the President of the country proposed to further increase academic scholarships, bringing them to Rb200,000 to academicians and 100,000 to corresponding members of the RAS.⁵

7. State of innovation business

The withdrawal of western tech companies from the Russian market has been the main shift in the business sector. This created both problems related to the complexity and cost of purchasing foreign technologies and opportunities for development using domestic designs.

The availability of own designs at the macro level can be judged by patent statistics. It recorded the departure of foreign tech companies: the number of patent applications for inventions filed in Russia by foreign applicants in 2022 decreased by 30.3% compared to the level of 2021, while in 2021 there was a slight increase compared to the previous year.⁶ There was also a slight decline

- 1 What is biomimetic? // Cleandex. 07.07.2008. URL: <http://www.cleandex.ru/articles/2008/07/06/biomimetic-1>
- 2 Decree of the President of the Russian Federation “On the development of nature-based technologies in the Russian Federation” of 02.11.2023 № 818. URL: <http://publication.pravo.gov.ru/document/0001202311020021>
- 3 *Belyaeva S.* Return to the best. The Head of the RAS reported on accomplishments and prospects // Poisk. No. 45-46, 17.11.2023. P. 3. URL: <https://poisknews.ru/science-politic/vozvrashenie-k-luchshemu-glava-ran-soobshhil-o-sdelannom-i-perspektivah/>
- 4 Expert: growth of monetary payments to RAS members will raise the prestige of the scientist’s profession // Nauka. TASS, 06.12.2023 r. URL: <https://nauka.tass.ru/nauka/19473045>
- 5 Gala evening on the occasion of the 300th anniversary of the Russian Academy of Sciences. 08.02.2024. URL: <http://kremlin.ru/events/president/news/73410>
- 6 *Streltsova E., Nesterenko A.* Toward technological sovereignty: Russia’s patent activity in 2015–2022 // Nauka. Technologies. Innovations. Express information. HSE ISSEK. 13.03.2023. URL: <https://issek.hse.ru/news/820285722.html>

in patenting by domestic applicants, with a 3% drop in patent applications filed by domestic applicants in 2022 relative to the previous year. Meanwhile, the data for 2023 may turn out to be a turning point in the direction of an increase in the number of Russian designs being patented.

At the level of individual technological areas and sectors, there was an intensification of interaction between companies and research institutes and universities, which was expressed in the growth in the number of orders, as well as a small overflow of researchers, including those with scientific degrees, into corporate science.¹

Innovation policy has always paid considerable attention to supporting small innovation companies (using, for example, such instruments as the Fund for Assistance to Small Enterprises Development in Science and Technology, Skolkovo Foundation, Internet Initiatives Development Fund (IIDF), platform NTI, etc.). However, the problem with Russian startups is that even granting successful development, they have little chance of being sold to a strategic investor, as there are not enough large private tech companies in the country. In turn, large state corporations have no market incentives to buy small firms, as the markets are rather monopolized and the domestic market itself is small. In addition, corporations do not have a culture of building a belt of independent companies around them to provide them with technological solutions. A number of large companies have a natural monopoly position in their field, and they have built systems close to subsistence farming.² Cultural traditions are always slow to change, so competition among large companies for technology startups has not increased in the past year.³ In terms of products, the situation with innovative solutions of startups was uneven. According to experts, a lot of designs have emerged in the field of unmanned aerial vehicles and IT solutions. There are also innovation solutions in pharmaceuticals, but there are fewer of them, as this is an expensive industry.

In the context of the need to form their own development lines, medium-sized private fast-growing companies have a more important role to play. It is for them that it is important to create favorable work conditions. Among them, there are about 500 “national champion” companies with high R&D expenditures and revenues ranging from Rb500 mn to Rb30 bn.⁴ At the end of 2023, a survey of 105 companies that are members of the National Champions Association was conducted. It turned out that they positively assessed the results of the year: for 67% of them the past year was successful, and for another 33% – stable; 93% of them saw their revenue grow.⁵ Most likely, this result was achieved due to the

- 1 *Mikhailchenko N.* Ita Corporations discipline science // Stimul. Journal about innovations in Russia. 14.09.2023. URL: <https://stimul.online/articles/interview/korporatsii-distipliniruyut-nauku/>
- 2 *Mekhanik A.* There is no such thing as science in machine tool engineering // Monocle. 20.11.2023. No. 5. URL: <https://monocle.ru/monocle/2023/05/v-stankostroyenii-nauki-ne-suschestvuyet/>
- 3 *Leibin V.* Skolkova, MIPT and gaps in the innovation cycle // Expert. 04.06.2023. No. 23. URL: <https://sk.ru/news/skolkovo-mfti-i-razryvy-v-cikle-innovacij/>
- 4 *Mekhanik A.* In caring for Russian gazelles // Stimul. Journal about Innovations in Russia. 17.07.2023. URL: <https://stimul.online/articles/interview/v-zabotakh-o-russkikh-gazelyakh/>
- 5 *Ivanova A.* 2023: what it was like for “national champion” companies // Stimul. Journal about innovations in Russia. 02.02.2024. URL: <https://stimul.online/articles/kompaniya/2023-god-kakim-on-byl-dlya-kompaniy-natsionalnykh-chempionov/>

fact that many “national champions” reoriented to import substitution, diversified their products, and began entering new markets (friendly countries). In particular, such countries as Saudi Arabia, Egypt and India were mentioned. At the same time, the calculation of the index of high-growth companies, first made on the basis of data for the fourth quarter of 2023, revealed that growth remains extensive with low innovation activity.¹

New tools to support companies have also become significant. For medium-sized tech companies, preferential lending at 3% per annum was established (the operator is SME Corporation) and grants were introduced for the improvement (“pre-growth”) of products to meet the requirements of large corporations in the context of co-financing (the operator is the Innovation Engineering Center established by Innopraktika). In November 2023, the law defining the criteria for the allocation of tech companies and the forms of their support came into force.² The forms of state support for tech companies include, in addition to the existing tax benefits and funding from the budget, provision of information and consulting services, export support, and, most importantly, the formation of demand for innovative and (or) high-tech products (works, services) (clause 2 of Article 4). At the same time, in the survey mentioned above,³ companies noted the insufficiency of state support. Among the main requests are the expansion of forms of funding (subsidizing the costs of developing innovative products, which is especially important for resource-intensive industries, such as pharmaceuticals), as well as assistance in introducing companies’ products to foreign markets. For this purpose, it is necessary to adopt legislative acts simplifying the registration of products abroad, in friendly countries.

Thus, at the country level, there were no noticeable changes in the innovation activity of companies, but there were positive changes due to the withdrawal of Western technology suppliers from the Russian market. The number of orders from companies for the development of technological solutions by research institutes and universities has increased, mostly proactively, rather than as a consequence of government incentives. Medium-sized fast-growing companies – “national champions” – managed to diversify their activities through import substitution and entering the markets of friendly countries. Potentially, they can become the drivers of the process of creating their own development lines.

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Last year, the concept of technological sovereignty was set forth in the Concept of Russia’s Technological Development until 2030 and operationalized through the need to create own development lines. Such work requires substantial financial resources and should be carried out by consortia of research institutions,

1 With a good gazelle attitude // Stimul. Journal about innovations in Russia. 04.03.2024. URL: <https://stimul.online/articles/sreda/s-khoroshim-gazelnym-nastroem/>

2 Federal Law No. 478-FZ dated 08/04/2023 “On the Development of Technology Companies in the Russian Federation”. URL: <https://rg.ru/documents/2023/08/08/fz478-site-dok.html>

3 *Ivanova A.* 2023: what was it like for companies – “national champions” // Incentive. A magazine about innovations in Russia. 02.02.2024. URL: <https://stimul.online/articles/kompaniya/2023-god-kakim-on-byi-dlya-kompaniy-natsionalnykh-chempionov/>

universities and companies. Unfortunately, simultaneously with the ambitious goals, the budget expenditures on civil science were decreasing, they dropped to 0.94% of GDP – a historical minimum for the last 25 years. Business expenditures on R&D in constant prices did not increase either, although they increased slightly in current prices.

This being said, we can note a point-by-point revitalization of collaboration between leading universities and medium-sized technology companies, in many cases proactively rather than as a result of any government incentives. Experts also noted the growth in some areas of companies' orders for R&D performed by research institutes and universities. So far, the potential of such initiatives is not considered at the state level as a strategic direction for the development of research institutes and universities.

Nevertheless, some programs to support university science were being restructured to obtain more practically oriented results (Priority-2030 Program, NLC), and the RAS supported the new agenda by promoting the ideas of revising the system of expertise in the country, so that it would be possible to concentrate resources on projects that would give practical results in the foreseeable future. At the same time, the activities aimed at building a new system of expertise were also aimed at concentration of all types of expert functions under the auspices of the RAS. The alliance between the RAS and NRC Kurchatov Institute was also notable last year, which led to the growth of NRC scale due to the accession of new institutes to it, and to the possibility for the RAS to expand its sphere of influence due to the transfer of NRC KI under its scientific and methodological leadership.

There have been no noticeable shifts in the innovation sphere, but there is a potential for more active involvement of medium-sized fast-growing companies in the creation of their own development lines due to the introduction of new forms of support by the state.

The course on technological sovereignty is one of the responses to the sanctions pressure. Other measures concerned the regulation of international scientific cooperation. Clearer country priorities for cooperation have emerged: the enlarged BRICS states and "friendly" countries in general. The results of this policy have already become visible in the form of expanding partnerships with China, India and a number of other countries. The prospects for developing cooperation with the new BRICS countries lie not so much in the scientific but rather in the technological field, as they are all focused on import substitution and localization of production. For Russia, such partnerships are also an opportunity to enter new technology markets.

Assessments of the sanctions pressure have shown that it is quite significant, especially for natural, technical and medical sciences, as well as for highly productive scientists who were previously closely involved in international academic cooperation. So far, the most sensitive is the impact of economic sanctions related to access to instruments, equipment, reagents, and software. However, the negative effect of isolation of Russian science from its traditional international partners may intensify.
