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R95 **Russian Economy in 2018. Trends and Outlooks. (Issue 40**) / [V. Mau at al; ed. Editors – Alexei Kudrin, doctor of sciences (economics), Alexander Radygin, doctor of sciences (economics), doctor of sciences Sergey Sinelnikov-Murylev, doctor of sciences (economics)]; Moscow: Gaidar Institute Publishers 2019. – 616 pp. – ISBN 978-5-93255-556-9

The review “Russian Economy. Trends and Outlooks” has been published by the Gaidar Institute since 1991. This is the 40th issue. This publication provides a detailed analysis of main trends in Russian economy, global trends in social and economic development. The paper contains 6 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 socio-political issues and challenges; 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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Science and innovations in Russia in 2018[1]

The past year marked the start of drawing up new integrated technological development plans for the Russian science and technology. The plans were originally presented by an Executive Order of the Russian President and then evolved into a nationwide project called "The 'Science' National Project" which is in turn linked to the Strategy for Scientific and Technological Development of the Russian Federation adopted in 2016 as well as a national program called "Digital Economy of the Russian Federation."

In addition to the plans, there were some important organizational changes that led to the ultimate separation of former academic research institutes from the Russian Academy of Science (the Academy) and to the establishment of a single Ministry of Science and Higher Education with authority over institutions of higher education and research-performing organizations, while the Academy was granted the legal status of public expert organization. Other important changes include positive moves towards the development of science in institutions of higher education and more active position of regional government authorities with regard to scientific and technological development. Yet, no breakthroughs or visible changes in technological innovations took place.

Although some system-wide issues facing the Russian science were not addressed in the past year, a basis for positive changes started emerging in some research areas. Public funding continued to account for nearly 70 percent of the total funding of science in Russia – this is an unprecedentedly high level to compare with scientifically developed countries and nations with policies focused on strengthening their scientific base (e.g., BRICS nations). Although business contribution to research and development (R&D) funding remains moderate (representing less than one third of Russia's total R&D expenditure), there is a trend towards higher values in absolute terms. State budget appropriations for science are growing at an outperforming rate amid slim demand for its application in the business sector. Furthermore, R&D expenditure in the Russian business sector are largely (around 60 percent) funded by the state[2], surpassing many times R&D expenditure in developed and high-growth countries. As a result, R&D expenditure as a percentage of Russia's GDP remains low (close to 1 percent) amid rising state funding of science. Therefore, there is obvious shortage of mechanisms designed to attract the business sector to funding (co-funding) research and development, with the aim to reduce, at least, the proportion of federal funding that is used as replacement for private funding. It is characteristic that after the 2008 crisis

[1] This Section was written by Irina Dezhina, Gaidar Institute, Skolkovo Institute of Science and Technology.

[2] OECD (2018), Main Science and Technology Indicators Volume 2018 Issue 1, OECD Publishing, Paris. DOI: 10.1787/msti-v2018-1-en. P.55.

businesses in most of the developed countries became bigger contributors to raising R&D expenditure, while federal funding rose at slower pace[1]. It is not the case with Russia: business remains a scarce source of contribution to R&D.

Another problem lies in a lack of balanced age structure of researchers. Two opposite age groups developed, one represents young researchers (at the age of 39), whose number has increased considerably in recent years, and another represents older researchers (at the age of over 60). The middle-aged generation of Russian scientists (at the age of 40–59), who are considered more productive, remains a small group (at present, they account for less than one third of the country's total researchers), whose proportion is shrinking. The scientific personnel structure is considered efficient (that is, when best possible results are achieved both in terms of quantity and quality) if young and older generations represent around 20 percent each, and middle-aged researchers constitutes 60 percent[2]. The second serious issue facing human resources in science is low (both internal and external) mobility of Russian researchers – this is what affects the quality of research outputs.

Another parameter is the material base of science, with only minor changes in terms of quality in recent years. The re-equipment of scientific instruments and equipment has been underway for years; however, federal support is focused more on universities than scientific institutions. Each sector of science has elite organizations that receive more resources than other organizations. However, the elite status of these organizations is not always linked to their research outputs, but rather to formal statuses and some other factors. The re-equipment, however, is faced with the problem of efficient equipment handling, which is given much less attention. As a result, the available equipment is not used as efficiently as it might be, there are no full-fledged core facilities. Some of the up-to-date equipment is underused because it was purchased either on a non-systemic basis or for the purpose of resolving one-time tasks. There are unique units of equipment that duplicate each other. Thus, the issue of optimum utilization of scientific equipment is as much critical as the issue of re-equipment.

Another problematic aspect lies in the quality of research output. A brief record of employing policies aimed at enhancing the performance of scientific workflow in Russia shows that quantitative parameters are given the top priority. That is what accounts for a bibliometric race that has been unfolding in recent years in the country, when the key measure of efficiency and performance in science is the number of published papers rather than the interest in the content of such papers (as measured by the citation rate)

[1] Rehm J. Ten Years after the Economic Crash, R&D Funding is Better than Ever. Nature, September 13, 2018. doi: 10.1038/d41586-018-06634-4

[2] Balatsky E., Yurevitch M. Modelling academic personnel's age structure // Terra Economicus, 2018, Vol. 16, No. 3, P. 70. DOI: 10.23683/2073-6606-2018-16-3-60-76

by academic and business communities. A point to note, however, is that some universities started to improve in this aspect last year.

6.3.1. Science in institutions of higher education and in public sector

Science in institutions of higher education, as always, continues to represent a small "fragment" of the country's scientific and research complex. Institutions of higher education account for 9.1 percent of the total volume of research and for 12.1 percent of the total number of researchers in this country[1]. Nowadays, the flagship program is represented by a project called Project 5-100 which is intended to raise the ranking of not less than five Russian institutions of higher education to top 100 global rankings by 2020. There are, however, the "weakest aspects" – the volume and the quality of research – that dampen the climb.

In five years since the Program's inception, quantitative performance measures for science in institutions of higher education have been improved substantially. The number of publication in journals indexed by international data bases has risen due to, among other things, an increase in the number of indexed Russian journals, a substantial increase in the number of university researchers participating in international conferences and study tours to foreign institutes and universities. Therefore, the substantial increase in financial resources has paid off. In particular, the number of papers published by researchers of institutions of higher education participating in Project 5-100 that are indexed by Web of Science have increased 4.5 times compared to 2012, with a 4-fold rise for those indexed by Scopus[2]. Accordingly, the institutions have strengthened their position by way of upgrading their global rankings, particularly in selected fields of science (Russia, as always, continues to have strong schools of physics, mathematics and astronomy).

However, the race for publication numbers has given rise to many strategies designed to increase rapidly publication numbers. Institutions of higher education participating in Project 5-100 are the major contributors to the race. Analysis of their publication strategies[3] reveals the most commonly used strategies (as shown below in descending order of preference (usage frequency)):

- Increasing the number of publications through author affiliation (the author adds the name of higher education institution to the primary place of employment);
- Promoting intensely conferences so that their theses are indexed by Scopus;

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1 Science indicators: 2018. Statistical Book. M.: NRU HSE, 2018. PP. 44; 78; 190; 205.

2 N. Bulgakova. Support the promotion. The Academy gets involved in higher education institutions' efforts to enhance competitiveness // Poisk, No. 44, November 2, 2018 http://www.poisknews.ru/theme/edu/39685/

3 Poldin O., Matveyeva N., Sterligov I., Yudkevich M. 2017. Publication Activities of Russian Universities: The Effects of Project 5-100. Educational Studies, Higher School of Economics, issue 2.

- Seeking and hiring highly cited authors;
- Inviting new researches for publications;
- Having publications in predatory journals.

It is characteristic that publications in predatory journals that are purged from databases is no longer considered as most commonly used strategy.

In the end, measures of quality are still lagging far behind; the citation rate for research papers of institutions of higher education that participate in Project 5-100 is many times less than the average citation rate of reference foreign institutions of higher education, that is, institutions with a similar specialization profile and number of teaching personnel and students. There is still only a small proportion (around 15 percent, according to experts) of academic teaching personnel with research papers published in international journals.

A positive trend is that managers of some institutions of higher education have shifted their focus towards the quality of research papers. Composite measures, including not only publication numbers, were introduced for measuring the performance in research. For example, the Novosibirsk State University pays less for researcher's publications if the researcher does not work with students, and also pays less in financial bonuses for publications that constitute theses of conferences or articles published in predatory journals. Lastly, selection of conferences was introduced, that is, researchers are not recommended to visit low-profile events[1]. Similar trends can be seen in the National Research University of Higher School of Economics (NRU HSE) and in the Moscow Institute of Steel and Alloys – these universities, for example, pay no bonuses on top of the salary for papers/articles published in third- and fourth-quartile journals.

The public sector, to which former academic institutions now pertain statistically, underwent successful readjustments to meet the new requirements focused on quantitative measures, including publication numbers. Despite the recent restructuring – the integration of former academic institutions, the establishment of centers of various types, etc. – the productivity of "academic science" remained the highest across the country, suggesting that multiyear trends are sustainable enough. According to data for 2017, for instance, while the proportion of articles with Academy's affiliation made up 25.4 percent of the total number of Russian publications indexed by Scopus, the contribution to the total citation accounted for 29.1 percent, with the proportion of authors with Academy's affiliation representing as low as 19.8 percent of the total Russian authors[2].

[1] S. Ermak, P. Kuznetsov, D. Tolmachev, K. Chukavina. Stop feeding the beast // Expert, No. 20, May 14, 2018 http://expert.ru/expert/2018/20/hvatit-kormit-zverya/

[2] Avanesova A., Shamliyan T. Comparative trends in research performance of the Russian universities // Scientometrics, June 14, 2018. DOI: 10.1007/s11192-018-2807-6

It is nonetheless the policy of promoting the development of science in institutions of higher education that serves as a catalyst to not only increase publication numbers but also promote Russian scientific journals to respective databases (basically, Scopus). Russia's Ministry of Education and Science held a contest among scientific journals. One hundred winners were awarded RUB 1 million for development purposes. Around 8000 collected works of conferences were deleted at a time from the Russian Science Citation Index and will no longer be considered for calculating scientometric indicators[1].

It is characteristic that the past year was marked by the emergence of a new measure of scientific productivity – h-alpha-index. The author of the Hirsch index, Jorge *Hirsch*, proposed the h-alpha-index for measuring the number of articles in which a scientist is the principal author (the alpha-author). The alpha-author has the greatest Hirsch index of all the co-authors. The introduction of such index allows one to measure scientists' scientific contribution rather than calculate their overall citation rate[2]. The new index has restrictions; for example, the Hirsch index for experimenters using sophisticated equipment units, including those that help obtain specimen or make a complex analysis, is often greater than for core authors of a scientific idea. The above manner of identifying the alpha-author leads to incorrect results in this case.

A new paradigm of accessing scientific journals – the obligatory open access – was underway alongside the efforts made to find more accurate measures of scientific productivity. The European Union issued a resolution on Open Access publishing, after which Science Europe presented Plan S[3]. Plan S requires that, from January 01, 2020, scientific publications that result from research funded by public grants must be published in compliant Open Access journals or platforms. A preliminary set of 14 criteria for selecting journals was proposed. Most of the criteria are linked to technical requirements for open platforms on which journals are based, and only one criterion – the expert evaluation requirement for materials that are proposed for publication – is linked to the quality of publications[4]. It will cost journals a lot to be able to meet technical requirements. According to a study made[5], as little as 15 percent of open-access journals and 3 percent in social sciences now meet the proposed criteria. However, there are undefined parameters, including how non-European universities and research institutions will pay for publications released in journals included in the list.

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1 S. Belayeva. There are positive signs. Russian journals move closer to world standards // Poisk, No. 18–19, May 11, 2018 http://www.poisknews.ru/theme/infosphere/35784/

2 J.E. Hitsch. hα: An index to quantify an individual's scientific leadership. Submitted October 3, 2018. https://arxiv.org/abs/1810.01605

3 Plan S. Making full and immediate Open Access a reality. https://www.coalition-s.org/

4 Brainard J. Few open-access journals meet requirements of Plan S, study says // Science, January 31, 2019. https://www.sciencemag.org/news/2019/01/few-open-access-journals-meet-requirements-plan-s-study-says?utm_medium=email&utm_source=FYI&dm_i=1ZJN,63X1U,E29D5V,NZXQM,1

5 Brainard J. Few open-access journals meet requirements of Plan S, study says // Science, January 31, 2019. https://www.sciencemag.org/news/2019/01/few-open-access-journals-meet-requirements-plan-s-study-says?utm_medium=email&utm_source=FYI&dm_i=1ZJN,63X1U,E29D5V,NZXQM,1

The introduction of Plan S implies on the one hand a move towards not subscribing to journals. On the other hand, journals included in the list will have a good and guaranteed portfolio of research papers. The changes will have an effect on Russian authors, at least on those who participate in European scientific programs (EU Framework Programs).

The past year saw institutes of the former academic sector come under the control of the recently established Ministry of Science and Higher Education. the Federal Agency for Research-performing organizations (FASO Russia), which used to supervise academic research-performing organizations, ceased to exist under Executive Order of the President No. 215 dated May 15, 2018 concerning the structure of federal executive bodies[1]. The Ministry of Science and Higher Education has, under the above Executive Order, a wide mandate to develop and carry out scientific, research and technical and innovation policies; the Ministry now also regulates the daily workflow of both universities and the former academic sector. The Academy was granted a new status – the Federal Law on the Russian Academy of Science was amended in July to enlarge the scope of Academy's authority[2]. In addition, debates were held during the year to discuss the status and functions of the Academy. However, multiple debates, creating an "information noise", had no effect on research-performing organizations.

The Academy, according to the adopted amendments, will carry out the research and methodological management of scientific and scientific and technological activities of not only research-performing organizations but also institutions of higher education, and carry out an expertise of research outputs in organizations of all types. The Academy will also carry out state-funded research, including on behalf of the Military Industrial Complex (MIC). The Academy will submit annual progress reports to the President of Russia on the implementation of the national scientific and technological policy in the Russian Federation. Thus, the Academy becomes a qualified expert entity for a wide range of issues rather than just the basic science with which it has always been associated. Therefore, the Academy will have to face challenges that are beyond its capacity. Nevertheless, the managers of the Academy believe that the Academy possesses a strong human resource base, including around 2000 corresponding members and Academy members (academicians) and approximately 500 young professors[3]. However, this is a relatively small number of specialists who will have to carry out an expertise of tens of thousands research topics[4] underway in all research-performing

1 http://kremlin.ru/events/president/news/57475

2 Federal Law No. 218-FZ dated July 19, 2018, "On Amendments to the Federal Law "On the Russian Academy of Science, Reorganization of State Academies of Science and on Amendments to Certain Legislative Acts of the Russian Federation.""

3 S. Belyaeva. President of the Russian Academy of Science Aleksandr Sergeev: Call of Duty // Poisk, No. 1–2, January 18, 2019 http://www.poisknews.ru/theme/ran/41116/

4 In particular, in 2018, reports on 11.5K research topics of former institutions of the Academy alone were reviewed. (Source: N. Volchkova. An authorized review. The Russian Academy of Science is all set to embark upon analysis of country's scientific potential // Poisk, No. 1-2, January 18, 2019 http://www.poisknews.ru/theme/science-politic/41115/). The figure would increase by several times

organizations and institutions of higher education where R&D is funded by the state. Furthermore, the Academy will carry out an expertise of not only research topics and research and development outputs but also monitoring and performance measurement of public research-performing organizations, prepare proposals for research institutes and institutions of higher education "with the aim to integrate their scientific potential, develop scientific research and support innovation activities"[1]. The above functions were defined as the "scientific and methodological management" by the Academy. Additionally, the scope of the management can be enlarged further to cover not only all federal state-funded research and development performing institutions but also institutions where research and development is funded via regional and local budgets: Russian government's Executive Order No. 1781 dd. December 30, 2018 provided recommendations for executive bodies to adopt statutes and regulations whereby the Academy will perform scientific and methodological management of organizations that fall within the scope of its authority, except organizations that were established by the Government of Russia (Moscow State University (MSU), S. Petersburg State University (SPSU), Russian Research Center 'Kurchatov Institute', National Research Center *"Zhukovsky Institute"*, Higher School of Economics (HSE) National Research University, The Russian Presidential Academy of National Economy and Public Administration (RANEPA)). However, managers of the Academy have plans to enter into individual agreements with the above organizations on scientific and methodological management[2].

A more detailed analysis of how the Academy is going to perform its scientific and methodological function reveals that deadlines for analysis and decision-making may be quite extended because, for example, if institutions of higher education work on various research topics, then the same institution would be supervised at a time by various branches of the Academy. Thus, this would be subject to more approvals within the Academy. In so doing, the Academy's evaluation is cause for making adjustments to topics of research: if the Academy believes that funding of certain topics is undesirable, then the topics can be refined and then reapproved upon re-consideration by the Academy, or if the Academy does not reapprove these topics, then funding would be discontinued. And this despite the fact that draft forms developed for evaluation of topics allow for a formal enough expertise because they do not require detailed conclusions.

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when including reports of institutions of higher education and business sector organizations on state-funded research works.

[1] C.3 of the "Rules for the Federal State-funded Institution Russian Academy of Science to perform scientific and research and methodological management of scientific and scientific and technological activities of research-performing organizations and educational organizations of higher education as well as expertise of scientific and scientific and technical outputs delivered by these organizations", endorsed by Russian Government's Executive Order No. 1781 dated December 30, 2018.

[2] N. Volchkova. An authorized review. The Russian Academy of Science is all set to embark upon analysis of country's scientific potential // Poisk, No. 1–2, January 18, 2019. URL: http://www.poisknews.ru/theme/science-politic/41115/

The above changes place an extra burden upon research-performing organizations and institutions of higher education because a unique reporting form must be used for each topic, whether it is funded or planed to be funded by the state. Since public funding accounts for 70 percent of the total funding in the country's scientific complex, the "avalanche" of reports and expertise can hardly be imagined. The existing scheme is yet far from being balanced: besides having the opportunity of making a formal evaluation, the Academy is deemed to bear no responsibility for decisions it makes – at least, no such responsibility follows from the official documents that have been available to date, except a provision on deadlines for the Academy to consider a series of issues which, however, have nothing to do with the expertise of research topics. The Russian Government issued on December 24, 2018 an Executive Order which lays down rules for cooperation between the Academy and the Ministry of Science and Higher Education, sets tight enough deadlines for the Academy to agree upon decisions on reorganization and liquidation of research-performing organizations, on making amendments to charters, on the approval by the Presidium of the Academy of nominees for heads of research-performing organizations and on the approval by the Academy President's of decisions to terminate the office of heads of research-performing organizations[1]. The Academy must make decisions within 5 working days to 30 calendar days, depending on what exactly needs approval.

New functions of the Academy are given a relatively moderate funding: around RUB 4.2 billion of budget allocations to the Academy are planned for 2019–2021(within the framework of the National Program "Scientific and Technological Development of the Russian Federation"), of which RUB 2.3–2.4 billion will cover daily operations such as, presumably, expert and monitoring activities (see *Table 20*). The Academy also expects to receive RUB 1 billion from the federal budget for its scientific and methodological management of all research-performing organizations and institutions of higher education in the country[2], which has not been denied by the state.

The Academy embarked by late in the year upon an initiative aimed at cooperation with various state departments. The Academy first of all expressed its willingness to cooperate with the Ministry of Science and Higher Education in order to raise the ranking of leading institutions of higher education in global rankings[3]. It is unclear, though, how the Academy is going to contribute to the promotion, but it will most likely

[1] Russian Government's Executive Order No. 1652 dated December 24, 2018 "On Approval of Rules for the cooperation between the Federal State-funded Institution Russian Academy of Science and the Ministry of Science and Higher Education of the Russian Federation while exercising their authority under the Federal Law "On the Russian Academy of Science, Reorganization of State Academies of Science and on Amendments to Certain Legislative Acts of the Russian Federation.""

[2] The Academy applies for RUB 1 billion to establish the framework for institutions of higher education and since promotion // RBC, November 13, 2018. URL: https://www.rbc.ru/rbcfreenews/5bead0fb9a794784ff42fea0

[3] The Academy is ready to cooperate with the Ministry of Education and Science to raise the ranking of Russian institutions of higher education in global rankings. October 28, 2018. URL: https://tass.ru/obschestvo/5730212

limit its efforts to paying a few visits to leading institutions of higher education. The initiative did not find support by institutions of higher education, as was expressed explicitly at a November 27 meeting of the Presidential Council for Science and Education[1]. The negative can be adequately explained by the ongoing "confrontation" between the parties. What is more, it is the Academy that quite often criticized institutions of higher education. In particular, President of the Academy Aleksandr Sergeev noted that universities started competing with each other in the field of science instead of training specialists, that is, what they are supposed to do as part of their core activity[2].

Table 20

Budget appropriations to Russian Academy of Science (a federal state-funded institution) in 2019–2021, RUB billion

Type of expenditure	2019	2020	2021
Total	4.2	4.2	4.3
Including operational expenses (provision of services) of public institutions	2.3	2.3	2.4
National awards in literature and arts, education, print media, science and techniques and other awards for meritorious services to the state	1.9	1.9	1.9

Source: Schedule 8 to the Explanatory Note attached to the Federal Draft Law regarding the Federal Budget for 2018 and the 2020 and 2021 Planning Period.

Late in the year, the President of Russia criticized indirectly the Academy by pointing to the fact that it is not unusual when basic research topics remain the same for decades, with no outputs delivered. "Not a single research paper with coverage in any citation database has been issued" with regard to 40 percent of research topics underway in academic institutions. In other words, it appears that either there are no outputs at all, or there are outputs that are irrelevant." However, since the Academy ceased to supervise research institutions five years ago, the responsibility for the above output is attributed not only to the legacy of the academic past but also to FASO Russia. In addition, the President criticized the fact that the 2017 performance measurement of the former academic research-performing organizations, including their division into three categories, failed to have led to any organizational and financial changes. The critique should rather be addressed to the Ministry of Science and Higher Education as the successor of FASO Russia.

Overall, managers of the Academy are in optimistic mood: according to the Academy's President, there is no other entity but the Academy that can provide an independent and nonpartisan expertise in the field of basic and applied research underway in the country. Yet, there is no solid ground for the optimism. The Academy has not carried out assessments of the time input in all of its "scientific and

1 The verbatim records of a meeting of the Presidential Council for Science and Education. November 27, 2018. URL: http://kremlin.ru/events/president/news/59203

2 The President of the Russian Academy of Science notes a decline in the knowledge and skills of graduates from Russian universities // RIA Novosti, May 25, 2018. URL: https://ria.ru/society/20180525/1521320822.html

methodological tasks", given the average speed of works performed in the Academy[1]. Additionally, there are no guarantees that members of the Academy can provide an expert evaluation of any research topics. No "research performance" measurement has so far been applied to Academy members and corresponding members, on top of that they enjoy some privileges for their publication activities, including, for example, the right to publish non-reviewed articles in an academic journal called "Russian Academy of Science Reports" (RASR)[2] and also they are allowed to use such articles for the purpose of grants and public assignments. Therefore, the question of how the Academy is to exercise in full the function of country's key expert in science still remains open.

6.3.2. New focus areas for national policy and national project for science

New focus areas of the national policy in the field of science were outlined in the Presidential Address to the Federal Assembly, initiating for the first time the linkage between "powerful infrastructure – talent acquisition and support to young people – research within research and educational centers"[3]. The same focus areas were recognized in an Executive Order of the President later in May[4], commissioning the Russian government to develop the 'Science' National Project, which is to achieve the following goals set forth in the Executive Order:

- To raise Russia's ranking to world's top 5 nations that perform research and development within the scope of focus areas of scientific and technological development;
- To ensure that scientific research in the Russian Federation is appealing for Russian and foreign top scientists and young high-potential researchers;
- To ramp up local R&D inputs using all sources, so that they outperform growth rates in the gross domestic product.

A few objectives were formulated to achieve the foregoing goals: to establish an advanced infrastructure for research and development, to re-equip not less than 50 percent of instruments used by leading organizations that perform research and development, to establish scientific centers of various types.

The 'Science' National Project (SNP) became part of a new state program called "Scientific and Technological Development of the Russian Federation." Despite the fact

1 A. Mekhanik. The Academy becomes key expert in science // Expert, No. 5, January 28, 2019. URL: http://expert.ru/expert/2019/05/ran-stanovitsya-glavnyim-nauchnyim-ekspertom/

2 V. Vdovin. Privileges offer benefits. Why does RASR publish non-reviewed articles // Poisk, No. 5, February 01, 2019. URL: http://www.poisknews.ru/theme/ran/41373/

3 Presidential Address to the Federal Assembly. March 01, 2018. URL: http://kremlin.ru/events/president/news/56957

4 Russian President's Executive Order No. 204 "On National Goals and Strategic Tasks of the Development of the Russian Federation until 2024", dated May 7, 2018. URL: http://kremlin.ru/acts/bank/43027

that the State Program itself will not be endorsed until April 1, 2019[1], the SNP gave rise to active debates back in late 2018. The project has the same three main objectives that were set forth in the Executive Order of the President.

The first objective is to raise Russia's ranking to world's top 5 leading nations that perform R&D in focus areas of growth (as identified in the Strategy for scientific and technological development of the country). The achievement of this objective will be measured exclusively through rankings, which may lead to false incentives. In particular, there are plans to raise the number of scientists in order to retain 4th place in international rankings regarding research personnel numbers, including plans to double publication numbers in order to move up in rankings.

The second objective is to make Russia appealing for Russian and foreign scientists as well as young researchers. However, the appeal will be measured by the number of foreign scientists working in Russian organizations regardless of the duration of their stay in the country rather than by enhancing the scientific workflow management, ensuring career tracks, inviting foreign scientists under long-term contracts (more than three years). If the duration of stay in Russia is of no importance, then "boosting" the number of foreign scientists would be no hardship. The second measure is precarious enough – there are plans to raise the number of researchers aged 39 or younger to 50.1 percent of the total number of researchers in the country – which may worsen the imbalance in the age structure of scientific personnel. It would be more appropriate for increase in the proportion of middle-aged (40–60) generation of researchers to be set as indicator, because any increase in this cohort would indicate that young individuals stay in science.

The third objective is to ramp up all R&D inputs using all available sources, in which case it would be more important to ramp up business sector's R&D inputs at outperforming growth rates, create a demand for research outputs. However, funding is expressed in a more softer manner in the SNP than even in the Strategy for Scientific and Technological Development of the Russian Federation with parallel funding as a goal. A little more than RUB 636 billion, including RUB 405 billion through state budget funding and around RUB 231 billion via extrabudgetary funding (that is, 36 percent of total inputs in the national project), are planned to be spent in 6 years (from 2019 to 2024) to implement all the activities that are to take place within the SNP framework.

The above objectives are planned to be achieved by implementing three projects: (1) to develop scientific and scientific-industrial cooperation, (2) to create an advanced infrastructure, and (3) to develop human resource potential. The state budget to extrabudgetary funding ratio for the total of three projects in 2019–2024 is presented in *Table 21*.

Known methods are expected to be applied for developing scientific and scientific-industrial cooperation: establishing various types of research and educational centers

[1] A meeting of the Presidium of the Presidential Council for Strategic Development and National Projects. December 17, 2018. URL: http://government.ru/news/35104/

(RECs). Many various types of RECs, including both scientific and scientific-industrial RECs, have been established over the past 20+ years. This time, however, RECs constitute units that are much more bigger in size.

Table 21

Funding plans for federal projects as part of 'Science' National Project, 2019–2024

Federal project	Total funding, RUB billion	State budget funding, RUB billion	Extrabudgetary funding, RUB billion	Proportion of extrabudgetary funding, percent
Development of scientific and scientific-industrial cooperation	215.0	57.3	157.7	73.3
Development of advanced infrastructure for research and development in the Russian Federation	350.0	276.6	73.4	21.0
Development of human resources in research and development	70.9	70.9	0	0

Source: 'Science' National Project's data sheet (according to data available as of February 11, 2019).

Debates on what RECs should be are still in progress, involving a broad variety of opinions. The President of the Academy believes that RECs should be established on the basis of existing research-performing organizations or educational institutions and equipped with modern equipment and managed by an international supervisory board. His opponents believe that RECs should be linked to industries and intend to address tasks facing a specific territory. Furthermore, there is no good understanding of whether RECs should constitute a legal entity, a structural unit within a legal entity, or a team comprised of persons from different organizations. Also, neither is there understanding of criteria to identify leading organizations that can be qualified for the REC status. Whether it is only standard statistical parameters (publications, patents, etc.) that should be considered, or expert evaluations should be included as well?

According to the data sheet to the Federal Project on "Development of scientific and scientific-industrial cooperation", there are plans to establish various types of RECs by 2024, including:

1. Not less than 15 world-class RECs through integration of universities and research institutes with enterprises. Such RECs can be established on a sector- or region-specific basis.
2. World-class international research centers, including a network of mathematical centers and genomic research centers – 3 genomic centers, 4 mathematical centers, 9 international centers according to the focus areas set forth in the Strategy for Scientific and Technological Development of the Russian Federation. It is a must for the above centers to attract young researchers, and key performance measures must include papers published in peer-reviewable journals.
3. Fourteen National Technological Initiative competence centers (NTI competence centers).

REC's specific features, such as the presence of world-class scientific infrastructure, partnership with real sector organizations, regional government's support, are under discussion. In particular, some experts opine that it is RECs that may come to participate

in the implementation of megascience projects. It is assumed that the key aspect in selecting organizations as the base for RECs will not be organization's type and characteristics but rather the interdepartmental nature of projects, however, if broadly interpreted, RECs must include science, education, industrial cooperation, and they altogether should promote territorial development. So far, the concept of "new REC" is therefore closest to the concept of federal university, which also provides for all types of cooperation, plus there is commitment to achieve regional goals. RECs no doubt differ from the other category of centers – world-class international centers – first of all in that the latter perform applied works.

Unlike RECs, an NTI competence center is a structural unit rather than an organization, which is established on the basis of research-performing or educational organization, whereas the NTI competence center constitutes a consortium of research-performing, educational and industrial organizations. It develops technological solutions for NTI cross-cutting technologies, and therefore a key reporting indicator for such a center would be the number of created technologies that are applied in the industry. Fourteen competence centers for cross-cutting technologies were set up back in 2018, funded by the Russian Venture Company. In fact, competence center consortiums have already started compiling a pool of projects.

According to the advanced infrastructure development project, there are plans to upgrade at least 50 percent of the instruments of leading organizations on top of the known objectives of constructing megascience units. The issue of enhancing the equipment utilization efficiency has not been raised, and focus areas are yet to be identified. For example, Russia has in recent years been lagging far behind countries that have the biggest number of high performance supercomputers. The presence of supercomputers in a country exhibits its data processing capacity. Supercomputers are employed in scientific research, aviation, healthcare, industry. Russia has two supercomputers and ranks at the bottom of the list of top 500 producers of supercomputers, whereas China (with 202 supercomputers), the United States (with 143 supercomputers) and Japan (with 35 supercomputers) rank on top of the list. Russia has no its own base of computer components needed for manufacturing supercomputers, which may further degrade the county's capacity amid sanctions because Russian supercomputers rely on US-made processors[1]. Perhaps, focus types of most expensive and unique units that need to be developed through state budget funding should be identified.

The third project focuses on supporting young people, being in line with the SNP's target. As noted above, this approach is precarious due to a threat of unbalancing the age structure of scientific personnel. Another point to note is that the SNP provides no factors that might make science appealing and relevant to young people. Furthermore, plans to increase substantially the publication feedback may discourage rather than motivate young people into science.

[1] Mamedyarov Z. America conquers the summit // Expert, No. 26, June 25, 2018. URL: http://expert.ru/expert/2018/26/amerikantsyi-pokorili-vershinu/

There are plans within the framework of the same project to continue attracting top foreign specialists and to work with the Russian-speaking scientific community. New quantitative and qualitative targets set forth in the Science SNP can produce a need to revise a few initiatives that are currently taking place. In particular, a megagrants program (grants for establishing laboratories in research institutes and institutions of higher education under the auspices of world's top scientists, including representatives of the Russian-speaking scientific community) is still underway, but its format is somewhat obsolete in the light of new objectives such as, for example, doubling the publication activity. The program's requirements for publication numbers are too soft now compared to what they were at the 2010 onset of the program, while there were no quality requirements for research outputs whatsoever. Should this program become part of the national project, then the selection criteria for projects, not to mention reporting, should be revised and updated.

Cooperation with the Russian-speaking scientific community becomes more difficult amid sanctions. On the one hand, Russian-speaking scientists do show interest in cooperating with Russia, particularly with its more organized segments – from RASA and RuSciTech[1]. In particular, they offer assistance in enhancing the quality of scientific expertise[2], developing Russian scientific journals. All these functions are important functions, and external expertise not only by Russian-speaking scientists is of great importance. There are other efforts – a few Russian universities launched interesting initiatives aimed at attracting Russian-born specialists. For example, the Siberian Federal University (SFU) has a program called Foreign Professor (funded through Project 5-100) designed to invite for a short term top foreign specialists as researchers and teachers. So far, all of the invited persons are Russian-born foreign specialists[3]. The new National Project, however, should also consider the fact that representatives of the Russian-speaking scientific community are yet not prepared to participate in projects that require them to stay long term in Russia, not to mention their returning back to Russia. For instance, according to a study of Boston Consulting Group, only 6 percent of professionals who emigrated to the Western Europe said they are ready to work in Russia[4].

On the other hand, there are external factors that may constrain the development of relationship with Russian-speaking scientific communities in foreign countries. In particular, the unfolding U.S. policy aimed at shutting off outflows of important scientific and technological information to China has an adverse effect on China's project called National "*Thousand of Talents Program*" designed to attract scientists.

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1 RASA is Russian-speaking Academic **S**cience **A**ssociation. URL: (https://www.dumaem-po-russki.org), RuSciTech is an international association of Russian-speaking science and technology professionals living outside Russia. URL: (http://ru-sci-tech.org/ru/).

2 Building bridges // Troitsky option – science, No. 267, November 20, 2018, P.4.

3 A project called Foreign Professor kicked off at the Siberian Federal University (SFU). June 21, 2018. URL: http://about.sfu-kras.ru/rating/5top100/news/20499

4 Half of Russian scientists say they want to emigrate. June 27, 2018. URL: https://www.finanz.ru/novosti/aktsii/polovina-rossiyskikh-uchenykh-zayavili-o-zhelanii-emigrirovat-1027322119

The next step was focused on similar programs of other countries. At present, legislative amendments are under consideration in the United States, whereby scientists participating in China's, Russia's and Iran's talents programs (megagrants programs as well as initiatives aimed at establishing international laboratories within the framework of Project 5-100 fall under this definition in Russia) shall not be entitled to grant-based funding from the U.S. Department of Defense and possibly from grant-based programs of other federal agencies.[1] The U.S. Department of Energy enforced a requirement early in 2019 whereby scientists/researchers who are participating or have plans to participate in Russia-funded projects must report to their senior managers. Accordingly, those who continue their participation in such programs will be advised to quit such programs or otherwise resign from U.S. public laboratories. Therefore, the number of Russia-born scientists interested in cooperating with Russia and working for public organizations is likely to be reduced in the offing.

Analysis of the composition of three federal projects as an attempt to apply a comprehensive approach to address science related issues leads to a conclusion that the focus on the relationship between science and real sector is restricted by a narrow segment related to the establishment of RECs and NTI competence centers. Overall, science remains a "thing in itself", being out of touch with economic problems and led, more than ever before, by rankings.

What is also worth noting is that development projects just indirectly consider the influence factor of sanctions although they appear to be long-term. The impact of sanctions on science let alone technologies has so far been underestimated. The problem is recognized just indirectly, resulting in more frequent discussions about since as soft power and as a factor of positive influence and maintaining relations amid unfavorable geopolitical situation.

6.3.3. State budget funding of research and development

The past year saw public funding of research and development continue to increase, and the trend is expected to continue down the line. There are plans to increase substantially allocations in 2019–2021 to non-defense research and development compared to target appropriations in 2018–2020. Public funding in 2019–2021 will rise at 2–12 percent a year (see *Table 22*).

There is a positive trend towards funding of knowledge-based programs. For instance, the third most important R&D expenditure is now a program called Development of Healthcare (see *Table 23*), with a substantial increase in allocations relative to previous years' budget plans. This is a critical socio-economic area that was previously given insufficient attention as part of R&D, particularly when compared with developed countries.

[1] Y. Sharma. Panic over US scrutiny of science talent programme // University World News, October 18, 2018, no.525. URL: http://www.universityworldnews.com/article.php?story=20181018183445307

Table 22

Dynamics of allocations for non-defense research and development

Indicator	2019	2020	2021
Federal budget expenditure on non-defense R&D, total, RUB billion	408.12	442.04	452.79
Year-to-year growth, percent	+12.7	+8.3	+2.4
Growth compared to the draft law for 2018-2020, each year, percent	+16.2	+1.2	-

Source: Schedule 8 to the Explanatory Note attached to the Federal Draft Law regarding the Federal Budget for 2018 and the 2020 and 2021 Planning Period; own calculations.

At the same time, expenditure on the development of electronic and radioelectronic industry remain relatively moderate, which poorly fits into plans on digitization and competitiveness in technological areas that are relevant for the national defense. There is a somewhat alarming trend towards further concentration of resources in a few programs, suggesting feeble prospects for raising funding in other areas.

In terms of the structure of expenditure by type of research – basic and applied research – there are plans to raise allocations for basic scientific research, so that by 2021 they account for 47.7 percent of total expenditure on non-defense scientific research and development.

Table 23

Dynamics of allocations for scientific research and development to national programs with biggest funding of research and development (RUB billion)

State Program	2018	2019	2020
Scientific and Technological Development of the Russian Federation	210.8	230.7	248.3
Space industry in Russia, 2013-2020	68.1	64.4	61.4
Development of healthcare	39.8	49.1	50.8
Development of aircraft industry, 2013-2025	36.6	44.8	39.8
Proportion of four programs in total allocations for non-defense R&D, percent	*87.1*	*88.0*	*88.4*
For reference: inputs in the program for "The Development of the Electronic and Radioelectronic Industry for 2013–2025"	9.1	9.7	9.7

Source: Schedule 8 to the Explanatory Note attached to the Federal Draft Law regarding the Federal Budget for 2018 and the 2020 and 2021 Planning Period; own calculations.

This conforms the level of European countries with the most developed scientific complex (France, UK). At the same time, the proportion of grant-based funding through two public scientific foundations – The Russian Science Foundation (RSF) and The Russian Foundation for Basic Research (RFBR) – will increase at a slower rate than allocations for basic research (see *Table 24*).

At present, grant-based funding by the foregoing foundations is far less than that in developed countries, accounting for 10.5 percent of total non-defense science spending, including that it will slide by 2021 to 10.1 percent. This is fuelled by the problem of "erosion" of foundations' programs, a decrease in the proportion of programs focusing on supporting research topics that are initiated by scientists. In particular, there is an excessive bias towards supporting young scientists whose participation in scientific projects is compulsory (a fixed proportion of young scientists shall be observed).

Table 24

Changes in volume of state budget allocations for basic research

Type of expenditure	2019	2020	2021
Basic research (subsection, Functional Classification of Costs (FCC)), RUB billion	179.4	199.5	215.9
Proportion in total expenditure on non-defense R&D, percent	*44.0*	*45.1*	*47.7*
Russian Foundation for Basic Research (RFBR)	22.2	22.9	23.9
Russian Science Foundation (RSF)	20.8	21.3	21.9
Proportion of RFBR and RSF in basic research expenditure, percent	*24.0*	*22.2*	*21.2*

Sources: Schedule 10 and Schedule 13 to the Federal Draft Law regarding the Federal Budget for 2018 and the 2020 and 2021 Planning Period; own calculations.

The problem of grant-based funding lies also in heightened focus on quantitative performance measures in the form of strict requirements for the number of publications to be issued while performing grant-funded research. Plans for quantitative measures are considered during examination of applications for projects. However, such requirements make no guarantee of quality of research outputs. In this respect, there is a counter example – The European Research Council (ERC), one of the most successful funder in the EU. The ERC was established in 2007 with the aim to promote scientific research on topics that are suggested by scientists. There are no "pressing topics/themes" or lines of research contributing to responses to "grand challenges." The sole evaluation criterion for applications for projects is the quality of research, excluding grant seekers' scientometric data. The outcome is that ERC-funded research were awarded six Nobel Prizes and *Wolf Foundation* Prizes, three Fields Medals[1]. Things will possibly change in Russia too. As was noted at the most recent meeting of the Presidential Council for Science and Education, grants are yet to become catalyst to science development in Russia, and that topics for grand-funded research should be suggested by scientists[2].

6.3. 4. Regional aspects of scientific and technological development

Two objectives – "technological breakthrough"[3] and spacial development – were simultaneously announced past year[4], which can set a new vector for the scientific and technological policy in Russia's regions. Prior to the announcement, innovation clusters were created at the regional level upon initiation of the federal government, "smart specialization" was determined, the construction of "smart cities" was commenced. The focus now will shift towards accomplishing the tasks of implementing the 'Science'

1 A. Vaganov. The principle of research bottom-up funding in the European Union // Nezavisimaya gazeta – science, May 23, 2018. URL: http://www.ng.ru/nauka/2018-05-23/10_7230_eurosouz.html

2 The verbatim records of a meeting of the Presidential Council for Science and Education. November 27, 2018. URL: http://kremlin.ru/events/president/news/59203

3 Putin says Russia needs technological breakthrough. TASS, April 26, 2018. URL: http://tass.ru/ekonomika/5161633

4 Putin offers to develop a special development program for Russia. RBC, March 1, 2018. URL: https://realty.rbc.ru/news/5a97ca8a9a79475d3e2a6447

National Project, including the establishment of RECs. It is understood that the Ministry of Science and Higher Education will establish and maintain relationship with regions in order to implement the National Project[1]. Although the project is yet to be endorsed, the work is underway to develop REC establishment concepts, involving regional government administrations of Krasnoyarsk, Tomsk, Novosibirsk, Irkutsk, the Altai Krai, Yakutsk and Tyumen.

Regional policies tend to pursue three goals. The first one is to identify focus areas of technological development that are not necessarily required to fall in line with respective focus areas at the nationwide level (it cannot be ruled out that academicians further translated this very component into the concept of "smart specialization"). The second goal is to coordinate between key stakeholders the critical elements of the policy in place. The third goal is to establish links between all the elements within the regional innovation framework in order to foster the development and transfer of technologies[2].

There was much debate last year about a "smart cities" agenda as part of new focus areas of regional scientific and technological development. The Russia Digital Economy Program 2017 (DEP), followed by the Presidential Address to the Federal Assembly on March 01, 2018 and, lastly, the Executive Order of the President of May 7, 2018 concerning national objectives and development strategic tasks, raised the issue of "smart cities" to the top-priority level of the federal technological development policy. Initiatives at the regional level are therefore expected to appear. The progress in this area can in part be seen through growing number of media publications about the creation of "smart cities" or their elements in Russia's regions. It is characteristic that a 3-year-old survey of the NRU HSE[3] showed that one of the key constraints to the promotion of "smart cities" in Russia is lukewarm support by regional and federal government authorities, being the reason for lack of incentives at the municipal level. Now there is an incentive. Moreover, it is the technological aspect that will most likely dominate, whereas the "managerial" approach aimed at aligning interests of all stakeholders will appear to be the weakest aspect. At least, it is the lack of consensus that has always been a "weakness" of the Russian innovation framework. According to foreign specialists, from the technological perspective it is important to address information security issues when creating "smart cities", while from the social perspective it is important to keep in mind the issue of inclusiveness, which means that there should be no categories of people that are not

1 The verbatim records of a meeting of the Presidential Council for Science and Education. November 27, 2018. URL: http://kremlin.ru/events/president/news/59203

2 K. Koschatzky and H.Kroll (2007). Which Side of the Coin? The Regional Governance of Science and Innovation, Regional Studies, Vol.41.8, pp.1117-1118.

3 It was held in 2015. Source: Boikova M., Ilyina I., Salazkin M. A "smart" model of development as a response by cities to challenges // Foresight, 2016, Vol. 10, No. 3, P. 71.

involved in the life of a "smart city" (because, for example, elder people experience difficulties when mastering online services)[1].

Another point to note is that all the subjects of the Russian Federation have raised their digitization budget expenditure, with leading regions focusing first of all on funding the creation of "smart cities", while lagging regions on the development of selected types of services for individuals[2]. However, the shortage of funds in regional budgets as well as limited number of skilled personnel for accomplishing digitization remain a serious problem. To date, revenues have been redistributed between federal/central government and subjects of the Russian Federation in favor of the government. That is exactly why regional government authorities are highly interested in being involved in implementing federal initiatives in science and technologies, because doing so can open an extra source of funding to regions. In addition, regional government authorities are limited in their capacity and in distribution of areas of responsibility: the majority of universities and research institutions are owned by the federal government. Focusing on supporting high-tech companies in this context appear to be one of the most adequate and reasonable solutions alongside any initiatives aimed at establishing relations. Such processes are already in progress in Russia's regions such as Tomsk, Irkutsk, Novosibirsk Oblasts.

There is a stand-alone initiative for regional scientific and technological development – a Novosibirsk Scientific Center's project called Akademgorodok 2.0 (Russian: "Academic Town"). Akademgorodok 2.0 is comprised of 31 subprojects, including the most resource-intensive subprojects such as the construction of a synchrotron – the Siberian *Ring Source of Photons* (SKIF) – and the establishment of two national centers for high performance computing and genetic technologies. The project Akademgorodok 2.0 is estimated at RUB 500 billion (of state budget funding)[3]. None of the 31 subprojects, except SKIF, have so far been guaranteed funding from the funds allocated to the 'Science' National Project (the megaunit is estimated at RUB 40 billion)[4]. The decision to construct SKIF was made in February a year earlier by the Presidential Council for Science and Education. Besides public funding, local government authorities are banking on funding from the private sector which might be interested in developments of scientific centers integrated in Akademgorodok.

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1 *Michinaga Kohno*: "Innopolis is an outdated model which should have been implemented 30 years ago." April 12, 2018. URL: https://realnoevremya.ru/articles/95516-intervyu-s-michinaga-kohno-ekspertom-po-umnym-gorodam

2 T. Kostyleva. A full version of regions rated by the development of digitization "Digital Russia" has been released. November 20, 2018. URL: http://d-russia.ru/vyshla-polnaya-versiya-rejtinga-regionov-po-urovnyu-razvitiya-tsifrovizatsii-tsifrovaya-rossiya.html

3 Half a trillion rubles. For real breakthrough // Expert, No. 40, October 1, 2018. URL: http://expert.ru/expert/2018/40/poltrilliona-rublej-za-nastoyaschij-proryiv/

4 B. Kork. Akademgorodok. Reloading // Expert, No. 40, October 1, 2018. URL: http://expert.ru/expert/2018/40/akademgorodok-perezagruzka/

However, there is no single view of how Akademgorodok should develop, and there is a sum of projects at various stages of maturity rather than a new development model. The above as well as rapid and closed nature of the concept development are the reasons why Akademgorodok 2.0 has been heavily criticized by external and local experts[1].

6.3.5. Technological development

There were no breakthroughs in technological innovations. Overall, the level of companies' innovation activities remained low in all sectors: the proportion of industrial enterprises involved in technological innovation stood at 9.6 percent, posting a decline from the proportion seen amid sanctions in 2014[2]. There are other assessments, mostly expert ones, of the level of innovation activities, showing that the proportion of innovation-active companies stood at 15–20 percent[3]. This figure, however, is one half as high as that recorded by nations with the developed technological base.

Also, a decline to 8 percent (from 9.5 percent in 2014) was seen in the proportion of companies involved in technological innovation in the area of information and communication technologies (ICT). Moreover, there was a decline in corporate venture deals in the IT industry. Investments in 2018 were estimated at USD 151.3 million, much less than the amount (USD 246.6 million) recorded in 2017[4]. Furthermore, analysis of IT-startups engaged in deals with corporations showed that the majority of purchased startups were startups whose founders were former co-owners and senior managers of medium-sized and big IT-companies, managers of IT-units and former corporate managers. At the same time, software exports continued to advance because, among other things, flagship companies swiftly refocused to new markets[5]. The 2018 year-end exports ran at more than USD 10 billion, twice the amount registered five years ago[6]. Furthermore, exports started outpacing sales in the domestic market.

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1 See, for example, a detailed analysis of the project's weaknesses: S. Smirnov. "We moving backwards." Humanitarian expertise of Akademgorodok 2.0 project. February 06, 2019. URL: https://tayga.info/144882

2 Fridlyanova S. Innovations in Russia: Key measures dynamics. Express information "Science, technologies, innovation". M.: NRU HSE, September 26, 2018. URL: https://issek.hse.ru/data/2018/09/26/1153998102/NTI_N_103_26092018.pdf.pdf

3 Butrin D. "We have managed to launch a few technologically active sectors" // Kommersant, No. 55, December 03, 2018 P. 4. URL: https://www.kommersant.ru/gallery/3814084

4 Y. Ammosov, A. Levashov. Corporate ventures in Russia's IT industry. TAdviser study. November 19, 2018. URL: http://www.tadviser.ru/index.php/Статья:Исследование_TAdviser_«Корпоративный_венчур_в_ИТ-индустрии_России»

5 For example, Kaspersky Lab's global sales proceeds have increased in the face of European and U.S. sanctions by virtue of refocusing on markets in CIS countries, Africa and the Middle East. Source: M. Maiorov. Hacker's nightmare. URL: https://stimul.online/articles/kompaniya/strashnyy-son-khakera/

6 Growth program: Russian software sales abroad top all-time highs // Expert, No. 7, February 11, 2019. URL: http://expert.ru/expert/2019/07/programma-rosta-prodazhi-rossijskogo-softa-za-rubezhom-byut-rekordyi/

Overall, H1 2018 saw transactions in the venture market drop in numbers as cumulative investment rise. This could be a sign of investors increasingly opting for conservative investment in "reliable" companies, as also evidenced by changes in preferred industries, such as contraction in the proportion of biotechnologies and increase in the segments of e-commerce, logistics and transport[1].

The tools in use to encourage technological development have so far had insufficient effect on all types of companies, including big, medium-sized and small companies. According to a report of consulting firm *A.T. Kearney*, Russia has lost dynamics of its industrial development (Industry 4.0) due to, first of all, immaturity of both the institutional structure and the development of technologies and innovations[2].

Also, there are policies focusing on the promotion of cooperation between companies and research-performing organizations and institutions of higher education, and on R&D outsourcing to companies. For example, innovation development programs running since 2010 at big companies with government equity participation are supposed to have a compulsory component such as cooperation with institutions of higher education. Despite the fact that companies allocated their resources for the purpose, more often there was no cooperation, but rather a sort of co-funding of research performed by institutions of higher education whose outputs were by no means always in demand. To date, as little as 3 percent of scientific projects of institutions of higher education have been implemented to the benefit of business companies, according to data from NRU HSE's education economics monitoring 2018[3]. Therefore, there was neither visible growth in patent activities, nor any serious increase in exports of technologies, expansion of the country's segment of small and medium-sized innovative companies. Products manufactured by non-energy small and medium-sized enterprises were marketable mostly in the domestic market, as evidenced by a small proportion of exporters, particularly when compared with innovation-led developed countries (see *Table 25*).

Analysis of the performance of public support instruments showed that the highest positive effect was due to Innovation Promotion Fund's programs[4].

1 Focus on Internet users // RBC, November 06, 2018. URL: https://www.rbc.ru/technology_and_media/06/11/2018/5bdc51819a79472f04cb2f46?from=main

2 Readiness for the Future of Production Report 2018. WEF in Collaboration with A.T.Kearney. URL: http://www3.weforum.org/docs/FOP_Readiness_Report_2018.pdf

3 Andruschuk. Science and business // Kommersant, August 13, 2018. URL: https://www.kommersant.ru/doc/3712714

4 The National Report on Innovations in Russia 2017. Ministry of Economic Development, Open Government, RBC, 2018.

Table 25

Proportion of exporters of non-energy commodities in small and medium-sized enterprises

Country	Proportion of exporters in small enterprises, percent	Proportion of exporters in medium-sized enterprises, percent
Russia	10.0	9.6
France	50.7	86.5
Hungary	53.3	78.6
Germany	42.5	69.2
U.S.A.	27.5	58.7

Source: Microeconomics of exports. Rating of Russian biggest exporters. Special report. // Expert, No. 39, September 24, 2018 URL: http://expert.ru/expert/2018/39/mikroekonomika-eksporta/

The rest of the instruments, according to experts, had a minor effect in recent 5 years on the development of innovations. The weakest effect came from instruments such as innovation promotion programs for big companies with government equity participation, ROSNANO's projects as well as projects implemented as part of the National Technological Initiative road maps (see *Fig. 3*). It was the NTI that was recognized as lagging behind original technological development plans for target markets. In particular, while three years ago Russia was competing in the *AeroNet market* with the United States in the development of remotely piloted vehicles, now Russia is visibly lagging behind its competitors[1]. The development is nevertheless moving forward – 8 NTI's road maps have been approved, with 450 projects worked out, including around 10 percent projects in progress[2].

A slowdown in the development was a catalyst to the revision of approaches, resulting in three main lines of further NTI development. The first line is to establish infrastructural centers for each NTI market. The centers will be information and analytical entities specializing in indentifying new trends, holding conferences and online workshops as well as providing organizational support to startups. Therefore, companies operating in NTI markets will receive organizational and analytical and network interconnection support. The second line is to establish financial institutions designed to support startups, and the third line is to set up NTI competence centers (already in progress), where the NTI is to be aligned with the new 'Science' National Project: the creation of new NTI competence centers is an objective to accomplish as part of the National Project. The above policies are intended to contribute to the emergence of higher-quality projects for NTI cross-cutting technologies.

1 Edovina T. "Technological development requires new forms and formats of organization" // Kommersant, No. 55, December 03, 2018, P. 15. URL: https://www.kommersant.ru/doc/3814104
2 Butrin D. "We have managed to launch a series of technologically active sectors" // Kommersant, No. 55, December 03, 2018, P. 4. URL: https://www.kommersant.ru/gallery/3814084

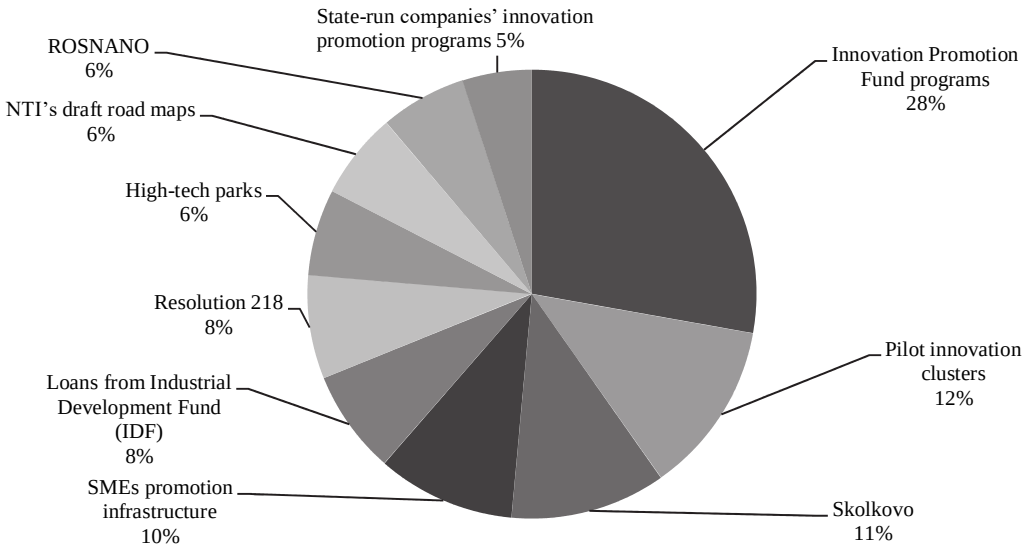

Fig. 3. Public support polices that have contributed most to promoting technological innovations in recent 5 years

Source: National Report on Innovations in Russia 2017. Ministry of Economy, Open Government, Russian Venture Company (RVC), 2018. P.21.

The Russia Digital Economy national program, which underwent changes during the year, could be another incentive for technological development. There is a basis for enhancing the digital development – according to recent data, digital economy has contributed 5.6 percent to Russia's GDP, surpassing the proportion of agricultural industry[1]. In addition, a survey 2018 of Skolkovo Business School revealed that managers in charge of digital transformation at some key state-run corporations have different views on how it should be implemented in their companies. This implies a wide range of new solutions rather than a lack of clarity over the matter of discussion. An important aspect of digital technologies development programs is the idea of relying upon companies. To date, 12 companies that are prepared to draft road maps for technological development have been identified, most of which are ready to be involved in the development of 2–3 technologies[2]. The front-runners are Rostech with plans to develop road maps for 7 digital technologies and MTS with road maps for 5 technologies. Companies that are involved in the development of road maps will have an opportunity to take the lead in technologies they select. This approach reminds of the principles of developing NTI road maps that have provisions for leadership and for ~~responsibility of parent cor~~porate developers for outputs. Although the approach has not

[1] Korovkin V. Russia facing the risk of missing "digital" opportunity for economic growth // ZNAK, December 05, 2018. URL: https://www.znak.com/2018-12-05/rossiya_riskuet_upustit_cifrovoy_shans_na_ekonomicheskiy_rost

[2] E. Balenko, A. Balashova, E. Litova. Companies to qualify for developing Digital Economy technologies // RBC, February 05, 2019. URL: https://www.rbc.ru/technology_and_media/05/02/2019/5c5820119a794707cf8ada4a?fbclid=IwAR2C0J5gpkxteRgCwFJhm8AW960oo29N-zPcnUQ4103SK9zfUHdxX4W1XlU

yet delivered unambiguously positive outputs, the Russia Digital Economy Program provides for the possibility to harness the NTI experience.

Despite a few advancements made so far, they are insufficient to change the overall technological innovations development landscape, and public support policies are yet to become more efficient. There are few reasons for that. The first reason is that federal funding of research and development is dominant even in the business sector, which somehow weakens business initiatives while supporting the practice of "state-funded innovation." The second reason is that innovations within the country have minor influence on the ability to compete. Access to administrative resources, particularly for big companies, remains the key aspect. The third reason lies in the fact that the level of innovation activities is determined by far not only the presence of policies designed to stimulate innovations. Basic economic factors (for example, terms of bank loans) are just as much important, but they at best do not interfere with the development of innovative processes.

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Science in Russia is facing long-lasting problems of quantitative and qualitative parameters of the scientific potential and the structure of funding. The proportion of public funding remains high as never before, no serious incentives have been offered to encourage the business sector to invest in research and development, the promotion of technological innovations has not yet delivered scalable outputs. Sanctions have so far failed to have an effect in terms of promoting own advanced export-led technologies.

There is a positive shift in basic and exploratory research, publication activities are on the rise in institutions of higher education and in the public sector. It is important that leading institutions of higher education have started harnessing the incentives to raise the number and the quality of publications. Activities aimed at promoting Russian journals in international databases, namely Web of Science and Scopus, also contribute to the profile of Russian science.

As envisioned by the Russian government, the rationale and quality of scientific research should be raised due to new functions of the Academy which will be in charge of scientific and methodological management of all the organizations across the country that perform state-funded research and development. The solution, however, has some problematic aspects, namely the Academy's human resources are insufficient to meet the required volumes of expertise, the Academy's mandate to make decisions without having to bear responsibility for them, as well as increase in the already heavy bureaucratic burden on research-performing organizations and institutions of higher education.

Science is regarded as inherent value, according to new public scientific development plans, which is a positive, to a certain extent, factor, indicating that the state recognizes this area as an important area. There are plans to raise state budget funding of basic science and to enhance human resource potential. However, some of the new policies ignore the existence of (HR, financial, organizational) misalignments in science. The new projects continue to show the gap between scientific development targets and economic needs of the country, and there is a prevalent focus on various ratings.