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The review provides a detailed analysis of main trends in Russian economy in 2016. The paper contains 6 big sections that highlight single aspects of Russia's economic development: the socio-political context; the monetary and budget spheres; financial markets; the real sector; social sphere; institutional challenges. The paper employs a huge mass of statistical data that forms the basis of original computation and numerous charts.

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### 6.5. The situation in the sphere of science and innovation<sup>1</sup>

Two ongoing parallel processes marked the year 2016. *The first* one had to do with the continuing implementation of previously planned measures, although it clearly fell behind the earlier established schedule. The scientific research community defined it as progressive stagnation. *The second* process involved the active elaboration, at the government level, of new strategic documents aimed at a fundamental revision of current policies in the sphere of science and innovation. These were the *Strategy for Scientific and Technological Development of the Russian Federation*, the *National Technology Initiative (NTI) Strategy*, and the draft federal law *On Scientific, Scientific-technological and Innovation Activity in the Russian Federation*, to supersede the Federal Law *On Science and State Scientific and Technological Policy* enacted in 1996. In August, a new RF Minister of Education and Science was appointed, and so it could be expected that the priorities of the government policy in the field of science and related measures would likewise be adjusted. The focus may well be shifted towards the sphere of education, which is also important from the point of view of science: the creation of high quality human resources in the field of scientific research begins in the secondary school education system. In spite of the introduction of a number of comprehensive measures aimed at support and promotion, some aspects of the issues that have to do with lack of personnel in certain key areas have never been resolved. Among other things, it is necessary to alter the hierarchical and age structure of research personnel, create proper conditions for their career growth, and properly adjust the highest-level qualification training system.

At the same time, the progress in the academic and higher education sectors was slower than necessary. The year 2016 saw a sort of anniversary - three years had elapsed since the start of reform in the Russian Academy of Sciences (RAS). The prevailing opinion within the academic community was that no serious organizational improvements had been achieved in the research sector, while productivity growth in the academic sector had been too slow. The response of the scientific researcher community began to resemble that observed in the mid-1990s, when the signs of destruction in the science sphere reached their historic high of the entire post-Soviet period. Most probably, such reactions were caused by the poor understanding of the half-baked reform measures coupled with lack of trust in the authorities, dwindling budget funding, and fears associated with possible personnel cuts in the future. Besides, the sphere of science has recently become 'swamped' in minor issues like calculating bibliometric measures, changing the documentation flow patterns for the Federal Agency for Scientific Organizations (FASO), merging some previously separate research institutes.

The pessimism felt by the scientific research community was evidently in contrast with some positive changes that last year had just become manifest. These were the increasing number and improving quality of scientific publications (the growth rate of publications in scientific journals soared in Q1; incidentally, the number of publications written without foreign co-authors was increasing at a higher rate than that written with foreign co-authors). Besides, some positive shifts also occurred in the sphere of commercial use of results of scientific research, including innovation clusters.

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### 6.5.1. New strategic documents

In 2016, the development of two new strategies was underway: the *Strategy for Scientific and Technological Development of the Russian Federation* (hereinafter – STD Strategy) and the *National Technology Initiative Strategy* (hereinafter – NTI Strategy); besides, in autumn 2016, work was started on Russia's development strategy for 2018–2024<sup>1</sup>, the sphere of science and technology being one of its principal aspects.

In each of these documents the emphasis is placed somewhat differently. The STD Strategy addresses specifically the scientific research field and the commercial use of intellectual products. The NTI Strategy regards the sphere of science and technology as one of the important components of Russia's entry into new hi-tech markets, but assigns a major role in this entry to business activities. The ever-increasing number of new strategic documents (in addition to the already adopted ones, including several sectoral strategies, one of the most recent being, for example, the strategy for developing the field of photonics) is a sign of something like a crisis unfolding in the sphere of science and technology, to which various stakeholders with different views are attempting to provide some sort of a solution. Indeed, the persisting core problems – the interdependence of all the components of the innovation system and the quality of state administration - are still there. Their existence was once again confirmed by the latest Global Innovation Index 2016 Report<sup>2</sup>. Russia, while having moved up 5 spots to 43rd place, still fell significantly behind most countries in terms of some important parameters like innovation linkages (112th among a total of 128 countries), rule of law (104th), state of cluster development (101st). This country still ranks high by its share of females employed with advanced degree (2nd place), domestic market scale, and patent applications filed with the national patenting agency – but these are by no means the key innovation development parameters.

The STD Strategy, approved by the RF President as of 1 December 2016<sup>3</sup>, relies in the main on the concept of Grand Challenges. This term came to this country a few years ago, having been borrowed from the European Union's practices. Grand Challenges are understood as existing major issues that include the situation with food supplies, demography, energy and other major issues, as well as national security threats. The Strategy is designed to link Grand Challenges with the national goals and priorities as set out in strategic planning documents. The importance of the new Strategy was underlined by the RF President in his Annual Presidential Address to the Federal Assembly, where several important provisions were put forth, including the necessity to develop cross-cutting technologies<sup>4</sup>, promote competition in the sphere of science and technology and to support talented young scientists on a long-term basis.<sup>5</sup>

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<sup>1</sup> Dmitry Medvedev and Alexei Kudrin discussed the work on the strategy for Russia's development from 2018 through 2024. Presidential Council for Economic Modernization and Innovative Development. September 22, 2016. See <http://i-russia.ru/all/news/31845/>

<sup>2</sup> The results of a comparative study of innovation systems in 128 countries. Source: *The Global Innovation Index 2016. Winning with global innovation*. JOHNSON Cornell University, INSEAD, WIPO, 2016. <https://www.globalinnovationindex.org/gii-2016-report>

<sup>3</sup> Executive Order on the Scientific and Technological Development Strategy of the Russian Federation No 642 of 1 December 2016.

<sup>4</sup> The term was introduced by the STD Strategy. It is applied to technologies that are important for developing different areas of economic activity (for example, digital and quantum technologies).

<sup>5</sup> Annual Presidential Address to the Federal Assembly, 1 December 2016. See <http://kremlin.ru/events/president/news/53379>

The STD Strategy sets out two important parameters that should determine the provision of funding to the research and development (R&D) sector: it is expected that, by the year 2035, its amount will make up 2% of GDP, and the share of private investment therein should be not less than that of public investment<sup>1</sup>. Such expectations with regard to spending allocated to science are very moderate – both in quantitative terms and from the point of view of the private sector's share, because even at present, the average amount of expenditures on science in the developed countries is generally above 2% of GDP, while the share of private investment is usually higher than that of government investment. This is the most pessimistic target set by the STD Strategy, because it is indeed difficult to achieve any serious success with a low level of funding.

The STD Strategy contains one provision whereby it is linked to the NTI Strategy: the National Technology Initiative is viewed as a promising instrument designed to ensure that fundamental knowledge, fundamental and applied scientific studies are transformed into products and services capable of ensuring for Russian companies the leading positions in the most auspicious markets in the framework of the already existing priorities and those that may emerge in the future (including after 2030).<sup>2</sup> The priorities listed in the STD Strategy correlate with the main technological development directions set out in the NTI Strategy. These are digital industrial technologies, robotic systems, new materials, *big data*, non-polluting energy, and so on. Later on, most probably, federal targeted programs (FTP) will be readjusted in an operative mode to suit those new themes, because at present the ongoing R&D FTP is structured in accordance with the priorities set out in 2011.

The NTI Strategy<sup>3</sup> formulates as its core idea the entry into new network markets by means of developing cross-cutting (backup) technologies, and setting up 'NTI companies'.<sup>4</sup> It is noteworthy that the strategy's orientation to network markets is not necessarily compatible with that to Grand Challenges. Indeed, promising markets may be found in a place where there are no challenges; or, they may suddenly spring up somewhere in response to newly emerging breakthrough hi-tech inventions. The NTI Strategy is not a standard-setting document, because the National Technology Initiative itself, according to its ideologist Dmitry Peskov, Director of the Young Professionals Division at the Center for Strategic Research (CSR), is something of a cross between a system, a project, a movement, and an ideology<sup>5</sup>. What is needed to produce new fast-growing Russian companies capable of entering world market, is not 'cadres, but talent; not ministries, but services'.<sup>6</sup> In accordance with this postulate, the project named NTI Strategy views the government policy instruments and measures as services, and scientific research as a function that is critically important for the emergence of new technologies.

In its turn, Russia's development strategy for 2018–2024 entered its preparatory phase, which involved, among other things, also an analysis of the outcome of previously implemented strategies. This analysis revealed that none of the innovative development measures set out in

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<sup>1</sup> *Strategy for Scientific and Technological Development of the Russian Federation*. Section 48 (November 2016) <http://sntr-rf.ru/upload/iblock/7df/01%20Проект%20Стратегии%20научно-технологического%20развития.pdf>

<sup>2</sup> *Strategy for Scientific and Technological Development of the Russian Federation*. Section 23. <http://sntr-rf.ru/upload/iblock/7df/01%20Проект%20Стратегии%20научно-технологического%20развития.pdf>

<sup>3</sup> For further details concerning the STD, see *Russian economy in 2015. Trends and outlooks* (Issue 37) – М.: Gaidar Institute, 2016, p. 361–364.

<sup>4</sup> NTI companies are businesses centered around breakthrough inventions and technologies that make it possible to achieve higher results with fewer resources.

<sup>5</sup> *Where do we go with the STD: the project's co-author Dmitry Peskov explains its prospects*. June 17, 2016. [http://news.ifmo.ru/ru/startups\\_and\\_business/initiative/news/5739/](http://news.ifmo.ru/ru/startups_and_business/initiative/news/5739/)

<sup>6</sup> *Ibid.*

*Strategy 2020* had been implemented in full,<sup>1</sup> and the innovation target achievement index for *Strategy 2020* was on the whole lower than that for *Strategy 2010*.<sup>2</sup> This is one of the reasons why last year saw the emergence of several draft strategies.

The noteworthy feature of the current versions of strategies is their very high degree of generalization. They focus mainly on the principles, while the actual mechanisms play a subordinate role, and sometimes they are not even adequately explained, while the expected results are poorly coordinated with the goals set by the strategies (for example, the inputs in the expected solutions to the problems formulated as Grand Challenges). At the same time, in view of the multitude of disputable and unresolved issues (including technical ones) across the entire sphere of science and technology (personnel, finance, organizational structure, administrative system, material base and other forms of necessary backing for the research process), strategies are indeed important because they provide a way to coordinate the directions of development, and the new documents explain the necessary points clearly enough.

#### 6.5.2. The scale and forms of budget funding allocated to research and development

The STD Strategy emphasizes the importance of fundamental research, and this is reflected in the budget projections for 2017–2019. It is planned to increase budget allocations to fundamental studies in the budget classification category of 'fundamental research'. More particularly, the volume of budget funding allocated to the Russian Foundation for Basic Research (RFBR) will be reduced, and that allocated to the Russian Science Foundation (RSF) will be increased. As of today, the RFBR is the only fund providing support to minor initiative projects that may yield findings worthy of being used as a foundation for bigger studies funded both in the framework of the Russian Science Foundation and various programs. The Fund ensures ongoing research across a broad spectrum of fields, without setting any priorities, which is especially important for many reasons, including the prospects of technological development, because it cannot be predicted in which field breakthrough technologies will emerge. Besides, last year the RFBR was merged with the Russian Humanitarian Science Foundation (RHSF), but the budget of the enlarged RFBR remained the same. The effectively reduced budget narrows the RFBR's opportunities for maintaining the proper environment where 'initiative studies' may be brewed.

The merger of the RFBR and the RHSF evidently occurred, first of all, due to budget constraints. In the early 1990s the RFBR was the only existing fund, and the RHSF gemmated from it specifically because projects launched in the fields of natural sciences, engineering, humanities and social sciences have different goals and priorities, and so they need different forms of support. The RF Ministry of Education and Science and the CEOs of the two funds explained the necessity of their merger by the need to optimize their administrative costs, further supported by the rather incoherently stated 'necessity' to 'solve new problems and respond to the challenges that Russian science is faced with'.<sup>3</sup> In addition, in the explanatory note attached to the government directive it was stated that this decision will help elaborate

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<sup>1</sup> *Analysis of factors involved in the implementation of top-level strategic planning documents*. Analytical report. Ed. M.E. Dmitriev. St. Petersburg: CSR, RANEP, IEP, NEP, 2016, p.26.

<sup>2</sup> *Ibid.*, p. 29.

<sup>3</sup> A. Gorbatova. *Safe merger*. March 4, 2016. See [http://www.strf.ru/material.aspx?CatalogId=221&d\\_no=116784#.WDqzPH3wip0](http://www.strf.ru/material.aspx?CatalogId=221&d_no=116784#.WDqzPH3wip0)

unified procedures of getting access to grants for each field of research.<sup>1</sup> However, with this goal in mind, it would have been reasonable to merge all the three funds, the RSF including – then the procedures could indeed become unified.

In its turn, the RSF is faced with another problem – unsustainable budget; it is planned that the Fund will receive financing not only from the government, but also from private sources. Incidentally, this is what Vladimir Putin noted at the meeting of the *Presidential Council for Science and Education*<sup>2</sup>.

For 2017, the RSF will receive an additional RUB 3.5bn, earmarked for the support of postdoctoral researchers, which is very important for Russian science in general and research laboratories in particular.<sup>3</sup> By 2019, the Russian Science Foundation budget is to increase significantly and top that of the RFBR by RUB 3.2bn.

While fundamental science may expect a somewhat greater inflow of funding - even if it is most likely to be eaten up by inflation, the way budget allocations to applied scientific research are distributed among the budget functions (*Table 17*) is indicative of their gradual dwindling, as well as of the fact that national defense is currently a top priority, as far as expenditures on R&D are concerned.

Applied studies in the national economy sector in 2017 will attract only about 57% of the amount allocated to those conducted in the sectors of national defense and national security, and by 2019 will shrink by 23.8% (on 2017). And finally, it is planned that, by 2019, the allocations to research in the healthcare sector will be increased (because the latter, in accordance with the draft STD Strategy, has been placed on the list of priorities), but by only 4.3% (on 2017) and from a very low baseline – RUB 16.1bn. For reference: this amounts to only 4.3% of the expenditures on studies in the sectors of national defense and national security.

The gradual withdrawal of the state from the system of support of studies oriented to applied results is an absolutely correct policy (at present, the relative volumes of government allocations to the development of innovation technologies are sufficiently high compared with the volumes of such allocations in the developed industrial countries). However, not all of the existing budget functions pertaining to applied studies on the expenditure side should be subject to cuts. One of the important functions of the state has always been, and remains, the support of start-up R&D companies. This function is performed by the Fund for the Promotion of the Development of Small Businesses in the Sphere of Science and Technology. Regretfully, over the next three years its budget is going to be frozen at the level of RUB 4bn, although the Fund has been providing large-scale support to Russian startups and small innovative businesses.

*Table 17*

**Changes in the distribution of budget allocations to applied scientific research**

Field	2017, bn RUB	Change on previous year, %	2018, bn RUB	Change on previous year, %	2019, bn RUB	Change on previous year, %
Applied scientific research, <b>national defense</b>	346.9	80.2	213.9	61.7	176.4	82.4
Applied scientific research, <b>national security and law enforcement activity</b>	26.1	94.5	22.8	87.5	22.3	97.7

<sup>1</sup> Directive of the RF Government of February 29, 2016, No 325-r on the reorganization of the RFBR and the RHSF. See [http://www.rfbr.ru/rffi/ru/news\\_events/o\\_1951236](http://www.rfbr.ru/rffi/ru/news_events/o_1951236)

<sup>2</sup> <http://kremlin.ru/events/councils/by-council/6/53313>

<sup>3</sup> The head of the RSF explains how the RUB 3.5bn promised by the President is going to be spent. Source: <https://indicator.ru/news/2016/11/21/glava-rnf-rasskazal-kuda-potratyat-obeshannye-prezidentom-3-5-mlrd-rublej/>

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### trends and outlooks

Exploration and use of outer space, <b>national economy</b>	56.8	35.8	59.2	104.3	65.5	110.5
Applied scientific research, <b>national economy</b>	211.0	182.4	189.9	90.0	160.8	84.7
Applied scientific research, <b>healthcare</b>	16.1	89.4	17.0	105.8	16.8	99.0

Source: own calculations based on data released by the RF Ministry of Finance.

On the whole, the amount of budget allocations to R&D will slightly increase in absolute terms, while actually declining or remaining unchanged when adjusted by inflation. This is a negative trend, especially considering the fact that the federal budget has so far remained the principal source of funding for R&D. At the same time, as federal budget expenditure allocated to R&D still displays a positive movement pattern, however modest, while over the next few years budget allocations are expected to shrink overall in absolute terms, it can be concluded that science has been recognized as a relatively important type of economic activity. Meanwhile, as shown by the experiences of the past decade, increased budget funding is by no means the only success factor capable of boosting the development of science and innovation. To improve the output of the science sector and newly created technologies, it will also take non-financial mechanisms both inside and outside of the sphere of science and technology.

#### 6.5.3. Transformations in the former academic sector

In autumn 2016, three years had elapsed since the start of the organizational reform of the Russian Academy of Sciences (RAS) – the period of time allotted to a thorough analysis of the situation in the academic sector, inventory checks, and to taking decisions concerning the methods of its optimization. The CEOs of the Federal Agency for Scientific Organizations (FASO) announced that the analysis of the property complex had been completed, with the identification of 600 entities (including land plots) available for transfer either to the treasury or to regions and municipalities<sup>1</sup>. Since property deals have always been a rather painful issue, and some analysts even have believed it to be the true reason behind the entire RAS reform business, the FASO specifically pointed out that there were no 'golden assets' among the property entities earmarked for transfer. Indeed, the possibility of murky property deals was more or less overlooked by the academic community. Far more significance was assigned to other issues like restructuring of the existing institutes, possible job cuts, funding of fundamental studies, and elaboration of comprehensive future research plans.

The outcome of the reform is estimated quite differently by the RAS and the FASO.

The FASO released data that pointed to positive changes in the system of academic institutes. The following achievements were noted: a 50% growth, on 2013, in the number of postgraduate researchers in the FASO's institutes;<sup>2</sup> a 1.5-fold increase, by early 2016, of the salaries paid to the staff of research institute; a 14% growth, over two years, of the number of publications in peer-reviewed journals; a significantly 'rejuvenated' director corpse;<sup>3</sup> and the creation of new federal research centers responsible for implementing priority research projects.

<sup>1</sup> *Science is being transformed into practice, and generally into economics. The head of the FASO told Kommersant about the progress of reform in the RAS.* Kommersant (in Russian), No 198, October 25, 2016, p. 1. See <http://kommersant.ru/doc/3125352>

<sup>2</sup> *Science is being transformed into practice, and generally into economics. The head of the FASO told Kommersant about the progress of reform in the RAS.* Kommersant (in Russian), No 198, October 25, 2016, p. 1. See <http://kommersant.ru/doc/3125352>

<sup>3</sup> Yu. Medvedev. *A strike in an academic style.* The Russian Newspaper (in Russian), No 6946, April 12, 2016. See <https://rg.ru/2016/04/12/glava-fano-rasskazal-skolko-uchenyh-ediat-chuzhoj-hleb.html>



The CEOs of the RAS and its academic institutes, on the contrary, offered negative assessments of both the results achieved by the FASO and the current situation, predicting 'further degradation and marginalization',<sup>1</sup> and stating that 'the point of no return' has already been passed,<sup>2</sup> and that the current low level of funding 'is barely sufficient for survival'.<sup>3</sup> Moreover, in September, the RAS trade union held a week of protest against the science budget cuts.<sup>4</sup> Indeed, the amount of budget allocations to R&D had been on the decline, while researcher salaries, which were to rise to twice the average salary paid in a given region by 2020, were being increased at a slower-than-planned rate. Out of the 700 institutes supervised by the FASO, only 170 had managed to achieve their 2016 salary target of 145.8% of region's average salary.<sup>5</sup>

So, the situation appears to be controversial, and it is important to understand what results have actually been achieved in the course of the RAS reform, and how they should be estimated. We may distinguish *three main directions of the reform*.

*The first one* is the restructuring of the institutes' activities in such a way that they would better answer the economy's needs and/or be more cost-effective in terms of quantity and quality of scientific products. The estimates can be, for example, an increased patents index, an increased number of small-sized companies set up by research institutes, expanded cooperation with industries, and growth in number of publications in peer-reviewed journals and the citation index. No structured data are available for any of these parameters, but restructuring and, even more importantly, the methods applied during its implementation were one of the most hotly debated issues.

Over the past year, several spectacular mergers took place, each of them involving research institutes that specialized in different fields but were located on one and the same site; the purpose of their merger was to bring down the number of administrative personnel and to pool together the available resources. The FASO believes that the reorganization will enable them to respond in a more balanced way to external challenges and to make use of competitive properties<sup>6</sup>. So far, there have been several precedents of mergers - completed or simply discussed<sup>7</sup>. The FASO's CEOs argued that the institutes were always merged on a purely voluntary basis, after a comprehensive discussion. The CEOs of the RAS, in their turn, argued that the mergers were enforced, in one or another way (for example, under the threat that an

<sup>1</sup> A. Vaganov. *Declining numbers of scientists is an inevitable process*. The Independent Newspaper (in Russian), August 2, 2016. See [http://www.ng.ru/science/2016-08-02/3\\_kartblansh.html](http://www.ng.ru/science/2016-08-02/3_kartblansh.html)

<sup>2</sup> D. Evdokimova. *Academician of the RAS Yuri Ryzhov: Science and education have already left this country*. Novye Izvestia (in Russian), August 1, 2016. See <http://www.newizv.ru/society/2016-08-01/243893-nauka-i-obrazovanie-uzhe-ushli-iz-strany.html>

<sup>3</sup> A. Makeeva, D. Labutina, A. Vikulova. *Scientists disprove the laws of funding*. Kommersant (in Russian), No 171, September 16, 2016. See <http://kommersant.ru/doc/3089459>

<sup>4</sup> *There is no money even for paying salaries*. Novaya gazeta (in Russian), No 102, September 14, 2016. See <https://www.novayagazeta.ru/articles/2016/09/14/69840-deneg-ne-hvataet-dazhe-na-oklady>; A. Makeeva, D. Labutina, A. Vikulova. *Scientists disprove the laws of funding*. Kommersant (in Russian), No 171, September 16, 2016. See <http://kommersant.ru/doc/3089459>

<sup>5</sup> N. Volchkova. *Sustainable stagnation? Scientists are once again promised troubles*. Poisk (in Russian), No 1-2, January 13, 2017. See <http://www.poisknews.ru/theme/science-politic/22023/>

<sup>6</sup> *Science is being transformed into practice, and generally into economics. The head of the FASO has informed Kommersant on the progress of the reform in the RAS*. Kommersant (in Russian), No 198, October 25, 2016, p. 1. See <http://kommersant.ru/doc/3125352>

<sup>7</sup> N. Volchkova. *Generalizing in particular. The RAS will make its own way*. Poisk (in Russian), No 45, November 11, 2016. See <http://www.poisknews.ru/theme/science-politic/21191/>

academic institute would be merged with a higher educational establishment, or that the number of its scientific research personnel would be cut, and so on). In the final analysis, according to its opponents, restructuring may result in a narrower field of scientific research and the loss of some of its very promising directions,<sup>1</sup> thus paving the way for further cuts, because the institutes after the merger lose their former status of a legal entity and are effectively turned into mere laboratories.<sup>2</sup> At the same time, some institutes really desired to be merged and in doing so, to acquire a new status (of a federal research center, a national research institute), because the FASO declared that the newly merged institutes would be relieved of the obligation to undergo a performance assessment.

On the whole, negative estimations of the restructuring prevailed, and the autumn session of the General Meeting of the RAS approved a resolution demanding that the restructuring process should be suspended, and those academic institutes that had already been merged should undergo their performance assessment. It should also be noted that there also exist valid reasons for restructuring the existing institutes, including those that have to do with their personnel structure and the fields of research. However, sometimes the attempts to merge some institutes indeed acquired a scandalous flavor. There were also some instances of scientific and research personnel cuts after restructuring had been completed, in spite of the promises that only an optimization of the administrative personnel would be carried out.<sup>3</sup> All these negative experiences undermined the trust in the ongoing reorganization.

The scientific researcher community is racked by a lingering suspicion that the ultimate goal of all these transformations is to reduce the overall number of researchers and worsen the conditions for doing scientific research. Such fears have been expressed both implicitly and explicitly. One example is the reaction to the proposal made by the RAS and the FASO, in the form of a letter released in October 2016 and addressed to the directors of research organizations and the heads of RAS branches, in which it was suggested that an unplanned intramural attestation of their scientific and research staff and research departments should be conducted. They were asked to submit the personal performance estimates for each researcher, including their involvement in scientific research (including international studies), tutoring and expert activities. In principle, such information can help in assessing more objectively the performance of the scientific and research personnel, which is useful for the administration of the academic institute. However, the letter caused much consternation among the scientific research community, and immediately it was suggested that such a monitoring was conducted in connection with forthcoming personnel cuts.<sup>4</sup> It is true that certain job cuts by way of optimization are indeed needed, and it is better to be open about it. When one goal is proclaimed initially (for example, 'simply to do a check'), and then certain actions are undertaken to achieve another one, this may give rise to tension and sometimes even hysteria, which can only make the actual implementation of reform even more difficult.

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<sup>1</sup> *Deputy head of the RAS: the current science management trends give rise to big risks.* RIA Novosti (in Russian), August 19, 2016. See <https://ria.ru/interview/20160819/1474792035.html>

<sup>2</sup> N. Volchkova. *Generalizing in particular. The RAS will make its own way.* Poisk (in Russian), No 45, November 11, 2016. See <http://www.poisknews.ru/theme/science-politic/21191/>

<sup>3</sup> *The biologic institutes at Pushchino will be merged by late 2016.* Scientific Russia (in Russian), April 29, 2016. See <https://scientificrussia.ru/articles/biologicheskie-instituty-v-pushchino-obedinyat-k-kontsu-2016-goda>

<sup>4</sup> D. Saprykina. *Either do scientific research, or vacate your positions: on the unplanned attestation of researchers.* Indicator (in Russian), October 21, 2016. See <https://indicator.ru/article/2016/10/21/esli-sotrudnik-ne-hochet-ego-ne-uvolish/>

One of the key problems has also arisen because the merger of institutes was started prior to the assessment of their academic performance and organizational structure, while the discussion of the principles and methodology of such an assessment (including the setting up of reference groups)<sup>1</sup> had been underway for year. The lengthy debate continued into 2016; in June of that year, the FASO made some adjustments to the assessment methodology, after having announced in early March that it was launching the process of data collection and estimation across the system of institutes.<sup>2</sup> The first assessment results were expected by July 2017.<sup>3</sup>

On the whole, the reform process in the RAS followed an inertia pattern. The was also true of the RAS in its capacity of the organization that elects new full members and corresponding members of the RAS. Last year's developments culminated in the election in the RAS, which demonstrated that the tradition of clandestine agreements and connections, including family relations, as well as the election, as full members and corresponding members of the Academy, high-ranking government officials and other personalities that have demonstrated no prominent achievements in scientific research, has by no means disappeared - instead, it has only become stronger.<sup>4</sup> However, while previously such goings-on were discussed only within the close circle of the academic community, now, thanks to the open dialogue between RF President Vladimir Putin and President of the RAS Academician Vladimir Fortov, it has become known to the public. The reason was the election to the RAS of certain government officials, the RF President's directive proclaiming such acts to be undesirable notwithstanding. As a result, all the officials elected as full members or corresponding members of the RAS were dismissed from their government posts, with the right to become full-time scientific researchers. Another aspect of the discussion of the results of the recent election to the Academy was that few of those elected that year were eminent scientists (judging by their bibliometric indices).<sup>5</sup> Such episodes undermined the Academy's reputation - given that in the past, the Academy had frequently referred to its high moral standards and principles of scientific research as a justification for its acts.

The *second* direction of activity is the optimization of the current activities of the academic institutes, whose performance can be measured by the shrinkage of their paper documentation turnover, and their workload - by the number of checks conducted by the FASO and the volume of reports requested by it. In reality, the 'reporting load' on the institutes has increased, in part due to the inventory checks. Besides, the role of the FASO in the choice of themes for the studies has become more prominent, further boosted by the mergers of institute, which inevitably lead to an adjustment of the research fields. The FASO decided to compare the

<sup>1</sup> For further details, see I. Dezhina. *The Situation in the Sphere of Science and Innovation. Russian economy in 2015. Trends and outlooks* (Issue 37) – M.: Gaidar Institute, 2016, p. 353–355.

<sup>2</sup> N. Volchkova. *A tournament of priorities. A new phase of science reform has started*. Poisk (in Russian), No 9, March 4, 2016. See <http://www.poisknews.ru/theme/science-politic/17875/>

<sup>3</sup> O. Kolesova. *Preservation with a reduction. Scientists are promised troubles*. Poisk (in Russian), No 51, December 23, 2016. See <http://www.poisknews.ru/theme/science-politic/21804/>

<sup>4</sup> A lot of material is available on this theme, including news releases and video footage, where the biographies of the relevant officials and the stories of their election as Full Members and Corresponding Members of the RAS are analyzed in detail, specifically for each RAS department. See, for example, B. Sobolev. *Family business: Full members of the Academy pull into the RAS even their good-for-nothing children*. Vesti.ru, December 3, 2016. <http://www.vesti.ru/doc.html?id=2828671>; *An expert estimates the loss for the RAS inflicted by the dismissal of government officials*. Lenta.ru, November 28, 2016. See <https://lenta.ru/news/2016/11/28/harm/>

<sup>5</sup> See, for example, A. Polyinin. *How to save the Academy of Science's reputation*. Indicator (in Russian), February 1, 2017. See [https://indicator.ru/article/2017/02/01/kak-spasti-reputaciyu-akademii-nauk/?utm\\_source=fbsharing&utm\\_medium=social](https://indicator.ru/article/2017/02/01/kak-spasti-reputaciyu-akademii-nauk/?utm_source=fbsharing&utm_medium=social)

ongoing research with those fields that are being actively developed on a world level, so as to select those worthy of support and promotion.<sup>1</sup> In this connection, no consideration was given to the existing fundamental research program of the RAS. In actual practice, the search for new priorities resulted in the elaboration of complex scientific research plans (CSRPs). This instrument is designed to establish network connections between the institutes of the FASO operating in the framework of promising research fields. The goal of such cooperation is to ensure the competitiveness of the ongoing studies on the international level and to speed up the commercialization of their applied results. At the same time, the powers of directing each of these network projects are transferred to a leading institute (coordinator). Since the CSRPs are funded in the main from the budget, this becomes essentially a new mechanism of distributing the financial resources available to the FASO. On the plus side, such scheme enables the RAS, the relevant government departments and businesses to assess the real importance of the selected themes, and to discard the outdated ones that have been dragged along for years from one fundamental research program into another.<sup>2</sup> The number of the selected priority fields in the form of CSRPs is on the rise: as of mid-year 2016, it amounted to 65.<sup>3</sup> However, CSRPs have also turned out to be a highly disputable and controversial undertaking – its supporters (who, as a rule, already participate in one or other ongoing CSRPs) say that this mechanism is efficient in reorienting the studies towards the most modern research fields. Its opponents argue that CSRPs represent a form of interference, by the FASO, with the selection of relevant directions of research, which has always been the prerogative of the RAS.

The *third* direction is the improvement of the quality of expert activities carried on by the RAS and the institutes operating under the FASO in the framework of their participation in the selection and implementation of priority directions of scientific research and in the conduct of expert estimations of major socioeconomic projects - the functions consolidated to the Academy in accordance with new legislation (introduced in 2013). The activities in that sphere have begun to be better organized, a new institute of 'experts of the RAS' has been created, the experts being elected on a competitive basis with due regard for the quantity or amount of work produced personally (the number of publications, the past experience of expert activities) and for the quality of their past performance (they need to be recommended by a member of the RAS, professor of the RAS or the Presidium of the RAS, and have a recommendation by the academic council of their institute). The Expert Council of the RAS conducted a check of 5,000 projects that had been implemented by a total of 1,582 state research organizations and higher educational establishments. Its results revealed that only 7% of them comply with the world standards, whereas 26% projects ought to be terminated because they lack any scientific significance. This is an important finding, although only a small fraction of the science sector was investigated. By far, not all of the ongoing projects were subject to the check; for example, none of those funded by grants issued by the RSF, the RFBR and the RHSF was considered, while the total number of projects in that category is about 20,000. The experts also confirmed the fact that so far the level of 'academic' science is above that of higher educational establishments, because the results of 'academic' studies are more often published in

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<sup>1</sup> N. Volchkova. *A tournament of priorities. A new phase of science reform has started*. Poisk (in Russian), No 9, March 4, 2016. See <http://www.poisknews.ru/theme/science-politic/17875/>

<sup>2</sup> N. Shatalova. *Plan we will: research institutes work in accordance with comprehensive scientific research plans*. XPIR, May 13, 2016. See <https://xpir.ru/articles/Planirovat-budem>

<sup>3</sup> Ibid.

international sources, and the results of those conducted by higher educational establishments – in Russian ones<sup>1</sup>.

Thus, against the backdrop of the generally negative assessment of the progress of reform in the academic sector, by the scientific research community who do not like the resulting job cuts, the pressure imposed by the additional reporting, and the plans for the future, some of the parameters still point to positive shifts. These have to do with publications and the adjustments made to the themes of scientific research.

#### 6.5.4. Science at higher educational establishments

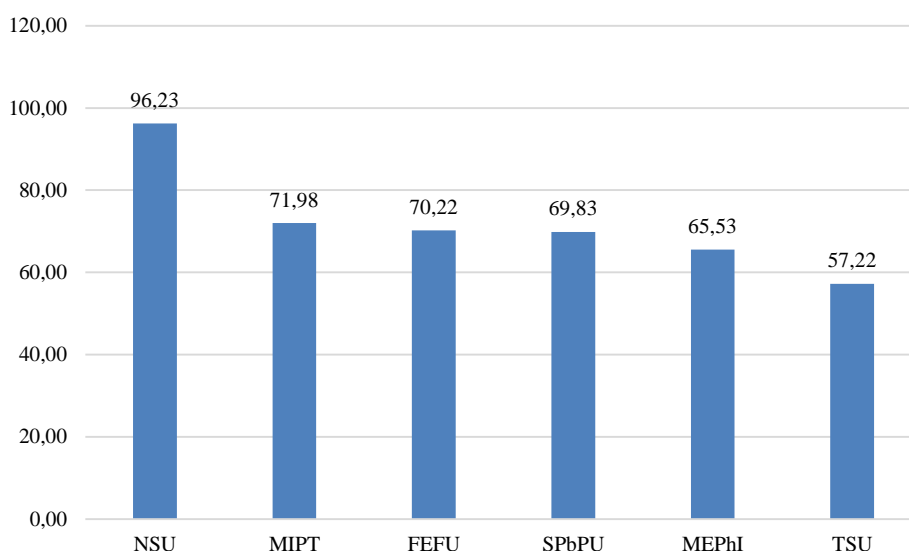
The measures designed to support scientific research at the leading higher educational establishments of Russia, including those that participate in Project 5-100 (its goal being that no less than five Russian universities should by 2020 be ranked among the world's top hundred) have been implemented in a rather consistent manner. The 21 higher educational establishments included in this program have achieved certain success, and so have justly deserved the additional chunks of budget funding allocated to them. Higher educational establishments may now boast of having strong scientific research groups, which have emerged, among other things, due to the participation of specifically invited foreign scientists. Some universities have increased the number of their publications several-fold on 2013: for example, the total number of publications issued by Tomsk State University has surged 4.3 times, that of NRU HSE – 4 times<sup>2</sup>.

It is the increasing number of publications prepared by the staff of leading higher educational establishments in the journals entered in the data sets run by Web of Science and Scopus that has become the most notable sign of improvement. The growth rates of the citation indexes of higher educational establishments have been moving ahead of those of the FASO institutes, although the number of co-authored publications likewise increased. The most remarkable are data relating to publications with high citation indexes (which means that they most frequently noticed by the scientific researcher community): in the majority of leading higher educational establishments, such publications are co-authored by scientists working in the academic sector (*Fig. 25*).

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<sup>1</sup> E. Shcherbina. *Let us change the theme. Russian science lacks resources and newness*. February 1, 2017. See <http://chr.dk.ru/sci/davaite-smenim-temu>

<sup>2</sup> *The equator of Project 5-100: the focus of higher educational establishments on their ranking by subject*. October 20, 2016. See <http://news.ifmo.ru/ru/education/official/news/6130/>



*Fig. 25. The publications with the highest citation indexes in Q1 JCR-2015 affiliated to the RAS, as %, 2011–2015.*

*Source:* I. Sterligov. Russia's Publication Activity: The main characteristics, the role of the RAS and higher educational establishments of the first wave of Project 5-100. Presentation at the MIPT. November 10, 2016.

The policy aimed at strengthening the science sector at higher educational establishments is on the whole quite correct, but it should be promoted not only through allocating additional funding to the projects and centers set up inside higher educational establishments. It is also important to maintain cooperation with academic institutes, and also to introduce systemic changes in the activity of higher educational establishments with a view towards a more adequate redistribution of the workloads between the faculty and researcher and their tutoring and consulting responsibilities, as well as the undergraduate to postgraduate student ratios. However, no such changes have been accomplished so far, or, at best, they have been minimal. At the same time, the amount of funding allocated to higher educational establishments has been increasing against the backdrop of a relative stagnation in the amount of budget allocations earmarked for the other sectors in the sphere of science. This has given rise to some negative phenomena like luring researchers to better paying jobs, artificially increasing the citation indexes, breaking up the research fields into smaller themes, and so on. The newly appointed (in August 2016) RF Minister of Education and Science Olga Vasilyeva noted, among other things, that citation indexes are rising at too high rates, which casts doubt on the scientific validity of the relevant ongoing studies: 'In an attempt to meet the necessary criteria we are looking for dubious journals and taking advantage of dubious opportunities for publication, and so the question arises as to the quality of those materials, and the price of the matter, which ultimately determines the value of these articles. Probably it is time to think of whether it is worthwhile to run so fast.'<sup>1</sup> This is one of the side effects of the striving to get a high ranking. It should be noted that the idea of university rankings is met with increasing criticism across the world because the majority of ranking systems assign too much importance to science

<sup>1</sup> Vasilyeva: *cornerstone higher educational establishments will not to be created by means of reorganization*. November 22, 2016 See <http://tass.ru/obschestvo/3804882>

citation and scientific achievements, thus undervaluing the actual quality of education that they offer. In the long run, this may have a negative impact on the academic level of their students<sup>1</sup>.

Some important parameters of the activity of leading higher educational establishments were simultaneously negatively influenced by economic factors, including the ruble's plunge. As a result, the number of specialists invited from abroad has shrunk by 20%,<sup>2</sup> the earnings of faculty are boosted only by increasing their academic workload up to the cap set by the RF Ministry of Education and Science (900 hours per year),<sup>3</sup> which reduces their opportunities to do high quality research. At present, even at the major higher educational establishments, the research staff spend 75% of their working hours on tutoring students.<sup>4</sup>

Towards the end of last year, the programs of support to higher educational establishments, including their research activities, began to be revised, and the main targets set for them may well be changed. In 2017, a high priority project titled *Educational establishments as centers of innovation-boosting environment* will be launched; according to the project's certificate, the higher educational establishments participating in Project 5-100 will be effectively reoriented to gaining high by-sector and by-subject rankings. By 2025, no less than 10 higher educational establishments must be ranked in the world's top hundred, and no less than 20 – in the world's top three hundred, for at least two consecutive years.<sup>5</sup>

It would be worthwhile to simultaneously revise the list of participating higher educational establishments in accordance with one more criterion: being ranked by one or several subjects, as of 1 January 2017, in the top three hundred of any of the international academic rankings (ranking by subject). It is these higher educational establishments that truly possess the potential to lodge securely in the group of leaders, and it would be critical to pool resources and ensure support for the aforesaid institutions. Then the list of participants in Project 5-100 may somewhat change, as some of the higher educational establishments formerly listed there may quit, to be replaced by others that had never been on that list but are already ranked in the world's top three hundred.

The quality of studies conducted by higher educational establishments may be further boosted if they are granted the right to award academic degrees, as has been the tradition at major foreign universities. So far, this right is enjoyed only by Moscow State University and St. Petersburg State University.<sup>6</sup> At the same time, it is logical to assume that this measure is premature, because in view of the currently widespread ethical norms, it may trigger an

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<sup>1</sup> P. G. Altbach, E. Hazelkorn. *Why most universities should quit the ranking game*. University World News. January 8, 2017, issue 442. See <http://www.universityworldnews.com/article.php?story=20170105122700949>

<sup>2</sup> T. Vozovikova. *To invest in promotion. The participants in Project 5-100 are hungry for new investments*. Poisk (in Russian), No 44, October 28, 2016. See <http://www.poisknews.ru/theme/edu/21079/>

<sup>3</sup> *The CEOs of higher educational establishments were accused of overstating the average salary of their faculty*. September 19, 2016. See [http://www.gosnews.ru/news/obshchestvo/rukovodstvo\\_vuzov\\_obvinili\\_v\\_zavyshenii\\_srednikh\\_zarplat\\_prepodavateley](http://www.gosnews.ru/news/obshchestvo/rukovodstvo_vuzov_obvinili_v_zavyshenii_srednikh_zarplat_prepodavateley)

<sup>4</sup> M. Choshanov. *A senseless race. Russian scientists have already lost at the starting line*. Poisk (in Russian), No 3, January 20, 2017. See <http://www.poisknews.ru/theme/science-politic/22137/>

<sup>5</sup> Certificate of Priority Project *Higher educational establishments as centers of innovation-boosting environment*, approved by the Presidium of the Presidential Council for Strategic Development and Priority Projects, protocol as of October 25 2016, No 9. See <http://government.ru/media/files/OnTUmegFLNj5Uqtac57y1WG1EtMG9ABe.pdf>

<sup>6</sup> Alterations have been made to the Federal Law On *Science and State Scientific and Technological Policy* as of May 23, 2016. See <http://kremlin.ru/acts/news/51971>

uncontrollable degree-awarding spree. In this connection, it is essential to elaborate strict criteria for universities with degree awarding powers, and the activity of the newly set up dissertation councils will have to be closely monitored. This function can be successfully performed by non-governmental organizations and networking communities, including *Dissernet*.

In addition to purely scientific studies, top-ranking higher educational establishments must engage in applied research and development activities that are in demand across the national economy. The key factor here will be their cooperation with businesses, as well as the creation of small-sized innovative companies. So far, the success achieved by leading higher educational establishments in that sphere has been less impressive than their efforts to raise their citation indexes. The survey of Russia's top 40 higher educational establishments (from among the participants in Project 5-100, national research universities, and federal universities) conducted by the RBC and ITMO University has revealed that approximately half of the small-sized innovative businesses set up by higher educational establishments do not earn any income, no profits are generated by intellectual property management, the number of international patents is low, and 28 out of the top 40 higher educational establishments lack such patents altogether.<sup>1</sup>

One of the persisting problems has to do with the quality of applied R&D projects implemented by higher educational establishments – they are met with weak demand in industry. The survey by the HSE Institute of Innovation Management ordered by *Skoltech*<sup>2</sup> has demonstrated that an average medium-sized hi-tech company generally expects from higher educational establishments to produce qualified human resources, and not new R&D products. They place only narrowly targeted orders for R&D, which is in part motivated by the narrow field of their own specialization. In this connection, three main interaction problems were identified, which have to do with cooperation in the field of scientific research and R&D:

- 1) higher educational establishments have poor understanding of the realities of commercial industrial production and the motives behind it;
- 2) the insufficient qualification of specialists working at higher educational establishments;
- 3) bulky bureaucratic procedures at higher educational establishments, and a highly formalized decision-making process.

Some additional data that did not contradict these findings were obtained in the course of a survey of members of the R&D Club,<sup>3</sup> which revealed that 77% of companies had never bought any licenses or patents from higher educational establishments, and that 84% of companies had never bought businesses set up by higher educational establishments.

So, while the quality of fundamental studies conducted by higher educational establishments is improving, one of the boosting factors being their cooperation with academic institutes and the hiring of foreign specialists, the quality of their applied studies is still too low, and businesses display low demand for these products.

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<sup>1</sup> T. Vozovikova. *No increase in profits. The experts are grieved by the incomes from innovations created by higher educational establishments*. Poisk (in Russian), No 45, November 11, 2016. See <http://www.poisknews.ru/theme/edu/21225/>

<sup>2</sup> The survey was conducted by the HSE Institute of Innovation Management in early 2016 among 150 hi-tech companies, of which 90% were medium-sized. The data from questionnaires were augmented by in-depth interviews with representatives of the companies.

<sup>3</sup> A. Makeeva, A. Saveliev. *Incomplete higher education*. Kommersant (in Russian), June 6, 2016.



#### 6.5.5. The problems with the performance assessment in the field of scientific research

The reform of public research organizations and higher educational establishments operating in the science sector has emphasized the importance of performance assessment indicators. This issue was the key discussion point throughout the course of 2016.

The discussion centered in the main around the methods of measuring the performance assessment indicators and the ways the pressure applied by the regulator in the form of requirements to the number and quality of publications (the Hirsh citation index) produces some unexpected side effects like the distortion and weakening of ethical norms and standards. In particular, the field of economics was chosen as an example of how the performance data can be distorted to better suit the interests of scientists; the systematization of available information resulted in the identification of six methods of doing so.<sup>1</sup> These are as follows: the works cited are not scientific publications (e.g., reference books and collections of statistics); the cited works are cited mostly by the co-coauthors; articles are always co-authored, or the number of co-coauthors is high; the citation of published articles in dependent and controlled journals is arranged; and finally, the articles are published in dubious periodicals. From the point of view of ethics, the situation is better in the former academic institutes, and more versatile in higher educational establishments. This can be explained by the fact that higher educational establishments are faced with the toughest requirements with regard to the number of publications and their citation indexes, especially if they belong to the categories of educational institutions earmarked for special government support (cornerstone universities, higher educational establishments participating in Project 5-100). Besides, it is in the academic sector that the most well-known scientific journals, including translated periodicals, have been published, and so it developed its own sophisticated practice of preparing and publishing scientific articles.

A separate theme in the discussion was the issue of bibliometric measurements *per se*: for example, how to achieve the target for Russia's WEB of Science index set in the RF President's Executive Order.<sup>2</sup> It should be noted that bibliometric indexes are also applied and discussed abroad, new measurements are being constructed with the purpose of most accurately reflect the inputs of scientists and journals in the progress of science.<sup>3</sup> This has become something of a frenzy – it reflects the strengthening trend of using bibliometric data in the performance assessments of individual scientists, as well as research laboratories and institutes, and to rely on them when making relevant decisions concerning the allocation of funding and human resources.

The focus on formal indicators has become too prevalent in the current policies in the science sector, and this orientation ultimately translates into lower real productivity<sup>4</sup>. This road has already been traveled by the majority of countries with well-developed science sectors, where

<sup>1</sup> E. Balatsky. M. Yurevich. *Measuring the academic ethics*. The Independent Newspaper (Science) (in Russian), May 25, 2016. See [http://www.ng.ru/nauka/2016-05-25/11\\_etika.html](http://www.ng.ru/nauka/2016-05-25/11_etika.html)

<sup>2</sup> Executive Order of the President of the Russian Federation of May 7, 2012, No 599 *On the Measures Designed to Implement the Government Policy on Education and Science*, whereby it is stipulated that, by 2015, Russia's WEB of Knowledge index should be increased to 2.44%. Source: <https://rg.ru/2012/05/09/nauka-dok.html>

<sup>3</sup> See, for example, Bjorn Hammarfelt, Alexander Rushforth (2016). *Judging merits in the age of the h-index: Citizen bibliometrics in biomedicine and economics*. <https://arxiv.org/pdf/1609.04931>; Loet Leydesdorff, Paul Wouters, and Lutz Bornmann (2016). *Professional and Citizen Bibliometrics: Complementarities and ambivalences in the development and use of indicators*. See <https://arxiv.org/pdf/1609.04793v1.pdf>

<sup>4</sup> D. Sarewitz. *The pressure to publish pushes down quality*. Nature, May 12, 2016, vol. 533, p. 147. See

a sound understanding of the importance of expert estimations has been gained. In this respect, Russia often falls behind, while of the other hand frequently overestimating the relevance of one or other specific measure. The 'viability' of the formal approach is easily explained – such estimations are very convenient for managers.

The issue of publications is closely interrelated with the theme of international cooperation between scholars and their mobility around the world. A recent research on scientific partnership between the APEC countries has demonstrated that Russia's share of articles co-authored by scientists from the USA and Germany is comparatively higher than that of joint publications with representatives of other countries (*Table 18*). Such a partnership will certainly have the most positive effect on the development of to positively influence scientific studies in Russia. Those same countries host a significant community of émigré scientists from Russia and the former USSR, which can account in part for the high co-authorship indices. At the same time, Russia is a partner of secondary importance for the USA, China and Japan, as witnessed by the fact that scientists from these countries have written less than 1% of articles with Russian co-authors.

*Table 18*

**Co-authored publications in 2011–2015, as % of the total number of national publications by each country**

	Partner country							
	USA	China	Germany	UK	France	Italy	Japan	Canada
USA	-	5	3	4	2	2	2	2
Japan	8	5	3	3	2	1	-	1
China	7	-	1	2	1	-	1	1
Russia	7	2	7	4	4	3	2	-

*Source:* Mapping Researcher Mobility. Measuring research collaborations among APEC economies. Australian Government, Department of Education and Training, APEC. May 2016.

It is a characteristic feature of the USA that, although the country is self-sufficient, it maintains cooperation on a relatively high level with a number of other countries (China, the UK). This fact point to the increasing universal internationalization of world science (with the exception of those countries that deliberately follow isolationist policies). An alarming development from this point of view is the consistent closure of the representative offices of foreign organizations and foundations that have been issuing grants to Russian scientists, designed to fund their scientific research, including their joint studies. In 2016, the Moscow office of IREX (The International Research and Exchange Board)<sup>1</sup> was closed, and the US Civilian Research and Development Foundation (CRDF Global) also began to curb its activity in Russia. Besides, Russia's cooperation with the USA in the field of nuclear and energy research was halted by way of imposing retaliatory sanctions.<sup>2</sup>

Thus, although international cooperation can indeed be a very good method of boosting the citation index, the incentives for actually cooperating with foreign countries in the current economic and political situation are rather controversial.

<sup>1</sup> <http://www.ntv.ru/novosti/1624710/>

<sup>2</sup> *Russia suspends its research agreement with the USA designed to promote cooperation in the peaceful uses of nuclear energy.* *BBC Russian*, October 5, 2016. See <http://www.bbc.com/russian/news-37568552>

#### 6.5.6. Emigration of scientists and the plans for returning expat scientists to Russia

The efficient performance of the science complex directly depends on the quality of human resources. The year 2016 was remarkable in that for the first time in many years, it saw a modest growth in the number of researchers, although it is now quite clear as yet how this phenomenon should actually be interpreted. Thus, for example, during the crisis of the late 1990s the number of scientific researchers began to grow, and the growth lasted for two years, after which it once again gave way to decline. Today, the slight increase in their number may point not to certain improvements in the situation in the science sector, but to the worsening conditions in the other sectors that triggered a temporary inflow of human resources there.

Simultaneously, there was a new upsurge in the outflow of scientific researchers from this country (especially young ones), with the increasing inclination in their community at large to either emigrate or to look for a job outside of the science sector. No accurate data are available as to the scale of this outflow, but according to expert estimations, it has been clearly on the rise. Even those who hold secure jobs at elite laboratories (for example, those set up in accordance with RF Government Decree No 220)<sup>1</sup> are now pondering about leaving the Russian science sector for good. Incidentally, the group of 'potential leavers' consists predominantly of highly motivated and productive young researchers.<sup>2</sup> More than half of them would like to stay at their laboratories 'if the situation does not get worse'.<sup>3</sup> This indicates the necessity, for efficient scientific research, of a good external environment and secure prospects for the existence of the relevant laboratories, and that it is not enough just to create good working conditions. Indeed, as estimated by the scientists themselves, no more than half of the laboratories created by way of implementing the provisions stipulated in Decree No 220 have become sustainable and viable entities.<sup>4</sup>

Some similar data concerning the intentions to 'migrate' have been obtained at the FASO's institutes. Young scientists note that their work has become more difficult as a result of dwindling opportunities for participation in international conferences and the funding cuts have halted the imports of reagents, as well as other financial constraints.<sup>5</sup> According to a survey conducted by the Siberian Branch of the RAS, about 40% of young scientists visualize no prospects for themselves in the Russian science sector.<sup>6</sup> The reasons for such outlooks, beside purely financial factors, are most probably the attitudes of the employees of academic institutes to the ongoing reform, whose goals and prospects are poorly understood by the scientific research community.

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<sup>1</sup> RF Government Decree No 220, April 10, 2010, On the Measures Designed to Attract Leading Scientists to Russian Educational Establishments for Higher Professional Learning, Scientific Institutions Subordinated to the Federal Agency for Scientific Organizations, State Research Centers of the Russian Federation in the Framework of Subprogram 'Institutional Development in the Scientific Research Sector of the State Program of the Russian Federation for the Development of Science and Technology in 2013–2020.

<sup>2</sup> S. Dushina, G. Nikolaenko, E. Evsikova. *Is it time to work in Russia? Young scientists under conditions of institutional changes*. *Sociology of Science and Technology* (in Russian), 2016, Vol. 7, No 3, p. 40.

<sup>3</sup> *Ibid.*, p. 44.

<sup>4</sup> Yu. Vishnevetskaya. *Brain-gaining: can Russian expat scientists be returned?* June 30, 2016. See <http://inosmi.ru/science/20160630/237032504.html>

<sup>5</sup> D. Terentiev. *Blood from the RAS*. May 11, 2016. See <http://argumenti.ru/toptheme/n529/438091>

<sup>6</sup> A. Aseev. *40% of young scientists in the Siberian Branch of the RAS see no research prospects in Russia*. March 1, 2016. See <http://www.ras.ru/news/shownews.aspx?id=98087056-e028-4c42-8c36-5c483eff0b3d#content>

It should be noted that the problems posed by an outflow of young people from the science sector are by no means typically Russian. Such problems exist in many countries, and they have become a sign of transformations taking place across the entire scientific knowledge production system. Elsewhere in the world, the departure of young people from the science sector has been caused by the complicated procedures of getting the necessary funding and the instability of its inflow, the heavy workload imposed on postdoctoral researchers, and the mounting pressure associated with the need to boost publications.<sup>1</sup> So, Russian science, in addition to its own troubles, is also partly involved in the global trend toward an organizational crisis in the sphere of science.

The outflow of human resources has already made evident the degradation of the intellectual environment. In some fields, the number of researcher groups performing at an international level has become insufficient, their interaction is receding, so one of the possible solutions could be promotion of international cooperation, including the cooperation with Russian expat scientists living abroad. In fact, the recipes for boosting international connections are well-known: science exchange; training abroad of postgraduate students and young Candidates of Sciences; allocation of funds to be used towards expenses for scholars who are to make presentations at international conferences; establishment of English language courses; an easing of visa requirements in order to simplify the visits of foreign scientists to Russia. All this has repeatedly been discussed, and is being done by some universities and research institutions. However, it is the incentives created by the government, and in some cases – government decisions, which is needed (especially with regard to the issuance of visas to foreign scientists).

Last year, Russia launched an internationalization approach based on attracting a massive inflow of Russian expat scholars was selected. The Agency for Strategic Initiatives (ASI) made public its plan of attracting to Russia a total of 15,000 scientists over 5 years,<sup>2</sup> while the Russian Venture Company (RVC) began to investigate the possibilities and methods for implementing that idea. Evidently it is expected that, by inviting scientists from abroad, the problem posed by the shortage of human resources in the science sector can promptly be solved.

As is typical of any argumentation concerning Russian expat scientists, there are rarely based on reliable calculations or any large-scale quantitative studies. This is also true of the figure 15,000. Meanwhile, as the Russian academic diaspora is becoming increasingly involved in Russian science (which is indeed happening due, among other thing, to the mega-grants program and Project 5-100), the number both of its supporters and opponents is increasing. However, on the whole, they all agree that it is necessary to promote international cooperation, and not only the above-mentioned cooperation between Russian-speaking scientists.

#### 6.5.7. The changing innovation landscape

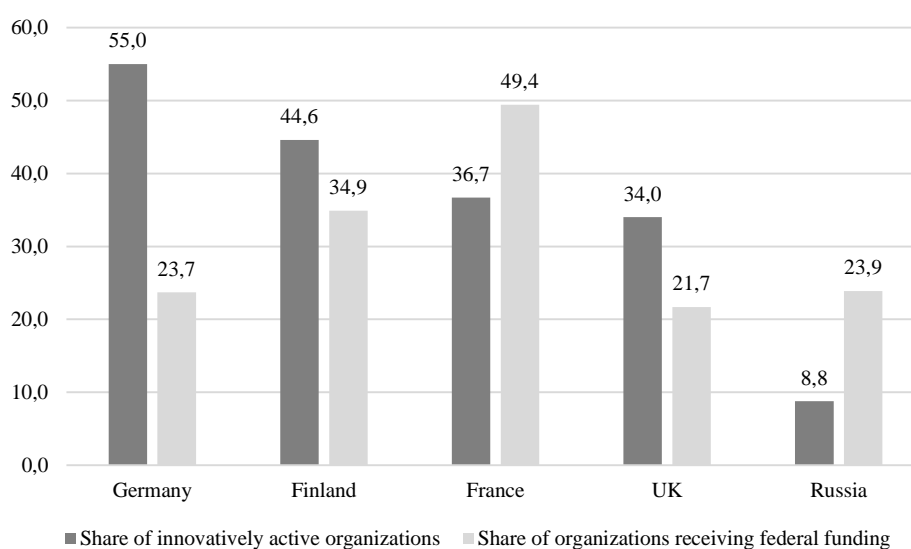
In 2016, the most proactive outlook with regard to technological innovations was demonstrated by the RF Ministry of Economic Development. It is at the Ministry's initiative that the program of creating innovative territorial clusters was launched and support was provided to export-oriented hi-tech companies (national champions). Besides, it is responsible

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<sup>1</sup> K. Powell. *Hard work, little reward: Nature readers reveal working hours and research challenges*. Nature, November 4, 2016. See [http://www.nature.com/news/hard-work-little-reward-nature-readers-reveal-working-hours-and-research-challenges-1.20933?WT.mc\\_id=FBK\\_NA\\_1611\\_FHNEWSHARDWORKLITTLEReward\\_PORTFOLIO](http://www.nature.com/news/hard-work-little-reward-nature-readers-reveal-working-hours-and-research-challenges-1.20933?WT.mc_id=FBK_NA_1611_FHNEWSHARDWORKLITTLEReward_PORTFOLIO)

<sup>2</sup> Yu. Vishnevetskaya. *Brain-gaining: can Russian expat scientists be returned?* June 30, 2016. See <http://inosmi.ru/science/20160630/237032504.html>; *Russia decides to get back 15,000 scientists from abroad*. See <http://www.silver.ru/news/130303/>

for implementing the programs of innovative development of companies with state participation. Last year saw many training courses, contests, workshops and conferences; their number had notably increased by comparison with the previous years, one of the contributing factors being the start of projects in the framework of the National Technology Initiative. In this connection, the state invests comparatively substantial resources in innovative development (Fig. 26). The share of innovatively active organizations in Russia is less than 9% vs. 30–50% in the developed industrial countries; at the same time, nearly 24% of Russian companies receive federal funding allocated to technological innovations. In foreign countries (with the exception of France) the situation is exactly opposite: the share of innovatively active organizations exceeds that of the companies that are allotted federal funding specifically for that purpose.



*Fig. 26. Organizations implementing technological innovations: Russia and the world (2014)*

*Source:* Science Indicators: 2016. Statistics Collection. M.: NRU HSE, 2016, p. 301, 306.

At the same time, the innovative activity indices of small and big businesses, as well as the scale of venture funding, have remained practically unchanged, or even became worse with regard to some of their parameters.

#### ***Small-sized innovative businesses and venture funding***

In the sector of venture businesses, last year was remarkable by the polarity of opinions and estimates of the current developments. Representatives of the development institutes cautiously voiced their positive attitudes, while entrepreneurs and business angels did not like the situation and often expressed their sharp criticism. Thus, for example, Managing Partner of Almaz Capital Partners Alexander Galitsky said that Russia had no venture industry at all,<sup>1</sup> and that instead of it an 'ecosystem of innovations' was being created in the form of seminars, conferences, contests, publications of analytical materials prepared by consulting agencies, and so on. Such results are more or less expectable, given that the development institutes are being

<sup>1</sup> Alexander Galitsky: *Quite simply, we have no venture industry*. 13 October 2016. See <http://realnoevremya.ru/articles/45299>

subjected to increasingly intricate regulation, and thus are forced to switch over to simpler activities. In fact, they only provide floors for the interaction between different entrepreneurs and businesses, including government representatives. The recipient companies also may use the brand name of the development institute that supports them as the proof that their activities have been objectively tested by experts. At the same time, the influence of development institutes on the innovation system as a whole has remained weak. The core of the innovative community has acquired stability: these are representatives of government departments and development institutes, several leading higher educational establishments, and some active private investors. All the innovation-themed forums are attended by basically the same group of major participants, and this has become a typical feature of the 'innovation management' sphere.

The conducted assessments and surveys confirm the fact that the environment is currently unfavorable for innovations, and so venture investors keep on to leaving Russia. According to the results of Venture Barometer 2016, a market research carried out by Russian venture fund *Prostor Capital*, the main factor that suppressed the development of venture capital in Russia were the political crisis and the economic sanctions introduced against Russia.<sup>1</sup> Russian venture investors continued to withdraw their money (preferring to invest in foreign startups), although of a lesser scale than in 2015. According to data released by Venture Barometer, 72% of the respondent business angels and managers of venture funds noted the existence of a trend towards investing in foreign assets. A year earlier the share of such respondents was 90%. The most attractive market is in the USA, where the yields are high and the risks are lower than in Russia. Besides, Western markets are more stable than the Russian ones. They are less dependent on prices of mineral resources and the factor of personal connections with bodies of state authority.<sup>2</sup>

At the same time, Russian investors have continued to operate in the framework of domestic projects because of their good quality/price ratio - the combination of low salaries of IT specialists and the high quality of their output.<sup>3</sup> Moreover, there exist some fields (machine learning technologies, artificial neural networks and artificial intelligence) where Russian IT specialists have few rivals. But even in these subsectors the number of viable startups is low.<sup>4</sup>

The estimates also varied with regard to availability of venture funding. Some participants in the venture market were convinced that there was no money (these are usually the owners of new projects in search of funding), while others argued that money was available, but that little of it was actually spent because private investors saw no deserving projects, and on the whole on the whole it was safer to invest in fields other than hi-tech. According to data released by the Russian Venture Company and the Russian Venture Investment Association, over the first three quarters of 2016 Russia's market for direct and venture investment amounted to 71% of

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<sup>1</sup> E. Krauzova. *Optimism against all odds: what sustains the confidence of venture investors in the Russian market*. Forbes, December 16, 2016. See <http://www.forbes.ru/investicii/finansy-i-investicii/335329-neunyvayushchiehto-podderzhivaet-veru-venchurnyh-investorov>

<sup>2</sup> K. Frumkin. *Russian oligarchs look for foreign startups*. April 18, 2016. See <http://fastsalttimes.com/sections/obzor/655.html>

<sup>3</sup> E. Krauzova. *Optimism against all odds: what sustains the confidence of venture investors in the Russian market*. Forbes, December 16, 2016. See <http://www.forbes.ru/investicii/finansy-i-investicii/335329-neunyvayushchiehto-podderzhivaet-veru-venchurnyh-investorov>

<sup>4</sup> S. Romanova, M. Podtserob. *There are few viable IT startups in Russia*. Vedomosti (in Russian), No 4206, November 18, 2016. See <http://www.vedomosti.ru/management/articles/2016/11/18/665933-rossii-zhiznesposobnih-it-startapov>

its volume in 2015, and 74% of deals were concluded by funds with state participation, so the activity of private investors was low. Generally, the idea of venture funding as a universal tool to be applied for supporting breakthrough technologies is giving way to an understanding that it is useful in sectors with a short business cycle, high growth potential, and low barriers to market entry. These are primarily e-commerce and IT.<sup>1</sup>

Higher educational establishments and research institutes may become an important source of new projects and companies. Here, the situation with regard to development of small-sized innovative businesses was less than favorable. This is confirmed by the results of monitoring of small-sized innovative businesses operating in the sphere of science and education.<sup>2</sup> The process of setting up small-sized companies hit its record high in 2011, after which it began to recede. One of the reasons was that the number of R&D products that could be relied upon in launching startups had been used up, another reason – the persisting legislative regulation issues: by Federal Law No 217,<sup>3</sup> the exclusive rights to R&D products were assigned to the state, and so private businesses had little interest in investing in such companies. So, in spite of the liberalization that has taken place since the enactment of that law (all the constraints on the participation of research organizations and educational establishments in the charter capital of economic societies, on the spending of dividends and the incomes generated by shares in capital by co-investors have been lifted), the downward trend in the number of newly founded small-sized innovative companies is rather stable.

#### *The support of medium-sized tech businesses*

Last year's most remarkable event in the innovation sphere was the launch of the RF Ministry of Economic Development's program of support for private hi-tech companies – leaders (national champions) for the period until 2020. Firstly, this was the first initiative that targeted exclusively those growing medium-sized businesses that had already demonstrated their sustainability and productive performance. Secondly, this was a well-substantiated program that was launched not 'from scratch', but as a result of a long-term (5 years) analytical investigation. The businesses participating in the program (the future national champions) were selected on the basis of TechSuccess data – the national ranking of innovative companies since 2012. As a matter of fact, TechSuccess is a tool for locating and monitoring the fast-growing medium-sized technology companies with a potential for leadership in Russia and abroad. The companies are ranked by the combination of their quantitative data (proceeds and their movement, exports, etc.) and expert estimations. Every year the requirements for these companies are revised and adjusted, and the estimation methodology is further perfected. Specifically, it is the expert estimations based on rankings that helped determine the needs and development constraints of the most promising companies and gave rise to the idea of a new tool. Essentially, this is individual support of private hi-tech export-oriented companies – leaders, with the purpose of enabling them to become transnational companies based in Russia. Three key criteria of successful completion of the project were determined, and all three have

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<sup>1</sup> Vladimir Kosteev: *Innovations emerge where there is a competitive environment*. November 15, 2016. See <http://sntr-rf.ru/expert/vladimir-kosteev-innovatsiya-poyavlyaetsya-tam-gde-est-konkurentnaya-sreda/>

<sup>2</sup> *Records and monitoring of small innovative businesses in the sphere of science and education*. RF Ministry of Education and Science. See <https://mip.extech.ru/index.php>

<sup>3</sup> Federal Law On Introducing Alterations to Some Legislative Acts of the Russian Federation with Regard to the Issues of Budget-funded Research Institutions and Educational Establishments Creating Economic Societies for Purposes of Practical Application (or Implementation) of the Results of Intellectual Activity, No 217-FZ dated August 2, 2009.

to do with the financial aspects (growth of hi-tech exports and sales).<sup>1</sup> Thus, a clearly defined goal was set, with a small number of measurable indices.

It should be noted that this tool is by no means an original Russian invention. Some countries are implementing similar programs (Denmark, The Netherlands, the UK, South Korea, Singapore, Malaysia, the Republic of South Africa and Kazakhstan). Their experiences have been studied in detail, and the Russian model has borrowed certain elements, including those applied in Kazakhstan, where such a program had been launched a year earlier.

In 2016, it was planned to carry out a two-phase selection procedure designed to determine 30 winner-companies (and this was accomplished), and then to start individual work with them. Individual work is understood as a variety of activities - organizational aid in getting access to the existing government support instruments (including programs initiated by the development institutes), project backing in the form of information and consulting, assistance in the exports of products and technologies (including through government trade representations). Thus, the case in point is not so much the allocation of additional budget resources, but administrative support and aid in removing the barriers. Importantly, in the course of the program's implementation some necessary alterations will be introduced in the normative legal acts regulating economic activities. Thus a feedback tool is implemented, whose purpose is to gradually change the 'ecosystem' of hi-tech business evolution.

#### ***The role of big state-owned companies in innovative development***

The government support of big state-owned companies continued mainly in the framework of Innovative Development Programs (IDP). These were revised in order to increase their orientation to the development of most promising technologies.

The role of big Russian companies in innovative development was considered by experts both in a negative context (the reliance on big companies had failed to promote innovative development) and from a directly opposite perspective. *The National Report on Innovations in Russia*, released by the RVC in October 2016, focused on the support of big companies.<sup>2</sup> The idea promoted by its authors is as follows: the share of big state-owned companies in the Russian economy is very high, and so the state can influence them, thus turning them into innovative businesses in a rather short time. The idea is further backed by data on a number of foreign initiatives, the slogan being *Our bet is on the way followed by Japan and Korea, and not the USA and Europe*. It is not clear why this bet is destined to win, given that the Asian way is very specific and relies on cultural values and mentality that are alien to Russia. The European way is more familiar for objective reasons. Besides, the experience gained in the course of implementing the IDP, in spite of the positive dynamics displayed by the available quantitative data, has so far failed to confirm the feasibility of such an approach.

#### ***Changes in the interaction with the development institutes***

In 2016, it was planned to reform the development institutes supporting technological innovations. At first, the government discussed certain radical acts that involved their closure or partial merger. Such plan could be explained by several reasons.

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<sup>1</sup> For more details on the selection criteria, see *From TechSuccess to national champions. National rating of Russian fast-growing technological companies TechSuccess-2016*. M.: The RF Ministry of Economic Development, RVC, PWC, NRU HSE, IDF. 2016. – p. 4-5 (in Russian).

<sup>2</sup> *The 2016 National Report on Innovations in Russia. Preliminary version*. M.: The RF Ministry of Economic Development, Open Government, RVC, 2016.



First: the development institutes began to duplicate their functions both in determining the content of the initiatives to be implemented and in providing multiple support to the same companies. This trend became intensified with the emergence of companies and projects set up as part of the National Technology Initiative. Many of them became the recipients of monies from several funds, and so it was assumed that it would be feasible to pool the sources. Besides, as the NTI was recognized to be one of the strategic innovation-boosting tools, the development institutes were required in any event to revise their policies in compliance with the new priorities.

Second: budget funding is on decline, including the allocations to innovative activity, and under such conditions, a closer coordination or even a merger would appear to be logical, as the financial resources will be pooled as a result.

Third: there was also criticism of the performance of the development institutes. While previously the main argument in their support was that it was too early to judge the results of their activity after so short a time, in 2016, when many of them could already boast of a decade-long history, that argument could no longer be taken seriously. However, in terms of their formal indices, the overall picture appeared rather bright. Over the last five years, five development institutes – RUSNANO, Skolkovo, RVC, the Fund for the Support of Small-sized Businesses in the Sphere of Science and Technology and VEB Innovation - received a total of RUB 405bn from the budget<sup>1</sup> and produced a nearly double return on the investment. But it remains unclear how this return has been calculated, and there are no evident major success stories. The absence of champion companies was admitted by RUSNANO's Chairman of the Executive Board Anatoly Chubais.<sup>2</sup> In this connection it should be added that the development institutes were subjected to frequent checks, their faulty decisions attracted far more attention than their successful projects, and so their operation was viewed with mistrust. So, a sort of vicious circle was created.

In early 2016, the schemes of a possible mergers were discussed very hotly. The representatives of the development institutes warned, that each of them has its own niche, and so a rashly attempted merger may produce the same results as the reform of the RAS, – the development institutes, if merged into big conglomerates, will not necessarily function better. The final decisions were softer and, most probably, more rational:

1. Skolkovo is to be transformed into an integration center for all the systemic development institutes, RVC and the Fund for the Support of Small-sized Businesses in the Sphere of Science and Technology will set up their offices there, and the events launched by the project office of the National Technology Initiative will also take place on that site.
2. Skolkovo will become an extraterritorial entity – its regime will be extended to the other territorial formations, including the innovation clusters<sup>3</sup>.
3. The Skolkovo Foundation and RVC will set up three new venture funds, where RVC will invest capital, and the Skolkovo Foundation will become the asset manager. This scheme will make it possible to save resources: prior to the merger, approximately 30% of RVC's portfolio consisted of Skolkovo residents. Besides, the expert systems will be pooled. The

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<sup>1</sup> I. Dashkovsky. *What will happen to Russian innovative projects*. Kommersant (in Russian), December 8, 2016. See <http://kommersant.ru/doc/2902134>

<sup>2</sup> O. Salmanov, P. Kantyshv. *Our goal is to build industrial plants and raise national champions*. Vedomosti (in Russian), May 25, 2016. See <http://www.vedomosti.ru/technology/characters/2016/05/25/642322-nasha-zadacha-zavodi-stroit-i-rastit-natsionalnih-chempionov>

<sup>3</sup> A. Kaledina. *RVC will move to Skolkovo*. Izvestia (in Russian), June 30, 2016; see <http://izvestia.ru/news/620115>

Skolkovo Foundation has established an expert system oriented to the themes of 5 clusters – the Foundation's specialization fields. When these are reoriented to the NTI projects, the field for expert estimations will be expanded due to the addition of RVC's potential. It is also expected that priority support will be granted to the companies operating in the fields of IT, transport and hi-tech medicine - that is, the fields covered by the NTI roadmaps. It is planned that no less than 30% of resources for the new funds will be provided by private investors, while the Skolkovo Foundation will be responsible for attracting such investments.<sup>1</sup> The ultimate configuration of the funds will be determined in 2017.

So, the clustering of the development institutes around the Skolkovo Foundation has been started - both in physical terms (the moving of offices) and in terms of organization (the creation of joint investment funds and the implementation of relevant measures needed for developing the NTI projects). The performance of the Skolkovo Foundation itself at the Board of Trustees meeting in mid-December was estimated positively: the Foundation had managed to attract off-budget resources in almost the same amount as budget funding (RUB 92bn vs. RUB 100bn), and 1,600 companies had become its residents.<sup>2</sup>

RUSNANO remained uninvolved in that process; the constant criticism and claims on the part of the Accounts Chamber notwithstanding, it will not be reformed. The government plans that RUSNANO will become a global venture investor in the field of nanotechnologies, and that the profits thus generated will be invested in biotechnology projects.<sup>3</sup> This field is being actively developed in many countries of the world, while in Russia it is underfunded. Due to the budget constraints, several sectoral programs were terminated, and so RUSNANO is expected to cover the financial gaps.

### *Regional initiatives: clusters and innovative development territories*

The innovation clusters created by federal authorities continued to be developed, they are regularly monitored, and so their internal interaction problems are promptly identified and dealt with

So far, the funding to the specialized organizations responsible for cluster development has been allocated in the main from the federal and regional budgets. It amounts to 64.4% vs. the world indices of 18% (state budget) and 23% (regional budget)<sup>4</sup>. Their most remarkable feature, however, is not the modest role of the state budget (this is typical of Russia's entire innovative sphere), but the absence among the funding sources available for Russian cluster organizations of commercial services (elsewhere in the world the share of that funding source is 8%). A noticeable growth of income generated by commercial services usually becomes visible when three years have elapsed since the creation of a cluster, as is already the case in Russia.<sup>5</sup>

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<sup>1</sup> *Three new venture funds of RVC and Skolkovo will fund STD projects in 2017*. TASS, September 12, 2016, see <http://tass.ru/ekonomika/3615651>; T. Edovina. *RVC and Skolkovo have signed a marriage contract*. Kommersant (in Russian), October 3, 2016, see <http://kommersant.ru/doc/3106470>; *Skolkovo will become an asset manager jointly with RVC's investment fund*. Lenta.ru, October 26, 2016, see [https://lenta.ru/news/2016/10/26/skolko\\_skolko/](https://lenta.ru/news/2016/10/26/skolko_skolko/)

<sup>2</sup> *The development of Skolkovo was discussed at the meeting of its Board of Trustees with the participation of Dmitry Medvedev*. December 14, 2016. See [https://www.ltv.ru/news/2016/12/14/316092-razvitie\\_skolkovo\\_obsuzhdali\\_na\\_zasedanii\\_popechitelskogo\\_soveta\\_s\\_uchastiem\\_dmitriya\\_medvedeva](https://www.ltv.ru/news/2016/12/14/316092-razvitie_skolkovo_obsuzhdali_na_zasedanii_popechitelskogo_soveta_s_uchastiem_dmitriya_medvedeva)

<sup>3</sup> A. Kaledina. *RVC will move to Skolkovo*. Izvestia (in Russian), June 30, 2016. See <http://izvestia.ru/news/620115>

<sup>4</sup> E. Kutsenko. *Russia's pilot territorial innovation clusters: a sustainable development model*. Foresight, 2015, V. 9, No 1, p. 39-40.

<sup>5</sup> The list of pilot innovation clusters was approved by the RF Government in August 2012.

One positive development is that the clusters are trying to find their own 'smart specialization'; however, this not an easy task because it is necessary not only to identify the areas of research (and industries) that are the most promising ones for a given region, but also to understand which technologies are going to ensure their development. The survey conducted by NRU HSE's Russian Cluster Observatory has revealed that approximately 40% of the regions have their own strategies elaborated with a view towards 'smart specialization'. However, they are for most part purely declarative, they lack roadmaps or proper monitoring and adjustment system, and the level of entrepreneurial initiative there is generally low.<sup>1</sup> The clusters, being dependent on state budget funding, continue to be oriented mainly to the nationwide technology priorities, which are drafted in a rather generalized manner.

Our own case studies of several clusters conducted in 2016<sup>2</sup> reveals that the process of cluster development is slow due to the inertia of the existing system of relationships and values; however, at the same time each cluster yields some unforeseen positive effects. These have to do with new approaches to education, including retraining of secondary school teachers, cooperation between big and small-sized businesses, implementation of multidisciplinary science projects. One cannot but agree with the frequently voiced opinion that what really takes place in Russia is the substitution of notions, and the clusters simply represent yet another form of getting budget funding to cover the cost of urgent projects being implemented at the municipal level, and by no means always related to innovative development. Perhaps in some places they are indeed innovative, but the study of several clusters that differ by the background of their participants and the degree of their maturity points to the fact that the local entities understand the importance of expanding and strengthening the horizontal connections for the development of their territories.

Last year, the selective approach was chosen by the RF Ministry of Economic Development, and so its innovation cluster support program was modified accordingly. The program's logic began to resemble the program of support of national champions. The successfully developing clusters will be granted individual support in a 'manual mode' in order to improve the quality of their governance systems.<sup>3</sup> The Ministry selected 11 clusters on the basis of a contest, and its main activities there will be launched next year.<sup>4</sup>

By contrast with the clusters, the special innovative development territories could not boast of a dynamic progress. The innovative territorial center INO Tomsk (its idea having been elaborated since 2010,<sup>5</sup> and the concept approved by a RF Government Decree in January 2015), was developing its plan of implementing a total of 65 measures. By late 2016, their number had increased to 79,<sup>6</sup> including the creation of interdepartmental R&D centers, the

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<sup>1</sup> E. Kutsenko. Presentation at the conference held by the IMEMO of the RAS. *The concept of smart specialization in regional and innovative policies*. December 9, 2016. See [http://www.imemo.ru/index.php?page\\_id=502&id=2782&p=&ret=498](http://www.imemo.ru/index.php?page_id=502&id=2782&p=&ret=498)

<sup>2</sup> I. Dezhina. The development of interaction networks: the role of Russian cluster initiatives. *Innovations*, 2016, No 9, p. 28-32.

<sup>3</sup> *The RF Ministry of Economic Development will start developing clusters*. May 16, 2016. See <http://rt.rbc.ru/tatarstan/freenews/5739ab379a794741d23f0a83?from=newsfeed>

<sup>4</sup> *The participants in the priority innovation cluster development project of the RF Ministry of Economic Development have been selected*. October 19, 2016. See <http://cluster.hse.ru/news/2255/>

<sup>5</sup> A. Popov, E. Veselova, S. Charnyshov. *Comfortable innovations*. *Expert.ru Siberia* (in Russian), No 42-44, 2010. See <http://expert.ru/siberia/2010/42/inovacii/>

<sup>6</sup> Directive of the RF Ministry of Economic Development, of July 29, 2016, No 1621-r *On implementing the concept of creating in Tomsk Oblast an innovative territorial center*. See <http://government.ru/docs/24067/>

development of the city of Seversk, and broader participation in the NTI projects of scientific research organizations, higher educational establishments and companies operating in Tomsk. Some of these measures have already been realized. Thus, for example, in December, at Tomsk State University of Control Systems and Radioelectronics (TUSUR), a NTI project office was set up. However, while in 2015 the INO Tomsk task force held 6 meetings, in 2016 it met only once.<sup>1</sup>

Another major project – the Technological Valley of Moscow State University (MSU) – from mid-year onwards found itself in a situation of confrontation between the government and MSU's CEOs. In March, the draft law 'On the Technological Valley of Moscow State University' was published, and the University's administration was surprised to learn that the project would be directed not by MSU, but by a specially created state-owned asset manager which, in addition to construction proper, would also be responsible for selecting the priority projects to be implemented in the field of science and technology. In many of its aspects, the draft law reproduces the regulation scheme applied in the creation of the Skolkovo innovative center. However, the Skolkovo project was launched at a new location without a university. In this connection, the official explanation of the exclusion of MSU from the text of the draft law was that it was a model law designed to determine the conditions for the creation of a technological valley around any higher educational establishment, and not only MSU.<sup>2</sup>

MSU's academic community responded with an official protest, whereby it demanded the cancelation of the draft law as running contrary to the interests of Moscow State University and the proclaimed goal of developing the sphere of education and science. However, what is feared most is the possibility of 'transfer to the asset manager's ownership of 'the lands and buildings that are consolidated forever in federal ownership and held by Moscow State University by right of continuous (termless) use and by right of operative management.'<sup>3</sup>

Then MSU elaborated an alternative draft law whereby the University was to retain all its lands and acquire the ownership right to the new properties to be erected there. The asset manager was to be an affiliation of MSU, and a development foundation (a financial institute owned by MSU) was to be set up. The government has already expressed its disagreement based on the fear that MSU, with its huge and cumbersome organizational structure, will be unable to efficiently negotiate, attract investors and gather resources.<sup>4</sup> Thus, science and technology issues have become a secondary matter, and the conflict centered around the issue of property ownership and management. By the year's end the draft law had not been properly finalized, and it was suggested that the Technological Valley of Moscow State University should be launched without the adoption of a special law.<sup>5</sup> It has not been decided yet which entity will function as the asset manager, and so it is still difficult to undertake any practical steps in that direction.

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<sup>1</sup> [https://ino-tomsk.ru/ru/rabochaya\\_gruppa/zasedaniya](https://ino-tomsk.ru/ru/rabochaya_gruppa/zasedaniya)

<sup>2</sup> D. Sarkisov. *A valley on the palm of the hand. What will happen to the Technological Valley of MSU*. Lenta.ru, March 18, 2016. See <https://lenta.ru/articles/2016/03/18/dolina/>

<sup>3</sup> See [http://tomsinov.com/russia\\_contemp/zakluchenie\\_tech\\_dolina.pdf](http://tomsinov.com/russia_contemp/zakluchenie_tech_dolina.pdf)

<sup>4</sup> F. Rustamova, Ya. Miliukova. *A dispute over the valley*. RBC, No 125, July 14, 2016. See <http://www.rbc.ru/newspaper/2016/07/15/578648bd9a7947905d06c40d>

<sup>5</sup> *The Technological Valley of MSU may be created without a special law*. October 26, 2016. See <https://rns.online/economy/Tehnologicheskaya-dolina-MGU-mozhet-bit-zapuschena-bez-spetsialnogo-zakona--2016-10-26/>

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Russia's 'science landscape' was made up of separately functioning sectors, each of which was dealing independently with its own problems. The RF Government decided to rely on the NTI as an integration platform and formulated the Grand Challenges. However, these could only be met with consolidated actions.

Science still lack competition both internally (there is no competition for the posts of scientific researchers, the inflow of foreign scientists is meager, the rotation and mobility of human resources is low) and externally, on a world scale. The main challenge for Russian science is the ever-continuing reform process. Besides, a typical feature of the year 2016 was the scientific research community's increasing distrust of the government's initiatives, and for good reason. The goals proclaimed by the latter often run contrary to its later acts.

Over the next 5 years, the resources earmarked for breakthrough technologies in the innovative sphere will, most likely, be allocated to the NTI, and under the existing budget this may indeed bear fruit. The main developments will occur with regard to improving innovations and creating products capable of entering market in the framework of international cooperation.

One serious drawback is that the share of funding allocated to innovation from the state budget is disproportionally high by comparison with private investment. The business environment remains complicated, and businesses are viewed with mistrust, which is counterproductive for innovative development. The fact that the government has begun to pay attention to fast-growing medium-sized companies may trigger changes for the better in the business environment, thus creating conditions for promoting not only the future national champions, but technology development at large.