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## TRENDS AND OUTLOOKS
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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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## 6.4. Science-industry cooperation in Russia: current status, problems, effects of government support[1]

In the modern world, close interaction and productive cooperation between business companies, scientific research centers and universities plays a very important role in ensuring sustainable economic development. According to the evolutionary theory, innovation is produced by the interaction of various components of a national innovative system responsible for the distribution and practical application of new knowledge that can be put to economic use.[2]

Today, the cooperation and mutually beneficial collaboration of science and businesses represent factors that strongly determine the competitive capacity of each of the parties involved in the process. By collaborating with scientific research centers and universities, business companies strive to get access to new scientific research data, to stay tuned to the latest achievements in the field of science and technology, and to optimize the structure of their own expenditures on R&D.[3] In the final analysis, through their cooperation with science, businesses get opportunities for implementing projects that otherwise would have been too costly or too risky.[4] It is not by chance that the developed industrial countries, for at least two decades already, have been demonstrating an increasingly strong trend towards boosting the role of universities and scientific research centers as sources of commercial technologies for businesses.[5] For their part, the organizations operating in the scientific research sector like to cooperate with businesses not only (and not primarily) because they expect to attract additional resources, but also because they can thus get opportunities for implementing and developing their scientific potential and rely on that cooperation as a source of new ideas for their future research.[6] In the process of cooperation, the participants can learn a lot from their partners, while contributing their competence, advantages and opportunities in their own specific fields.

[1] This section is authored by M. Kuzyk (IAC, RANEPA); Yu. Simachev (NRU HSE; RANEPA); N. Zudin (CSR).
[2] Metcalfe, J. S. (1994) Evolutionary economics and public policy. Economic Journal, 104(425), pp. 931–944; Edquist, C. (1997) System of Innovation Approaches – Their Emergence and Characteristics. In: C. Edquist (Ed.). System of Innovation. Technologies, Institutions and Organizations. L.: Pinter/Cassell, pp. 1–35.
[3] Lee, Y. (2000) The sustainability of university-industry research collaboration: an empirical assessment. Journal of Technology Transfer 25(2): 111–133; Caloghirou, Y., Tsakanikas, A., Vonortas, N.S. (2001) University–industry cooperation in the context of the European framework programmes. Journal of Technology Transfer 26 (1-2): 153–161; Bodas Freitas, I. M., Verspagen, B. (2009) The Motivations, Organization and Outcomes of University-Industry Interaction in the Netherlands. UNU-MERIT Working Papers. No 2009-011.
[4] Caloghirou, Y., Kastelli, I., Tsakanikas, A. (2004) Internal capabilities and external knowledge sources: complements or substitutes for innovative performance? Technovation 24(1): 29–39.
[5] Henderson, R., Jaffe, A., Trajtenberg, M. (1998) Universities as a source of commercial technology: A detailed analysis of university patenting. Review of Economic and Statistics 80(1): 119–127. Caloghirou, Y., Kastelli, I., Tsakanikas, A. (2004) Internal capabilities and external knowledge sources: complements or substitutes for innovative performance? Technovation 24(1): 29–39.
[6] Meyer-Krahmer, F., Schmoch, U. (1998) Science-based Technologies University-Industry Interactions in Four Fields. Scientific research Policy, 27 (8), pp. 835–852; Lee, Y. (2000) The sustainability of university-industry scientific research collaboration: an empirical assessment. Journal of Technology Transfer 25(2): 111–133; D'Este, P., Perkmann M. (2011) Why do academics engage with industry? The entrepreneurial university and individual motivations. The Journal of Technology Transfer, 36(3), pp. 316–339.

At the same time, when speaking of the development of interaction between business companies and scientific research organizations, it is necessary to bear in mind the existence of profound differences in their values, priorities and motives that inevitably give rise to barriers that may preclude effective collaboration; to lower those barriers is critically important for the successful functioning of an innovation system.[1] That is why the government policies in the sphere of science, technology and innovation represent a factor of paramount importance, one of its key goals being the promotion of interaction, connections and partnerships between the participants of innovative processes, in view of the existing systemic failure.[2] In accordance with the Triple Helix model (science-industry-government) that has been gaining in popularity in recent years, the latter is responsible, first of all, for the creation of favorable conditions for and promotion of intensive interaction between science and industry.[3] In other words, the important function assigned to the government in the Triple Helix model is to coordinate the scientific research development vectors and their use by industry.[4]

### 6.4.1. The scale of interaction between Russian business companies, scientific research organizations and higher educational establishments in the innovation sphere

On the basis of available official statistics it is impossible to estimate the percentage of Russian companies operating in industry that cooperate with scientific research organizations and higher educational establishments in the framework of their innovative activity. Meanwhile, the Data Books published annually by NRU HSE have made it possible to estimate the relative share of such companies. Thus, in 2014, approximately half (49%) of all innovatively active companies operating in processing industry outsourced their research and development (R&D) activities pertaining to innovative technologies; at the same time, 15% of these companies implemented their R&D projects in partnership with scientific research organizations, and 9% – in partnership with higher educational establishments (*Fig. 10*). In this connection, we should note the upward trend displayed by the growth rate of the relative share, in Russia, of innovative companies that outsource their innovative activities, and of those that collaborate with higher educational establishments in the framework of their R&D projects.

[1] Siegel, D., Waldman, D., Link, A. (1999) Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study. NBER Working Papers 7256, National Bureau of Economic Scientific research , Inc.; Kodcharat, Ya., Chaikeaw, A. (2012) University and Industrial Sector Collaboration: the Key Factors Affecting Knowledge Transfer. International Journal of Business and Social Science 3(23): 130–137; Yu. Simachev, M. Kuzyk, V. Feygina. R&D cooperation between Russian firms and research organizations: is there a need for state asistance? *Voprosy ekonomiki* (in Russian), No 7, pp. 4–34.

[2] Gok, A., Edler J. (2011) The Use of Behavioural Additionality in Innovation Policy-Making. MBS/MIoIR Working Paper, No 627, The University of Manchester.

[3] Etzkowitz, H., Leydesdorff, L. (2000). The Dynamic of Innovations: from National System and "Mode 2" to a Triple Helix of University-Industry-Government Relations. Scientific research Policy, 29, pp. 109-129; Tether B. S., Tajar A. (2008) Beyond industry-university links: Sourcing knowledge innovation from consultants, private scientific research organisations and the public science-base. Scientific research Policy, 37 (6/7), pp. 1079-10954; Yu. Simachev, M. Kuzyk, V. Feygina. R&D cooperation between Russian firms and research organizations: is there a need for state asistance? *Voprosy ekonomiki* (in Russian), No 7, pp. 4–34.

[4] I. Dezhina, V. Kiseleva. 'Triple Helix' in Russia's innovation system, *Voprosy ekonomiki* (in Russian), No 12.

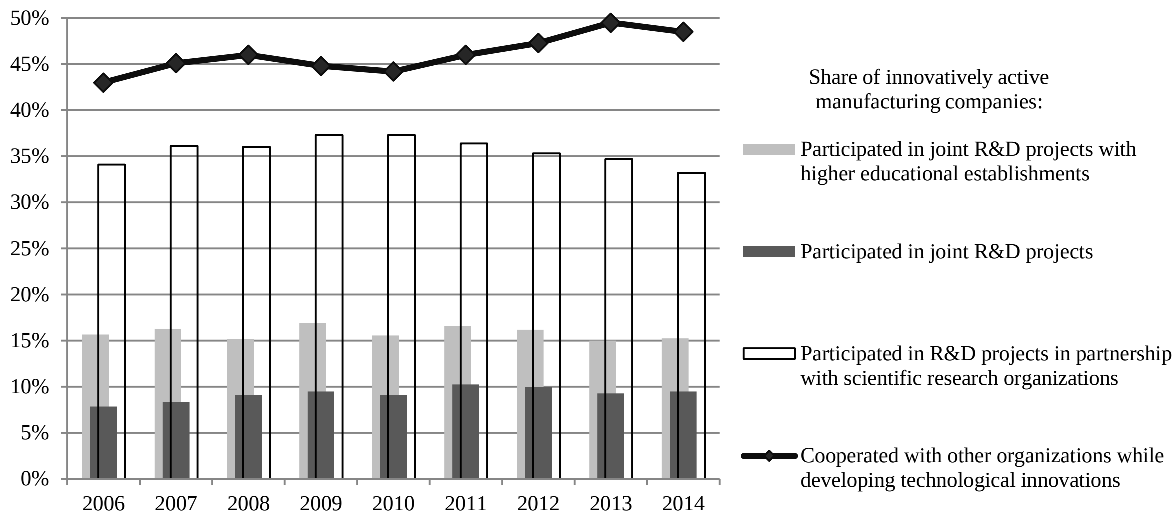


*Fig. 10.* The cooperation of Russian industrial companies in the framework of their innovative activity

*Source:* own calculations based on NRU HSE's data.

As demonstrated by the results of a selective survey of more than 650 Russian industrial enterprises conducted by the Interdepartmental Analytical Center (IAC) in H2 2012,[1] 33% of innovatively active companies interacted with scientific research organizations and/or higher educational establishments in the framework of their innovation projects. And finally, according to data released by the OECD, over the period 2009–2011, 23% of Russia's big innovatively active companies cooperated with scientific research organizations and/or universities in the innovation sphere[2].

The OECD's comparable statistics for more than thirty countries point to the relatively low scale of cooperation between science and industry in Russia (*Fig. 11*): by its relative share of big innovatively active companies interacting with scientific research organizations and higher educational establishments, this country lags behind not only the developed industrial countries, but also some of the countries that have only recently joined that group (Korea, the Republic of South Africa (RSA), Brazil), and many of the states of the former socialist camp (Hungary, the Czech Republic, Slovakia, Poland, Slovenia).

[1] The survey was organized and conducted in August-September 2012 by the Interdepartmental Analytical Center, the Centre for Business Tendencies Studies of the NRU HSE Institute for Statistical Studies and Economics of Knowledge, and the Information and Publishing Center *Statistics of Russia*. This survey of Russian enterprises and organizations and the other surveys mentioned in this Section were conducted in the form of specialized questionnaires (devised by the Interdepartmental Analytical Center) offered to their CEOs. The final sample consisted of 652 enterprises, of which 608 operated in processing industries.

[2] OECD (2013) OECD Science, Technology and Industry Scoreboard 2013. OECD Publishing.

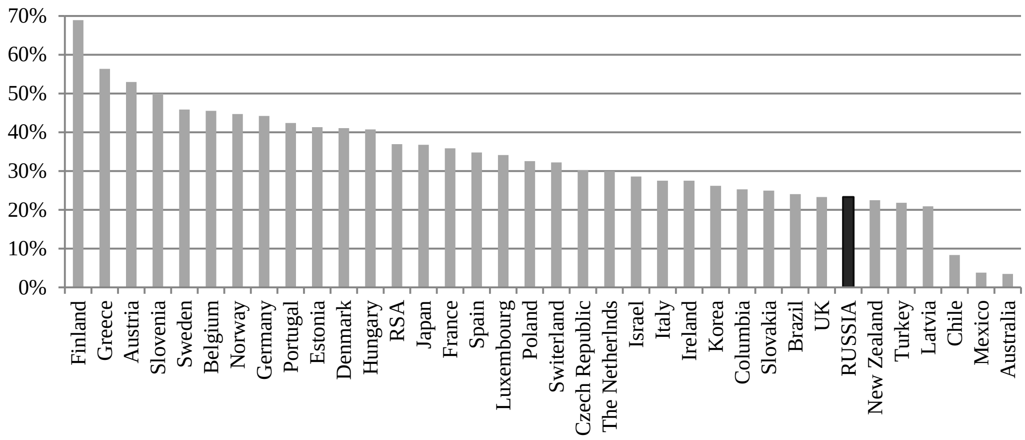


*Fig. 11.* The relative share of companies interacting with scientific research organizations and higher educational establishments in the innovation sphere, in 2010–2012 (or the nearest period for which comparable data are available), in the total number of big innovatively active companies

*Source*: OECD.

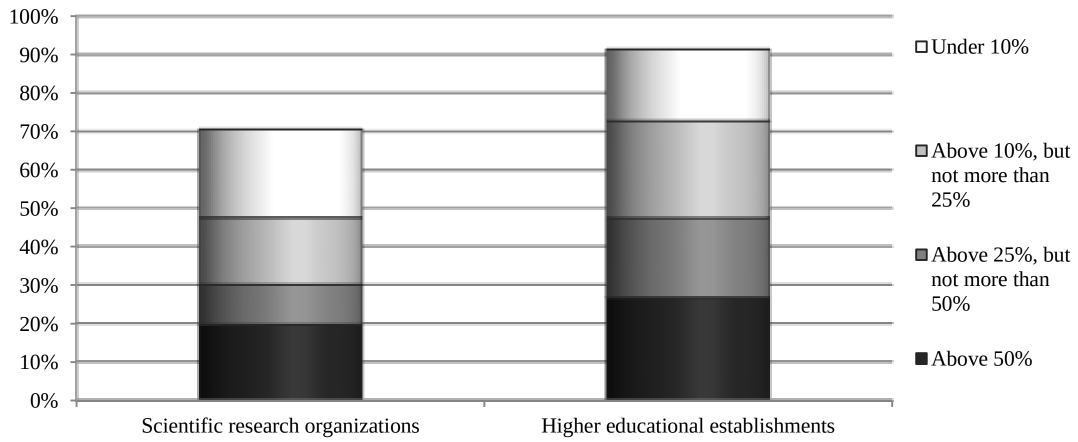


*Fig. 12.* The relative share of R&D ordered by industry in the total volume of R&D completed by Russian scientific research organizations and higher educational establishments in 2015

*Source*: IAC.

As for the organizations operating in the R&D sector, available statistical data cannot give even a very approximate idea of the relative share of those of then that actually cooperate with industrial enterprises while elaborating and implementing their innovations. According to data yielded by specialized surveys[1] for 2015, R&D projects in industry were participated in by 70%

[1] The survey of CEOs of Russian scientific research organizations was conducted in September-October 2015 by the Interdepartmental Analytical Center in collaboration with the Information and Publishing Center *Statistics of Russia*; the final sample was represented by 191 scientific research organizations, of which 111 were academic institutes, and the other 80 were sectoral science organizations.

scientific research organizations and 91% of higher educational establishments. Meanwhile, the results of a similar survey of organizations in the R&D sector [1] conducted in 2012 demonstrated that the scale of cooperation between industry and scientific research organizations was roughly the same as in 2015 (67%), while the corresponding index for higher educational establishments was significantly lower (62%).

Nevertheless, although the formal indices of the involvement of scientific research organizations, and especially higher educational establishments, in cooperation with industry in the field of scientific research are impressive, the actual scale of such interaction in terms of total volume of R&D projects is rather modest. Thus, approximately only one of each five scientific research organizations and one of each four higher educational establishments could boast of no less than half of their R&D budget being funded by orders placed by businesses (*Fig. 12*).

### 6.4.2. The productivity of interaction of Russian industrial enterprises with scientific research organizations and higher educational establishments in the innovation sphere

The key motive that businesses are guided by when interacting with the sphere of science, as noted earlier, is their desire to gain access to the results of state-of-the-art R&D products that can be used as a foundation for their technological innovations. That is why an important sign of success in the science-industry cooperation is the actual use, by businesses in the framework of their innovative activity, of the R&D products offered by scientific research organizations and higher educational establishments. In Russia, as confirmed, among other sources, by official statistics and survey data, scientific research organizations – and especially higher educational establishments – very seldom provide incentives and direct sources of innovation for businesses, in this respect significantly falling behind the other contractors employed by enterprises along their value added chains, their consumers and suppliers, and their rival companies (both foreign and Russian ones), as well as business companies and some publicly available information sources (*Fig. 13* and *14*).

It should be noted that the analytical studies of the comparative significance of various industrial innovation sources in foreign countries have likewise shown that in terms of quantitative indices, the contribution of R&D products of scientific research organizations and higher educational establishments to the innovative activity of business companies is much less than that of their consumers, suppliers, rival companies, as well as from information some internal and external sources. Such findings were obtained, e.g., in the study by *Laursen, Salter*[2] based on data for more than 2,500 industrial companies in the UK; in the study by *Amara*,

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The survey of CEOs of Russian higher educational establishments was conducted by the Interdepartmental Analytical Center in September-October 2015; the surveyed sample consisted of 151 higher educational establishments.

[1] The survey of Russian scientific research organizations and higher educational establishments based on a formalized questionnaire distributed among their CEOs was conducted in August-September 2012 by the Interdepartmental Analytical Center, the Centre for Business Tendencies Studies of the NRU HSE Institute for Statistical Studies and Economics of Knowledge, and the Information and Publishing Center *Statistics of Russia*. The surveyed sample consisted of 361 organizations (251 scientific research organizations and 110 higher educational establishments).

[2] Laursen, K., Salter, M. (2004) Searching high and low: what types of firms use universities as a source of innovation? Scientific research  Policy, 33(8), pp. 1201–1215.

*Landry*[1], which reviewed the data yielded by surveys of 5,500 industrial companies in Canada; and in the recent study by *Gómez, Salazar, Vargas*[2] based on panel data for approximately 1,000 industrial enterprises in Spain.

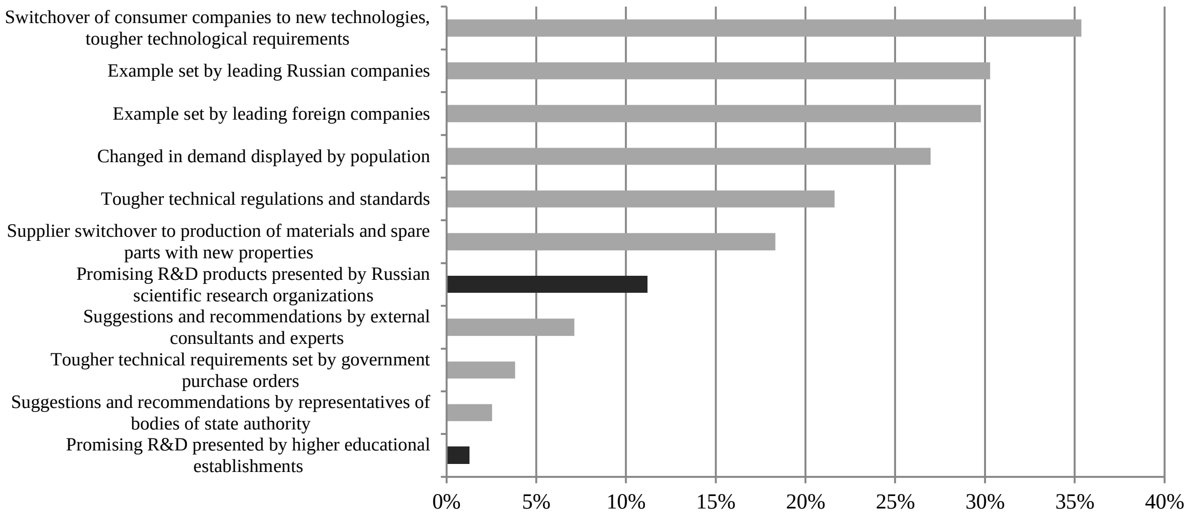


*Fig. 13.* The main incentives of Russian industrial companies for technological innovations in 2012 (frequency of mention by the CEOs of surveyed innovatively active companies)

*Source*: IAC.

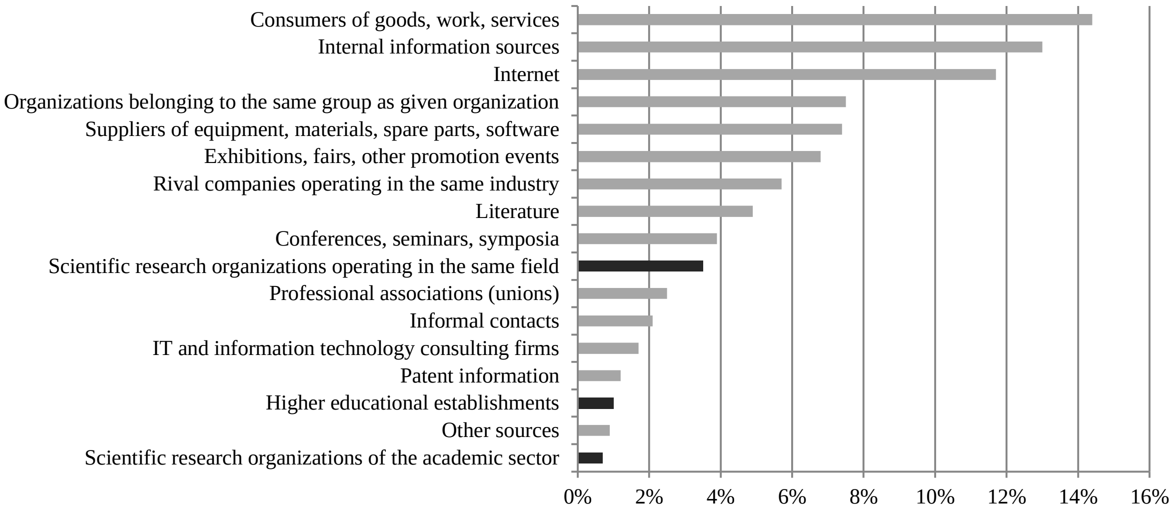


*Fig. 14.* The main sources of information on technological innovations for companies in 2014 (relative share in the total number of companies operating in industry and in the sector of production and supply of electric energy, gas and water)

*Source:* NRU HSE.

[1] Amara, N., Landry, R. (2005) Sources of Information as Determinants of Novelty of Innovation in Manufacturing Firms: Evidence from the 1999 Statistics Canada Innovation Survey. Technovation 25, pp. 245–259.
[2] Gómez , J., Salazar, I., Vargas, P. (2016) Sources of Information as Determinants of Product and Process Innovation. PLoS One, 11(4).

At the same time, many studies point to the high importance of interaction between business companies, universities and scientific research centers in the framework of their innovative activity, especially when its outcome is successful. Thus, according to the results obtained by *Cohen, Levinthal*[1] on the basis of a survey of more than 1,700 business entities representing more than 300 industrial enterprises in the USA, universities and scientific research centers are more important sources of knowledge for companies' innovative activity than the suppliers of materials and equipment. In the study by *Romijn, Albu*[2] based on a UK survey of small businesses in the electronics and software sector, it was found that the organizations operating in the R&D sector are an important source employed in the launch and development of innovative hi-tech startups; at the same time, the activity of such organizations does not give rise to many partnerships, resulting instead in the creation of a few successfully competing companies. The study by *Amara, Landry*[3] (mentioned earlier) revealed that the specific feature of the innovations based on source like universities and scientific research organizations is their higher degree of novelty. In the study by *Ukrainski, Varblane*[4] based on a comparative analysis of the main sources of information concerning the innovative activity of companies operating in the timber, timber processing, and pulp-and-paper industry in Estonia and Finland, it was found that for Estonian companies, universities and scientific research centers were the least important source of innovations, whereas for Finnish companies the information generated in the scientific research sector had much higher significance, on a par with the information received from suppliers and rival companies. And finally, in the study by *Tether, Tajar*[5] based on the results of a survey of CEOs of more than 8,000 companies across the UK, it was concluded that the R&D sector as a source of scientific knowledge and innovations for businesses could not replace other external and internal information sources, and served instead as a supplementary source.

In view of the already mentioned rather modest scale on which Russian businesses have been using the R&D products of scientific research organizations and higher educational establishments as sources for their own innovations, it appears reasonable to assess the contribution of science-industry cooperation to the results achieved by business companies. As shown by the findings in the course of the already discussed survey of CEOs of industrial enterprises (*Table 14*), those of them that collaborate with the organizations operating in the R&D sector demonstrate on the whole a higher yield of their innovative activity. Thus, in particular, these companies much more frequently demonstrate improved material efficiency and energy efficiency, as well as cleaner production. Besides, those industrial enterprises that cooperated with higher educational establishments in the innovation sphere more often

[1] Cohen, W., Levinthal, D. A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation. Administrative Science Quarterly, 35(1), pp. 128–152.
[2] Romijn, H. A., Albu, M. (2001) Explaining innovativeness in small high-technology firms in the United Kingdom. Eindhoven Centre for Innovation Studies, ECIS working paper series, vol. 200101. URL: https://pure.tue.nl/ws/files/1746464/545742.pdf
[3] Amara, N., Landry, R. (2005) Sources of Information as Determinants of Novelty of Innovation in Manufacturing Firms: Evidence from the 1999 Statistics Canada Innovation Survey. Technovation 25, pp. 245–259.
[4] Ukrainski, K., Varblane, U. (2005) Sources of Innovation In The Estonian Forest And Wood Cluster. University of Tartu – Faculty of Economics and Business Administration Working Paper Series 36. URL: http://www.mtk.ut.ee/sites/default/files/mtk/RePEc/mtk/febpdf/febawb36.pdf
[5] Tether B. S., Tajar A. (2008) Beyond industry-university links: Sourcing knowledge for innovation from consultants, private scientific research organizations and the public science-base. Scientific research Policy, 37 (6/7), pp. 1079–1095.

demonstrated higher labor productivity, and those that interacted with scientific research organizations demonstrated a higher innovation input in their improved competitive capacity. And finally, both the interaction with organizations operating in the science sector and the cooperation with higher educational establishments positively correlate with the degree of novelty of their products, a finding that is close to the results observed in the previously cited study by *Amara*, *Landry*[1].

For a more accurate and methodologically better-verified assessment of the input of science-industry cooperation in the activity of companies and its comparison with the inputs of other external sources of innovations, we relied on the propensity score matching (*PSM*) procedure. Thus method makes it possible to set each of the companies that have interacted with organizations operating in the science sector against another, highly matching innovative company that has practiced none of such interaction[2]. The control group is matched by a set of control indices like the length of a company's stay in the market, industry,[3] scope of activity (measured by payroll number), form of ownership, and financial status. The effect of cooperation was assessed for each of the performance indices presented in *Table 14* as an average between the indices achieved by the companies that did interact with organizations operating in the science sector, and the companies in the control group.

*Table 14*

**The results of companies' innovative activity depending on their interaction with scientific research organizations and/or higher educational establishments, as of 2012 (frequency of mention by CEOs of innovatively active companies in each category)**

| | | Interaction in innovation sphere | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | with scientific research organizations and/or higher educational establishments | | | with scientific research organizations | | | with higher educational establishments | | |
| | | yes, % | no, % | *chi-square* | yes, % | no, % | *chi-square* | yes, % | no, % | *chi-square* |
| 1 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Improved performance indices due to innovations | proceeds of sales of products | 46.2 | 41.4 | *0.787* | 44.8 | 42.2 | *0.242* | 50.0 | 42.3 | *0.792* |
| | output of new (or upgraded) products | 48.5 | 43.3 | *0.920* | 49.6 | 42.9 | *1.541* | 52.8 | 44.3 | *0.959* |
| | volume of exports | 13.1 | 8.0 | *2.583* | 12.8 | 8.2 | *2.057* | 13.9 | 9.2 | *0.808* |
| | production profitability | 29.2 | 25.5 | *0.627* | 29.6 | 25.4 | *0.778* | 36.1 | 25.8 | *1.786* |
| | labor productivity | 36.2 | 31.6 | *0.830* | 36.0 | 31.7 | *0.707* | 47.2 | 31.7 | *3.581** |
| | material efficiency | 18.5 | 10.6 | *4.628*** | 18.4 | 10.8 | *4.265*** | 22.2 | 12.3 | *2.790** |
| | energy efficiency | 21.5 | 12.9 | *4.855*** | 22.4 | 12.7 | *6.053*** | 33.3 | 14.0 | *0.194**** |
| | clean production | 17.7 | 9.5 | *5.438*** | 18.4 | 9.3 | *6.543*** | 16.7 | 11.8 | *0.733* |
| | none of indices is improved | 1.5 | 6.8 | *5.070*** | 1.6 | 6.7 | *4.620*** | 0.0 | 5.6 | *2.125* |

[1] Amara, N., Landry, R. (2005) Sources of Information as Determinants of Novelty of Innovation in Manufacturing Firms: Evidence from the 1999 Statistics Canada Innovation Survey. Technovation 25, pp. 245–259.
[2] It should be noted that the PSM method is most often applied for revealing the effects, on companies, of various incentives created by the government (see, i.e., Fier et al., 2006; Baghana, 2010; Marzucchi, Montresor, 2013; Cantner, Kösters, 2015; Simachev et al., 2017). The procedure is described in detail in (Newey, 2009).
[3] For the purpose of ensuring the correctness of estimates, the industries were aggregated by their technological development level.

*Cont'd*

| 1 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Innovation input in companies' competitive capacity | none or negligible | 18.9 | 28.9 | *4.472* | 18.0 | 29.1 | *5.409** | 16.7 | 26.5 | *2.598* |
| | moderate | 65.4 | 57.0 | | 66.4 | 56.7 | | 72.2 | 58.5 | |
| | strong – innovations almost entirely account for competitive capacity | 15.7 | 14.1 | | 15.6 | 14.2 | | 11.1 | 15.0 | |
| degree of novelty of innovative (new and upgraded) products | no innovative products | 17.1 | 27.0 | *30.647**** | 17.7 | 26.5 | *29.260**** | 19.4 | 24.2 | *11.225*** |
| | product is new for enterprise | 44.2 | 57.8 | | 43.5 | 57.8 | | 44.4 | 54.2 | |
| | product is new for Russia | 34.1 | 14.8 | | 33.9 | 15.3 | | 27.8 | 20.5 | |
| | product is new on global scale | 4.7 | 0.4 | | 4.8 | 0.4 | | 8.3 | 1.1 | |

Chi-squared test, significant difference:
* at 10%;
** at 5%;
*** at 1%.
*Source:* IAC; own calculations.

The PSM procedure was applied to four types of partnerships in the innovation sphere[1]:

– interaction with scientific research organizations (over the three years prior to the survey, 32% of innovatively active companies had demonstrated the relevant experience);
– interaction with higher educational establishments (demonstrated by 9% of innovative companies);
– implementation of joint innovative projects with partner enterprises along the value added chain (19% of innovative companies);
– implementation of joint innovative projects with companies with similar or related specialization (i.e., with real or potential rivals – 9% of innovative companies demonstrated this experience).

The results of our calculations have confirmed the existence of a significant input of the interaction of business companies with scientific research organizations in achieving higher resource efficiency and cleaner production, and the input of cooperation with higher educational establishments in productivity growth and energy intensity reduction (*Fig. 15*). Besides, partnering with higher educational establishments in the innovation sphere had a positive effect on the overall growth of proceeds, correlated negatively with the output of new and upgraded products.

Judging by the results of our comparison of the effects of different types of innovation-oriented partnerships on companies' performance, there are no grounds for believing that the interaction of business companies with scientific research organizations and higher educational establishments has produced any notable benefits. Rather, the opposite is true: by the majority of performance indices, both subtypes of science-industry cooperation fall behind either their interaction with partner enterprises along the value added chain, or their partnership with companies of similar specialization, or both. The only obvious exception is that the cooperation with higher educational establishments is significantly more frequently than the other types of partnership matches labor productivity growth.

[1] It should be specifically emphasized that these are forms of partnership, and not sources of information on innovations.

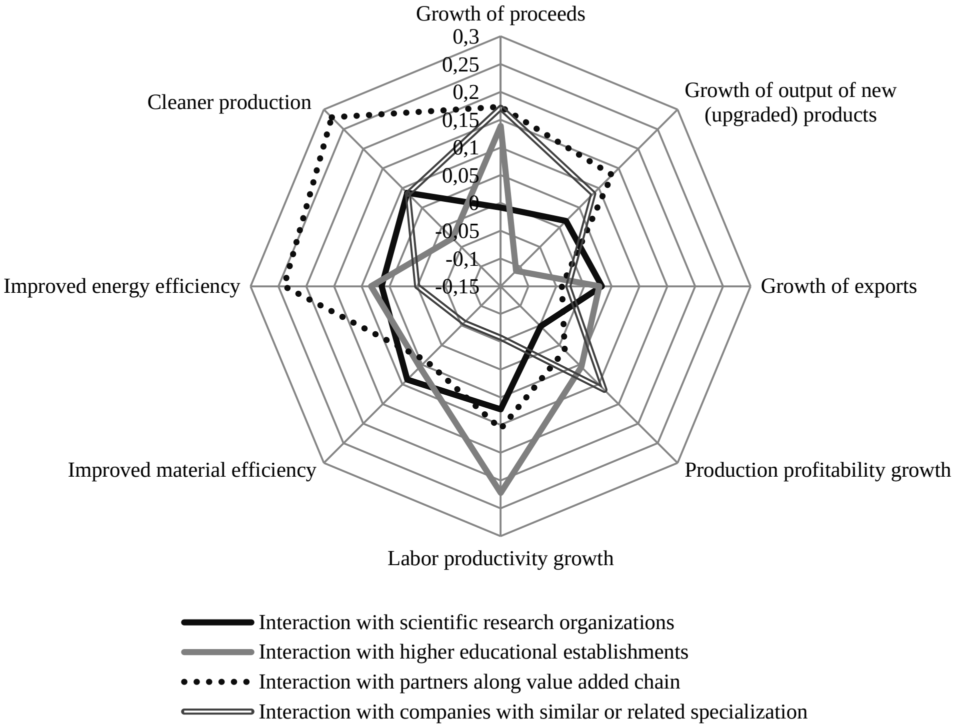


*Fig. 15.* The estimated effects of different areas of cooperation on the results of companies' innovative activity, as of 2012

**Note.** The potential significance of the estimated effect of cooperation on each index varies from (-1) to 1, where 1 corresponds to the case when an improved index was demonstrated by all of the companies participating in cooperation of a given type, and it was never improved for any of the companies that had not participated in that type of cooperation; (-1) corresponds to the opposite case, when positive effect was absent for all of the companies with an experience of cooperation of a certain type, and was observed in all the companies that lacked that experience; 0 corresponds to equal frequency of positive effects demonstrated by companies both with and without the experience of a given type of cooperation.
*Source:* IAC, own calculations.

A similar picture is yielded by an assessment of the aggregate input of innovations in the competitive capacity of companies interacting with different categories of partners (*Fig. 16*): a significant input is less typical of the companies that interacted with scientific research organizations and higher educational establishments, and is more typical of the companies that implemented joint projects with their partners along the value added chains and rival companies.

Thus, in Russia, similarly to many foreign countries, scientific research organizations and higher educational establishments are relatively seldom relied upon as sources of innovations for industry. However, for Russian companies, by contrast with their counterparts in a number of developed industrial countries, their interaction with organizations operating in the R&D sector is on the whole less important, and produces less notable results than their cooperation with partners along the value added chain and rival companies.

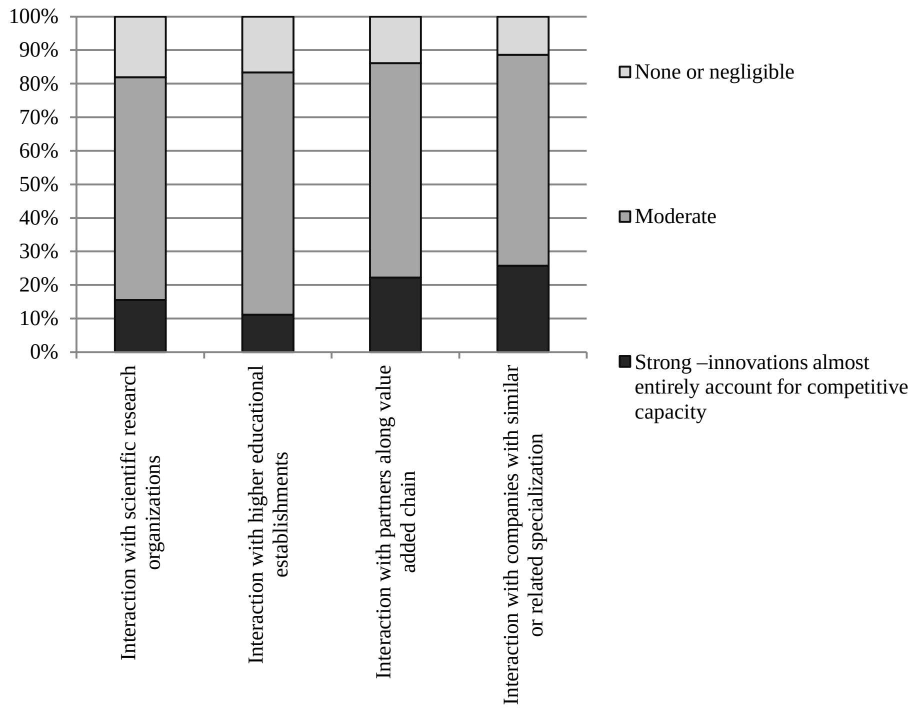


*Fig. 16.* The input of innovations in the competitive capacity of companies, relative to the type of innovative partnership, as of 2012 (frequency of mention by CEOs of companies in each category)

*Source*: IAC.

### 6.4.3. Problems and obstacles to the development of science-industry cooperation in Russia

When discussing the fundamental issues of interaction between the organizations operating in the R&D sector and industrial companies, researchers most often point out the significant differences in their goals, approaches, organizational culture, behaviors, etc. - that is, factors that are traditionally explained by the fundamental differences in the motives and mentalities of scientists and businessmen.[1] The upshot is that, even in the presence of strong mutual incentives to collaborate, serious problems may arise during the phase of adjusting the R&D products of universities and scientific research organizations to the standards that companies need to comply with in order to successfully implement these products, which in its turn sometimes results in dissolution of a potentially mutually beneficial partnership.[2] Among the

[1] Siegel, D., Waldman, D., Link, A. (1999) Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study. NBER Working Papers 7256, National Bureau of Economic Scientific research , Inc.; Bodas Freitas, I. M., Verspagen, B. (2009) The Motivations, Organization and Outcomes of University-Industry Interaction in the Netherlands. UNU-MERIT Working Papers. No 2009-011; Kodcharat, Ya., Chaikeaw, A. (2012) University and Industrial Sector Collaboration: the Key Factors Affecting Knowledge Transfer. International Journal of Business and Social Science 3(23): 130–137; Yu. Simachev, M. Kuzyk, V. Feygina. R&D cooperation between Russian firms and research organizations: is there a need for state asistance? *Voprosy ekonomiki* (in Russian), No 7, pp. 4–34.

[2] Bodas Freitas, I. M., Verspagen, B. (2009) The Motivations, Organization and Outcomes of University-Industry Interaction in the Netherlands. UNU-MERIT Working Papers. No 2009-011.

significant obstacles to productive interaction between the science sector and businesses, unfavorable market conditions, inefficient management, and lack of proper knowledge, by one party, of the real needs and opportunities of the other party, are often noted.[1] The latter is especially significant in Russia, as demonstrated by the results of some empirical studies.[2]

Official statistics does not reflect the most urgent issues of science-industry cooperation, and so, in order to identify those issues, we are going to rely on the results of a survey of representatives of the cooperating parties – industrial companies, scientific research organizations, and higher educational establishments, conducted in autumn 2015.[3] All respondents were offered a list of 10 issues, of which they were asked to tick off the most important ones. In this connection, the CEOs of industrial enterprises were required to note separately the cooperation issues relative to each of the three subsectors of the Russian science sector: academic institutes; sectoral science organizations; and higher educational establishments.

As demonstrated by the survey's results, representatives of businesses were most concerned about the high costs and inadequate quality of the work and services provided by the Russian scientific research sector (*Fig. 17*). Besides, these data once again underlined the urgency of the issues of insufficient information transparency in Russian science, or at least as it was viewed by businesses.

As for the problems typical of the interaction with representatives of some specific subsectors in the science sector (as described by the surveyed CEOs), these were found to have similar profiles. It must only be pointed out that the high cost of supplied products was mentioned rather seldom with regard to higher educational establishments, while they more frequently than the other types of organizations experienced difficulties with providing the entire set of necessary services; the interaction with scientific research institutions in the academic sector is more frequently characterized by lack of proper customization of their products compared with the other subsectors; and the cooperation with sectoral science organizations is slightly less dependent on government support (compared with the other areas of cooperation).

[1] Ghani, N. (1991) European collaborative scientific research projects. Engineering Management Journal, 1, (2), pp. 63-70; Schibany, A., Jörg, L., Polt, W. (1999) Towards Realistic Expectations. The Science System as a Contributor to Industrial Innovation. Seibersdorf: Österreichisches Institut für Wirtschaftsforschung; Bodas Freitas, I. M., Verspagen, B. (2009). The Motivations, Organization and Outcomes of University-Industry Interaction in the Netherlands. UNU-MERIT Working Papers. No 2009-011.

[2] Zasimova L., Kuznetsov B., Kuzyk M., Simachev Yu., Chulok A. (2008) The issues of industry's transition to innovative development: microeconomic analysis of the specificity of behavior of companies, the movement and structure of demand for technological innovations. Series Scientific Reports: Independent Economic Analysis, No 201. M.: Moscow Public Science Foundation; Yu. Simachev, M. Kuzyk, V. Feygina. R&D cooperation between Russian firms and research organizations: is there a need for state assistance? *Voprosy ekonomiki* (in Russian), No 7, pp. 4–34.

[3] The survey of CEOs of enterprises and organizations based on a formalized questionnaire was conducted in September-October 2015. The survey of CEOs of higher educational establishments was organized and conducted by the Interdepartmental Analytical Center, the surveyed sample consisted of 151 organizations. The surveys of CEOs of industrial enterprises and scientific research organizations were conducted by the Interdepartmental Analytical Center in collaboration with the Information and Publishing Center *Statistics of Russia*; the surveyed sample consisted of 658 enterprises operating in processing industries and 191 scientific research organizations.

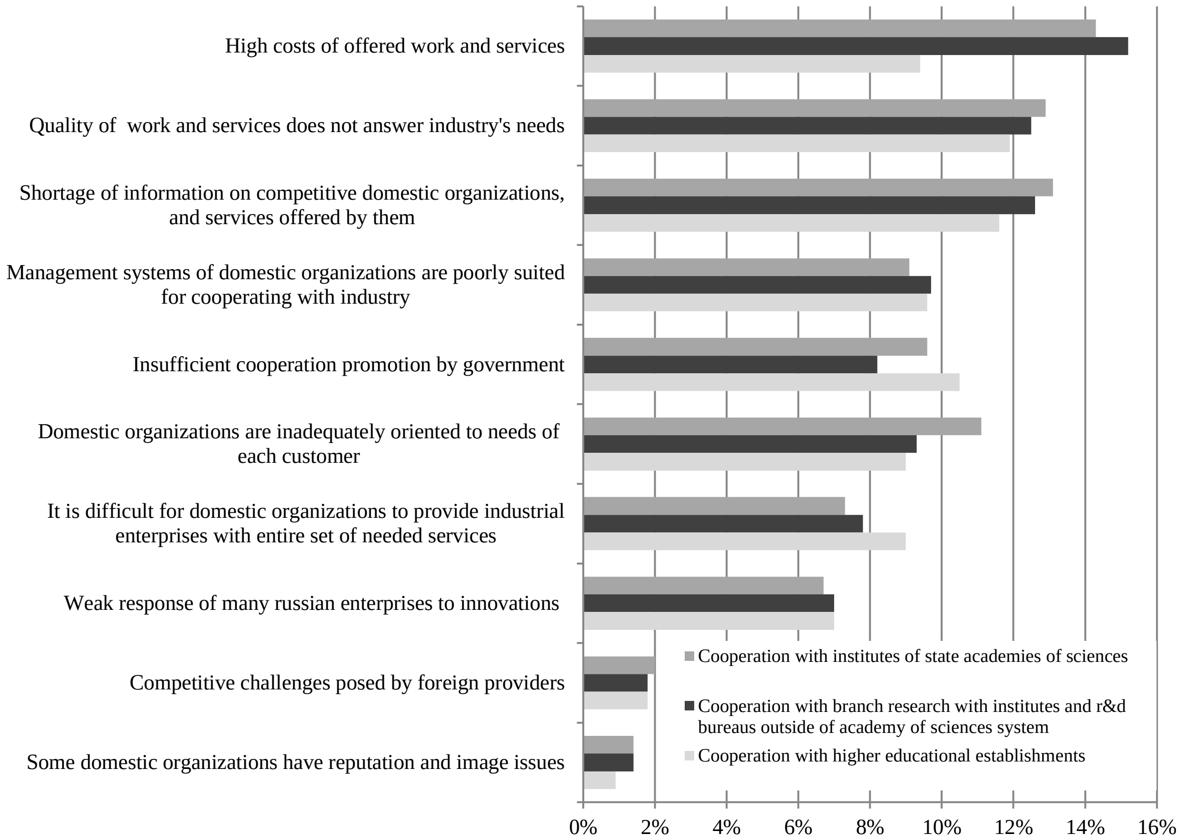


*Fig. 17.* The issues of and obstacles to the interaction of industrial companies with organizations operating in various subsectors of the science sector, as of 2015 (frequency of mention by CEOs of companies)

*Source*: IAC.

From the point of view of organizations operating in the R&D sector, the key issues in their interaction with businesses are the weak response of the latter to innovations and the inadequacy of government promotion of science-industry cooperation (*Fig. 18*). At the same time, the problems identified as the most serious ones by the CEOs of industrial companies (high costs and inadequate quality of the work and services offered by the domestic science sector) were among the least frequently mentioned factors by representatives of the science sector. Another important distinction is that on the whole, the estimates offered by businesses are much more optimistic: thus, almost half of the CEOs of industrial enterprises (48%) said that they had experienced no problems associated with science-industry cooperation, while this opinion was shared by only 9% of surveyed representatives of scientific research organizations, and by 5% of representatives of higher educational establishments.

By contrast with the CEOs of business companies who saw no significant differences between the scientific research institutions in the academic sector, sectoral science organizations, and higher educational establishments from the point of view of interaction issues, the representatives of each of the latter significantly differed in their estimates of the problems of and obstacles to science-industry cooperation. Thus, the institutes and R&D bureaus in the category of sectoral science organizations, compared with the other types of organizations, were the least frequent to point out the weak responsiveness of Russian companies to innovations; at the same time, they more frequently than the other respondents pointed to the acute competitive challenges posed by foreign organizations and the high costs of domestic supply. Higher educational establishments stand out because they experienced the strongest need for government support of their cooperation with businesses; besides, representatives of higher educational establishments were more attentive to the problem posed by lack of information on the products offered by the R&D sector.

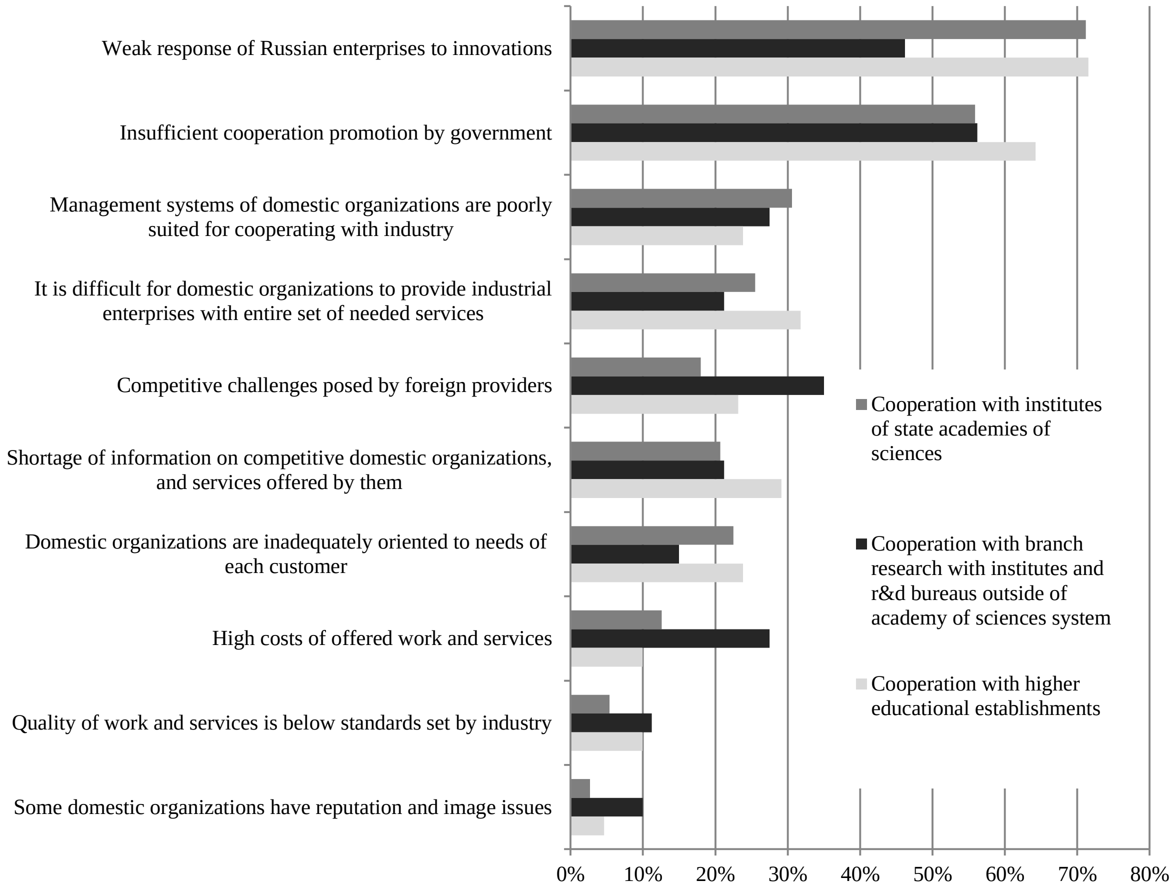


*Fig. 18.* The problems of and obstacles to the interaction of organizations in the academic sector, branch sciences and higher educational establishments with businesses, as of 2015 (frequency of mention by CEOs of organizations)

*Source*: IAC.

By way of summing up our discussion of issues typical of science-industry cooperation, we will briefly outline the specific types of work and services needed by businesses, and explain how the existing needs are satisfied by domestic scientific research organizations and higher educational establishments (*Fig. 19*).

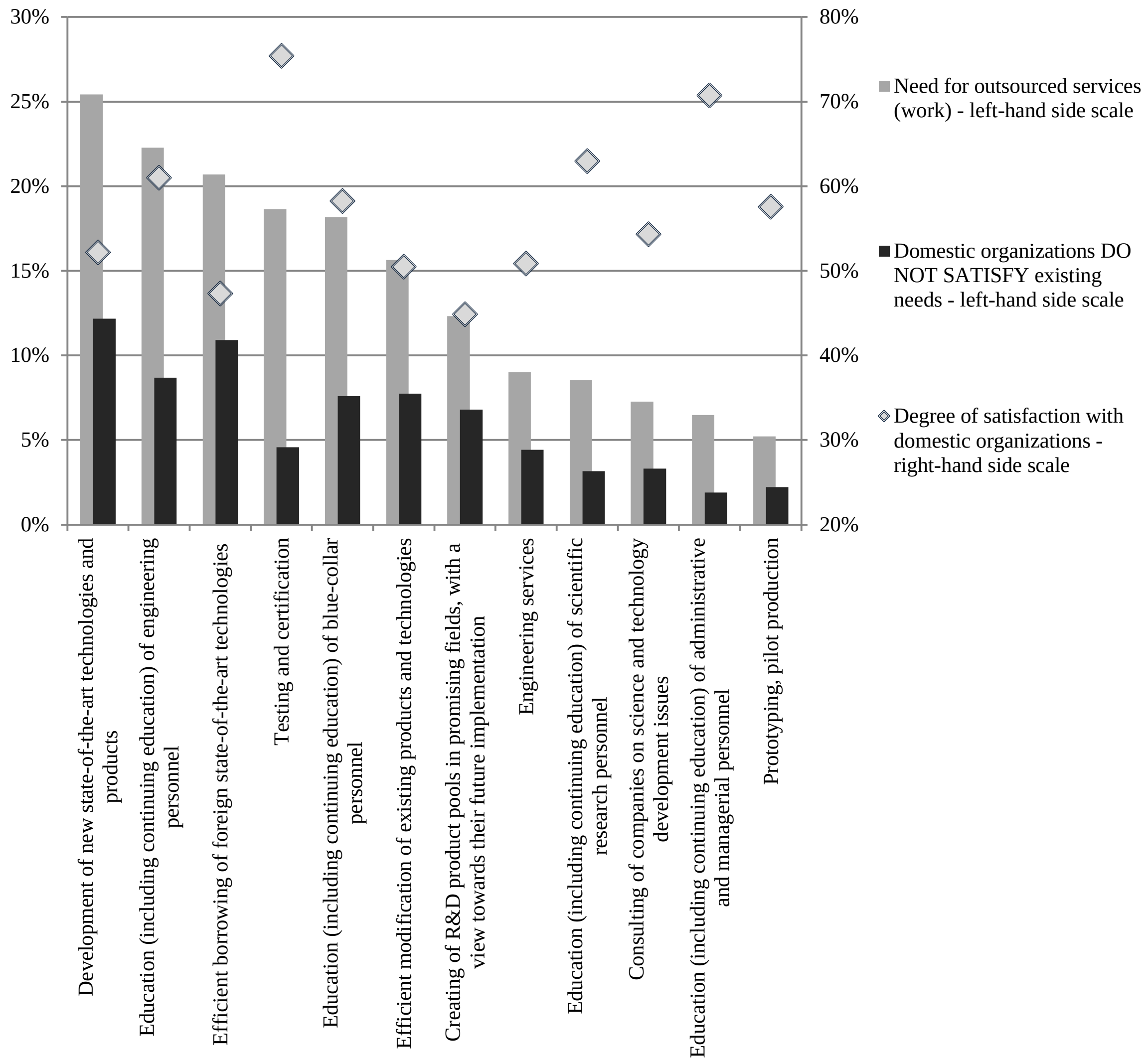


*Fig. 19.* The specific needs of Russian industrial companies in outsourced work and services, and how these are satisfied by domestic organizations, as of 2015

*Source:* IAC, own calculations.

Industrial enterprises most frequently display demand for projects involving the elaboration of new products and technologies, productive borrowing of foreign state-of-the-art technologies, and education and continuing education of engineering personnel. It is noteworthy that approximately only half of the total demand for the first two types of services can be satisfied by Russian organizations. The other areas where the existing demand is much higher than the domestic supply, are the creation of R&D product pools needed by businesses, modification of existing products and technologies, and engineering services. The areas where the needs of Russian business companies are most fully satisfied are product testing and certification, and education and continuing education of administrative and managerial personnel.

### 6.4.4. Government promotion of science-industry cooperation and its results

Traditionally, the lack of proper cooperation and coordination of the entities involved in innovative activity is considered to be one of the key systemic failures.[1] It is specifically for this reason that the government must exercise the important function of promoting cooperation and partnership, and ensuring the movement of knowledge flows between science and businesses, even if this function does not fully correspond to the perfect market principles.[2] It should be added that while at present it is universally recognized that government support of cooperation between the science sector and businesses is indeed feasible, some doubts are still being expressed as to the actual positive effects of the practical steps undertaken by the government in that sphere.[3] However, in an overwhelming majority of empirical studies that analyzed the effects on the development of cooperation of the various instruments and measures applied in the framework of government policy, it was found that government support indeed produced some positive (albeit sometimes very weak) influence on the interaction between science and businesses.[4] At the same time, the new science-industry links and partnerships created thanks to government support are by no means always sustainable; often it happens so that once the support is discontinued, the interaction also ceases[5].

In Russia, in view of the very modest scale of science-industry cooperation and the serious problems observed in that sphere, the government has, over recent years, invested some

[1] Smith, K. (2000) Innovation as a Systemic Phenomenon: Rethinking the Role of Policy. Enterprise and Innovation Management Studies, 1 (1), pp. 73–102; Gok, A., Edler J. (2011) The Use of Behavioural Additionality in Innovation Policy-Making. MBS/MIoIR Working Paper, No 627, The University of Manchester.

[2] Smith, K. (2000) Innovation as a Systemic Phenomenon: Rethinking the Role of Policy. Enterprise and Innovation Management Studies, 1 (1), pp. 73–102; Yu. Simachev, M. Kuzyk, V. Feygina. R&D cooperation between Russian firms and research organizations: is there a need for state assistance? *Voprosy ekonomiki* (in Russian), No 7, pp. 4–34.

[3] Caloffi, A., Mariani, M., Rossi, F., Russo, M. (2016) R&D collaboration policies: are they really able to promote networking? Open Evaluation 2016, Vienna, 24-25 November 2016.

[4] Georghiou, L., Malik, K.,Cameron H. (2005) DTI Exploratory study on behaviouraladditionality. PREST, Manchester Business School and University of Manchester; Pegler, B. (2005) Behavioural Additionality in Australian Business R&D Grant Programs: A Pilot Study. Department of Industry, Tourism and Resources; Falk, R. (2007) Measuring the effects of public support schemes on Firms innovation activities. Scientific research Policy, 36(5), pp. 665–679; Hægeland, T., Møen, J. (2007) Input additionality in the Norwegian R&D tax credit scheme. Statistics Norway Reports, 2007/47. URL: http://www.ssb.no/a/publikasjoner/pdf/rapp_200747/rapp_200747.pdf; Busom, I., Fernandez Ribas, A. (2008) The impact of firm participation in R&D programmes on R&D partnerships. Scientific research Policy, 37(2), pp. 240–257; Idea Consult. (2009) Does Europe change R&D-behaviour? Assessing the behavioural additionality of the Sixth Framework Programme. Final Report. Prepared for: European Commission Scientific research Directorate-General Directorate A – Inter institutional and legal matters – Framework Programme. URL: https://ec.europa.eu/scientific research /evaluations/pdf/archive/fp6-evidence-base/evaluation_studies_and_reports/evaluation_studies_and_reports_2009/assessing_the_behavioural_additionality_of_the_sixth_framework_programme.pdf; Marzucchi, A., Montresor, S. (2013) The Multi-Dimensional Additionality of Innovation Policies: A Multi-Level Application to Italy and Spain. SPRU Working Paper Series, 2013-04;, Wanzenbock I., Scherngell, T., Fischer, M. (2013). How do firm characteristics affect behavioural additionalities of public R&D subsidies? Technovation, 33 (2-3), pp. 66–77; Lohmann, F. 2014. The Additionality Effects of Government Subsidies on R&D and Innovation Activities in the Aviation Industry. A Project Level Analysis. Master´s Thesis. URL: http://essay.utwente.nl/64836/1/Lohmann_MA_MB.pdf

[5] Fier, A., Aschhoff, B., Löhlein, H. (2006) Detecting Behavioural Additionality: An Empirical Study on the Impact of Public R&D Funding on Firms' Cooperative Behaviour in Germany. ZEW Discussion Papers, No 06-037. URL: https://www.econstor.eu/bitstream/10419/24229/1/dp06037.pdf

significant effort in its promotion. Elsewhere, we have already presented a detailed overview of the government's acts and measures,[1] and so here we are offering only a brief description of the main instruments applied for that purpose.

*Special procedure for exempting from profits tax certain types of R&D costs.*[2] This instrument, introduced in 2009, envisages that the costs charged by an organization to scientific research and development in compliance with the established list[3] (in coordination with the Priority directions for the development of science, technologies and technical equipment in the Russian Federation and the List of critical technologies of the Russian Federation) should be estimated, when calculating the amount of taxable profits, with a multiplier of 1.5. This tax exemption is directly linked to the goal of promoting science-industry cooperation, as it is applied to the R&D projects being implemented by the taxpayer organization both with and without outsourcing certain work to external providers. Over recent years, the annual cap on R&D costs to be exempt from tax has been RUB 6–9bn, or 12–18% of the total amount of R&D costs.

Subsidies designed to cover part of R&D costs incurred by companies implementing innovative projects ordered by Russian higher educational establishments and state scientific research institutions. This instrument of financial support, better known by the number of the RF Government's decree whereby it was introduced (218),[4] is oriented to promoting the development of partnerships of companies with higher educational establishments and state scientific research institutions in the framework of industrial projects. Its key specific feature is that, although the final recipient of a government subsidy is the higher educational establishment or the state scientific research institution responsible for the implementation of a given R&D project, the main link in the government support chain (at least formally) is the company actually implementing the project: it acts as the entity that receives government funding, pays for and approves the results of R&D, and implements these results in the production process. Importantly, in addition to launching the production of new products and upgrading the existing ones, the projects thus supported should envisage the creation of jobs and the involvement in R&D of young scientists and specialists, undergraduate and postgraduate students, as well as publication and patenting of the achieved results. Since 2010, in the framework of this mechanism, the government has selected more than 300 projects for providing this type of support, the annual volume of budget funding amounting to RUB 5–7bn.

Promotion of the project-implementation companies set up by state scientific research institutions and educational establishments. This activity de facto had two components. The

[1] Yu. Simachev, M. Kuzyk (2015) Public policy for stimulating scientific and industrial cooperation. Section 6.4. In: Russian Economy in 2014. Trends and Outlooks. (Issue 36). Ed. S.G. Sinelnikov-Murylev (editor-in-chief), A.D. Radygin. Ye. T. Gaidar Institute for Economic Policy. Moscow, Gaidar Institute Press, p. 465–511.

[2] Federal Law No 158-FZ dated July 22, 2008 *On Introducing Alterations to Chapters 21, 23, 24, 25 and 26 of Part Two of the Tax Code of the Russian Federation and Some Other Acts of Legislation of the Russian Federation on Taxes and Levies*.

[3] Decree of the RF Government No 988, dated December 24, 2008 *On Approving the List of R&D Types, the Costs of Which Are Incurred by a Taxpayer, in Accordance with Item 2 of Article 262 of Part Two of the Tax Code of the Russian Federation, Are to Be Added to Other Costs in the Amount of Actual Costs Upwardly Adjusted by Factor of 1.5*.

[4] Decree of the RF Government No 218, dated April 9, 2010 *On Measures of Government Support of the Development of Cooperation of Russian Higher Educational Establishments, State Research Institution and Organizations Implementing Comprehensive Projects Aimed at Launching Hi-tech Production, in the Framework of Subprogram 'Institutional Development of the Scientific Research Sector' of the State Program of the Russian Federation for the Development of Science and Technology in 2013–2020'* .

first one was the easing of the legislative norms regulating the creation of educational establishments and scientific research institutions, the scientific research conducted by economic societies,[1] and the management of their property by budget-funded institutions.[2] The upshot was the ability of scientific research organizations and higher educational establishments to actively create project-implementation companies and endow them with property. As a result, over the period 2009-2016, approximately 3,000 such companies were set up. The second important instrument, oriented to the project-implementation companies created by scientific research institutions and educational establishment, was the reduction of rates for the payment of their contributions to government extrabudgetary funds over the period until 2019.[3] It appears to be obvious that this type of support is oriented to the development of science-industry cooperation, because the newly established project-implementation companies operate as businesses rather than scientific research entities, and besides, they should serve as links through which the state-of-the-art R&D products created in the science sector can be transferred to big businesses.

*Technological platforms.* The evolvement of this instrument in Russia represented an attempt to borrow the successful experience of the European Union, where technological platforms had become an efficient mechanism for prioritizing those R&D products that were in high demand in the business sector, and thus consolidating the efforts of businesses, scientific research institutions and government bodies in their framework. Initially, Russia's technological platforms had been employed as a means of developing communication pathways between the government, science, and businesses that were necessary for long-term joint planning and coordination of scientific research activities in the framework of preparation and subsequent implementation of strategic scientific research programs.[4] However, soon these technological platforms were incorporated into the existing system for distributing financial support: first, the Russian Technology Development Foundation began to issue loans for the implementation of projects supported by technological platforms, [5] and then the support of technological platform projects began to be channeled in the framework of the basic Federal Target Program in the

[1] Federal Laws: No 217-FZ dated August 2, 2009, *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 273-FZ dated December 29, 2012, *On Education in the Russian Federation*; No 185-FZ dated July 2, 2013, *On Introducing Alterations to Some Legislative Acts of the Russian Federation, and Deeming Some Legislative Acts (or Some Provisions of Legislative Acts) to be Null and Void in Connection with the Adoption of the Federal Law 'On Education in the Russian Federation'*.

[2] Federal Law No 83-FZ dated May 8, 2010 *On Introducing Alterations to Some Legislative Acts of the Russian Federation in Connection with the Improvement of the Legal Status of State (Municipal) Institutions*.

[3] Federal Laws: No 272-FZ dated October 16, 2010 *On Introducing Alterations to the Federal Law 'On Insurance Contributions to the Pension Fund of the Russian Federation, the Social Insurance Fund of the Russian Federation, the Federal Compulsory Medical Insurance Fund and the Territorial Compulsory Medical Insurance Fund, and Article 33 of Federal Law 'On Compulsory Pension Insurance in the Russian Federation*; No 185-FZ dated July 2, 2013, *On Introducing Alterations to Some Legislative Acts of the Russian Federation, and Deeming Some Legislative Acts (or Some Provisions of Legislative Acts) to be Null and Void in Connection with the Adoption of the Federal Law 'On Education in the Russian Federation'*..

[4] The procedure of drawing-up the list of technological platforms (approved by decision of the Government Commission on High Technology and Innovation as of August 3, 2010, Protocol No 4).

[5] Now the Industrial Development Fund. After its 'reformatting in 2014, the support of technological platform projects is no longer one of the Fund's priorities.

field of science and technology *Research and Development …*[1] As present, Russia has 35 technological platforms, participated by more than 3,500 enterprises and organizations.

*Subsidies to the innovative territorial cluster development programs*. By contrast with technological platforms, where all the participants must operate in one and the same field, however broadly defined, or at least be interested in that field's development, innovative territorial clusters are based on the principle of one and the same territory. At the same time, however, the key requirement to a cluster, alongside the territorial proximity of its participants, is the existence of a science-industry chain in one or several sectors of the economy that should unite them all, as well as a mechanism for coordinating the activities of and cooperation between the cluster participants. Since clusters are viewed primarily as a regional development instrument, their support takes the form of targeted allocations to the regions, while the latter also participate in funding the clusters from their own sources. An important distinctive feature of the cluster development programs is their strong emphasis on infrastructure development, and not only in the field of innovation, science and technology, but also the in the engineering, transport, and sometimes also social infrastructure sectors. Today, Russia has 25 innovative territorial clusters in 20 RF subjects, which unite a total of about 1,000 enterprises, organizations, regional and local bodies of authority. The annual volume of funding allocated to the cluster development programs from the federal budget varies between RUB 1.25bn and RUB 2.5bn.

*Programs of innovative development of biggest companies with state participation*. The elaboration, approval and implementation, by biggest state-controlled companies, of their innovative development programs is expected to ensure the creation and implementation of new technologies, innovative products and services in compliance with world standards, thus conducing to the achievement, by these companies, of a broad range of goals, including the reduction of per unit costs and improvement of product quality, higher labor productivity, efficient energy use, and clean production. One of the important directions in the implementation of these programs is the interaction with higher educational establishments and scientific research organizations, primarily in determining the priority fields for collaborating, planning, and implementing joint projects and R&D programs.[2] At present, innovative development programs are being implemented by 60 biggest companies operating in the public sector.

*Subsidies to the projects involving the creation and development of engineering centers on the basis of higher educational establishments*.[3] This instrument is oriented to the use, in the interests of businesses, of the state-of-the-art know-how generated by higher educational establishments, the commercialization of their R&D products, and the involvement of undergraduate students in real engineering projects and broadening their opportunities for finding their future jobs. The bulk of government allocations must be spent on purchasing

[1] Federal Targeted Program *Research and Development in the Priority Areas of Development of the Russian Scientific and Technological Complex for 2007–2013* (approved by Decree of the RF Government No 613, dated October 17, 2006); Federal Targeted Program *Research and Development in the Priority Areas of Development of the Russian Scientific and Technological Complex for 2014–2020* (approved by Decree of the RF Government No 426, dated May 21, 2013).
[2] Recommendations for elaborating programs of innovative development of joint-stock companies with state participation, state corporations and federal state unitary enterprises (approved by decision of the Government Commission on High Technology and Innovation as of August 3, 2010, Protocol No 4).
[3] Plan of measures (roadmap) in the field of engineering and industrial design (approved by the RF Government's Directive No 1300-r dated July 23, 2013).

equipment, software and intangible assets; however, it is also planned that the engineering centers should also take advantage, while pursuing their activities, of the already existing scientific-research and experimental base in possession of the higher educational establishments hosting them. On the whole, engineering centers must serve as the much-needed interface between higher educational establishments and businesses, enabling the latter to productively draw upon the knowledge, competence and material base of the former in order to successfully achieve their goals. Currently, a total of 30 engineering centers function on the basis of higher educational establishments, and another 11 centers are being set up (the relevant projects were selected and approved in 2016).

On the whole, in spite of the strong focus on the support of science-industry cooperation in the framework of the currently implemented government innovative policy, we cannot say on the basis of available data that any radical progress has already been achieved with regard to increasing the scale of interaction between the science sector and businesses, or to boosting the productivity of that process. Thus, as noted earlier, the data presented in *Fig. 10* point to only a very slight increase in the scale of cooperation involving businesses over the past decade, and this happened in the main due to the more widespread practice of launching joint scientific research projects with higher educational establishments. Besides, we should note growth in the number of joint R&D projects of industrial companies and higher educational establishments and their increased relative share in the total number of joint projects; however, this was offset by a notable decline in the joint scientific research activity of companies with scientific research organizations (*Fig. 20*).

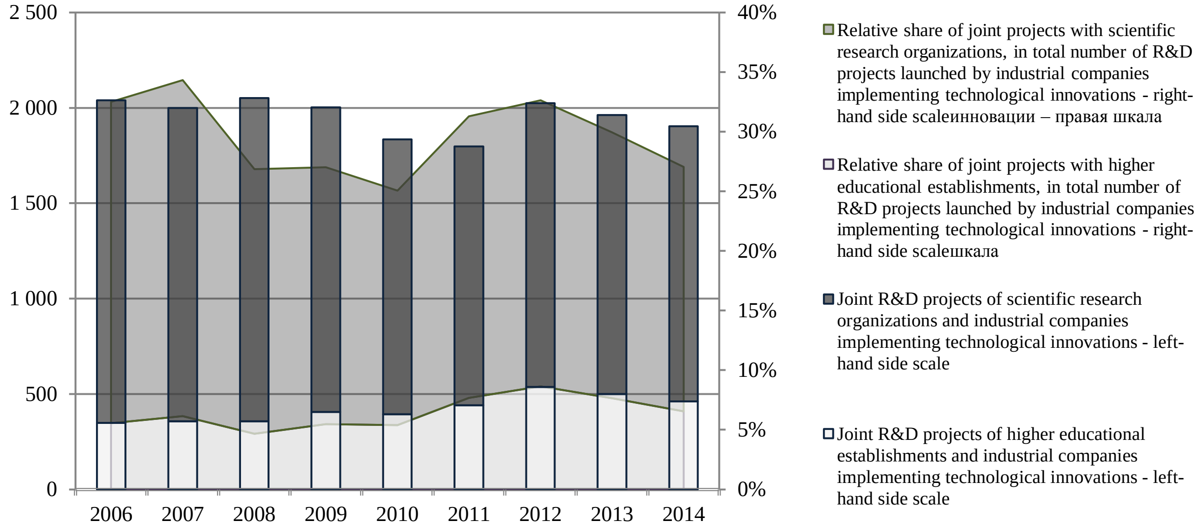


*Fig. 20.* Joint R&D projects with scientific research organizations and higher educational establishments, launched by industrial companies implementing technological innovations

*Source:* own calculations based on NRU HSE's data.

In our opinion, it is still too early to speak of any cardinal changes taking place in the interaction between businesses and higher educational establishments in the field of R&D; suffice it to say that the share of the business sector in the internal R&D costs of higher educational establishments has not been demonstrating a sustainable growth over the past decade - rather, it displays a downward trend (*Table 15*).

*Table 15*

**Internal R&D costs in the higher education sector covered by the business sector**

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Higher education sector's internal R&D costs covered by business sector | | | | | | | | | | | |
| in actual prices for each year, RUB bn | 3.91 | 5.17 | 7.27 | 8.24 | 7.77 | 10.72 | 13.22 | 17.71 | 18.66 | 22.59 | 24.03 |
| in constant 1989 prices, RUB thousand | 76.94 | 88.43 | 109.09 | 105.00 | 96.92 | 117.20 | 124.57 | 155.37 | 155.07 | 175.15 | 172.86 |
| Business sector's relative share in higher education sector's internal R&D costs, % | 29.3 | 29.3 | 31.0 | 28.6 | 22.4 | 24.5 | 24.0 | 27.2 | 27.5 | 27.3 | 27.4 |

*Source:* own calculations based on NRU HSE's data.

As for the role of organizations operating in the R&D sector in supplying information to be applied in innovation development, we may note certain growth in the significance of sectoral science organizations (alongside the stably low levels of significance of scientific research institutions belonging to the academic sector and higher educational establishments – *Fig. 21*). However, this change notwithstanding, all categories of scientific research organizations continue to be among the least usable sources of innovation in industry (*Fig. 14*).

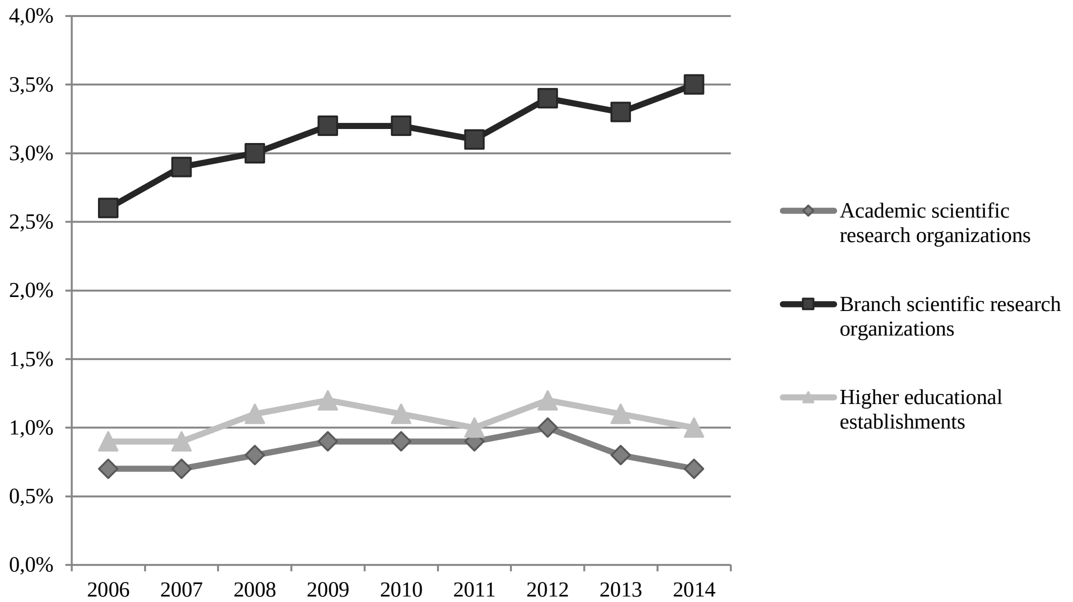


*Fig. 21.* The relative share of companies operating in industry and the sector of production and supply of electric energy, gas and water, which relied on organizations operating in the R&D sector as the main source of information on technological innovations

*Source:* own calculations based on NRU HSE's data.

Thus, the government's efforts to promote science-industry cooperation have not so far yielded any results that could be felt on the macro level. However, it should be borne in mind that the majority of instruments applied by the government were introduced not earlier than 2011. Meanwhile, it is a well-known fact that government promotion measures, even when they are very successful and constructive, quite often bring results with a significant lag – up to several years,[1] and the lag becomes more visible when we apply macro data. Therefore it necessary to assess the input of implemented policy in the development of science-industry cooperation at the micro level.

The findings of the 2015 survey of Russian companies demonstrate that the creation of new science-industry cooperation links or strengthening of the already existing ones represents one of the most rarely observed consequences of government support, its incidence being nearly four times lower than that of the most commonly seen effect - the replacement of private investment by government funding and growth of investment in new equipment (*Fig. 22*). At the same time, 'sector-oriented' government support measures designed to promote science-industry cooperation much more frequently result in its strengthening (23% of cases vs. 8% for innovative policy in general). This index is even higher for certain specific measures and instruments: thus, in particular, progress in the development of science-industry cooperation was demonstrated by 31% of enterprises applying the profits tax exemption mentioned earlier, and by 33% of companies participating in the joint projects with higher educational establishments or scientific research institutions supported by the government in the framework of measures outlined in Decree No 218. Besides, when set against innovative policy at large, the cooperation promotion measures rather more frequently give rise to many other positive effects, among which growth of the aggregate expenditure allocated to innovation, expenditures on R&D, investments in new equipment, and a higher scale and rate of project implement are the most notable ones. Interestingly, all these effects, including cooperation development, have to do with inputs or behaviors, while the 'output effects' of the science-industry cooperation promotion mechanisms like proceeds, output of new and upgraded products, profitability and overall competitive capacity of a business company, look less impressive against the backdrop of the entire scope of government innovative policy.

This, while the input of the science-industry cooperation promotion policy implemented by the government cannot be traced very graphically on the macro level, at the level of each individual company we may speak of some sufficiently significant results being produced by these measures, at least they appear to be so when set against the other government instruments employed in the support of innovations.

[1] Shin T. (2006) Behavioural additionality of public R&D funding in Korea. In: Government R&D Funding and Company Behaviour. Ch. 9. OECD Publishing, pp. 167–180; Lopez-Acevedo, G., Tan, H. (2010) Impact Evaluation of SME Programs in LAC. The World Bank. URL: http://siteresources.worldbank.org/INTLACREGTOPPOVANA/Resources/Impact_Evaluation_SME_Programs_ENG_Final.pdf; Crespi G., Maffiolly A., Melendez M. (2011) Public Support to Innovation: the Colombian COLCIENCIAS' Experience. Technical Notes IDB-TN-264. Inter-American Development Bank. URL: http://www.iadb.org/wmsfiles/products/publications/documents/35940030.pdf.

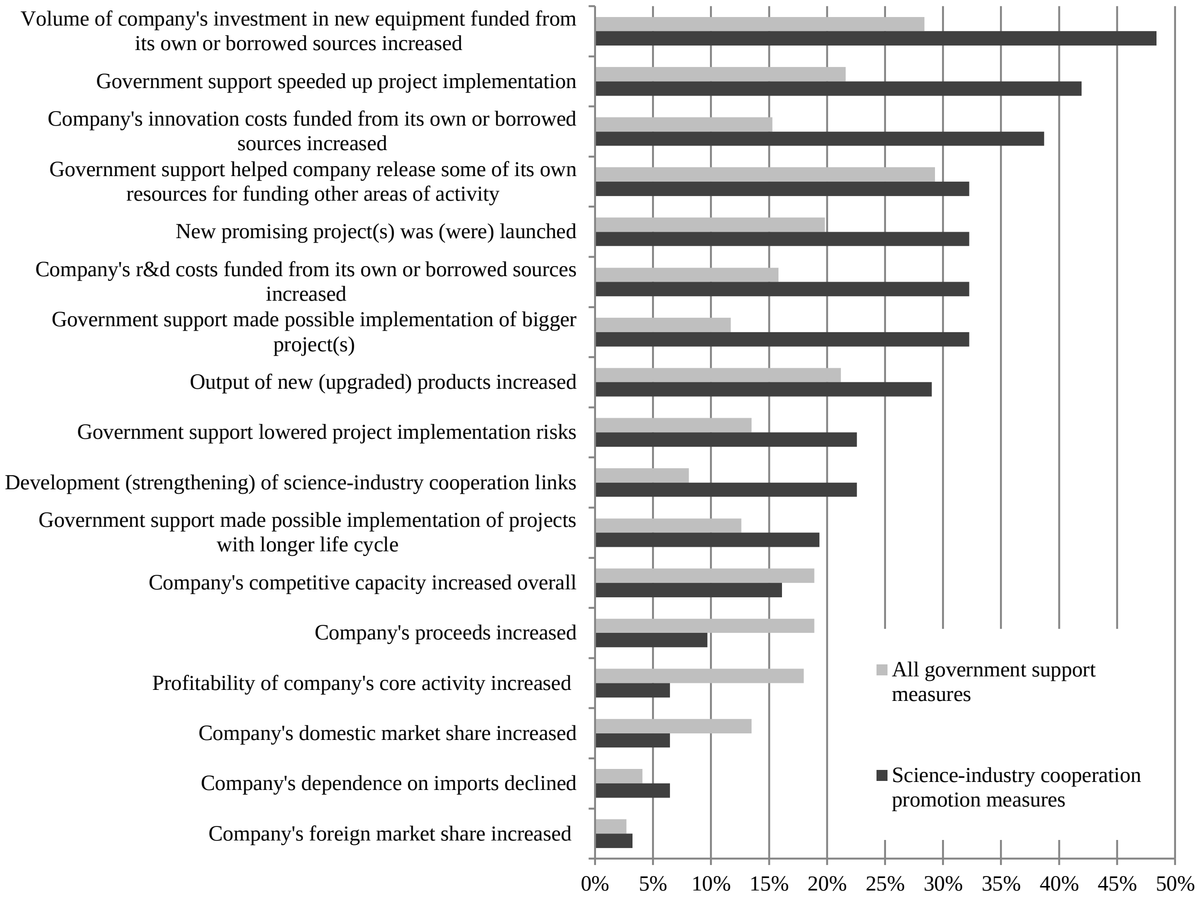


*Fig. 22.* The influence of government support measures on the activity of companies, as of 2015 (frequency of mention by CEOs of companies - recipients of measures in each category)

*Source:* IAC, own calculations.

### 6.4.5. The reasons for the low level of interaction between the science sector and businesses: some conclusions and generalizations

In our view, today we may identify two main reasons why, in spite of the comprehensive measures being implemented in the framework of Russia's innovative policy and designed to boost science-industry cooperation, the scale and productivity of interaction between science and businesses are still very low, and demonstrate no obvious signs of growth.

**The first reason** is that each of the measures designed to promote cooperation links and partnerships between the science sector and industry is being influenced by factors that impose significant constraints on the scale of their implementation and their input in cooperation development. Some of these factors were taken into account by the government in the phase of planning these measures, and some of them emerged spontaneously.

The profits tax exemption based on a 1.5 times increase in the actual R&D costs, similarly to any other tax instrument, is potentially oriented to the broadest possible range of 'consumers.' The first and most obvious constraint on its application is that only specifically defined R&D

themes entered on the special list are entitled to that exemption. The list presently consists of approximately 450 items, which very closely follow (as noted earlier) the Priority directions for the development of science, technologies and technical equipment in the Russian Federation and the List of critical technologies of the Russian Federation. Nevertheless, in spite of this limitation, in the third year after its introduction, the exemption was already applied to nearly 1/4 of all R&D costs reported for the purposes of taxation (*Fig. 23*).

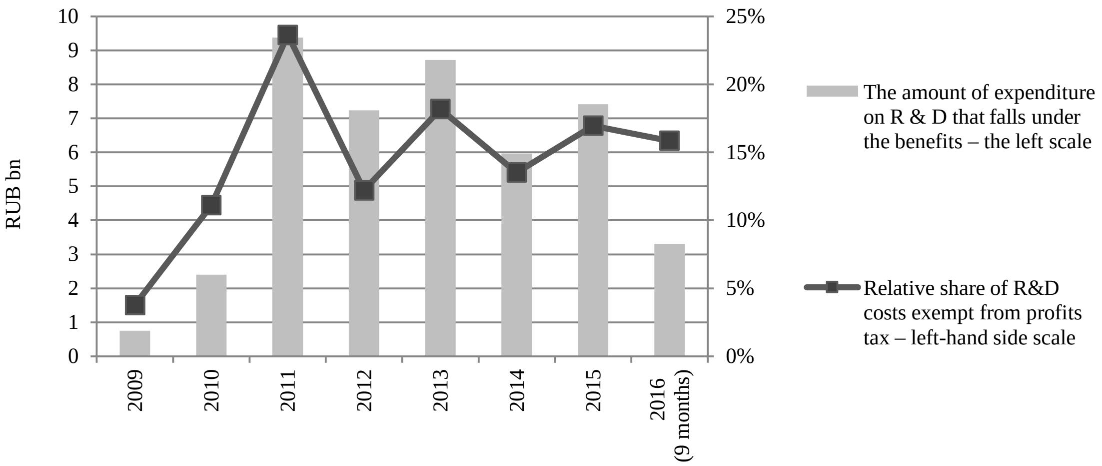


*Fig. 23.* Taxpayers' R&D costs subject to profits tax exemption in accordance with the special list

*Source:* Federal Tax Service; own calculations.

The second constraint introduced in response to the too widespread use of tax exemptions (probably 'too widespread' only from the point of view of the controlling bodies) is that a taxpayer must submit to the tax inspectorate a R&D report. The upshot was that the exemption began to be applied on a much lower scale. However, even now it is still significant – about 15% of the total amount of R&D costs reported for the purposes of taxation are exempt from the tax. The more important circumstance is that the exemption is relied upon by a constant and very limited group of subjects – both in 2014 and in 2015 its 'consumers' were 64 companies,[1] which amounts to only 5% of its potential 'targets' – the taxpayers reporting R&D costs.

The most evident limitation of the financial support mechanism applied to joint innovative projects of business companies with scientific research organizations is that its recipients on 'science side' may only be higher educational establishments and state scientific research institutions (and initially - higher educational establishments only). Meanwhile, these entities comprise only slightly more than half of all legal entities involved in R&D.[2]

Another limitation of the subsidizing mechanism is that, although the number of projects receiving support is rather large (more than 300), the range of actual participants is relatively narrow because they are always roughly the same ones. And while this approach may be justified when applied to higher educational establishments, because by far not all of them are

[1] For reference: another exemption from profits tax – amortization premium – was applied in 2015 by more than 11,000 enterprises and organizations.

[2] Voinilov Yu., Gorodnikova N., Gokhberg L. et al. (2017). Science and technology indicators in the Russian Federation: HSE Data Books 2017. M.: NRU HSE.

competent enough in the field of science and technology to produce R&D products truly needed by businesses, the feasibility of repeated allocation of government support to the same big business structures may well be questioned, to say the least.

And finally, yet another important point is that, while rather strong effects and behavior changes can be displayed by the higher educational establishments and business companies participating in a government-supported project,[1] the fact of their collaboration *per se* often has nothing to do with government support, being the upshot of long-standing connections and relationships. If that is the case, the true result of that support is not the initiation of new science-business partnerships, but only some additional 'capitalization' on the already ongoing cooperation.

The rather significant limitation of the mechanism of government promotion of the creation of project-implementing companies by scientific research organizations and higher educational establishments is that the relevant set of instruments is targeted only at the organizations operating as budget-funded and autonomous institutions, and thus only at the economic societies created by such institutions. For this reason, the reduced rates of mandatory payments to government extrabudgetary funds are not applicable to the absolutely similar companies that have been set up by joint-stock companies, and so on.

A sort of constraint on this form of government support - at least, with regard to its influence on the economy - is that probably a majority of established project-implementing companies exist only formally,[2] and their creation was prompted not so much by the desire of their founders to commercialize their R&D products, as by the externally imposed directives and targets. It is not by chance that most of these companies were set up by higher educational establishments, which are required to comply with the relevant targets assigned to them in government programs.

Technological platforms differ from the mechanisms and areas of government support discussed earlier in that they formally are not restricted in their choice of the organizational-legal form of their participants and the themes of their scientific research projects. However, in actual practice, their activity has been increasingly focused on following the priorities set by the government - among other things, because these are linked to the measures outlined in the Federal Targeted Program *Research and Development in the Top Priority Areas of Development of the Russian Scientific and Technological Complex*, and most of the projects in the framework of technological platforms are funded under that FTP. It should also be noted, in spite of the versatility of the existing platforms and the impressive number of enterprises and organizations operating in their framework (approximately 3,500), only a few platforms are *de facto* the recipients of the bulk of government allocations, and the actual beneficiaries are most often their biggest major participants.

The financial support from the federal budget of the innovative territorial cluster development programs is distributed much more evenly than the funding allocated to technological platforms in the form of tenders. Besides, as clusters are expected first of all to promote regional development, they receive not only federal budget allocations, but also

[1] I. Dezhina, Yu. Simachev. Matching grants for stimulating partnerships between companies and universities in innovation area: initial effects in Russia. The Journal of the New Economic Association, 2013, No 3.
[2] See, e.g., Sterligov, I. (2011) A third of all small businesses based at higher educational establishments exist only on paper. Science and Technology of the Russian Federation (STRF.ru.) URL: http://www.strf.ru/material.aspx?CatalogId=221&d_no=41450#.VNqByeY0Enh; Ruposov V. Economic activity analysis of ISTU small innovation enterprises. Proceedings of Irkutsk State Technical University, 2014. No 4.

support from the budgets of their regions, and the amount of the latter is usually rather substantial. However, at the same time, many of the measures thus funded (most frequently – from regional budgets) have little to do with the cooperation promotion and joint activities of the enterprises and organizations operating inside a cluster – *de facto*, the priority of regional funding is usually not the promotion of cluster participants and their interaction, but the development of the area in which the cluster is situated. It should also be noted that some clusters represent the already long-standing regional industry-science-education conglomerates, whose official formalization as clusters could do little to improve the well-developed links between their participants. Another extreme is 'cluster hypertrophy': the inclusion of a very large number (about 100) of enterprises and organizations, probably in the hope of gaining access to government support. If that is the case, the prospects not only of the development of joint activities of all its participants, but even of their coordination inside a cluster appears to be doubtful.

The evident limitation of the innovative development programs is that their 'specific target' is the group of 60 biggest companies of the public sector. Another less evident but nevertheless very significant limitation is that practically every company in that group, due to its size and long history, has developed a set of reliable partners, including in the science sector and among higher educational establishments. So, the cooperation with scientific research organizations and higher educational establishments envisaged in the development programs takes place, as a rule, as part of their habitual 'interaction profile',[1] similarly to the mechanism of support of joint innovative projects of business companies with higher educational establishments and scientific research institutions. It is not by chance that the recipients of support in the framework of that mechanism are several biggest companies operating in the public sector and implementing innovative development programs.

And finally, the key limitation of the pilot project support mechanism employed in the creation of engineering centers is that these may be set up only on the basis of higher educational establishments, and more specifically, only those subordinated to the RF Ministry of Education and Science. In this connection it must be added that the unquestionable and obvious advantage of this mechanism is its orientation to one of the fields that suffer most from the acute deficit of domestic supply of work and services needed by businesses, and so, in order to eliminate that deficit, it would be feasible to make use of the opportunities and competences not only of higher educational establishments, but also of scientific research organizations. Besides, in actual practice the contribution of some of the newly established engineering centers in the development of cooperation between their 'parent' higher educational establishments and businesses is restricted by the lack of interest, on the part of the latter, in using their services (due to the poor choice of the focus of their activity, the higher educational establishment's reputation, etc.), or, on the contrary, by the excessively high reliance of the business partner on the engineering center, when the latter turns it into its own 'satellite', to the detriment of its interaction with other companies.

[1] This fact is further confirmed in the report that analyzed the intermediate results of innovative development programs on the basis of official reporting and monitoring data. It was noted that there were no noticeable changes in the composition of participants in R&D projects resulting from the involvement of new scientific research organizations operating in the R&D sector (M.A. Gershman, T.S. Zinina, M.A. Romanov et al. Innovative development programs for companies with state stakes: intermediate results and priorities. Ed. by L.M. Gokhberg, A.N. Klepach, P.B. Rudnik et al. M.: NRU HSE, 2015).

All these limitations significantly narrow the range of real beneficiaries of the science-industry cooperation promotion measures and instruments relative to their potential number.

**The second reason** why the development of interaction between science and businesses in Russia is slow has been the less than favorable environment for generating knowledge and its 'conversion' into new products and technologies. As shown by international comparative studies, the level of science-industry cooperation development in Russia's economy was as least not worse than the scientific research and innovative activity indices in other countries (*Fig. 24*).

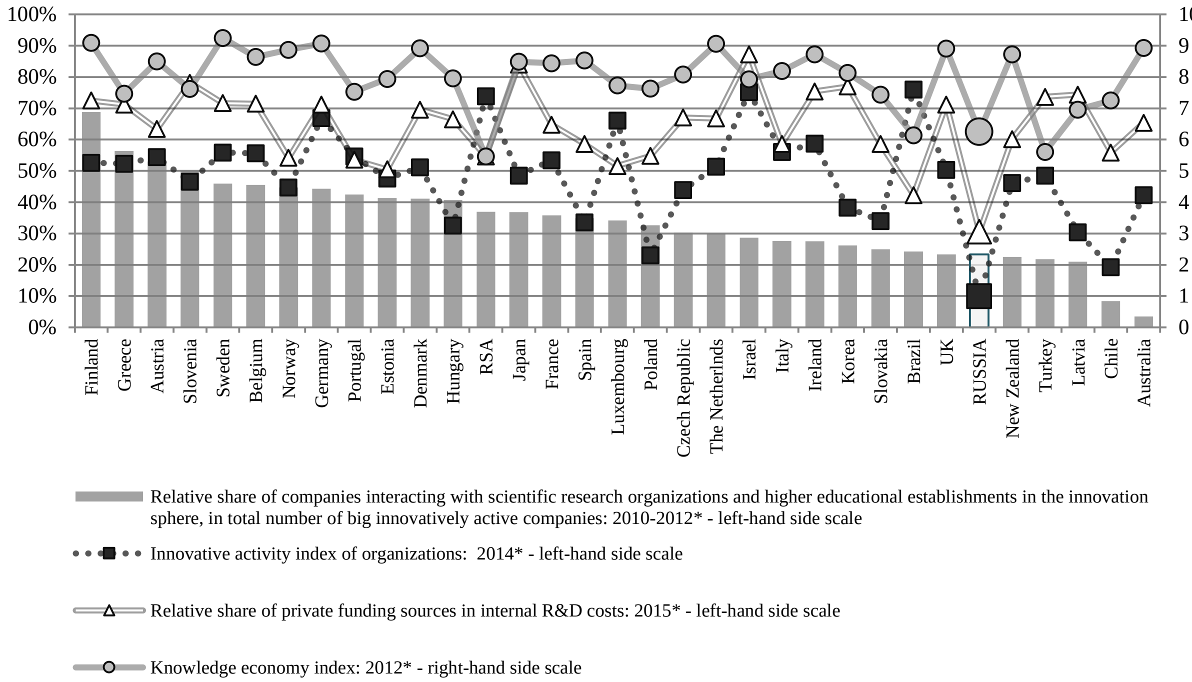


*Fig. 24.* Science-industry cooperation, scientific research, and innovative activity indices – international comparative data

* Or the nearest period for which comparable data are available.
*Sourceu:* own calculations based on data released by the OECD, the NRU HSE, and the World Bank.

The analysis presented here has led to a number of conclusions and recommendations concerning the areas of development for the science-industry cooperation promotion measures and instruments applied by the government and the potential for improving their performance and increasing their inputs in innovative development on the macro level.

Firstly, as shown by these estimates, there exists a substantial resource for increasing the yield of the measures being implemented, which can become visible in the positive changes in the activity of direct recipients of support. However, these opportunities are naturally restricted to the existing group of beneficiaries, which is comparatively small due to the specificity of these instruments. So, even in the event of ensuring significant effects of government support for each individual recipient, it is unlikely that the situation may notably improve on the macro level. Thus, *the main resource for strengthening the influence of the government's science-industry cooperation promotion policy on economic development will be, in our opinion, not so much the increased 'intensity' of implementation of the relevant measures (their increased input* *in the development of each support recipient), but the 'extensive' expansion of the range of their real beneficiaries*.

Secondly, the current government policy of supporting the interaction between the science sector and businesses mostly targets biggest players on either side, while small organizations and enterprises are relatively uninvolved in its 'orbit', with the exception of project-implementing companies set up by scientific research institutions and educational establishments. Thus, in particular, there exist strong grounds for believing that the 'consumers' of the special profits tax exemption for R&D costs are in the main big enterprises and organizations – just because they constitute only 5% of the total number of taxpayers reporting their R&D costs, while the relative share of their R&D costs – and not even the entire amount, but only the tax-exempt amount – is higher, about 15%. The mechanism of supporting the cooperation of business companies and higher educational establishments in the framework of measures outlined in Decree No 218, which envisages a rather large scale of the projects to be implemented, is also predominantly oriented to big entities. The bulk of support distributed in the framework of technological platforms, as has already been noted, goes to big players. Big-sized businesses and scientific research organizations are also prominent among the participants of innovative territorial clusters. In the framework of innovative development programs with the participation of biggest companies operating in the public sector, the latter de facto are not actively outsourcing their services to small businesses, although this is stipulated as one of the mandatory components of these programs.[1] Thus, *new participants in the implementation of government science-industry cooperation promotion policy can - and should be - recruited not from the group of big companies and scientific research organizations (as a rule, these have been already successfully cooperating for a long time), but from among small entities and the relatively recently created organizations and companies, which have not yet developed their own science-industry cooperation systems.[2] It must be added that in foreign countries, innovative startups are frequently regarded as an important source of demand for R&D products.*

Thirdly, the currently implemented science-industry cooperation promotion measures *clearly display their focus on developing the science-business interaction on the institutional level*, the parties involved being the organizations operating in the R&D sector (primarily state scientific research institutions and higher educational establishments) and industrial companies. Meanwhile, in order to expand cooperation, create new partnerships, promote network interaction, and ultimately to increase the flexibility of the entire system of cooperation links, *it is vital to promote the development of science-industry cooperation at the level of individual entities.*

Fourthly, since the current level of science-industry cooperation in Russia on the whole reflects the situation in the national innovation system, *it will be impossible to achieve fundamental progress in science-industry cooperation by relying only on 'branch-oriented' cooperation measures promotion; instead, it will be necessary to generally improve the innovative climate and to develop an appropriate environment for knowledge generation*.

[1] M.A. Gershman, T.S. Zinina, M.A. Romanov et al. Innovative development programs for companies with state stakes: intermediate results and priorities. Ed. by L.M. Gokhberg, A.N. Klepach, P.B. Rudnik et al. M.: NRU HSE, 2015.

[2] In should be noted that in foreign countries, innovative startups are often viewed as an important source of demand for R&D products (Cohen W., Nelson R.R., Walsh J.P. (2002) Links and Impacts: the Influence of Public Scientific research on Industrial R&D. Management Science, 48 (1), pp. 1–23).

*Table 16*

**The scale, advantages and limitations in the use of the principal instruments and measures applied by the government in its support of science-industry cooperation**

| Instrument (direction) of support | Implementation scale | Strengths, advantages | Limitations, implementation issues |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| Special exemption from profits tax for some types of R&D costs | Cap on R&D costs to be exempt from tax is RUB 6–9bn, or approximately 15% of all R&D costs reported for taxation purposes. In 2014 and 2015, the exemption was applied by 64 organizations | • 'Genuine' exemption – it truly reduces the tax load.<br>• Potentially broad range of beneficiaries.<br>• Promotion of those R&D fields that are government priorities.<br>• Prior to 2012 it was relatively easy to apply | • 'Selective' application – the R&D theme must comply with the special list.<br>• From 2012 – too complicated procedure for its application and administration.<br>• It is *de facto* a targeted measure: very low – for tax exemption – number of beneficiaries |
| Subsidies to companies implementing innovative projects, to cover the costs of their R&D, orders for which are placed with Russian higher educational establishments and state scientific research institutions | More than 300 projects, annual budget funding volume is RUB 5–7bn | • Companies and higher educational establishment (or scientific research organization) apply jointly, which implies their mutual interest in collaboration<br>• R&D is ordered directly by the company project initiator, which lowers the risk of generating results that do not correspond to its needs<br>• Orientation to the creation of hi-tech industries, new and upgraded products, involvement in R&D of undergraduate and postgraduate students, publishing activity<br>• Large scale and long period of application, well-elaborated procedures<br>• Stronger orientation of scientific research conducted by higher educational establishments to real needs of businesses<br>• Development of higher educational establishments' competence in those fields of scientific research, engineering and education that are truly in demand<br>• Large-scale participation in project implementation of the personnel of higher educational establishments, undergraduate and postgraduate students, creation of a significant number of new jobs, sufficiently high scale of publishing activity | • Excessively tough restrictions on participation in R&D projects: only higher educational establishments and state scientific research institutions prior to 2012 – only higher educational establishments)<br>• Too strong emphasis on a substantial (frequently – predominant) relative share of R&D in the structure of projects<br>• Limited opportunities for using the allocated budget resources<br>• Cap on the amount of budget subsidies<br>• From 2013 – insufficiently flexible project funding scheme<br>• As a rule, the supported projects rely on long-standing science-industry links and partnerships<br>• Some partnerships are purely formal, some projects are not viable<br>• Problems with the distribution of rights to R&D products between the participants |
| Promotion of the creation, by scientific research institutions and educational establishments, of joint-stock companies for implementing the products of their intellectual activity | Over the period 2009-2016, 2,900 project-implementing companies were set up | • Orientation to commercialization of R&D products<br>• High demand by higher educational establishments | • Applied only to scientific research organizations and higher educational establishments registered as budget-funded or autonomous institutions, and to the project-implementing companies created by these entities<br>• Purely nominal existence and non-viability of many of the newly created companies |

*Cont'd*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Technological platforms | 35 technological platforms, participated by more than 3,500 enterprises and organizations | • Borrowing of foreign best practices<br>• Orientation to cooperation between the government, the science sector, and businesses, development of more common views and coordination of interests<br>• Promotion of long-term R&D planning<br>• Reasonable number of platforms | • Preferential orientation to government priorities in the field of science and technology, and not to the needs of businesses<br>• Lack of involvement in certain socially important fields<br>• Excessive orientation to big state-owned players (state-owned companies, scientific research centers, higher educational establishments), to their interests<br>• Focus on the attraction of government resources<br>• Concentration of the bulk of budget allocations in the hands of a narrow range of platforms and their key participants<br>• Relatively low involvement of private businesses<br>• In some cases – insufficient focus on developing international cooperation |
| Subsidizing of the innovative territorial cluster development programs | Support of 25 clusters in 20 RF subjects, participated by a total of approximately 900 enterprises and organizations; the annual volume of federal budget funding is RUB 1.25-2.5bn | • Borrowing of foreign best practices<br>• Orientation to regional development, promotion of closer interaction between businesses, the science sector, the education sector, and authorities, real involvement of regional administrations, including financial participation<br>• Existence of detailed (as a rule) cluster development programs, approved and controlled by regional authorities<br>• Orientation to the use and further development of the existing state-of-the-art competence<br>• Focus on infrastructure development, achievement of synergic effects<br>• Relatively small volume and even distribution of budget funding | • Formal nature of some clusters, weak interaction between their participants<br>• Lack of a real 'activity focus' in some clusters<br>• 'Hypertrophy' of some clusters<br>• Much of the expenditure allocated by RF subjects has little to do with the actual development of clusters: construction and repair of roads, social infrastructure projects, upkeep of residential areas, etc.<br>• Excessive orientation to long-standing links and partnerships<br>• In some cases – creation of infrastructure components simply for the sake of a good report, with no regard for the real demand for their services<br>• Insufficient focus on developing international cooperation<br>• Focus on the attraction of government resources |
| Programs of innovative development of biggest companies operating in the public sector | The programs for 60 companies have been approved and are being implemented | • Orientation not only to boosting the innovative and scientific-research activity of companies, but also to more cost-effective use of resources and better medium- and long-term competitive capacity<br>• Setting development targets for companies based on relevant comparative indices achieved by major foreign companies (technological audit)<br>• Strategic innovative activity planning<br>• Clear focus on science-industry cooperation promotion<br>• Regular monitoring of program implementation | • Lack of information transparency concerning the programs and the activities of companies in the framework of their implementation: as a rule, there is no open access even to the full text of a program<br>• The programs *de facto* are secondary to the other strategic planning documents adopted by the companies – long-term development strategies and programs<br>• Strong orientation to long-standing science-industry cooperation links and partnerships |

*Cont'd*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Subsidizing of projects involving the creation and development of engineering centers based at higher educational establishments | 30 engineering centers are operating, another 11 are being set up; the annual volume of federal budget funding is RUB 0.5-1bn | • Orientation to the needs of business that are currently inadequately satisfied by Russian organizations<br>• Orientation to commercial use of the state-of-the-art competence of higher educational establishments, involvement of their R&D products in economic activities<br>• Opportunities for involving students, finding their future jobs<br>• The examples of productive cooperation of federal ministries are set by the RF Ministry of Education and Science and the RF Ministry of Industry and Commerce | • Engineering centers may only be based at higher educational establishments subordinated to the RF Ministry of Education and Science<br>• Dual nature – each engineering centers consists of a two separate divisions - a higher educational establishments and a separately registered legal entity, where the former is the direct recipient of support, and the main performance assessment criterion is the amount of proceeds generated by the latter<br>• Formal nature of some centers, they have little to do with engineering activity<br>• Some centers get few orders and generate low proceeds<br>• Low activity diversification at some centers, some of them being simply an 'extension' of their industrial partner |